



To: **H.E. Elisa Morgera**, UN Special Rapporteur on Climate Change

Dear Ms. Morgera,

We, the Global Alliance on Incinerator Alternatives (GAIA) - Asia Pacific are pleased to transmit to you our input for the upcoming thematic report on human rights in the full life cycle of critical minerals and renewable energy. We are a global network with 141 alliances and grassroots organizations in the Asia Pacific region with a mission to catalyze a global shift towards environmental justice by strengthening grassroots social movements that advance empowering resource conservation solutions, fight pollution and build regenerative solutions in cities through local campaigns, shifts in policy and finance, research and communication initiatives, and movement building.

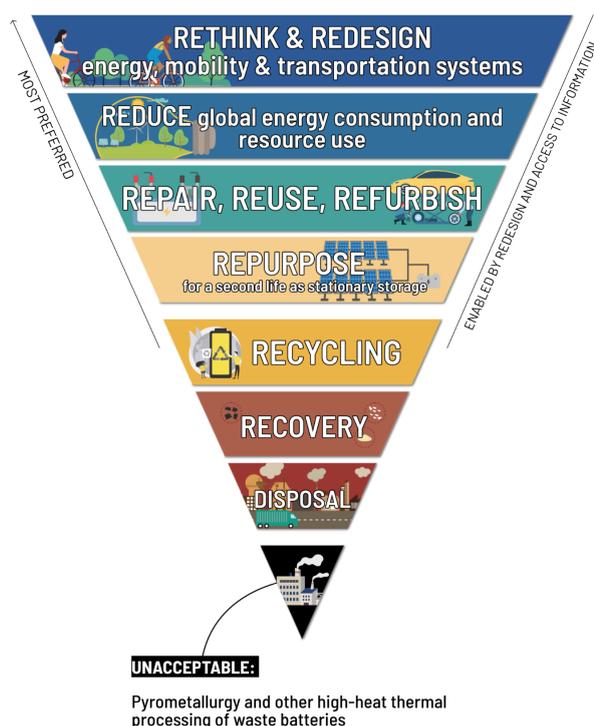
As the world moves away from fossil fuel based sources of energy to renewable sources of energy, we are faced with challenges in addressing the catastrophic impacts of the scale and speed of battery development in the Asia Pacific region. This kind of transition has and will create more inequities if not addressed by the international community.

Batteries play a pivotal role in our society's ability to harness the abundant energy from wind and solar sources, and so reduce reliance on fossil fuels. As with any energy system, renewables come with their own set of challenges and impacts. With rapidly evolving battery technologies and build-out of infrastructure supporting widespread electrification, it is imperative that waste and pollution are addressed in the design of policies and programs that drive the way production for batteries are built.

This submission is distinct but related to GAIA Global's concurrent submission on the same call for inputs, as the issues in the Asia-Pacific region necessitate specific discussion points on potential human rights-related issues, as well as region-specific recommendations from the broad calls of GAIA as a whole.

GAIA's Framework: The zero waste hierarchy to EV battery end of life management

GAIA's battery zero waste hierarchy highlights solutions to respond to the environmental justice and human rights concerns to prevent the same unjust system from replicating itself in the name of clean energy, circularity and decarbonization. The model below takes inspiration from the zero waste movement and prioritizes upstream solutions such as reuse and product redesign as priority interventions, while relegating those that do not address the problem from a holistic perspective and has inherent risks especially when it comes to environmental and communal health.



Reduced energy consumption and resource use will have the greatest positive impact on health air, soils and environment for the most communities

A key element in a decarbonized future is the electrification of the transport sector, as the transition of transport systems and battery storage support clean air and reduce reliance on fossil fuels. The transport sector's emissions – which account for a quarter of all energy-related greenhouse gas emissions – are a major contributor to urban and regional air pollution,¹ with almost 91% of its final energy still coming from fossil fuel sources.² Global transport emissions will have to be reduced by 17% by 2050 to meet the temperature goals limiting warming to 2C.³ Achieving this requires a systems shift that ensures that no further harm is done and that technological solutions are pursued with accessibility, social costs, and well-being in mind.

¹ "Transport," UNEP - UN Environment Programme, n.d., <https://www.unep.org/explore-topics/energy/what-we-do/transport>.

² "Transport - Energy System - IEA," IEA, n.d., <https://www.iea.org/energy-system/transport>.

³ "Chapter 10: Transport," IPCC, n.d., <https://www.ipcc.ch/report/ar6/wg3/chapter/chapter-10/>.

The Asia-Pacific region's positionality in the global decarbonization of the transport sector

Global transport-based emissions vary across different geographies, depending on the rate of economic growth. Asia has seen a significant rise in emissions since 1970, and is now the largest contributor to transport-based emissions.⁴

The Asia-Pacific region also plays a significant role in the electrification of the transport sector as it is presently where most extraction, manufacturing, deployment and remanufacturing of virgin and secondary materials for critical parts for the batteries are concentrated, with regional alliances between China and its surrounding countries influencing how EVs are being pushed globally. Another significant factor in the importance of the region is the presence of critical minerals, with 8 out of the 25 countries in the world supplying the most critical minerals for EV battery production being found in Asia-Pacific, with key nickel and cobalt deposits in Indonesia and the Philippines.⁵

Throughout the course of GAIA's work on EV batteries, we have seen significant concerns in how EV batteries are treated at their end of life, which leads to potential human rights issues that threaten the well-being of the environment and the communities that call them home if they are not addressed from a zero waste perspective.

EV battery recycling carries significant environmental and health harms

There are two major types of technologies that are being used increasingly in EV battery recycling, which are hydrometallurgy and pyrometallurgy. These are processes that involve the chemical and thermal breakdown of used EV batteries to extract and separate critical minerals from other components of the battery to be reprocessed and used again. The type of EoL processing largely depends on the chemical composition and cell systems of the batteries being recycled.⁶ That being said, most recycling requires manual or automated disassembly, before undergoing a hydro- or a pyrometallurgical process, or oftentimes, a mix of both.

While both of these technologies dominate the EV battery EoL market share, serious concerns remain on their safety, emissions intensity, and overall effectiveness in ensuring that the life cycle of EV batteries are truly circular.⁷ Most pyrometallurgical processes result in high emissions values due to their energy requirements and emissions from thermal processes, which negate the potential emissions savings from virgin critical mineral mining. Thermal treatment in pyrometallurgical processes to produce black mass have also been shown to

⁴ David Rapson and Erich Muehlegger, "Global Transportation Decarbonization," *The Journal of Economic Perspectives* 37, no. 3 (August 1, 2023): 163–88, <https://doi.org/10.1257/jep.37.3.163>.

⁵ "Outlook for Key Minerals – Global Critical Minerals Outlook 2024 – Analysis – IEA," IEA, n.d., <https://www.iea.org/reports/global-critical-minerals-outlook-2024/outlook-for-key-minerals>.

⁶ Linda Reinhart et al., "Pyrometallurgical recycling of different lithium-ion battery cell systems: economic and technical analysis," *Journal of Cleaner Production* 416 (September 1, 2023), <https://www.sciencedirect.com/science/article/pii/S0959652623019923?via%3Dihub>.

⁷ Jianghong Feng, Ping Guo, and Guangyi Xu, "Barriers to Electric Vehicle Battery Recycling in a Circular Economy: An Interpretive Structural Modeling," *Journal of Cleaner Production* 469 (July 22, 2024): 143224, <https://doi.org/10.1016/j.jclepro.2024.143224>.

incompletely break down per- and polyfluoroalkyl substances (PFAS), in addition to the production and release of new and fluorinated substances.⁸

Hydrometallurgy, despite being less intense in terms of emissions, still produces wastewater due to the use of specific aqueous solutions. Without proper wastewater treatment, these runoffs can potentially contaminate groundwater and pose significant dangers to communities living near plants. The specific hydrometallurgical processes that result in reactions between the metal slags and the leaching agents, reactants, and precipitants result in byproducts that include toxic gases, which can be emitted during the entire hydrometallurgical process.

These plants are usually housed or are part of large industrial parks and complexes. Because of the intense energy requirements needed to run these processes, industrial parks have captive energy sources that are not part of the grid and feed directly into the power supply of the industrial park. This is happening in Indonesia through their use of captive coal plants, which has led to significant increases in emissions from coal.⁹ There are also increasingly serious impacts on communities in the smelting and processing stage (midstream), usually because of high levels of pollution and weak environmental safeguards.¹⁰

In most developing countries in Asia Pacific where the waste management infrastructure is weak and lack of opportunities in the formal economy is high, a whole informal recycling economy has been built around e-waste recycling, including EV batteries which has taken the primary role in the recovery of EV batteries. While this sector subsidizes the city from collection services and delivery of materials for the recycling factories, the very composition of batteries risks creating toxic sinks both impacting workers and communities nearby the informal recycling shops.¹¹

Furthermore, used batteries have heavy metals, lead, mercury, and cadmium can cause lung cancer and damage vital organs,¹² increases the risk of stillbirths and can lead to neurological disorders.¹³

Particularly in Southeast Asia, policies and programs pushed by governments, international financial institutions (IFIs) and industries are focused on recycling over more environmentally and socially preferred options for end-of-life (EoL) management of waste from technologies for

⁸ Amanda Rensmo et al., "Lithium-ion Battery Recycling: A Source of Per- and Polyfluoroalkyl Substances (PFAS) to the Environment?" *Environmental Science Processes & Impacts* 25, no. 6 (January 1, 2023): 1015–30, <https://doi.org/10.1039/d2em00511e>.

⁹ "Manufacturing of Electric Vehicle Batteries in Indonesia Riddled by Human Rights and Environmental Abuses - Business & Human Rights Resource Centre," Business & Human Rights Resource Centre, n.d., <https://www.business-humanrights.org/en/from-us/media-centre/manufacturing-of-electric-vehicle-batteries-in-indonesia-riddled-by-human-rights-and-environmental-abuses/>.

¹⁰ Fair Finance Asia and Profundo, "Unearthing the Hidden Costs," December 2024.

¹¹ Chn Staff, "Indian Start-ups Mine E-waste for Battery Minerals but Growing Industry Has a Dark Side," Climate Home News, February 9, 2025, <https://www.climatechangenews.com/2025/01/21/indian-start-ups-mine-e-waste-for-battery-minerals-but-growing-industry-has-a-dark-side/>.

¹² None Ankit et al., "Electronic Waste and Their Leachates Impact on Human Health and Environment: Global Ecological Threat and Management," *Environmental Technology & Innovation* 24 (October 28, 2021): 102049, <https://doi.org/10.1016/j.eti.2021.102049>.

¹³ World Health Organization: WHO, "Electronic Waste (E-waste)," October 1, 2024, [https://www.who.int/news-room/fact-sheets/detail/electronic-waste-\(e-waste\)#:~:text=E%2Dwaste%20contains%20several%20known,and%20function%20of%20the%20lungs.](https://www.who.int/news-room/fact-sheets/detail/electronic-waste-(e-waste)#:~:text=E%2Dwaste%20contains%20several%20known,and%20function%20of%20the%20lungs.)

conserving material resources from waste. In a recent report, in scenarios where vehicle electrification progresses, even if all used batteries can be reused in the power generation sector, a large number of batteries will still end up as waste,¹⁴ which can be attributed to the lack of standardization across manufacturers.

The importance therefore of ensuring that extraction for clean energy technologies allows for reduction of dispensable extraction, making redesign, repurposing, reuse and repair as standard practice should be paramount over recycling. However, international financial institutions (IFIs) like World Bank (WB) and the Asian Development Bank (ADB) push recycling as the centerpiece of addressing the expected unmanaged wastes in the next ten years. Under the frameworks of circular economy, harmful recycling methods such as metallurgy, pyrometallurgy and incineration technologies were pushed even though these technologies destroy most precious materials in those used batteries. In the name of circularity, IFIs also influence trade regimes and industry plans to ignore multilateral environment agreements regulating the transport of hazardous waste while keeping the domestic capacities for safe and just circularity of the global south unaddressed.¹⁵

Exportation of used EVs and EV battery waste trade reinforces waste colonialism

Most EV batteries in the market right now are not designed for repair, as they have proprietary parts and disassembly procedures specific to the manufacturer to maintain competitive advantage against other manufacturers. If the product cannot be repaired, then the product becomes hazardous waste and contributes to waste colonialism as there is no domestic capacity to safely dispose of the waste. This therefore raises health risks and environmental justice issues, particularly in the global south, which has historically been overburdened by waste colonialism.¹⁶ This is evident, for instance, in Indonesia, where despite relatively-established recycling ecosystems, multiple reports of health concerns in Jakarta and Bogor continue to persist relating to exposure to batteries.¹⁷

In addition, as the EV battery supply chain gets more consolidated around the region and more EV battery recycling plants begin to operate, they will have to source spent EV batteries from other countries to sustain their own operations and not lose money, as is happening in Malaysia where there is not yet enough local EV battery waste to adequately supply at the recycling infrastructure at least until 2030, resulting in waste imports.

There is now a global recognition that batteries even at their end of life still contain significant value but obtaining that value differs in different batteries. Lead acid batteries are often

¹⁴ Naoko Doi et al., "Reuse of Electric Vehicle Batteries in ASEAN" (Economic Research Institute for ASEAN and East Asia, March 2024).

¹⁵ Ngo Forum On Adb, "Forum Network Letter – Concerns on ADB CM2CET Value Chains Approach," *Ngoforumonadb* (blog), February 17, 2025, <https://www.forum-adb.org/post/forum-network-letter-concerns-on-adb-cm2cet-value-chains-approach/>. The ADB policy brief states recycling repeatedly without addressing better options. See Cyn-Young Park and Anna Cassandra Melendez, "Building Resilient and Responsible Critical Minerals Supply Chains for the Clean Energy Transition," *ADB Briefs*, May 1, 2024, <https://doi.org/10.22617/brf240251-2>.

¹⁶ Global Alliance for Incinerator Alternatives et al., "Electric Vehicle Batteries and Waste Colonialism," 2024, <https://www.no-burn.org/wp-content/uploads/2024/06/07-Battery-Infosheet-EV-Battery-Risks-of-Waste-Colonialism.pdf>.

¹⁷ Michelle Anindya, "Indonesia's EV Ambitions Highlight Urgent Battery Recycling Challenges," *Dialogue Earth*, September 16, 2024, <https://dialogue.earth/en/energy/indonesias-ev-ambitions-highlight-urgent-battery-recycling-challenges/>.

recycled domestically mostly by informal waste recyclers because of its simplicity and despite its risks. But Lithium ion batteries are more complex to recycle and thus in the absence of domestic recycling capacity, trade in used batteries, regarded internationally as hazardous waste, comes in. The appetite for obtaining secondary materials from used batteries has increased due to the growing environmental concerns and restrictions in the access to virgin materials as a result of an ongoing geopolitical conflict giving birth to EV battery recycling policies in both resource-constrained and mineral-rich countries. But just like any global value chain, the global south has been a part of the global value chain for secondary raw materials for battery recycling only insofar as taking the hazardous, low-value and labor-intensive processes for remanufacturing by the global north. The differentiated capacities of the global north to the global south to process secondary materials creates new sets of inequities.

Lastly, the region is also seeing increasing trading of second-hand vehicles and/or EVs with obsolete technology. For instance, in some MENA countries such as Egypt, second-hand EVs are seen by the government as expedited ways to increase uptake of EVs in the transport sector.¹⁸ In the Asia-Pacific region this takes on a different form, with older EV technology from China in the form of lead-acid battery-powered two- and three-wheeler EVs finding their way in emerging markets in India, the Philippines, and Indonesia.¹⁹ These older technologies are relatively easier to disassemble than the most advanced EV batteries right now, but this comes at a cost of higher chances of exposure to toxic fumes. This undoubtedly affects the health of those who handle them, but it also contaminates the immediate environment.

Right to just and favorable working conditions (in mining, manufacturing, processing, recycling, wastepickers)

The rights of workers from upstream (miners), midstream (manufacturing workers) and downstream (recyclers, wastepickers) phases in the lifecycle of EV batteries are especially affected in this transition, of which impacts are amplified precisely because of the lack of safeguards for the labor sector in the region especially for the informal sector.

In countries that have a significant informal waste economy like the Philippines, wastepickers have started collecting and selling used batteries, with some reporting injuries and even deaths from handling and dismantling them. As mentioned, these batteries are the older lead-acid types, which result in chemical burns and even death when handled improperly. Because of the lack of oversight in e-waste regulations, most e-waste like lead-acid batteries are overlooked and end up in the informal economy. Our field visits in communities in Malabon, Metro Manila in the Philippines have uncovered an extensive network of informal actors involved in battery trading, which is lucrative for companies who collect the batteries, but not so with the wastepickers who end up bearing the brunt of all the risks associated with handling the batteries.

¹⁸ Economy Division et al., "Used Vehicles and the Environment: A Global Overview of Used Light Duty Vehicles - Flow, Scale and Regulation," 2020, <https://stg-wedocs.unep.org/handle/20.500.11822/34175>.

¹⁹ "Trends in Other Light-duty Electric Vehicles - Global EV Outlook 2024 - Analysis - IEA," IEA, n.d., <https://www.iea.org/reports/global-ev-outlook-2024/trends-in-other-light-duty-electric-vehicles#electric-two-and-three-wheelers>.

Because of the difficulty of storing these batteries, they end up getting left in open spaces in densely-populated communities, increasing the risk of exposure to other members of the community. This has led to the workers and their kin falling ill with chemical burns and respiratory issues due to lead exposure. This happens not only in Manila, but also in India where there is a significant informal sector present.²⁰

Among different e-batteries, lead acid batteries have been the preferred option for e-trikes because of its affordability leading to a surmountable amount of waste which opened self-employment opportunities for informal recyclers. However, the increased demand for e-trikes have increased the burden of lead toxicity in developing countries, including Patna, Bihar.²¹ These activities can cause significant biological and neurologic damage, even at small concentrations, and young children are at higher risk. However, most of the residents are not aware of the risk factors associated with lead poisoning.

While it is possible to find out if there is still latent energy left in spent batteries in older technology, these are more difficult to ascertain in newer format batteries without specialized equipment. One of the major risks in disassembling EV batteries is the risk of electrocution and explosions due to latent charges being left in spent batteries. Another community partner in Manila also reported a suspected death of a wasteworker due to electrocution from disassembling a lead-acid battery. Meanwhile, in New Delhi, a city where poverty is prevalent, 50,000 informal workers are exposed to the toxicity and hazards without their knowledge by recovering lithium from e-waste including EV batteries.

These underscore the significant health and occupational safety risks that workers have to face in the disassembly and handling of EV batteries. Additionally, because of the proprietary nature of battery designs, handling needs specialized training specific to the manufacturer. This increases the risk of taking batteries apart improperly. These are not confined to the informal sector alone; even highly-automated plants like the Mercedes-Benz plant in South Korea have experienced accidental thermal runoff whose fires spread even beyond the plants.²²

Labor rights violations in EV manufacturing plants and unsafe working conditions, with a report by Trend Asia documenting 68 workplace incidents in Indonesia, resulting in 76 injuries and 17 deaths from 2015–2021 in Maluku and Sulawesi.²³ Nickel mines where battery manufacturers source their virgin minerals have reported issues on displacement and culture loss.²⁴ In Indonesia, for example, deaths from nickel mines intended for EV battery manufacturing have been reported from PT Gunbuster Nickel Industry, Tsingshan Steel Group, and PT Bintang

²⁰ "What Do EV Batteries Have to Do With Health?," Stanford Woods Institute for the Environment, October 12, 2023, <https://woods.stanford.edu/news/what-do-ev-batteries-have-do-health>.

²¹ Jamal Akhtar Ansari et al., "Blood Lead Levels in Children Living Near an Informal Lead Battery Recycling Workshop in Patna, Bihar," *Journal of Health and Pollution* 10, no. 25 (March 1, 2020), <https://doi.org/10.5696/2156-9614-10.25.200308>.

²² Julian Ryall, "South Koreans Hit the Brakes on EVs After Battery Fires," *Dw.Com*, August 19, 2024, <https://www.dw.com/en/south-koreans-hit-the-brakes-on-evs-after-battery-fires/a-69978616>.

²³ "Manufacturing of Electric Vehicle Batteries in Indonesia Riddled by Human Rights and Environmental Abuses - Business & Human Rights Resource Centre," Business & Human Rights Resource Centre, n.d., <https://www.business-humanrights.org/en/from-us/media-centre/manufacturing-of-electric-vehicle-batteries-in-indonesia-riddled-by-human-rights-and-environmental-abuses/>.

²⁴ Ilo Asia-Pacific, "Is Nickel Mining for EVs Fuelling Abuses in Southeast Asia?," *Eco-Business*, May 17, 2023, <https://www.eco-business.com/news/is-nickel-mining-for-evs-fuelling-abuses-in-southeast-asia/>.

Delapan Group.²⁵ Our members in Malaysia have likewise raised the persistent issue of workers' rights abuses as these plants usually employ undocumented migrants, taking advantage of their willingness to work at any cost.

Lastly, our members have also raised the issue of the lack of transparency on how exactly these batteries are processed. Both for the informal sector and with white-listed recycling, there is little to no information on the traceability of these spent batteries, what is done to them, and how the recycled critical minerals are handled and eventually sold to be used again. Aside from the obvious lack of information, opaque processes also help perpetuate concomitant health and occupational hazards that the informal sector particularly experience. Our community partners in Manila have reported scouring the internet, particularly in YouTube, to teach themselves about battery disassembly. Further, the lack of transparency also means that they are susceptible to being scammed and short-changed by scrap buyers and battery collectors.

Data injustice could occur when wealth-privileged nations are able to invest greater time, energy and capital into building expansive battery passport networks while other nations are left at a disadvantage, exacerbating power asymmetries in the visibility, representation or autonomy in producing the data. These issues raise the question of who would be qualified to enforce such verification standards, especially when batteries cross international borders. For example, self-assessment by companies should be avoided, and independent third-party systems with robust community consultation and strict accountability mechanisms should be preferred.

Barriers in state regulation, international law, and business conduct

Of all the countries leading the charge on EV battery EoL management, only China, India, and South Korea have EV battery-specific EoL policies despite the dominant market share of the AP region globally. While a few countries have entered EoL policies into law, such as battery management rules and extended producer responsibility policies Malaysia, Singapore, and India, these policies are still in their nascent stages and pending mass-scale implementation. This tells us that while there is a very friendly policy environment for the consumption of EVs, end of life policy considerations for EV batteries are not able to catch up to the demand of EVs.

Although many countries restrict the importation of e-waste, there are trends toward relaxations of these restrictions for used batteries including Korea and Philippines to support the local recycling industry. The international community must ensure that multilateral environmental agreements (MEAs) governing the transboundary movement of wastes including the Basel, Stockholm, Rotterdam, and Waigani Conventions are observed even in the adoption of new sustainability frameworks such as circular economy.

Lastly, while international instruments governing global business conduct have become more popular in public discourse like the Corporate Sustainability Due Diligence Directive (CS3D) from the European Commission, these instruments have faced significant pressure from industry players to delay the implementation. This has culminated in the so-called

²⁵ Amy Chew, "Indonesia's Electric Battery Hub Bid Clouded by Mining Deaths," *Al Jazeera*, July 11, 2023, <https://www.aljazeera.com/economy/2023/7/11/indonesias-electric-battery-hub-bid-clouded-by-mining-deaths>.

“stop-the-clock” proposal which effectively delays CS3D implementation by a year, and corporate disclosures and reporting as mandated in the Corporate Sustainability Reporting Directive (CSRD) by 2 years.²⁶ This industry pushback is happening even as producer responsibility is increasingly being seen by civil society actors as a critical element in international cooperation in relation to business and human rights, and as potential legal, regulatory, and reputational threats by industry players.²⁷ At the same time, these shifts are happening against the backdrop of deeper integration between industry players within the critical mineral and renewable energy value chain.

Mining companies are merging, buying subsidiary companies, and participating in joint ventures (JVs) with smelters and refiners. This is creating a more integrated transition minerals value chain between the upstream, midstream, and downstream stages. In the past few years, automobile and battery companies, including Ford Motor Corporation, Hyundai Motor Group, and Volkswagen (VW), have announced agreements and strategic partnerships with mines, chemical manufacturers, and processing plants. This means that battery manufacturer investors are playing a more active role in – and have greater responsibility for – identifying, mitigating, and addressing human rights and environmental harms across all stages of the value chain.²⁸ This raises the stakes, but also the need to better regulate business practices and conduct as supply chains become more integrated and the corporate veil becomes more apparent.

Recommendations

While projections insist that EV batteries will only make modest dents in the demand for critical minerals as illustrated above, the current business models that govern critical mineral extraction for the purpose of EV battery manufacturing can and has already led to the various rights issues outlined above, which can replicate and embed themselves further as the world demands more critical minerals for the transition. We can thus see the EV issue as an issue that requires a **full life cycle approach**²⁹ that takes into account compounding impacts of supply chain decisions, while at the same time prioritizing upstream solutions to address problems that are premised on the implicit disposability of products for profit maximization.

One concrete step in adopting a more sustainable approach to the management of EV batteries is to **codify this framework as a policy for EoL Management**, especially in countries that have yet to develop their battery EoL management policies. This can be further integrated in different Extended Producer Responsibility (EPR) laws to cover more upstream-focused and circular approaches to include e-waste, specifically EV batteries. This can also potentially include creating comprehensive safety nets for informal sector workers who bear the brunt of unregulated battery waste through information drives, training, and capacity building in

²⁶ Herbert Smith Freehills, “The EU Omnibus Package – What Do We Know so Far?” (Herbert Smith Freehills, February 27, 2025).

²⁷ ClientEarth and Frank Bold, “Corporate Environmental Due Diligence and Reporting in the EU” (ClientEarth and Frank Bold, September 2024).

²⁸ Fair Finance Asia and Profundo, “Unearthing the Hidden Costs,” December 2024.

²⁹ GAIA, “Zero Waste Hierarchy for Batteries - GAIA,” GAIA -, October 24, 2024, <https://www.no-burn.org/resources/zw-hierarchy-for-batteries/>.

handling dangerous items such as EV batteries. This of course should be complemented by an equally robust system to collect batteries at the cost of the producers.

Another way to bolster current policies in EoL management is to look at regulations on EV batteries and their management and disposal in international conventions such as the Basel Convention, and the EU Battery regulations and localizing these standards in the region. These conventions cover a broad range of recommendations that are actually aligned with the zero waste approach, such as regulations for safety, repairability, reusability, recyclability, and access to information on battery condition and movements.

Specific to battery recycling, GAIA also advocates for complementary systems to ensure that whatever form EV battery recycling assumes in the next few years, they do so not only with the zero waste lens in mind, but also in taking on more humane and rights-based systems:

GAIA advocates for the Right to Repair of EV batteries. One of the ways we can ensure the sustainability of EV batteries is by prolonging its lifespan as much as possible, which means that batteries should be easy to manage and repair. However, repairing EV batteries is very challenging, requiring additional training or specialized service centers, prohibitively costly meaning consumers or insurers opt to scrap rather than repair the battery, and sometimes impossible due to proprietary technology or battery construction, as well as complicated testing regimes to ensure that batteries are safe to use. While there are some developing policies on consumer right to repair, much more robust and effective laws are needed to ensure consumer right to repair of EV batteries to counter premature obsolescence and automakers monopolizing repair services. Such a right to repair includes: (i) providing universal and fair access to diagnostic information, tools and repair manuals; (ii) removing firmware, software and hardware barriers preventing consumer repair; (iii) following standard design criteria for core components, and (iv) ensuring fair access to and availability of spare parts.³⁰

Another way to ensure that EV battery recycling can have a chance at being sustainable is through battery passports.³¹ A battery passport is a digital twin of a physical battery, storing information including the battery's label, manufacturing history and origin of its materials, battery chemistry, state of health, use history, safe handling and end-of-life (EoL) management. The battery passport is a means to support end-to-end traceability, and provides crucial information for decision-making on repair, reuse, repurposing and recyclability of the battery. A robust and widely accessible battery passport helps provide information critical to removing important barriers to repair, reuse, repurposing, recycling and end-of-life of EV batteries.

Beyond digital labeling, manufacturers can be doing more to support safe recycling and reuse efforts through the distribution of tools, repair training and guides. However, manufacturers

³⁰ "The Right to Repair of Electric Vehicle Batteries," 2024, <https://www.no-burn.org/wp-content/uploads/2024/06/03-Battery-Infosheet-The-Right-to-Repair-of-Electric-Vehicle-Batteries.pdf>.

³¹ Allie Carl/Axios, "Battery Passports," 2024, <https://www.no-burn.org/wp-content/uploads/2024/06/05-Battery-Infosheet-Battery-Passports.pdf>.



could attempt to unfairly charge repair workers for such resources and certification. It is thus crucial that policies center equity and justice in order to prevent such outcomes.

Lastly, **GAIA advocates for IFIs to prioritize material conservation and environmental protection strategies in their circular economy approaches** in critical mining frameworks for transition minerals. The frenzy on recycling as the strategy for circular economy risks ignoring the toxicity, hazards, and long-term implications of current recycling methods such as pyrometallurgy, hydrometallurgy, and incineration. These risks are magnified in a globalized world where countries do not have domestic capacity for safe and just recycling and where most recovery of materials is engaged by the informal waste sector. We encourage IFIs to support domestic capacities for repurposing, reuse, and repair before recycling especially in a globalized world. IFIs must prioritize efforts toward reduced extraction, safer battery designs, rejecting hazardous methods that destroy materials as “recycling” and ensure protection for the informal waste recyclers.