KOMMERSKOLLEGIUM
NATIONAL BOARD OF TRADE SWEDEN

Trade Rules for a Circular Economy

The case of used lithium-ion batteries

2023

Preface

Sustainability is both one of the great challenges of our time, and at the core of what we do at the National Board of Trade. As part of our work on analysing how international trade can contribute to environmentally, socially and economically secure sustainable development, this study takes a closer look at trade in used li-ion batteries.

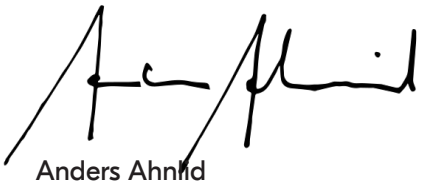
These batteries play a vital role in the electrification of transportation and the expansion of renewable energy. As demand continues to grow, our study examines how well-functioning trade in used batteries, along with circular concepts such as recycling and second use, can both help meet the growing demand (a question of economic sustainability) and reduce the environmental impact of battery production.

In this study, we identify and detail key barriers to trade in used li-ion batteries. We also present several recommendations for policymakers interested in promoting a circular economy, and trade in used goods.

The study has been written by Isaac Ouro-Nimini, with advice and comments from Kristina Olofsson and Åsa Sandström, and with layout and graphics by Loise Näsvall.

Finally, we would like to extend our special thanks to the companies and industry organisations that have provided valuable input on their experiences and made it possible for us to complete this study.

Stockholm, February 2023



Anders Ahnlid
Director-General
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Executive summary

There is broad international consensus, exemplified in the Paris Agreement and the Sustainable Development Goals, that we must limit the environmental and climate impact of economic activity. Meeting this challenge will require significant policy action, including transitioning from a linear to a circular economy.

Trade can be a key component in this transition, as we illustrate using the case of trade in waste li-ion batteries. These batteries play an important role in both the electrification of transportation and the expansion of renewable energy.

Demand for li-ion batteries and the metals critical to their production is set to increase by several times over in the near future. Recycling and repurposing batteries could help meet this growing demand, but as of 2019, only about half of all available end-of-life li-ion batteries (about 100,000 tonnes) were recycled, with batteries from electric vehicles representing only a small share.

By 2030, more than 1.6 million tonnes of used li-ion batteries (with half of that amount coming from electric vehicles) could enter the recycling market, far outstripping current global recycling capacity. Trade could enable the economies of scale needed to boost investment in the industry, and could also help alleviate current local and regional capacity constraints and make it possible for businesses to implement circular initiatives.

To realise the benefits of trade in used li-ion batteries, trade policy must support the trade in used goods. The trade and trade-related rules that greatly affect the used battery trade, however, are largely designed with a linear, rather than circular, economy in mind. Businesses face costly and cumbersome administrative procedures and must adapt to a patchwork of regulations that vary between countries.

We present several recommendations as to how regulations covering the trade and transport of waste could be designed and implemented to support the trade in used goods necessary for the transition to a circular economy, without compromising international safety standards that protect the environment and human health. Key recommendations include:

- **Simplifying trade procedures between trusted parties**
  Complementing or amending the Basel Convention could address some trade barriers while maintaining high standards of environmental protection, and a model agreement is already in force between OECD members.
- **Simplifying transport regulations**
  Investigate whether it is possible to draft regulations that allow operators more flexibility in their approach to aspects such as packing, without compromising safety.
- **Facilitating trade procedures for waste batteries**
  Trade facilitation measures, such as increased transparency and simplified administrative procedures, could be adopted unilaterally or through a joint statement between interested parties.
- **Advancing fast-track procedures**
  Authorities could fast-track procedures for shipments of waste destined for vetted facilities, reducing administrative red tape.
- **Harmonising and extending coverage**
  The application of the rules on the transport of dangerous goods could be harmonised, and an effort could be made to increase the number of countries applying these rules, so that companies could adapt to the same set of rules.

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1 Introduction

1.1 Purpose

The purpose of this study is to contribute to the discussion about trade and the circular economy and offer some recommendations as to how key trade and trade-related policy rules could encourage circularity by enabling and supporting the trade in used goods. In doing so, we believe this study can also contribute to the wider discussion on trade and sustainability.

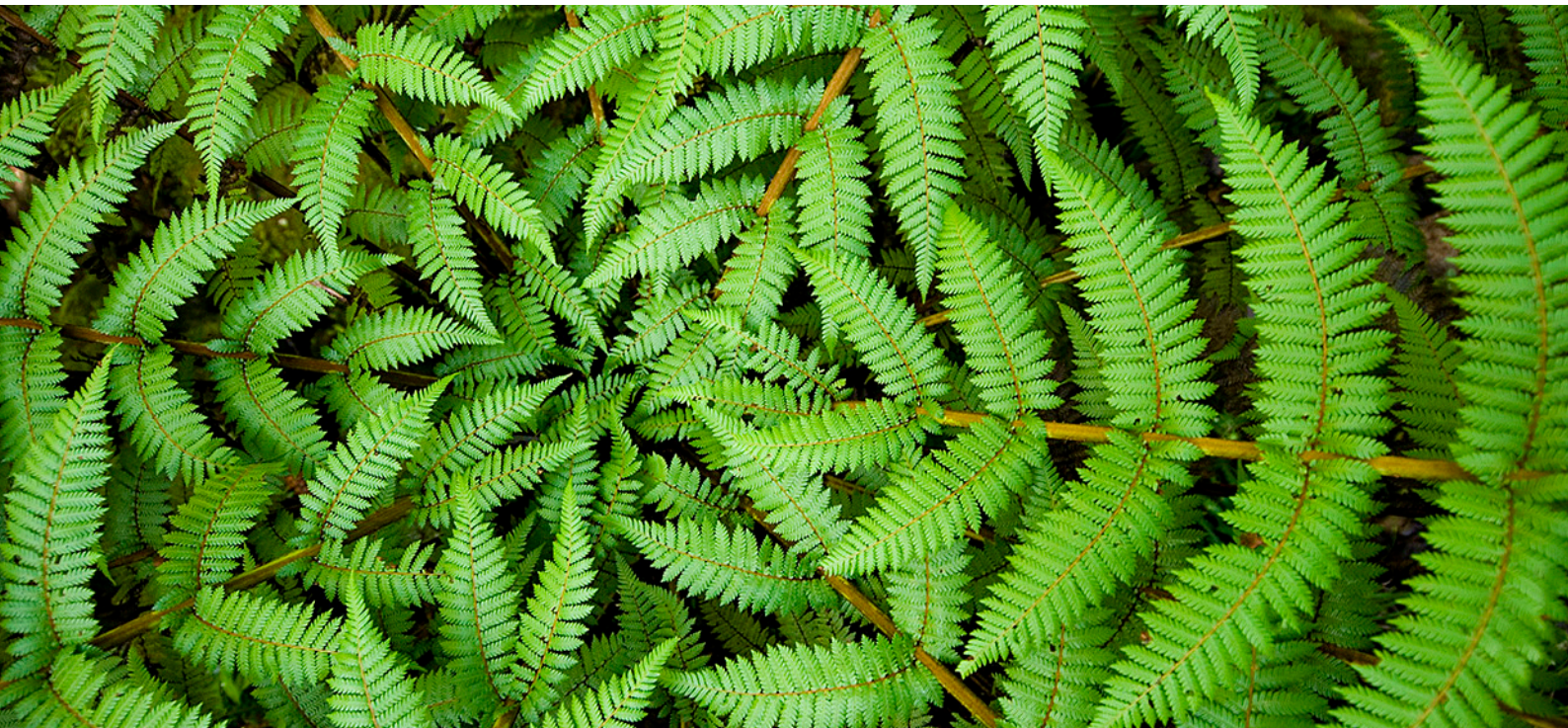
The role of trade policy in a circular economy will be illustrated using the example of the trade in used industrial li-ion batteries, goods which are crucial for the expansion of renewable energy and the electrification of transportation. These two processes can in turn contribute to protecting our climate and enabling a more sustainable economy.

The following sections cover the purpose of this study in more detail, its scope, and the methods used. Important definitions used in the study may be found here. In Section 2, we describe the main benefits of circularity, and the important role trade policy can play in realising these benefits. Section 3 details key international trade rules and trade-related rules and how they affect the used li-ion batteries trade. Finally, Section 4 contains our recommendations for how these rules could be used to support circularity.

1.2 Methods

We attempted to identify and detail key trade and trade-related rules that affect the used li-ion batteries trade by reviewing prior studies and publications on the issue and gathering information from written input and semi-structured interviews with businesses.

As part of our research, we reached out to a broad spectrum of businesses and industry organisations, aiming for wide geographical representation. We were able to contact representatives from six different companies and industry organisations, who provided information on the trade and trade-related rules that have the greatest impact on their businesses. These companies and organisations are active in the recycling, electric vehicle manufacturing, and battery manufacturing sectors. Although they are concentrated in Europe and North America, and do not necessarily represent their entire industries, they have provided valuable input concerning their first-hand experiences in the used batteries



trade. Their input, obtained both in interviews and in written form, has guided the emphasis of our analysis, allowing us to focus on the trade and trade-related rules that most affect those in the business of trading used li-ion batteries.

We found relatively few previous studies on the subject, but some research has been done on the regulatory barriers facing trade in used goods and on the role of batteries in transportation and renewable energy. These studies were primarily carried out by the Organisation for Economic Co-operation and Development (OECD) and the World Economic Forum (WEF), though several other sources are used in our study as well.

Focusing on these key trade and trade-related rules, we describe some ways in which the rules affect the trade in used li-ion batteries, and also present a number of recommendations as to how these rules could be better aligned with the goal of circularity.

1.3 Definitions

In this section, we will briefly explain and define some important terms and concepts used in this study which may not be familiar to readers coming from a trade policy background.

Circular economy

What defines a *circular economy* and what is *circularity*? We use the definition developed by the Ellen McArthur Foundation, which is commonly used in academia:

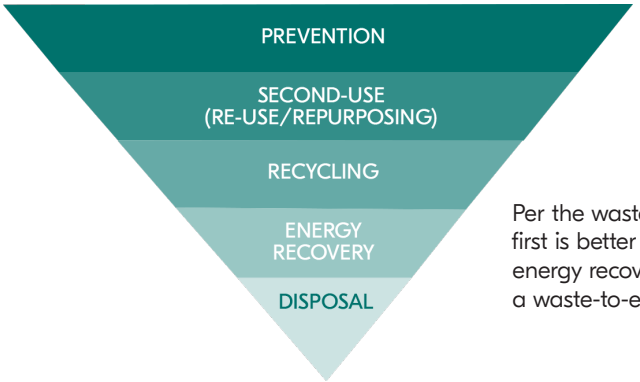
> *A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.*[1]

When terms like 'circular economy' or 'circularity' are used in this study, they refer to the concept as defined above. This definition captures the element of circularity most relevant for this study: policies that keep products and materials in use for longer periods.

Waste hierarchy, recycling and second-use

There are different ways of keeping products and materials in use for longer periods, not all of them equally beneficial from a circular perspective. The *waste hierarchy* is a method of ordering these different options from most to least beneficial.

Figure 1. The waste hierarchy[2]



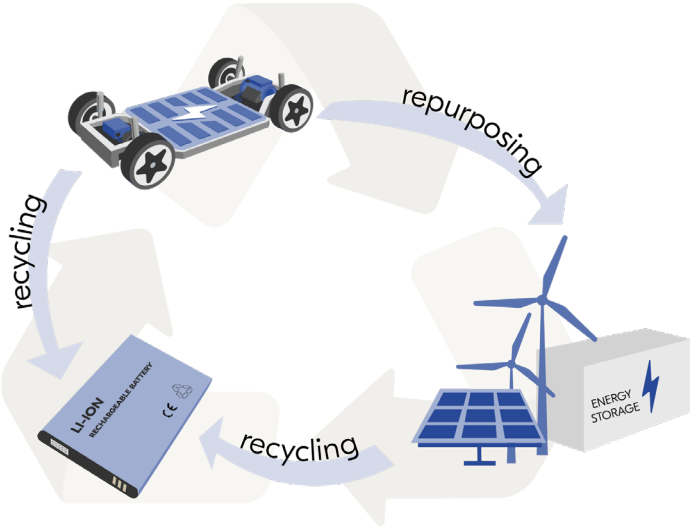
Per the waste hierarchy, re-using a product first is better than immediately using it for energy recovery by way of incineration in a waste-to-energy plant.[3]

1 The Ellen McArthur Foundation, 'What is a circular economy?', May 2022,
2 European Commission, Waste Framework Directive, May 2022,
3 See, for example, the EU Waste Framework Directive (Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives).

All the different options in the waste hierarchy could be relevant in the case of li-ion batteries. For example, the first and most beneficial step, prevention, might mean implementing regulations that require battery manufacturers to use fewer critical materials in the manufacturing process or design batteries in such a way that they are more easily recyclable.

In this study, however, we will focus on second-use and recycling, as these options are the most relevant for the trade and trade-related rules we analyse. These two options also elegantly illustrate the benefits of cross-border trade in used batteries.

Figure 2. Recycling and repurposing



A li-ion car battery could be repurposed as energy storage in a renewable energy system or it could be recycled, and the recovered materials used to produce a new li-ion battery.

Per the waste hierarchy, a second-use option such as repurposing is more environmentally friendly and thus a better option than immediate recycling. Recycling also often results in an unavoidable degradation in material quality.[4] In the case of batteries, however, a conflict of aims between second-use and recycling may exist, as detailed in section 2.1 below.

Box 1. Second-use and recycling

Second-use

Includes options such as re-use and repurposing. Extending the lifespan of a product that has reached end-of-life or been discarded, by means of a second use. For example, a li-ion battery used in an electric vehicle might later, with some modifications, be repurposed for energy storage in a renewable energy system.

Recycling

Recovering materials from a product that can be used in the manufacture of other products. For example, valuable metals can be extracted from a discarded li-ion battery and used in the production of new li-ion batteries.

4 International Energy Agency (IEA), *Global EV Outlook 2020* (2020), 194; Organisation for Economic Co-operation and Development (OECD), *Resource efficiency, the circular economy, sustainable materials management and trade in metals and minerals* (2021), 11.

The first steps of the circular process are the same for both second-use and recycling: collection and transportation to sorting facilities. The relevant international rules normally only differ between new and used products, and only rarely between the end purposes of second-use or recycling.

Battery electric vehicles and internal combustion engine vehicles

An internal combustion engine (ICE) is still the most common way of powering a vehicle. In this study, the term ICE vehicles refers to vehicles running primarily on fossil fuels, though some internal combustion engines also run on renewable fuels like biodiesel.

A battery electric vehicle (BEV) is instead wholly powered by electricity from an onboard battery.

1.4 Scope and limitations

The focus of this study is the **international trade and trade-related rules** that govern the trade in used **industrial li-ion batteries**. In the following sections, we will expand on what we mean by international trade and trade-related rules and on the important role industrial li-ion batteries play in the transition to a more sustainable economy.

1.4.1 International trade and trade-related rules

We use the terms international trade and trade-related rules to include rules that might not normally be considered part of international trade law, but that nonetheless have a significant impact on the international trade in used li-ion batteries.

The input we gathered from businesses and our review of prior publications indicates that the rules governing the trade in waste and the transport of dangerous goods greatly affect the used li-ion batteries trade. We have therefore chosen these rules as the focus of this study, even though they are usually seen as belonging to other areas of law than international trade, such as international transport law or environmental law.

There are, of course, many other trade and trade-related rules that affect the trade in used batteries besides those chosen as the focus of this study. International trade and circularity are broad and growing fields, and the recommendations we offer in this study are not intended to prejudge ongoing and future discussions on batteries and circularity in other important areas chiefly outside the scope of this study.

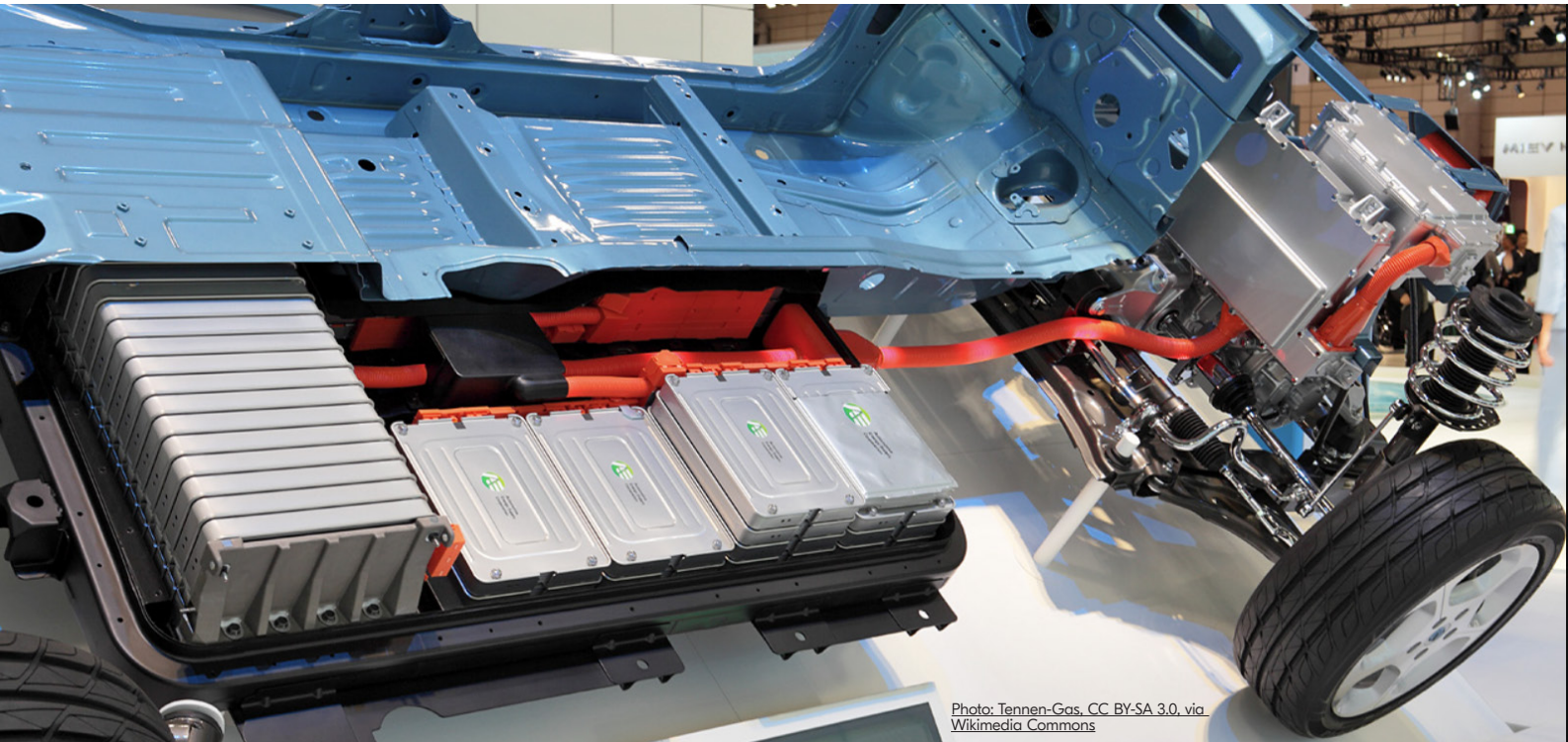


Photo: Tennen-Gas, CC BY-SA 3.0, via Wikimedia Commons

Finally, the scope has been narrowed to focus on international rules as opposed to domestic, although we do touch upon the domestic implementation of international rules.

1.4.2 Industrial li-ion batteries

Industrial li-ion batteries were chosen as the subject of this study due to the key role they play in the expansion of renewable energy and the electrification of transportation, two processes that are in turn important for reducing greenhouse gas (GHG) emissions.

Box 2. Li-ion battery technology

Li-ion batteries have the highest energy density of any battery technology currently on the market, can deliver large amounts of power and energy for high-power applications compared to other technologies, and are comparatively low maintenance. However, they are also costly, suffer from safety issues related to overheating, and are subject to aging, meaning they lose capacity and frequently fail after a number of years.

Li-ion batteries are today ubiquitous and are found in everything from mobile phones to aircraft.

Source: Clean Energy Institute (University of Washington), 'Lithium-ion Battery', March 2022

The subject example referred to throughout the study is a li-ion battery that is mostly intact. Li-ion batteries intended for recycling, however, may also be crushed and processed into an intermediate material called 'black mass'. This material usually contains high amounts of valuable metals that can be used in the production of new batteries. The same trade and trade-related rules (and, as we will describe later in this study, the same issues related to those rules) apply whether a li-ion battery is sent across a border mostly intact or in the form of black mass, though the exact classification of the item made under those rules may vary.

Further, we use the term *industrial* to signify larger batteries used for commercial purposes such as storage in renewable energy systems or to power electric vehicles, which differ from the smaller batteries used in consumer electronics such as mobile phones (unless otherwise specified, the term 'li-ion battery' as used in this study refers to the industrial type). Again, it is the same set of trade and trade-related rules that are relevant regardless of size, but industrial batteries have uses that are particularly important for sustainability.

Electrification of transportation

The transport sector accounts for about 14 per cent of global GHG emissions, with passenger road transport representing the largest share. Within the EU, transportation accounts for about 20 per cent of GHG emissions and the sector is the main cause of air pollution in urban areas.[5]

BEVs emit fewer GHGs on average than ICE vehicles. While the carbon footprint of producing a BEV is generally bigger than that of an ICE vehicle,[6] this disparity is 'compensated' by lower emissions in use. A BEV entirely fuelled by zero-GHG emission electricity

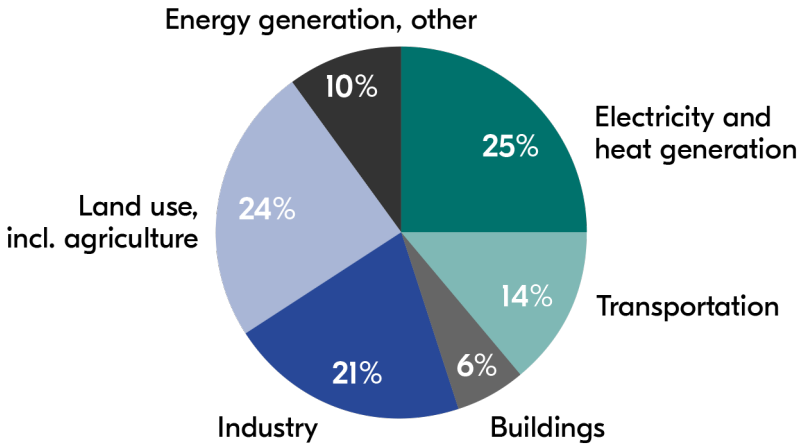
5 United States Environmental Protection Agency (USEPA), 'Global Greenhouse Gas Emissions Data', March 2022, World Economic Forum (WEF), Paving the Way: EU Policy Action for Automotive Circularity (2021); European Commission, 'Transport emissions', March 2022.

6 Circular Economy Initiative Deutschland, Resource-Efficient Battery Life Cycles – Driving Electric Mobility with the Circular Economy (2020), 19.

is 3 to 4 times less emission intensive per km than a comparable ICE vehicle.[7] The electrification of transportation can also help improve local air quality, as BEVs do not produce some of the toxic emissions associated with ICEs.[8]

The share of BEVs in the global vehicle fleet is set to greatly increase in the coming decades, driven mainly by public incentives and legislation, and this increase could enable the decoupling of increased transport needs and increased GHG emissions.[9] Projections indicate that li-ion battery technology is likely to continue to dominate the market for BEVs, since although there are alternative technologies, none have yet been used in real-life conditions in commercial electric vehicles.[10]

Figure 3. Global GHG emissions



Together, electricity and heat generation, along with transportation, account for more than a third of global GHG emissions. According to the Intergovernmental Panel on Climate Change, GHG emissions caused by human activity need to be cut almost in half from 2010 levels by the end of this decade for the world to achieve the goal of limiting global warming to below 1.5 °C.[11]

Expansion of renewable energy

Electricity and heat generation account for about 25 per cent of global GHG emissions, with electricity generated by coal, natural gas or oil being the single largest source of GHG emissions globally.[12] In most markets, electricity generation is shifting towards intermittent renewables such as wind power and solar power, which generate far lower GHG emissions during use.

The intermittent nature of these renewable energy sources, however, requires balancing solutions that can address issues of oversupply (such as during periods of strong winds) and undersupply (when the wind drops). Li-ion batteries are in many ways an ideal balancing solution and, according to a study by the WEF,[13] are expected to be the dominant

7 Global EV Outlook 2020, 190.

8 WEF, *A Vision for a Sustainable Battery Value Chain in 2030 - Unlocking the Full Potential to Power Sustainable Development and Climate Change Mitigation* (2019), 13.

9 Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020.

10 Global EV Outlook 2020, 187.

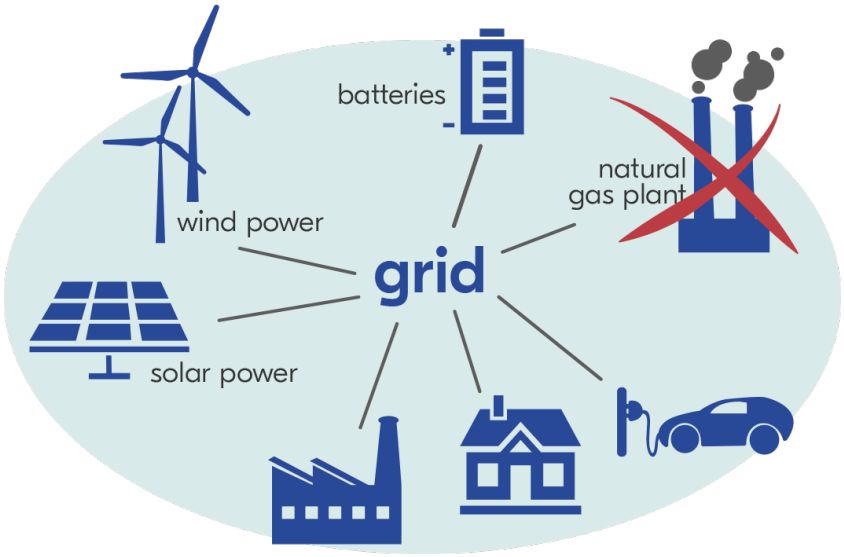
11 USEPA, 'Global Greenhouse Gas Emissions Data'. Intergovernmental Panel on Climate Change, *Special Report - Global Warming of 1.5 °C* (2018).

12 USEPA, 'Global Greenhouse Gas Emissions Data'.

13 Sustainable Battery Value Chain in 2030.

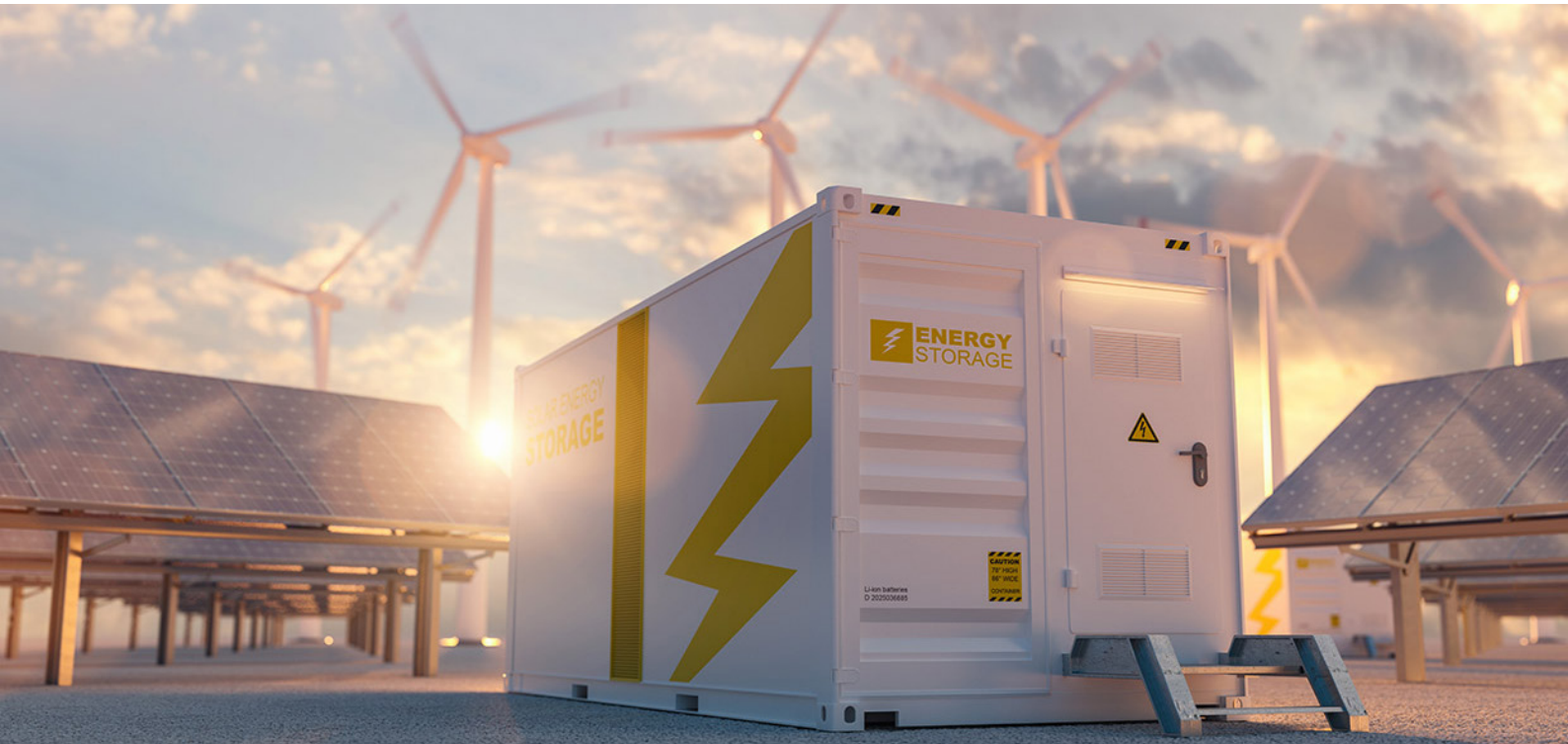
solution in the near future. The most common currently used solution to managing periods of increased load is the use of natural gas power plants.[14] Switching to batteries would therefore further contribute to lowering GHG emissions.

Figure 4. Renewable energy grid



The ongoing electrification of other sectors, such as transportation, will place even greater demand on electricity grids at certain hours, making balancing solutions even more important.[15]

14 University of Calgary, 'Energy Education (Peaking power)', March 2022
15 Teknikföretagen, *Vägen mot elektrifiering* (2020), 10; Sustainable Battery Value Chain in 2030, 14.



2 Trade and the circular economy

Our economy has traditionally followed a linear *take-make-waste* approach. When a product reaches its end-of-life, our main concern has been how to safely dispose of it. More than 90 per cent of the 100 billion tonnes of resources consumed each year are eventually discarded in landfills or incinerated.[16]

Today, there is a growing awareness of the value to be found in end-of-life products and the benefits of transitioning to a circular economy. As we will detail in this section, trade is an important tool for realising the benefits of circularity and enabling circular initiatives such as *take-back schemes*.[17]

A take-back scheme is where manufacturers (who are sometimes required to do so by law) take back batteries that have reached their end-of-life so that these can have a second-use or be recycled. Take-back schemes for BEV batteries exist in different forms in several European countries, such as Norway and the Netherlands, and they feature in the ongoing process to replace the EU Battery Directive with a new battery regulation.[18]

The case of electric vehicle batteries illustrates the importance of such schemes, and the importance of well-functioning trade in enabling the schemes to work as intended.

BEVs are still a comparatively new product and few batteries have currently reached their end-of-life. In 2019, only about half of all available end-of-life li-ion batteries (about 100,000 tonnes) were recycled, with batteries from BEVs representing only a small share of the total.[19] This affects the economic viability of recycling facilities, as they require major capital investment, though it also means they benefit from economies of scale.

Box 3. Second-use and recycling

Global recycling capacity is currently concentrated in Asia, with China by far the largest market for recycling li-ion batteries. Ordered by highest quantity of li-ion batteries recycled, China is followed by South Korea, the EU, the United States, Canada and then Japan. Malaysia, Indonesia, the Philippines and Singapore are growing markets for li-ion battery recycling, though more batteries are still recycled in China than the rest of the aforementioned countries combined.

Local recycling capacity is insufficient in some parts of the world, although global recycling capacity outstrips demand, and the competition for batteries to recycle can be very high.

International trade can promote economies of scale by giving companies access to a larger supply of discarded batteries than they would have access to if they only relied on domestically or regionally available waste batteries. With access to a larger supply, it would be

16 Barrie Jack et al, *The role of international trade in realising an inclusive circular economy* (2022), 6.

17 Also called Extended producer responsibility (EPR), as the responsibility of the manufacturer is extended to parts of the life cycle of the product.

18 Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020. Propulsion Québec, *Study of Extended Producer Responsibility for Electric Vehicle Lithium-Ion Batteries in Quebec* (2020), 31.

19 Svenska Miljöinstitutet (IVL), *Hållbar elektromobilitet* (2020), 31; Energimyndigheten, *State-of-the-art in reuse and recycling of lithium-ion batteries* (2019), 13.

possible for companies to more quickly recover the initial costs associated with setting up recycling facilities.

There are also other ways in which trade can contribute to circularity for li-ion batteries. For example, trade can increase global recycling rates and make recycling more efficient by moving trade flows to places where there is a comparative advantage in recycling in terms of cost, quality, skills and other location-specific advantages [20], and by disseminating best practices and new technologies related to recycling.[21]

As many countries lack adequate recycling facilities, trade can help address the problem of improper battery disposal. Even when batteries end up in a well-regulated local landfill, they represent lost value that could instead have been exported to a facility that could either have repurposed the batteries or recycled them.

Trade could also help alleviate the local capacity problems currently facing the recycling industry.[22] This is especially important for companies that face requirements for recycling or second-use (such as mandatory take-back schemes), but where local capacity is insufficient. Businesses providing input to this study have highlighted this problem and see trade as necessary to be able to fulfil recycling mandates.[23]

While few EV batteries have currently reached their end-of-life, this will soon change. By 2030, more than 1.6 million tonnes of used li-ion batteries could enter the recycling market (with half of that coming from EVs), far outstripping current global recycling capacity.[24] Global recycling capacity would have to greatly increase to fully realise the benefits of a circular economy and trade can play an important, enabling role in the growth of the industry. The current situation also offers a window of opportunity to put in place enabling trade policies sooner rather than later, before capacity problems are compounded.

20 World Trade Organization, Trade Policies for a Circular Economy: What can we learn from the WTO experience? (2020), 8.

21 OECD, International Trade and the Transition to a More Resource Efficient and Circular Economy: A Concept Paper (2018), 13.

22 Interviews and business input.

23 Interviews and business input.

24 OECD, Trade Policies to Promote Circular Economy: A Case Study of Lithium-Ion Batteries (2022), 4 and 9.

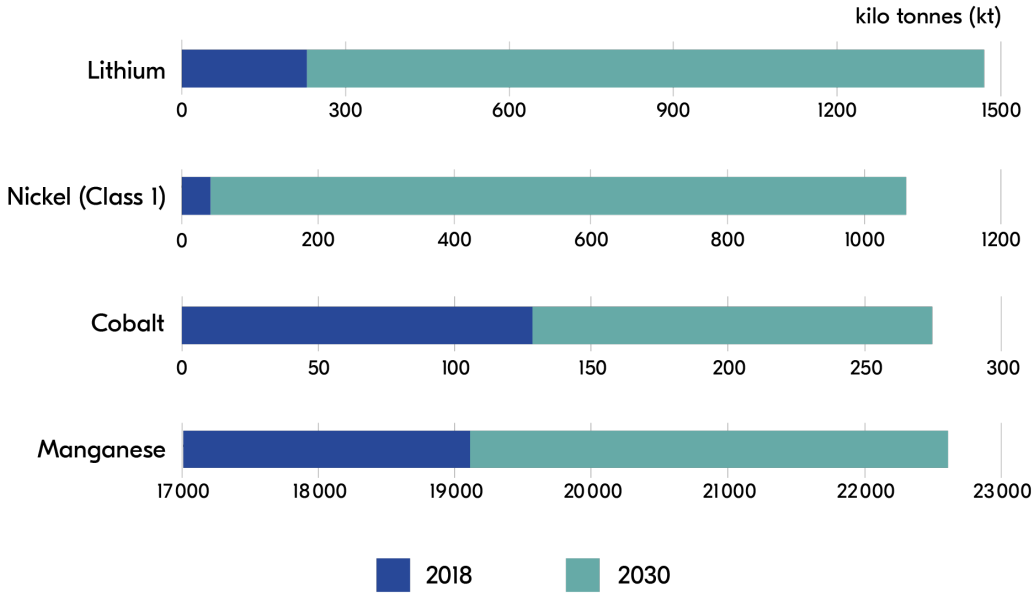
2.1 Benefits of circularity

In the previous section, we detailed how trade can support a circular economy for li-ion batteries. In this section, we will describe some of the benefits of circularity, focusing on second-use and recycling as the two options most relevant for the case of trade and trade-related rules affecting the used li-ion batteries trade.

Meeting the growing demand for natural resources

The electrification of transportation and the expansion of renewable energy are two processes that will greatly increase the demand for batteries. The WEF estimates that to keep pace with growing demand, battery production will have to scale up by a factor of 19 by 2030.[25] As the demand for batteries grows, so too does the demand for several metals critical to their production, including lithium, nickel, cobalt and manganese. By 2030, demand for these metals is projected to have increased several times over.

Figure 5. Estimates of total global demand for critical metals[26]



Total global demand in kilo tonnes per year for 2018 and estimated demand in 2030. According to similar estimates, the amount of cobalt and lithium required solely to produce EV batteries in 2030 would be greater than the current total demand for all applications.[27]

Failing to meet the growing demand for these metals risks hampering electrification efforts, putting climate goals further out of reach.

At the same time, there are environmental and social concerns related to mining. Globally, the extraction and processing of natural resources accounts for 50 per cent of all GHG emissions and 90 per cent of biodiversity loss.[28] Mining of some of the metals required for li-ion batteries is concentrated in a few key countries, some of which may lack proper environmental oversight and labour standards.

25 Sustainable Battery Value Chain in 2030, 29.
26 Sustainable Battery Value Chain in 2030, 21.
27 Hållbar elektromobilitet, 19.
28 The role of international trade, 6; United Nations Environment Programme, *Sustainable Trade in Resources: Global Material Flows, Circularity and Trade* (2020), 38.

One example is the Democratic Republic of Congo, home to about 70 per cent of all currently mined cobalt. While this is an important industry, sustaining 10 million people and accounting for 80 per cent of exports,[29] concerns have been raised about hazardous working conditions, forced labour, and even child labour.

Even where mining is carried out in an environmentally and ethically sound manner, there could be supply chain risks related to the geographically concentrated industries. About 99 per cent of all lithium is found in just four countries: Argentina, Australia, Chile, and China. China also accounts for 60 per cent of the world's supply of refined cobalt.[30] South Africa contains about 80 per cent of all manganese deposits, the mining of which requires large areas of land and may release airborne contaminants.[31]

Recycling and second-use as alternatives and additions to extraction

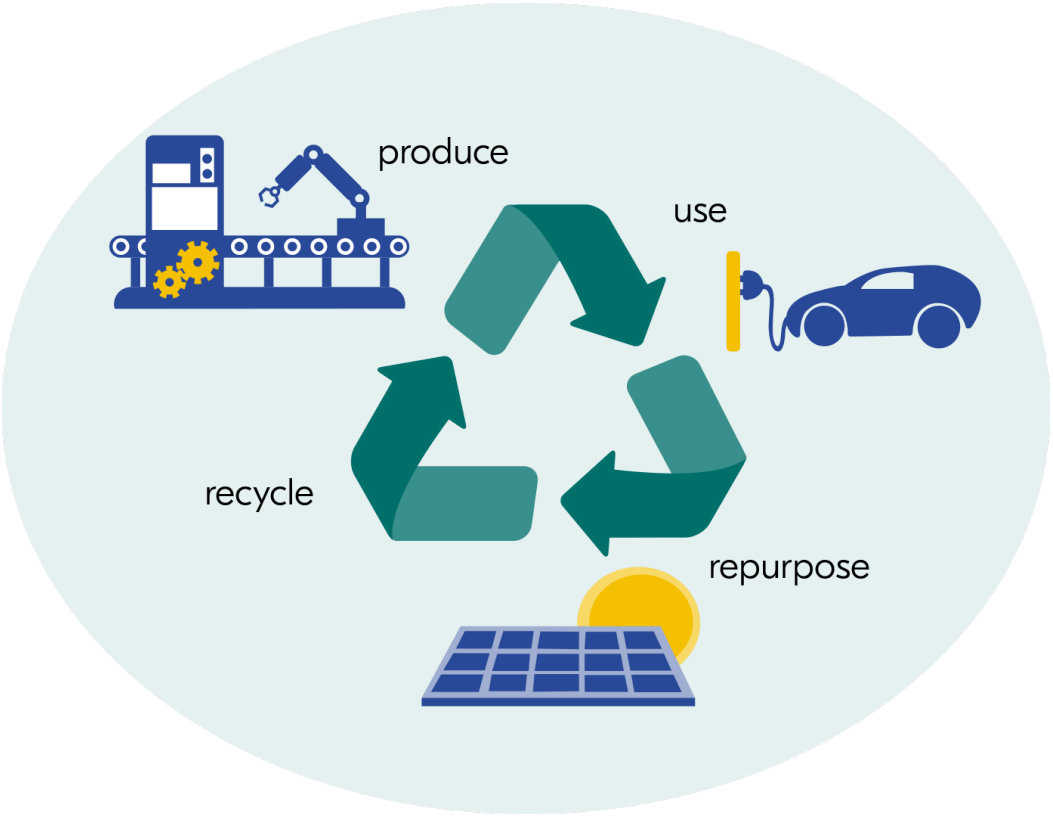
Critically important metals such as cobalt can be **recycled** to a much larger extent than they are at present.[32] The production of secondary raw materials (as opposed to primary raw materials from mining) generally involves less energy-intensive processes, and therefore fewer GHG emissions.[33] The actual emissions output would depend on both the recycling process used (especially the energy input) and the material composition of the batteries.[34] One study indicated that recycling EV batteries could save approximately 1 kg of CO2 equivalent per kg of batteries recycled.[35]

Battery recycling can still be an energy intensive process, however, and recycling plants would need to be powered by zero-emission sources such as renewable energy if recycling is to have the greatest possible impact on overall GHG emissions. Recycling can also produce contaminated wastewaters, though most recycling processes would result in fewer negative effects on the local environment than mining.[36]

Li-ion batteries can also be **repurposed** before they are recycled. Batteries used for EVs require a higher efficiency than many other applications and are discarded when their efficiency becomes too low. At that point, the batteries can still be used in other less energy-intensive applications, such as renewable energy grids. After use in an electric vehicle, a li-ion battery could still be used for another 5 to 15 years in such applications.[37]

29 Sustainable Battery Value Chain in 2030, 16.
30 Sustainable Battery Value Chain in 2030, 21.
31 Ibid.
32 Hållbar elektromobilitet, 18.
33 OECD, *International Trade*, 7.
34 Global EV Outlook 2020, 195.
35 Kommerskollegium, *Trade Barriers to Goods and Services Important for Climate Action*, 2020, 23.
36 Rinne Marja et al, *Simulation-based life cycle assessment for hydrometallurgical recycling of mixed LIB and NiMH waste*, Resources, Conservation & Recycling (no. 170, 2021).
37 Global EV Outlook 2020, 196.

Figure 6. Li-ion battery uses



Li-ion batteries play a key role in both the expansion of renewable energy and the electrification of transportation, and a battery from an EV can be repurposed for use in a renewable energy grid.

Like recycling, the manufacturing of batteries can also be an energy-intensive process. Producing a BEV generally results in more emissions than producing a similar ICE vehicle, due in no small part to the battery production process. A study by the OECD estimates that GHG emissions from the manufacturing of BEVs could be lowered by 14 per cent to 23 per cent by 2040 if the vehicles' li-ion batteries are recycled.[38]

Recycling also provides new material flows that could mitigate the risks to supply chains from the geographically-concentrated mining of virgin resources. Recycling could provide an important, diversified source of raw materials.[39] By some projections, recycling could supply at least 28 per cent of demand for new battery materials by 2040, although these projections assume recycled batteries are not first repurposed.[40]

38 Trade Policies to Promote Circular Economy, 4.
39 Harper et al, Recycling lithium-ion batteries from electric vehicles (Nature anniversary collection, 2019), 75.
40 Trade Policies to Promote Circular Economy, 4.

Box 4. Recycling versus second-use of li-ion batteries

According to the waste hierarchy introduced in section 1.3, second-use is preferable to immediate recycling. At the same time, recycling operations favour economies of scale and require a large amount of input to be attractive to investors or even profitable. Following the waste hierarchy could then result in there being fewer batteries available for recycling, in turn making it more difficult to run recycling operations and inhibiting the growth of the industry.

Consequently, the waste hierarchy might not be appropriate in the case of li-ion batteries, and some researchers have argued that batteries should be immediately recycled.*

While this is an issue for the industry, it is less of an issue when it comes to trade policy. Trade and trade-related rules would normally cover both second-use and recycling, as the activities covered are the same, regardless of whether the end destination is a facility for repurposing or recycling.

As will be detailed in this study, the best option from a trade policy perspective would be to remove unnecessary trade barriers to the trade in used li-ion batteries for both purposes and to use other policy tools to address any conflict between second-use and recycling.

*) Global EV Outlook 2020, 194; Recycling lithium-ion batteries, 75.

Many recycling processes are labour intensive, requiring qualified personnel and specialised tools, and expanding the recycling industry could provide additional benefits by creating employment opportunities.[41] As batteries can be dangerous when improperly handled, these benefits should be balanced against the risk of workers being exposed to hazardous materials in countries where workplace safety laws may be lacking.

41 OECD, International Trade, 34; Hållbar elektromobilitet, 31. Recycling lithium-ion batteries, 75.

3 Barriers to trade in used li-ion batteries

To fully realise the benefits of circularity in li-ion batteries, it is important that trade policy enable and support the trade in used batteries. As we will illustrate in this section of the study, however, the rules governing the used li-ion batteries trade are largely adapted to the linear *take-make-waste* approach.

Our analysis, based on input from companies and industry organisations, as well as a review of prior studies and publications, identifies two sets of rules as being the most relevant for the used li-ion batteries trade:

- Rules governing *trade* in waste, namely the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (**Basel Convention**).
- Rules governing the transport of waste, namely the Agreement concerning the International Carriage of Dangerous Goods by Road (**ADR**), the Convention concerning International Carriage by Rail (**COTIF**), and related agreements covering transport by sea and air.

The following sections will detail these rules and describe their impact on the used batteries trade. Although there is some overlap between the different rules, each set of rules will be covered separately.

3.1 The Basel Convention and trade in waste

The Basel Convention was created in reaction to incidents of waste dumping. In the 1980s, as waste disposal costs increased significantly in the developed world, some exporters turned to exporting waste to developing countries, especially countries in Africa, as a cheaper option.[42] This led to waste being dumped at sites with insufficient monitoring and inadequate processing facilities, with resulting negative consequences for the environment and human health.

Following public outcry about these incidents, 53 countries and the European Economic Community negotiated and later signed the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal*. The Convention currently has 189 signatories and has been implemented through national legislation in many countries. Notably, however, the Convention has not been ratified by the United States, the third largest producer of waste in the world. [43]

Purpose of the convention

The aim of the Basel Convention, as per the preamble, is:

> *to protect, by strict control, human health and the environment against the adverse effects which may result from the generation and management of hazardous wastes and other wastes.*[44]

This mission has seen some success. In 2009, however, at the 20th anniversary of the adoption of the Basel Convention, the convention secretariat produced a report card indicating that illegal traffic in hazardous waste remained a serious concern, that the transboundary movement of hazardous waste continued to rise, and that many importing countries

42 Center for Strategic & International Studies, 'The Basel Convention: From Hazardous Waste to Plastic Pollution', March 2022

43 Basel Convention, 'Overview', March 2022. Information on parties and signatories to the convention is available at the Basel Convention website.

44 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, Preamble.

still lacked sufficient recycling capabilities, resulting in waste being dumped at landfills instead of being recycled.[45]

The Basel Convention and the trade in used batteries

The Basel Convention regulates the trade in used li-ion batteries to the extent that any such trade is covered by a few important definitions, namely *transboundary movement* and *waste*, which is divided in turn into *hazardous waste* and *other waste*.

Box 5. Is the Basel Convention applicable?

Transboundary movement?

☑ The waste shipment must involve at least one country that is party to the Convention.

☑ The contents of the waste shipment must be intended for disposal (including recycling) as defined by the Convention.

Hazardous waste or other waste?

☑ The waste must be considered either hazardous or listed in Annex II (i.e., considered 'other waste').

- In addition, to be considered hazardous it must be listed in Annex I or Annex VIII and have one or more characteristics from Annex III or be considered as hazardous waste per the domestic legislation of one of the parties involved.

The scope of the definitions that determine the applicability of Basel Convention rules are found in the text of the Convention and its annexes. For a more detailed analysis of these rules, see Annex I of this study.

Should a shipment of hazardous waste or other waste be covered by the Convention, then the rules of the Convention would apply. The next step for any presumptive parties involved in the trade in used li-ion batteries is to understand these rules (keeping in mind that the actual rules any company would be obliged to follow would likely be domestic legislation implementing the Convention).

As a general obligation, parties should only allow waste export if the exporting state does not have the capacity to suitably dispose of the wastes itself, or if the waste is required as raw material input for recycling or recovery.[46] The latter requirement would normally be the case for the circular use of used li-ion batteries and could permit waste export. Assuming the Convention permits waste export, any trade in used li-ion batteries would face a number of prohibitions:

- ⛔ No export to and import from countries that are not parties to the Convention.
- ⛔ No export to parties which have prohibited imports of that type of waste.
- ⛔ No export unless the importing state and transit states consent in writing (i.e., **Prior Informed Consent**).[47]
- ⛔ No export if there is reason to believe the waste will not be managed in an environmentally sound manner.[48]

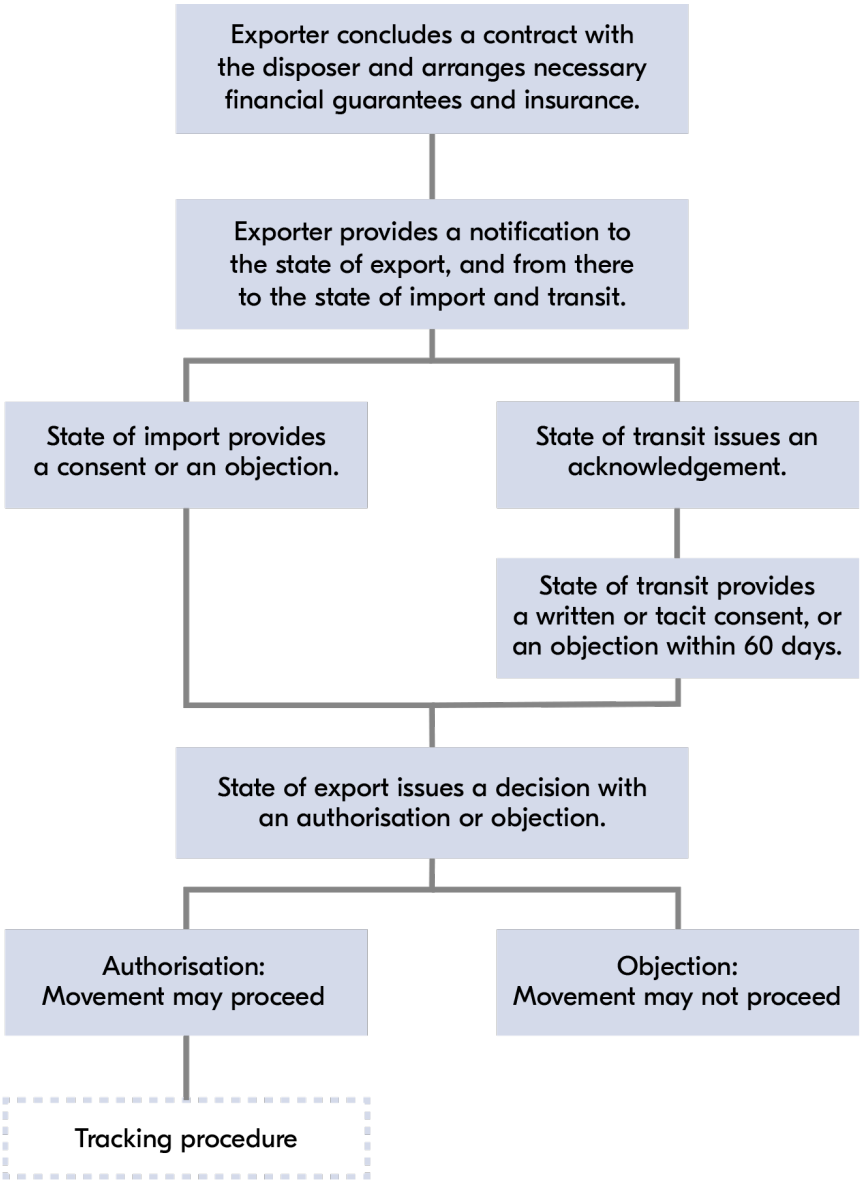
45 Basel Convention secretariat, *Report Card (November 2009)*; 'From Hazardous Waste to Plastic Pollution'.
46 Basel Convention, Art 4.9.
47 Basel Convention, Art 4, 6.
48 Basel Convention, Art 4.

If a shipment is not covered by the Convention, however, none of the rules (including PIC) would apply.

Prior Informed Consent

The PIC system can, according to businesses, be a very cumbersome procedure, requiring explicit consent in writing for a specific import. The competent authority of the exporting party must first provide a written notice to the competent authority of any other country involved in the proposed transboundary movement. That notice includes information on the reason for export, details on the exporter, the intended disposal site, insurance information, etc. Transporting waste to or through those countries is only permissible once written consent has been received.

Figure 7. PIC flowchart[49]



A flowchart adopted from the Singapore National Environment Agency showing the main stages of the PIC procedure.

49 Singapore National Environment Agency, 'Basel Convention Control Procedure', March 2022

There is an additional *Ban Amendment* in Annex VII of the Convention; the parties that have ratified the Ban Amendment are obligated to prohibit all transboundary movements of hazardous waste from OECD to non-OECD countries.[50]

Barriers to the trade in used batteries

The rules of the Basel Convention present several challenges for the companies involved in the trade in used batteries. The first, and perhaps foremost, is determining whether a shipment of used li-ion batteries falls under the scope of the Basel Convention and therefore must follow the rules and procedures stipulated therein. That is, whether a shipment of used li-ion batteries should be classified as hazardous waste/other waste, or as something else. Uncertainty regarding this classification means higher costs for the companies involved.[51] A shipment might be classified as hazardous waste in one or more countries of transit, but as non-waste in the destination country.[52] This lack of predictability is a major concern for businesses.[53]

Box 6. Examples

Examples from three convention member states and the United States of domestic legislation governing the trade in waste

China
According to Chinese law, any substance and article which has lost its original use values or is discarded or abandoned though has not yet lost use values or is included in the waste management system is classified as waste. Used li-ion batteries are likely considered to be waste unless they qualify for an exemption, such as being re-used under their original use without further repair/reprocessing or after being repaired/reprocessed at the place they were originally manufactured.

United States
In the United States, relevant legislation exists on both the state and federal levels. State legislation in California, for example, classifies waste li-ion batteries as hazardous waste. Under federal law, however, used li-ion batteries destined for re-use might not be considered waste at all, while batteries destined for recycling would be considered 'universal waste', and be subject to less stringent regulations.

Japan
In Japan, the definition of hazardous waste is based on the definition used in the Basel Convention.

Nigeria
In Nigeria there is no domestic legislation in place that implements the Basel Convention, and the constitution of Nigeria requires domestic laws to be enacted to implement any international agreements. Therefore, only general custom rules are likely to be applied to imports of used li-ion batteries.

These examples illustrate the divergence in rules governing the trade in waste.

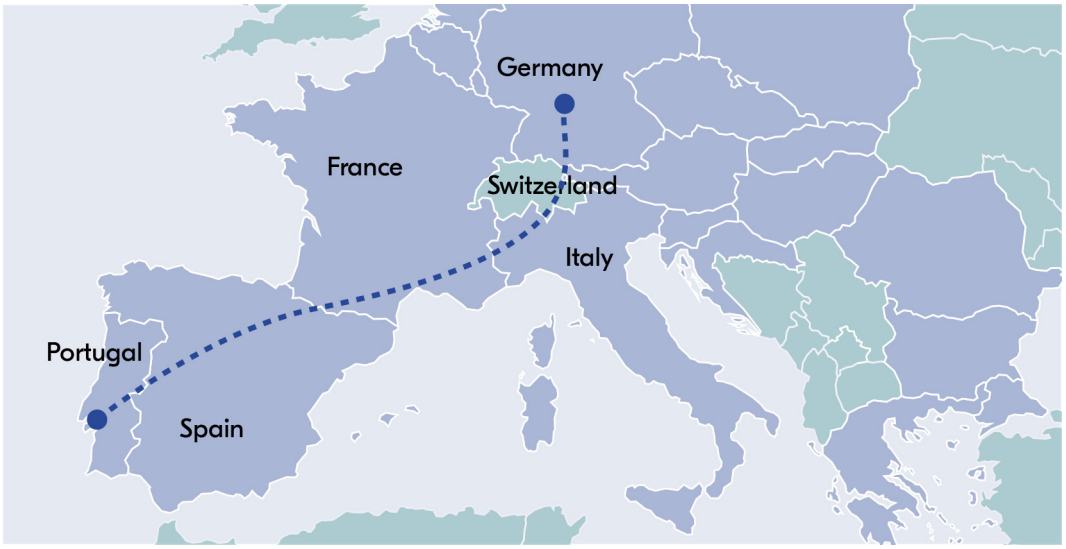
Source: WEF, Annex — Comparative Analysis of Legal Frameworks (2020), 15; Interviews and business input.

50 Basel Convention.
51 Interviews and business input.
52 WEF, *Facilitating Trade Along Circular Electronics Value Chains* (2020), 15.
53 Interviews and business input.

One North American company active in the recycling industry described this lack of predictability and these divergences as one of their primary challenges, especially where there are divergences concerning whether even non-damaged used li-ion batteries should be classified as hazardous waste. Trade in newly produced li-ion batteries is described by the same company as being 'comparatively easy'. A European recycling company also described the lack of uniform application of Convention rules as a major challenge to their business model.[54] A major European car manufacturer also identified the lack of predictability regarding the applicability of rules governing the trade in waste as a major concern.[55]

The Basel Convention provides a framework of rules, but as the examples above illustrate, the implementation of these rules differs between member states, as authorities in the countries involved in a transboundary movement, including transit countries, may have different views on how a shipment should be classified, and whether the Basel Convention is applicable. The problem with member states applying different classifications under the Basel Convention is found even within the European Union, despite the existence of the Waste Shipment Regulation. [56]

Figure 8. Transit within the single market



In this fictional example, a Portuguese exporter would need to know whether the Basel Convention applies to the shipment of used li-ion batteries in five different member states, as well as apply and wait for written consent from authorities in the same states, even though trade would take place within the European single market.

The result of these divergences is a system described by companies as being complex and imprecise, and a limiting factor for investment in repair, recycling, and second-use infrastructure.[57] This is especially unfortunate, as the recycling and second-use industries are already facing regional capacity problems, and recycling often requires large volumes of input to be profitable.

54 Interviews and business input.

55 Interviews and business input.

56 Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste. Commission Staff Working Document Evaluation of Regulation (EC) No 1013/2006 of the European Parliament.

57 Facilitating Trade Along Circular Electronics Value Chains; Naturvårdsverket, *Avfallskoder för litium-jonbatterier samt klassning av alkaliska batterier som farligt avfall* (2021), 34.

If the Convention is applicable, then the PIC system is applicable as well. This system is time-consuming and costly for the companies involved, and there is often uncertainty over both the length of processing time and whether consent will be given, further increasing costs.[58] One North American recycling company reported it taking almost 9 months to complete the necessary procedures to import used batteries from Europe. According to a European recycling company, the average processing time is almost 6 months, with costs of 6,500 USD per application to the authorities of each Convention state involved.[59]

Car manufacturers may put out a contract for battery recycling covering a regional market, allowing recycling companies to put in bids. But as the recycling companies cannot be sure beforehand whether the permits required to move the batteries will be approved, one recycling company described the process as 'putting in a bid and then hoping for the best when it comes to the permits'. [60]

Other administrative difficulties include the requirement that information sent to authorities in importing and exporting countries must match exactly; if any errors are made, the process must be restarted. Some companies interviewed for a study by the WEF also highlighted the risk of legal action if classifications are misinterpreted.[61]

Consent given for a shipment may also be time-limited. One North American recycling company highlighted the risk of delays in getting consent from all the authorities involved, or other required permits, resulting in a notice of written consent no longer being valid by the time the shipment is ready to leave.[62]

58 Facilitating Trade Along Circular Electronics Value Chains, 12.
59 Interviews and business input.
60 Interviews and business input.
61 Facilitating Trade Along Circular Electronics Value Chains, 15.
62 Interviews and business input.

3.2 The ADR/COTIF and the transport of waste

Alongside the Basel Convention, which governs trade in waste, we have international agreements which govern the transport of different goods, including waste.

The rules for the international transport of waste are directly referenced in the Basel Convention. Per Article 4.7(b) of the Convention, hazardous or other waste that is being transported across borders must be 'packaged, labelled, and transported in conformity with generally accepted and recognised international rules and standards in the field of packaging, labelling, and transport'.

In most scenarios involving used industrial li-ion batteries, this entails following the rules of one or more international agreements regulating the transport of dangerous goods:

- The *agreement concerning the International Carriage of Dangerous Goods by Road* (ADR), a United Nations treaty regulating road transport.
- The *Convention concerning International Carriage by Rail* (COTIF), of the Intergovernmental Organisation for International Carriage by Rail, regulating train transport.

There are agreements covering air and sea transport as well, but the input we received from companies active in the trade of used li-ion batteries concerned road and rail transport. The focus of this section will therefore be on those two transport methods, though the rules for transporting dangerous goods by sea are very similar, while transport by air is very rare.[63]

Purpose of the agreements

The rationale behind the creation of both the ADR and the COTIF is similar to that of the Basel Convention, as all three agreements aim to protect the environment and human health. Where the Basel Convention aims to prevent hazardous waste being dumped in developing countries, the ADR/COTIF focus on transport safety by way of preventing or mitigating dangerous incidents, such as transport accidents, that could have a negative effect on the local environment and human health. Like the Basel Convention, the ADR/COTIF have been implemented through national laws and regulations in many of the signatory states, and the rules of the two agreements on international transport are enforced by national authorities. [64]

The ADR has 52 signatories, including all of Europe and parts of Africa and Central Asia. The COTIF has 51 signatories, though not all of them apply the rules covering the transport of dangerous goods (found in Appendix C of the convention). However, these rules are applicable in nearly all of Europe, much of the Middle East, and parts of North Africa.

The ADR/COTIF and the transport of used batteries

The ADR and COTIF feature very similar language and follow largely the same structure.

The agreements prohibit the international transport of certain dangerous goods, while other dangerous goods may be transported only if the requirements in the agreements, regarding aspects such as packaging and labelling, are fulfilled.[65] A classification system listing dangerous goods categorised using different numbers is used by both agreements; the numbers can be cross-referenced with tables that indicate which requirements apply to the carriage of a particular dangerous good.

63 United Nations Economic Commission for Europe, 'About the ADR', March 2022.

64 Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR) (Vol 1), Territorial applicability.

65 ADR Art 2, Convention concerning International Carriage by Rail (COTIF), Appendix C, Art 1.

Figure 9. ADR/COTIF structure

3088	SELF-HEATING SOLID, ORGANIC, N.O.S.	4.2	S2	III	4.2	274 665	0	E1	P002 IBC08 LP02 R001	B3	MP14	T1	TP33
3089	METAL POWDER, FLAMMABLE, N.O.S.	4.1	F3	II	4.1	552	1 kg	E2	P002 IBC08	B4	MP11	T3	TP33
3089	METAL POWDER, FLAMMABLE, N.O.S.	4.1	F3	III	4.1	552	5 kg	E1	P002 IBC08 R001	B4	MP11	T1	TP33
3090	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9	M4		9A	188 230 310 376 377 387 636	0	E0	P903 P908 P909 P910 P911 LP903 LP904 LP905 LP906				
3091	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9	M4		9A	188 230 310 360 376 377 387 390 670	0	E0	P903 P908 P909 P910 P911 LP903 LP904 LP905 LP906				

P909 **PACKING INSTRUCTION** **P909**

This instruction applies to UN Nos. 3090, 3091, 3480 and 3481 carried for disposal or recycling, either packed together with or packed without non-lithium batteries.

(1) Cells and batteries shall be packed in accordance with the following:

(a) The following packagings are authorized, provided that the general provisions of 4.1.1 and 4.1.3, are met:

Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);

Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H2); and

Jerricans (3A2, 3B2, 3H2).

(b) Packagings shall conform to the packing group II performance level.

(c) Metal packagings shall be fitted with an electrically non-conductive lining material (e.g. plastics) of adequate strength for the intended use.

(2) However, lithium ion cells with a Watt-hour rating of not more than 20 Wh, lithium ion batteries with a Watt-hour rating of not more than 100 Wh, lithium metal cells with a lithium content of not more than 1 g and lithium metal batteries with an aggregate lithium content of not more than 2 g may be packed in accordance with the following:

(a) In strong outer packaging up to 30 kg gross mass meeting the general provisions of 4.1.1, except 4.1.1.3, and 4.1.3.

(b) Metal packagings shall be fitted with an electrically non-conductive lining material (e.g. plastics) of adequate strength for the intended use.

(3) For cells or batteries contained in equipment, strong outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3. Equipment may also be offered for carriage unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.

(4) In addition, for cells or batteries with a gross mass of 12 kg or more employing a strong, impact resistant outer casing, strong outer packagings constructed of suitable material and of adequate strength and design in relation to the packaging's capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3.

Two screenshots, the first showing one of the classifications applicable to li-ion batteries along with the associated packing instructions, the other showing an excerpt of one of the associated packing instructions.

The requirements are often quite specific, detailing how goods are to be packed and labelled. For example, packing instructions 908 and 909 list several requirements for damaged or defective li-ion batteries destined for recycling, among which are the following:

- Individually packed, each damaged cell or battery enclosed in an inner package of a leak proof container (such as a 'Ziploc' bag).
- Each inner package enclosed by thermal insulation material.
- Fitted with a venting device where necessary.
- Secured against movement.
- Enclosed in absorbent material where necessary.
- Packed in packaging that conforms to a certain performance level.
- Packed in different ways depending on fixed levels of watt-hour rating and weight.

The above is just one example illustrating the level of detail found in the ADR/COTIF. The exact requirements that would apply to a shipment of used li-ion batteries could still vary from member state to member state, as the packaging and label requirements stem from domestic laws and regulations implementing the ADR/COTIF.

For example, EU legislation[66] implementing the agreements adds further requirements to the transport of damaged or defective li-ion batteries destined for recycling, such as additional weight and quantity limitations, and makes some of the circumstantial ADR/COTIF requirements mandatory.

Barriers to trade in used batteries

When it comes to their effects on trade, the situation with the ADR/COTIF is similar to that of the Basel Convention in that businesses face requirements that are costly and cumbersome to fulfil. Unlike with the Basel Convention, however, there is no uncertainty regarding whether transport safety rules are applicable to shipments of used li-ion batteries.

The ADR/COTIF have been implemented differently in the signatory states and in some cases complemented with additional requirements, resulting in businesses having to adjust to several different sets of rules and requirements.

One study estimates that up to half of the total costs for the disposal of li-ion batteries may be from high transportation costs related to safety regulations. Even when it is possible to cover the costs, the specialised personnel and equipment necessary to fulfil transport requirements might not be available.[67]

One European battery manufacturing company highlighted the requirement for each cell or battery to be enclosed in an inner package of a leak proof container as being particularly cumbersome to fulfil. It meant having to open and re-seal each individual pack of batteries, making it difficult to automate handling and thereby reduce costs. [68] A recycling company with facilities located in two developed countries highlighted the issue of having to adjust to two different sets of rules on the transport of dangerous goods. In one of the countries, international agreements on the transport of dangerous goods were applicable, while in the other they were not, and the company instead had to follow differing domestic regulations.

Another concern raised by businesses is that it is almost inevitable, given their level of detail, that current regulations will conflict with advancements in battery technology. This issue will likely become more pressing over time. [69]

66 Directive 2008/68/EC of the European Parliament of the Council of 24 September 2008 on the inland transport of dangerous goods and Council Directive 94/55/EC of 21 November 1994 on the approximation of the laws of the Member States with regard to the transport of dangerous goods by road.

67 A Case Study of Lithium-Ion Batteries, 6.

68 Interviews and business input.

69 Interviews and business input.

4 Recommendations on how to facilitate the safe trade and transport of used li-ion batteries

The Basel Convention system can be both complex and costly, attributes that may serve as a limiting factor on both investment and trade. The reason for this can be traced back to the history and purpose of the Convention itself, which is not meant to encourage trade. The Convention was created in an era when the concept of the circular economy received very little attention. In fact, the Convention explicitly discourages trade in the hazardous/other wastes goods covered by the Convention.[70] As we have explained in previous sections, and in more detail in Annex I, that may include the trade in used li-ion batteries.

Like the Basel Convention, the ADR/COTIF present businesses with several trade barriers that can make trade more difficult and costly, thus slowing the transition to a circular economy. Differing and detailed regulations on how used li-ion batteries may be transported increase costs and time spent on administration.

When trade is made impossible or unnecessarily difficult and expensive, it makes the transition to a circular economy more difficult. For individual companies, it makes fulfilling recycling requirements difficult.

Few, however, would argue against the need for safety regulations. Indeed, some of the companies we have been in contact with specifically mentioned the positive aspects of having such regulations in place. Our recommendations in the following section on how trade and trade-related rules could better support the trade in used li-ion batteries are all based on the idea that circularity can be encouraged while ensuring high safety and environmental protection standards.

Simplifying trade procedures between trusted parties

One way to mitigate some of the issues with the Basel Convention would be to complement it with another agreement. Article 11 of the Convention allows parties to create other international agreements regulating the transboundary movement of waste, as long as they do not include provisions with a lower degree of environmental protection than the Convention. The most important such agreement is the *OECD Decision of the Council on the Control of Transboundary Movements of Wastes Destined for Recovery Operations* (OECD Decision).

The OECD Decision governs certain trade in waste between OECD countries and is to be implemented through national legislation in each member country. It only applies to waste that is destined for recovery processing, such as recycling.

The decision establishes a separate (but complementary to the Basel Convention) control system with two categories of waste:

- *Green wastes*, which are wastes that pose a low risk to human health and the environment. Shipments in this category are not required to follow the PIC system, greatly simplifying trade and lowering costs for the operators involved. Shipments are instead subject to the normal controls and border procedures required for international trade.
- *Amber wastes*, which are wastes that pose a higher risk and shipments of which follow a simpler and more streamlined version of the procedure stipulated in the Basel Convention.

70 Per Art 4.2(d), parties have an obligation to ensure trade in hazardous waste and other wastes is reduced to a minimum.

The Basel Convention is meant to discourage trade in certain wastes to prevent the kind of negative incidents that provided the impetus for its creation: hazardous waste being sent to developing countries which may lack both processing capabilities and proper enforcement of environmental standards. The OECD Decision, on the other hand, is based on a different perspective, as it aims to facilitate trade in recyclable waste.[71] The unwritten logic behind the Decision seems to be that the risk of waste being dumped is lower when it comes to trade between the developed economies of the OECD.

Although industrial li-ion batteries are generally not considered *green wastes*,[72] the OECD Decision provides a good example of how waste trade could be managed without compromising the aims of protecting human health and the environment that are at the core of the Basel Convention.

A similar approach could be taken to the trade in used li-ion batteries. Interested countries could agree to **simplify Basel Convention procedures** for all used industrial li-ion batteries, or only for used batteries of certain types or in a certain condition. This could feasibly be done within the existing framework of the OECD by amending the lists of wastes in the OECD Decision, but it could also be accomplished in the form of a new international agreement using language similar to the OECD Decision, an agreement that could potentially include non-OECD members as well.[73] Such an agreement could build upon the same basic premise as the Decision, encouraging trade between trusted partners where neither the enforcement of agreed international rules nor domestic laws on environmental protection are in question.

An advantage of creating a separate agreement would be the possibility of taking the idea of *green list wastes* further, by also including a list of **approved facilities**. These would be sites where the parties to the agreement have ensured that waste is delivered to, and processed in, a proper manner. Such an agreement could potentially include vetted sites in non-OECD member countries where much of global recycling and refurbishment capacity is located. The simplified export procedures used for 'pre-consented' facilities in the OECD Decision could be used as an inspiration.

Many issues need to be solved if such an experimental solution is to be viable, including how any inspections would work in practice, which party or parties would bear the costs

71 OECD, 'The OECD Control System for waste recovery', March 2022.

72 Interviews and business input; Input from Basel Convention national focal points; Avfallskoder.

73 Although such an agreement would likely require an amendment to the Ban Amendment in Annex VII of the Basel Convention, see section 3.1.

of the system, and which party would carry the ultimate legal responsibility for ensuring the rules are followed. The different methods applied to ensure that rules on sanitary and phytosanitary measures in trade agreements are enforced could be used as a source of inspiration, as could the novel enforcement mechanisms in the EU proposal for a regulation on deforestation-free products.[74]

Article 11 of the Basel Convention sets out two criteria for any alternative agreement on trade in waste:

- The agreement should not derogate from the *environmentally sound management* of waste required by the Convention.
- The agreement should not include provisions that are less environmentally sound than those found in the Convention, taking special note of the interests of developing countries.

Box 7. Environmentally sound management

Environmentally sound management is mentioned several times in the Convention, and is defined in Article 2.8:

> "Environmentally sound management of hazardous wastes or other wastes means taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes."

To address these requirements, any new agreement could include environmental protection criteria that precludes countries without robust domestic legislation on environmental protection from joining. Another option could be a separate system of control – for example, through third-party inspections of member states and facilities – to ensure environmentally sound management.

Figure 10. Options for the environmentally sound management of used li-ion batteries

There are several options available to ensure that any new agreement on hazardous waste guarantees high standards of environmental protection.

74 EUs proposal for a regulation on deforestation-free products

An optional agreement would not place any special requirements on developing countries. Furthermore, developing countries not participating could still benefit, as the initiative could contribute to lowering global GHG emissions by encouraging circularity. Also, it would be in the interest of developing countries that waste be recycled or repurposed rather than dumped in poorly regulated landfills on their territory.

Any new agreement or amendment to the OECD Decision would need to be the result of **careful balancing of the benefits of trade in used li-ion batteries and any environmental hazards posed by such batteries**. The OECD Decision illustrates that it is possible to strike a balance for some wastes. Whether the same is true for used industrial li-ion batteries – possibly only certain types or in a certain condition – is something that several parties, including environmental protection agencies, would have to weigh in on.

Simplifying transport regulations

Transport rules could be simplified while maintaining the same level of protection/safety. A point of departure would be to investigate whether transport safety regulations need their current level of detail, as there may be ways to draft regulations that allow operators more flexibility in their approach to aspects such as packing without compromising safety. Different packing methods that all conform to high safety standards might feasibly be recognised as valid through tests or mutual recognition schemes.

Such an investigative exercise would need to be performed in a format that allows dialogue between multiple stakeholders, including environmental protection agencies and affected industries.

Our recommendation is also that rules and regulations should, where possible, be technology neutral. This is especially important given the rapid advancement of battery technology.

Advancing fast-track procedures

Building on the idea presented above about using a green list of facilities and the OECD system of 'pre-consented' facilities, authorities could fast-track procedures for shipments of waste destined for vetted facilities.

Article 6.4 of the Basel Convention allows transit parties to use a method of *tacit consent*. Parties may waive the requirement for prior written consent, either in general or under certain circumstances, and replace it with a system whereby the transit party acknowledges receipt of the notification of a shipment and, unless it objects within 60 days [75], the shipment is allowed. This option could be used for shipments of used li-ion batteries.

Facilitating trade procedures for waste batteries

The administrative procedures associated with the Basel Convention, especially the PIC system, can be complex and costly for the parties involved, and serve as a limiting factor for investment in circularity. Some of these negative effects could be addressed through new trade facilitation measures.

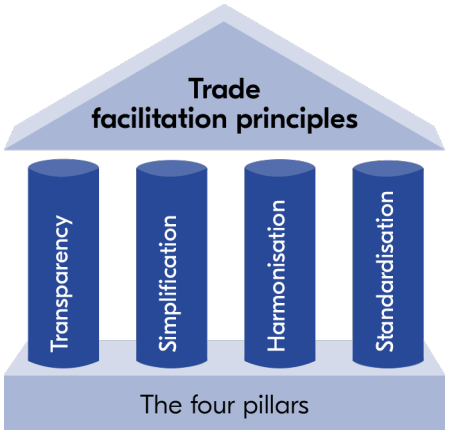
Trade facilitation measures aim to improve procedures associated with international trade, making trade faster and less costly, while still ensuring that legitimate policy objectives (such as environmental protection) are maintained. Often seen as 'win-win' measures, they can benefit the parties involved in trade through increased predictability and lower transaction costs. [76]

75 A similar 30-day procedure is used in the OECD Decision.

76 United Nations Economic Commission for Europe (UNECE), 'Trade facilitation — principles and benefits', March 2022.

The WTO Trade Facilitation Agreement provides a general baseline of trade facilitation requirements applicable to all trade in goods. As these requirements are mostly quite basic, and some of them vague, more specific and concrete measures based on best practices in trade facilitation could be implemented to improve trade procedures related to the trade in used batteries. The UN/CEFACT[77] trade facilitation recommendations[78] and the OECD Decision[79] could be used as sources of inspiration. Such measures should be based on the fundamental principles of trade facilitation: transparency, simplification, harmonisation and standardisation. They should take into account that an essential factor in achieving the principles of trade facilitation is full cooperation between governmental authorities and the business community.

Figure 11. Trade facilitation principles[80]



Facilitation measures should also build upon Articles 5 and 10 of the Basel Convention on international cooperation and the role of competent authorities and focal points.

Trade facilitation reforms can be adopted unilaterally by countries interested in promoting circularity, but it could also be possible to create a joint statement between interested parties that outlines commitments to trade facilitation reforms. Negotiations could take place within the WTO, where discussions on both trade facilitation and the circular economy are already taking place. A statement could be supplemented with offers of technical capacity building in developing countries to assist them in the implementation of the reforms.

Measures that simplify the administrative procedures involved in the trade in used batteries have been requested by businesses.[81] Such measures may be easier and faster to put into action than any new agreement complementing the Basel convention, especially if the measures are implemented unilaterally.

77 United Nations Centre for Trade Facilitation and Electronic Business.
78 UNECE, 'Trade Facilitation Recommendations', September 2022.
79 Both the green and amber procedures in the OECD Decision are streamlined when compared to the Basel Convention.
80 Kommerskollegium.
81 Vägen mot elektrifiering, 25; Facilitating Trade Along Circular Electronics Value Chains; Interviews and business input.

Harmonising and extending coverage

The application of the international rules on the transport of dangerous goods could be harmonised by aligning the working practices of national authorities in implementing these rules. There are already existing frameworks attached to the ADR/COTIF agreements for sharing best practices and, where necessary, these frameworks could be strengthened. As it may not be possible for a diverse group of countries to agree on a common understanding of the correct balance between safety and other concerns, harmonisation could initially be addressed on a regional or even bilateral basis. Reducing the number of different sets of rules that transport operators face would simplify transport and encourage trade.

An effort could also be made to increase the number of countries applying these rules, either through encouraging new signatories or through efforts that align domestic legislation with the international agreements. Such efforts would have the additional positive impact of addressing another issue highlighted by companies: having to follow stringent safety regulations should not be a form of competitive disadvantage.[82]

Finally, countries interested in promoting circularity could harmonise their classification of used li-ion batteries under the Basel Convention, such as by issuing joint technical guidance documents. Whether or not this would result in the trade in used li-ion batteries being covered by the Basel Convention, it would reduce uncertainty for businesses.

Working within existing forums

Both the Basel Convention and the ADR/COTIF include provisions that could be used as platforms for work on the trade in used li-ion batteries.

For the Basel Convention, this includes the high-level Conference of Parties meetings held regularly, a number of subsidiary bodies such as committees and working groups, and various partnerships. The next Conference of Parties meeting of the Basel Convention is scheduled to be held in May 2023, and one Convention working group has already advanced work on the collection of data related to waste li-ion batteries, [83] while another has been mandated to review the various annexes with the aim of increasing legal clarity.[84]

For the COTIF, this includes the Intergovernmental Organisation for International Carriage by Rail, where the General Assembly meets triennially (the next ordinary meeting will take place in 2024) to consider, among other things, amendments, but where a number of subsidiary bodies meet more frequently. There are several UN bodies tasked with developing and updating the ADR, and there are mechanisms in place for member states to sign complementary agreements.[85]

82 Interviews and business input.

83 Comparative Analysis of Legal Frameworks, 9.

84 Basel Convention, 'Annexes I, III, IV and related aspects of Annexes VIII and IX', March 2022.

85 UNECE, 'ADR Multilateral agreements', March 2022.

4.1 Three additional areas for recommendations

Based on input gathered from businesses and our review of prior studies, we can make additional recommendations as to how trade and trade-related policy can facilitate the trade in used batteries. We have categorised these recommendations into the following categories: **Market Access**, **Transparency** and **Data**.

Improved market access

If the benefits of the trade in used li-ion batteries are to fully materialise, recycling and second-use industries need access to markets around the globe. Market access for **services** can be secured through trade agreements that include non-discrimination and market access commitments for services related to recycling and repurposing. While the best outcome would be tied to including such services in multilateral negotiations at the WTO, commitments can also be made in ongoing negotiations on bilateral or plurilateral trade agreements, or unilaterally by interested countries. Discussions have already taken place in the WTO on new market access commitments for environmental services, and the EU includes commitments on recycling services in some free trade agreements.

To best promote circularity, any new commitments should include a wide range of services, going beyond recycling and environmental services and including the movement of natural persons. In our previous studies we have indicated that services are often tied to each other and to goods, and that companies increasingly offer packages consisting of both goods and services to customers. A holistic approach is therefore required to make the best use of trade policy instruments.[86]

Trade in used **goods** can be promoted by lowering tariffs and addressing non-tariff barriers (NTB). Although tariffs for waste li-ion batteries are low or at zero in a few countries, there is a potential to reduce costs related to tariffs in other countries with high recycling capacities (see Box 8).

In the WTO, the issue of NTBs on *remanufactured*[87] goods was raised as early as 2001 at the Ministerial Conference in Doha. While the trade in used batteries was not the focus of the discussions, they did reveal specific measures that hindered trade in remanufactured goods, such as requirements that imported remanufactured goods meet special tests or must be accompanied by special certificates.

A ministerial decision on the trade in remanufactured goods was proposed, but the initiative never took off. The decision would have included a definition of remanufactured goods, a call to improve market access for such goods and to avoid unnecessary NTBs, as well as the creation of a dedicated working group in the WTO.[88]

We have highlighted several compelling arguments for governments to focus on enabling the trade in used goods to support the transition to a circular economy. With these in mind, there is reason to revisit the ideas brought forward in the proposed ministerial decision on trade in remanufactured goods from 2001 and expand them to include repurposing and recycling as well. This could be done as part of the discussions on the circular economy already ongoing in the WTO Committee on Trade and Environment. A ministerial declaration or a joint statement could provide impetus to such discussions.

86 Kommerskollegium, *Making Green Trade Happen* (2014).

87 Remanufacturing is when a used product is restored to 'as new' status, through the use of re-used or repaired parts. See https://www.remanufacturing.eu/about-remanufacturing.php.

88 Trade Policies for a Circular Economy, 14.

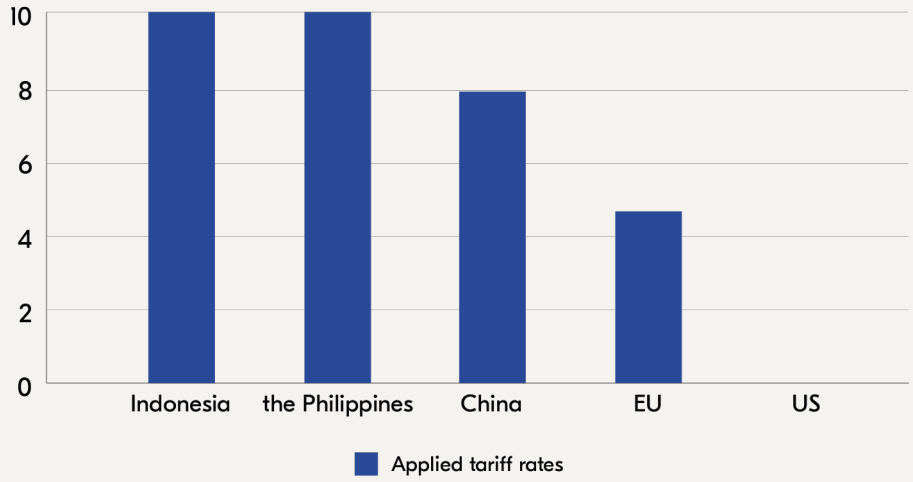
Box 8. Tariffs

A tariff is the classic example of a trade barrier. Tariffs increase the cost of trade through a direct added cost in the form of the tariff itself. Even relatively small tariffs can have a significant impact, as firms are often integrated into global value chains and tariff costs cumulate when goods cross borders several times.

The tariff rate applicable to a used industrial li-ion battery depends on how it is classified at the time of import. The determining factor once again becomes whether a used li-ion battery should be classified as waste, and if so, what kind of waste. Different kinds of waste are sorted under different tariff codes.

Countries with significant recycling industries generally apply medium to low tariffs on waste batteries. Some allow duty-free import of waste batteries.

Applied tariff rates for waste li-ion batteries 2022 (per cent)



Of the countries with the largest recycling capacity (see Box 3),* Indonesia and the Philippines appear to apply the highest Most Favoured Nation (MFN)** tariff rate on waste li-ion batteries at up to 10 per cent, followed by China at up to 8 per cent.*** Neither the US nor the EU appear to currently apply tariffs on waste li-ion batteries, although for the EU this is the result of temporary autonomous tariff suspensions (normally a rate of up to 4.7 per cent appears to apply).

Tariffs on non-waste batteries are generally slightly higher in the same set of countries. Malaysia applies a 20 per cent MFN tariff on non-waste li-ion batteries, the highest rate among countries with significant recycling capacity.

The tariff situation for non-waste batteries is analysed more closely in one of our previous publications: *Trade Barriers to Goods and Services Important for Climate Action — and opportunities for reform*. To fully harness the benefits of trade policy in supporting the transition to a circular economy, tariffs on batteries and the inputs used in the production of batteries should be lowered to encourage trade and circularity.

The tariff situation is also closely tied to the overarching used li-ion batteries classification problem — that is, whether they should be considered waste, hazardous waste or non-waste. Businesses have highlighted this issue,**** and our previous recommendations on harmonisation to remove legal uncertainty apply here as well.

Tariff codes could be clarified unilaterally, in concerted action with other countries, or even multilaterally through the World Customs Organization.

*) China, South Korea, the EU, Japan, Canada and the United States.
**) Most Favoured Nation
***) EU Access2Markets Database, May 2021.
****) Interviews and business input.

Transparency – a core issue

The WTO includes several trade transparency functions, such as the Trade Policy Review mechanism, where WTO members' trade policies are discussed at regular intervals. WTO members could make use of this mechanism both to highlight their own policies related to trade and circularity – including the trade in used batteries – and to bring attention to issues with other members' trade policies that may act as trade barriers to the trade in used goods.

Simply highlighting the obstacles facing the trade in used li-ion batteries is beneficial, as it improves understanding. Transparency and dialogue can also help build trust and confidence, both of which are key to making the trade in used goods work, given the legitimate concerns regarding safety and hazards to the environment.[89]

The key role of data

It is worth mentioning the key role of data in the technological innovations that could support the trade in used goods, such as digital product passports.

Lack of information on the material composition of used goods (especially batteries) is a major issue for the recycling and second-use industries, and having access to more complete information could significantly improve recycling and sorting processes.[90] More comprehensive information on the composition of a battery could be conveyed by digital passports utilising technologies such as QR codes or RFID tags on batteries and their components.[91]

Most digital solutions, such as QR codes, are reliant on the parties involved being able to share data. Implementing the trade facilitation measures for the trade in used batteries discussed above may also be contingent on operators being able to share data across borders.

There are legitimate concerns regarding both privacy and the protection of intellectual property rights on items such as battery cell chemistry that need to be considered, however, and that could motivate some trade-restrictive measures. That said, these issues can be taken into account and the proper safeguards created while still avoiding unnecessary trade barriers to data, such as local storage requirements. We have published a number of studies on the importance of data for trade, such as *No Transfer, No Trade – The Importance of Cross-Border Data* (2014) and *No Transfer, No Production – A Report on Cross-Border Data* (2015).

The key role that data plays and could play in the trade of used li-ion batteries also supports the recommendation made above: having a broad approach to liberalising market access for services related to recycling and second-use.

89 Trade Policies for a Circular Economy, 96.

90 Resource-Efficient Battery Life Cycles; Facilitating Trade Along Circular Electronics Value Chains.

91 Resource efficiency, the circular economy, sustainable materials management and trade in metals and minerals, 13; Recycling lithium-ion batteries from electric vehicles.

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Annex I. Applicability of the Basel Convention to the trade in used li-ion batteries

The Basel Convention regulates the trade in used li-ion batteries to the extent that any such trade is covered by a few important definitions, namely: *transboundary movement* and *waste*, divided in turn into *hazardous waste* and *other waste*.

Transboundary movement is defined as movement of hazardous or other wastes from one national jurisdiction to or through another, or to or through an area not under the jurisdiction of any state, as long as at least two states are involved.[92]

Waste is defined as any substance or object that is either disposed of, intended to be disposed of, or required to be disposed of by national law.[93] Disposal is defined by the operations listed in Annex IV, which are divided into operations that do not lead to resource recovery (such as disposal at a landfill) and operations that may lead to resource recovery, direct re-use, or alternative uses.

Hazardous waste is defined as 'wastes that belong to any category contained in Annex I, unless they do not possess any of the characteristics contained in Annex III' [94] as well as covering wastes that are defined as hazardous wastes by the domestic legislation of a party of export, import or transit.

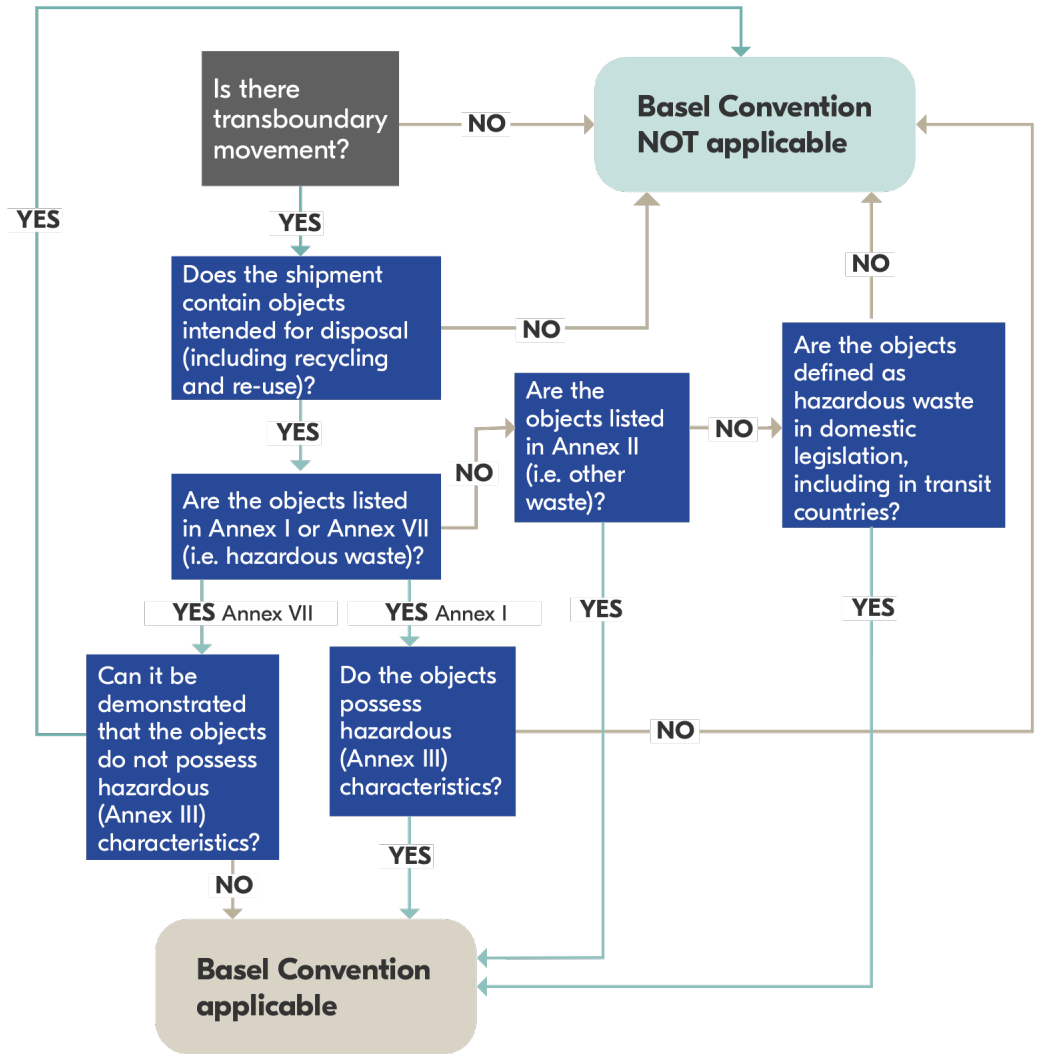
Other wastes are 'wastes that belong to any category contained in Annex II'. [95]

In determining whether the Basel Convention applies to the trade in used li-ion batteries, the focus turns to the content of the various annexes to the Convention. Annex I lists waste streams that are considered hazardous and constituents that can make waste containing them hazardous. Annex II lists other waste and Annex III contains a list of hazardous characteristics, such as being explosive or corrosive. The list in Annex III is non-exhaustive, and many countries have their own national tests that are applied to decide if any of the hazardous characteristics are exhibited.[96] There is also an Annex VIII listing presumptively hazardous wastes, but if it can be demonstrated in a specific instance that an item listed in Annex VIII is lacking an Annex III characteristic, it may be considered non-hazardous. Annex VIII is mirrored by Annex IX, which lists presumptively non-hazardous wastes not covered by the Convention, but which may still be subject to Basel Convention procedures if they contain Annex I materials that exhibit Annex III characteristics.

As the definitions above indicate, there are numerous considerations that must be taken into account when determining if the export of goods, such as used li-ion batteries, falls under the scope of the Convention.

92 Basel Convention, Art 2.3.
93 Basel Convention, Art 2.1.
94 Basel Convention, Art 1.1.
95 Basel Convention Art 1.2.
96 Comparative Analysis of Legal Frameworks, 8.

Figure A1. Basel Convention flowchart 1



A simplified flowchart illustrating some of the many considerations that need to be taken into account when determining if the Basel Convention is applicable.

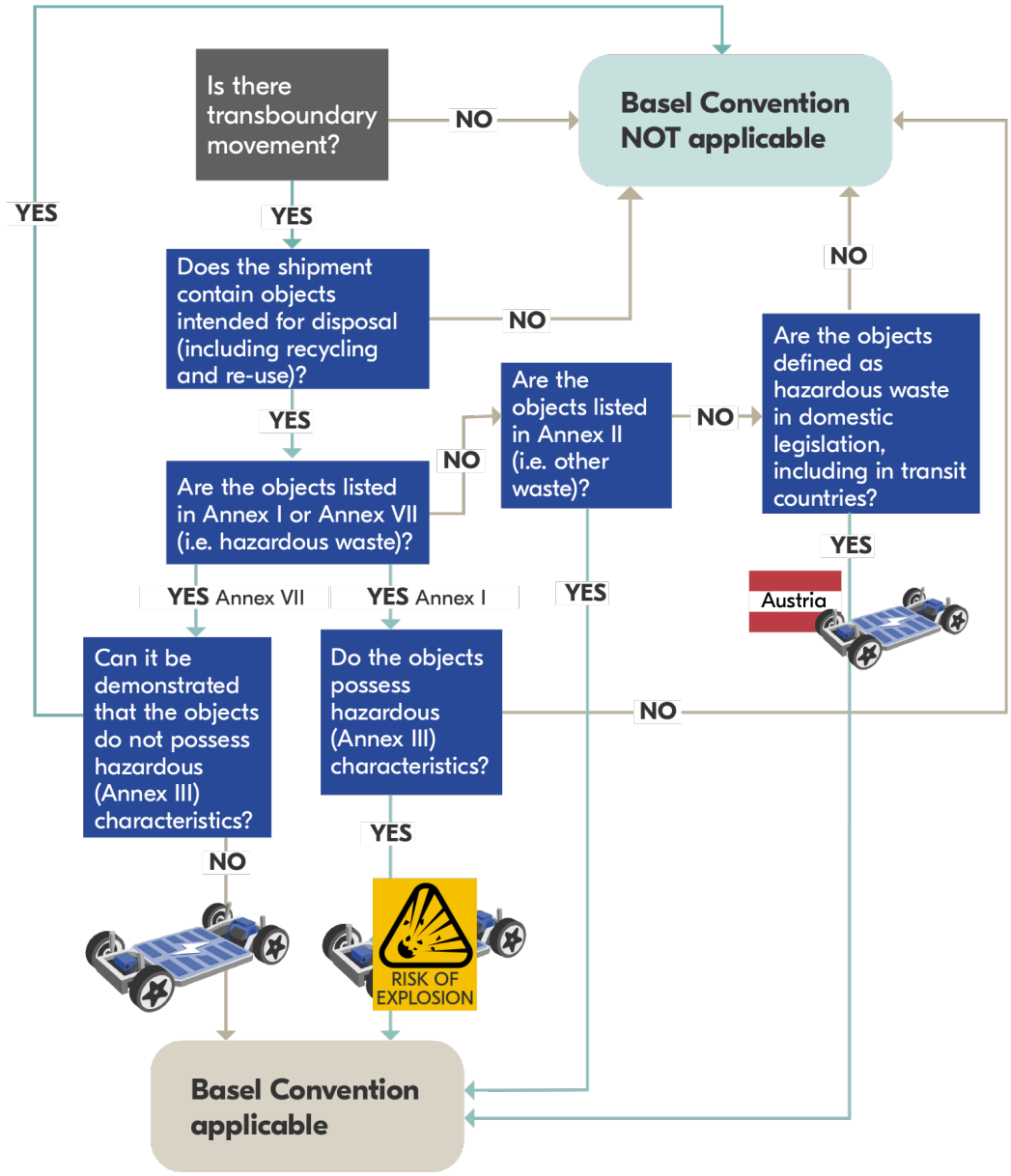
Based on the input we have received from companies and industry organisations, it is clear that shipments of used li-ion batteries *may* fall under the scope of the Basel Convention for several reasons. First, used li-ion batteries likely include one or more materials listed in Annex I.[97] Further, they may be covered under one or more entries in Annex VIII[98] and testing results might reveal them to be hazardous. Several countries, such as Austria, have also designated used li-ion batteries as hazardous waste in their domestic legislation.[99]

97 Comparative Analysis of Legal Frameworks, 9. For example Y32: Inorganic fluorine compounds excluding calcium fluoride, or Y15: Wastes of an explosive nature not subject to other legislations.

98 Comparative Analysis of Legal Frameworks, 9. For example, A1170, Unsorted waste batteries and A1180, Waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries included in Annex VIII.

99 Comparative Analysis of Legal Frameworks, 9.

Figure A2. Basel Convention flowchart 2



The Basel Convention may be applicable to the trade in used li-ion batteries under several different considerations.

Sammanfattning på svenska
Summary in Swedish

Det finns bred internationell samsyn, vilket tar sig uttryck i Parisavtalet och Agenda 2030, att vi behöver minska de negativa klimat- och miljöeffekterna från dagens ekonomiska system. För att detta ska uppnås krävs stora policyförändringar, bland annat att ställa om från dagens linjära ekonomi till en cirkulär ekonomi.

I denna rapport använder vi exemplet med handel med använda litiumjonbatterier för att visa på den viktiga roll handeln spelar för att möjliggöra omställningen till en cirkulär ekonomi. Litiumjonbatterier spelar i sin tur en nyckelroll i två viktiga hållbarhetsprocesser: utbyggnaden av förnybar energi och elektrifieringen av transportsektorn.

Efterfrågan på nya batterier, och även de kritiska metaller som krävs för att producera nya batterier, ser ut att öka kraftigt i framtiden. Återvinning och återanvändning av litiumjonbatterier skulle delvis kunna möta upp den ökade efterfrågan. År 2019 så var det dock endast hälften av alla använda litiumjonbatteri (ca 100 000 ton) som gick till återvinning, och batterier från elfordon utgjorde endast en liten andel. År 2030 beräknas mer än 1,6 miljoner ton använda batterier gå till återvinning, en betydligt större mängd än vad återvinningsindustrin i dag kan hantera. Hälften av alla batterier kan då komma från elfordon.

Genom handel kan anläggningar uppnå de stordriftsfördelar som behövs för ökade investeringar i återvinning och återanvändning. Handel kan också bidra till att åtgärda de lokala och regionala kapacitetsproblem som idag finns i återvinningsindustrin, och göra det möjligt för företag att leva upp till åtaganden om återvinning och återanvändning.

För att realisera fördelarna med handel så krävs det att handelsreglerna uppmuntrar och underlättar handeln med använda batterier. Nuvarande handelsregler är dock generellt sett utformade utifrån en linjär, och inte en cirkulär, ekonomi. De företag som är aktiva inom återvinning och återanvändning behöver hantera krångliga administrativa krav och ett svårnavigerat ramverk av regler för handel med använda batterier.

Vi har tagit fram ett antal rekommendationer kring hur handelsreglerna för använda batterier kan utformas på ett sätt som uppmuntrar och underlättar handeln, utan att rucka på de viktiga säkerhetskrav som finns till för att skydda miljön och människors liv och hälsa.

Våra rekommendationer gäller bland annat förenklade handelsprocedurer, möjligheten att komplettera Baselkonventionen med andra överenskommelser som kan underlätta handeln, undersöka huruvida reglerna kring transportsäkerhet kan förenklas, och utökat marknadstillträde för varor och tjänster.

The National Board of Trade Sweden is the government agency for international trade, the EU internal market and trade policy. Our mission is to facilitate free and open trade with transparent rules as well as free movement in the EU internal market.

Our goal is a well-functioning internal market, an external EU trade policy based on free trade and an open and strong multilateral trading system.

We provide the Swedish Government with analyses, reports and policy recommendations. We also participate in international meetings and negotiations.

The National Board of Trade, via SOLVIT, helps businesses and citizens encountering obstacles to free movement. We also host several networks with business organisations and authorities which aim to facilitate trade.

As an expert agency in trade policy issues, we also provide assistance to developing countries through trade-related development cooperation. One example is Open Trade Gate Sweden, a one-stop information centre assisting exporters from developing countries in their trade with Sweden and the EU.

Our analyses and reports aim to increase the knowledge on the importance of trade for the international economy and for global sustainable development. Publications issued by the National Board of Trade only reflect the views of the Board.

The National Board of Trade Sweden, February 2023. ISBN: 978-91-89742-06-2

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