State:	State of Hawai‘i	**Solid Waste Issue:**	Lithium-ion Batteries Rechargeable Lithium-Ion batteries including consumer, automotive and home power storage uses.
Population (2020 Census):	1.43 million		
Last Update to ISWMP:	2000; No information found specific to lithium-ion (Li-ion) batteries. Battery Topics (for lead-acid): State Regulations, Battery Recyclers, Diversion Quantities[1]		
Waste Characterization Data:	There is no waste characterization data specific to Li-ion batteries for the State.		

Overview:

Consumer, Automotive, and Home Power Storage Li-Ion Batteries

Li-ion batteries are used in many products including household items, vehicles, and energy storage systems. Li-ion batteries contain metals such as aluminum, copper, cobalt, iron, and lithium that can be recovered during the recycling process. It is estimated that approximately 95 percent of Li-ion battery components can be recycled into new batteries.[2] Despite the fact that Li-ion batteries are highly recyclable, it is estimated that only about five percent of Li-ion batteries are recycled in the United States.[3] Furthermore, most battery recyclers in the State of Hawai‘i do not accept Li-ion batteries. There are some challenges to be considered in the Li-ion battery recycling industry. For example, various cell chemistries require different recycling processes, and the chemistry of Li-ion batteries is expected to continue to evolve, further complicating the recycling process. The lack of standardization across manufacturers and the lack of companies/organizations addressing Li-ion battery recycling presents additional challenges. There are also safety hazards to be considered during the disassembly process. Overall, the Li-ion battery recycling industry is not yet sufficiently mature.

Li-ion batteries can be found in most electronic devices such as smartphones, tablets, and laptops. Although the average lifecycle of light-duty Li-ion batteries is close to 15 years[4], these products often end up in the residential recycling and waste stream, which are known to cause fires in waste collection vehicles and material recovery facilities.

Additional information on how counties in Hawai‘i manage Li-ion batteries, any existing waste characterization data, and relevant articles regarding Li-ion battery management issues are provided in the County-specific fact sheets.

Legislative Actions and Hawai‘i Revised Statutes (HRS):

Li-ion batteries are subject to state regulations as further described below (HAR 11-273.1). The following summarizes current or recently proposed State law or legislation related to batteries that may apply to Li-ion batteries.

Act 92 (2021) – Report on Recommendations on Waste Management of Clean Energy Products in Hawai‘i

In 2021, the Hawai‘i State Legislature passed Act 92 requiring the Hawai‘i Natural Energy Institute (HNEI) to conduct a study to determine the best practices for the collection, disposal, and recycling of clean energy materials in Hawai‘i, including PV panels and Li-ion batteries. The project began in September 2021 and the report findings were subsequently published in December 2022.

	Report: **Recommendations on Waste Management of Clean Energy Products in Hawai'i[5]-** • Ensure and enforce waste generator responsibility; • Pursue and manage EPR where possible; • Implement an Advanced Disposal Fee program; • Continue tracking composition of clean energy materials and updating predicted disposal loading rates; • Develop an environmental waste management strategy for clean energy waste streams; • Organize education and training of relevant staff as to best practices, responsibilities, and laws for management of clean energy waste streams; • Assist recyclers; • Identify and track EPR opportunities and mainland recyclers; • Identify funding for the disposal and recycling of clean energy materials; and • Consider state-wide agreements with off-island recyclers that support long-term and cost-effective access. **HB 1576 – Relating to Solid Waste** In 2019 House Bill 1576 was a bill that would have required retailers of certain batteries to implement a program in which the retailer accepts used batteries for reuse, recycling, or other means of disposal. It would have also required the Department of Health to expand its recycling operations to accommodate batteries recycling. However, the bill was deferred.[6] **HRS Chapter 342J Hazardous Waste** Regulates the generation, transportation, treatment, storage and disposal of hazardous waste, including facilities that collect Li-ion batteries for disposal or recycling. It should be noted that all hazardous waste generated in a household is considered Household Hazardous Waste (HHW) and is exempt from hazardous waste regulation.
Hawai'i Administrative Rules (HAR):	**Chapter 11-273.1** Describes the requirements for the identification, handling, transportation, and disposal of hazardous wastes, including Li-ion batteries. Under **HAR 11-273.1**, electronic waste (including Li-ion batteries) can be managed as a Universal Waste which streamlines regulation to encourage recycling.[7]
United States Environmental Protection Agency (USEPA):	**Federal Resource Conservation and Recovery Act (RCRA)** Under the RCRA administered by the USEPA, individuals that generate solid wastes must determine if it is hazardous waste. RCRA hazardous waste provisions (40 CFR Part 273) allow for Li-ion batteries to be managed as universal waste. These provisions are intended to promote safe management of specific hazardous wastes using simplified management standards, while still ensuring the safe disposal or recycling of hazardous waste. The Department of Health's Hazardous Waste Program has adopted administrative rules in accordance with USEPA's requirements and is authorized to implement the hazardous waste program in lieu of USEPA. In May 2023, the US EPA released a guidance memorandum to address the hazardous waste status of Li-ion batteries. In the memorandum, the US EPA "recommends that all lithium batteries be managed" as universal waste.[8]

Estimated Annual Generation and Diversion:

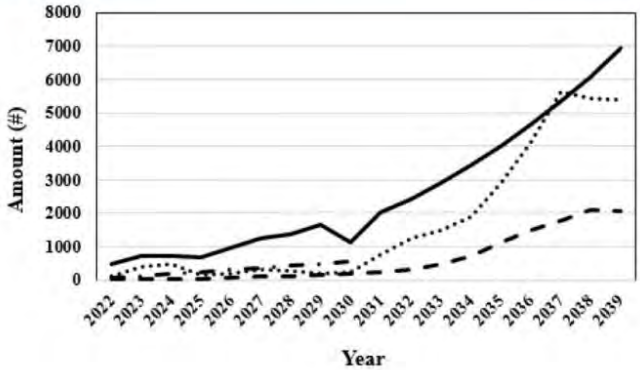
Consumer Products

Li-ion batteries are commonly found in items such as cellphones, laptops, tablets, power tools, digital cameras, children’s toys, e-cigarrettes, watches, remote controls, and small and large appliances. Data could not be found to estimate annual generation or diversion of these products in the State of Hawai‘i.

Electric Vehicle Li-ion Batteries

Most electric vehicles today are equipped with Li-ion batteries due to their high energy density. As of January 2023, there is an estimated total of 22,806 registered electric passenger vehicles and 68 registered electric freight vehicles in the State of Hawai‘i[9]. It is expected that the number of electric vehicles will continue to grow, and as a result, so will the number of Li-ion batteries to be managed in the future. As presented in the graph below, the yearly disposal rate for EV Li-ion batteries in 2022 was approximately 650 EV Li-ion batteries between the four counties and is expected to reach over 14,000 EV Li-ion batteries by 2039.

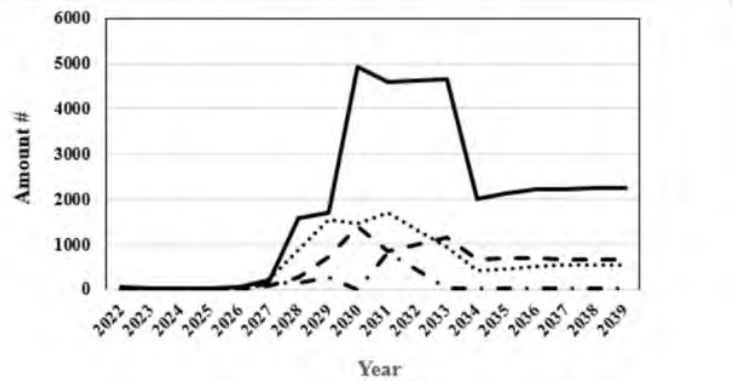
Figure 43. Estimated quantity and timing of EV LIB disposal for O‘ahu (straight line), Hawai‘i County (dotted line), Maui County (dashed line), and Kaua‘i (dashed-dotted line).



Home Power Storage (Grid-Connected) Systems

Li-ion batteries are the dominant technology for application to power storage systems. According to Hawaiian Electric, who provides electricity to approximately 95 percent of residents in the State of Hawai‘i, there are approximately 96,920 PV systems installed as of 2022 between the residential and commercial sector.[10] These figures exclude statistics for Kaua‘i County, who is serviced by Kaua‘i Island Utility Cooperative. Between 92 to 96 percent of these PV systems are residential. Using an average rate of 94 percent, it was estimated that the total number of PV systems installed within the residential sector is approximately 91,105. The Hawai‘i Natural Energy Institute reports an estimated total of 15,320 home Li-ion battery storage systems as of 2021 (excluding Kaua‘i).[11] The figure below presents the estimated disposal rate for grid-connected Li-ion batteries from 2022 – 2039.

Figure 44. Estimated quantity and timing of grid-connected LIB disposal across all scale for O‘ahu (straight line), Hawai‘i County (dotted line), Maui County (dashed line), and Kaua‘i (dashed-dotted line).



Diversion: According to the 2000 ISWMP, 1,932 tons of batteries were collected for recycling in FY 1997/1998. There is no waste diversion data specific to Li-ion batteries in the 2000 ISWMP.

Number of Permitted Collectors and Recyclers/Processors:

There is no existing list of permitted Li-ion battery recyclers listed on the State’s website. Six Li-ion battery recyclers for consumer electronics (Li-ion batteries for vehicles and home power storage not identified as accepted) were identified using external sources[12], including:

- Best Buy (two locations)
- Home Depot (three locations)
- Batteries Plus Bulbs

Material Management Complaints:

None at this time.

Advance Disposal Fee (ADF):

None.

In 2012, the Hawai‘i State Legislature considered a household battery deposit and recycling law. House Bill 2811 would establish a 5-cent fee per battery package paid by distributors for products made or imported into the state. It would also create a 10-cent refundable deposit per battery paid by customers. The bill did not pass.[13]

Solid Waste Stream Issue Statement:

Li-ion batteries from consumer electronics, photovoltaic systems, electric vehicles and hybrid vehicles comprise a small but increasing proportion of the state’s total solid waste stream. Li-ion batteries contain varying chemistries which require different, recycling processes. Furthermore, the chemistry of Li-ion batteries is expected to continue evolving, which could further complicate the recycling process. Li-ion batteries pose potentially adverse public health and environmental impacts if disposed improperly, due to their flammability and toxic chemicals in their composition. Li-on batteries can contain toxic materials such as compounds from lithium, nickel, and arsenic as well as carcinogenic materials from nickel, arsenic, and

	occasionally cobalt, copper, and polypropylene. Improper disposal of Li-ion batteries may lead to these chemicals leaching into the soil to contaminate both surface and groundwater, and negatively impacting human health. They may also combust, causing fires in collection trucks, processing facilities and at the landfill. Presently, the Li-ion battery recycling industry is underdeveloped.
Industry Expert Speaker(s):	Dr. Michael Cooney, University of Hawai'i – Natural Energy Institute **Report to the Hawai'i State Legislature in Accordance with Act 92 (2021)** Recommendations on Waste Management of Clean Energy Products in Hawai'i (Lead Author) Email: mcooney@hawaii.edu Telephone: (808) 956-7337, (808) 956-2336 Michael J. Cooney - Hawai'i Natural Energy Institute (hawaii.edu)

[1] Hawai'i 2000 Plan for Integrated Solid Waste Management (hawaii.gov)
[2] Sustainable Energy: Recycling Renewables (renewablesassociation.ca)
[3] Lithium-Ion Battery Recycling (cas.org)
[4] The lithium-ion battery life cycle report (squarespace.com)
[5] 2023 HNEI Act92 Final Report Clean Energy Products Waste Management (hawaii.edu)
[6] Hawai'i State Legislature (hawaii.gov)
[7] E-waste Guidance Document (hawaii.gov)
[8] Lithium Battery Recycling Regulatory Status and Frequently Asked Questions (epa.gov)
[9] Monthly Energy Trend Highlights – January 2023 Highlights (hawaii.gov)
[10] Hawaiian Electric sees brisk pace of solar installations (hawaiianelectric.com)
[11] 2023 HNEI Act92 Final Report Clean Energy Products Waste Management (hawaii.edu)
[12] Lithium-ion Batteries - Recycling Centers (earth911.com)
[13] Hawaii Considering Battery Recycling and Deposit Law (waste360.com)