Final report

Electric Vehicle and Renewable Energy E-waste End-of-Life Management – Grenada, Saint Lucia and Jamaica

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Acronyms/Abbreviations

A

Alternating current .... *AC*

B

Basel Convention Regional Centre .... *BCRC*

Best Available Techniques .... *BAT*

Best Available Techniques/Best Environmental Practices .... *BAT/BEP*

Best Environmental Practices .... *BEP*

BlackForest Solutions .... BFS

Bureau of Standards Jamaica .... *BSJ*

Business to Business *B2B*

Business to Consumers *B2C*

C

Cadmium telluride .... *CdTe*

Caribbean Community .... *CARICOM*

Copper Indium Gallium Selenide .... *CIGS*

D

Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH .... *GIZ*

Direct Current .... *DC*

E

Electric Bicycles .... *E-Bikes*

Electrical and Electronic Equipment .... *EEE*

electric-vehicle .... *EV*

end-of-life .... *EoL*

End-of-Life Vehicles .... *ELV*

Environmental Impact Assessment .... *EIA*

Environmental, health, and safety .... *EHS*

environmentally sound management .... *ESM*

Extended Producer Responsibility .... *EPR*

F

Federal Ministry of Economic Affairs and Climate Action .... BMWK

G

Globally Harmonized System .... *GHS*

Grenada Investment Development Corporation .... *GIDC*

Grenada National Accreditation Board ...... *GNAB*

Grenada National Training Agency .... *GNTA*

Grenada Solid Waste Management Authority .... *GSWMA*

I

Induction Motor .... *IM*

International Climate Initiative .... *IKI*

L

Lead-acid batteries .... *LAB*

Lithium Cobalt Oxide .... *LCO*

Lithium Iron Phosphate .... *LFP*

Lithium Manganese Oxide .... *LMO*

Lithium Nickel Cobalt Aluminium Oxide ..... *LNCA*

Lithium Nickel Manganese Cobalt Oxide ... *LNMC*

Lithium-ion batteries .... *LIB*

Lithium-titanate .... *LTO*

M

Ministry of Climate Resilience, The Environment & Renewable Energy .... *MoCRERE*

Ministry of Finance, Saint Lucia Electricity Limited .... *LUCELEC*

Ministry of Health, Wellness and Elderly Affairs .... *MoHWEA*

Ministry of Infrastructure, Ports, Transport, Physical Development and Urban Renewal ....*MIPTPDUR*

Moana Taka Partnership .... *MTP*, *MTP*

N

National Environment and Planning Agency ....*NEPA*

National Skills Development Centre .... *NSDC*

National Solid Waste Management Authority ....*NSWMA*

National Utilities Regulatory Commission . *NURC*

Nationally determined contribution...............*NDC*

Nickel-Metal Hydride ....*NiMH*

Non-Governmental Organization .... *NGO*

O

Organisation of Eastern Caribbean States *OECS*

P

Pay-As-You-Go .... *PAYG*

Permanent Magnet Synchronous Motor ...*PMSM*

Personal protective equipment .... *PPE*

photovoltaic ....*PV*

Plug-in hybrids ....*PHEV*

Polychlorinated Terphenyls .... *PCT*

Printed circuit boards .... *PCB*

Prior informed consent ....*PIC*

Producer Responsibility Organization..........*PRO*

Public–private partnership........................... *PPP*

R

renewable-energy ....*RE*

S

Safety data sheets .... *SDS*

Saint Lucia Air and Sea Ports Authority . SLASPA

Saint Lucia Bureau of Standards .... *SLBS*

Saint Lucia Electricity Limited .... *LUCELEC*

Saint Lucia Solid Waste Management Authority .... *SLSWMA*

Secretariat of the Pacific Regional Environment Programme........................... *SPREP*, *SPREP*

Sir Arthur Lewis Community College

SALCC..90

small-island developing states.....................*SIDS*

Sport Utility Vehicles ....*SUV*

Standard hybrid..*HEV*

Standard Operating Procedures .... *SOP*

State-of-health ....*SoH*

Statistical Institute of Jamaica ....*STATIN*

Supporting the implementation of NDCs in the Caribbean - transforming the transport and energy sectors ....NDC-TEC

T

TA Marryshow Community College......... *TAMCC*

Technical and Vocational Education & Training ....*TVET*

Technical working group .... *TWG*, *TWG*

Terms of Reference...................................... *ToR*

The Federal Ministry of Economic Affairs and Climate Action.....................................*BMWK*

Training of trainers ....*ToT*

U

United Nations Environment ....*UNEP*

United Nations Environmment Programme*UNEP*

Used Electrical and Electronic Equipment. *UEEE*

used lead-acid batteries.............................*ULAB*

W

Waste Electrical and Electronic Equipment ....*WEEE*, *WEEE*

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1. Introduction

The present report consolidates the results of the consultancy *"End-of-Life Electric Vehicle Battery and Renewable Energy E-waste Management – Grenada, Jamaica, and Saint Lucia"*, implemented by BFS within the framework of the NDC-TEC Programme of GIZ.

In recent years, the governments of Grenada, Saint Lucia, and Jamaica have advanced in implementing strategies for the electrification of transport and the expansion of renewable energy generation. These developments, while crucial for decarbonization, introduce a new environmental challenge: the emergence of end-of-life (EoL) components from electric-vehicle (EV) and renewable-energy (RE) systems such as lithium-ion batteries, photovoltaic (PV) panels, and electronic subsystems. The disposal and recycling of these components are complex, often involving hazardous substances, specialized handling requirements, and international shipment procedures governed by the Basel Convention. In small-island developing states (SIDS) with limited technical capacity, economies of scale, and available land, the absence of a structured system for environmentally sound management (ESM) increases the risk of unsafe storage, contamination, and fire incidents, while weakening the potential for material recovery and circular-economy opportunities.

Against this background, BFS has supported national and regional stakeholders in assessing the current situation, identifying gaps, and recommending feasible pathways for establishing or enhancing EoL management systems for EV and RE components. The specific objectives were to conduct a stocktake and market assessment in the three flagship countries (Task 2 according to the Terms of Reference ToR), develop an inventory of priority components requiring intervention (Task 3), identify and evaluate applicable Best Available Techniques (BAT) and Best Environmental Practices (BEP) (Task 5), and propose country-specific roadmaps (Task 6) validated through national validation workshops (Task 7). The purpose of this final report (Task 8) is to integrate the findings of all previous project tasks and to present validated recommendations based on the evidence collected that can guide policy decisions, capacity-building efforts, and infrastructure planning.

Overall, the assessment demonstrates that Grenada, Saint Lucia, and Jamaica have established solid policy foundations for sustainable energy transitions but remain constrained by regulatory fragmentation, limited financing mechanisms, and a lack of trained personnel for hazardous-waste handling. Each country shows distinct priorities and entry points for improvement: Grenada focuses on strengthening standards enforcement and institutional capacity, Saint Lucia places emphasis on the creation of an

Extended Producer Responsibility (EPR) scheme to ensure long-term financing, and Jamaica may function as a regional hub for aggregation and export of hazardous components, given its advanced logistics infrastructure and regulatory experience.

The scope of this report corresponds to the ToR provided by GIZ and encompasses all project activities undertaken between December 2024 and October 2025. It covers the three participating countries and addresses both national and regional dimensions of ESM within the Caribbean Community **(**CARICOM**)** and Organisation of Eastern Caribbean States (OECS) frameworks. The report is based primarily on desk research, stakeholder interviews, and validation workshops, complemented by facility visits in each country in July 2025.

The document is structured as follows: Section 2 presents the methodology applied throughout the project, Sections 3 summarizes the baseline assessment for Grenada, Saint Lucia, and Jamaica, Section 4 consolidates the component's inventory, Sections 5 and 6 summarizes the Best Available Techniques/Best Environmental Practices (BAT/BEP) for the ESM of EoL EV and RE components, and the evaluation of their applicability within a SIDS context, and Section 7 provides detailed country roadmaps and regional recommendations. The concluding section synthesizes key messages and outlines strategic next steps for implementation.

2. Methodology

The methodology adopted for this assignment was designed to systematically assess the readiness of Grenada, Saint Lucia, and Jamaica for ESM of EoL EV and RE components. It combined desk-based research, stakeholder engagement, and technical validation through a sequence of interlinked tasks defined in the ToR (Tasks 1-8), as illustrated in the following figure:

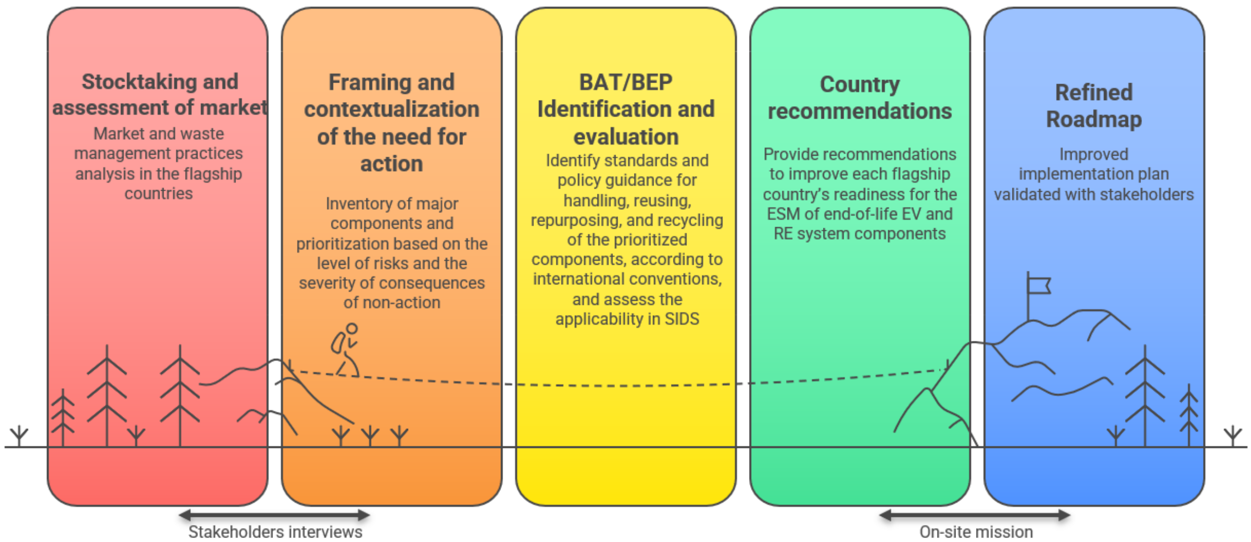


Figure 1. Project methodology

The project started with a stocktaking and market-assessment phase to generate an evidence base on the current state of EV and RE technologies and their associated waste streams in each of the three flagship countries. This involved a comprehensive review of legislation, institutional mandates, infrastructure, and market dynamics related to waste and resource management. The team collected secondary data from official government sources, international databases, and previous studies, supplemented by information provided directly by national institutions and private operators. A gap analysis was applied to identify opportunities for improvement in technology uptake, policy frameworks, and waste-management capacities.

Parallel to the desk review, the team carried out stakeholder mapping and engagement activities to ensure inclusivity and validation of the findings. Key actors were identified across government agencies, regulatory bodies, utilities, private importers, recyclers, civil-society organisations, and academia. Structured interviews and focus discussions were conducted to capture operational realities, challenges, and expectations regarding the management of EV batteries, solar panels, inverters, and related components. In total, thirteen institutions and enterprises were engaged directly or indirectly through these consultations, as stated in the following table:

Table 1. List of stakeholders interviewed. Source: (BFS, 2025)

Country	Institution	Interview Date
Grenada	Waste management private operator	February 20, 2025
	Grenada Solid Waste Management Authority (GSWMA)	February 27, 2025
	Grenada Electricity Services Ltd. (Grenlec)	February 28, 2025
	Basel Convention Focal Point	March 11, 2025
	Private EV dealership and PV panels installer	March 19, 2025
Saint Lucia	Private EV dealership	February 5, 2025
	Private PV panels installer	February 19, 2025
	Technical working group (TWG), including Saint Lucia Solid Waste Management Authority (SLSWMA), dealerships, etc.	February 20, 2025
	Waste management private operator	February 26, 2025
Jamaica	Waste management private operator	January 30, 2025 & February 6, 2025
	Private EV dealership	February 6, 2025
	Waste management private operator	March 3, 2025
	National Environment and Planning Agency (NEPA)	April 2, 2025

Building upon the collected information, the team developed an inventory of major components within EV and RE systems and classified them according to their environmental risks, material composition, and management feasibility. Each component was evaluated against criteria such as hazard potential, recycling value, availability of handling infrastructure, and implications of inaction. This inventory formed the foundation for the selection of priority waste streams requiring technical and policy interventions.

In the subsequent stage, the project team conducted a review and evaluation of BAT/BEP relevant to each priority component. The assessment encompassed both global and regional experiences, referencing European Union directives on Waste Electrical and Electronic Equipment (WEEE), international industry standards and conventions, and pilot models implemented in other SIDS. Each BAT/BEP option was scored using a weighted evaluation matrix that considered technical performance, economic viability, institutional compatibility, health and safety requirements, and environmental outcomes.

The results were then adapted to the Caribbean context, identifying feasible management routes for each waste category.

Following the technical evaluation, country-specific recommendations and roadmaps were formulated through iterative consultations with national stakeholders. Draft recommendations were presented during national validation workshops held in Grenada (14-16 July 2025), Saint Lucia (17-18 July 2025), and Jamaica (21-23 July 2025), complemented by an additional online session in August 2025 for Jamaica. During these workshops, participants were divided into thematic working groups corresponding to four strategic pillars: regulatory framework, collection and take-back logistics, standards and customs control, and infrastructure and resources, to review and refine the proposed activities. The qualitative feedback obtained from these sessions was consolidated and integrated into the final country roadmaps. The final stage of the methodology involved integration and synthesis, consolidating all prior analyses, inventories, and workshop results into this final report. The report's structure mirrors the logical sequence of tasks, progressing from context and evidence generation to validation, recommendations, and regional conclusions.

3. Stocktaking and Assessment of market

This section derives from the development of Task 2: Stocktaking and Assessment of Market, of the project. It presents a comprehensive summary of the current market status in Grenada, Saint Lucia, and Jamaica, focusing on the EV and RE sectors. The objective is to assess national conditions related to market maturity, infrastructure readiness, institutional capacity, and waste-management practices for EoL components. The findings serve as the analytical foundation for identifying gaps, challenges, and opportunities within each country, forming the baseline for subsequent policy recommendations and capacity-development measures.

The assessment integrates four analytical dimensions: 1. The structure and installed capacity of EV and RE markets, 2. the existing regulatory and institutional frameworks governing imports, operation, and EoL management, 3. The level of private-sector participation and financial mechanisms supporting these markets, and 4. The availability of infrastructure for collection, recycling, and transboundary shipment. Together, these dimensions provide a clear picture of each country's progress toward a circular and low-carbon economy, while highlighting key areas requiring technical support, regulatory reform, and investment to achieve ESM of EV and RE components.

3.1. Grenada

3.1.1. Baseline assessment

Grenada's electric-vehicle market is in its early stages but is growing steadily, supported by government policies aligned with the NDC target to reduce transport-sector greenhouse-gas emissions by 20 percent by 2025, compared to 2010 levels (Government of Grenada, 2020). The government promotes this transition through tax exemptions, reduced import duties, and a mandate that 25 percent of new government vehicles be electric or hybrid by 2025 (Ministry of Infrastructure and Energy, 2023). Before 2021, EV adoption in Grenada was minimal, with almost no public charging infrastructure and transport accounting for about 39 percent of national greenhouse-gas emissions (UNEP, 2024). The first pilot began in 2015 when GRENLEC introduced several EVs and launched an awareness campaign (GRENLEC, 2015). Since then, imports have increased, primarily from Nissan, BYD, Tesla, Hyundai, and Mercedes-Benz, supported by dealerships including Go Mobility, Grenada Nissan, Hyundai Grenada, Huggins Automotive, and EcoSolutions (Government of Grenada, 2024).

As of early 2025, Grenada had nine public Level-2 charging stations, mainly in the south and operated by Green Power Grenada (Ministry of Infrastructure and Energy, 2025). The government projects a fleet of 19,000 EVs by 2030 and estimates a need for 800 Level-2 and 68 fast-charging stations nationwide (UNEP, 2024). Import restrictions now prohibit vehicles older than 10 years, and duties on EVs and charging equipment have been removed (Government of Grenada, 2020). Despite these initiatives, high purchase costs remain a barrier, with new EVs costing 26 to 45 percent more than comparable internal-combustion vehicles (World Bank, 2024). Dealerships often lack maintenance capacity and trained technicians for these kinds of vehicles (UNEP, 2024). Three-year warranties with no scheduled maintenance are common, and no major battery failures have been reported (GRENLEC, 2015). Formal take-back systems for EV batteries are still under development (Basel Convention, 2021).

It's important to mention that Grenada has no dedicated EV legislation, yet several strategic documents (most notably the National Sustainable Development Plan 2020–2035) explicitly encourage the import of electric and hybrid vehicles and enforce the ban on vehicles older than ten years (Government of Grenada, 2020). The regulatory environment for EoL management relies on general waste-management law, principally the Waste Management Act (2001), which forbids unauthorized disposal and allows the GSWMA to remove derelict vehicles and scrap metal (GSWMA, 2001). Following its accession to the Basel Convention in 2021, Grenada must manage hazardous waste (like lithium or lead-acid batteries) according to international standards (Basel Convention, 2021). Lacking domestic treatment facilities, the country exports most hazardous waste, mainly to India and South Korea, often via Trinidad and Tobago (UNEP, 2024).

While Grenada's focus has largely been on renewable-energy deployment, its total installed renewable capacity is currently around 5 MW out of a conventional capacity of approximately 52 MW (CCREEE, 2023), less attention has been given to the waste implications associated with EoL RE equipment. The Waste Management Act of 2001 and the Solid Waste Management Authority Act of 1995 (amended in 2008) together form the principal legal basis for the management of solid and hazardous waste, which implicitly covers solar panels and stationary storage batteries once they reach the end of their useful life.

Nationally, e-waste generation in 2022 was estimated at roughly one kiloton (equivalent to 10.4 kilograms per capita), with no official records on quantities formally collected or recycled, indicating that most of the e-waste remains managed informally (UNEP, 2024). The country lacks specialized facilities for recycling or processing EV and RE components such as PV modules and batteries (Government of Grenada, 2024). Existing practices rely primarily on temporary storage or landfilling, with both private operators and GSWMA citing the absence of dedicated infrastructure, consistent funding mechanisms, and technical training for safe and sustainable handling (UNEP, 2024). Collectively, these limitations underscore the urgent need for Grenada to strengthen institutional capacity, operational frameworks, and financial incentives to manage the growing volume of waste generated from the transition to electric mobility and renewable energy systems (Basel Convention, 2021).

Key takeaways of Grenada's twin transitions (toward electric mobility and renewable power generation), supported by fiscal incentives, remain constrained by economic, technical, and institutional limitations (Government of Grenada, 2024). The country has made tangible progress through fiscal incentives, public-sector leadership, and early infrastructure deployment (UNEP, 2024). Nevertheless, significant gaps persist in:

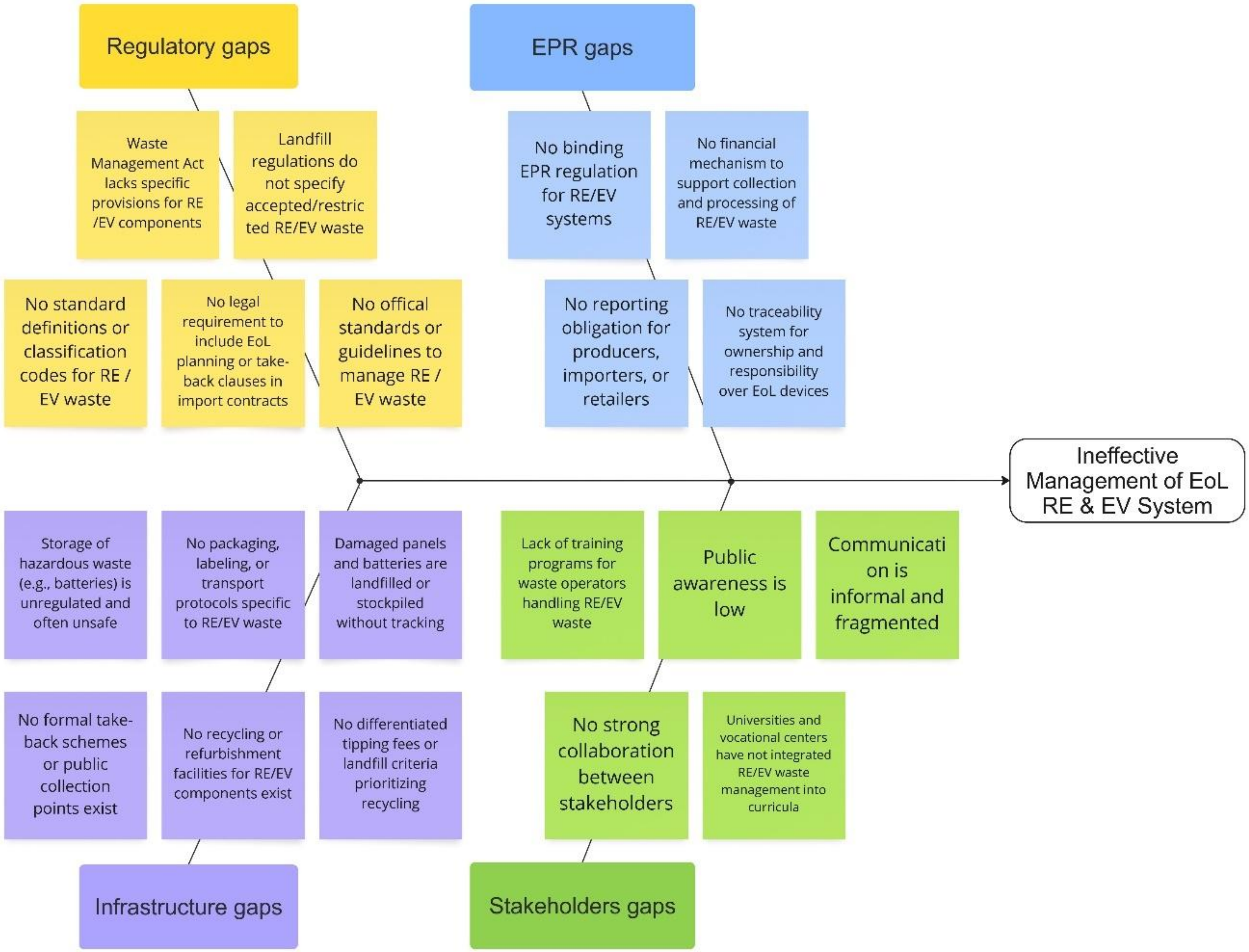
- Establishing formal EoL management systems for EV and RE components
- Strengthening local capacity and enforcement for hazardous-waste handling
- Developing recycling and export logistics to ensure environmentally sound management under the Basel Convention
- Building data and monitoring systems to track waste flows and material recovery.

Addressing these issues will be essential for Grenada to achieve its 2030 targets sustainably and to serve as a replicable model for small-island developing states transitioning to circular, low-carbon energy and transport systems.

3.1.2. Gap assessment

This following section summarizes the gap analysis (details can be found in the corresponding Landscape Assessment Report) of the current framework and practices in managing EoL RE and EV systems in Grenada. It compares the existing "as-is" conditions with desired "to-be" scenarios, highlighting critical gaps clustered in regulatory, infrastructure, and stakeholders' dimensions, summarized in Figure 2. The analysis is based on stakeholder interviews, legal documents, and operational insights serving as a foundation for prioritizing policy and infrastructure interventions.

Figure 2. Gap analysis summary for Grenada. Source: (BFS, 2025)



3.2. Saint Lucia

3.2.1. Baseline assessment

Saint Lucia's electric-mobility and RE transitions remain in early yet dynamic stages, characterized by expanding policy support, gradual market growth, and persistent infrastructural and regulatory gaps, particularly in the management of EoL EV and RE-related waste (UNEP, 2024; Government of Saint Lucia, 2023). The country's EV market, though still small, is accelerating in line with national efforts to decarbonize transport and diversify the energy mix. In 2019 only 23 EVs were registered, but by the end of 2023 this number had increased to 231 electric and hybrid vehicles (roughly 0.55 percent of the national fleet) supported by four public charging stations (LUCELEC, 2023). Import statistics confirm a sustained upward trajectory: annual hybrid and EV imports rose from fewer than 20 units in 2014 to over 1800 in 2024, reflecting growing consumer interest and government incentives (Ministry of Infrastructure, 2024). The administration's current roadmap targets 2025 milestones such as the inclusion of EVs in the government fleet, the creation of technician-training and certification programs, and awareness campaigns emphasizing environmental and economic benefits compared with combustion engines (MIPTPDUR, 2023). Additional fiscal incentives are being prepared to simplify EV importation and accelerate charging infrastructure deployment (Government of Saint Lucia, 2023).

In practice, responsibility for used-battery disposal falls to vehicle owners or insurance companies. While warranty, auditing, and compliance reporting with the manufacturer are consistent, logistical barriers, particularly the cost and complexity of sea returns, affect proper reverse logistics (UNEP, 2024). Overall, the EV market is entering a stage of steady expansion, heightened by clear policy direction but limited by high purchase costs, scarce servicing capacity, and insufficient waste-handling infrastructure (Basel Convention, 2021). Measures taken work alongside the Motor Vehicle and Road Traffic Act, which governs vehicle classification and licensing, and are enforced through customs regulations and technical standards developed by the Saint Lucia Bureau of Standards (SLBS 2023). Building on this, the National Energy Policy Action Plan 2023 - 2030 establishes a detailed framework for decarbonizing transport. Under Goal 4 ("Decarbonize the Transport Sector"), the Government seeks to integrate EVs into its fleet by 2030, develop certification programs for local technicians, intensify public-education campaigns, introduce additional import incentives, expand charging networks, and enact a supportive legal and institutional environment (UNEP, 2024). Implementation responsibilities are shared among the Ministry of Infrastructure, Ports, Transport, Physical Development and Urban Renewal (MIPTPDUR), the Ministry of Finance, Saint Lucia

Electricity Limited (LUCELEC), and other agencies. These coordinated measures aim to transform electric mobility from a pilot phase into a structured component of Saint Lucia's energy transition (Government of Saint Lucia, 2023).

Fiscal incentives remain the strongest catalyst. Importers of pure EVs pay only a fraction of normal import duty and excise tax, with a 5 percent rate currently applied to electric and hybrid vehicles (Ministry of Finance, 2024). Customs authorities are revising vehicle classifications to distinguish EVs and hybrids clearly, facilitating accurate concession application. The Government's collaboration in the Global E-Mobility Program financed by the Global Environment Facility and implemented by United Nations Environment Programme (UNEP) further demonstrates its commitment (UNEP, 2024). Through this initiative, Saint Lucia is procuring at least ten electric vehicles for the public fleet, expanding public-charging infrastructure, and developing procurement and maintenance guidelines (Government of Saint Lucia, 2023). The country's National Adaptation Plan 2018-2028 and updated NDC also prioritize transport-sector decarbonization, targeting a 7 percent reduction in energy-related emissions by 2030 compared with 2010 levels (Government of Saint Lucia, 2020). Saint Lucia is tied to the Basel Convention, and therefore exports of used batteries must follow the Convention's prior-informed-consent procedures. However, a complete domestic e-waste policy translating these obligations into operational practice is still missing. Current practice remains export-based: the country lacks recycling facilities, and e-waste is shipped abroad under Basel Convention procedures (UNEP, 2024).

Data on EV-related waste in Saint Lucia is limited. Basel Convention reports only record exports of used lead-acid batteries (ULABs) from conventional vehicles to Korea with transit in Jamaica between 2016 and 2023, with no official data on lithium-ion batteries (Basel Convention, 2021). The waste system is designed for municipal waste, lacking facilities for electronic or hazardous materials. With only basic landfilling and minor energy recovery operations, lithium-ion batteries are mostly handled informally (collected, stored, or exported without oversight). Private operators export ULABs but have no capacity for lithium-ion batteries, citing high transport costs, lack of government support, and competition from informal collectors who store waste unsafely, raising fire and contamination risks (Government of Saint Lucia, 2023). Workshops and informal mechanics may replace high-voltage batteries without any reporting or disposal system, leading to growing stockpiles (UNEP, 2024). Stakeholders call for official drop-off points, standardized collection, and Basel-compliant export processes.

Similar issues affect the RE sector, as Saint Lucia remains dependent on diesel but aims to achieve 50% renewable electricity by 2030 Government of Saint Lucia, 2023). Installed solar capacity reached 5 MW in 2022 versus 88 MW of diesel generation. The 3 MW La Tourney Solar Farm, operational since 2018, produces around 5 million kWh annually and offsets over a million liters of diesel (LUCELEC, 2023). Distributed rooftop systems add

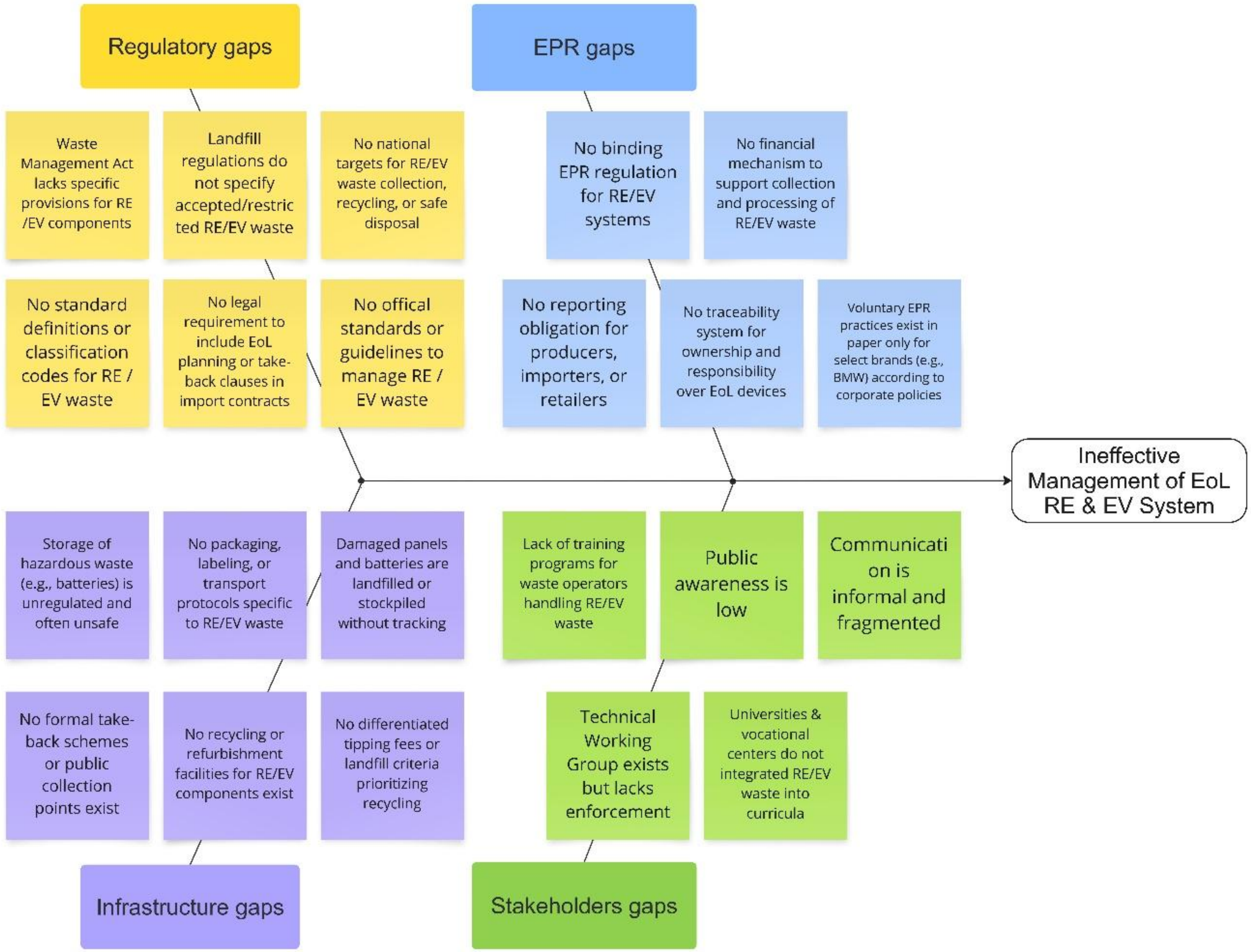
1.7 MW, and demand for hybrid grid-plus-battery systems is growing, though regulation lags. Wind and geothermal development remain in early stages, supported by a $21.9 million World Bank project in the Soufrière region (World Bank, 2023). The Waste Management Act covers solid and hazardous waste but lacks provisions for solar panels or batteries. No PV-specific or e-waste regulations exist, and the 2017 National Waste Management Strategy remains largely aspirational. In 2022, Saint Lucia generated about 2 kilotons of e-waste (11.4 kg per capita), yet only 0.03 kilotons were formally recycled, with most waste handled informally (UNEP, 2024). Only lead-acid batteries are routinely exported for recycling. Authorities and stakeholders stress the need for clear national guidelines and regional cooperation to manage EoL solar panels and batteries safely.

Overall, Saint Lucia's clean-energy and e-mobility transition is advancing under solid policy frameworks but is affected by weak infrastructure, limited funding, and absent EoL systems (Government of Saint Lucia, 2023). Building monitoring capacity, setting disposal standards, and developing regional recycling options will be essential to ensure environmental sustainability alongside the country's low-carbon goals.

3.2.2. Gap assessment

This following section summarizes the gap analysis (details can be found in the corresponding Landscape Assessment Report) of the current framework and practices in managing EoL RE and EV systems in Saint Lucia. It compares the existing "as-is" conditions with desired "to-be" scenarios, highlighting critical gaps clustered in regulatory, infrastructure, and stakeholders' dimensions, summarized in Figure 3. The analysis is based on stakeholder interviews, legal documents, and operational insights serving as a foundation for prioritizing policy and infrastructure interventions.

Figure 3. Gap analysis summary for Saint Lucia. Source: (BFS, 2025)



3.3. Jamaica

3.3.1. Baseline assessment

Jamaica is consistently advancing toward cleaner transport and energy systems, with EVs and RE becoming a central part of the sustainability agenda (Government of Jamaica, 2023; UNEP, 2024). EV adoption is still emerging but gaining attention thanks to supportive policy reforms, growing public interest, and private sector investment. In 2018, Jamaica had about 536,000 internal combustion engine vehicles and only 10 registered EVs, by 2022 the number increased to 150, and by the middle of 2023 to over 200, including cars, Sport Utility Vehicles (SUV), trucks, and e-bikes (UNEP, 2024). Although EVs represent less than one percent of the national total quantity, growth has been consistent, driven by government incentives and increasing model availability (Government of Jamaica, 2023). The number of public charging stations has expanded to 25, with further installations planned by the Jamaica Public Service Company (JPS, 2023).

The National Energy Policy and the Electric Mobility Framework set interesting goals for overall electrification of the transport sector. Plans go from small pilot projects to a full national shift led by public transport, which could encourage more private drivers to follow. By 2030, the goal is of 12 percent of all vehicles and 16 percent of public ones to be electric (Ministry of Science, Energy, Telecommunications and Transport, 2023). The government is supporting this with a charging network, tax breaks, and lower import duties. This change could cut greenhouse gas emissions by about 14 percent compared to current levels (World Bank, 2023). Since all EVs are imported and none are made locally, strong policy support is needed to keep costs low and manage transport and storage challenges. Dealers report problems with EV battery handling and disposal. Luxury brands like Porsche and Audi require special safety systems before selling EVs and use costly containers, up to US$70,000 each, for damaged batteries, which is too expensive for small markets. Some companies are testing shared container systems overseas to reduce these costs (UNEP, 2024).

Brands like BYD allow battery swaps but lack proper collection systems, resulting in the accumulation of used batteries. Lithium Iron Phosphate (LFP) batteries are safer than older types, but still expensive to discard. Without official Tesla service, local mechanics take on repairs. One dealer even built a separate fire-safe room for unstable cars, showing how serious the risks from lithium-ion batteries can be. Government support for electric transport has increased quickly. Import duties on EVs fell from 30 to 10 percent, and new cars get license-fee exemptions (Ministry of Finance and the Public Service, 2023). Lower duties now also apply to electric bikes until 2029. The 2023 EV policy sets out how to grow charging networks, attract private investment, and promote clean transport zones in cities. It also encourages dealers to collect used batteries, reuse them for energy storage, or send them for recycling through approved companies. A technical group is working on safety and labeling rules for EV battery recycling. These are reasonable steps, but enforcement remains weak, and there is no law specifically focused on EV waste. NEPA issues permits for storage and export, though Jamaica still has no central battery treatment site (NEPA, 2024). In practice, the country's waste system cannot yet handle large volumes of EV or lithium-ion batteries. Reports under the Basel Convention show exports only for used lead-acid batteries, mostly to South Korea and Costa Rica, with no records yet for lithium-ion. Private companies collect and export lead-acid batteries, but not lithium ones, because of high costs and limited support. Informal scrap collectors make tracking harder, and poor storage raises fire and contamination risks. Some companies have tested fireproof boxes and return programs, but to date, the procedure has not been required. NEPA issues export permits each year and checks shipments for compliance, but lithium-ion batteries are not yet exported in large numbers. Authorities agree that Jamaica needs national guidelines, more public education, and stronger enforcement, especially after the Basel Convention Amendment from 2025 (Basel Convention, 2021).

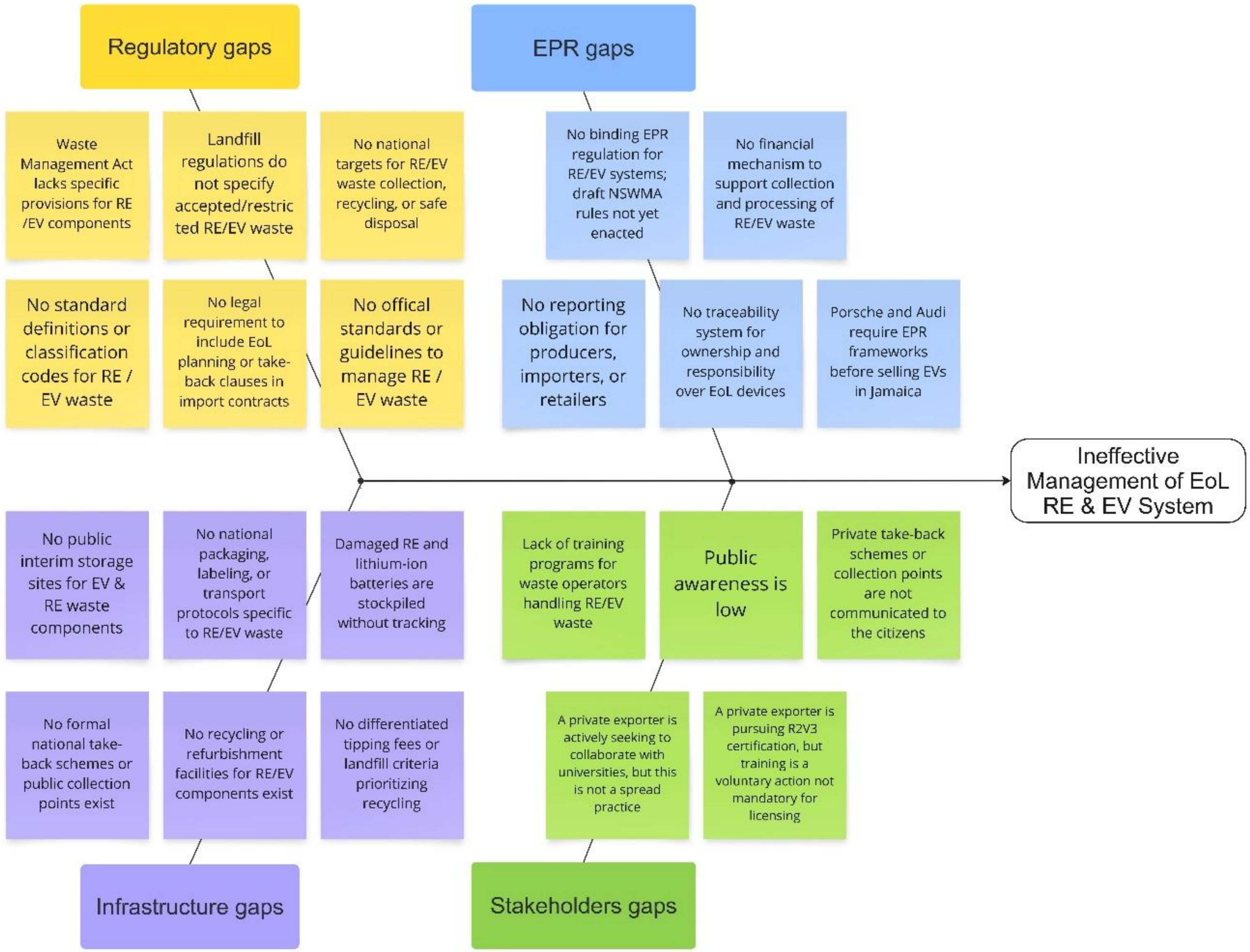
The shift to RE is also underway. Jamaica still depends on oil for most of its power generation (about 89 percent), but RE now makes up about 11 percent, one of the highest shares in the Caribbean (World Bank, 2023). The country has the region's largest wind farm, Wigton (62.7 MW), and about 110 MW of solar as of 2023, reaching a total installed capacity in RE of around 1,071 MW (Wigton Windfarm Ltd., 2023). The island's strong sunlight gives good potential for more solar projects. The 2022 energy plan and the 2015 Electricity Act aim for 50 percent renewable power by 2030, with new project tenders, net billing, and tax breaks (Government of Jamaica, 2022). Homeowners can claim up to 30 percent tax credit for solar systems. Project bids and tariffs are managed by the Generation Procurement Entity and the Office of Utilities Regulation (OUR, 2023). However, Jamaica still lacks facilities to handle waste from solar panels, inverters, and large batteries.

Waste generation will rise as early solar systems reach the end of their life. Wind farms will also add waste soon, with the first Wigton phase expected to generate more than 200 tons of blade material that is difficult to recycle (Wigton Windfarm Ltd., 2023). Metal parts like towers and generators are usually sold as scrap, which helps reduce waste. In 2022, Jamaica produced about 21 million kilograms of electronic waste, or 7.4 kilograms per person, but only 0.1 million kilograms were properly recycled, meaning most remains unmanaged (UNEP, 2024). Waste operators and NEPA note that public awareness of e-waste is low and that agencies lack resources to manage it. The National Solid Waste Management Authority (NSWMA) has added e-waste bins and holds landfill permits, but collection is still limited. Private recyclers handle lead-acid batteries profitably, while lithium and solar waste stay in storage, waiting for export options. NEPA treats lithium batteries as hazardous and follows Basel rules, though no local standards exist yet Basel Convention, 2021). New Basel rules for non-hazardous electronic waste will add more requirements for recyclers and customs officers; therefore, more training and enforcement are urgently needed. Jamaica's clean energy shift is moving forward, driven by clear policies and growing market interest, but limited infrastructure, weak coordination, and low public awareness remain barriers. The lack of recycling systems and EoL management could create new environmental problems if not addressed. Better data, stronger enforcement, and regional recycling partnerships will be key to making the country's energy transition both sustainable and balanced.

3.3.2. Gap assessment

This following section summarizes the gap analysis (details can be found in the corresponding Landscape Assessment Report) of the current framework and practices in managing EoL RE and EV systems in Jamaica. It compares the existing "as-is" conditions with desired "to-be" scenarios, highlighting critical gaps clustered in regulatory, infrastructure, and stakeholders' dimensions, summarized in Figure 4. The analysis is based on stakeholder interviews, legal documents, and operational insights serving as a foundation for prioritizing policy and infrastructure interventions.

Figure 4. Gap analysis summary for Jamaica. Source: (BFS, 2025)



4. Framing and Contextualization of the Need for Action

This section derives from Task 3 - Framing and Contextualization of the Need for Action, which establishes the analytical foundation for identifying and prioritizing areas where immediate policy, technical, and operational interventions are required. The task builds upon the baseline assessments and gap analyses conducted under Task 2, translating their findings into a structured understanding of the risks, material flows, and infrastructure limitations associated with EV and RE components at their EoL.

The framing exercise aimed to contextualize the scale and urgency of action for small island developing states, recognizing their growing dependence on imported clean technologies and their limited capacity for safe treatment, recycling, or export of hazardous waste streams. By integrating technical data, institutional mapping, and stakeholder insights, the task provides a strategic rationale for intervention, linking environmental risk with material value, circularity potential, and feasibility of management. This section introduces the inventory of major components and their prioritization based on risk and recovery potential. It provides the foundation for designing targeted actions in subsequent sections, ensuring that future policy and infrastructure planning respond effectively to the most critical waste streams, particularly batteries and solar panels, where both environmental risk and opportunity for material recovery are highest.

4.1. Inventory of Major Components

This study developed an inventory and ranking system to identify which parts of EV and RE systems create the highest environmental and safety risks at the end of their life. The goal was to help SIDS plan ahead for growing waste streams as these technologies become more prevalent. The assessment examined not only the equipment already in use in the three focus countries, but also newer or less common technologies that are likely to expand in the near future. The inventory included all main types of EVs battery electric (BEVs), plug-in hybrids (PHEVs), standard hybrids (HEVs), electric bikes, scooters, motorcycles, and buses. For RE systems, the focus was on solar and wind technologies, and on their electrical and electronic parts that fall under international waste categories for electronic equipment and batteries. Large utility-scale projects often include EoL clauses in their contracts, but smaller or individual installations usually do not. These smaller systems, therefore, became the focus in the assessment. The analysis also covered the main types of batteries used in these systems, including both lead-acid and lithium chemistries such as LFP, Lithium Manganese Oxide (LMO), Lithium Nickel Manganese Cobalt Oxide (LNMC), Lithium Cobalt Oxide (LCO), Lithium Nickel Cobalt Aluminium Oxide (LNCA), and Nickel-Metal Hydride (NiMH).

Each component was evaluated against the following criteria: (i) material value looked at whether useful materials could be recovered locally or sold to international recyclers, (ii) recycling infrastructure examined whether countries already have facilities to process the materials or would need to export them, (iii) consequences of inaction assessed how harmful the component could become if mishandled, (iv) circularity and repairability looked at how easily the item could be repaired, reused, or refurbished to extend its life, (v) feasibility of managing risks checked if local infrastructure, such as storage sites, recycling centers, or trained workers, can safely deal with it. Each criterion received a score from 0 (low concern) to 2 (high concern). A high score indicated that the item must be prioritized due to its hazardousness, value, and/or difficulty to handle locally.

Detailed reasoning behind the prioritization according to each criterion is presented below:

Table 2. Rationale behind prioritization of inventory components, high (2) to low (0) priorities. Source: (BFS, 2025).

Criteria/ Priority	2	1	0
A. Weighed score of the market value	The component is critically hazardous and has no intrinsic value, it is therefore costly to handle it at its EoL which requires export	The component has no positive market value to justify its export, but it may be deposited in a hazardous waste landfill or sanitary landfill according to national law (may also need exporting)	There is a demand in the national/international market for the component, it can be exported/sold to the local industry at a profit.
B. Recycling infrastructure availability	There are no treatment capacities to recycle the dominant component of the product, it must be disposed of.	There are only international technical capacities to recycle the dominant component of the product, but some manual dismantling is possible.	There are both local and international technical capacities to recycle the dominant component of the product (or, there is already a takeback/replacement system in place)
C. Severity of consequences for inaction	Inaction poses significant environmental and/or health risks, materials can easily leach/be released into the environment. Mismanagement can lead to fires and explosions	Inaction could result in moderate environmental risks, and mismanagement of the devices potentially leads to material loss/material value loss (reducing possibilities of sale, reuse, or recycling)	Inaction has minimal consequences; the component is inert and can be landfilled, or could be safely stored at equipped interim storage centers.

Criteria/ Priority	2	1	0
D. Circularity and repairability	The component is neither locally repairable nor recyclable; no known safe reuse potential. Or the component's failure leads to the whole device's discarding.	Subcomponents may be maintained or refurbished but not cost-effectively or only under prolonged waiting times and logistical efforts. Its replacement is possible without discarding the whole device. The potential for technicians to repair exists.	The component is locally repairable or recyclable using existing tools or manual methods.
E. Feasibility of mitigating risks with local capabilities	No feasible options exist to manage or contain risks using local infrastructure or skills, export is necessary.	Partial risk mitigation may be possible, but requires infrastructure to be built/retrofitted/expanded for interim storage capabilities	Risks can be effectively mitigated with existing local skills, storage facilities, engineered landfills for materials with low reactivity, or recovery processes without a need for export.

4.2. Major Findings

The results consolidated in Table 3 show that batteries and solar panels are by far the most critical components, requiring the most attention and planning. Lithium-ion batteries, particularly those of the LMO and LFP types, are now widely used in solar systems. These batteries have good resale value when undamaged and can be sold to international recyclers, but they also pose fire and explosion risks if punctured, stored poorly, or exposed to high heat and humidity. Since there are no facilities in the flagship countries to safely discharge, dismantle, or pack these batteries for export, many are being stored temporarily by private operators who are waiting for better export options.

Solar panels are the second most critical waste stream. Most panels in use are monocrystalline silicon types, which are heavy and hard to recycle. They contain recoverable materials such as aluminum, glass, silver, and silicon, but recycling them locally is not possible at present. Panels made with cadmium or Copper Indium Gallium Selenide (CIGS) are more dangerous because they contain heavy metals that can leach into soil or water if the panels are broken. Manual dismantling is limited and often causes further breakage, making handling and transport more difficult. In small islands, damaged panels are hard to stack and store safely. Broken glass and exposed wiring can cause injuries or fires, and recyclers generally pay less or even charge fees for taking damaged panels. Proper storage and packaging are therefore essential but still missing in most places.

Other components of RE systems, like inverters, charge controllers, and meters, carry lower environmental risks but still add to total e-waste volumes. These devices contain metals and plastics that are not biodegradable, and if burned, they can release toxic fumes. They are complex to dismantle but could be collected and exported in bulk for treatment abroad. Overall, the findings highlight that SIDS face similar challenges: the most hazardous and difficult materials are high-energy batteries and solar panels, while the main barrier is limited infrastructure for safe handling and export. Some of these materials have market value, but the costs of collection, transport, and export are often higher than the revenue they generate.

As a result, used batteries and panels are being stockpiled or landfilled, waiting for better management options. The framework used in this study helps governments decide where to focus first. It separates components that can be handled locally, with small improvements such as technician training or basic dismantling, from those that must be exported for specialized treatment. It also shows the need for clearer national rules, better tracking systems, and stronger collaboration between government, recyclers, and importers. Batteries and solar panels should be treated as top priorities for setting up dedicated collection, storage, and export systems, while lower-risk components can continue to be managed through regulated waste channels.

Table 3. Prioritization matrix for all components. Source: (BFS, 2025).

Type of system	Components	Weighed score of the market value	Management infrastructure availability	Severity of consequences for inaction	Circularity and repairability	Feasibility of mitigating risks with local capabilities	Sum
Battery Electric Vehicles (BEVs)	Battery (most common type LFP, NMC)	1	2	2	2	2	9
	Electric motor (Permanent Magnet Synchronous Motor (PMSM), Induction Motor (IM))	0	0	1	1	2	4
	Controller	1	1	1	1	2	6
	Inverter	0	1	2	1	2	6
	Onboard charger	1	1	1	1	1	5
	DC Converter	0	1	2	1	2	6
	Display screens and board electronics	1	2	0	2	0	5
Plug-in Hybrid Electric Vehicles (PHEVs)	Battery (most common type LFP, NiMH)	0	1	2	2	2	7
	Electric motor (PMS, IM)	0	0	1	1	2	4
	Controller	1	1	1	1	1	5
	Inverter	0	1	2	1	2	6
	Onboard charger	1	1	1	1	1	5
	DC Converter	0	1	2	1	2	6
	Display screens and board electronics	1	2	0	2	0	5
Hybrid Electric Vehicles (HEVs)	Battery (most common type NiMH, LFP)	0	1	2	2	2	7
	Electric motor	0	0	1	1	2	4
	Controller	1	1	1	1	1	5
	Inverter	0	1	2	1	2	6
	DC Converter	0	1	2	1	2	6
	Display screens and board electronics	1	2	0	2	0	5
	Battery (LFP, NCM)	2	2	1	2	2	9

Type of system	Components	Weighed score of the market value	Management infrastructure availability	Severity of consequences for inaction	Circularity and repairability	Feasibility of mitigating risks with local capabilities	Sum
Electric Bicycles (E-Bikes)	Electric motor	1	1	0	1	1	4
	Controller	1	1	1	1	1	5
	Sensors	2	1	1	1	1	6
	Display screens	1	2	0	2	0	5
Electric Scooters	Battery (most common type LFP)	0	1	2	2	2	7
	Electric motor	1	1	0	1	1	4
	Controller	1	1	1	1	1	5
	Charge port	1	1	0	2	1	5
	Display screens	1	2	1	2	0	6
Electric Motorcycles	Battery (most common type NMC, somewhat LFP)	1	1	2	2	2	8
	Electric motor	1	1	0	1	1	4
	Controller	1	1	2	1	1	6
	Charge port	2	1	1	2	1	7
	Display screens	1	2	0	2	0	5
Electric Buses	Battery (most common type LFP)	0	1	2	2	2	7
	Electric motor	0	1	1	1	1	4
	Controller	0	1	1	1	1	4
	DC Converter	0	1	1	1	2	5
	Charge port	2	1	1	1	1	6
	Display screens and board electronics	1	2	1	1	1	6
Electric vans	Battery (most commonly LFP)	0	1	2	2	2	7
	Electric motor(s)	0	1	1	1	1	4
	Controller	0	1	1	1	1	4
	DC Converter	0	1	2	1	1	5

Type of system	Components	Weighed score of the market value	Management infrastructure availability	Severity of consequences for inaction	Circularity and repairability	Feasibility of mitigating risks with local capabilities	Sum
	Inverter	0	1	2	1	1	5
	Charge port	1	1	1	1	1	5
	Display screens and board electronics	1	2	1	1	1	6
Solar energy	Solar panel	2	1	1	2	1	7
	Battery*	0	1	2	2	2	7
	Controller	1	1	2	1	1	6
	Inverter	1	1	2	1	1	6
	Breakers	1	1	1	2	1	6
	Utility meter	1	1	1	2	1	6
	Screens and displays	2	2	1	1	1	7
Wind turbines	Battery storage (most commonly LFP)	0	1	2	2	2	7
	Generator	1	2	2	1	1	7
	Controller	1	1	2	1	1	6
	Power converter	1	1	2	1	1	6
	Cabling	0	2	1	2	1	6
	Metering	1	1	1	2	1	6
	Sensors	2	1	1	1	1	6
	Monitoring	2	1	1	0	1	5
ULAB (automotive)		0	1	2	2	2	7
ULAB (RE)		0	1	2	2	2	7
Automotive	LNMC	0	1	2	2	2	7
	LCO	1	1	2	2	2	8
	LNCA	1	1	2	2	2	8
	NiMH	2	1	2	2	2	9

Type of system	Components	Weighed score of the market value	Management infrastructure availability	Severity of consequences for inaction	Circularity and repairability	Feasibility of mitigating risks with local capabilities	Sum
Renewable energies (lithium)	LMO	1	1	2	2	2	8
	LFP	0	1	2	2	2	7

5. Best Available Techniques (BAT) and Best Environmental Practices (BEP)

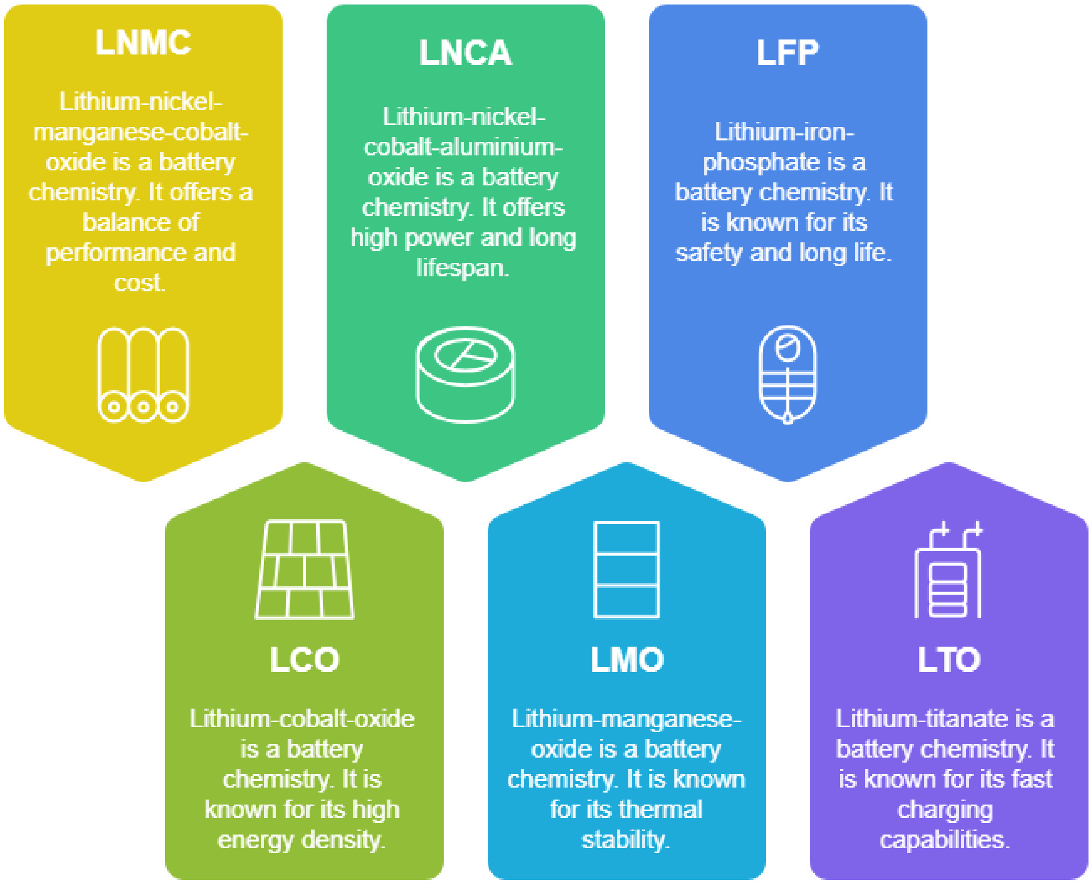
This section summarizes the execution of Task 5 “Identify and evaluate current and emerging best available techniques (BAT) for the environmentally sound management (ESM) of EV and RE equipment components at the end of their life”. It provides an overview of the principal processes, technologies, and operational standards currently applied or emerging internationally to ensure safe, efficient, and sustainable handling of ELV and RE components. The identification process focused on evaluating BAT and BEP across the entire EoL chain, including collection, dismantling, material recovery, recycling, and disposal. The objective is to highlight proven and scalable methods that minimize environmental impacts, optimize material recovery, and comply with international conventions such as the Basel Convention and related regional frameworks.

The section also establishes a comparative baseline for subsequent evaluation in the next phase of Task 5, where the technical, economic, and environmental feasibility of each BAT and BEP will be assessed in relation to the Caribbean context. This ensures that the final recommendations are both technologically relevant and adaptable to the institutional, infrastructural, and economic realities of the region.

5.1. Lithium-ion Batteries

Lithium-ion batteries (LIBs) comprise several chemistries with distinct characteristics that influence their performance, cost, and EoL management. The main types include LNMC, LCO, LNCA, LMO, LFP, and LTO (lithium-titanate) as summarized in the following figure. These variations determine not only the functional use of LIBs but also their suitability for reuse, recycling, and repurposing strategies in both electric mobility and renewable energy sectors.

Figure 5. Main types of lithium-ion battery chemistries and their key characteristics, highlighting variations in performance, safety, and cost. (Source: BFS, 2025)



5.1.1. Handling

Lithium-ion batteries (LIBs) encompass several chemistries, each with specific characteristics influencing performance, safety, and cost (Tianyu Zhao et al., 2024). Cobalt-based types offer higher energy density, making them suitable for electric vehicles and mobile applications, though they are more expensive (Akram & Abdul-Kader, 2024). In contrast, LFP and LTO prioritize safety and stability, ideal for renewable energy storage but limited by lower energy density and higher costs (Chen et al., 2023).

Each chemistry differs in voltage, capacity, charge/discharge rate, cycle life, and safety profile (Kampker et al., 2023). LNCA and LNMC provide high capacity and power, with energy densities typically ranging between 150–250 Wh/kg and cycle lives of 1,000-2,000 cycles, while LFP and LTO excel in safety and thermal stability (Tianyu Zhao et al., 2024). LFP batteries usually offer 90–160 Wh/kg with 2,000–7,000 charge cycles and a lifespan of 10–15 years, whereas LTO, despite its lower energy density of around 70–90 Wh/kg, achieves over 10,000 cycles and supports exceptionally fast charging, making it valuable for specialized applications such as grid stabilization and high-frequency cycling in renewable energy systems (Akram & Abdul-Kader, 2024; Chen et al., 2023).

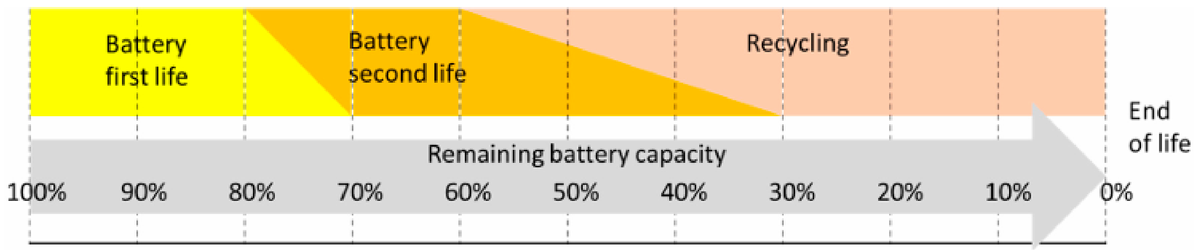
To ensure safe handling, industry guidelines emphasize correct collection, labeling, and storage of lithium batteries (UNEP, 2024). Collection systems must use clearly marked, weather-protected bins, with trained staff ensuring safe handling, isolation of damaged units, and adherence to fire prevention measures (Basel Convention, 2021). Storage facilities should comply with technical standards, maintain ventilation and fire barriers, and include quarantine areas for defective batteries (UNEP, 2024).

Packaging and transport follow international conventions which regulate the classification, packaging, labeling, and documentation of lithium battery waste (IATA, 2023). These frameworks mandate UN-approved containers, strict short-circuit prevention, and limits on package weight and state of charge (Basel Convention, 2021). Air transport is subject to the most stringent restrictions, allowing only approved or prototype batteries under specific safety conditions (IATA, 2023). Finally, labeling and traceability requirements under EU regulations will soon require manufacturers to disclose detailed battery information, including chemical composition, manufacturing data, and environmental impact, to support safe dismantling, recycling, and reuse within the circular economy framework (EU, 2023).

5.1.2. Reusing and/or repurposing

Battery repurposing and recycling decisions are guided by their remaining capacity. Batteries operating between 100–80% capacity are considered within their first life, primarily used in EVs. Once capacity declines to 80–60%, batteries are suitable for second-life applications, such as stationary or backup energy storage. When capacity falls below 60%, performance becomes insufficient for reuse, making the battery a candidate for recycling.

Figure 6. Lifecycle stages of a battery, from first use through second-life applications to final recycling. (Source: Lieskoski et al., 2024)



LIBs play a central role in enabling circular energy systems by extending product life before recycling (Akram & Abdul-Kader, 2024; UNEP, 2024). Their reuse and repurposing provide several key benefits, including a reduction in raw material extraction, particularly lithium, cobalt, and nickel, which helps mitigate environmental degradation (Chen et al., 2023; Hive Power, 2022). They also prevent landfill accumulation and reduce the risk of toxic leakage by postponing disposal, thereby contributing to safer waste-management practices in accordance with global ESM principles (UNEP, 2024). Moreover, LIBs facilitate renewable-energy integration by providing cost-effective energy-storage solutions that stabilize solar and wind power generation, improving grid reliability and reducing dependence on fossil fuels (Akram & Abdul-Kader, 2024; Chen et al., 2023).

However, several challenges hinder the large-scale implementation of these benefits. Recycling efficiency remains limited due to the absence of standardized battery designs and the high energy demands of current recycling processes (Kampker et al., 2023). Environmental and safety risks also persist, as improper handling or reuse can lead to the leakage of toxic materials or the release of hazardous gases (UNEP, 2024). Additionally, LIBs pose fire hazards related to thermal runaway and unstable conditions during operation or storage, risks that are amplified in regions lacking proper EoL infrastructure and trained personnel (Hive Power, 2022). Their performance can also be unpredictable due to uneven degradation across cells, necessitating rigorous inspection, testing, and monitoring prior to repurposing to ensure safety and reliability (Kampker et al., 2023; Akram & Abdul-Kader, 2024).

Globally, battery repurposing and remanufacturing capacity remains concentrated in a few regions. Europe leads with a strong and expanding network of industrial actors, followed by several in the United States and emerging facilities in South Africa (BFS, 2025; UNEP, 2024). Prominent companies across these regions specialize in second-life battery systems, remanufacturing, and energy-storage integration (Chen et al., 2023). The limited geographic distribution of such facilities indicates that battery repurposing remains economically and technically concentrated in industrialized markets. For SIDS, the establishment of this infrastructure locally is likely unviable due to high investment requirements, logistical constraints, and limited economies of scale (BFS, 2025; UNEP, 2024).

5.1.3. Recycling

LIB recycling relies on three main process routes, mechanical, hydrometallurgical, and pyrometallurgical, that together enable recovery of valuable materials. Mechanical processing breaks and separates the battery components into key fractions such as metals and black mass. Hydrometallurgy then dissolves and refines these fractions through leaching and precipitation to extract pure metals. Pyrometallurgy uses high-temperature treatment to melt and reduce the remaining materials into reusable alloys. Each route presents its own operational challenges and opportunities for efficiency improvement, and in practice, they are often combined to maximize recovery yield and minimize environmental impact.

The following table presents a summary of the three main recycling routes:

Table 4. Lithium-ion battery recycling technologies, processes, and improvement opportunities. (Based on: Lieskoski et al., 2024)

Recycling Type	Mechanical Processing	Hydrometallurgy	Pyrometallurgy
Process	Mechanical crushing (shredding) of battery cells and modules Release of recyclable materials as shredded material Safety risks due to electrolyte residues, removed by drying/pyrolysis Mechanical separation of 'Black Mass' (Co, Ni, Mn, C), foils, and separator parts Further processing in metallurgical and chemical processes	Recovery of pure non-ferrous metals from active materials Black mass is dissolved using acid digestion Transition metals (Ni, Mn, Co) are precipitated as salts - Chemical processes include leaching crystallization, precipitation	High-temperature processes applied directly or after mechanical steps Production of alloys and slag containing valuable metals (Cu, Co, Ni, Li) Loss of manganese and aluminum due to high temperatures Fluorides removed through high-temperature treatment Economic efficiency with a high recyclable material proportion

Recycling Type	Mechanical Processing	Hydrometallurgy	Pyrometallurgy
Mechanical Overview	Shredded material Black Mass Separator Current collectors	Black Mass Acid leaching Precipitation Solids separation	Metal alloy (Ni, Co, Cu, Fe) Electrolyte evaporation and energetic use Melting & reduction of metals Melting & decomposition of polymers & binders
Challenges	Requires advanced process engineering for material separation Only discharged cells can be processed Difficult removal of electrolyte components due to varying boiling points	The influence of feedstock contamination is not well-understood Cross-contamination affects material quality and yield Scaling up known processes to industrial scale	Recovery of valuable materials lost in pyrolysis (Mn, Al, polymers) High energy consumption required for efficiency Electrolyte recovery is not yet feasible without mechanical processing
Opportunities for Improvement	Integration of thermal steps for complete electrolyte removal Grade separation for better hydrometallurgical processing	Avoidance of cross-contamination through upstream separation Removal of fluoride ions through upstream processing - Improving graphite recovery	Combining with mechanical processes Removing non-recoverable materials before thermal treatment

5.2. Nickel Metal Hydride Batteries

NiMH batteries consist of a nickel hydroxide cathode, a metal hydride alloy anode (containing rare-earth elements such as lanthanum, cerium, and neodymium), and an alkaline electrolyte of potassium or sodium hydroxide (Kampker et al., 2023; UNEP, 2024). The typical composition includes roughly 30–35% cathode, 25–45% anode, and smaller proportions of electrolyte, separator, and casing materials (Akram & Abdul-Kader, 2024). NiMH technology is widely used in hybrid vehicles, railways, and off-grid renewable systems requiring reliable energy storage (Chen et al., 2023). These batteries offer 1,000–5,000 charge cycles, a 10–15-year lifespan, and efficiency levels between 60–70%, with energy densities ranging from 75–80 Wh/kg (Hive Power, 2022; UNEP, 2024). Proper maintenance is key to extending battery life. Best practices include using chargers specifically designed for NiMH batteries, removing them once fully charged, avoiding overcharging, maintaining regular discharge cycles, storing at room temperature, and preventing exposure to extreme heat or cold (Basel Convention, 2021; Lieskoski et al., 2024).

5.2.1. Handling

According to the United Nations Environmment Programme (UNEP) Guidelines on General Material Handling, the management of NiMH batteries requires strict control to prevent chemical releases and ensure occupational safety throughout all stages, from handling and collection to storage and transport. Due to their composition, NiMH batteries pose fire and explosion risks during transport, making proper separation, packaging, and labeling essential. All stakeholders must be trained to minimize the release of hazardous substances and to implement immediate containment and clean-up in case of leakage or spillage. The UNEP Guidelines on Battery Collection further emphasize that battery chemistries must be identified and segregated at collection points to mitigate fire hazards. Damaged or leaking NiMH batteries must be placed in acid-resistant, leakproof containers, and the draining of electrolytes is strictly prohibited. Collection entities must ensure that batteries are transferred only to licensed facilities authorized for environmentally sound recycling operations.

For storage, the UNEP Guidelines on Safety Storage specify that NiMH batteries must be kept in temperature-controlled, well-ventilated areas, away from direct sunlight and excessive heat. Storage must allow for emergency access and prevent heat propagation through adequate spacing or fireproof insulation. Quantities must be limited to ensure safety and structural stability. Packaging and labeling practices must comply with the UN

Model Regulations on the Transport of Dangerous Goods and the Globally Harmonized System (GHS). Under the UNEP Transport Guidelines, NiMH batteries categorized as hazardous waste must be transported in compliance with strict regulations. Transport procedures must include measures to prevent movement, short circuits, and electrolyte leakage, supported by adequate cushioning and spill control materials. Personnel must be trained in emergency response procedures, and transport plans must include contingency measures for fire or spillage. Finally, NiMH batteries are considered “Not Restricted” for air transport if they meet safety provisions preventing short circuits and unintentional activation. Air shipments must clearly indicate “Not Restricted” along with a reference to Special Provision A199, ensuring compliance with air safety and electromagnetic emission standards.

5.2.2. Reusing and/or repurposing

Repurposing and reusing NiMH batteries presents both environmental and economic advantages. By extending their operational life, these batteries help reduce dependence on raw material extraction and contribute to lowering electricity storage costs by approximately 12-41%, according to recent studies (Akram and Abdul-Kader, 2024). Their integration into renewable energy systems, such as solar installations, can also reduce carbon emissions by providing stable, cost-effective energy storage solutions (Chen et al., 2023). However, several challenges remain in realizing large-scale second-life use of NiMH batteries. Technological barriers arise from the variety of chemistries, cell sizes, and configurations, which complicate standardization and scaling efforts (Kampker et al., 2023). From an economic perspective, the declining cost of new batteries reduces the financial appeal of repurposing older ones. In addition, regulatory and market gaps persist, with few clear policies defining quality standards, safety requirements, and financial models for second-life applications (Hive Power, 2022). Finally, performance degradation over time requires detailed testing and certification to ensure reliability and safety in energy storage applications.

5.2.3. Recycling

The recycling of NiMH batteries involves a combination of mechanical, thermal, and chemical processes designed to recover valuable materials such as nickel, cobalt, and rare earth elements. Each method varies in efficiency, cost, and environmental impact. The following table summarizes the main recycling approaches currently used, highlighting their processes, advantages, limitations, and material recovery potential, as documented in recent studies and industrial practices.

Table 5. Summary of Nickel-Metal Hydride (NiMH) battery recycling methods, recovered materials, and process characteristics. (Based on: Ebin et al., 2018; Nickelhütte Aue GmbH, 2025; Umicore, 2025; SNAM, 2025; Gravita India; Drehmoment.net; Benchmark Minerals.)

Recycling Type / Process	Description	Recovered Materials	Advantages	Challenges	Sources
Mechanical Pre-Treatment	Grinding and sieving of spent NiMH batteries to classify materials by size and separate metals, plastics, and other components. This step enriches valuable metal content for further processing.	Mixed metal fractions (Nickel, Iron, Cobalt), plastics, separators.	Enables efficient separation and material recovery; reduces impurities before further treatment.	Limited recovery of rare earth elements (REEs) without additional chemical processing.	Ebin et al. (2018); Gravita India; Drehmoment.net; Benchmark Minerals.
Pyrometallurgical Recycling	High-temperature smelting used to recover metals from battery waste. Commonly involves incorporating NiMH batteries into stainless steel production.	Nickel, Iron, Cobalt.	Industrially proven, scalable method; compatible with existing metallurgical infrastructure.	Rare earth elements (REEs) remain in slag, making their recovery complex and inefficient.	Ebin et al. (2018); Nickelhütte Aue GmbH (2025); Umicore (2025).
Hydrometallurgical Recycling	Chemical leaching using acids (sulfuric, nitric, hydrochloric) and oxidants to dissolve metals. Solvent extraction or precipitation	Nickel, Cobalt, Rare Earth Elements.	Higher efficiency in recovering REEs and transition metals compared	Requires complex chemical management; potential environmental impact	Ebin et al. (2018); SNAM (2025).

Recycling Type / Process	Description	Recovered Materials	Advantages	Challenges	Sources
	separates individual elements.		to pyrometallurgy; allows metal purity refinement.	from acid use.	
Combined Hydro-Pyrometallurgical Process	Sequential use of thermal (pyro) and chemical (hydro) methods for high recovery efficiency. Pyro stage produces metal-rich intermediates, followed by hydrometallurgical leaching for purification.	Nickel, Cobalt, Iron, and other high-value metals.	Maximizes recovery yield and material purity; adaptable to different battery chemistries.	High energy consumption; requires specialized equipment and treatment of chemical residues.	Nickelhütte Aue GmbH (2025); Umicore (2025).

5.3. Lead Acid Batteries

Lead-acid batteries are among the most widely used energy storage systems, valued for their reliability, cost-effectiveness, and high recyclability. Structurally, they consist primarily of lead metal and lead oxides, which make up about two-thirds of the total battery weight, along with a sulfuric acid electrolyte, plastic or hard rubber casing, and cell separators typically made from polypropylene or fiberglass. At the end of their life, lead-acid battery waste streams include metallic lead, lead alloys, lead oxides, lead sulfate, diluted sulfuric acid, and various plastic components. Each of these materials requires careful management to prevent environmental contamination and to enable efficient recovery of valuable metals through established recycling processes (UNEP, 2024; DoITPoMS, University of Cambridge).

5.3.1. Handling

According to the *UNEP Technical Guidelines on the Environmentally Sound Management of Waste Lead-Acid Batteries* (UNEP, 2024), the safe handling of used lead-acid batteries is essential to prevent the release of lead and acid into the environment. Lead and its compounds, found in plates, slags, and residues, are highly toxic, so these wastes must never be discharged onto open ground or mixed with other materials. Handlers and end users are expected to follow strict safety measures, using protective equipment, keeping batteries intact, and immediately cleaning up any spills or leaks (UNEP, 2024; Heinrich Böll Stiftung, 2018).

Batteries collected for recycling must only be transferred to licensed facilities that operate under recognized environmental standards. Breaking or draining batteries before shipment is prohibited, and collection points should store them in acid-resistant containers within well-ventilated, covered spaces (UNEP, 2003; Ecomena, n.d.). UNEP (2003, 2024) further recommends storing ULABs on impermeable, acid-proof surfaces with drainage systems connected to effluent treatment plants. Areas must be clearly marked, accessible only to trained staff, and equipped with fire-fighting tools and air-filtration systems to control lead dust.

Packaging and labeling follow the UN Model Regulations and the GHS. Containers must be leak-proof and approved under UN 2794, with visible hazard markings and the chemical symbol "Pb" to identify lead content (YUASA, n.d.; Exide Technologies, 2016). During transport, ULABs are treated as hazardous materials. They should be sealed, secured, and clearly labeled in line with international standards, and transported only by certified carriers trained to handle hazardous waste. Vehicles must carry spill-response kits and contingency plans to address possible leaks or fires (Battery Rescue, 2020; UNEP, 2003). These practices together support compliance with the Basel Convention and help ensure that lead recovery from used batteries protects both human health and the environment (UNEP, 2024).

5.3.2. Reusing and/or repurposing

Reusing or repurposing lead-acid batteries (LABs) offers several environmental and economic benefits. Extending their operational life delays disposal and maximizes the use of existing materials, thereby reducing the need for new lead extraction and minimizing the environmental footprint of mining activities (Akram & Abdul-Kader, 2024). Repurposing also helps prevent contamination from lead and acid leakage that can occur when batteries are improperly discarded or landfilled. Additionally, second-life applications, such as using refurbished batteries for solar microgrids and rural electrification, can enhance energy access and support low-cost, decentralized power systems, while reducing pressure on recycling infrastructure (Chen et al., 2023; Hive Power, 2022).

However, several challenges hinder large-scale implementation. Battery performance and degradation vary greatly between units, requiring careful testing and assessment before reuse (Kampker et al., 2023). Safety concerns related to acid handling and potential lead exposure also demand strict operational controls. Inconsistent aging histories make it difficult to predict performance in second-life applications, and the lack of unified regulations or technical standards across the supply chain further limits the scalability of repurposing initiatives (Akram & Abdul-Kader, 2024; Kampker et al., 2023).

5.3.3. Recycling

Modern ULAB recycling combines pyrometallurgical, hydrometallurgical, and acid treatment methods to achieve lead recovery rates above 99%. These integrated approaches reduce emissions, enable resource reuse, and align with circular economy principles (Tianyu Zhao et al., 2024; Aurubis Beerse, 2025), as can be seen in the following table:

Table 6. Overview of state-of-the-art ULAB recycling processes, efficiency, and environmental performance. (Based on: Tianyu Zhao et al., 2024; GME Recycling, 2024; FC Erzgebirge, 2024; Aurubis Beerse, 2025.)

Recycling Type	Process Description	Efficiency & Environmental Performance	Key Features / Advantages	References
Pyrometallurgical Recycling	Involves high-temperature smelting (above 1000°C) using reducing agents such as coke to convert lead compounds into metallic lead. A more sustainable two-step process introduces pre-desulfurization to minimize SO_2 emissions, followed by lower-temperature	Achieves lead recovery rates of up to 99%, depending on smelting technique. Advanced methods like vacuum smelting and roasting reduce energy use and pollutant emissions.	Enables high recovery efficiency, industrial scalability, and the reuse of recovered lead in new batteries. However, requires significant energy input and emission control systems.	Tianyu Zhao et al. (2024); GME Recycling (2024); FC Erzgebirge (2024).

Recycling Type	Process Description	Efficiency & Environmental Performance	Key Features / Advantages	References
	smelting for improved efficiency.			
Hydrometallurgical Recycling	Uses aqueous chemical leaching and electrochemical processes to extract and purify lead. In conventional hydrometallurgy, lead paste is leached and reduced chemically, while in electrochemical methods, lead ions are reduced at the cathode to produce high-purity metallic lead.	Recovers lead at >99% purity with lower energy consumption compared to pyrometallurgy. Reduces air pollution and eliminates the need for high-temperature furnaces.	Offers lower environmental impact, high metal purity, and compatibility with circular economy goals. Emerging as a cleaner alternative to pyrometallurgy.	Tianyu Zhao et al. (2024); Aurubis Beerse (2025).
Acid Treatment Process	Neutralizes sulfuric acid from used batteries with industrial alkaline compounds, converting it into water and sodium sulfate. The treated water meets discharge standards, and sodium sulfate is reused in glass, textiles, or detergents.	Allows recovery of neutralized by-products and reduces acid-related contamination. Some facilities reclaim acid for reuse in new batteries.	Promotes zero-liquid-discharge potential, supports closed-loop acid management, and enhances sustainability in ULAB recycling.	Aurubis Beerse (2025); Tianyu Zhao et al. (2024).

5.4. High-voltage electronic sub-systems

EV power electronics form the core of energy conversion and control within the vehicle, ensuring efficient interaction between the battery, motor, and auxiliary systems. These components include inverters that convert DC battery power into AC for motor operation, DC-DC converters that supply low-voltage systems, and onboard chargers that manage power flow between the grid and the vehicle's battery. Together with printed circuit boards (PCBs) that govern electronic control, these systems are essential to EV performance but also introduce specific challenges for safe handling, recycling, and recovery at end of life. The following chart summarizes the EU's regulatory framework and best practices for managing these components throughout their lifecycle.

- The inverter converts the direct current of the battery to alternating current (AC) for operation of the electric motor.
- The Direct Current (DC) voltage converter supplies the on-board electrical system (low volt auxiliary consumers) with low voltages.
- Onboard-charger with an AC-DC converter is used in EV cars as a link between the external grid and battery.
- The power electronics also comprises PCBs which control electronics.

5.4.1. Handling

The WEEE Directive applies to high-voltage electronic components such as inverters, DC converters, and onboard chargers once they are removed from vehicles. While full vehicles are covered under the End-of-Life Vehicles (ELV) Directive 2000/53/EC, any detached component is classified as Electrical and Electronic Equipment (EEE) and must therefore comply with WEEE requirements for collection, treatment, and reporting. Storage and treatment facilities must meet specific technical standards to prevent contamination and ensure worker safety. Sites must include impermeable and weatherproof surfaces, spillage collection systems, and appropriate containers for hazardous components such as PCBs, Polychlorinated Terphenyls (PCTs), and batteries. All WEEE must bear the crossed-out wheeled bin symbol, indicating that these items cannot be disposed of with general waste and must enter dedicated collection systems.
Together, these provisions ensure that high-voltage electronic components from electric vehicles are handled, stored, labeled, and transported in a manner that safeguards human health, the environment, and material recovery efficiency throughout the product's end-of-life phase.

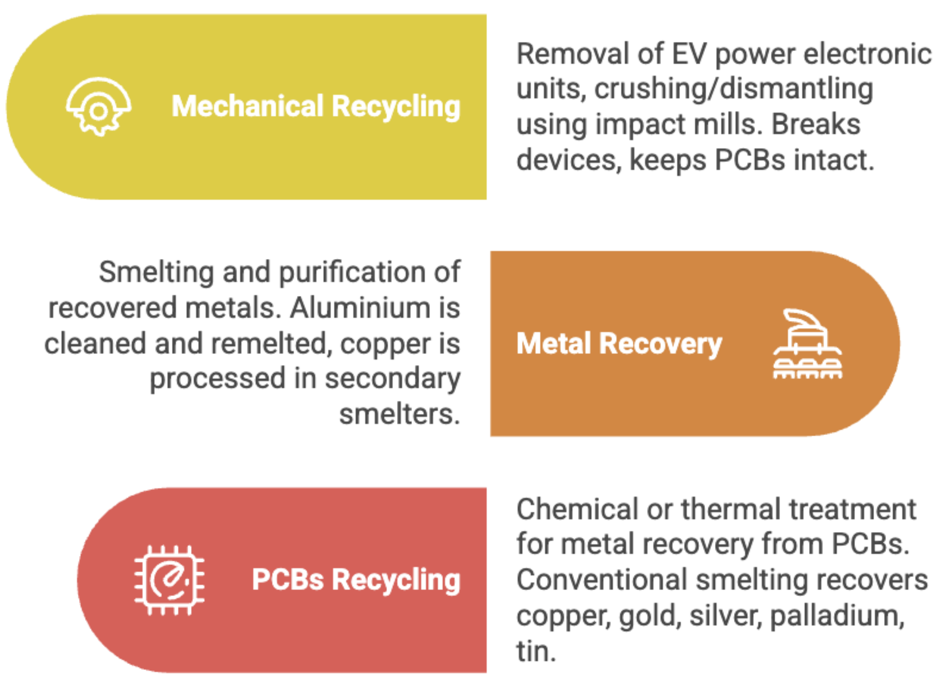
5.4.2. Reusing and/or repurposing

Currently, there is no viable repurposing pathway for EV power electronics. The high level of integration and complexity within these components makes their disassembly and reuse technically and economically impractical. As a result, recycling remains the only feasible option for material recovery at the end of life. Nevertheless, this area represents an emerging field of research and development, offering potential future business opportunities as technologies for component separation and reuse continue to advance.

5.4.3. Recycling

Recycling this type of sub-system usually follows the standard metal scrap recovery process. However, it requires special conditioning to extract valuable or hazardous parts, such as PCBs. The following figure summarizes the steps for their recycling.

Figure 7. Overview of recycling and recovery processes for EV power electronics. Based on: Akram & Abdul-Kader (2024); Chen et al. (2023); UNEP (2024).



5.5. Solar panels

Solar panels are composed of several key materials whose proportions vary depending on the technology used. In crystalline silicon modules, which dominate the global market, most of the mass comes from glass and aluminum, while a smaller share corresponds to silicon semiconductors, polymers, and trace metals. Thin-film technologies, on the other hand, use less glass and aluminum but incorporate a greater variety of compound semiconductors and metals. CIGS and Cadmium telluride (CdTe) panels rely heavily on elements such as indium, gallium, selenium, cadmium, and tellurium, which enable high energy conversion efficiency but complicate recycling because of their toxicity and limited global supply. The proportion of polymers and complex coatings is also increasing in newer designs, which enhances module durability but adds another layer of waste-management complexity.

Table 7. Comparative composition and characteristics of main photovoltaic (PV) module types. Based on: Akram & Abdul-Kader (2024); Chen et al. (2023); UNEP (2024); Lieskoski et al. (2024).

Characteristics	Crystalline Silicon (c-Si)	Thin-Film (General)	CIGS (Copper-Indium-Gallium-Selenide)	CdTe (Cadmium Telluride)
Glass Content	76% (2023), 80% (2030)	Decreasing	89% (2023), 88% (2030)	97% (2023), 96% (2030)
Polymer Content	10%	Increasing	4%	3% (2023), 4% (2030)
Aluminium Content	8% (2023), 7% (2030)	Minimal / N.A.	7% (2023), 8% (2030)	N.A.
Silicon / Semiconductors	5% (2023), 3% (2030)	Increasing	0.2% increase (by 2030)	0.13% (2023), 0.07% (2030)
Other Metals	0.1% (Silver, Tin, Lead)	Higher proportion of compound semiconductors & metals	10% Cu, 28% In, 10% Ga, 52% Se	Nickel, Zinc, Tin (increase from 0.26% to 0.41%)
Efficiency	21% (Back-junction), 19% (Hetero-junction)	Technology-dependent	15% (2023), 20%+ (Future Target)	15.4% (2015), Target 20%+
Notes	Dominant technology;	Lightweight, flexible,	High metal complexity;	High efficiency potential; relies

Characteristics	Crystalline Silicon (c-Si)	Thin-Film (General)	CIGS (Copper-Indium-Gallium-Selenide)	CdTe (Cadmium Telluride)
	mostly glass and aluminium; lower complexity; easier recycling; gradual efficiency gains.	increasing use of mixed semiconductors; recycling more complex.	valuable but rare materials; efficiency improving rapidly.	on cadmium and tellurium; strong need for safe recycling systems.

5.5.1. Handling

The following table presents a consolidation of the guidelines to handle solar panels at the end of their life:

Table 8. Key international guidelines and best practices for the handling, collection, storage, labeling, and transport of end-of-life (EoL) photovoltaic (PV) panels. Based on: European Commission (2012, 2023); UNEP (2024); Basel Convention (2021).

Category	Main Guidelines and Steps
General Handling of Solar Panels	• Collect and transport panels carefully to prevent breakage and release of hazardous substances. • Store panels in covered, weather-resistant facilities to avoid environmental contamination. • Recycle crystalline silicon panels to recover glass, aluminum, and silicon. • Use specialized recycling for panels containing hazardous substances (e.g., cadmium). • Refurbish and reuse functional panels to extend lifespan and reduce waste.
WEEE Directive (PV Panel Collection)	• Revised in 2012 to include PV panels under EoL management responsibilities. • Based on EPR, producers must cover costs for collection, treatment, and monitoring.

Category	Main Guidelines and Steps
	○ Financing: Producers provide financial guarantees, fund collection points, or join compliance schemes. ○ Reporting: Monthly/annual reporting on panels sold, collected, and treated. ○ Information: Panels must be labeled and consumers informed of proper disposal at dedicated facilities.
Financing Mechanisms (WEEE Directive II)	Business to Consumers (B2C) (Private Households): Producers are fully responsible for collection and recycling; Pay-As-You-Go (PAYG) and compliance schemes are common. Business to Business (B2B) (Commercial Use): Producers and owners may share collection and recycling responsibilities; financing through contracts or internal cash flows is allowed; strong regulation required to maintain standards.
Extended Producer Responsibility (EPR)	• Promotes circular economy through reuse and reduction of raw material use. • Producers must manage waste collection, recovery, and disposal for PV panels. • Compliance can be individual or via EPR. • Producers must register under the national WEEE system, finance waste management, offer free household returns, meet recycling targets (65%), report activity, label products with crossed-out bin symbol, and inform users and recyclers.
Safety Storage of EoL PV Panels	• Store PV modules separately from other WEEE under weatherproof, impermeable conditions. • Comply with hazardous waste storage standards • Obtain environmental permits and adhere to accumulation time limits. • Follow universal waste rules (less stringent than hazardous waste) when applicable.

Category	Main Guidelines and Steps
	• Keep modules in dry, safe, clearly labeled areas to prevent exposure to cadmium, lead, or other toxic substances.
Labelling And Identification of EoL PV Panels	• Use robust packaging to minimize shocks and vibrations during transport. • Separate panels with protective sheets and corner guards. • Include necessary documentation: commercial invoice, packing list, customs forms. • Clearly label all shipments per regulatory and safety standards.
Transportation of EoL PV Panels	• Secure panels properly during loading and transit. • Use enclosed vehicles where possible to prevent environmental exposure. • Display hazardous material placards when required. • Maintain documentation such as waste manifests and safety data sheets (SDS). • Apply extra containment for cracked or damaged panels to avoid hazardous material release.

5.5.2. Reusing and/or repurposing

Currently, there is no viable repurposing path for EV power electronics. The high complexity and integrated design of these components make disassembly and reuse impractical, limiting their potential for second-life applications. As a result, recycling remains the only feasible option for material recovery at present. Nonetheless, this area represents an active field of research and development, as well as a potential business opportunity for future innovation in circular-economy solutions.

5.5.3. Recycling

The following table presents a consolidation of the recycling routes for solar panels at the end of their life:

Table 9. Summary of photovoltaic (PV) panel recycling methods, processes, and recovery efficiencies. Based on: Akram & Abdul-Kader (2024); UNEP (2024); Lieskoski et al. (2024); Basel Convention (2021).

Recycling Method	Main Process Description	Recovered Materials & Efficiency
Mechanical Recycling	Panels are manually dismantled to remove aluminium frames, junction boxes, and cables. Non-functional modules are crushed or shredded: materials are separated through sieving, filtering, and density separation.	Recovers glass, aluminium, silicon, copper, silver, tin, plastics. Up to 95% recovery efficiency depending on panel type.
Thermal Recycling	Crushed panels are heated to separate bonded materials. Two methods: 500°C for 1 hour at 450°C/h, gradual heating to 650°C at 10°C/min, held for 1 hour. New technologies use light-pulse delamination to separate layers in seconds.	Recovers 91% glass, aluminium, polymers, silicon (with silver), junction boxes, and bus bars. Enables clean recovery of thin-film layers containing Cd or Te.
Chemical Recycling	Uses solvents and acids to dissolve layers and recover high-value elements. Processes include phosphoric acid to recover wafers, trichloroethylene (80°C, 10 days) to remove EVA, and sulfuric/sodium-based extractions for Cadmium telluride.	Recovers 90% glass and 90% semiconductor materials (Cd, Te). Also recovers silicon cells and polymers.
Hybrid / Combined Approaches	Integrates mechanical, thermal, and chemical methods to improve recovery rates depending on PV technology type (crystalline or thin-film).	Multi-material recovery (glass, silicon, metals, polymers) with increasing purity levels.

6. BAT/BEP Application Assessment in Flagship Countries

This section derives from the second part of Task 5 - Identify and evaluate current and emerging BAT and BEP for the environmentally sound management of EV and RE components at their EoL. It evaluates how the identified BAT/BEP can be adapted and applied within the specific contexts of Grenada, Saint Lucia, and Jamaica, taking into account their regulatory frameworks, market maturity, and technical capacities. The assessment examines the extent to which existing national systems align with international standards and highlights opportunities to integrate proven techniques, such as safe dismantling, intermediate storage, and controlled export for treatment, into national waste-management operations. It also identifies the technological and institutional gaps that may limit adoption, emphasizing the need for capacity building, regional cooperation, and investment in suitable recycling and recovery infrastructure.

Ultimately, this section provides a comparative overview of the readiness of each flagship country to implement BAT/BEP principles, outlining short- and medium-term actions to strengthen environmentally sound management across the EV and RE value chains.

6.1. Application Assessment

The assessment reviewed the BAT/BEP for the environmentally sound management of EV and RE components once they reach the end of their life. It focused on those materials that pose the highest environmental and logistical risks for SIDS identified in Section 4.2: lithium-ion and nickel-metal-hydride batteries, high-voltage electronic subsystems such as inverters and converters, energy-storage batteries, and solar panels.

The goal was to understand which management options are realistic, safe, and aligned with international obligations, while recognizing the limits of local infrastructure and market scale. Because landfilling is neither safe nor sustainable for these materials, the assessment centered on the practices most often recognized as viable worldwide: safe interim storage, export for treatment, local reuse or repurposing, and recycling. Safe interim storage is considered an essential first step, providing a controlled space to accumulate and prepare hazardous waste (particularly batteries) for export. Facilities must follow Basel Convention safety standards, including fire-prevention systems and containment measures.

Though not a final solution or a source of profit, storage facilities make aggregation for export possible. Export remains the main pathway for recovery or disposal where no national treatment exists. Under the Basel Convention, waste can be shipped abroad for recycling or destruction once stored safely and documented. Local reuse or repurposing offers another promising route, following the global waste-management hierarchy by keeping components in use for as long as possible. For example, used EV batteries can be repurposed for stationary RE storage, though this requires testing, disassembly, and adaptation skills that are still limited in the region. Recycling, in turn, targets the recovery of valuable materials such as metals or glass, but it demands high investment and technical capacity, conditions that are difficult to sustain at the current scale of waste generation in Caribbean islands.

The study also aligned its analysis with the broader international framework that governs hazardous materials. The Stockholm, Rotterdam, Minamata, and Basel Conventions (together with the UN's Strategic Approach to International Chemicals Management) set out the global rules for handling, shipping, and treating electronic and chemical waste. These instruments guide how components containing persistent organic pollutants, mercury, or other hazardous substances must be managed, and they underpin the recommendations for storage, transport, recycling, and export proposed in this report.

To identify which practices could realistically be implemented in the Caribbean context, the assessment compared them using eight criteria spanning economic, technical, and environmental dimensions. These included cost, market potential, technical performance, infrastructure compatibility, required skills, regulatory alignment, health and safety needs, and environmental performance. Each practice was scored on how well it met these aspects, from ideal (2) to not ideal (0), to highlight options that balance feasibility, safety, and cost. This approach helps distinguish what can be achieved locally from what will continue to depend on export or external partnerships.

Detailed reasoning behind the prioritization according to each criterion is presented below:

Table 10. Rationale behind prioritization of inventory components, high (2) to low (0) priorities. Source: (BFS, 2025).

ID	Cluster	Criterion	0 (Not Ideal)	1 (Moderate)	2 (Ideal)
A	**Economic**	**Implementation Costs**	Prohibitively high initial and operational costs. No foreseeable financing or return on investment.	Medium costs requiring external subsidies, donor aid, or pooled financing. Viable but not yet self-sustaining.	Affordable to implement and maintain. Can operate sustainably within local/regional funding or blended financing models.

ID	Cluster	Criterion	0 (Not Ideal)	1 (Moderate)	2 (Ideal)
B		**Market Potential**	No market for resulting products; no domestic or regional demand; only generates disposal costs.	Small-scale or emerging markets exist; or just international demand for the products.	Existing markets (national or regional) absorb output; consistent demand for resulting products.
C	**Technological**	**Technical Effectiveness**	Fails to meet EoL handling standards; unable to ensure depollution, recovery, or safe disposal.	Handles key materials but with limited recovery efficiency or environmental control, there is no state-of-the-art process.	Demonstrates high performance in pollutant removal and hazardous waste handling, recovery, and EoL standards compliance.
D		**Infrastructure Compatibility**	Requires advanced infrastructure or utilities unavailable in SIDS/CARICOM (e.g., specialized shredders, labs).	Some adaptation possible (e.g., modular units, shared infrastructure, outsourcing critical steps).	Can be operated with existing infrastructure and utilities (power, space, waste handling, supplies). Enough throughput.
E		**Skill and Training Requirements**	Only operable by highly specialized or scarce labor; certifications may be internationally required.	Requires targeted training, but with feasible upskilling pathways.	Can be implemented with local or entry-level training; minimal need for technical accreditation.
F		**Regulatory and Standards Alignment**	Non-compliant with Basel, Stockholm, Rotterdam, Minamata and SAICM conventions /WEEE/EPR or national regulations; risks legal barriers or import/export issues.	Partial alignment; requires adaptations, permits, or clarification from local authorities.	Fully aligned with applicable regulations; supports traceability and legal waste movements (including transboundary).
G		**Health & Safety Requirements**	Requires extensive H&S infrastructure (e.g., ventilation, PPE, medical monitoring, firefighting systems).	Moderate risks can be mitigated with SOPs and training.	Minimal risk with standard precautions; easily integrated into existing safety protocols.
H	**Environmental**	**Environmental Performance**	Generates harmful emissions, waste, or risk of leaks/spills; major GHG or toxic exposure.	Mitigates some impacts but lacks full containment or advanced treatment features.	Designed to prevent emissions and contamination; high circularity and minimal residuals.

6.2. Major Findings

Practices such as safe interim storage and export scored highest for compatibility with existing infrastructure, as similar approaches are already in operation for ULAB. They can be expanded with investment, particularly for safely handling lithium-ion batteries. Reuse, repurposing, and local recycling scored lower, mainly because they require a higher investment, specialized technicians, and higher waste volumes to become financially feasible.

Overall, the analysis summarizes in Table 11 shows that safe storage and regulated export remain the most practical and compliant options for SIDS in the short term. These allow countries to meet international standards while avoiding the environmental hazards of uncontrolled disposal. In the longer term, building capacity for reuse, repair, and selective recycling could help capture more value and strengthen circular-economy opportunities across the region.

Table 11. BAT/BEP assessment matrix. Source: (BFS, 2025)

	#	A	B	C	D	E	F	G	H	
	Cluster	Economic		Technological					Environmental	
	Criterion	Implementation costs	Market Potential	Technical Effectiveness	Infrastructure Compatibility	Skill and Training Requirements	Regulatory and Standards Alignment	Health & Safety Requirements	Environmental Performance	Total
	Interim storage	2	0	1	2	1	2	1	1	10
Lithium-ion	Export	2	2	2	2	1	2	0	2	13
	Re-use / Repurposing	0	2	1	1	0	1	0	1	6
	Recycling	0	1	2	0	0	1	0	1	5
NiMH	Export	2	2	2	2	1	2	1	2	14
	Re-use / Repurposing	0	2	1	1	0	1	1	1	7
	Recycling	0	1	2	0	0	1	1	1	6
Lead acid	Export	2	2	2	2	1	2	1	2	14
	Re-use / Repurposing	1	2	1	1	1	1	1	1	9
	Recycling	1	1	2	0	1	1	1	1	8
PV panels	Export	2	0	2	2	1	2	2	2	13
	Recycling	1	0	1	1	0	1	1	1	6
High-voltage electronic subsystems	Export	2	2	2	2	1	2	2	2	15
	Recycling	1	2	1	0	1	1	1	1	8

7. Country Recommendations

In the following section, the **country-specific roadmaps** for Grenada, Saint Lucia, and Jamaica are presented. Each roadmap contains a set of activities designed to achieve the ESM of ELV and RE components within each national context. The recommendations are structured around **four strategic pillars** (regulatory framework, collection and take-back logistics, standards and customs control, and infrastructure and resources), which together form a comprehensive framework.

Pillar 1 focuses on strengthening the regulatory framework and the associated financial mechanisms required to sustain the EoL management system. In all three countries, this pillar aims to update or expand existing waste management legislation to explicitly cover EV and RE components and to align national instruments with international conventions. While Jamaica and Saint Lucia expressed a clear interest in introducing EPR as a long-term financing and accountability mechanism, Grenada preferred to follow incremental regulatory improvements and levy-based cost recovery rather than immediate EPR adoption.

Pillar 2 addresses the establishment of a national take-back and collection system. The same three activities were proposed across the three countries, focusing on the standardization of collection protocols, the implementation of public-awareness campaigns, and the creation of operational take-back schemes. Together, these activities aim to build the foundational logistics and behavioral framework that will enable the formal recovery and aggregation of EV and RE waste components.

Pillar 3 targets import control, standards, and transboundary movement. The same four activities were developed across the three countries to enhance quality control at the border, improve technical handling standards, institutionalize mandatory data reporting, and promote regional cooperation under Article 11 of the Basel Convention. The pillar emphasizes harmonized procedures and cooperation among Caribbean Basel Focal Points to facilitate legal and cost-effective waste exports.

Finally, **Pillar 4** focuses on strengthening physical and human capacities to ensure operational readiness and long-term sustainability. Each country's approach reflects its specific priorities: Grenada emphasizes consolidating its existing infrastructure and institutional capacities, Saint Lucia seeks to promote reuse and refurbishment initiatives as part of a circular-economy strategy, and Jamaica is positioned to serve as a regional aggregation and export hub, considering its advanced logistics infrastructure and experience in hazardous-waste shipments.

7.1. Grenada

The following sub-section details the specific roadmap for Grenada, summarized in the following table, including the responsible and supporting institutions for its implementation.

Table 12. Grenada's roadmap activities

Pillar	Activity	Responsible	Support
Regulatory Framework	1. Amend Waste Management Act	Ministry of Climate Resilience, The Environment & Renewable Energy (MoCRERE) / GSWMA	Ministry of Health, Wellness & Religious Affairs, Grenada Ports Authority, Physical Planning Unit, Ministry of Finance, Ministry of Infrastructure and Physical Development, Public Utilities, Civil Aviation and Transportation
Regulatory Framework	2. Amend Environmental Levy Act	Ministry of Finance	GSWMA, MoCRERE, Customs, importers, Grenada Ports Authority, Chamber of Industry and Commerce
Collection & Take-back Logistics	3. Standardize collection protocols	GSWMA	Garages, dealers, Basel Convention Regional Centre (BCRC) - Caribbean, Fire Service, Grenada Bureau of Standards
Collection & Take-back Logistics	4. Fund national public awareness campaigns	GSWMA	Ministry of Education, Non-Governmental Organization (NGOs), local media houses, dealers, garages, OECS Communications Unit
Collection & Take-back Logistics	5. Launch national EV and RE take-back scheme	GSWMA	MoCRERE, Grenada Ports Authority, Physical Planning Unit, Ministry of Finance, Ministry of Infrastructure and Physical Development, Public Utilities, Civil Aviation and Transportation

Pillar	Activity	Responsible	Support
Standards & Custom control	6. Enforce import quality standards and EoL planning	Customs / MoCRERE	GSWMA, Grenada Ports Authority, Ministry of Foreign Affairs, Trade & Export Development, Ministry of Finance, car dealers, solar/EV distributors
	7. Issue technical Standard Operating Procedures (SOPs) for RE/EV handling	GSWMA	Basel Focal Point, MoCRERE, Ministry of Foreign Affairs, Trade & Export Development, Customs, BCRC-Caribbean, Fire Service, private sector logistic, exporters
	8. Mandate data reporting on imports and exports	Customs / MoCRERE	Basel Focal Point, private importers and exporters, Central Statistical Office, GSWMA, Grenada Bureau of Standards
	9. Establish cooperation agreement between the Basel Focal points	Basel Focal Point / Ministry of Foreign Affairs, Trade & Export Development	GSWMA, Basel Focal Points of OECS countries and Trinidad & Tobago, OECS Secretariat, BCRC-Caribbean
Infrastructure & Resources	10. Define final disposal & export criteria	GSWMA / MoCRERE	Grenada Bureau of Standards, Customs, BCRC-Caribbean, Basel Focal Point, private importers, Fire Department
	11. Strengthen existing infrastructure	GSWMA	MoCRERE, Ministry of Finance, BCRC-Caribbean, Customs, garages, waste management operators, Fire Department, Planning and Development Authority, Grenada Bureau of Standards
	12. Conduct feasibility study: Regional pre-treatment and repurposing facilities	MoCRERE	GSWMA, BCRC-Caribbean, OECS Secretariat, Planning and Development Authority

Pillar	Activity	Responsible	Support
	13. Create technician upskilling programs	Ministry of Education	Education centers (e.g., TA Marryshow Community College (TAMCC), Grenada Investment Development Corporation (GIDC), Grenada National Training Agency (GNTA), Grenada National Accreditation Board (GNAB), OECS Technical and Vocational Education & Training (TVET), etc.), GSWMA, MoCRERE, BCRC-Caribbean, private sector
	14. Establish compliant interim storage	GSWMA / MoCRERE	Ministry of Finance, Ministry of Infrastructure and Physical Development, Public Utilities, Civil Aviation & Transportation, BCRC-Caribbean, Fire Service, Planning and Development Authority
	15. Participate in regional export aggregation hub	Basel Focal Point/ GSWMA	Ministry of Foreign Affairs, Trade & Export Development, Basel Focal Points of OECS countries and Trinidad and Tobago, OECS Secretariat, Customs, BCRC-Caribbean, regional transport providers, exporters

Strategic pillars

- Pillar 1: Regulatory framework

The roadmap in Grenada begins by proposing the strengthening of the country's legal foundation. In the short term, the Waste Management Act would be amended to authorize technical standards, landfill restrictions, licensing for new actors, and digital tracking requirements for hazardous EV and RE components. In parallel, the Environmental Levy Act would be revised to expand customs-based levies to batteries, PV modules, and inverters, providing a cost-recovery mechanism for ESM. Medium-term activities include operationalizing these reforms through implementing regulations, inspection protocols, and data systems. In the long term, these two legal instruments could be integrated into a coherent framework capable of supporting EPR and take-back obligations aligned with regional Basel and OECS standards.

- Pillar 2: Collection and take-back logistics

The second pillar focuses on building the operational backbone for safe recovery of EV and RE components. Early actions introduce standardized national collection protocols and public-awareness campaigns to prepare citizens, garages, and importers for proper take-back participation. These would be followed by the launch of a national EV and RE take-back scheme, mapping and designating collection points linked to compliant interim storage and monitored data flows. In the medium term, voluntary participation will transition toward mandatory roles for importers and garages, supported by trained stakeholders. In the long term, Grenada could operate a fully functional, traceable take-back network integrated with a potential regional export and recycling systems.

- Pillar 3: Standards and customs control

This pillar strengthens governance at the border, ensuring that products entering the country meet quality, safety, and traceability requirements. In the short term, import guidelines and documentation would be updated to require EoL plans and performance certificates for all EVs and RE systems. Complementary technical SOPs would be issued for labeling, packaging, storage, and transport, providing uniform instructions to Customs, garages, and waste operators. Mid-term activities include establishing a national digital reporting hub for import and export data and preparing a cooperation agreement among regional Basel Focal Points to ease transboundary movements. In the long term, these measures collectively position Grenada to potentially participate in regional EPR schemes and maintain full compliance with Basel Convention reporting and control obligations.

- Pillar 4: Infrastructure and resources

The final pillar consolidates the physical and human capacity needed for implementation. Short-term activities establish technical criteria for disposal and export and begin improving existing workshops and collection facilities to meet Basel-aligned safety standards. A feasibility study could then determine the most cost-effective model for local pre-treatment and/or second-life operations. In the medium term, targeted technician upskilling programs, developed in collaboration with TAMCC, GIDC, and OECS TVET, would create certified professionals in battery and PV-module handling. In parallel, a compliant interim storage site must be established to safely consolidate materials pending export. Over the longer term, Grenada could fully engage in a regional export aggregation hub, enabling cost-efficient, Basel-compliant shipment of EoL components and completing the circular economy transition of the country.

Vision for Grenada after roadmap implementation

Once Grenada completes the 15 activities under the four strategic pillars listed in Table 13, the country will have transitioned from a reactive and corrective approach to waste management into a preventive and circular system for EV and RE components.

By then, Grenada will have built the full institutional, technical, and human infrastructure needed to manage these components from import to end-of-life. Regulatory instruments, such as the amended Waste Management Act and Environmental Levy Act, will function as the basis of an integrated framework, facilitating the government the licensing, inspection, and financing of ESM.

Data collected through the national digital reporting hub will give real-time visibility into import volumes, local stored levels, and export flows, empowering authorities to take policy decisions based on data and report easily to international conventions.

On the operational side, citizens, garages, and importers will participate routinely in the national take-back scheme, guided by clear collection protocols and sustained public-awareness campaigns.

Materials will move through a safe and traceable chain, from consumer return points to upgraded storage and pre-treatment facilities, managed by trained technicians and operated following standardized SOPs.

The interim storage facility will function as the hub of this network, ensuring compliance with the requirements of the Basel Convention and providing logistical preparation for regional export.

At the regional level, Grenada will have become an active partner in the Caribbean's shared export-aggregation system, collaborating with OECS and/or CARICOM states to lower costs and strengthen collective capacity for hazardous-waste management. By this stage, the country will be positioned to adopt an EPR scheme, transferring part of the financial and operational obligation of EoL management to importers and manufacturers.

The overall vision is a resource-efficient and internationally compliant Grenada where:

- every imported component is traceable to its EoL destination;
- waste is viewed as a recoverable resource, not a danger;
- technicians and small enterprises generate green employment through safe refurbishment and repurposing; and
- institutions work collaboratively within a transparent, well-financed system.

Through this transformation, Grenada will emerge as a regional model for implementing circular economy on small islands, demonstrating that even with limited scale, coordinated governance, informed citizens, and regional partnerships can achieve comprehensive management of the life cycle of renewable energy and electric mobility technologies.

7.1.1. Pillar 1: Regulatory Framework

Activity 1: Amend the Waste Management Act (2001)

Objective

To strengthen Grenada's Waste Management Act by introducing explicit legal provisions that enable ESM of emerging waste streams from EV and RE systems.

Rationale

The existing Act provides a foundation for hazardous-waste control but does not yet include the technical, institutional, or digital tools needed to manage new emerging waste streams of concern, such as lithium-ion batteries, PV panels, and associated components. Amending the legislation will empower GSWMA and MoCRERE to issue standards, enforce landfill restrictions, license new operators, and introduce electronic data-tracking mechanisms consistent with the waste-hierarchy principle.

Table 13. Grenada's activity 1 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Legal analysis:** Review comparative legal frameworks to map the current provisions of the 2001 Act against best international practices, such as OECS and Basel obligations. The review will identify: (a) missing definitions of special or emerging hazardous waste streams such as EV batteries and PV panels; (b) sections where the Minister or the Authority may issue subsidiary regulations; and (c) inspection and enforcement powers that can be expanded. The output should be a proposal showing where enabling

Timeline	Milestones / Key Actions
	clauses for SOPs, digital tracking, and landfill restrictions prioritizing waste hierarchy (e.g., material recovery, reuse, repurposing) can be inserted.
	2. Drafting of amendments: Develop draft clauses introducing: (i) authority for the GSWMA to issue technical standards and landfill restrictions; (ii) mandatory data-reporting requirements for importers and collectors; (iii) licensing obligations for all actors involved in the management chain of hazardous RE/EV components (e.g., informal garages, battery service providers, panel's installers, etc.); (iv) circular-economy and waste-hierarchy principles; and (v) proportional administrative fines and penalties. The Act may include a mandatory five-year review clause to allow continuous alignment with technological change.
Medium term (Years 2–3)	**3. Stakeholder consultation:** Organize national consultations combining technical workshops and public hearings. The process should test the practicality of new obligations for the stakeholders involved (e.g., importers, garages, exporters, recyclers, and Customs); assess enforcement costs; and collect comments for redrafting.
	4. Approval and parliamentary process: Following Cabinet approval of drafting instructions, the Attorney-General's Chambers will conduct legal vetting and table the Bill in Parliament.
Long term (Years 4–5 +)	**5. Adoption and enforcement:** Issue subsidiary regulations specifying SOPs for collection, transport, and interim storage of EV and RE waste; establish inspection procedures, digital manifest requirements, and a schedule of offences. Training for enforcement officers, private stakeholders, and Customs agents will accompany rollout.

Activity 2: Amend Environmental Levy Act

Objective

To update Grenada's Environmental Levy Act to include fees for EV and RE components, specifically lithium-ion batteries, PV modules, and inverters, creating a predictable financing mechanism to support the ESM of these products through storage, repurposing, or export.

Rationale

The current Environmental Levy Act applies primarily to vehicles and selected white goods but does not address high-risk EV and RE components. Without a financial recovery mechanism, Grenada relies on limited public resources to manage EoL hazardous components. Amending the Act will extend the levy system to new product categories, allowing import-based fees to cover handling, export, and repurposing costs. This measure represents a pragmatic, customs-integrated alternative to a full EPR scheme, providing immediate cost recovery while building readiness for future regulatory expansion.

Table 14. Grenada's activity 2 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Legal analysis:** Conduct a comparative analysis of the current Levy Act to identify entry points for adding EV and RE components under the Second or Third Schedule. Review similar fiscal mechanisms in the OECS and Small Island Developing States (SIDS) (e.g., Barbados, Seychelles) to determine compatibility with Grenada's Customs and Excise Act.
	2. Drafting of amendments: Develop draft clauses to: (i) define covered product categories and HS codes (as "waste-risk goods"); (ii) establish refund provisions linked to proven ESM (e.g., repurposing or Basel-compliant export); (iii) specify levy allocation to a dedicated ESM fund managed by GSWMA for interim storage, transport, and export; and (iv) incorporate transparency provisions requiring annual public reporting on levy collection and use. The Act may include a mandatory five-year review clause to allow future integration of EPR mechanisms.
Medium term (Years 2–3)	**3. Financial modelling and fee calibration:** Calculate flat or tiered fees per unit or kilogram that reflect the true EoL management cost of each product class, based on expected import volumes and average export/treatment costs.
	4. Stakeholder consultation: Conduct structured consultations with importers, Customs, MoCRERE, GSWMA, the Ministry of Finance, local distributors, aggregators, and exporters to validate cost assumptions and ensure the levy remains proportionate and enforceable; and collect comments for redrafting.
	4. Approval and parliamentary process: Following Cabinet approval of drafting instructions, the Attorney-General's Chambers will conduct legal vetting and table the Bill in Parliament.
Long term (Years 4–5 +)	**5. Adoption and enforcement:** Upon enactment, operationalize the updated levy through Customs and GSWMA systems. Train Customs officers to apply revised HS codes and collection procedures. Over time, integrate the levy into a hybrid fiscal–regulatory model where importers or producers can transition from paying flat fees to participating in a formal EPR scheme.

7.1.2. Pillar 2: Collection and Take-Back Logistics

Activity 3: Standardize collection protocols

Objective

To develop and adopt clear, easy-to-follow national protocols that guide consumers, installers, and maintenance service providers on how to return EoL batteries, PV panels, and other EV and RE components to authorized collection points. The protocols will establish a consistent process for the public to hand over components intact, ensuring that products reach formal facilities without being dismantled or improperly discarded.

Rationale

At present, individuals and businesses dispose of used solar panels, inverters, or EV batteries in an uncoordinated manner, often mixing them with general waste or leaving them at garages and workshops. This practice increases the risk of breakage, leakage, and fire, and makes subsequent ESM more difficult.

By introducing standardized consumer-facing collection protocols, Grenada will ensure that all end users know where, how, and under what conditions EoL components must be delivered. These protocols will improve safety, support data collection for the national take-back scheme, and build public confidence in the country's emerging RE/EV waste-management system.

Table 15. Grenada's activity 3 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Benchmarking:** Review existing collection practices for used electronics and batteries. Compare current practices with Basel Technical Guidelines, manufacturer recommendations and international best practices for battery and PV handling.
	2. Drafting of national protocols: Prepare a concise set of national instructions describing how and where citizens should return EV and RE components. The guidance will specify that items must remain intact, prohibit casing removal or battery disassembly, and list all approved collection points. It will also include basic safety reminders, such as avoiding exposure to heat or moisture during transport.
Medium term (Years 2–3)	**3. Validation:** Test the draft protocols through consultation sessions and focus groups with households, garages, importers, solar installers, and local councils. These exercises will evaluate clarity, accessibility, and practicality from a user perspective. Feedback will be consolidated for redrafting.

Timeline	Milestones / Key Actions
	4. Dissemination: Communicate the validated protocols through multiple communication channels. Printed leaflets and posters will be displayed at municipal offices, customs counters, and retail outlets, while digital versions will be shared via social media and government websites. Short radio and community-TV segments will reinforce key messages. Demonstration events in schools, repair workshops, and local markets will illustrate the correct process for returning items.
Long term (Years 4–5 +)	**4. Institutional integration and monitoring:** Incorporate the standardized protocols into import licenses, consumer warranties, and installation agreements so that every new EV or RE product is accompanied by clear EoL return guidance. Local authorities will incorporate the same messages into municipal waste education programs. GSWMA will maintain an updated public directory of authorized collection sites and establish a simple monitoring system to record quantities of EoL items received through formal channels. Periodic surveys will assess awareness levels and compliance.

Activity 4: Fund national public awareness campaigns

Objective

To design and implement national awareness and education campaigns that inform households, technicians, importers, and small businesses about the risks of improper disposal of EV and RE components and the benefits of returning them through authorized collection points. The campaigns will cultivate behavioural change by promoting safe handling practices, trust in formal waste systems, and active participation in Grenada's developing take-back scheme.

Rationale

Public awareness of how to manage used EV and RE components in Grenada remains low. Consumers and small enterprises often discard batteries, inverters, and panels with general waste or leave them in open storage, unaware of the potential hazards. This lack of awareness threatens public health, increases the risk of fires or pollution, and undermines collection and recycling initiatives.

Targeted communication is therefore essential to close the information gap and motivate participation. By integrating behaviour-change principles, visual communication, and community outreach, this activity will support the implementation of standardized collection protocols (Activity 3) and ensure that the population understands both why and how to return materials safely.

Table 16. Grenada's activity 4 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling condition:** Activity 3
Medium term (Years 2–3)	**1. Message development and production of materials:** Develop communication materials in multiple formats to ensure accessibility for all audiences. These may include radio and television spots, short video clips for social media, posters, flyers, and illustrated brochures. Materials will be translated into simple, locally relevant language and incorporate Grenadian imagery and testimonials. Special attention will be given to messages for rural communities and informal-sector workers, who may have limited access to online information.
Medium term (Years 2–3) / **Long term (Years 4–5 +)**	**2. National campaign rollout:** Launch national campaign using a multi-channel approach combining traditional media (radio, television, newspapers) with digital platforms and community-level engagement. Activities may include radio talk shows, press features, school presentations, and informational booths at public events. Collaboration with importers and distributors will ensure that awareness materials are displayed at points of sale and attached to new product packaging.

Activity 5: Launch national EV/RE take-back scheme

Objective

To establish a structured national system for the collection and temporary storage of EoL EV and RE components.

The scheme will formalize take-back procedures, define roles for importers, dealerships, garages, private collectors, and the GSWMA, and ensure that all EoL materials are channelled through safe, traceable, and environmentally sound management routes.

Rationale

Grenada currently lacks an organized mechanism for retrieving used EV batteries, PV modules, and inverters once they reach end-of-life. Without an official collection structure, materials often remain abandoned in garages or are informally dismantled, creating safety and environmental hazards.

A national take-back scheme will allow small quantities generated across the island to be aggregated, safely stored, and prepared for eventual regional export. This initiative will translate the new regulatory provisions (Activities 1 and 2), consumer protocols (Activity 3), and awareness campaigns (Activity 4) into a functioning operational system that builds trust among stakeholders and demonstrates the viability of a circular approach to EV and RE waste.

Table 17. Grenada's activity 5 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling condition:** Activity 3
	1. Mapping and design of collection points: Identify and assess suitable drop-off locations that can serve as official collection points for batteries and PV panels (this is also required for Milestone 2 in Activity 3). Potential sites include existing municipal depots, ports, large garages, and dealerships with adequate space and access. Each location will be evaluated against safety, accessibility, and logistical criteria such as proximity to interim storage and transport routes.
Medium term (Years 2–3)	**2. Partnership agreements:** Draft formal agreements with drop-off locations and municipal authorities outlining their responsibilities for receiving, recording, and transferring EoL components. These partnerships will establish the operational model of the scheme and set the basis for future regulatory obligations.
	3. Pilot phase: Launch a pilot take-back programme at two or three locations representing different geographic contexts (urban, peri-urban, and rural). During this phase, operational workflows, data-collection forms, and reporting channels will be tested and refined.
Long term (Years 4–5 +)	**4. Nationwide rollout:** Expand the take-back network across the country by integrating all participating collection points into a unified registry and reporting platform, linking them with the interim-storage facility developed under Activity 14. A help-desk or hotline will be created for citizens and businesses seeking information about where and how to return items in line with Activity 3.

7.1.3. Pillar 3: Standards and Custom Control

Activity 6: Enforce import quality standards and EoL planning

Objective

To apply and enforce minimum quality, documentation, and traceability requirements for all imported EV and RE components entering Grenada by preventing the importation of defective or near-end-of-life products and to ensure that each imported item is accompanied by an identifiable plan for ESM once it reaches end-of-life.

Rationale

A growing proportion of EV and RE components arriving in Grenada, such as used hybrid and electric vehicles, are imported without any foreseen arrangement for proper disposal, even though acknowledging that Grenada does not have adequate infrastructure to offer ESM at the end-of-life of these components. This practice increases future waste volumes and raises safety concerns related to defective or degraded components. By enforcing stricter import-quality standards and requiring EoL planning from importers, the country can reduce hazardous waste generation, enhance consumer safety, and align with regional trade and Basel-Convention commitments. The activity provides a preventive mechanism that complements downstream interventions such as take-back and export aggregation, allowing the country to move forward into the waste hierarchy, promoting waste prevention.

Table 18. Grenada's activity 6 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Define minimum import standards:** Establish a list of minimum quality criteria for imported EV and RE components, specifying, for example, the maximum age of used vehicles, minimum state-of-health (SoH) percentages for batteries, and compliance with recognized international safety standards (IEC, ISO, UN). The criteria may also require importers to submit certificates of origin, proof of performance testing, and manufacturer declarations on expected lifespan.
	2. Develop documentation: Design a standardized declaration form for importers to disclose the anticipated lifetime of each imported item and outline their intended take-back or disposal pathway once the product reaches EoL. This form will include basic data fields such as product category (HS code), serial number, and estimated useful life.
Medium term (Years 2–3)	**3. Legal integration:** Amend import-license regulations and public-procurement guidelines to incorporate the new standards and EoL-planning obligations, ensuring that no importer or distributor will be permitted to place EV or RE products on the market without fulfilling these conditions. Customs will update its digital import-declaration platform to include mandatory fields for SoH values, product age, and EoL-plan reference numbers.
	4. Capacity building: Deliver training sessions for Customs officers, inspectors, and licensing officials to familiarize them with the new quality standards, documentation templates, and verification procedures. A reference handbook will be prepared to guide officers in identifying non-compliant consignments and applying detention or rejection protocols.

Timeline	Milestones / Key Actions
Long term (Years 4–5 +)	**5. Monitoring and compliance:** Establish a coordinated inspection and data-reporting system to record import quantities (Activity 8), verify documentation, and flag high-risk consignments for follow-up. Penalties for non-compliance will be introduced.

Activity 7: Issue technical SOPs for RE/EV handling

Objective

To develop and disseminate national technical SOPs that define the safe handling, labeling, packaging, temporary storage, and export of EV and RE components throughout their life cycle.

These SOPs will serve as binding technical references for licensed operators, customs officers, garages, and waste handlers to ensure consistent application of ESM principles across Grenada.

Rationale

Currently, there are no standardized technical instructions on how EV batteries, solar modules, or inverters should be handled once they are removed from service or prepared for shipment, exposing workers to electrical, chemical, and fire hazards and increasing the likelihood of contamination and/or non-compliance with Basel-Convention requirements.

Developing national SOPs will provide clear technical guidance, align practices with regional and international standards, and enable inspection and enforcement under Grenada's waste-management legislation. The SOPs will build on Activities 3, 5, and 6 by enlarging the EoL managing chain policy and quality-control requirements into operational procedures after collection.

Table 19. Grenada's activity 7 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Reference materials:** Collect and review existing technical guidance, including Basel Convention Technical Guidelines, BAT/BEP recommendations (international and from OECS/CARICOM countries), and manufacturer manuals for lithium-ion batteries and photovoltaic equipment. This desk review will identify the minimum safety and performance criteria applicable to Grenada's context, including packaging standards, chemical-compatibility considerations, and emergency-response requirements.

Timeline	Milestones / Key Actions
	2. Drafting of national SOPs: Prepare a set of concise, modular SOPs collaboratively with a multidisciplinary drafting team comprising GSWMA engineers, the Fire Service, the Grenada Bureau of Standards, private sector, and BCRC-Caribbean specialists. Each module will describe specific procedures such as safe inspection of decommissioned components, voltage-discharge checks, safe lifting and stacking, labeling and hazard signage, waste streams compatibility, spill-containment measures, and response to thermal incidents and accidents.
Medium term (Years 2–3)	**3. Validation:** Refine the SOPs through validation workshops organized with key institutional partners to test the clarity and applicability of the draft procedures. Participants will assess whether the instructions can be realistically implemented with existing infrastructure and identify any additional training or equipment needs. Feedback will be integrated to improve the SOPs.
	4. Capacity building: Deliver training sessions to customs inspectors, garage operators, port workers, and waste-collection and handling operators, combining theoretical instruction with practical demonstrations, focusing on hazard recognition, correct use of personal protective equipment (PPE), incident response, and reporting obligations. A certification process will be established for trained personnel, linked to license renewals and inspection checklists.
Long term (Years 4–5 +)	**5. Legal adoption:** Issue officially the SOPs through ministerial order or gazetting, thereby acquiring regulatory status as it will be stated in the Waste Management Act (Activity 1). All waste-handling licenses and import permits will reference compliance with these SOPs as a condition of operation.

Activity 8: Mandate data reporting on imports and exports

Objective

To establish a mandatory national reporting framework that requires all importers, exporters, and waste handlers of EV and RE components to provide standardized data on product volumes, movements, and destinations.

This system will enable Grenada to maintain a national mass-balance inventory of RE/EV materials, improve traceability along the entire product life cycle, and fulfill its international reporting obligations under the Basel Convention and related agreements.

Rationale

Currently, EV and RE components importation, collection, and export information remains fragmented across Customs, port authorities, and private importers, making it difficult to plan infrastructure, monitor compliance, or quantify waste generation trends. Introducing a legally binding reporting framework will address this gap by establishing consistent formats, clear responsibilities, and shared access to accurate information across agencies, facilitating the generation of annual reports to be submitted to the Basel Convention's Electronic Reporting System, which is currently not being done.

It will also support a potential future implementation of EPR schemes and strengthen Grenada's position as a compliant party to multilateral environmental conventions.

Table 20. Grenada's activity 8 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Policy mandate:** In line with Activity 1 amendments to the Waste Management Act, the obligation for importers, exporters, and licensed waste operators to report data on EV and RE components will be included in the Act. The regulation will specify the frequency of reporting (quarterly or biannual), the responsible authorities, and the penalties for non-submission or falsification. This legal instrument will clearly define data ownership, confidentiality provisions, and the roles of GSWMA, Customs, and the Central Statistical Office in managing and validating the information.
Medium term (Years 2–3)	**2. Development of reporting tools:** Design standardized reporting templates compatible with Customs' digital declaration systems to capture information such as product type, quantity, manufacturer, import date, serial number (where applicable), and declared end-of-life pathway (in alignment with Activity 6). For exports, the templates will record storage origin, type of waste, consignee, and receiving facility. The reporting tools will be designed for both digital and manual submission to ensure accessibility for all regulated entities, and will ensure alignment with international and regional reporting tools, such as the Basel Convention's Electronic Reporting System.
	3. Capacity building: Provide targeted training for Customs officers, importers, and exporters to ensure accurate data entry and understanding of the new reporting obligations.

Timeline	Milestones / Key Actions
	Awareness sessions will also be conducted with private operators and municipal authorities to demonstrate how the data will be used for planning and compliance monitoring. This early engagement will promote cooperation and reduce resistance during rollout.
	4. Establishment of a centralized digital data hub: Develop or adapt a national electronic platform to serve as a centralized data hub for all component transactions, integrating data from Customs import declarations, waste-collection records, and Basel export permits. User dashboards will allow authorized agencies to visualize material flows and generate analytical reports. Formal data-sharing agreements will be signed among MoCRERE, GSWMA, Customs, and the Central Statistical Office.
Long term (Years 4–5 +)	**5. Monitoring and compliance:** Establish monitoring routines for validating submissions, identifying missing reports, and following up with non-compliant operators. Annual summary reports will be produced and submitted to the Basel Convention's Electronic Reporting System, covering imports, exports, and domestically treated materials.

Activity 9: Establish cooperation agreement - Basel Focal points

Objective

To negotiate and formalize a regional cooperation agreement among the Basel Convention Focal Points of Grenada, other OECS member states, and/or select CARICOM countries (such as Trinidad and Tobago) to harmonize procedures for the transboundary movement of hazardous EV and RE waste.

The agreement will define standardized communication, consent, and transport protocols to facilitate timely and compliant export of EoL materials for ESM.

Rationale

Grenada, like other SIDS, faces high costs and administrative complexity in exporting small volumes of hazardous waste for recycling or disposal abroad, as current arrangements require individual notification, consent, and approval from different Competent Authorities, which may take months.

A formal cooperation agreement among regional Basel Focal Points will streamline these processes, reduce duplication, and create predictable timelines for the export of EoL EV and RE components, enabling the future development of shared regional export hubs

(Activity 15) and strengthen the Caribbean's collective capacity to comply with international hazardous-waste regulations.

Table 21. Grenada's activity 9 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Stakeholder identification:** Compile a list of Basel Focal Points and Competent Authorities across OECS and CARICOM countries (especially the ones where Grenada's waste usually transit such as Trinidad and Tobago), including their legal mandates and current national procedures.
Medium term (Years 2–3)	**2. Drafting of the cooperation framework:** Draft an initial framework agreement in collaboration with BCRC-Caribbean, in accordance with Article 11 of the Basel Convention, which explicitly allows for such agreements between parties, and align with existing regional examples such as the MERCOSUR and OECD models[1]. The draft will outline objectives, scope, and operational modalities, including information exchange, document templates, notification procedures, mutual recognition of packaging and labeling standards, and protocols for emergency communication during transport.
	3. Regional consultations: Conduct virtual and in-person meetings with all participating states to review the draft text, clarify legal obligations, and ensure that the agreement reflects the capacities and priorities of each member country. Technical inputs will be incorporated before finalization.
	4. Legal review and endorsement: The final draft agreement will undergo legal vetting by the Attorney-General's Chambers in Grenada and equivalent offices in partner countries. This review will confirm compatibility with domestic laws and the Basel Convention, define the authority for signature, and specify mechanisms for amendment and dispute resolution. Once vetted, the agreement will be submitted to national Cabinets for approval.
Long term (Years 4–5 +)	**5. Operationalization:** Create a shared contact database and an online workspace (hosted by BCRC-Caribbean) to manage notifications, documentation, and shipment tracking.

[1] See all the available Article 11 Agreements here:

https://www.basel.int/Implementation/LegalMatters/Compliance/GeneralIssuesActivities/Activities201617/ControlsystemArticle11agreements/tabid/5328/Default.aspx

Timeline	Milestones / Key Actions
	Standardized templates for prior informed consent (PIC) requests and movement documents will be distributed to reduce administrative delays.

7.1.4. Pillar 4: Infrastructure and Resources

Activity 10: Define final disposal & export criteria

Objective

To adopt a clear, enforceable decision framework (“gate criteria”) that determines when EoL EV and RE components must be reused, refurbished/repurposed, exported for treatment, stabilized, or landfilled. The framework will specify technical, environmental, legal and cost thresholds and embed them in licensing, landfill rules and customs/export procedures.

Rationale

Without uniform criteria, EoL batteries, PV modules and associated components are handled case-by-case, increasing risk of unsafe landfilling, inconsistent (and potentially illegal) exports and missed recovery opportunities. A standardized decision tree can align operators, inspectors and customs around the same rules, reduce fire and contamination risks, and optimize the use of limited storage and export capacity while complying with international obligations.

Table 22. Grenada’s activity 10 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Benchmark for standards review:** Conduct a comprehensive benchmark review of international and regional standards relevant to the disposal, repurposing, and export of EV and RE components, to compare the criteria and methodologies used by other SIDS (e.g., Trinidad and Tobago, and Costa Rica) and advanced jurisdictions (e.g., the European Union or Japan) to define EoL thresholds and routing decisions for batteries, PV modules, and components.
	2. Technical gate criteria: Draft measurable “go/no-go” thresholds for each component class, for example: • **Li-ion traction batteries:** if SoH ≥ 60% and no damage history → eligible for diagnostics/repurposing; if SoH 40–60% or minor cosmetic damage → stabilize & prepare for export; if SoH < 40%, swelling, leakage, fire event or exposed cells → quarantine & mandatory export after safe containment.

Timeline	Milestones / Key Actions
	• **Lead-acid batteries:** intact cases → export; cracked/leaking → immediate containment and priority export. • **PV modules:** intact with power ≥ 80% of nameplate → reuse testing; cracked glass, delamination, hot-spot, shattered backsheet → export (no landfilling).
Medium term (Years 2–3)	**3. Cost thresholds:** Set transparent cost caps and gate fees that prioritize ESM over landfilling, recognizing SIDS logistics. For example, if compliant export cost ≤ the stabilized disposal alternative by a defined margin, export is mandatory. Include minimum batch/weight thresholds for aggregation to avoid unsafe prolonged storage, and incentives for compliant operators who follow EoL protocols.
	4. Validation: Refine the criteria through validation workshops organized with key institutional partners to test their clarity and feasibility. Participants will assess whether the criteria can be realistically implemented with existing infrastructure. Feedback will be integrated into the decision tree.
Long term (Years 4–5 +)	**5. Legal adoption:** Issue officially the decision tree through ministerial order or gazetting, thereby acquiring regulatory status as it will be stated in the Waste Management Act (Activity 1). All waste-handling licenses and import permits will reference compliance with this decision tree as a condition of operation.

Activity 11: Strengthen existing infrastructure

Objective

To assess, upgrade, and integrate existing national infrastructure, such as garages, repair workshops, waste operators, and exporters, that already handle EV and RE components, by building a functional network of compliant facilities capable of safely managing collection, pre-treatment, and temporary storage in accordance with the new standards and technical procedures.

Rationale

Grenada already possesses several decentralized sites that occasionally handle used batteries, inverters, PV panels, and other components, without unified safety protocols, record-keeping, or physical safeguards such as fireproof storage areas or containment systems.

By strengthening these existing facilities, Grenada can establish a cost-effective and rapid foundation for national take-back and export operations, leveraging private-sector capacity while ensuring adherence to Basel Convention and national environmental regulations.

Table 23. Grenada's activity 11 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Mapping:** Conduct a comprehensive survey of existing businesses and entities that currently manage or could manage EV and RE components, including garages, auto-electrical workshops, solar-installation companies, scrap-metal dealers, waste-logistics operators, etc. Each facility will be profiled according to location, ownership, activity type, infrastructure condition, and safety capacity. As a result, it will be identified which facilities can be upgraded for compliance and which require new investment.
	2. Capacity assessment: Evaluate each facility's readiness to meet environmental, health, and safety (EHS) standards, as well as international agreements, by assessing space availability, structural integrity, fire-risk level, drainage and ventilation, spill-prevention systems, and proximity to residential areas. This will identify critical gaps, such as the lack of impermeable flooring, ventilation, firefighting systems, or secure storage racks, that must be addressed before facilities can receive hazardous components.
Medium term (Years 2–3)	**3. Enabling conditions:** Activity 7
	4. Upgrades implementation: Provide support to implement the required upgrades to targeted facilities identified as strategic collection or pre-treatment sites. This may include provision of specialized equipment such as insulated tools, fireproof cabinets, containment pallets, and spill-response kits. Private-sector facilities demonstrating compliance commitment will be prioritized for public–private partnership (PPP) support.
Long term (Years 4–5 +)	**5. Regulatory integration:** Update and strengthen Grenada's existing waste-management permitting system under Waste Management Act (Activity 1) to ensure that all licensed facilities handling EV and RE components comply with the latest technical, safety, and environmental standards. This step will involve revising license conditions and inspection protocols to integrate the new state-of-the-art requirements developed under Activities 7, 8, 10 and 11.

Timeline	Milestones / Key Actions
	License holders will be required to maintain facilities in line with these updated standards, and compliance will be verified through periodic audits and inspection checklists.

Activity 12: Conduct feasibility study

Objective

To assess the technical, environmental, financial, and institutional feasibility of establishing national or regional facilities for the pre-treatment, repurposing, and second-life use of EoL EV and RE components, by evaluating options ranging from small-scale diagnostic and disassembly workshops and in-house acid treatment to participation in shared regional treatment hubs, providing evidence for strategic investment decisions.

Rationale

Grenada currently lacks facilities for assessing, repurposing, or preparing EV and RE components for reuse or export, which is key under the Basel Convention amendments enacted in January 2025 to determine if an Electric and Electronic Equipment has the status of “Used” (UEEE) or “Waste” (WEEE).

Today, all materials must therefore be shipped abroad, mostly as hazardous waste, increasing costs and limiting local value retention.

A structured feasibility study will determine whether domestic or joint regional processing options are economically viable, environmentally safe, and consistent with national circular-economy ambitions.

Table 24. Grenada’s activity 12 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Scope:** Define the scope, target technologies, and analytical parameters of the study to develop a Terms of Reference for bidding. The scope will include technical assessment of pre-treatment activities (battery discharging, safe dismantling, acid neutralization, SoH testing, cell sorting, and packaging), repurposing of batteries for stationary storage, and mechanical or chemical recycling options for PV modules.
Medium term (Years 2–3)	**2. Feasibility study:** The consultants will conduct the technical and economic feasibility assessment and provide a final recommendation. Potential funding sources, including donor grants, concessional loans, or PPP, will be identified.
Long term (Years 4–5 +)	**3. Operationalization:** Allocate budget for the construction of the preferred scenario designated for the development of detailed facility design, site selection, required permits, and institutional and financing structure.

Activity 13: Create technician upskilling programs

Objective

To design and implement specialized training programs for technicians, mechanics, electricians, and solar installers on the safe handling, repair, disassembly, and repurposing of EV and RE components, providing nationally recognized certification and linking skills development to licensing and accreditation frameworks, ensuring a competent workforce capable of supporting the country's transition to circular-economy systems.

Rationale

As Grenada's EV and RE sectors expand, the number of used batteries, PV panels, and components requiring safe maintenance or decommissioning will increase. Currently, few technicians possess the necessary knowledge to manage these systems safely, particularly regarding high-voltage components, hazardous materials, and EoL preparation, leading to improper handling, unnecessary waste generation, and potential safety hazards.

A structured upskilling program will equip technicians with the technical and safety competencies needed for ESM, while also creating green employment opportunities in repair, refurbishment, and repurposing.

Table 25. Grenada's activity 13 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Curriculum design:** Convene a working group to design the curriculum framework, including institutions such as TAMCC, the GNTA, the GNAB, and GIDC. The curriculum will integrate both theoretical and practical modules on lithium-ion battery safety, PV-module diagnostics, SoH testing, fire prevention, and EoL preparation, considering reference materials from BCRC-Caribbean, (UNEP), and international vocational programs adapted for the local context.
Medium term (Years 2–3)	**2. Material development:** Produce comprehensive training manuals, instructor guides, and demonstration videos, including safety checklists, case studies, and visual aids showing correct procedures for battery isolation, dismantling, and packaging. A modular approach will allow for short courses, continuing education, and full certification programs, in alignment with Grenada's Technical and vocational education and training standards.

Timeline	Milestones / Key Actions
	3. Training of trainers (ToT): Select an initial cohort of instructors from TAMCC for example, and vocational centers to undergo regional-level training provided by BCRC-Caribbean or other specialized partners. The ToT phase will ensure a pool of qualified trainers capable of delivering high-quality instruction in line with international best practices.
Long term (Years 4–5 +)	**4. Program rollout:** Launch the national training program targeting technicians from the automotive, electrical, and RE sectors, offering the courses in multiple tiers, from basic awareness to advanced certification, allowing technicians to progressively build competence. Training will include classroom sessions, hands-on laboratory exercises, and supervised internships at GSWMA facilities or private partners.

Activity 14: Establish compliant interim storage

Objective

To designate, equip, and operate a compliant interim storage facility for EoL batteries and other EV and RE components in Grenada, by providing safe, centralized containment of hazardous materials prior to reuse, repurposing, or export, in accordance with Basel Convention and BAT/BEP standards.

Rationale

At present, Grenada has no centralized or properly equipped storage site for hazardous or high-risk EV and RE waste. Therefore, materials such as lithium-ion batteries and PV modules are stored informally at garages or dispersed across multiple temporary locations, increasing the risk of fires, chemical leaks, and human exposure.

Establishing a purpose-built interim storage site will minimize these risks, ensure compliance with international transport and safety requirements, and serve as the operational link between national collection points (Activity 5) and future regional export aggregation hubs (Activity 15).

Table 26. Grenada's activity 14 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Site selection:** Identify potential sites for the interim storage facility based on accessibility, security, environmental sensitivity, and distance from residential zones, prioritizing government-owned land or existing waste-management sites, like the GSWMA recycling facility located in a leased space, to reduce acquisition costs.

Timeline	Milestones / Key Actions
	A preliminary environmental assessment will screen each option for flood risk, drainage, and proximity to transport routes and ports.
Medium term (Years 2–3)	**2. Technical specifications:** Develop the facility design incorporating BAT/BEP and Basel-aligned safety features such as impermeable flooring, containment bunds, ventilation, temperature control, and fire-suppression systems. Separate storage zones will be designated for different waste categories (e.g., lithium-ion, lead-acid, PV modules), with clear segregation to prevent cross-contamination.
	3. Environmental Impact Assessment (EIA): Obtain all necessary environmental permits and planning approvals. To this aim, an EIA must be conducted in accordance with Grenada's environmental legislation.
	4. Construction or retrofitting: Depending on the selected option, either a new storage building will be constructed or an existing warehouse will be retrofitted to meet required safety standards. Works will include flooring reinforcement, installation of drainage and ventilation systems, electrical grounding, and the placement of fireproof containers and spill-containment pallets.
Long term (Years 4–5 +)	**5. Operationalization:** License the facility officially and incorporate it into the national waste-management registry. The facility will be integrated

Activity 15: Participate in regional export aggregation hub

Objective

To integrate Grenada into a regional "hub-and-spoke" system for the aggregation, shipment, and export of EoL EV and RE components in compliance with the Basel Convention.

Grenada will act as a spoke country, consolidating collected materials at its interim storage facility for shipment to a designated export hub, for example in Trinidad and Tobago or another OECS/CARICOM partner, with economies of scale, logistics network, and certified downstream treatment capacity.

Rationale

Grenada's small waste volumes and high logistics costs make direct export of hazardous components to distant recycling facilities economically unfeasible. Therefore, a shared regional export system could allow multiple SIDS to pool consignments, reduce per-ton shipping costs, harmonize documentation, and negotiate better terms with international recyclers.

Participation in a regional export aggregation hub will ensure compliance with transboundary waste-movement regulations, improve cost efficiency, and secure a long-term, sustainable outlet for hazardous EV and RE waste, in alignment with Article 11 of the Basel Convention (Activity 9) and regional strategies promoted by the OECS and BCRC-Caribbean.

Table 27. Grenada's activity 15 milestones

Timeline	**Milestones / Key Actions**
Short term (Year 1)	**0. Enabling conditions:** Activities 9 and 14
Medium term (Years 2–3)	
	1. Pilot: Organize a joint pilot export operation with the regional hub to test end-to-end procedures, including packaging, labeling, transboundary movement documentation, customs clearance, and final disposal or recycling confirmation. BCRC-Caribbean will provide technical oversight to ensure compliance with Basel notification and consent protocols. Following the shipment, an evaluation report will capture lessons learned, cost implications, and recommended process improvements.
Long term (Years 4–5 +)	**2. Operationalization:** Once the pilot is deemed successful, and Activities 9 and 14 are operationalized, Grenada will institutionalize the regional export process as part of the national take-back system. SOPs developed in Activity 7 and the decision tree from Activity 10 will be updated to guide exporters and Customs officials on documentation flow, inspection routines, and emergency response during loading and transit. A regular shipping calendar will be established to coordinate Grenada's exports with other participating islands, maximizing container utilization and minimizing costs.

7.2. Saint Lucia

The following sub-section details the specific roadmap for Saint Lucia, summarized in the following table, including the responsible and supporting institutions for its implementation.

Table 28. Saint Lucia's roadmap activities

Pillar	Activity	Responsible	Support
Regulatory Framework	1. Amend Waste Management Act	Ministry of Health, Wellness and Elderly Affairs (MoHWEA) / Saint Lucia Solid Waste Management Authority (SLSWMA)	Basel Focal Point, UNEP, Customs
	2. Establish EPR scheme	MoHWEA, SLSWMA	Ministry of Finance, Customs, importers, Chamber of Commerce
Collection & Take-back Logistics	3. Standardize collection protocols	Department of Environmental Health	SLSWMA, SLBS, Garages, dealers, BCRC-Caribbean, Fire Service
	4. Fund national public awareness campaigns	SLSWMA	Ministry of Education, NGOs, local media houses, dealers, garages, Organisation of Eastern Caribbean States (OECS) Communications Unit, Public relations and marketing firms
	5. Launch national EV and RE take-back scheme	SLSWMA	MoHWEA, Ministry of Infrastructure, Ports, Transport, Physical Development and Urban Renewal (MoIPTPDUR), Saint Lucia Air and Sea Ports Authority (SLASPA)

Pillar	Activity	Responsible	Support
Standards & Custom control	6. Enforce import quality standards and EoL planning	SLBS / National Utilities Regulatory Commission (NURC)	Customs, SLSWMA, MoHWEA, Ministry of External Affairs, International Trade, Civil Aviation and Diaspora Affairs, Ministry of Finance, car dealers, solar/EV distributors
	7. Issue technical SOPs for RE/EV handling	SLSWMA / SLBS	Basel Focal Point, MoHWEA, Customs, BCRC-Caribbean, Fire Service, private sector logistic, exporters
	8. Mandate data reporting on imports and exports	Basel Focal Point / SLSWMA	Customs, private importers and exporters, Central Statistical Office
	9. Establish cooperation agreement between the Basel Focal points	Basel Focal Point / Ministry of External Affairs, International Trade, Civil Aviation and Diaspora Affairs	SLSWMA, Basel Focal Points of other countries, OECS Secretariat, BCRC-Caribbean
Infrastructure & Resources	10. Define final disposal & export criteria	SLWMA / Ministry of Sustainability	SLBS, Ministry of Finance, Customs, BCRC-Caribbean, Basel Focal Point, private importers, Fire Department, Insurance firm
	11. Strengthen existing infrastructure	SLSWMA / Ministry of Sustainability	Ministry of Finance, BCRC-Caribbean, Customs, garages, waste management operators, Fire Department
	12. Incentivize battery reuse business models	Ministry of Education / Ministry of Sustainability	SLBS, Chamber of Commerce, BCRC-Caribbean, garages, waste management operators, Education centers (Sir Arthur Lewis Community College SALCC, National Skills Development Centre NSDC)

Pillar	Activity	Responsible	Support
	13. Conduct feasibility study: Regional pre-treatment and repurposing facilities	SLSWMA / Ministry of Sustainability	Saint Lucia Development Bank, BCRC-Caribbean, OECS Secretariat
	14. Create technician upskilling programs	Ministry of Education / Ministry of Sustainability	Education centers (SALCC, NSDC), SLBS, Saint Lucia Garage Association, SLSWMA, BCRC-Caribbean, private sector, OECS TVET
	15. Establish compliant interim storage	SLSWMA / Ministry of Sustainability	Ministry of Finance, Economic Development and Youth Economy, BCRC-Caribbean, Fire Service, Saint Lucia Development Bank
	16. Participate in regional export aggregation hub	Basel Focal Point/ Ministry of Foreign Affairs, Trade & Export Development	SLSWMA, Basel Focal Points of other countries, OECS Secretariat, Customs, BCRC-Caribbean, regional transport providers

Strategic pillars

- Pillar 1: Regulatory framework

Saint Lucia's roadmap would begin with strengthening its legal structure for managing EoL EV and RE components. In the short term, the Waste Management Act would be revised to empower SLSWMA to issue technical standards, digital tracking rules, landfill restrictions, and extended licensing for refurbishers. Simultaneously, a national EPR framework would be drafted to assign financial and operational responsibility for batteries, PV modules, and inverters to producers and importers. The medium-term phase focuses on piloting this EPR scheme, launching a digital product registry, and transitioning into a regulated Producer Responsibility Organization (PRO) housed within the SLSWMA. Over the long term, these reforms would evolve into a unified regulatory system that combines product standards, financing, and compliance obligations under a coherent EPR and circular-economy model aligned with regional Basel and OECS practices.

- Pillar 2: Collection and take-back logistics

The second pillar centers on operational readiness for safe collection, aggregation, and data-driven management of EV and RE components. In the short term, Saint Lucia would publish standardized collection and safety protocols for households, garages, and importers, alongside targeted awareness campaigns to enhance participation in formal take-back systems, preparing the ground for the medium-term launch of a national EV and RE take-back scheme, designating official collection points linked to interim storage and reporting tools. In the long term, participation would become mandatory for importers and dealers, followed by data reporting obligations and integrated with regional export logistics. Through these steps, Saint Lucia would establish a traceable national take-back network capable of safely consolidating hazardous components for compliant regional shipment.

- Pillar 3: Standards and customs control

This pillar enhances the quality assurance, traceability, and cross-border control of EV and RE product flows. Early actions could introduce import quality standards requiring disclosure of product age, SoH, and EoL plans as licensing conditions, ensuring accountability across the supply chain. Complementary technical SOPs would be issued for labeling, packaging, and transport, forming a reference for Customs, garages, operators, and exporters. In the medium term, digital data reporting could become mandatory for all importers and exporters, feeding into a centralized mass-balance system managed by SLSWMA and the Basel Focal Point. A regional cooperation agreement among Basel Focal Points in the OECS and key trade partners, such as Trinidad and Tobago or Jamaica, could streamline export authorization and accelerate consent procedures. In the long term, Saint Lucia's customs and waste systems would be fully integrated into regional tracking and compliance frameworks, enabling efficient and transparent EoL trade management.

- Pillar 4: Infrastructure and resources

The final pillar builds the technical, human, and financial foundation for sustainable implementation. Short-term activities include defining final disposal and export criteria to guide landfill restrictions and EoL decision-making, while upgrading existing garages and operators to Basel-compliant standards. Medium-term actions would focus on battery reuse incentives, a national feasibility study to evaluate pre-treatment and/or repurposing facilities, and technician upskilling programs through SALCC, NSDC, and OECS TVET. Concurrently, a compliant interim storage facility could be established to consolidate EV and RE components for export safely. In the long term, Saint Lucia would actively participate in a regional export aggregation hub, likely with Trinidad and Tobago or Jamaica, leveraging shared logistics and cost efficiencies to close the loop on its EoL value chain and achieve full circular-economy integration across the Eastern Caribbean.

Vision for Saint Lucia after roadmap implementation

Once Saint Lucia completes the 16 activities under the four strategic pillars listed in Table 29, the country will have transitioned from fragmented and reactive management of EV/RE waste streams to a cohesive, self-sustaining system aligned with international environmental and circular-economy standards.

A modernized Waste Management Act and a fully operational EPR framework will underpin a transparent, enforceable legal foundation for tracking, financing, and regulating the selected EoL components.

Across the island, citizens, garages, and importers will actively participate in a nationwide take-back network, supported by standardized consumer protocols, continuous awareness campaigns, and clearly designated collection points.

At the border, strengthened customs control and harmonized import standards will ensure that only compliant, high-quality EVs and RE systems enter the market, each accompanied by traceable end-of-life plans.

Domestically, trained and licensed operators, backed by certified technicians and upgraded facilities, will manage materials safely and efficiently through compliant interim storage and pre-treatment steps.

Institutionally, Saint Lucia will operate a digital mass-balance registry linking import, collection, and export data, enabling precise reporting under the Basel Convention and Sustainable Development Goals.

Regionally, the island will serve as an integrated spoke in the OECS export aggregation system, shipping consolidated EoL components to regional hubs under Article 11 cooperation agreements.

Economically, the system will be sustained through EPR revenues and green-enterprise participation, fostering innovation in battery reuse, repair, and circular entrepreneurship.

The overall vision is a resilient, resource-efficient, and internationally compliant Saint Lucia where:

- every imported component is traceable to its EoL destination;
- waste is viewed as a recoverable resource, not a liability;
- technicians and small enterprises generate green employment through safe refurbishment and repurposing; and
- institutions work collaboratively within a transparent, well-financed system.

In this future state, Saint Lucia will stand as a regional model of small-island circularity, where policy, infrastructure, and human capacity converge to ensure that every imported energy or mobility technology is responsibly managed through its full lifecycle, contributing to a cleaner environment, resilient green jobs, and climate-compatible development.

7.2.1. Pillar 1: Regulatory Framework

Activity 1: Amend Waste Management Act

Objective

To strengthen Saint Lucia’s Waste Management Act by introducing legal provisions that enable the ESM of EV and RE components. The amendment will authorize the issuance of technical standards, digital tracking, landfill restrictions, and an expanded licensing system covering all actors involved in handling, refurbishing, and exporting EV and RE waste.

Rationale

The existing Waste Management Act provides a foundation for hazardous-waste control but lacks the specific tools needed to regulate emerging waste streams such as lithium-ion batteries, PV modules, and EV components. Currently, there are no legal pathways to issue technical SOPs, track hazardous materials digitally, or enforce differentiated landfill restrictions.

Updating the Act will establish enabling provisions for licensing refurbishers, garages, PV installers, transporters, and operators handling EV and RE waste, introduce a national digital registry for hazardous-waste flows, and embed waste hierarchy principles within the legal framework.

Table 29. Saint Lucia's activity 1 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Legal analysis:** Review comparative legal frameworks to map the current provisions of the Act against best international practices, such as OECS and Basel obligations. The review will identify: (a) missing definitions of special or emerging hazardous waste streams such as EV batteries and PV panels; (b) sections where the Minister or the Authority may issue subsidiary regulations; and (c) inspection and enforcement powers that can be expanded. The output should be a proposal showing where enabling clauses for SOPs, digital tracking, and landfill restrictions prioritizing waste hierarchy (e.g., material recovery, reuse, repurposing) can be inserted.
	2. Drafting of amendments: Develop draft clauses introducing: (i) authority for the SLSWMA to issue technical standards and landfill restrictions; (ii) mandate collection targets, data reporting, and licensing for new actors (collectors, transporters, refurbishers, exporters); (iii) licensing obligations for all actors involved in the management chain of hazardous RE/EV components (e.g., informal garages, battery service providers, panel's installers, etc.); (iv) circular-economy and waste-hierarchy principles; and (v) proportional administrative fines and penalties. The Act may include a mandatory five-year review clause to allow continuous alignment with technological change.
Medium term (Years 2–3)	**3. Stakeholder consultation:** Organize national consultations combining technical workshops and public hearings. The process should test the practicality of new obligations for the stakeholders involved (e.g., importers, garages, exporters, recyclers, and Customs); assess enforcement costs; and collect comments for redrafting.
	4. Approval and parliamentary process: Following Cabinet approval of drafting instructions, the Attorney-General's Chambers will conduct legal vetting and table the Bill in Parliament.
Long term (Years 4–5 +)	**5. Adoption and enforcement:** Issue subsidiary regulations specifying SOPs for collection, transport, and interim storage of EV and RE waste; establish inspection procedures, digital manifest requirements, and a schedule of offences. Training for enforcement officers, private stakeholders, and Customs agents will accompany rollout.

Activity 2: Establish EPR scheme

Objective

To design and implement a national EPR framework that assigns legal, financial, and operational responsibility for the EoL management of EV and RE components, such as batteries, PV modules, and inverters, to producers and importers. The EPR scheme will establish a polluter-pays system that ensures sustainable cost recovery for ESM, supports a circular economy, and aligns with international and regional best practices.

Rationale

Saint Lucia currently lacks a dedicated financial mechanism to manage hazardous and complex EoL components from EVs and RE systems. Without structured funding and clear producer accountability, the collection, management and export of these materials remain sporadic and dependent on budget allocation. An EPR system provides a transparent and predictable mechanism for financing the waste management chain through producer fees and take-back obligations.

By integrating EPR into national legislation, Saint Lucia can formalize producer roles, establish a central digital registry for product tracking, and generate steady revenue to support long-term ESM operations. The approach mirrors successful SIDS models such as that in the Dominican Republic, while laying the groundwork for potential regional EPR integration under OECS or CARICOM frameworks in the future.

Table 30. Saint Lucia's activity 2 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. EPR framework drafting:** Define the scope of covered products (e.g., batteries, PV modules, inverters); roles and responsibilities of producers, importers, retailers, and PRO; collection targets, reporting frequency, and compliance mechanisms; sanctions for non-compliance and incentives for environmentally friendly design (eco-modulation of the EPR fee).
Medium term (Years 2–3)	**2. Stakeholder consultation:** Organize national consultations with importers, distributors, Customs, the Chamber of Commerce, and civil-society organizations to ensure practical feasibility and market buy-in. Feedback will be used to refine fee structures, reporting systems, and enforcement provisions.
	3. Pilot phase: Launch a pilot scheme, acting SLSWMA as pilot PRO, with selected importers to test the financial model, collection logistics, and digital reporting mechanisms. This pilot phase will prioritize one high-risk category, such as for example lithium-ion batteries, to gather performance data and inform the national roll-out.

Timeline	Milestones / Key Actions
	4. EPR fee model: Develop a standardized fee model, calculating fees according to product type, quantity, and lifecycle costs, and earmarked to fund interim storage, transport, export, and capacity-building activities. Revenue management procedures will be openly shared to ensure transparency and accountability.
Long term (Years 4–5 +)	**5. Centralized digital registry:** Create or adapt a digital registry from existing SLSWMA or Customs systems to track products placed on the market, EPR fees paid, quantities collected, and materials exported. The registry will interface with Customs and the Basel reporting system to enable full traceability of EV and RE components throughout their lifecycle.
	6. PRO institutionalization: Formalize the PRO, initially operated under SLSWMA oversight, through regulation. Its mandate will include fee collection, compliance monitoring, data reporting, and financing of approved recycling and export operations. A governance structure will be established to ensure balanced representation from government, producers, and civil society.

7.2.2. Pillar 2: Collection and Take-Back Logistics

Activity 3: Standardize collection protocols

Objective

To develop and roll out simple, uniform collection protocols that guide consumers, garages, importers, and service workshops in safely returning EoL EV and RE components to designated collection points.

These protocols will define how and where components should be delivered, ensuring that items arrive intact, undismantled, and ready for proper management under the national take-back scheme.

Rationale

Currently, there are no standardized instructions in Saint Lucia for how consumers and basic handlers should manage used EV or RE components before disposal.

This gap leads to unsafe practices such as dismantling, uncontrolled storage, or abandonment in informal sites. Without simple, enforceable guidance, take-back systems cannot function effectively or safely.

By creating accessible collection protocols, supported by clear messaging, signage, and training, Saint Lucia will protect health and safety, reduce fire and contamination risks, and ensure that high-value materials reach authorized facilities intact. The protocols will serve as the practical link between households, service points, and the national collection network managed by SLSWMA.

Table 31. Saint Lucia's activity 3 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Benchmarking:** Review existing collection practices for used electronics and batteries. Compare current practices with Basel Technical Guidelines, manufacturer recommendations and international best practices for battery and PV handling.
	2. Drafting of national protocols: Prepare a concise set of national instructions describing how and where citizens should return EV and RE components. The guidance will specify that items must remain intact, prohibit casing removal or battery disassembly, and list all approved collection points. It will also include basic safety reminders, such as avoiding exposure to heat or moisture during transport.
Medium term (Years 2–3)	**3. Validation:** Test the draft protocols through consultation sessions and focus groups with households, garages, importers, solar installers, and local councils. These exercises will evaluate clarity, accessibility, and practicality from a user perspective. Feedback will be consolidated for redrafting.
	4. Dissemination: Communicate the validated protocols through multiple communication channels. Printed leaflets and posters will be displayed at municipal offices, customs counters, and retail outlets, while digital versions will be shared via social media and government websites. Short radio and community-TV segments will reinforce key messages. Demonstration events in schools, repair workshops, and local markets will illustrate the correct process for returning items.
Long term (Years 4–5 +)	**4. Institutional integration and monitoring:** Incorporate the standardized protocols into import licenses, consumer warranties, and installation agreements so that every new EV or RE product is accompanied by clear EoL return guidance. Local authorities will incorporate the same messages into municipal waste education programs. SLSWMA will maintain an updated public directory of authorized collection sites and establish a simple monitoring system to record quantities of EoL items received through formal channels. Periodic surveys will assess awareness levels and compliance.

Activity 4: Fund national public awareness campaigns

Objective

To design and implement nationwide public-awareness and education campaigns that inform households, garages, importers, and technicians about the risks of improper disposal of EV and RE components and the benefits of formal take-back and collection systems.

The campaigns will build knowledge, shape behavior, and encourage safe participation in Saint Lucia's emerging circular economy for EV and RE waste.

Rationale

Public awareness of EV and RE waste risks in Saint Lucia remains limited, and most consumers lack clear information about how or where to return used components such as batteries and PV modules. Without proactive outreach, voluntary participation in take-back systems will remain weak, and informal or unsafe disposal will continue.

Well-structured communication campaigns are essential to foster behavioral change, increase take-back participation, and enhance public trust in SLSWMA and related institutions.

These campaigns will also amplify messages from Activities 3 and 5, ensuring that citizens understand both why and how to return components safely.

Table 32.Saint Lucia's activity 4 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling condition:** Activity 3
Medium term (Years 2–3)	**1. Message development and production of materials:** Develop communication materials in multiple formats to ensure accessibility for all audiences. These may include radio and television spots, short video clips for social media, posters, flyers, and illustrated brochures. Materials will be translated into simple, locally relevant language and incorporate Saint Lucia's testimonials. Special attention will be given to messages for rural communities and informal-sector workers, who may have limited access to online information.
	2. National campaign rollout: Launch national campaign using a multi-channel approach combining traditional media (radio, television, newspapers) with digital platforms and community-level engagement. Activities may include radio talk shows, press features, school presentations, and informational booths at public events. Collaboration with importers and distributors will ensure that awareness materials are displayed at points of sale and attached to new product packaging.

Activity 5: Launch national EV/RE take-back scheme

Objective

To establish a national collection and take-back system for ELV and RE components, ensuring their safe and traceable recovery, consolidation, and temporary storage prior to export or recycling.

The scheme will define the roles of importers, garages, private collectors, and SLSWMA, forming the operational foundation for ESM of these high-risk components.

Rationale

Saint Lucia currently has no structured mechanism for collecting used lithium-ion batteries, PV modules, or inverters. As a result, these components are often informally stored, dismantled, or discarded in uncontrolled environments, creating fire hazards, contamination risks, and loss of recyclable materials.

A national take-back scheme will allow small quantities generated across the island to be aggregated, safely stored, and prepared for eventual regional export.

This initiative will translate the new regulatory provisions (Activities 1 and 2), consumer protocols (Activity 3), and awareness campaigns (Activity 4) into a functioning operational system that builds trust among stakeholders and demonstrates the viability of a circular approach to EV and RE waste.

Table 33. Saint Lucia's activity 5 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling condition:** Activity 3
	1. Mapping and design of collection points: Identify and assess suitable drop-off locations that can serve as official collection points for batteries and PV panels (this is also required for Milestone 2 in Activity 3). Potential sites include existing municipal depots, ports, large garages, and dealerships with adequate space and access. Each location will be evaluated against safety, accessibility, and logistical criteria such as proximity to interim storage and transport routes.
Medium term (Years 2–3)	**2. Partnership agreements:** Draft formal agreements with drop-off locations and municipal authorities outlining their responsibilities for receiving, recording, and transferring EoL components. These partnerships will establish the operational model of the scheme and set the basis for future regulatory obligations.
	3. Pilot phase: Launch a pilot take-back programme at two or three locations representing different geographic contexts (urban, peri-urban, and rural). During this phase, operational workflows, data-collection forms, and

Timeline	Milestones / Key Actions
	reporting channels will be tested and refined in integration with EPR pilot from Activity 2.
Long term (Years 4–5 +)	**4. Nationwide rollout:** Expand the take-back network across the country by integrating all participating collection points into a unified registry and reporting platform, linking them with the interim-storage facility developed under Activity 15. A help-desk or hotline will be created for citizens and businesses seeking information about where and how to return items in line with Activity 3.

7.2.3. Pillar 3: Standards and Custom Control

Activity 6: Enforce import quality standards and EoL planning

Objective

To establish and enforce minimum quality, lifespan, and documentation standards for all imported EV and RE systems and components, by requiring importers and distributors to disclose the expected service life, SoH for used products, and provide a clear EoL take-back or recovery plan as part of licensing and import procedures. This will ensure that only safe, durable, and traceable products enter Saint Lucia's market and that producers remain accountable for their entire product lifecycle.

Rationale

At present, Saint Lucia allows the import of used EV and RE components without disposal-plan requirements, accelerating waste generation, introducing unsafe or non-compliant products, and shifting disposal costs to the public sector. Implementing import-quality standards and mandatory EoL planning will align national trade controls with Basel-Convention obligations and circular-economy objectives by preventing premature entry of low-quality or expired products.

Table 34. Saint Lucia's activity 6 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Define minimum import standards:** Establish a list of minimum quality criteria for imported EV and RE components, specifying, for example, the maximum age of used vehicles, minimum SoH percentages for batteries, and compliance with recognized international safety standards (IEC, ISO, UN). The criteria may also require importers to submit certificates of origin, proof of performance testing, and manufacturer declarations on expected lifespan.

Timeline	Milestones / Key Actions
	2. Develop documentation: Design a standardized declaration form for importers to disclose the anticipated lifetime of each imported item and outline their intended take-back or disposal pathway once the product reaches EoL. This form will include basic data fields such as product category (HS code), serial number, and estimated useful life.
Medium term (Years 2–3)	**3. Legal integration:** Amend import-license regulations and public-procurement guidelines to incorporate the new standards and EoL-planning obligations, ensuring that no importer or distributor will be permitted to place EV or RE products on the market without fulfilling these conditions. Customs will update its digital import-declaration platform to include mandatory fields for SoH values, product age, and EoL-plan reference numbers.
	4. Capacity building: Deliver training sessions for Customs officers, inspectors, and licensing officials to familiarize them with the new quality standards, documentation templates, and verification procedures. A reference handbook will be prepared to guide officers in identifying non-compliant consignments and applying detention or rejection protocols.
Long term (Years 4–5 +)	**5. Monitoring and compliance:** Establish a coordinated inspection and data-reporting system to record import quantities (Activity 8), verify documentation, and flag high-risk consignments for follow-up. Penalties for non-compliance will be introduced.

Activity 7: Issue technical SOPs for RE/EV handling

Objective

To develop, validate, and disseminate technical SOPs for the safe handling, labeling, packaging, temporary storage, and export of EV and RE components throughout their life cycle.

The SOPs will ensure that all actors (Customs, garages, collection contractors, storage operators, and exporters) apply uniform, internationally recognized safety and environmental standards in accordance with the Basel Convention and national waste regulations.

Rationale

Saint Lucia currently lacks standardized operational guidance for ESM of EV and RE components.

Without clear instructions, actors along the value chain handle lithium batteries, inverters, and PV modules inconsistently, creating fire, contamination, and occupational hazards.

Establishing technical SOPs will close this gap by introducing standardized handling procedures aligned with Basel Technical Guidelines and BAT/BEP.

These SOPs will form the technical foundation for implementing several subsequent actions, such as the safe operation of interim storage (Activity 15).

Table 35.Saint Lucia's activity 7 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Reference materials:** Collect and review existing technical guidance, including Basel Convention Technical Guidelines, BAT/BEP recommendations (international and from OECS/CARICOM countries), and manufacturer manuals for lithium-ion batteries and photovoltaic equipment. This desk review will identify the minimum safety and performance criteria applicable to Saint Lucia's context, including packaging standards, chemical-compatibility considerations, and emergency-response requirements.
Medium term (Years 2–3)	**2. Drafting of national SOPs:** Prepare a set of concise, modular SOPs collaboratively with a multidisciplinary drafting team comprising SLSWMA engineers, the Fire Service, SLBS, private sector, and BCRC-Caribbean specialists. Each module will describe specific procedures such as safe inspection of decommissioned components, voltage-discharge checks, safe lifting and stacking, labeling and hazard signage, waste streams compatibility, spill-containment measures, and response to thermal incidents and accidents.
	3. Validation: Refine the SOPs through validation workshops organized with key institutional partners to test the clarity and applicability of the draft procedures. Participants will assess whether the instructions can be realistically implemented with existing infrastructure and identify any additional training or equipment needs. Feedback will be integrated to improve the SOPs.
	4. Capacity building: Deliver training sessions to customs inspectors, garage operators, port workers, and waste-collection and handling operators, combining theoretical instruction with practical demonstrations, focusing on hazard recognition, correct use of PPE, incident response, and reporting obligations. A certification process will be established for trained personnel, linked to license renewals and inspection checklists.

Timeline	Milestones / Key Actions
Long term (Years 4–5 +)	**5. Legal adoption:** Issue officially the SOPs through ministerial order or gazetting, thereby acquiring regulatory status as it will be stated in the Waste Management Act (Activity 1). All waste-handling licenses and import permits will reference compliance with these SOPs as a condition of operation.

Activity 8: Mandate data reporting on imports and exports

Objective

To establish a mandatory data-reporting system for all importers, exporters, and handlers of EV and RE components, ensuring transparent tracking of quantities entering, circulating within, and leaving Saint Lucia.

The system will consolidate customs declarations, collection records, and export documentation into a digital mass-balance registry, allowing national authorities to monitor product lifecycles, enforce compliance, and improve environmental reporting under international frameworks.

Rationale

At present, Saint Lucia lacks a centralized and disaggregated database on EV and RE products imported, collected, and exported.

This data gap limits the government's ability to plan infrastructure investments and monitor future EPR performance.

Requiring systematic reporting from importers and exporters will establish traceability across the entire product lifecycle, strengthen enforcement of take-back obligations, and enhance transparency for policymakers.

Table 36. Saint Lucia's activity 8 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Policy mandate:** In line with Activity 1 amendments to the Waste Management Act, the obligation for importers, exporters, and licensed waste operators to report data on EV and RE components will be included in the Act. The regulation will specify the frequency of reporting (quarterly or biannual), the responsible authorities, and the penalties for non-submission or falsification. This legal instrument will clearly define data ownership, confidentiality provisions, and the roles of SLSWMA, Customs, and the Central Statistical Office in managing and validating the information.

Timeline	Milestones / Key Actions
Medium term (Years 2–3)	**2. Development of reporting tools:** Design standardized reporting templates compatible with Customs' digital declaration systems to capture information such as product type, quantity, manufacturer, import date, serial number (where applicable), and declared end-of-life pathway (in alignment with Activity 6). For exports, the templates will record storage origin, type of waste, consignee, and receiving facility. The reporting tools will be designed for both digital and manual submission to ensure accessibility for all regulated entities, and will ensure alignment with international and regional reporting tools, such as the Basel Convention's Electronic Reporting System.
	3. Capacity building: Provide targeted training for Customs officers, importers, and exporters to ensure accurate data entry and understanding of the new reporting obligations. Awareness sessions will also be conducted with private operators and municipal authorities to demonstrate how the data will be used for planning and compliance monitoring. This early engagement will promote cooperation and reduce resistance during rollout.
	4. Establishment of a centralized digital data hub: Develop or adapt a national electronic platform to serve as a centralized data hub for all component transactions, integrating data from Customs import declarations, waste-collection records, and Basel export permits. User dashboards will allow authorized agencies to visualize material flows and generate analytical reports. Formal data-sharing agreements will be signed among MoHWEA, SLSWMA, Customs, and the Central Statistical Office.
Long term (Years 4–5 +)	**5. Monitoring and compliance:** Establish monitoring routines for validating submissions, identifying missing reports, and following up with non-compliant operators. Annual summary reports will be produced and submitted to the Basel Convention's Electronic Reporting System, covering imports, exports, and domestically treated materials.

Activity 9: Establish cooperation agreement - Basel Focal points

Objective

To negotiate, formalize, and operationalize a regional cooperation agreement among the Basel Focal Points of Saint Lucia and other OECS members, alongside Trinidad and

Tobago, Jamaica, or the Dominican Republic, to streamline transboundary movements of EV and RE waste.

The agreement will define procedures for notification, consent, documentation, and shared responsibilities, enabling efficient, legally compliant exports under Article 11 of the Basel Convention.

Rationale

Transboundary shipment of hazardous or controlled waste under the Basel Convention involves complex, time-consuming procedures. Concretely, in the Caribbean, differing national processes and limited coordination among Competent Authorities often cause delays or blockages in export approvals, leading to the accumulation of hazardous waste on small islands.

A formal cooperation framework among Basel Focal Points will harmonize notification and consent procedures, establish consistent documentation standards, reduce administrative bottlenecks, and enable joint regional shipments of EV/RE waste under shared oversight.

This mechanism will provide the legal foundation for Saint Lucia's participation in a Regional Export Aggregation Hub (Activity 16), ensuring full compliance with Basel obligations while improving operational efficiency and cost effectiveness.

Table 37. Saint Lucia's activity 9 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Stakeholder identification:** Compile a list of Basel Focal Points and Competent Authorities across OECS and CARICOM countries (especially the ones where Saint Lucia's waste usually transit such as Jamaica), including their legal mandates and current national procedures.
Medium term (Years 2–3)	**2. Drafting of the cooperation framework:** Draft an initial framework agreement in collaboration with BCRC-Caribbean, in accordance with Article 11 of the Basel Convention, which explicitly allows for such agreements between parties, and align with existing regional examples such as the MERCOSUR and OECD models[2]. The draft will outline objectives, scope, and operational modalities, including information exchange, document templates, notification procedures, mutual recognition of packaging and labeling standards, and protocols for emergency communication during transport.

[2] See all the available Article 11 Agreements here:

https://www.basel.int/Implementation/LegalMatters/Compliance/GeneralIssuesActivities/Activities201617/ControlsystemArticle11agreements/tabid/5328/Default.aspx

Timeline	Milestones / Key Actions
	3. Regional consultations: Conduct virtual and in-person meetings with all participating states to review the draft text, clarify legal obligations, and ensure that the agreement reflects the capacities and priorities of each member country. Technical inputs will be incorporated before finalization.
	4. Legal review and endorsement: The final draft agreement will undergo legal vetting by the Attorney-General's Chambers in Saint Lucia and equivalent offices in partner countries. This review will confirm compatibility with domestic laws and the Basel Convention, define the authority for signature, and specify mechanisms for amendment and dispute resolution. Once vetted, the agreement will be submitted to national Cabinets for approval.
Long term (Years 4–5 +)	**5. Operationalization:** Create a shared contact database and an online workspace (hosted by BCRC-Caribbean) to manage notifications, documentation, and shipment tracking. Standardized templates for PIC requests and movement documents will be distributed to reduce administrative delays.

7.2.4. Pillar 4: Infrastructure and Resources

Activity 10: Define final disposal and export criteria

Objective

To establish formal technical, environmental, and financial criteria that determine when EV and RE components, such as lithium-ion batteries, PV modules, and inverters, should be reused, refurbished, repurposed, stabilized, landfilled, or exported for treatment. The criteria will guide decision-making for both authorities and operators, ensuring that disposal and export practices are cost-effective, transparent, and aligned with Basel Convention requirements.

Rationale

Saint Lucia currently lacks clear decision-making rules for the final disposition of EV and RE components once they reach EoL. Without defined "gate criteria," recyclable materials risk being landfilled, while hazardous items may be stored indefinitely or exported unnecessarily, creating safety, cost, and environmental concerns.

Developing standardized disposal and export criteria will support evidence-based decisions on whether materials are treated locally or shipped abroad, ensure alignment with international BAT/BEP and regional standards, and facilitate cost planning and forecasting for future EPR systems (Activity 2).

Table 38. Saint Lucia's activity 10 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Benchmark for standards review:** Conduct a comprehensive benchmark review of international and regional standards relevant to the disposal, repurposing, and export of EV and RE components, to compare the criteria and methodologies used by other SIDS (e.g., Trinidad and Tobago, and Costa Rica) and advanced jurisdictions (e.g., the European Union or Japan) to define EoL thresholds and routing decisions for batteries, PV modules, and components.
	2. Technical gate criteria: Draft measurable "go/no-go" thresholds for each component class, for example: • **Li-ion traction batteries:** if SoH ≥ 60% and no damage history → eligible for diagnostics/repurposing; if SoH 40–60% or minor cosmetic damage → stabilize & prepare for export; if SoH < 40%, swelling, leakage, fire event or exposed cells → quarantine & mandatory export after safe containment. • **Lead-acid batteries:** intact cases → export; cracked/leaking → immediate containment and priority export. • **PV modules:** intact with power ≥ 80% of nameplate → reuse testing; cracked glass, delamination, hot-spot, shattered backsheet → export (no landfilling).
Medium term (Years 2–3)	**3. Cost thresholds:** Set transparent cost caps and gate fees that prioritize ESM over landfilling, recognizing SIDS logistics. For example, if compliant export cost ≤ the stabilized disposal alternative by a defined margin, export is mandatory. Include minimum batch/weight thresholds for aggregation to avoid unsafe prolonged storage, and incentives for compliant operators who follow EoL protocols.
	4. Validation: Refine the criteria through validation workshops organized with key institutional partners to test their clarity and feasibility. Participants will assess whether the criteria can be realistically implemented with existing infrastructure. Feedback will be integrated into the decision tree.
Long term (Years 4–5 +)	**5. Legal adoption:** Issue officially the decision tree through ministerial order or gazetting, thereby acquiring regulatory status as it will be stated in the Waste Management Act (Activity 1). All waste-handling licenses and import permits will reference compliance with this decision tree as a condition of operation.

Activity 11: Strengthen existing infrastructure

Objective
To assess, upgrade, and integrate existing facilities and operators, such as garages, repair workshops, waste collectors, and exporters, that already handle EV and RE components in Saint Lucia.
The goal is to enable these actors to perform ESM functions, including pre-treatment, segregation, documentation, and safe temporary storage of components, in line with Basel Convention standards.
Rationale
Saint Lucia already possesses a network of decentralized facilities and informal operators (e.g., garages, solar installers, logistics companies) that occasionally handle used batteries, panels, or inverters. However, these actors often lack technical capacity, standardized equipment, and regulatory guidance to handle hazardous materials safely or document them correctly.
By strengthening and formalizing existing infrastructure, Saint Lucia can rapidly establish a functional operational base for its national take-back scheme (Activity 5) and interim storage system (Activity 15), maximizing existing assets, reducing capital expenditure, and ensuring that operators meet safety, environmental, and licensing standards while contributing to the circular economy.

Table 39. Saint Lucia's activity 11 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Mapping:** Conduct a comprehensive survey of existing businesses and entities that currently manage or could manage EV and RE components, including garages, auto-electrical workshops, solar-installation companies, scrap-metal dealers, waste-logistics operators, etc. Each facility will be profiled according to location, ownership, activity type, infrastructure condition, and safety capacity. As a result, it will be identified which facilities can be upgraded for compliance and which require new investment.
	2. Capacity assessment: Evaluate each facility's readiness to meet EHS standards, as well as international agreements, by assessing space availability, structural integrity, fire-risk level, drainage and ventilation, spill-prevention systems, and proximity to residential areas. This will identify critical gaps, such as the lack of impermeable flooring, ventilation, firefighting systems, or secure storage racks, that must be addressed before facilities can receive hazardous components.

Timeline	Milestones / Key Actions
Medium term (Years 2–3)	**3. Enabling conditions:** Activity 7
	4. Upgrades implementation: Provide support to implement the required upgrades to targeted facilities identified as strategic collection or pre-treatment sites. This may include provision of specialized equipment such as insulated tools, fireproof cabinets, containment pallets, and spill-response kits. Private-sector facilities demonstrating compliance commitment will be prioritized for PPP support.
Long term (Years 4–5 +)	**5. Regulatory integration:** Update and strengthen Saint Lucia's existing waste-management permitting system under Waste Management Act (Activity 1) to ensure that all licensed facilities handling EV and RE components comply with the latest technical, safety, and environmental standards. This step will involve revising license conditions and inspection protocols to integrate the new state-of-the-art requirements developed under Activities 7, 8, 10 and 11. License holders will be required to maintain facilities in line with these updated standards, and compliance will be verified through periodic audits and inspection checklists.

Activity 12: Incentivize battery reuse business models

Objective

To promote and support the development of local enterprises and partnerships that specialize in the reuse, refurbishment, and second-life applications of lithium-based and other battery chemistries from EV and RE systems.

The activity aims to create an enabling environment for green entrepreneurship, fostering new revenue streams, technical capacity, and local employment while reducing hazardous-waste volumes.

Rationale

As the adoption of EVs and solar energy systems accelerates in Saint Lucia, increasing volumes of EoL batteries are expected, and most of these still retain significant residual capacity suitable for second-life applications, such as stationary storage or low-demand uses.

However, local businesses currently lack technical standards, skills, and financial incentives to safely refurbish or repurpose batteries, resulting in premature disposal and loss of economic value.

Encouraging battery reuse enterprises will extend product lifespans and reduce the volume of hazardous waste, strengthen local innovation and circular economy initiatives, and create skilled, green jobs in Saint Lucia's growing RE and e-waste sectors.

Table 40. Saint Lucia's activity 12 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Research and benchmarking:** Research international and regional models for safe and viable battery reuse, drawing on UN Manual of Tests and Criteria (UN 38.3), IEC standards such as IEC 62933 (Electrical Energy Storage Systems), and examples from Barbados' IDB-funded pilot on EV battery reuse (BA-T1089-P002).
Medium term (Years 2–3)	**2. Stakeholder consultation and partnerships:** Held engagement sessions with battery importers, garages, solar companies, and academic institutions to assess market potential, available space, and business interest. This step will identify potential partners for pilot projects and define the policy instruments needed to stimulate private investment (tax incentives, grants, or low-interest loans).
	3. Enabling policy and financial incentives: Design incentive mechanisms such as reduced import duties for diagnostic and refurbishing equipment, tax credits or grants for registered battery-reuse companies, and integration of reuse obligations into EPR framework (Activity 2).
	4. Capacity building: Develop specialized curricula in collaboration with SALCC, NSDC, and OECS TVET (linked to Activity 14) for safe dismantling, SoH testing, and second-life integration. Technicians and small enterprises will be trained and certified, ensuring compliance with safety and performance standards.
Long term (Years 4–5 +)	**5. Pilot phase:** Support the development of at least one pilot facility to demonstrate battery reuse for home or commercial storage applications. Results will be documented to assess financial viability, energy performance, and environmental benefits.
	6. Program rollout: Scale small-scale projects into permanent business models, potentially linked with the national take-back scheme (Activity 5) to receive EoL batteries directly. Saint Lucia will establish national standards for refurbished batteries and integrate certification processes into the SLBS framework. Over time, local reuse enterprises may evolve into regional centers of excellence, supporting battery repurposing across the OECS region.

Activity 13: Conduct feasibility study

Objective

To conduct a national feasibility study assessing the technical, environmental, and economic viability of establishing local pre-treatment, repurposing, and second-life facilities for EV and RE components in Saint Lucia.

The study will identify optimal solutions for safely managing EoL components, whether through local processing, regional cooperation, or hybrid approaches, and develop a roadmap for potential pilot infrastructure and investment mobilization.

Rationale

Saint Lucia currently has no domestic infrastructure for processing, repurposing, or preparing EV and RE components for export. Therefore, all hazardous and complex waste fractions must be shipped abroad, which is costly and limits circular-economy potential.

A feasibility study is essential to evaluate the cost-effectiveness and safety of local pre-treatment options (e.g., SoH testing, battery discharging, PV disassembly, acid neutralization), determine the scale at which such facilities would be viable, and identify the technical, regulatory, and financial requirements for potential investment.

The study's findings will guide policy decisions, donor engagement, and private-sector partnerships, ensuring that future infrastructure investments align with Saint Lucia's sustainability and waste-management priorities.

Table 41. Saint Lucia's activity 13 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Scope:** Define the scope, target technologies, and analytical parameters of the study to develop a Terms of Reference for bidding. The scope will include technical assessment of pre-treatment activities (battery discharging, safe dismantling, acid neutralization, SoH testing, cell sorting, and packaging), repurposing of batteries for stationary storage, and mechanical or chemical recycling options for PV modules.
Medium term (Years 2–3)	**2. Feasibility study:** The consultants will conduct the technical and economic feasibility assessment and provide a final recommendation. Potential funding sources, including donor grants, concessional loans, or PPP, will be identified.
Long term (Years 4–5 +)	**3. Operationalization:** Allocate budget for the construction of the preferred scenario designated for the development of detailed facility design, site selection, required permits, and institutional and financing structure.

Activity 14: Create technician upskilling programs

Objective

To develop and implement specialized training and certification programs for technicians, mechanics, solar installers, and other professionals involved in handling EV and RE components.

The programs will focus on safe dismantling, repair, testing, repurposing, and disposal practices, enhancing occupational safety, service quality, and Saint Lucia's technical capacity to manage EoL components in line with international standards.

Rationale

Currently, Saint Lucia lacks technicians trained specifically in the handling, disassembly, or reuse of EV batteries, PV modules, and inverters, resulting in unsafe practices, missed opportunities for reuse, and a reliance on foreign expertise.

Creating accredited upskilling and certification programs will improve the safety and efficiency of the national take-back and reuse system (Activities 5 and 12), equip local technicians to perform safe diagnostics, SoH testing, and repair of EV/RE components, and create new job opportunities in the circular economy and green-energy sectors.

Table 42. Saint Lucia's activity 14 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Curriculum design:** Convene a working group to design the curriculum framework, including institutions such as SALCC, NSDC, and OECS TVET. The curriculum will integrate both theoretical and practical modules on lithium-ion battery safety, PV-module diagnostics, SoH testing, fire prevention, and EoL preparation, considering reference materials from BCRC-Caribbean, UNEP, and international vocational programs adapted for the local context.
Medium term (Years 2–3)	**2. Material development:** Produce comprehensive training manuals, instructor guides, and demonstration videos, including safety checklists, case studies, and visual aids showing correct procedures for battery isolation, dismantling, and packaging. A modular approach will allow for short courses, continuing education, and full certification programs, in alignment with Saint Lucia's Technical and vocational education and training standards.
	3. Training of trainers (ToT): Select an initial cohort of instructors from SALCC for example, and vocational centers to undergo regional-level training provided by BCRC-Caribbean or other specialized partners.

Timeline	Milestones / Key Actions
	The ToT phase will ensure a pool of qualified trainers capable of delivering high-quality instruction in line with international best practices.
Long term (Years 4–5 +)	**4. Program rollout:** Launch the national training program targeting technicians from the automotive, electrical, and RE sectors, offering the courses in multiple tiers, from basic awareness to advanced certification, allowing technicians to progressively build competence. Training will include classroom sessions, hands-on laboratory exercises, and supervised internships at SLSWMA facilities or private partners.

Activity 15: Establish compliant interim storage

Objective

To designate, equip, and operationalize a compliant interim storage facility for EoL EV and RE components in Saint Lucia, serving as a secure consolidation point where used batteries, PV modules, and inverters can be safely accumulated, inventoried, and prepared for export or repurposing in full compliance with Basel Convention standards.

Rationale

At present, Saint Lucia has no centralized, compliant facility for storing hazardous or high-risk EV/RE components. Therefore, these materials are often stored informally at garages or workshops, creating risks of fire, leakage, and worker exposure.
A purpose-equipped interim storage site is critical to safely manage EoL components collected under the national take-back scheme (Activity 5) and enable cost-efficient consolidation of export shipments under regional cooperation mechanisms (Activities 9 and 16).

Table 43. Saint Lucia's activity 15 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Site selection:** Identify potential sites for the interim storage facility based on accessibility, security, environmental sensitivity, and distance from residential zones, prioritizing government-owned land or existing waste-management sites to reduce acquisition costs. A preliminary environmental assessment will screen each option for flood risk, drainage, and proximity to transport routes and ports.
	2. Technical specifications: Develop the facility design incorporating BAT/BEP and Basel-aligned safety features such as impermeable flooring, containment bunds, ventilation, temperature control, and fire-suppression

Timeline	Milestones / Key Actions
Medium term (Years 2–3)	systems. Separate storage zones will be designated for different waste categories (e.g., lithium-ion, lead-acid, PV modules), with clear segregation to prevent cross-contamination.
	3. Environmental Impact Assessment (EIA): Obtain all necessary environmental permits and planning approvals. To this aim, an EIA must be conducted in accordance with Saint Lucia's environmental legislation.
	4. Construction or retrofitting: Depending on the selected option, either a new storage building will be constructed or an existing warehouse will be retrofitted to meet required safety standards. Works will include flooring reinforcement, installation of drainage and ventilation systems, electrical grounding, and the placement of fireproof containers and spill-containment pallets.
Long term (Years 4–5 +)	**5. Operationalization:** License the facility officially and incorporate it into the national waste-management registry. The facility will be integrated

Activity 16: Participate in a regional export aggregation hub

Objective

To integrate Saint Lucia into a regional "hub-and-spoke" export system for ESM of EoL EV/RE components. In this arrangement, Saint Lucia will act as a spoke country, consolidating collected materials at its interim storage facility (Activity 15) for export to a designated regional hub, for example in Trinidad and Tobago, with economies of scale, logistics network, and certified downstream treatment capacity.

Rationale

Due to Saint Lucia's small size and limited waste volumes, establishing a full-scale national recycling or hazardous-waste treatment facility is economically unfeasible at the moment.

Direct export of small consignments to distant facilities in Europe or North America is prohibitively expensive and logistically complex. Therefore, a regional aggregation mechanism offers a cost-efficient and environmentally sound solution by allowing multiple SIDS in the region to pool consignments to achieve viable export volumes, share costs and infrastructure for packaging and transport, and access international recycling markets through certified regional hubs.

Table 44. Saint Lucia's activity 16 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling conditions:** Activities 9 and 15
Medium term (Years 2–3)	**1. Pilot:** Organize a joint pilot export operation with the regional hub to test end-to-end procedures, including packaging, labeling, transboundary movement documentation, customs clearance, and final disposal or recycling confirmation. BCRC-Caribbean will provide technical oversight to ensure compliance with Basel notification and consent protocols. Following the shipment, an evaluation report will capture lessons learned, cost implications, and recommended process improvements.
Long term (Years 4–5 +)	**2. Operationalization:** Once the pilot is deemed successful, and Activities 9 and 15 are operationalized, Saint Lucia will institutionalize the regional export process as part of the national take-back system. SOPs developed in Activity 7 and the decision tree from Activity 10 will be updated to guide exporters and Customs officials on documentation flow, inspection routines, and emergency response during loading and transit. A regular shipping calendar will be established to coordinate Saint Lucia's exports with other participating islands, maximizing container utilization and minimizing costs.

7.3. Jamaica

The following sub-section details the specific roadmap for Jamaica, summarized in the following table, including the responsible and supporting institutions for its implementation.

Table 45. Jamaica's roadmap activities

Pillar	Activity	Responsible	Support
Regulatory Framework	1. Strengthen EPR Provision within E-Waste Regulation Addendum	National Solid Waste Management Authority (NSWMA)	Ministry of Local Government and Community Development, Ministry of Legal and Constitutional Affairs, Customs, Jamaica Chamber of Commerce / Importer Associations, private sector
	2. Strengthen Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulation	National Environment and Planning Agency (NEPA)	NSWMA, MSETT, Ministry of Legal and Constitutional Affairs, Customs, importers, exporters, handlers, transporters, private sector
	3. Update National Renewable Energy Policy	Ministry of Science, Energy, Telecommunications and Transport (MSETT)	Jamaica Public Service Company (JPS), NSWMA, Customs, importers, solar/wind installers, generation parks, private sector
Collection & Take-back Logistics	4. Standardize collection protocols	NSWMA (non-HW) / NEPA (HW)	Garages, dealers, exporters, waste management operators, BCRC-Caribbean, Fire Service

Pillar	Activity	Responsible	Support
	5. Fund national public awareness campaigns	NSWMA	NEPA, Ministry of Education, NGOs, local media houses, dealers, garages, OECS Communications Unit
	6. Launch national EV/RE take-back scheme	NSWMA	MSETT, municipal cooperations and local authorities
Standards & Custom control	7. Enforce import quality standards and EoL planning	Customs / NSWMA	MSETT, Ministry of Foreign Affairs and Foreign Trade, Ministry of Finance, car dealers, solar/EV distributors, Bureau of Standards Jamaica (BSJ), Trade Board Limited
	8. Issue technical SOPs for RE/EV handling	NSWMA	Basel Focal Point, Customs, BCRC-Caribbean, Fire Service, private sector logistic, exporters
	9. Mandate data reporting on imports and exports	Customs	Basel Focal Point, private importers and exporters, Statistical Institute of Jamaica (STATIN), NSWMA
	10. Establish cooperation agreement between the Basel Focal points	Basel Focal Point / Ministry of Foreign Affairs and Foreign Trade	NSWMA, Basel Focal Points of other countries, OECS Secretariat, BCRC-Caribbean
Infrastructure & Resources	11. Strengthen existing infrastructure	NSWMA	Ministry of Finance, BCRC-Caribbean, Customs, waste management operators, Fire Department, municipal cooperations and local authorities
	12. Conduct feasibility study: Regional pre-	Development Bank of Jamaica	NSWMA, Ministry of Finance, Development banks/agencies, BCRC-Caribbean, OECS Secretariat

Pillar	Activity	Responsible	Support
	treatment and repurposing facilities		
	13. Create technician upskilling programs	Ministry of Education, Skills, Youth and Information	Education centers (HEART/NSTA Trust), NSWMA, MoHW, BCRC-Caribbean, private sector
	14. Establish compliant interim storage	NSWMA	Ministry of Finance, BCRC-Caribbean, Fire Service
	15. Participate in regional export aggregation hub	Basel Focal Point / Ministry of Foreign Affairs and Foreign Trade	NSWMA, Basel Focal Points of other countries, OECS Secretariat, Customs, BCRC-Caribbean, regional transport providers

Strategic pillars

- Pillar 1: Regulatory framework

Jamaica's roadmap could begin with reinforcing its legal instruments to integrate EPR and hazardous-waste control for EV and RE components. In the short term, the E-Waste Regulation Addendum would incorporate EPR provisions covering PV panels, inverters, and lithium-ion batteries, while the Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations would be amended to authorize NEPA to issue Basel-aligned SOPs and permit conditions. Medium-term steps would update the National Renewable Energy Policy (2009–2030), integrating EoL planning and second-life pathways for RE equipment, as done in detail in the National EV Policy (2023). Over the longer horizon, these reforms could form a cohesive legal foundation enabling cost-recovery mechanisms, licensing for compliant operators, and harmonized enforcement under Jamaica's Basel Convention obligations.

- Pillar 2: Collection and take-back logistics

This pillar focuses on building Jamaica's operational ecosystem for recovering EV/RE components. In the short term, national collection protocols could be developed for safe handling of EoL components until their disposal at one authorized collection point. Nationwide awareness campaigns led by NSWMA would follow, targeting garages, importers, and consumers to encourage formal disposal and take-back participation. Long-term measures introduce a national EV/RE take-back scheme, linking mapped collection points with compliant interim storage and digital data flows.

- Pillar 3: Standards and customs control

Jamaica could strengthen border governance and technical standards to manage imports and exports of EV/RE components responsibly. Short-term actions include enforcing import-quality and lifespan standards, requiring importers to declare EoL plans and meet minimum performance thresholds for vehicles and batteries. In the medium term, technical SOPs would guide labeling, packaging, storage, and shipping, complemented by a national data-reporting mandate for importers and exporters linking Customs, NSWMA, and STATIN into a unified digital mass-balance system. Long-term objectives foresee a formal cooperation agreement among Basel Focal Points across the Caribbean to streamline notification and consent processes for transboundary movement, positioning Jamaica as a key regional coordination hub for compliant export aggregation, considering its privileged position and logistics capabilities, supporting neighboring countries to achieve economies of scale.

- Pillar 4: Infrastructure and resources

The final pillar consolidates Jamaica’s physical and human-resource capacity to implement the roadmap. Initial actions could focus in strengthening existing infrastructure, such as garages, workshops, and waste-handling facilities, through equipment support and operator training. Concurrently, a feasibility study led by the Development Bank of Jamaica could assess options for national pre-treatment and repurposing facilities versus regional partnerships. Medium-term initiatives could create technician-upskilling programs with Human Employment and Resource Training Trust/National Service Training Agency (HEART/NSTA) and BCRC-Caribbean to certify workers in lithium-battery and PV-module management. In the longer term, Jamaica could establish compliant interim storage for EV/RE waste and fully participate in a regional export aggregation hub, acting as a Caribbean center for safe, Basel-compliant consolidation and shipment of end-of-life components.

Vision for Jamaica after roadmap implementation

Once Jamaica completes the 15 activities under the four strategic pillars listed inTable 45, the country will have evolved into a regional model for ESM of EV and RE components, combining robust national systems with leadership in regional cooperation. The country will operate under a coherent legal and institutional framework that fully integrates EPR, data transparency, and enforcement mechanisms aligned with international conventions. Its regulatory framework, strengthened through modernized e-waste and hazardous-waste regulations, will ensure that all imported technologies meet quality, safety, and lifecycle requirements, creating a self-sustaining system where producers and importers actively contribute to EoL management.

Technically, Jamaica will maintain a nationwide, traceable collection and take-back network, supported by harmonized public guidance, awareness campaigns, and certified operators managing safe aggregation, interim storage, and export. The establishment of a Basel-compliant interim storage facility and the integration of digital tools for data reporting will provide full visibility of material flows, enabling the taking of policy and investment decisions based on data. The local workforce, empowered through targeted training and certification programs, will have the expertise to dismantle, repurpose, and safely handle EV and RE components, expanding green employment opportunities and reducing safety incidents.

At the regional scale, Jamaica’s logistics strength and strategic geographic position will secure its role as the Caribbean’s primary hazardous-waste export and coordination hub.

Through formal cooperation with other Basel Focal Points and participation in a shared export-aggregation system, Jamaica will facilitate efficient, cost-effective, and legally compliant transboundary movements for smaller island states. This will not only lower export costs and enhance compliance across the region but also strengthen the collective capacity of Caribbean SIDS to meet their environmental commitments.

In essence, the implementation of this roadmap will transition Jamaica from a corrective and reactive waste management approach to an integrated, circular, and regionally connected system, capable of safely managing the entire lifecycle of modern energy technologies. The country will stand as a benchmark in the Caribbean for combining sound environmental governance, digital innovation, and regional solidarity to achieve a just, low-carbon, and resource-efficient future.

7.3.1. Pillar 1: Regulatory Framework

Activity 1: Strengthen EPR provision within e-waste regulation addendum

Objective

To ensure that Jamaica's E-Waste Regulation includes comprehensive EPR provisions covering high-risk EV and RE components, particularly PV modules, inverters, and lithium-ion batteries, by establishing cost-recovery and accountability mechanisms that make importers, producers, and distributors legally responsible for financing and coordinating ESM of their products at end-of-life.

Rationale

Jamaica's existing National Solid Waste Management Act does not contain detailed provisions for managing modern e-waste or hazardous EV/RE components. The planned E-Waste Regulation Addendum therefore provides the most practical and timely entry point for integrating EPR without overhauling the parent Act.

Embedding EPR will (i) create a predictable funding base for collection and treatment of e-waste, (ii) clarify responsibilities among importers, retailers, and waste operators, and (iii) ensure traceability through a national digital registry. The approach aligns Jamaica with the evolving regulatory models in other SIDS (e.g., Dominican Republic) and with global conventions, particularly the Basel and Stockholm Conventions, by promoting producer accountability and circular-economy financing.

Table 46. Jamaica's activity 1 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. EPR framework drafting:** Complete legal drafting of the E-Waste Regulation text to embed EPR clauses on enforcement, tracking, and take-

Timeline	Milestones / Key Actions
	back, defining the scope of covered products (e.g., batteries, PV modules, inverters); roles and responsibilities of producers, importers, retailers, and PRO; collection targets, reporting frequency, and compliance mechanisms; sanctions for non-compliance and incentives for environmentally friendly design (eco-modulation of the EPR fee).
Medium term (Years 2–3)	**2. Stakeholder consultation:** Organize national consultations with importers, distributors, Customs, the Chamber of Commerce, and civil-society organizations to ensure practical feasibility and market buy-in. Feedback will be used to refine fee structures, reporting systems, and enforcement provisions.
	3. Pilot phase: Launch a pilot scheme, acting NSWMA as pilot PRO, with selected importers to test the financial model, collection logistics, and digital reporting mechanisms. This pilot phase will prioritize one high-risk category, such as for example lithium-ion batteries, to gather performance data and inform the national roll-out.
	4. EPR fee model: Develop a standardized fee model, calculating fees according to product type, quantity, and lifecycle costs, and earmarked to fund interim storage, transport, export, and capacity-building activities. Revenue management procedures will be openly shared to ensure transparency and accountability.
Long term (Years 4–5 +)	**5. Centralized digital registry:** Create or adapt a digital registry from existing NSWMA or Customs systems to track products placed on the market, EPR fees paid, quantities collected, and materials exported. The registry will interface with Customs, NEPA and the Basel reporting system to enable full traceability of EV and RE components throughout their lifecycle.
	6. PRO institutionalization: Formalize the PRO, initially operated under NSWMA oversight, through regulation. Its mandate will include fee collection, compliance monitoring, data reporting, and financing of approved recycling and export operations. A governance structure will be established to ensure balanced representation from government, producers, and civil society.

Activity 2: Strengthen Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulation

Objective

To reinforce Jamaica's Natural Resources (Hazardous Waste) (Control of Transboundary Movement) Regulations, ensuring full alignment with the Basel Convention Technical Guidelines (2025 updates) and empowering NEPA to issue binding SOPs and technical permit conditions for facilities that refurbish, store, dismantle, transport, or export EV and RE components.

The revision will create an enforceable framework for ESM of hazardous fractions, particularly batteries and PV panels, and strengthen coordination among NEPA, NSWMA, and Customs.

Rationale

While Jamaica's hazardous-waste regulations already classify many EV/RE components as hazardous, the current framework does not confer authority to NEPA to issue binding SOPs.

The 2025 amendments to the Basel Convention (clarifying "used" vs "waste" electronics and requiring proof of reuse) provide an opportunity to modernize Jamaica's definitions, documentation requirements, and inspection authority. Strengthening the regulation will clarify legal distinctions between used and waste equipment, embed international best practice for permitting and audit, and enable Jamaica to control transboundary movement of hazardous RE/EV waste more effectively.

Table 47. Jamaica's activity 2 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Legal analysis:** Review comparative legal frameworks to map the current provisions of the Regulation against best international practices, such as OECS and Basel obligations (including 2025 Amendments). The review will identify: (a) missing definitions of special or emerging hazardous waste streams such as EV batteries and PV panels; (b) sections where the Minister or the Authority may issue SOPs or impose technical conditions through permitting; and (c) inspection and enforcement powers that can be expanded. The output should be a proposal including digital tracking, and landfill restrictions prioritizing waste hierarchy (e.g., material recovery, reuse, repurposing).
	2. Drafting of amendments: Develop draft clauses introducing: (i) "used" vs "waste electronics definitions, including a presumption that Used Electrical and Electronic Equipment (UEEE) is waste unless proven

Timeline	Milestones / Key Actions
	functional with test results; (ii) authority for the NSWMA to issue technical standards and landfill restrictions; (iii) mandate collection targets, data reporting, and licensing for new actors (collectors, transporters, exporters, refurbishers); (iv) licensing obligations for all actors involved in the management chain of hazardous EV/RE components (e.g., informal garages, battery service providers, panel's installers, etc.); (v) circular-economy and waste-hierarchy principles; and (vi) proportional administrative fines and penalties. The Act may include a mandatory five-year review clause to allow continuous alignment with technological change.
Medium term (Years 2–3)	**3. Stakeholder consultation:** Organize national consultations combining technical workshops and public hearings. The process should test the practicality of new obligations for the stakeholders involved (e.g., importers, garages, exporters, recyclers, and Customs); assess enforcement costs; and collect comments for redrafting.
	4. Approval and parliamentary process: Following Cabinet approval of drafting instructions, the Attorney-General's Chambers will conduct legal vetting and table the Bill in Parliament.
Long term (Years 4–5 +)	**5. Adoption and enforcement:** Issue subsidiary regulations specifying SOPs for collection, transport, and interim storage of EV and RE waste; establish inspection procedures, digital manifest requirements, and a schedule of offences. Training for enforcement officers, private stakeholders, and Customs agents will accompany rollout.

Activity 3: Update National Renewable Energy Policy

Objective

To revise and update Jamaica's National Renewable Energy Policy (2009–2030) so that it explicitly addresses EoL management, circular economy principles, and ESM of RE systems such as solar PV, wind turbines, and inverters.

The updated policy will integrate EoL planning, reuse and repurposing pathways, import-quality controls, and technical handling standards, ensuring alignment with the requirements set by the National Electric Vehicle Policy (2023) and international frameworks under the Basel Convention.

Rationale

The current RE policy primarily focuses on generation targets, grid integration, and investment incentives, with little consideration for the downstream impacts of expanding renewable infrastructure. As solar and wind installations proliferate, Jamaica faces growing risks of uncontrolled disposal, material loss, and safety hazards from failing or obsolete equipment.

By embedding lifecycle and EoL provisions in the policy, the Government will align RE expansion with environmental and waste-management objectives, establish institutional clarity for handling, reuse, and disposal of RE systems, and create synergy between the RE and EV policy frameworks.

Table 48. Jamaica's activity 3 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Legal analysis:** Conduct a comprehensive review of the current policy, benchmarking it against the EV Policy and international circular-economy standards to identify missing provisions related to EoL and circularity. The output should be a proposal including communication campaigns (Activity 5), import standards requirements (Activity 7), waste hierarchy prioritization (e.g., material recovery, reuse, repurposing) (Activity 12), and training programmes for key professionals (Activity 13).
	2. Drafting of amendments: Draft policy sections covering: (i) communication campaigns (Activity 5); (ii)EoL planning and take-back requirements for importers and distributors (Activity 6); (iii) minimum import-quality and registration standards (Activity 7); (iv) waste hierarchy prioritization (e.g., material recovery, reuse, repurposing) (Activity 12); and training programmes for key professionals (Activity 13); keeping a similar structure to the EV Policy.
Medium term (Years 2–3)	**3. Stakeholder consultation:** Organize national consultations combining technical workshops and public hearings. The process should test the practicality of new obligations for the stakeholders involved (e.g., importers, garages, exporters, recyclers, and Customs); assess enforcement costs; and collect comments for redrafting.
	4. Approval and parliamentary process: Following Cabinet's endorsement of the revised policy framework, MSETT will finalize the updated National Renewable Energy Policy text. Once cleared, the revised policy will be approved by Cabinet and formally adopted as Government policy, after which it will be gazetted and publicly launched to guide implementation across relevant ministries, agencies, and private-sector stakeholders.
Long term (Years 4–5 +)	**5. Adoption and enforcement:** Issue subsidiary documents specifying SOPs for collection, transport, and interim storage of RE waste; establish inspection procedures, digital manifest requirements, and a schedule of

Timeline	Milestones / Key Actions
	offences. Training for enforcement officers, private stakeholders, and Customs agents will accompany rollout.

7.3.2. Pillar 2: Collection and Take-Back Logistics

Activity 4: Standardize collection protocols

Objective

To establish and communicate user-friendly national collection protocols that guide consumers, importers, garages, and maintenance service providers on how to return complete EV and RE components, such as batteries, PV modules, and inverters, to designated take-back points.

The protocols will focus on consumer guidance and behavioural change, ensuring that end-users deliver components intact to official collection sites and do not dismantle or discard them informally.

Rationale

Most Jamaicans are unaware of how or where to dispose of EV and RE equipment safely. Uncoordinated or informal removal of parts leads to material loss, safety hazards, and contamination.

By creating standardized national collection instructions harmonized across municipalities and collection partners, the Government will promote safe consumer participation in the take-back system, prevent partial dismantling and informal resale of hazardous components, and improve traceability and recovery rates for EV/RE waste.

Table 49. Jamaica's activity 4 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Benchmarking:** Review existing collection practices for used electronics and batteries. Compare current practices with Basel Technical Guidelines, manufacturer recommendations and international best practices for battery and PV handling.
	2. Drafting of national protocols: Prepare a concise set of national instructions describing how and where citizens should return EV and RE components. The guidance will specify that items must remain intact, prohibit casing removal or battery disassembly, and list all approved collection points. It will also include basic safety reminders, such as avoiding exposure to heat or moisture during transport.
	3. Validation: Test the draft protocols through consultation sessions and focus groups with households, garages, importers, solar installers, and local

Timeline	Milestones / Key Actions
Medium term (Years 2–3)	councils. These exercises will evaluate clarity, accessibility, and practicality from a user perspective. Feedback will be consolidated for redrafting.
	4. Dissemination: Communicate the validated protocols through multiple communication channels. Printed leaflets and posters will be displayed at municipal offices, customs counters, and retail outlets, while digital versions will be shared via social media and government websites. Short radio and community-TV segments will reinforce key messages. Demonstration events in schools, repair workshops, and local markets will illustrate the correct process for returning items.
Long term (Years 4–5 +)	**4. Institutional integration and monitoring:** Incorporate the standardized protocols into import licenses, consumer warranties, and installation agreements so that every new EV or RE product is accompanied by clear EoL return guidance. Local authorities will incorporate the same messages into municipal waste education programs. NSWMA will maintain an updated public directory of authorized collection sites and establish a simple monitoring system to record quantities of EoL items received through formal channels. Periodic surveys will assess awareness levels and compliance.

Activity 5: Fund national public awareness campaigns

Objective

To design, fund, and roll out nationwide public awareness and education campaigns that inform citizens, importers, garages, and technicians about the environmental and safety risks of improper disposal of EV and RE components, and the benefits of using official collection and take-back systems.

The campaigns will promote behavioural change by making formal collection channels visible, accessible, and trusted by the general public.

Rationale

Public knowledge about EV and RE waste management in Jamaica is limited. System owners and workshops may dispose of used batteries, panels, or inverters informally or abandon them on-site, creating fire hazards and pollution. Therefore, without broad awareness, the standardized collection protocols (Activity 4) and take-back scheme (Activity 6) cannot succeed.

Strategic communication will then encourage voluntary participation in the take-back system, aiming at reducing illegal dumping and unsafe handling.

Table 50.Jamaica's activity 5 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling condition:** Activity 3
Medium term (Years 2–3)	**1. Message development and production of materials:** Develop communication materials in multiple formats to ensure accessibility for all audiences. These may include radio and television spots, short video clips for social media, posters, flyers, and illustrated brochures. Materials will be translated into simple, locally relevant language and incorporate Jamaica's testimonials. Special attention will be given to messages for rural communities and informal-sector workers, who may have limited access to online information.
	2. National campaign rollout: Launch national campaign using a multi-channel approach combining traditional media (radio, television, newspapers) with digital platforms and community-level engagement. Activities may include radio talk shows, press features, school presentations, and informational booths at public events. Collaboration with importers and distributors will ensure that awareness materials are displayed at points of sale and attached to new product packaging.

Activity 6: Launch national EV/RE take-back scheme

Objective

To establish a national take-back system for collecting and temporarily storing EoL EV and RE components through an integrated network of public and private drop-off points. The scheme will define responsibilities, procedures, and financial mechanisms for importers, garages, collection firms, and municipalities, creating the operational backbone for Jamaica's environmentally sound management of EV/RE waste.

Rationale

Jamaica currently lacks a structured mechanism for returning or aggregating EoL EV/RE components. As a result, many batteries, panels, and inverters are stockpiled, posing fire and contamination risks.

A formal national take-back scheme will provide safe, traceable collection routes, and will be integrated with national data-reporting systems (Activity 9) and interim-storage capacity (Activity 14).

Table 51. Jamaica's activity 6 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling condition:** Activity 3
	1. Mapping and design of collection points: Identify and assess suitable drop-off locations that can serve as official collection points for batteries and PV panels (this is also required for Milestone 2 in Activity 4). Potential sites include existing municipal depots, ports, large garages, and dealerships with adequate space and access. Each location will be evaluated against safety, accessibility, and logistical criteria such as proximity to interim storage and transport routes.
Medium term (Years 2–3)	**2. Partnership agreements:** Draft formal agreements with drop-off locations and municipal authorities outlining their responsibilities for receiving, recording, and transferring EoL components. These partnerships will establish the operational model of the scheme and set the basis for future regulatory obligations.
	3. Pilot phase: Launch a pilot take-back programme at two or three locations representing different geographic contexts (urban, peri-urban, and rural). During this phase, operational workflows, data-collection forms, and reporting channels will be tested and refined in integration with EPR pilot from Activity 1.
Long term (Years 4–5 +)	**4. Nationwide rollout:** Expand the take-back network across the country by integrating all participating collection points into a unified registry and reporting platform, linking them with the interim-storage facility developed under Activity 14. A help-desk or hotline will be created for citizens and businesses seeking information about where and how to return items in line with Activity 4.

7.3.3. Pillar 3: Standards and Custom Control

Activity 7: Enforce import quality standards and EoL planning

Objective

To apply and enforce minimum quality, lifespan, and documentation standards for all imported EVs and RE systems entering Jamaica, by requiring the disclosure of the expected useful life of their products and submission of EoL return or take-back plans as part of import licensing and procurement processes. This activity seeks to prevent low-quality or non-compliant components from entering the Jamaican market, ensuring that every imported product is traceable and manageable through its full lifecycle.

Rationale

Used or sub-standard EV and RE equipment, such as used hybrid vehicles, are being imported without corresponding EoL management provisions. These products fail prematurely, increasing waste volumes and burdening Jamaica's emerging take-back system.

By enforcing import-quality and EoL planning requirements, Jamaica will promote durability and accountability in the EV/RE market, reduce the volume of prematurely discarded e-waste, and ensure that importers assume clear responsibility for EoL management.

Table 52. Jamaica's activity 7 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Define minimum import standards:** Establish a list of minimum quality criteria for imported EV and RE components, specifying, for example, the maximum age of used vehicles, minimum SoH percentages for batteries, and compliance with recognized international safety standards (IEC, ISO, UN). The criteria may also require importers to submit certificates of origin, proof of performance testing, and manufacturer declarations on expected lifespan.
	2. Develop documentation: Design a standardized declaration form for importers to disclose the anticipated lifetime of each imported item and outline their intended take-back or disposal pathway once the product reaches EoL. This form will include basic data fields such as product category (HS code), serial number, and estimated useful life.
Medium term (Years 2–3)	**3. Legal integration:** Amend import-license regulations and public-procurement guidelines to incorporate the new standards and EoL-planning obligations, ensuring that no importer or distributor will be permitted to place EV or RE products on the market without fulfilling these conditions. Customs will update its digital import-declaration platform to include mandatory fields for SoH values, product age, and EoL-plan reference numbers.
	4. Capacity building: Deliver training sessions for Customs officers, inspectors, and licensing officials to familiarize them with the new quality standards, documentation templates, and verification procedures. A reference handbook will be prepared to guide officers in identifying non-compliant consignments and applying detention or rejection protocols.
Long term (Years 4–5 +)	**5. Monitoring and compliance:** Establish a coordinated inspection and data-reporting system to record import quantities (Activity 9), verify

Timeline	Milestones / Key Actions
	documentation, and flag high-risk consignments for follow-up. Penalties for non-compliance will be introduced.

Activity 8: Issue technical SOPs for RE/EV handling

Objective

To develop and issue technical SOPs for the safe handling, labeling, packaging, temporary storage, and export of EoL EV and RE components.

These SOPs will serve as official technical guidance for public agencies, private operators, garages, exporters, and Customs officers, ensuring consistent and ESM practices throughout Jamaica's EV/RE waste chain.

Rationale

Currently, Jamaica has no standardized technical instructions guiding the safe management of EV and RE components. This gap exposes handlers to fire, electrocution, and contamination risks, while creating inconsistencies across inspection and permitting processes.

Developing and institutionalizing national SOPs will reduce occupational and environmental risks during handling and storage, establish uniform technical expectations for all licensed operators, and strengthen Customs' and NEPA's ability to inspect and approve shipments.

Table 53.Jamaica's activity 8 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Reference materials:** Collect and review existing technical guidance, including Basel Convention Technical Guidelines, BAT/BEP recommendations (international and from OECS/CARICOM countries), and manufacturer manuals for lithium-ion batteries and photovoltaic equipment. This desk review will identify the minimum safety and performance criteria applicable to Jamaica's context, including packaging standards, chemical-compatibility considerations, and emergency-response requirements.
	2. Drafting of national SOPs: Prepare a set of concise, modular SOPs collaboratively with a multidisciplinary drafting team comprising NSWMA and

Timeline	Milestones / Key Actions
Medium term (Years 2–3)	NEPA engineers, the Fire Service, BSJ, private sector, and BCRC-Caribbean specialists. Each module will describe specific procedures such as safe inspection of decommissioned components, voltage-discharge checks, safe lifting and stacking, labeling and hazard signage, waste streams compatibility, spill-containment measures, and response to thermal incidents and accidents.
	3. Validation: Refine the SOPs through validation workshops organized with key institutional partners to test the clarity and applicability of the draft procedures. Participants will assess whether the instructions can be realistically implemented with existing infrastructure and identify any additional training or equipment needs. Feedback will be integrated to improve the SOPs.
	4. Capacity building: Deliver training sessions to customs inspectors, garage operators, port workers, and waste-collection and handling operators, combining theoretical instruction with practical demonstrations, focusing on hazard recognition, correct use of PPE, incident response, and reporting obligations. A certification process will be established for trained personnel, linked to license renewals and inspection checklists.
Long term (Years 4–5 +)	**5. Legal adoption:** Issue officially the SOPs through ministerial order or gazetting, thereby acquiring regulatory status as it will be stated in the Natural Resources Regulation (Activity 2). All waste-handling licenses and import permits will reference compliance with these SOPs as a condition of operation.

Activity 9: Mandate data reporting on imports and exports

Objective

The objective of this activity is to establish a mandatory national data-reporting system that requires all importers, exporters, and handlers of EV and RE components to provide regular, detailed information on the quantities of products entering, circulating within, and leaving Jamaica.

By introducing this requirement, the country will ensure traceability of materials across their entire lifecycle, enabling accurate monitoring, enforcement, and planning for ESM of EV and RE waste.

Rationale

Jamaica currently lacks a coordinated and centralized data framework for tracking the importation, domestic flow, and export of EV and RE components. The absence of reliable data undermines enforcement of take-back and EPR obligations outlined in Activity 1, limits the country's ability to report under the Basel Convention, and weakens the foundation for planning storage and export infrastructure. It also restricts Jamaica's capacity to monitor progress toward national commitments such as NDC.

Establishing a compulsory digital reporting mechanism will close this information gap by generating real-time insights into product lifecycles, strengthening Customs and permitting oversight, and improving Jamaica's transparency and regional alignment in hazardous-waste monitoring and control.

Table 54. Saint Lucia's activity 9 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Policy mandate:** In line with Activities 1 and 2, the obligation for importers, exporters, and licensed waste operators to report data on EV and RE components will be included in the Regulations. The regulation will specify the frequency of reporting (quarterly or biannual), the responsible authorities, and the penalties for non-submission or falsification. This legal instrument will clearly define data ownership, confidentiality provisions, and the roles of NSWMA, NEPA, Customs, and STATIN in managing and validating the information.
Medium term (Years 2–3)	**2. Development of reporting tools:** Design standardized reporting templates compatible with Customs' digital declaration systems to capture information such as product type, quantity, manufacturer, import date, serial number (where applicable), and declared end-of-life pathway (in alignment with Activity 7). For exports, the templates will record storage origin, type of waste, consignee, and receiving facility. The reporting tools will be designed for both digital and manual submission to ensure accessibility for all regulated entities, and will ensure alignment with international and regional reporting tools, such as the Basel Convention's Electronic Reporting System.
	3. Capacity building: Provide targeted training for Customs officers, importers, and exporters to ensure accurate data entry and understanding of the new reporting obligations. Awareness sessions will also be conducted with private operators and municipal authorities to demonstrate how the data will be used for planning

Timeline	Milestones / Key Actions
	and compliance monitoring. This early engagement will promote cooperation and reduce resistance during rollout.
	4. Establishment of a centralized digital data hub: Develop or adapt a national electronic platform to serve as a centralized data hub for all component transactions, integrating data from Customs import declarations, waste-collection records, and Basel export permits. User dashboards will allow authorized agencies to visualize material flows and generate analytical reports. Formal data-sharing agreements will be signed among MSETT, NSWMA, NEPA, Customs, and STATIN.
Long term (Years 4–5+)	**5. Monitoring and compliance:** Establish monitoring routines for validating submissions, identifying missing reports, and following up with non-compliant operators. Annual summary reports will be produced and submitted to the Basel Convention's Electronic Reporting System, covering imports, exports, and domestically treated materials.

Activity 10: Establish cooperation agreement - Basel Focal points

Objective

The objective of this activity is to negotiate and formalize a regional cooperation agreement between Jamaica's Basel Focal Point and the Focal Points of other Caribbean countries, particularly those within OECS and the wider BCRC-Caribbean network. The agreement will define clear procedures for notification, consent, and documentation under the Basel Convention, as well as protocols for data sharing and coordinated shipment of hazardous EV and RE waste.

Although Jamaica is an SIDS, its strategic geographical position and robust logistics infrastructure provide a significant advantage in regional trade and transport. The country already handles considerable volumes of hazardous-waste exports under the Basel Convention, demonstrating mature administrative and port-handling systems. *These strengths position Jamaica not only to streamline its own waste movements but also to support neighbouring SIDS in improving their transfrontier-shipment arrangements and negotiation capacities, contributing to a more efficient and cooperative regional framework.* Establishing this agreement will prevent duplication in export approvals, harmonize documentation, and create the institutional foundation for Jamaica's role in the regional export-aggregation system under Activity 15.

Rationale

While Jamaica shares many of the structural challenges faced by SIDS, such as limited economies of scale and high shipment costs, it benefits from a privileged regional logistics network, with well-connected maritime routes and established partnerships with licensed disposal facilities abroad. This enables the country to play a proactive role in facilitating compliant transboundary movements of hazardous waste for itself and for smaller island states with limited infrastructure.

Several OECS and CARICOM members continue to experience fragmented permitting processes and prolonged clearance times for Basel notifications. A formal cooperation agreement between the Basel Focal Points will reduce these inefficiencies by creating a unified regional mechanism for pre-consent, joint notification, and coordinated communication among competent authorities. Such collaboration will ensure compliance with Article 11 of the Basel Convention while fostering regional solidarity, improving transparency, and allowing Jamaica to act as a technical and logistical hub to assist other SIDS in strengthening their ESM practices. By aligning documentation and approval procedures, the agreement will accelerate ESM of EV and RE waste and support harmonization across the Caribbean's regulatory and operational landscape

Table 55. Jamaica's activity 10 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Stakeholder identification:** Compile a list of Basel Focal Points and Competent Authorities across OECS and CARICOM countries (especially the ones that usually make transit in Jamaica, such as Saint Lucia and Barbados), including their legal mandates and current national procedures.
Medium term (Years 2–3)	**2. Drafting of the cooperation framework:** Draft an initial framework agreement in collaboration with BCRC-Caribbean, in accordance with Article 11 of the Basel Convention, which explicitly allows for such agreements between parties, and align with existing regional examples such as the MERCOSUR and OECD models[3]. The draft will outline objectives, scope, and operational modalities, including information exchange, document templates, notification procedures, mutual recognition of packaging and labeling standards, and protocols for emergency communication during transport.

[3] See all the available Article 11 Agreements here:

https://www.basel.int/Implementation/LegalMatters/Compliance/GeneralIssuesActivities/Activities201617/ControlsystemArticle11agreements/tabid/5328/Default.aspx

Timeline	Milestones / Key Actions
	3. Regional consultations: Conduct virtual and in-person meetings with all participating states to review the draft text, clarify legal obligations, and ensure that the agreement reflects the capacities and priorities of each member country. Technical inputs will be incorporated before finalization.
	4. Legal review and endorsement: The final draft agreement will undergo legal vetting by the Attorney-General's Chambers in Jamaica and equivalent offices in partner countries. This review will confirm compatibility with domestic laws and the Basel Convention, define the authority for signature, and specify mechanisms for amendment and dispute resolution. Once vetted, the agreement will be submitted to national Cabinets for approval.
Long term (Years 4–5 +)	**5. Operationalization:** Create a shared contact database and an online workspace (hosted by BCRC-Caribbean) to manage notifications, documentation, and shipment tracking. Standardized templates for PIC requests and movement documents will be distributed to reduce administrative delays.

7.3.4. Pillar 4: Infrastructure and Resources

Activity 11: Strengthen existing infrastructure

Objective

The objective of this activity is to strengthen the technical, regulatory, and operational capacity of Jamaica's existing infrastructure, such as garages, repair workshops, waste operators, exporters, and municipal facilities, that already handle EV and RE components. The initiative aims to integrate these dispersed actors into a coordinated and compliant national network capable of performing safe segregation, aggregation, documentation, and temporary storage functions.

Rationale

Jamaica possesses a strategic geographical position and well-established logistics infrastructures, along with a solid track record in transboundary movement of hazardous waste to licensed treatment facilities abroad, positioning the country to support other small island states by sharing technical expertise and demonstrating scalable, compliant hazardous-waste operations. This existing capability provides a strong foundation for upgrading national EV and RE waste management systems. However, many smaller facilities, such as garages and workshops, which may come in contact with EV batteries, continue to operate without standardized environmental controls, specialized equipment, or access to technical guidance.

By strengthening and formalizing these actors under a unified framework, Jamaica can immediately expand its domestic collection capacity while simultaneously improving safety, compliance, and coordination between public and private sectors.

Table 56. Saint Lucia's activity 11 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Mapping:** Conduct a comprehensive survey of existing businesses and entities that currently manage or could manage EV and RE components, including garages, auto-electrical workshops, solar-installation companies, scrap-metal dealers, waste-logistics operators, etc. Each facility will be profiled according to location, ownership, activity type, infrastructure condition, and safety capacity. As a result, it will be identified which facilities can be upgraded for compliance and which require new investment.
	2. Capacity assessment: Evaluate each facility's readiness to meet EHS standards, as well as international agreements, by assessing space availability, structural integrity, fire-risk level, drainage and ventilation, spill-prevention systems, and proximity to residential areas. This will identify critical gaps, such as the lack of impermeable flooring, ventilation, firefighting systems, or secure storage racks, that must be addressed before facilities can receive hazardous components.
Medium term (Years 2–3)	**3. Enabling conditions:** Activity 8
	4. Upgrades implementation: Provide support to implement the required upgrades to targeted facilities identified as strategic collection or pre-treatment sites. This may include provision of specialized equipment such as insulated tools, fireproof cabinets, containment pallets, and spill-response kits. Private-sector facilities demonstrating compliance commitment will be prioritized for PPP support.
Long term (Years 4–5 +)	**5. Regulatory integration:** Update and strengthen Jamaica's existing waste-management permitting system under Natural Resources Regulation (Activity 2) to ensure that all licensed facilities handling EV and RE components comply with the latest technical, safety, and environmental standards. This step will involve revising license conditions and inspection protocols to integrate the new state-of-the-art requirements developed under Activities 8, 9, and 11.

Timeline	Milestones / Key Actions
	License holders will be required to maintain facilities in line with these updated standards, and compliance will be verified through periodic audits and inspection checklists.

Activity 12: Conduct feasibility study

Objective

The objective of this activity is to conduct a national feasibility study to assess the technical, environmental, and financial viability of establishing local pre-treatment, repurposing, and/or second-life facilities for EV and RE components in Jamaica. The study will evaluate the comparative advantages of developing domestic infrastructure versus participating in a shared regional treatment system, providing the evidence base for future investment decisions.

Rationale

Jamaica currently lacks dedicated infrastructure for assessing and certifying the status of UEEE, repurposing, or preparing EoL EV and RE components for recycling or compliant export. As the national market for solar installations, hybrid vehicles, and lithium batteries expands, these components are expected to reach their EoL in increasing volumes within the next decade. Without a defined pre-treatment or repurposing pathway, valuable materials risk being lost to landfill or informal handling, while export costs remain high.

Conducting a structured feasibility study will provide the analytical foundation for developing a cost-effective, environmentally sound, and regionally integrated treatment model. The study will determine the most efficient approach, whether to establish a centralized national facility for pre-treatment options (e.g., SoH testing, battery discharging, PV disassembly, acid neutralization) or integrate repurposing activities into existing industrial zones.

Table 57. Jamaica's activity 12 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Scope:** Define the scope, target technologies, and analytical parameters of the study to develop a ToR for bidding. The scope will include technical assessment of pre-treatment activities (battery discharging, safe dismantling, acid neutralization, SoH testing, cell sorting, and packaging), repurposing of batteries for stationary storage, and mechanical or chemical recycling options for PV modules.

Timeline	Milestones / Key Actions
Medium term (Years 2–3)	**2. Feasibility study:** The consultants will conduct the technical and economic feasibility assessment and provide a final recommendation. Potential funding sources, including donor grants, concessional loans, or PPP, will be identified.
Long term (Years 4–5 +)	**3. Operationalization:** Allocate budget for the construction of the preferred scenario designated for the development of detailed facility design, site selection, required permits, and institutional and financing structure.

Activity 13: Create technician upskilling programs

Objective

The objective of this activity is to develop and implement specialized training and certification programs for technicians, mechanics, and RE installers focused on the safe handling, disassembly, repair, repurposing, and EoL preparation of EV and RE components.

The program will enhance national technical capacity in managing advanced energy technologies and hazardous materials, ensuring that Jamaica has a skilled workforce capable of supporting its transition toward circular-economy practices.

Rationale

The rapid uptake of EVs, solar panels, wind turbines, and battery systems in Jamaica has created an emerging demand for technicians trained not only in installation and maintenance but also in safe EoL management. Currently, the workforce lacks formal training in critical areas such as lithium-ion battery safety, PV module diagnostics, hazardous-material identification, and fire prevention. Without this expertise, informal or unsafe handling practices can lead to accidents, property damage, and environmental contamination.

Developing a national upskilling program will ensure that the country's technicians acquire the competencies needed to manage EV and RE components responsibly, while also unlocking employment opportunities in repair, repurposing, and recycling sectors. The program will align with Basel Convention Technical Guidelines, incorporate BAT/BEP standards, and contribute directly to Jamaica's green-jobs and human-capital development agenda.

Table 58. Jamaica's activity 13 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Curriculum design:** Convene a working group to design the curriculum framework, including institutions such as HEART/NSTA Trust and OECS TVET. The curriculum will integrate both theoretical and practical modules on lithium-ion battery safety, PV-module diagnostics, SoH testing, fire prevention, and EoL preparation, considering reference materials from BCRC-Caribbean, UNEP, and international vocational programs adapted for the local context.
Medium term (Years 2–3)	**2. Material development:** Produce comprehensive training manuals, instructor guides, and demonstration videos, including safety checklists, case studies, and visual aids showing correct procedures for battery isolation, dismantling, and packaging. A modular approach will allow for short courses, continuing education, and full certification programs, in alignment with Jamaica's Technical and vocational education and training standards.
	3. Training of trainers (ToT): Select an initial cohort of instructors from HEART/NSTA Trust for example, and vocational centers to undergo regional-level training provided by BCRC-Caribbean or other specialized partners. The ToT phase will ensure a pool of qualified trainers capable of delivering high-quality instruction in line with international best practices.
Long term (Years 4–5 +)	**4. Program rollout:** Launch the national training program targeting technicians from the automotive, electrical, and RE sectors, offering the courses in multiple tiers, from basic awareness to advanced certification, allowing technicians to progressively build competence. Training will include classroom sessions, hands-on laboratory exercises, and supervised internships at NSWMA facilities or private partners.

Activity 14: Establish compliant interim storage

Objective

The objective of this activity is to designate, upgrade, and operationalize an interim storage facility for EoL EV and RE components in Jamaica. The facility will serve as a secure, centralized point for the temporary accumulation, sorting, and preparation of hazardous components prior to export.

It will comply with Basel Convention safety standards for hazardous waste and align with the national regulatory frameworks overseen by the NEPA and NSWMA. Given Jamaica's existing logistics and port infrastructure, the facility will be strategically located to support both national consolidation and regional export-aggregation efforts envisioned under Activity 15.

Rationale

At present, Jamaica does not have a designated facility for the compliant storage of EoL EV and RE components such as lithium-ion batteries, PV modules, and inverters. Informal and scattered storage practices by workshops, importers, or garages create serious risks of fire, leakage, and occupational exposure, while also limiting traceability. Establishing a Basel-aligned interim storage facility will ensure that hazardous materials are properly contained and inventoried, thereby enabling safe logistics, legal compliance, and efficient transboundary shipment.

Given Jamaica's geographical advantage and mature logistics network, the country is well-positioned to host such a facility with potential dual function: to serve its national market and to act as a regional consolidation point for smaller neighboring islands that lack compliant infrastructure. This approach will strengthen Jamaica's national waste-management system, reduce export costs through economies of scale, and enhance regional cooperation in hazardous-waste management.

Table 59. Saint Lucia's activity 14 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**1. Site selection:** Identify potential sites for the interim storage facility based on accessibility, security, environmental sensitivity, and distance from residential zones, prioritizing government-owned land or existing waste-management sites to reduce acquisition costs. A preliminary environmental assessment will screen each option for flood risk, drainage, and proximity to transport routes and ports.
Medium term (Years 2–3)	**2. Technical specifications:** Develop the facility design incorporating BAT/BEP and Basel-aligned safety features such as impermeable flooring, containment bunds, ventilation, temperature control, and fire-suppression systems. Separate storage zones will be designated for different waste categories (e.g., lithium-ion, lead-acid, PV modules), with clear segregation to prevent cross-contamination.
	3. Environmental Impact Assessment (EIA): Obtain all necessary environmental permits and planning approvals. To this aim, an EIA must be conducted in accordance with Jamaica's environmental legislation.

Timeline	Milestones / Key Actions
	4. Construction or retrofitting: Depending on the selected option, either a new storage building will be constructed or an existing warehouse will be retrofitted to meet required safety standards. Works will include flooring reinforcement, installation of drainage and ventilation systems, electrical grounding, and the placement of fireproof containers and spill-containment pallets.
Long term (Years 4–5 +)	**5. Operationalization:** License the facility officially and incorporate it into the national waste-management registry. The facility will be integrated

Activity 15: Participate in a regional export aggregation hub

Objective

The objective of this activity is to integrate Jamaica into a regional "hub-and-spoke" system for the aggregation, shipment, and export of EoL EV and RE components in compliance with the Basel Convention. Under this system, Jamaica could act as a regional hub, consolidating hazardous waste such as lithium-ion batteries and PV modules from surrounding SIDS before export to licensed treatment and recycling facilities abroad.

The activity will operationalize Jamaica's role as a regional leader in transboundary waste management, capitalizing on its advanced port infrastructure, efficient customs processes, and established track record in hazardous-waste exports. *It will also support smaller Caribbean states in achieving economies of scale, lowering export costs, and improving compliance with Basel procedures.*

Rationale

Due to their limited waste volumes and high transport costs, most Caribbean SIDS cannot feasibly export hazardous EV and RE waste independently. A regional aggregation mechanism allows multiple countries to pool consignments, reduce per-ton shipping costs, and share administrative processes under a unified Basel Article 11 agreement.

Jamaica is uniquely positioned to assume this regional role. It possesses a strategic geographic location along major shipping routes, modernized port and logistics facilities, and an established legal and administrative framework for the transboundary movement of hazardous waste. The country has already demonstrated its capacity through regular exports of hazardous waste under Basel permits, proving its operational reliability and compliance.

By participating as a regional export hub, Jamaica can help surrounding SIDS improve their transfrontier shipment conditions, ensure legal compliance, and negotiate better contracts with international recyclers. This initiative not only advances regional circular-economy goals but also strengthens Jamaica's position as a logistics and environmental governance leader in the Caribbean.

Table 60. Jamaica's activity 15 milestones

Timeline	Milestones / Key Actions
Short term (Year 1)	**0. Enabling conditions:** Activities 10 and 14
Medium term (Years 2–3)	**1. Pilot:** Organize a joint pilot export operation with a "spoke" to test end-to-end procedures, including packaging, labeling, transboundary movement documentation, customs clearance, and final disposal or recycling confirmation. BCRC-Caribbean will provide technical oversight to ensure compliance with Basel notification and consent protocols. Following the shipment, an evaluation report will capture lessons learned, cost implications, and recommended process improvements.
Long term (Years 4–5 +)	**2. Operationalization:** Once the pilot is deemed successful, and Activities 10 and 14 are operationalized, Jamaica will institutionalize the regional export process as part of the national take-back system. SOPs developed in Activity 8 will be updated to guide exporters and Customs officials on documentation flow, inspection routines, and emergency response during loading and transit. A regular shipping calendar will be established to coordinate imports with participating islands, maximizing container utilization and minimizing costs.

7.4. Regional approach

Given the absence of local recycling capacity for the targeted components in OECS/CARICOM countries, it is recommended to develop coordinated regional export programs that consolidate EoL materials for bulk shipment. This recommendation addresses the core economic barrier of the low waste volumes generated at individual national level, which makes separate exports logistically inefficient.

Aggregating waste streams across multiple OECS/CARICOM states will enable countries to reach viable shipment volume, reducing the per-ton export cost. Consolidated shipments also improve regulatory compliance by ensuring that exports are prepared, documented, and transported in line with Basel Convention obligations for hazardous waste. Harmonizing packaging, labeling, and transport permits across the region is essential to facilitate the export process and reduce administrative processes.

For high-voltage electronic subsystems, specifically, regional aggregation allows the export of safely disassembled inverters, DC converters, and onboard chargers to specialized e-waste recycling facilities abroad, where precious and rare metals (e.g., gold, palladium, copper), as well as for battery recycling which requires access to highly specialized recycling facilities to be properly recovered, as illustrated in the following figure:

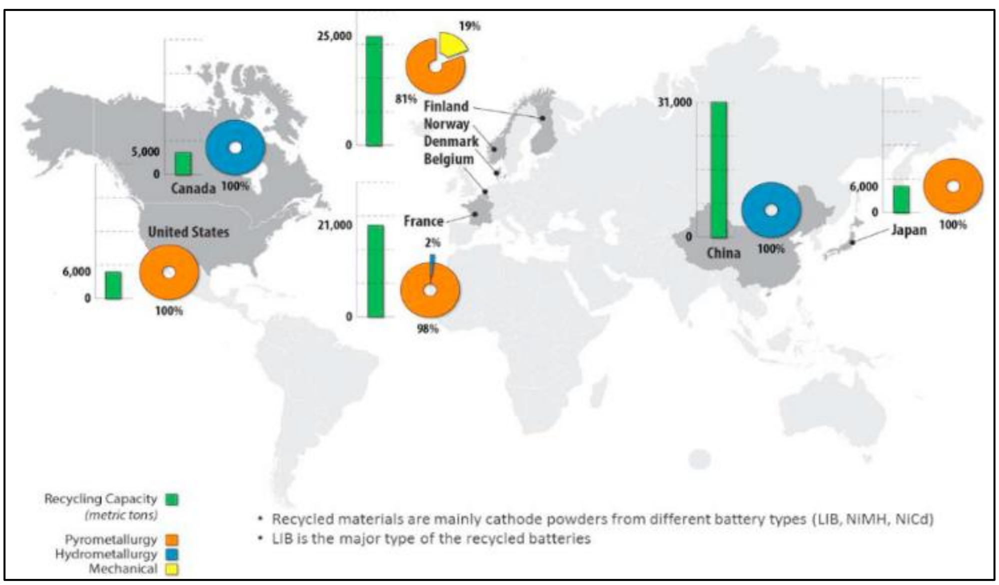


Figure 8. Worldwide recycling capacities of the spent batteries in metric tons. Source: (Steward, Mayyas, & Mann, 2019)

Similarly, EoL solar panels, whose recyclability is not financially attractive, benefit from bulk export arrangements that lower logistics costs and facilitate access to proper recyclers.

These partnerships can also support knowledge exchange and open channels for future circular economic initiatives. Moreover, increasing dialogue between national Basel Convention focal points in the Caribbean region can improve regulatory alignment, facilitating transboundary movement procedures, and supporting the development of a regional compliance framework.

This regional strategy is especially crucial for SIDS with limited infrastructure and economies of scale. It enables cost-effective and compliant export of hazardous and valuable waste components, making it a foundational pillar of BAT/BEP implementation in the Caribbean context.

Following this approach, a regional export scheme for managing hazardous waste in SIDS has been suggested in the Pacific, as illustrated in Figure 8. The scheme suggests identifying subregions serving as collection points to subsequently send the collected waste to nearby countries with processing facilities by utilizing a reverse logistics approach.

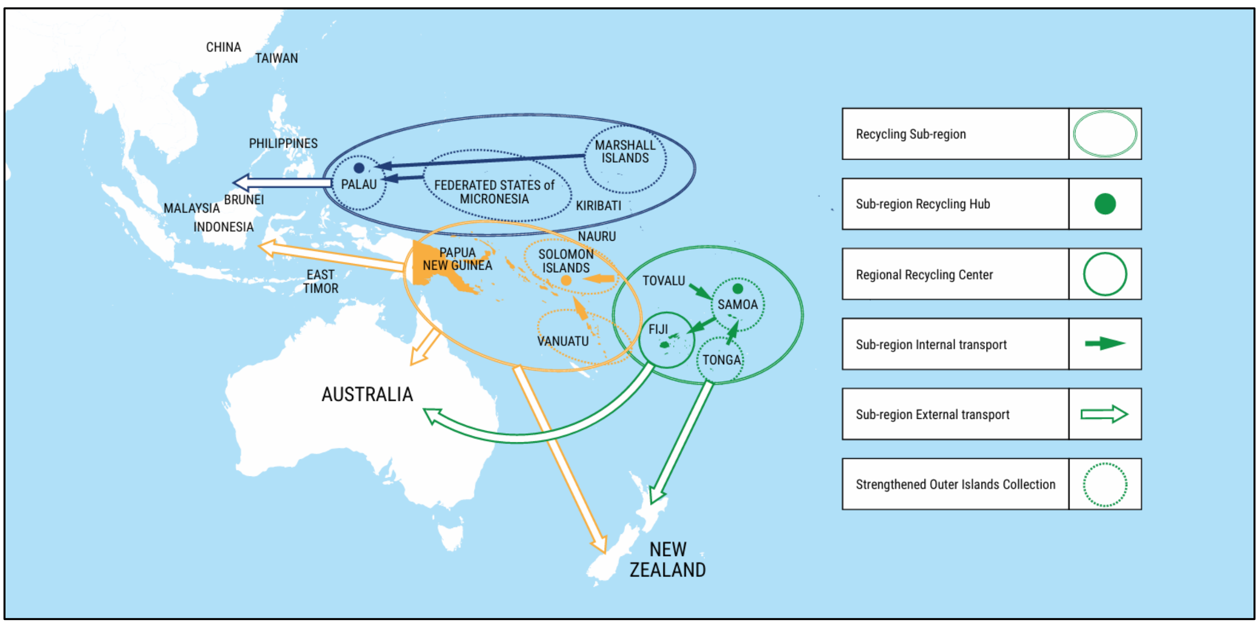


Figure 9. Example of "Hub and Spoke" regional cooperation model. Source: (UNEP, 2019)

Additionally, partnerships with freight carriage companies can be considered, such as for example the Moana Taka Partnership (MTP), established between Swire Shipping and the Secretariat of the Pacific Regional Environment Programme (SPREP). Moana Taka provides free shipping on mainline Swire routes from Pacific countries to recycling markets in the Pacific Rim. However, the demand for shipping from Pacific countries to recycling markets exceeds the scope of Swire's shipping routes. Swire Shipping provides both the containers and ocean freight carriage on a pro bono basis, as well as dedicated resources to support programme coordination and work on scaling up the programme across the Pacific region (GEF, 2025).

This regional approach has also been considered by the OECS, considering the fragmented geography of the region. The Recycle OECS Project has proposed a “twinning” arrangement, for example between Grenada and Dominica, aiming to meet minimum volume thresholds for export. Also, OECS introduced the concept of “regional massification” as a potential solution to overcome the high costs associated with shipping waste (OECS, 2024), increasing the negotiation power of the region with recyclers.

Going further, within the African and Indian Ocean Islands Circular Economy Action Plan, it has been proposed to harmonize the EPR schemes of the countries in the Region, aiming to establish a regional EPR working committee and roadmap, initially for tire and packaging waste, an approach that may be useful also for the Caribbean region (Mohabeer, 2025).

8. Conclusion

The project confirms that Grenada, Saint Lucia, and Jamaica have made significant progress in transitioning towards electric mobility and renewable energy but remain at an early stage in developing systems to manage the resulting end-of-life components. The absence of dedicated legislation limited technical capacity, and the lack of domestic reusing, repurposing, and recycling infrastructure are common constraints that expose these countries to safety, environmental, and compliance risks. The three nations are different in terms of institutional readiness and the size of their markets. However, they all aim to adopt ESM practices that align with the Basel Convention and the broader goals of the circular economy.

The findings show that managing the EoL EV and RE components in a sustainable way will depend on strengthening the regulatory framework, getting institutions to work together, and creating regional solutions to deal with economies of scale. Priorities for Grenada lie on improving its current technical skills, whereas Saint Lucia would prefer to focus on setting up an EPR mechanism to ensure financial sustainability. Contrasting, Jamaica is in a good position to serve as a regional hub for aggregation and export of hazardous components. Together, these complementary roles form a foundation for regional cooperation in hazardous-waste management within the CARICOM and OECS frameworks.

In line with the objectives of the report, the project concludes that the most immediate and feasible actions are to: improve the regulatory framework, operationalize national take-back schemes linked to upgraded existing facilities to Basel-compliant standards, and initiate Article 11 cooperation agreements among Caribbean Basel Focal Points to enable shared export arrangements. These steps will create the minimum conditions for transparency, safety, and compliance while preparing the ground for future investments in pre-treatment or repurposing infrastructure. Over the medium term, implementing training and certification programmes for technicians and introducing EPR-based financing mechanisms will ensure long-term sustainability.

The project's broader implication is that SIDS can achieve circularity in the clean-energy transition if they act collectively, considering their size limitations and the need to achieve economies of scale. With targeted capacity building, regional cooperation, and sustained political commitment, Grenada, Saint Lucia, and Jamaica can establish themselves as leaders in safe, transparent, and economically viable end-of-life management of EV and RE components, setting an example for other Caribbean nations pursuing similar transitions.

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