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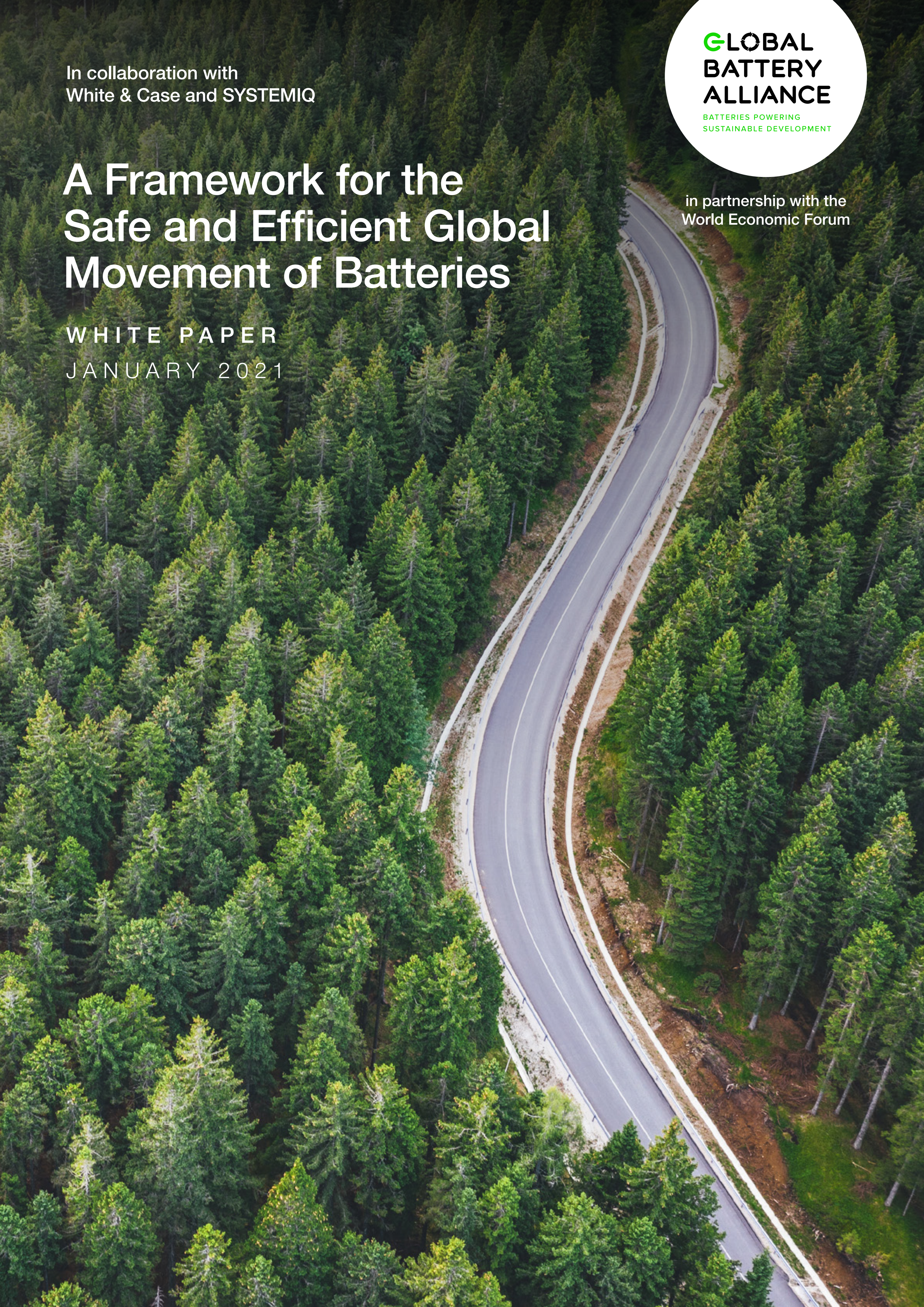
GLOBAL BATTERY ALLIANCE
BATTERIES POWERING SUSTAINABLE DEVELOPMENT

in partnership with the
World Economic Forum

A Framework for the Safe and Efficient Global Movement of Batteries

WHITE PAPER

JANUARY 2021



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Contents

3 Foreword

4 1 The opportunity

7 2 The challenge

9 3 The solution space

14 4 Recommendations

16 Acknowledgements

18 Endnotes

Foreword

A vision for promoting dialogue and collaboration among stakeholders to create a responsible global transboundary framework to drive a responsible and sustainable circular battery value chain.

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As companies and governments continue to invest in and promote the use of electric vehicles and renewable energy, the need to ensure that batteries act as a sustainable enabler of climate change mitigation is becoming increasingly urgent. Over the next decade, global battery demand is expected to increase by 19 times current levels to meet growing markets for electric vehicles and energy storage.

This opportunity statement presents a vision to transform the global value chain of electric vehicle batteries to foster recycling, reuse and repurposing of electric vehicle (EV) batteries, aiming to create truly efficient circular economy-based solutions while preserving protections to prevent mismanagement of recycling and end-of-life batteries.

The used EV battery market (second life in stationary application) could surpass 200 GWh/y by 2030 and provide up to 60% of stationary power storage capacity demand globally in 2030. High-performance recycling of EV batteries could provide approximately 10% of key battery materials, which would account for approximately $10 billion based on current value. Further, extending the life of electric vehicle batteries, in combination with greater utilization of batteries, enable 30% of the required reductions in carbon emissions in the transport and power sectors to stay on track to stay below the 2°C Paris Agreement target.[1]

It further presents five recommendations to advance a global transboundary system to facilitate preserving products that reach the end of their first life, and activities to retain or extend the products functionality, and improves recycling systems to achieve maximum recovery of end-of-life material and effective and economic recovery of high-value materials.

These recommendations are to: advance standardization of definitions and transactions triggers; preserve product characterization to foster product value preservation and recovery; launch and scale effective corporate reverse logistics programmes; establish traceability and disclosure systems; and implement pilot programmes with compliant facilities to develop a full chain of custody disclosure.

Concurrent with the publication of this opportunity statement, the Global Battery Alliance has published an associated Legal Annex, which provides an overview of the existing legal frameworks in a number of jurisdictions.

The hope is that this opportunity statement will promote dialogue and collaboration among stakeholders to facilitate agreement on a global framework for transboundary movement of EV and large form batteries for foster a circular system. A key element of this involves better facilitating trade in reverse materials flows. Over 50 WTO members have recently launched discussions on trade and the environment. It would be a missed opportunity not to leverage such momentum to ensure 21st century commerce serves circular, sustainable objectives.

The World Economic Forum and the Global Battery Alliance are grateful for the many insights from Global Battery Alliance members and other report contributors. Technical analysis support was provided by White & Case LLP and Systemiq.

This opportunity statement has been developed by the Global Battery Alliance, a global multistakeholder membership collaboration platform hosted by the Forum that seeks to catalyse and accelerate action towards a socially responsible, environmentally sustainable and innovative battery value chain to power the Fourth Industrial Revolution.

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1 The opportunity

A sustainable and circular BEV battery value chain to unlock significant environmental and economic benefits.

> **Sustainable resource management is essential to achieve the goals of the Paris climate change agreement and stay within planetary boundaries. To achieve them, optimal treatment of used batteries against the highest environmental and social standards is an important part of the solutions needed.**
>
> Janez Potocnik, Co-Chair, International Resource Panel (IRP), Paris

The foundation of this opportunity statement is an analysis of the existing regulatory frameworks governing recycling, reuse and repurposing of electric vehicle (EV) batteries led by White & Case LLP on behalf of the Global Battery Alliance. This document sets forth the opportunity, then aims to highlight a number of challenges these regulatory frameworks bring. The analysis was carried out with the aim of creating a truly efficient circular economy-based solution for the treatment of EV batteries while preserving all the protections to prevent mismanagement of recycling and end-of-life management of batteries. It also introduces five specific recommendations towards a transportation framework that supports a circular value chain for EV batteries.

According to a report published by the Global Battery Alliance in 2019,[2] in the coming decade, the scale-up of a sustainable and circular global battery value chain will be critical to realize the potentials of electric road mobility and advance climate change mitigation. Global battery demand is projected to increase by 19 times the current levels over the next decade, particularly due to a rapidly increasing market for battery electric vehicles (BEVs). By 2030, nearly 2 million metric tonnes of EV batteries per year are projected to reach the end of their first life, with this figure multiplying in the subsequent decade following a market increase of electric vehicles. Thus, a sustainable scaling, productive application and safe end-of-life management of BEV batteries is of utmost importance.[3]

Increased application of circular economy levers to EV and large-form storage batteries – including ensuring their smart integration into power grids (smart and/or bidirectional charging), extending their lifetime through repair, refurbishment and repurposing for second-life application in stationary storage, and improved material recovery through advanced recycling – have the potential to substantially increase the net value added, value recovery and environmental footprint of these batteries. Together with further improvements in battery technologies and application of low-cost renewable energy sources, these circular economy levers are projected to reduce total lifetime costs of batteries in 2030 by over 20%, in turn increasing the demand of EV batteries by 35% and simultaneously enabling 30% of the required emissions reductions in the transport and power sectors by 2030 to stay within the 2°C Paris Agreement goal emissions budget, compared to in 2030, compared to a scenario without concerted circular economy action. Hence, creating a sustainable, circular battery value chain will be a key driver to achieve the Paris Agreement's emissions reduction goals for the transport and power sectors.[4]

In 2030, the repurposing of used EV battery market (for second life in stationary application) could represent 60 GWh/y by 2030 and provide up to 6% of stationary power storage capacity demand globally in 2030.[5] Repurposing of EV batteries is likely to be prioritized by policy-makers to maximize the utilization and benefits of batteries. Potential applications of second-life batteries include backup power (for example for decentralized installations such as transmission towers), off-grid and micro-grid energy storage, reserve capacity (to balance the grid in case of supply/demand fluctuations), and arbitraging of grid energy prices (depending on local electricity markets).

Further, second-life applications could unlock additional value beyond the material value of batteries, namely by improved power grid performance, increased shares of renewable energy sources in electricity mixes and lower infrastructure costs for electric vehicle charging.

Moreover, high-performance recycling of EV batteries could provide approximately 10% of key battery materials, which would account for approximately $10 billion based on current value. This value is predicted to grow four-fold until 2040. Ultimately, all batteries will need to be recycled for legislative and environmental reasons. Specific examples for circular economy measures already practiced today include remanufacturing, like Nissan is practicing,[6] and second-life repurposing and recycling, as Volkswagen[7] is practicing.

A sustainable and circular BEV battery value chain could unlock significant environmental and economic benefits and should therefore be fostered.

CASE STUDY

Application of second-life batteries for efficient extension of spent vehicle batteries

In Aachen, Germany, Eveon and PEM Motion are developing and piloting a 2 MWh energy storage system consisting of second-life vehicle batteries. The goal of the project is to explore and commercialize their potential to support vehicle-charging infrastructure, improve renewable energy grid integration and support recycling possibilities.

Modular and flexible, the system is combined with grid integration for renewable energies (functioning as intelligent buffer between power generation and grid consumption), as well as vehicle smart charging for a faster and more cost-effective construction of charging facilities.

Due to the modular system design and individual control of the deployed batteries, the complex characterization and testing of the end-of-life batteries necessary for transferring them into second-life application should be carried out format-independently in the energy storage device itself. This will reduce investment costs by an estimated 30% compared to conventional systems.

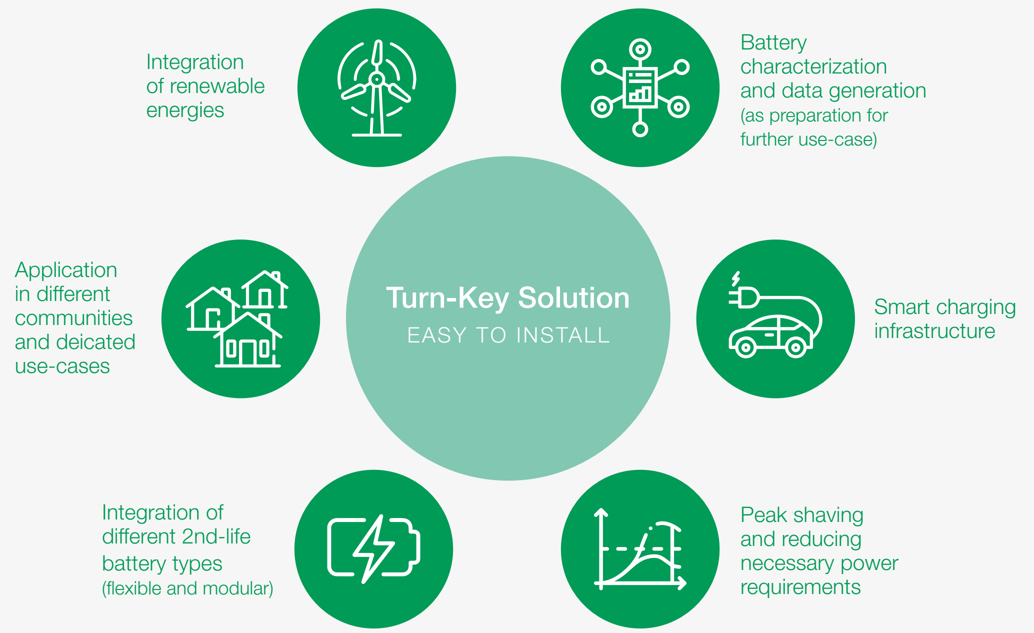
The knowledge gained from this can be used to optimize the battery cells with regard to their first lifecycle and to tailor their further use in second-life applications – feeding into the development of a trusted platform for second-life batteries and data, such as part of a battery passport.

By enabling cost-effective life extension of spent vehicle batteries, the approach thereby helps to lower lifecycle costs and overall greenhouse gas (GHG) balance of the batteries used and creates further benefits in the power grid. Due to its modular, containerized set-up – which allows flexible installations of different capacities for different use cases – it is designed to be deployed as a turn-key solution even in remote locations, including less developed markets, where it could contribute to electrification and local economic value generation.

Open for project partners and investors, the project expects to scale to 20 MWh within two years and aims to sell 50 units by 2023, thus reaching commercial scale and economics for second-life batteries.

FIGURE 1

Offering a modular energy storage system and also generate valuable data



Source: Adapted from Eveon Circular – A brand of PEM Motion

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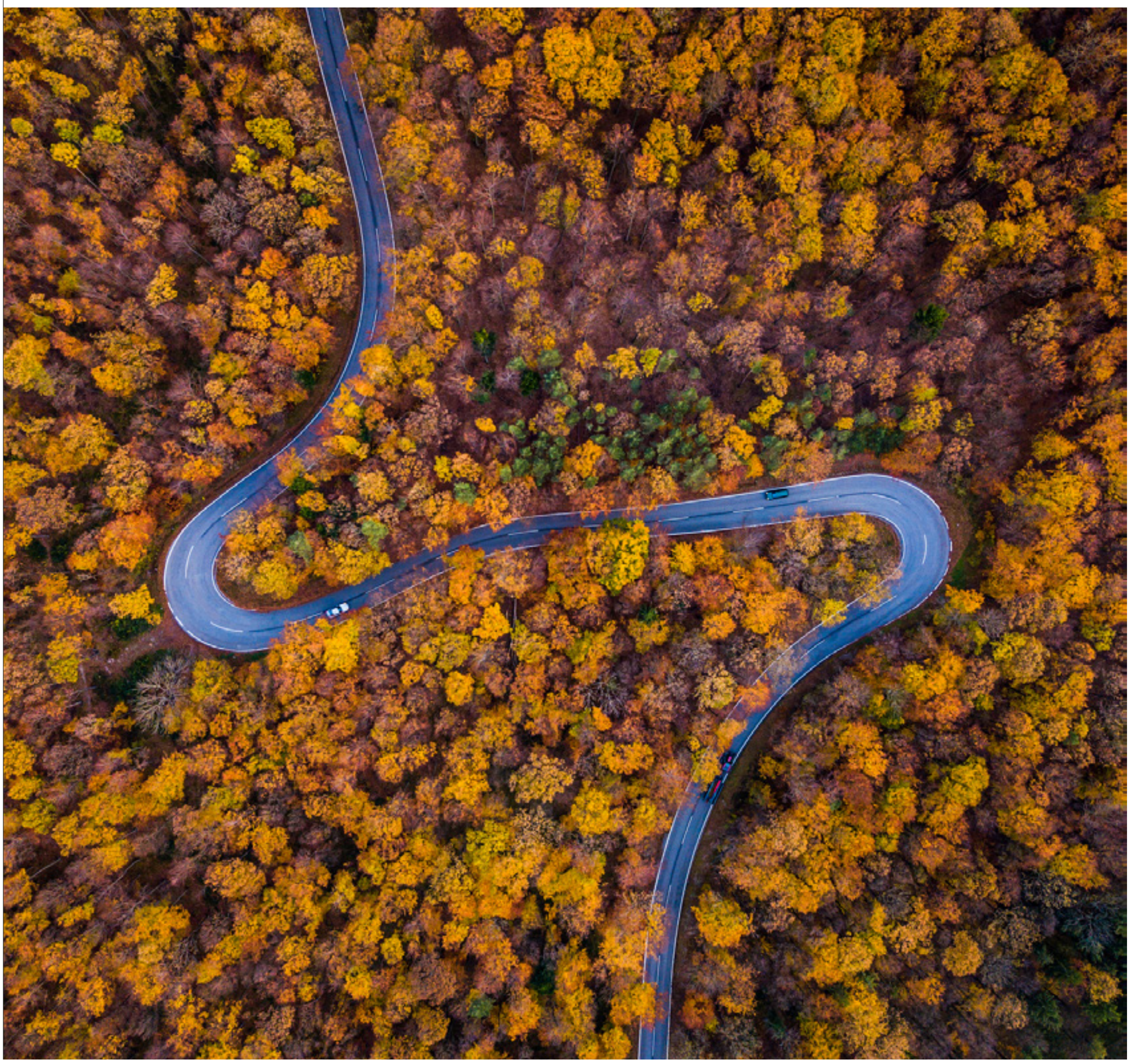
2

The challenge

Enabling transboundary movement of end-of-life EV batteries to foster circularity in alignment with regulation and transparency of transactions to prevent irresponsible disposal.



> **The transboundary movement of used batteries is an enabler for a strong and competitive second-life industry and therefore an important issue in the European battery ecosystem. To ensure the sustainable success of this recovery strategy, a global agreement on standard processes is essential.**
>
> Uwe Seidel, Project Manager, International Technology Cooperation and Clusters, Institute for Innovation and Technology, VDI/VDE Innovation + Technik, Germany

In addition to the relative evolution of material and battery costs and prices, low transactional costs will be a key determinant of the viability of circularity measures, especially for second-life applications and optimizing recycling. To enable these circularity measures, it is key that potentially suitable batteries reach relevant expert facilities at scale to be diagnosed for triaging, disassembled, tested for functionality and safety, repacked, reassembled and tested again. Suitable batteries can then be used for stationary or lower value mobile storage application while component parts that cannot be reused or repaired can be recycled. These steps would need to be enabled while ensuring full enforcement of regulatory requirements and transparency of transactions to prevent irresponsible disposal under the guise of recycling, in particular in developing economies.

To facilitate diagnosis of potential for reuse, repurposing and recycling, the transboundary movement of end-of-life EV batteries needs to be truly enabled. Without a global circular economy, value capture through economies of scale, efficient allocation of batteries to their highest value application, and ultimately the most environmentally and economically beneficial solutions will be hindered.

Many legal and logistical challenges currently exist, which hinder the benefits outlined above from being realized. Most critically, multi-national and national legal frameworks for transport of used batteries were – rightfully – designed to stop irresponsible disposal that results in environmental and public risks in developing economies. The key question is how to ensure the full and effective application of these frameworks, while facilitating transboundary movement for potential second-life uses and advance circularity via life extension activities such as refurbishment, repurposing and efficient recycling for high value material recovery of batteries. While there have been some amendments in various legal frameworks to distinguish "waste" transactions from certain circularity activities, such as recycling, the countries' frameworks often use different terminologies and interpretations of key terms, resulting in jurisdictional inconsistencies in classifications.

Depending on type, batteries may contain toxic materials such as lead, mercury, cadmium, nickel and/or cobalt and, in the case of lithium-Ion batteries (LIB), may be flammable. If a battery is determined to be a waste, it may need to be treated as hazardous waste when it comes to cross-border transportation – depending on specific battery type, condition (especially in case of damage), and different interpretations and legal consequences across different countries and regions of what triggers the classification as "hazardous".

Historically, hazardous wastes were often found to be exported from developed economies to regions with lower environmental and labour standards and have a significant informal sector, where inappropriate handling and disposal conditions made them a danger to local workers, communities and the environment. In response, national and international regulatory interventions, such as the Basel Convention, have been created to control waste dumping and have been able to stop the most egregious examples of this practice. The Basel Convention is a vital piece of global policy architecture for avoiding waste dumping that needs to continue to address fraudulent transactions that lead to dumping in developing economies.

World Economic Forum communities have begun to look at measures to facilitate responsible trade of plastics and electronic wastes for a circular economy. Two studies have been put forth that focus on risky trade alone; trade that leads to environmental dumping could miss opportunities for materials to be repurposed through repair, re-use or recycling. The latter activities require economies of scale to be viable and so entailing cross-border movement.

This paper proposes a focused effort on BEV and large-form batteries because their size, weight, value and value added potential in power grids provide:

- Unique opportunities to identify BEV batteries and trace them (e.g., via battery passports).
- More controlled logistics and chain of custody.
- The need for specialization in all aspects of circularity (repair/refurbishment, repurposing and recycling.

Below: Getty Images

3 The solution space

A vision to transform the global value chain of EV batteries to foster recycling, reuse and repurposing.

> **The global demand for batteries and their carbon reduction benefits are clear calls to apply circular economy principles across the value chain – from design and second life to safe recycling and minimizing waste. We must ensure harmonization of private sector investments and regulatory frameworks to enable truly global circular batteries.**
>
> David B. McGinty, Global Director, Platform for Accelerating the Circular Economy (PACE), World Resources Institute, USA

Preserving product characterization to foster value preservation and recovery

The most important step in advancing circularity is preserving and extending a product's status as product for as long as possible. Globally, there should be priority on clarity in the "trigger" decision that shifts a product's characterization to becoming waste. Merely achieving the end of first life should not automatically trigger an "end-of-life" designation. A key aspect driving circularity is to preserve a "product" characterization if legitimate reuse, refurbishment, or reengineering activities have been confirmed via adequate disclosure of the transaction mechanisms.

The International Resource Panel in its seminal report, *Re-defining Value – The Manufacturing Revolution Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy*, noted: "[r]emanufacturing needs an accepted international definition that reflects the rigorous industrial process of remanufacturing itself. It is important that the development of these definitions be *distinguished* from the related, but inherently different, discussion of whether 'cores' constitute waste and/or other classifications. Oversimplified and uninformed definitions of remanufacturing create unnecessary regulatory barriers for legitimate VRP (value-retention processes – defined as remanufacturing, refurbishment, repair and direct reuse) product offerings; alternate methods to control the quality and nature of VRP products entering an economy through trade, outside of waste-related compliance systems, should be considered".

Under the Basel Convention technical guidelines on transboundary movements of electrical and electronic waste and used electrical and electronic equipment – in particular regarding the distinction between waste and non waste under the Basel Convention – there are the beginnings of recognizing conditions to avoid a waste classification.[8] Shipments of used equipment destined for failure analysis, repair, or refurbishment are non-waste if the: domestic legislation of any of the countries involved in the transboundary movement (i.e. countries of export, import, and transit) does not define the used equipment as waste; used equipment in question is accompanied by the required documentation and declarations and a valid contract is in place; and used equipment is shipped with appropriate protection against damage. If the used equipment is shipped for direct reuse (e.g. after repair), it must meet the same requirements and the guidelines provide that it should be tested to demonstrate functionality. Under the guidelines, a transporter must provide detailed documentation to support a claim that used equipment is not waste.

One example of prescribing a "product" classification to avoid triggering a waste is found in a "remanufacturing" exclusion of US Environmental Protection Agency's definition of solid waste rule. The rule provides a remanufacturing exclusion permitting a used product to preserve its "product" classification if certain conditions are met, such as a certification of the remanufacturing activities into a product, notification of the remanufacturing activity by both parties, and associated recordkeeping reporting requirements, including shipping records (such as financial records, bills of lading and electronic confirmation of receipt).

Notwithstanding such rules, under the current system, in practice it can be difficult to differentiate waste transactions from life extension transactions, leaving aside the possibility of fraudulent transactions. The determination of which designation a product receives is often placed on trade officers who frequently lack the necessary information to make an informed judgement. Classification for safe and higher value use of batteries at end of life is thus fragmented at national levels and often left to individual contractual agreements between single market actors, effectively prohibiting consistent and scalable commercial handling of such solutions.

Consistent definitions in alignment with a circular economy hierarchy

In terms of realizing the goals of a circular economy in the context of the BEV and large-form battery sector, it is vital that there are clear, coherent and sustainable avenues available to reuse, repurpose or recycle batteries to try and sustain their value in the economy for as long as possible, rather than defaulting to disposal and landfill. To achieve this, there must first be a global consensus on what the terms "reuse", "repurposing" and "recycling" mean.

Each term is defined under the Basel Convention, as well as by most national and regional legislation governing the transboundary movement of waste. The approach set forth under the Basel Convention has emerged as the dominant understanding of each of these terms. However, it is important to note that definitions across the multiple national and subnational legal regimes implementing the Basel Convention that govern the transboundary movement of batteries remain inconsistent, which leads to confusion in practice.

For the purposes of this opportunity statement, the following definitions drawn from the Basel Convention – listed in cascading order of circular economy priority and visualized in Figure 2 – are adopted in order to ensure consistency of understanding within the present discussion:

- **Reuse** refers to the utilization of a product, object or substance for the same purpose for which it was conceived. Where an object is being reused for the purpose for which it was original conceived, the object is not deemed waste under the Basel Convention. In case of BEV batteries, this would include transboundary movement for testing, repair and/or refurbishment for reuse in its original application in a vehicle.

- **Repurposing** refers to using a product for an application other than the original purpose for which it was utilized. Repurposing is a relatively new concept and not expressly defined in the Basel Convention. However, the foundation for repurposing is found in the explanatory notes to "reuse" in the convention's glossary of terms, which encourages "alternative uses", meaning reusing an object for a purpose other than for which it was conceived. Such "alternative use" is acknowledged as equivalent to reuse, which can help to prevent an object or substance from becoming "waste".

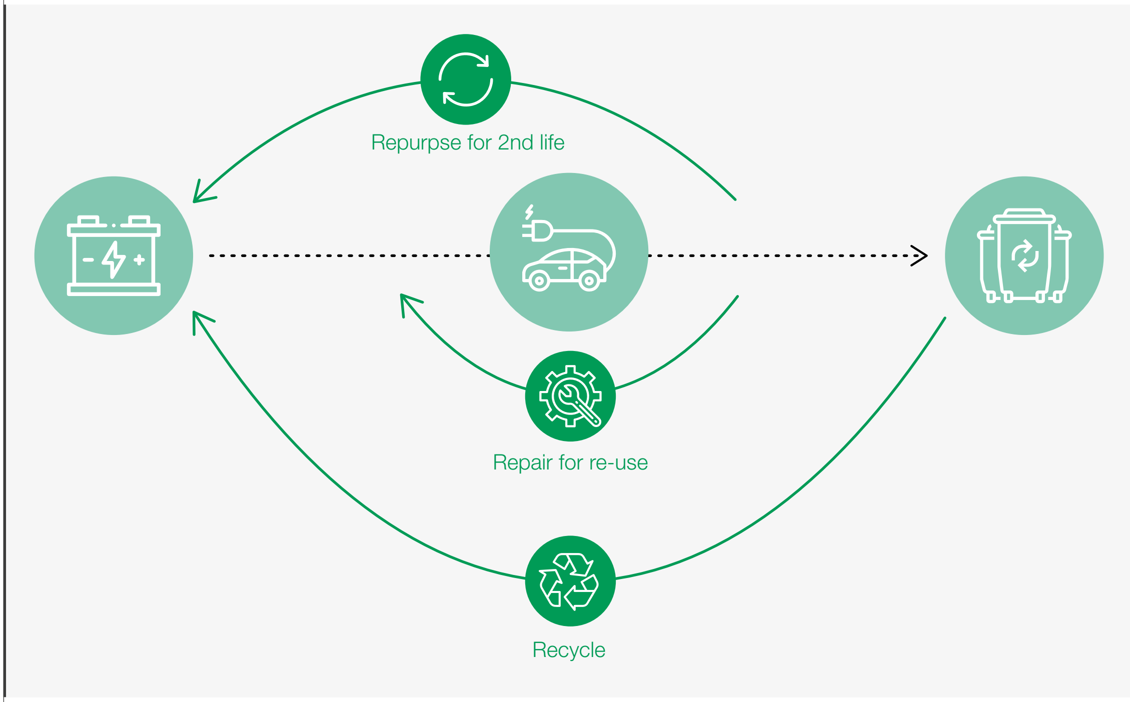
  Repurposing BEV batteries, for example, may include using a battery for energy storage (second-life application) in different applications as long as the battery function remains. This understanding means battery packs can be disassembled to module level for configuration in second-life products. Used batteries, for instance, may be repurposed for various types of stationary energy storage systems, ranging from small residential systems to larger containerized grid-scale energy storage solutions of various kinds; these systems are used to provide a variety of grid services including time-shift management, frequency response, backup power, demand side response and auxiliary capacity. Repurposing may also refer to application of BEV battery modules or cells in other types of modes of transportation, such as two- and three-wheelers, fork lifts or other lower-performance applications.

- **Recycling** refers to the reprocessing of materials from a used product, though not necessarily for the original purpose.[9] Reclamation of metals, metal compounds or other technical materials, such as those in lithium-ion batteries, fall within the express definition of recycling under the Basel Convention. The range of material value recovered depends primarily on local regulatory requirements and economics of the recoverable materials, which has led to a wide range of material recovery rates and value. While current recovery rates are around 50-60% of total weight, the potential for higher recovery rates of up to 95% of each of the important battery materials have been proposed as feasible for the medium term, principally using novel and optimized treatment processes.[10,11]

In case of lead-acid batteries, recovery of >99% of lead is possible with a rigorous regulatory systems regarding the collection, transportation and recycling systems, along with a deposit return programme.[12] The Global Battery Alliance has issued a compilation of best practices for an effective lead-acid battery recycling system to foster adoption in developing economies.

> **A circular economy is essential for the next generation of energy storage solutions. Without it, our ability to achieve a genuinely sustainable battery lifecycle will not be possible.**
>
> Steve Christensen, Executive Director, Responsible Battery Coalition, USA

FIGURE 2 **Conceptual framework for "re-" activities of end-of-life vehicle batteries according to definitions used here. Expert facilities are required for each step, creating the need for economies at scale and thus regular transboundary movements of the batteries in question.**



Source: Global Battery Alliance/ World Economic Forum

Creating favourable regulatory framework conditions

To achieve a framework for circularity, a number of building blocks must first be achieved: definitions and custom codes need to be harmonized across jurisdictions and practices; pre-authorized facilities need to be created; and practices that facilitate reliable and verified information for trade officers must be established, while preserving the rigor and transparency to prevent waste shipments that result in public health and environment impacts from mismanaged recycling.

Some elements to support transboundary development of circularity measures are already in place. For example, in 2016, the US EPA adopted a rule to drive greater tracking and transparency in cross-border transactions involving hazardous waste for recycling or disposal. This includes: mandatory electronic reporting to enable import and export data sharing with co-regulators, the general public and individual hazardous waste exporters and importers; linking the consent to export with the exporter declaration submitted to US Customs and Border Protection, which will provide for more efficient compliance monitoring; contracts between the exporters and management facilities; and tracking of international hazardous waste shipments from start to the end of life.[13]

Further, companies and parties which work with EV batteries strongly support the need for better traceability in the supply chain for batteries, not just in terms of advancing the circular economy but for economical, logistical and safety considerations as well. Data traceability is a critical lever to ensure compliance with existing (or new) obligations for battery transport, including social and environmental practices.

> **As global demand for batteries increase, contributing to more efficient and cleaner products, it is essential to consider the lifecycle management of batteries and critical issues related to battery reuse, repurposing and recycling. A fundamental element of this circular economy is value retention and extending product life.**
>
> Nabil Nasr, Associate Provost for Academic Affairs, Director, Golisano Institute for Sustainability, Rochester Institute of Technology, USA

Tracing technology to bridge information gaps and expand value added

In addition to regulatory adjustments, developing technology solutions such as digital traceability mechanisms or smart contracts also presents opportunities to support circularity. Together, these elements will serve as key foundational elements for a global circular economy of batteries.

A pending solution to address traceability issues, which could ultimately support a circular economy, is a "battery passport". A battery passport would essentially be a unique identification of the product (thus also supporting fraud protection) in which static and dynamic data about the product are safely and permanently stored and made available as needed for the duration of the lifetime of the product. Such a passport would contain information about key parameters, such as the material composition and their environmental and social footprints, origin, health, and/or chain of custody of the battery.

A battery passport would be linked to the physical battery as it moves through and is processed from the manufacturer through first life, into potential second-life application until the battery, or its component parts, reach end of life and is transferred to high-value recycling. Such a digital product passport would allow such information to be stored and shared with multiple actors and facilitate accurate categorization of potential reuse, repurposing and recycling of EV batteries.

It would also provide a reliable container for both data on upstream value chain activities and those created during its life. Thus, it could not only ensure compliance with existing (or new) regulatory obligations for battery transport, handling and end-of-life management, but also create further value-added opportunities both for the public (e.g. efficient and consistent attribution of ownership; transparency on environmental and social footprints of the product and embedded materials) and private actors (e.g. improved information on residual value, safety conditions, or credible and efficient auditing of sustainability parameters).

Both public and private actors have roles to play in creating a battery passport. Regulators should enable the basic building blocks of such a battery passport, especially those that benefit the public good the most. Recent activities by the European Union in context of the Circular Economy Action Plan[14] and the new EU Battery Regulation point in this direction. Standard setting bodies are called upon to create the governance fabric upon which different solutions achieve interoperability, and thus scale. Individual innovators and companies are to develop and implement parts of the solution.

The Global Battery Alliance is advancing a battery passport to serve as a public purpose assurance mechanism for tracing the battery value chain and authenticating data against a set of common standards in alignment with government requirements for sustainability, and responsibility, as well as data disclosure.

4 Recommendations

Five key interventions to enable transboundary flow to foster a circular battery value chain.

The following five recommendations for public and private actors are selective key interventions intended to support a global system that preserves products that reach the end of their first life and where all activities are designed to retain or extend the products functionality, and improves recycling systems to achieve maximum recollection of end-of-life material and effective and economic recovery of high-value materials.

These recommendations can be best understood as either policy proposals or pilot programmes. The policy proposals are intended to promote legislative changes to serve as the foundation for a circular economy while the pilot programmes offer the potential to implement elements of key intervention at a smaller scale in order to refine the practices for large scale implementation.

Policy programmes

1. Advance standardization of definitions and transactions triggers
While the definitions set out in the Basel Convention have emerged as the predominant understanding in the practical application of reuse, repurposing and recycling, because EV batteries are subject to various other legal regimes other than Basel Convention, there exists confusion in regards to the correct categorization for batteries. The application of the various legal regimes can lead to inconsistent treatment of a singular item, such as batteries that may be a regulated waste in some contexts but a used product in commerce that is not waste in others. For a circular value chain to function, a clear, global understanding of key terms must be established, maintained and integrated into national regimes. Priority terms for definition include reuse, repurposing, second life, waste, recycling and recyclate. Establishing agreed upon definitions across jurisdictions will ensure the EV batteries are treated consistently throughout the lifespan.

2. Preserve product characterization to foster product value preservation and recovery
Harmonizing the regulatory frameworks to enable a consistent, efficient and transparent classification and handling of end-of-life traction batteries should be aspired to as they could potentially unlock significant environmental, social and economic value by creating a circular battery value chain. For example, in the BEV battery scenario, if a contract is in place that establishes the logistics to take the battery from a vehicle to a refurbishment facility, then the "product" characterization should be preserved and default "waste" trigger avoided.

Pilot programmes

3. Launch and scale effective corporate reverse logistics programs
As EV batteries become more widespread, companies will need efficient reverse logistics programmes to ensure that EV batteries can be recovered and placed into a circular economy. Not only will this be required according to legislative requirements (in the EU according to Extended Producer Responsibility legislation), but it might also reduce (or in the case of second-life application, transfer to others) the potentially significant liability for end-of-life management.[15] It has proven successful for intermediary organizations to organize the collection process and bring sufficient scale to reverse logistics operations. This could be combined with a form of pre-consent procedures in which facilities would provide detailed information demonstrating compliance with all pertinent requirements and would be pre-approved for faster shipment coupled with regular periodic reporting post-transactions. This avoids the burden on all parties to make such demonstrations on every transaction and lessens mistakes and fraud. Data transparency across the value chain can support this by enabling lower transaction costs. However, it is important to ensure that those operations are supported from the very beginning to account for transboundary movements, or their impact will stay limited.

A circular economy could be promoted through improved direct company control over their EV batteries via leasing. For example, several car manufacturers are already reclaiming (or planning to reclaim) every battery reaching end of life for further use. Others, such as Chinese auto manufacturer NIO, are retaining ownership over the entire battery life via battery swapping or battery-as-a-service schemes.[16] Similar measures by other companies to extend control over a battery throughout the entirety of its lifespan could be adopted, which would allow companies to ensure EV batteries are only disposed of once all potential second-life applications are exhausted.[17]

4. Establish traceability and disclosure system
Traceability of batteries should be promoted as it is key to understanding the utility of a battery and its parts. To establish a circular economy, information on the safety and health status of the battery needs to be readily available to trade officers and other actors in order to properly diagnose whether the battery is available for reuse, recycling and repurposing. Proper labelling of the exact make-up of an EV battery, such as through the Global Battery Alliance's battery passport, would allow decision-makers to determine the best categorization for the specific EV battery based on its composition.

Critical issues that need to be addressed in the acceptance of traceability systems are the balancing of information to drive circularity and authenticity while protecting proprietary interests. This can be done through a voluntary or regulatory forced scheme. China for example has taken a regulatory step to facilitate reverse logistics by introducing a tracing platform. Battery manufacturers are obliged to code the batteries according to the national standard and deliver the coding information to automotive manufacturers. Automotive OEMs collect information along the value chain (battery manufacturing, vehicle manufacturing, vehicle sales, battery recycling) and upload the battery information onto the traceability management platform. The efforts by the European Union mentioned above may be following suite while leaving more flexibility for implementation.

“

Addressing transboundary issues is critical to drive the circularity of battery life through refurbishment, repurposing and recycling. This is necessary to reduce the cost of batteries and to achieve the Paris Agreement goals.

Jonas De Schaepmeester, Manager, Sustainability and Closed-Loop, Battery Materials, Umicore, Belgium

5. Implement pilot programmes with compliant facilities to develop a full chain of custody disclosure
Decisions on the categorization of batteries should be made according to certain requirements with a goal of harmonizing and improving the categorization of batteries for a potential second-life application. One successful policy framework that has proven successful in a similar context of transnational regulation is the North Sea Resources Roundabout[18] (NSRR), a voluntary international agreement between France, the Netherlands, the United Kingdom and Flanders with the aim of transitioning towards a circular economy of secondary resources. Transposing its principles in a new pilot policy scheme could help strengthen a legal circular economy framework for batteries. The key elements for the NSRR include:

– Facilitating cross-border use of secondary resources to increase industry uptake

– Stimulating cross-border secondary resource optimization through cooperation of public and private partners, identifying barriers related to “waste or resource” status and presenting possible solutions for certain specified secondary resources

– Increasing investment by private partners related to secondary resource use in the case of proven solutions

– Sharing information and data with participants and observers

As applied to EV batteries, one proposed method for developing the model framework is through a pilot programme that would establish two groups. Drawing from the success of the NSRR, the first group would consist of:

– Private companies in a specific product, material, or sector located in two adjacent countries in two global regions

– Government participants, including but not limited to relevant policy departments, border inspection and trade officials, from relevant adjacent companies

– Observers

A second wider stakeholder group would allow stakeholders to contribute knowledge, solutions and provide access to broader networks. This group would foster public and private engagement in home countries and regions. Potential advisers for the stakeholder group could be the European Commission or the Basel Convention Secretariat.

With this opportunity statement, the Global Battery Alliance aims to foster solutions the implement the above recommendations, as well as encourage proposals to convene stakeholders at a regional or international level.

Acknowledgements

The Global Battery Alliance, hosted in the World Economic Forum, brings together leading businesses along the entire battery value chain with governments, international organizations, NGOs and academics to actively shape a battery value chain that powers sustainable development. Leaders from private companies, governments, civil society organizations and academia have been engaged for this report.

The opinions expressed herein may not correspond with the opinions of all members and organizations involved in the Global Battery Alliance or the contributors below. Any views expressed in this publication are strictly those of the authors and should not be attributed in any way to White & Case LLP.

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Endnotes

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2. Ibid
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8. We note that the Basel Secretariat is currently engaging in discussions to improve clarification on the categorization of materials as "products" versus "wastes".
9. Annex IV, Section B of the Basel Convention sets out specific operations that are understood to be recycling for the purposes of the Convention. Operations to recover energy from waste are not considered recycling under the Basel Convention. Basel Convention, Glossary of Terms, Page 5.
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