MOUNTAIN VIEW SOLAR PROJECT

Decommissioning Analysis

AES Mountain View Solar, LLC

Document No.: 10378206-HOU-R-01
Issue: C**, Status:** FINAL
Date: 14 June 2023

IMPORTANT NOTICE AND DISCLAIMER

1. This document is intended for the sole use of the Customer as detailed on the front page of this document to whom the document is addressed and who has entered into a written agreement with the DNV entity issuing this document ("DNV"). To the extent permitted by law, neither DNV nor any group company (the "Group") assumes any responsibility whether in contract, tort including without limitation negligence, or otherwise howsoever, to third parties (being persons other than the Customer), and no company in the Group other than DNV shall be liable for any loss or damage whatsoever suffered by virtue of any act, omission or default (whether arising by negligence or otherwise) by DNV, the Group or any of its or their servants, subcontractors or agents. This document must be read in its entirety and is subject to any assumptions and qualifications expressed therein as well as in any other relevant communications in connection with it. This document may contain detailed technical data which is intended for use only by persons possessing requisite expertise in its subject matter.

2. This document is protected by copyright and may only be reproduced and circulated in accordance with the Document Classification and associated conditions stipulated or referred to in this document and/or in DNV's written agreement with the Customer. No part of this document may be disclosed in any public offering memorandum, prospectus or stock exchange listing, circular or announcement without the express and prior written consent of DNV. A Document Classification permitting the Customer to redistribute this document shall not thereby imply that DNV has any liability to any recipient other than the Customer.

3. This document has been produced from information relating to dates and periods referred to in this document. This document does not imply that any information is not subject to change. Except and to the extent that checking or verification of information or data is expressly agreed within the written scope of its services, DNV shall not be responsible in any way in connection with erroneous information or data provided to it by the Customer or any third party, or for the effects of any such erroneous information or data whether or not contained or referred to in this document.

4. Any energy forecasts estimates or predictions are subject to factors not all of which are within the scope of the probability and uncertainties contained or referred to in this document and nothing in this document guarantees any particular wind speed or energy output.

KEY TO DOCUMENT CLASSIFICATION

Strictly Confidential	:	For disclosure only to named individuals within the Customer's organization.
Private and Confidential	:	For disclosure only to individuals directly concerned with the subject matter of the document within the Customer's organization.
Commercial in Confidence	:	Not to be disclosed outside the Customer's organization.
DNV only	:	Not to be disclosed to non-DNV staff
Customer's Discretion	:	Distribution for information only at the discretion of the Customer (subject to the above Important Notice and Disclaimer and the terms of DNV's written agreement with the Customer).
Published	:	Available for information only to the general public (subject to the above Important Notice and Disclaimer).

Project:	Mountain View Solar Project	
Report title:	Decommissioning Analysis	
Customer:	AES Mountain View Solar, LLC	
Contact person:	Megan Kane	
Date of issue:	14 June 2023	
Project No.:	10378206	
Document No.:	10378206-HOU-R-01	
Issue/Status	C/FINAL	
Proposal No.:	234981-HOU-P-01-C	

DNV Energy USA Inc.
1501 4th Avenue, Suite 900
Seattle, WA 98101 USA
Tel: +1 206 387 4200
Enterprise No.: 23-2625724

Task and objective:

Solar PV and battery energy storage power project decommissioning analysis.

Prepared by:	Verified by:	Approved by:
Jessica Lee Project Manager	Justin Puggioni Siting and Acoustics Engineer	Reem Bashatly Head of Section, Owner's Engineering
Niki Tsaprazi Project Manager, Owner's Engineering	Daniel Pardo Project Manager, Owner's Engineering	

☐ Strictly Confidential
☐ Private and Confidential
☐ Commercial in Confidence
☐ DNV only
☐ Customer's Discretion
☒ Published

Keywords:
Decommissioning, Solar PV, BESS, Scrap

Issue	Date	Reason for Issue	Prepared by	Verified by	Approved by
A	17 November 2022	First draft	J. Lee	J. Puggioni	R. Bashatly
B	3 February 2023	Inclusion of Customer comments	N. Tsaprazi	D. Pardo	R. Bashatly
B	31 March 2023	Issuing as Final	N. Tsaprazi	D. Pardo	R. Bashatly
C	14 June 2023	Correction of typos	N. Tsaprazi	C. Lintz	D. Pardo

Table of contents

List of figures

List of abbreviations

Abbreviation	Meaning
BESS	Battery Energy Storage System
COD	Commercial operation date
DNV	DNV Energy USA Inc.
HV	High-voltage
PV	Photovoltaic
RCRA	Resource Conservation and Recovery Act
U.S.	United States

EXECUTIVE SUMMARY

At the request of AES Mountain View Solar, LLC (“AES”), DNV Energy USA Inc. (“DNV”) performed a decommissioning analysis for Mountain View solar photovoltaic (PV) power plant and battery energy storage system (BESS) located in Waianae Valley on the Island of Oahu – City and County of Honolulu, Hawai’i. The study presents the steps and process associated with the dismantling, removal, and salvage or disposal of the equipment.

A Project summary for Mountain View PV and BESS power plant (“Project”) are presented in Table ES-1.

Table ES-1 Project main characteristics

Characteristic	Value
Installed capacity (PV)	7 MW ac
Installed capacity (BESS)	35 MWh
Terrain complexity	Simple
# Substations	1
Main power transformer	One (34.5 kV/46 kV)
Length of gen-tie line	0.03 mi

Based on the documentation provided by AES, the solar PV component of the Project has a rated capacity of 7 MW ac and consists of 37,520, monocrystalline cell bifacial 525 Watt modules and, six inverter stations and associated infrastructure. The BESS component of the Project has a capacity of 35 MWh ac-coupled system and consists of 13 module racks of Li-Ion, 40 ISO battery containers. The battery system includes twelve 650 kW containers, 5-hour duration.

Per AES’s request, DNV has assumed that decommissioning of the Project will take place 25 years after the Project’s commercial operation date (COD).

DNV assumes that there are strong parallels between solar project construction and decommissioning, and consequently bases the methodology for decommissioning on its extensive experience with solar project construction. The complete decommissioning process is assumed to be the sequence of disassembly, removal, disposal, and recycling (where applicable) of the PV modules, battery banks, and balance of system. As further explained in Section 5, recycling technologies for PV modules and utility scale batteries remain in early stages. AES is committed to exploring innovative recycling options for main Project components such as PV modules and batteries as well as never disposing of main Project components within the State of Hawai’i.

Assessments of salvage opportunities are based on the bill of quantities identified in this report. The average material weights, masses, and volumes for the pile and racking components are derived from previous DNV studies, AES´s documentation and/or supplier technical specification sheets. Salvaging of Project components in this report refers to delivery of dismantled materials, as described in Section 5, to a third party that participates in scrap markets as a regular business activity.

Although DNV assumes certain commodity prices and disposal service rates based on present day estimates, it does not forecast such future values, as many cost factors could vary in the future, including scrap metal prices, government requirements, transportation costs, labor rates, recycling technologies, and decommissioning market maturity. Decommissioning scenarios from legal, regulatory, or commercial perspectives other than the ones specifically mentioned in this report have not been evaluated by DNV.

Technology for recycling or repowering of PV modules 25 years after the COD is likely to significantly improve compared to today's options. The same is true for recycling of utility scale batteries. Some private companies have already announced technology options around PV module recycling and refurbishment. Recycling of utility scale batteries has also started to be an option. As recycling technology becomes more widely available, the end-of-life destination of PV modules and batteries is likely to improve.

DNV notes that this report is based on broad assumptions toward the approach to decommissioning, and the market conditions at the time of decommissioning, dictating labor costs, scrap value, and resale options. DNV recommends that the decommissioning analysis be reviewed in detail near the end of the expected operating period (e.g., at operating year 23, assuming a 25-year operating life).

1 INTRODUCTION

At the request of AES Mountain View Solar, LLC (“AES”), DNV Energy USA Inc. (“DNV”) performed a decommissioning analysis for Mountain View solar PV power plant and battery energy storage system (BESS), the “Project”, located in Waianae Valley on the Island of Oahu – City and County of Honolulu, Hawai’i. Figure 1-1 below presents the general location of the Project. The study presents the steps and process associated with the dismantling, removal, and salvage or disposal of the equipment.

Based on the documentation provided by AES, the solar PV component of the Project has a rated capacity of 7 MW ac and consists of 37,520, monocrystalline cell bifacial 525 Watt modules and, six inverter stations and associated infrastructure. The BESS component of the Project has a capacity of 35 MWh ac-coupled system and consists of 13 module rack of Li-Ion, 40 ISO battery containers. The battery system includes twelve 650 kW containers, 5-hour duration.

Figure 1-1 Site plan and location

Per AES’s request, DNV has assumed that decommissioning of the Project will take place 25 years after the Project’s COD.

This study assumes that decommissioning includes the removal of all PV modules, racking system, piles, battery banks, substation, underground collection lines, ancillary equipment, and other physical material owned by and pertaining to the Project. Restoration of the Project area, including the Project gravel roads and erosion control infrastructure, has also been considered.

2 STUDY ASSUMPTIONS

DNV's decommissioning study methodology assumes there are strong parallels between a project's construction and decommissioning programs. DNV has used an internal bottom-up decommissioning model it developed from its experience in the solar and battery energy storage industry to formulate these study results.

The study is broken down into three sections: disassembly, removal, and salvage/disposal.

2.1 Regulatory and decommissioning assumptions

The decommissioning study has been prepared in accordance with the regulatory requirements set forth in the Conditional Use Permit (CUP), condition Y [1] issued by the City of Honolulu on 14 June 2022 for the Project, including:

- The Project area must be restored to an equivalent or improved condition, as compared to the existing conditions prior to construction.
- The Project must be decommissioned within 12 months from the end of operations.

Also, the Customer indicated that these conditions are reflected in the land lease agreements, i.e., the Grant of Easement Agreement. More specifically, the Grant of Easement Agreement requires that:

- All Project Improvements must be removed from the lease area, with the exception of any HECO-owned utility interconnection infrastructure.
- Hazardous Materials will be removed from the easement areas and disposed of per Environmental Laws.
- All excavations must be filled.
- A Phase I Environmental Site Assessment will be completed for the Easement Areas

2.1.1 Project restoration and decommissioning assumptions

For this decommissioning study, DNV assumes that the land will be returned to a condition comparable to the environmental condition prevalent prior to construction, as shown in the below photos.

DNV has assumed the decommissioning will include regrading and reseeding of the Project area with native grasses. DNV has assumed a baseline requirement of one reseeding; a secondary reseeding may be required if the initial work proves inadequate in returning the site to approximate pre-existing conditions.

Figure 2-1 Preconstruction Photo 1 with existing road

Figure 2-2 Preconstruction Photo 2

2.1.2 Waste management and assumptions

The City and County of Honolulu has an ordinance for the collection and disposal of refuse [2]; however, this ordinance does not account for the disposal of waste or hazardous waste from utility-scale solar and storage projects. The State of Hawai'i provides guidance for waste disposal from construction and demolition activities [3] in accordance with HAR § 11-262-11. The Guidance advises advance planning for the salvage, reuse or dispose of general waste, and the characterization of hazardous waste. Further, a hazardous waste determination should be made in accordance with HAR § 11-261 for appropriate disposal of material. Hawai'i defers to the U.S. Environmental Protection Agency (EPA) regulations for the disposal of hazardous waste.

The Resource Conservation and Recovery Act (RCRA), which provides the EPA the authority to control hazardous waste including disposal, does not explicitly classify solar PV panels or lithium-ion batteries as hazardous waste. However, as the characteristics of PV modules and lithium-ion batteries could be interpreted as hazardous waste under 40 CFR § 273.2, it is likely that the Project will be required to adhere to the RCRA, or similar legislation, at the facility's end-of life. In the case of this Project, DNV anticipates that these requirements will include record keeping, labelling, and disposal at an approved recycling facility. DNV notes that the Project is also subject to U.S. Department of Transportation regulation 49 CFR 173.185 which deems used or new batteries as "Class 9" miscellaneous hazardous material and includes packaging and labeling requirements to mitigate the risk of accidents. AES confirmed it will follow the applicable regulation at the time of decommissioning for transport of the dismantled batteries.

It should be noted that the Hawai'i Natural Energy Institute (HNEI) was mandated in 2021 by the Hawai'i State Department of Health to conduct a comprehensive study to determine the best practices for disposal and recycling of discarded clean energy products in Hawai'i, including PV panels [4]. DNV therefore recommends that the management of Project waste be revisited prior to decommissioning. For this study, DNV has assumed all Project waste will be transported and disposed of outside of Hawai'i.

2.1.3 Emergency response and communications plan

DNV understands that AES will document an emergency response and communications plan for the Project prior to the Project COD, and that this emergency response plan will be utilized during decommissioning.

2.2 Planning and mobilization

Before executing any decommissioning works, it is necessary to plan the work carefully, secure the appropriate permits and insurance, and manage the program of work and associated health and safety risks to ensure the successful completion of the work. Decommissioning activities not specifically accounted for in the derivations presented later in this study, include environmental studies, permits, environmental protection plans, hazardous material classification and handling, on-site administrative infrastructure and staff, utilities, off-site project management and insurance/legal services.

DNV assumes that contractors will mobilize and will require a temporary laydown yard to house necessary office trailers, staff parking, and facilities during the decommissioning process.

2.3 Schedule

DNV has assumed that the decommissioning program will take approximately 20 to 25 weeks. Additionally, it is assumed that all decommissioning work is performed in generally conducive weather conditions. The PV portion of the Project will dictate the total length of the decommissioning activities because it's more labor and equipment intensive than the BESS portion of it. This study assumes that the dismantling rate of PV modules, racking, and pile removal of approximately 70 fixed tilt arrays per workday and that two to three workdays of mobilization and demobilization are allowed before and after dismantling. While disassembly could, in theory, be done with slightly less care than during assembly (as damage to components are not as much of a concern), safety and resale considerations will likely dictate that disassembly be accomplished in much the same fashion as erection, although in reverse order.

It is also assumed that other works across the site such as concrete foundation removal, underground and overhead collection systems disassembly, substation disassembly and reclaiming of roads, inverter stations, and other excavations will be done simultaneously and/or in concert with the PV module, racking, and pile removal.

3 DISASSEMBLY

The disassembly of the Project pertains to all work just prior to physical transportation of the infrastructure from the Project site. In the case of the PV modules, racking, piles, and battery banks it includes the dismantling and loading of these onto trucks for transport. In the case of concrete foundations or gravel roads, it pertains to the teardown, aggregate stripping, excavation, and backfilling, all reclaiming as necessary and dust palliative measures of removed roads and disturbed project areas.

Although certain activities must be sequenced appropriately, based on DNV's knowledge of solar PV project construction considerations, it is assumed that many activities (e.g., PV modules, collection system, and substation disassembly) may be undertaken in parallel, facilitating an efficient decommissioning process.

DNV has assumed that the scope of the disassembly work includes the labor, machinery, and tools required to perform the tasks described in each of subsections 3.1 to 3.7, as well as the loading of dismantled material onto transport vehicles for removal from the Project site.

3.1 PV modules

Once the site is mobilized, DNV assumes that the decommissioning of PV modules would start immediately and sequentially. These activities entail disconnecting and removing modules and PV harness wiring from the racking system.

DNV has also assumed that all PV modules will remain fully intact for purposes of transport.

PV module disassembly includes labor to remove modules and PV wiring from the support system, equipment and tools needed to support module removal, labor and materials to secure modules for shipping, as well as loading the components onto transport trucks.

3.2 PV support system

DNV has assumed that the decommissioning of the racking system would start two to three weeks after PV module removal has commenced. Disassembly of a PV support system typically entails the removal of all hardware in reverse order as installation.

The scope of the disassembly work includes the labor, machinery, and tools required to perform the tasks and the loading of the dismantled material onto transport vehicles for removal from the site.

DNV has also assumed that the PV support system will be fully disassembled prior to loading onto transport trucks.

PV support system disassembly includes the labor to remove and disassemble the PV support system from its respective pile foundations, equipment and tools needed to disassemble the PV support system, labor, and materials to secure PV support system for shipping as well as loading the components onto transport trucks.

3.3 Pile foundations

DNV has assumed that the full removal of pile foundations will start two to three weeks after the commencement of PV support system disassembly and removal. Based on the data provide by AES, there are a total of 16,117 piles on site.

DNV has assumed that the H-Beam piles installed at Project can be removed by vibrating, or yank and pull methodology.

Each pile foundation should be fully removed from the Project site, and no material shall be left in the subsoils. DNV assumed that each foundation will remain fully intact for ease of loading into trucks.

3.4 Collection system

DNV has assumed the full decommissioning and removal of the collection system. DNV notes that the regulation allows the Project to leave a portion of the underground collection system in the ground below the required grade clearance. That said, due to the relatively high value of conductors, removal and resale of the underground cables may yield a positive return to the Project. More importantly, AES confirmed that all cabling will be removed, and trenches restored.

3.4.1 Cabling

The collection system cabling is composed of dc conductor hung on the messenger system, underground dc cables, buried ac three-phase cables, bare copper grounding cable, and fiber cable. The decommissioning of the underground collection system includes the excavation and reclamation of buried conductors. All conductors and cables will be cut into manageable sections during excavation and removal, and all excavated material will be returned to trenches and covered with topsoil post excavation.

3.4.2 Inverter stations

The Project collection system contains inverter stations that require decommissioning. An inverter station includes a step-up transformer installed on a skid and mounted on a concrete pad.

Once all inverter stations are disconnected from the collection system and decommissioned, a crane is required to assist with the transport loading onto trailer trucks before being removed from the Project site. After the inverter stations have been removed from the concrete pads, excavation and reclamation can begin. DNV has assumed that the inverter stations will be decommissioned at an appropriate time during the decommissioning activities so as not to interfere with other ongoing work.

3.5 High-voltage substation and gen-tie power line

The Project includes a high-voltage (HV) substation which includes typical equipment seen in North American solar PV power project substations for projects of this size, including grounding transformers, bus bars, relay switches, circuit breakers, air disconnect switches, capacitor banks, reactor banks, dead-end structures, and a control building. The Project includes a 0.03 mi (176 ft) overhead 46 kV gen-tie line.

The scope of the disassembly work includes the labor and machinery required to perform the disassembly tasks, including disconnection work at the terminals, including a crane, and the loading of the dismantled material onto transport vehicles for removal from the site.

3.6 Civil work and others

3.6.1 Roads and temporary laydown area

In practice, it is likely that some of the roads will be kept when the Project reaches its operational end of life. For purposes of this study, DNV has assumed that only the new gravel roads and erosion control infrastructure will be removed and remediated. Decommissioning of the gravel roads will typically include stripping back the surfaces and replacing them with topsoil in keeping with the surrounding environment, as well as applying dust palliative to the soil in the disturbed areas.

3.6.2 Regrading

Regrading tasks include the labor and equipment required to remove any culverts and stormwater management systems, repairing any equipment damage, and filling of pit holes, trenches, or other borings or excavations created during project decommissioning.

3.6.3 Reseeding

DNV has assumed reseeding the Project area with native grasses. Reseeding costs include the material and equipment required to reseed the Project area.

3.6.4 Fencing and access gates

The Project area is surrounded by a fence. DNV has assumed that all mesh, fence post, and access gates will be entirely removed for the Project area. These works typically require an excavator to pull out the post and general labor to remove the mesh. DNV has assumed that the fencing will be decommissioned at an appropriate time during the decommissioning activities so as not to interfere with other ongoing work.

The scope of the disassembly includes the labor, equipment, and haul away of material in dumpster trucks.

3.7 Battery energy storage system

DNV has assumed that the decommissioning of the battery banks would begin parallel with the inverter decommissioning. The Project consists of a battery system with 12 containers of 13 module racks each. The scope of the disassembly work includes the labor, machinery, and tools required to fully disconnect the batteries, dc panels, Power Conversion System (PCS), and PCS skids, as well as the loading of the dismantled material onto transport vehicles for removal from the site. This study accounts for:

- Dismantling and unloading of the battery banks from containers and loading onto trucks for transport
- Dismantling of the skid stations onto trucks for transport
- Dismantling of concrete BESS foundation pads

4 REMOVAL

Removal of the Project in this study refers to transporting the equipment and material from the site to the appropriate landfill, aggregate rework facility, scrap yard, or recycling facility. DNV has assumed that appropriate disposal yards will be located outside of Hawai'i as the final destination for main Project components such as PV modules and batteries. Construction waste such as concrete rubble will be landfilled on the island. Waste and scrap materials will be transported between ports in shipping containers. Various truck sizes are applied in the DNV decommissioning model, depending on which Project component is being calculated. Unloading the transported material once it reaches its destination is also accounted for in the decommissioning process.

4.1 PV modules, PV support system, and pile foundations

DNV has assumed that the scope of the removal of the PV modules, PV support system, and piles includes the labor and vehicles required to transport the dismantled equipment to an appropriate disposal, salvage, or recycling facility. While foundation rubble is expected to be landfilled in Hawai'i, the more complex and valuable material, such as PV modules and metal structures, will be transported off island. For the study, DNV has assumed a similar methodology is being used to remove the material as was used initially to transport to the site during construction.

4.2 Collection system

The total collection system includes cabling, disconnects and flex boxes, and inverter stations. Cabling material will mainly include the wound reels and/or cut cables removed by trucks. The disconnects and flex boxes include the related components to be transported in shipping bins in transport trailers by trucks and shipped off island. Each inverter station shall be either salvaged/dismantled or resold as second-hand equipment at an appropriate salvage facility. The material will mainly include inverters, transformers, and steel skids all to be removed by trucks to be shipped off island from the receiving port to the appropriate facilities.

4.3 High-voltage substation and gen-tie power line

It is assumed that foundation rubble and general waste would be transported to a landfill while grounding transformers, bus bars and other valuable materials would be taken to a scrapyard for salvage.

4.4 Civil work and others

DNV has assumed only gravel roads will be removed and that compacted dirt roads will remain. DNV has assumed that the compact aggregated and paved surfaces resulting from the gravel roads will be transported to a landfill. The mesh, poles and gates metals from the fencing and security system as well as the materials from the weather stations shall be transported to a recycling facility.

4.5 Battery energy storage system

The batteries are anticipated to either be shipped back to the manufacturer facility or AES will self-dispose at an alternative recycling facility. In either case, AES confirmed off island transportation, using industry Best Management Practices for safe transport, to an appropriate facility is planned.

Finally, as mentioned in Section 2.1.2 batteries currently require packaging and labeling characteristics that mitigate the risk of accidents. AES confirmed it will follow the applicable regulation at the time of decommissioning for transport of the dismantled batteries.

5 SALVAGE – DISPOSAL

While it is impossible to predict the exact evolution of an industry 25 years into the future, it is not unreasonable to assume that there may exist by that time consolidated centers that will fully recycle PV modules given that many projects will have been decommissioned or repowered prior to that time. DNV notes that attention is being placed by industry into possible uses or methods for recycling PV modules however these topics remain in early stages. Likewise, there is a lot of industry attention placed into repurposing utility scale batteries to alternative battery-based applications. For instance, these batteries can be given a second life to serve power backup for telecommunication systems or irrigation systems. Regulations, technologies, and best practices for recycling utility scale batteries are rapidly developing. Large-scale recycling of lithium-ion batteries is just becoming available in North America. Some companies that offer recycling services today for utility scale batteries include INMETCO, Li-Cycle, and Retriev Technologies.

The BESS industry is still in early stages; there are few BESS projects have been decommissioned. Decommissioning practices, regulations, and the options available to owners who need to decommission will evolve in the coming years and decades. Thus, whatever planning is made early in a BESS facility's life should be kept updated in order to incorporate new information and take advantage of emerging opportunities. Presently, there is a lack of stable markets and regulatory policy for the collection, transport, and recovery of lithium-ion batteries commonly deployed in BESS. This contrasts with stable markets and regulations applicable to, for example, scrap metals or the lead-acid batteries widely deployed to start vehicles with internal combustion engines.

The RCRA, which provides the EPA the authority to control hazardous waste including disposal, does not explicitly classify solar PV panels or lithium-ion batteries as hazardous waste. However, as the characteristics of lithium-ion batteries could be interpreted as hazardous waste under 40 CFR § 273.2, it is likely that the Project will be required to adhere to the RCRA or similar legislation at the Project's end-of-life.

While it may become easier to recycle PV modules and BESS in the future, DNV performed this study assuming only the application of present day means for PV and BESS recycling.

Following the disassembly and removal of all materials from the Project site, five potential destinations for the remediated material are typically envisaged by DNV when performing decommissioning studies. These scenarios may add extra cost to the decommissioning budget or offer an opportunity to reclaim some value from the project components to offset against the cost of decommissioning.

1. Low-grade material such as aggregate, concrete rubble, wood, non-recyclable materials, and other mixed general waste will in all likelihood be sent to a local landfill.
2. Medium-grade materials such as small- and medium-gauge cabling, small motors, cabinets of mixed electronics, and lighting may be sent to salvage centers to be stripped for parts and sold for re-use or re-processing. This may be done at a nominal, neutral, or negative cost (positive return) to the Project. However, following applicable regulation at the time of decommissioning this material may also be sent to landfill if an appropriate third-party cannot be found.
3. High-grade materials such as large steel components (PV support systems, piles, fencing, gates), large-gauge copper and aluminum cabling from the collection system and gen-tie power line, will be sent to reprocessing centers at a net neutral cost or positive return to the Project. HV substation equipment such as bus work, circuit breakers, and grounding transformers contain a significant amount of conductive material such as copper and aluminum. Dead-end and other steel structures contain a significant amount of steel.
4. Reusable components that are deemed to be undamaged, functional, and have not fulfilled their design life could be sold to a third party for a modest second-hand price. Some electrical infrastructure equipment as well as

recently replaced components could fall into this category. Inverter step-up transformers and the HV substation main power transformer fall in this category.

5. Batteries and PV modules are sent back to the manufacturer or transferred to a recycling third party.

6 CONCLUSIONS AND RECOMMENDATIONS

It is stressed that this report is based on broad assumptions regarding the decommissioning approach, the market conditions at the time of decommissioning, dictating contracting costs, scrap metals markets, and resale options. DNV notes that better visibility on these factors will be possible closer to the end of the operating period (e.g., two to four years prior to the end of operations). The need for decommissioning after 25 years of operation could be reviewed at another point in the future taking into consideration potential extended operational revenue as well as Project operations beyond the originally planned life. Consideration to repowering the Project in the future, which refers to replacing PV modules and batteries with newer ones that incorporate the latest technological advancements, is recommended closer to the end of the originally planned operational period.

7 REFERENCES

[1] City and County of Honolulu, Conditional Use Permit (CUP) Nos. 2022/CUP-21, 22, and 23, Waiver Permit Nos. 2022/W-17, 19, and 20, AES Mountain View Solar, 85-580 Waianae Valley Road – Waianae, Tax Map Keys 9-2-001: 8-5-003: 031 and 032 and 8-5-019: 035, 14 June 2022.

[2] Revised Ordinances of Honolulu, 2021, Chapter 9, Collection and Disposal of Refuse. Online: https://www.honolulu.gov/rep/site/ocs/roh/ROH_Chapter_9_.pdf

[3] State of Hawai'i, Department of Health, Guidance for Construction & Demolition (C&D) Waste Disposal, 2013. Online: https://health.hawaii.gov/shwb/files/2013/10/constdemguid.pdf

[4] Hawai'i Natural Energy Institute Research Highlights, Energy Policy & Analysis, Disposal and Recycling of Clean Energy Products in Hawai'i, November 2021. Online: https://www.hnei.hawaii.edu/wp-content/uploads/Disposal-and-Recycling-of-Clean-Energy-Products-in- Hawai'i.pdf

About DNV

We are the independent expert in assurance and risk management. Driven by our purpose, to safeguard life, property and the environment, we empower our customers and their stakeholders with facts and reliable insights so that critical decisions can be made with confidence. As a trusted voice for many of the world's most successful organizations, we use our knowledge to advance safety and performance, set industry benchmarks, and inspire and invent solutions to tackle global transformations.