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STATE OF HAWAI'I

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CHAIRMAN DESIGNATE
HAWAIIAN HOMES COMMISSION

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DEPUTY TO THE CHAIRMAN

STATE OF HAWAI'I
DEPARTMENT OF HAWAIIAN HOME LANDS

P. O. BOX 1879
HONOLULU, HAWAI'I 96805

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August 28, 2012

Mr. Gary Hooser, Director
Office of Environmental Quality Control
Department of Health, State of Hawai'i
235 S. Beretania Street, Room 702
Honolulu, Hawai'i 96813

Dear Mr. Hooser:

Re: Finding of No Significant Impact (FONSI), Final Environmental Assessment, Kalaeloa Home Lands Solar, TMK: (1) 9-1-13:029, Ewa District, Island of Oahu

The State of Hawaii, Department of Hawaiian Home Lands, Hawaiian Homes Commission has reviewed the comments received during the 30-day public comment period. The Hawaiian Homes Commission has determined that this project will not have significant environmental effects and has issued a FONSI.

Please publish a notice for this project in the next OEQC Environmental Notice publication. Enclosed is a completed OEQC Publication Form, two copies of the FEA-FONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If you have any questions regarding the project, please contact Carolyn Darr, Land Agent at (808) 620-9457 or via email at carolyn.i.darr@hawaii.gov. Or, you may contact David Robichaux of North Shore Consultants at (808) 637-8030 or via email at robichaud001@hawaii.rr.com.

Aloha,

Linda Chinn, Administrator
Land Management Division

Enclosures

c: Jody Allione, Kalaeloa Home Lands Solar, LLC

Project Name: Kalaeloa Home Lands Solar, LLC 4.0 MW Photovoltaic Park, Kalaeloa District, Kapolei, Hawai`i

Publication Form
The Environmental Notice
Office of Environmental Quality Control

Applicable Law:	HRS 343
Type of Document:	Final Environmental Assessment
Island:	Oahu
District:	Kalaeloa
TMK:	(1) 9-1-013:029
Permits Required:	DHHL Lease**,** NPDES Form C, Building/Grading, FAA Obstruction Evaluation, Airport Area Analysis

Applicant Kalaeloa Home Lands Solar, LLC
Jody Allione, Project Development Manager
jodyallione39@gmail.com (808) 347-3174

Approving Agency Department of Hawaiian Home Lands
Linda Chinn, Administrator
PO Box 1879
Honolulu, HI 96805
Linda.Chinn@hawaii.gov (808) 620-9500

Consultant: North Shore Consultants
David M. Robichaux, Principal
PO Box 790
Haleiwa, HI 96712
robichaud001@hawaii.rr.com (808) 368-5352

Project Summary:

The Kalaeloa Home Lands Solar Park will result in 5 MW of renewable poser to be provided to the public utility grid. Temporary noise and dust will be generated during construction; however these are expected to be limited in duration and consistent with the surrounding land use. The PV Park is within the controlled activity area for Runway 11-29. Fences at the end of the airport property now serve as arresting gear for emergency overruns. Upon completion of the proposed action the area will contain truss structures that will serve a similar function. Aircraft operations at the Kalaeloa Airport are not expected to be significantly impacted from glint and glare according to a study commissioned for this project. No secondary or cumulative impacts were identified despite the proposed addition of a second PV Park in the area. Having received comments from agencies, interested parties, and the Hawaiian Homes commission, The Department of Hawaiian Home Lands has reached a finding of no significant impact.

Final Environmental Assessment

Kalaeloa Home Lands Solar, LLC
5.0 MW Photovoltaic Park,
Kalaeloa, Oahu, Hawaii
TMK # 9-1-013:029

Prepared for

State of Hawaii
Department of Hawaiian Home Lands

August 2012

Final Environmental Assessment

Kalaeloa Home Lands Solar, LLC
5.0 MW Photovoltaic Park,
Kalaeloa, Oahu, Hawaii TMK # 9-1-013:029

Approving Agency

State of Hawaii Department of Hawaiian Home Lands
Hale Kalanianaole
91-5420 Kapolei Parkway
Kapolei, Hawaii 96707
Mr. Todd Gray, Project Manager

Proponent

KALAELOA HOME LANDS LLC

Corinne Onetto, Project Director
Jody Allione, Project Development Manager

Prepared by

NORTH SHORE CONSULTANTS, LLC
PO Box 790
Haleiwa, HI 96712
Mr. David Robichaux, Project Manager

PROJECT SUMMARY

This Environmental Assessment (EA) has been prepared in accordance with Chapter 343, Hawai`i Revised Statutes (HRS), for the Kalaeloa Home Lands Solar, LLC 5.0 MW photovoltaic park proposed for the 29 acre parcel designated as TMK # 9-1-013:029 in Kapolei, Island of Oahu, Hawaii.

Name: Kalaeloa Home Lands Solar, LLC 5.0 MW DC Photovoltaic Park

Location: Kalaeloa, Kapolei, Oahu, Hawaii

Judicial District: Kapolei

Applicant: Kalaeloa Home Lands Solar, LLC

Approving Agency: Department of Hawaiian Home Lands

Recorded Fee Owner: State of Hawai`i, Department of Hawaiian Home Lands

Tax Map Key: TMK (1) 9-1-013:029

Land Area: 29 acres

Existing Use: Vacant

Proposed Use: Construction of a photovoltaic park to provide renewable energy to the island's electric grid.

Land Use Designations:
State Land Use: Urban District
General Plan: Military Use
County Zoning: F-1 Military Use
Kalaeloa Master plan Eco-industrial Use
Special Management Area (SMA): Not within the SMA

Major Approvals Required:
Lease agreement with Department of Hawaiian Home Lands
FAA Obstruction analysis/ Airport Area Assessment
NPDES construction Stormwater Permit (NOI and Form C)

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B. Letter from USFWS regarding Threatened and Endangered Species
C. Archaeological Reconnaissance Report: Rechtman Consulting, LLC
D. Reflectivity Study for JRF
E. FAA Determination Regarding Hazards to Aircraft Operations

1.0 PROJECT LOCATION, PURPOSE AND NEED

1.1 Project Location

Kalaeloa Home Lands Solar LLC has leased approximately 29 acres near the southwest corner of the Island of Oahu, City and County of Honolulu, Hawaii (Figure 1-1). The site is immediately west of the John Rogers Field (JRF), which was formerly Barbers Point Naval Air Station before the military installation was closed under the Base Realignment and Closure (BRAC) program in 1999. The parcel, (also called the subject property) is designated Tax Key Map Number 9-1-013:029 and is owned by the Department of Hawaiian Home Lands (DHHL), State of Hawaii. It is located at the west end of Runway 29, the cross-wind runway at JRF.

The subject property is accessed by an extension of Midway Road, within the former Barbers Point Naval Air Station (Figure 1-2). The subject property is shown in Figure 1-3.

The approximate latitude/longitude is:

Latitude (north) 21 ^{o} 18' 46"

Longitude (west) 158° 05' 07"

Figure 1-1: Site location near the southwest corner of Oahu

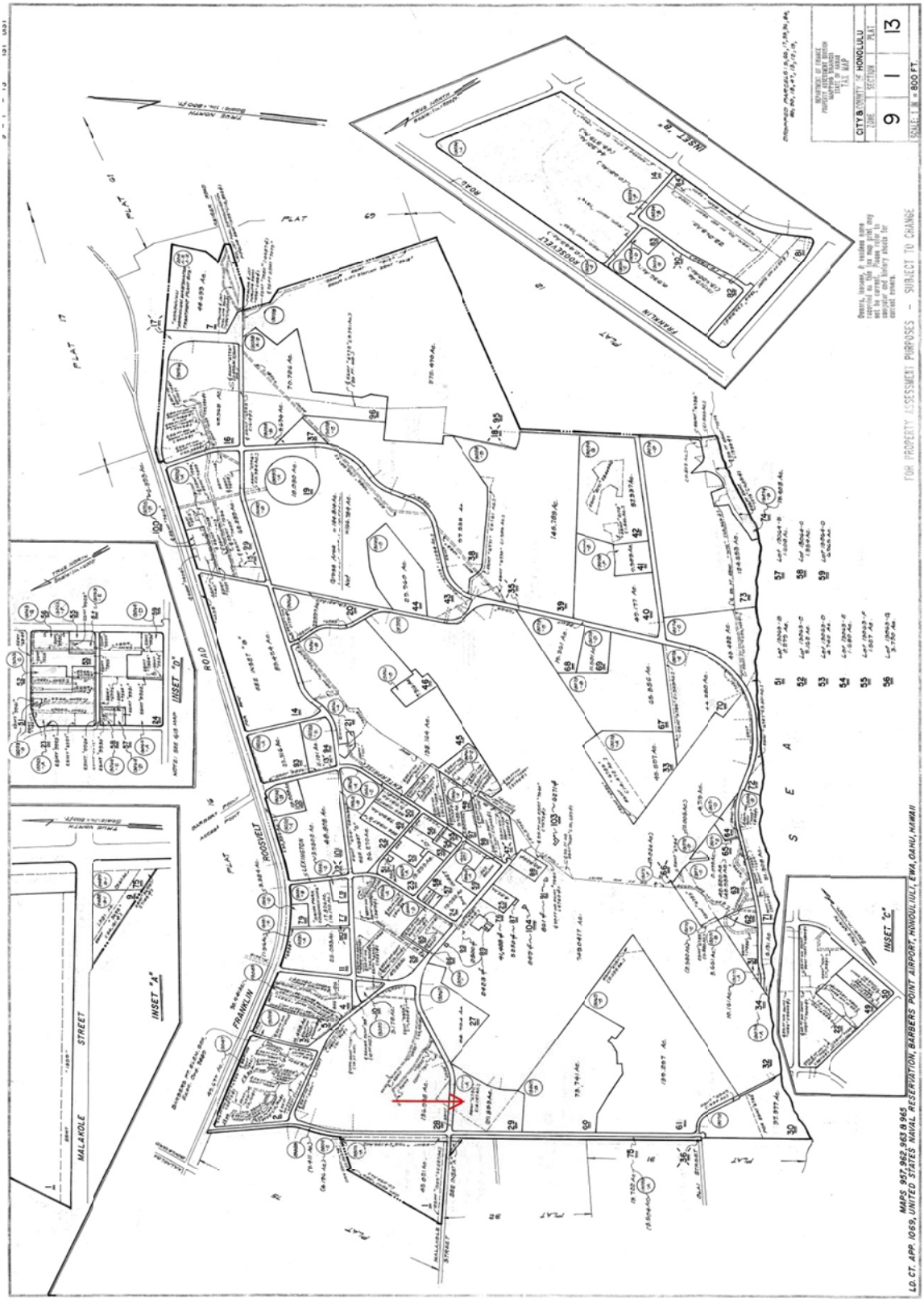
ıe

The purpose of the proposed project is to provide renewable solar electric power to Oahu's electric grid. The proposed action would produce approximately 5.0 MW for sale to Hawaiian Electric Company (HECO). The energy generated would reduce Oahu's dependence on fossil-fuel for power generation by providing electricity to power approximately 1000 homes. This would result in the offset of more than 200,000 tons of emissions over 30 years and eliminate the need of over 16,000 barrels of oil per year. The proposed action would assist the state in reaching the Hawaii Clean Energy Initiative (HCEI) goal of having 70 percent of the State's energy come from renewable sources by 2030.

Reducing the amount of fossil fuels burned for energy generation will improve Hawaii's environment by:

• reducing greenhouse gas emissions;
• reducing dependency on imported fossil fuel and the variations in price and availability associated with geopolitical instabilities; and
• reducing the environmental risks associated with fossil fuel transport and storage.

Figure 1- 3: Tax Map Key Map of the site.



1.2.1 Current Generating Capacity on Oahu

HECO owns and operates 16 power generation units at three stations, Honolulu, Waiau, and Kahe, plus 30 MW of distributed generation. All units are fueled by low-sulfur fuel oil (LSFO), except for two combustion turbines (CT) at Waiau that are fueled by diesel. HECO does not currently operate any renewable energy units. Three large independent power producers (IPPs) furnish firm capacity renewable energy power to the HECO grid. H-POWER provides power for HECO from its 46 MW waste-to-energy facility, and AES-Hawaii (AES) provides power from its 180 MW firm capacity plant using coal and solid waste. Kalaeloa Partners, L.P., the other IPP to HECO, provides electricity from a 208-MW firm capacity facility using fuel oil. In addition to firm capacity IPPs, HECO also purchases electricity from other IPPs on a non-firm, as available basis. Those include energy from Tesoro Hawaii, Chevron, and from a 20 MW wind project located at Kahuku. Table 1 shows Oahu's sources of electricity supplies as of September 2009.

Table 1-1: Sources of Electric Generation on Oahu, 2009

Fuel Type	**MW-Hour Generation/Year**	**Percent**
Diesel or Low Sulfur Fuel Oil	5,949,157	77
Coal	1,448,811	19
Solid Waste	360,323	5
Biofuel	3307	0.04
Wind, Solar, Biomass	0	0
Total	7,761,598	100
Total Renewable	**363,630**	**5**

Source: Department of Business, Economic Development, and Tourism (2010).

Actual generation of energy from renewable and dispatchable sources varies according to availability and need. The most recent data on Oahu's sources of alternative and traditional energy is in HECO's 2009 Renewable Portfolio Standard Report (HECO, 2009). Oahu's Renewable Portfolio Standard (RPS) includes savings from renewable displacement technologies including rooftop PV (15,668 MWh/Yr.) and solar water heating (86,967 MWh/Yr.); The RPS also includes electrical savings from energy efficient technologies such as energy star appliances. Energy efficient technologies contributed 604,348 MWh/Yr. from pre-2009 participants and 46,930 MWh/Yr. from new purchases. The total RPS on Oahu as of 2009 is 15.1% after inclusion of these other energy savings considerations.

Act 95 requires HECO to reach a RPS standard of 15% by 2015. This standard is based on all of the Hawaiian Electric Companies. Due to higher alternative percentages on Maui and The Big Island the overall RPS fraction is 19% as of 2009 (DBEDT, 2010). Data from 2009 is the most recent complete data; however, partial data from March 2011 shows an additional 100 MW from HECO biofuel combustion turbine CT-1 and 30 MW from the Kahuku wind farm (HCEI, 2011). These two

facilities will add roughly 940,000 MWh annually if they are operated continuously. Assuming no other changes, these two facilities increase Oahu's RPS to 28%.

Although both the state and County of Honolulu are in compliance with Act 95 RPS standards, there is considerable room for improvement and we are quite a long way from the Hawaii Clean Energy Initiative goal of 70% by 2030.

2.0 PROPOSED ACTION AND ALTERNATIVES CONSIDERED

2.1 Proposed Action (Project Description)

AES Solar Power, LLC has proposed to build a 5.0 MW solar power photovoltaic system on approximately 29 acres. . The photovoltaic system will be a series of ground supported flat panels with three control/cabinet enclosures and transformers. Solar panels will be mounted on tracking mechanisms which allow the panels to follow the sun in order to maximize power output. All-weather gravel maintenance roads will be constructed around the site perimeter and between rows of solar panels. The site is laid out to maximize the number of installed solar panels (Figure 2-1).
Each panel is approximately 39 inches wide and 66 inches long, dark in color, and stand between 6 and 8 feet above ground level. Approximately 17,000 panels will be required to produce an average of 5.0 MW of peak power. The total annual output from the facility will be approximately 8,400 MWh/Yr. The maximum height varies throughout the day as panels move to maintain the best sun angle. Similar tracker-mounted panels are shown in Figure 2-2 and 2-3.

The facility will be unmanned except for regular maintenance activities such as mowing, landscaping or panel cleaning. Electrical maintenance will be conducted as needed. No employee housing or other habitable structures will be constructed on the site. The installation emits little noise, and no dust, or odors during operation. Electrical power is produced during daylight hours; however, in the traditional sense, the hours of operation cannot be determined without instrumentation.

Alternating Current (AC) electric power will be transmitted to one of the nearby substations located to the north of the site (Figure 2-4). Details on transmission and connectivity are dependent upon completion of HECO's interconnection study; but it is likely that transmission will be by underground conduit to a new substation that will be utilized by other alternative energy providers as well as the proponent.

2.2 Alternative Actions Considered and Rejected

Alternatives to the proposed action that were considered as part of the planning process include alternative locations and alternative technologies.

Fixed tilt PV panels were considered at the same location. The trackers are more efficient and produce more daily output. The capability of altering the angle of the tilt in the few instances of potential glare is an important quality at the proposed location.

Figure 2-1: Site layout: Alternative layouts ranging between 3.5 MW AC and 5.0 MW AC are being considered subject to final selection of the EPC contractor. The base configuration for each option is illustrated below.

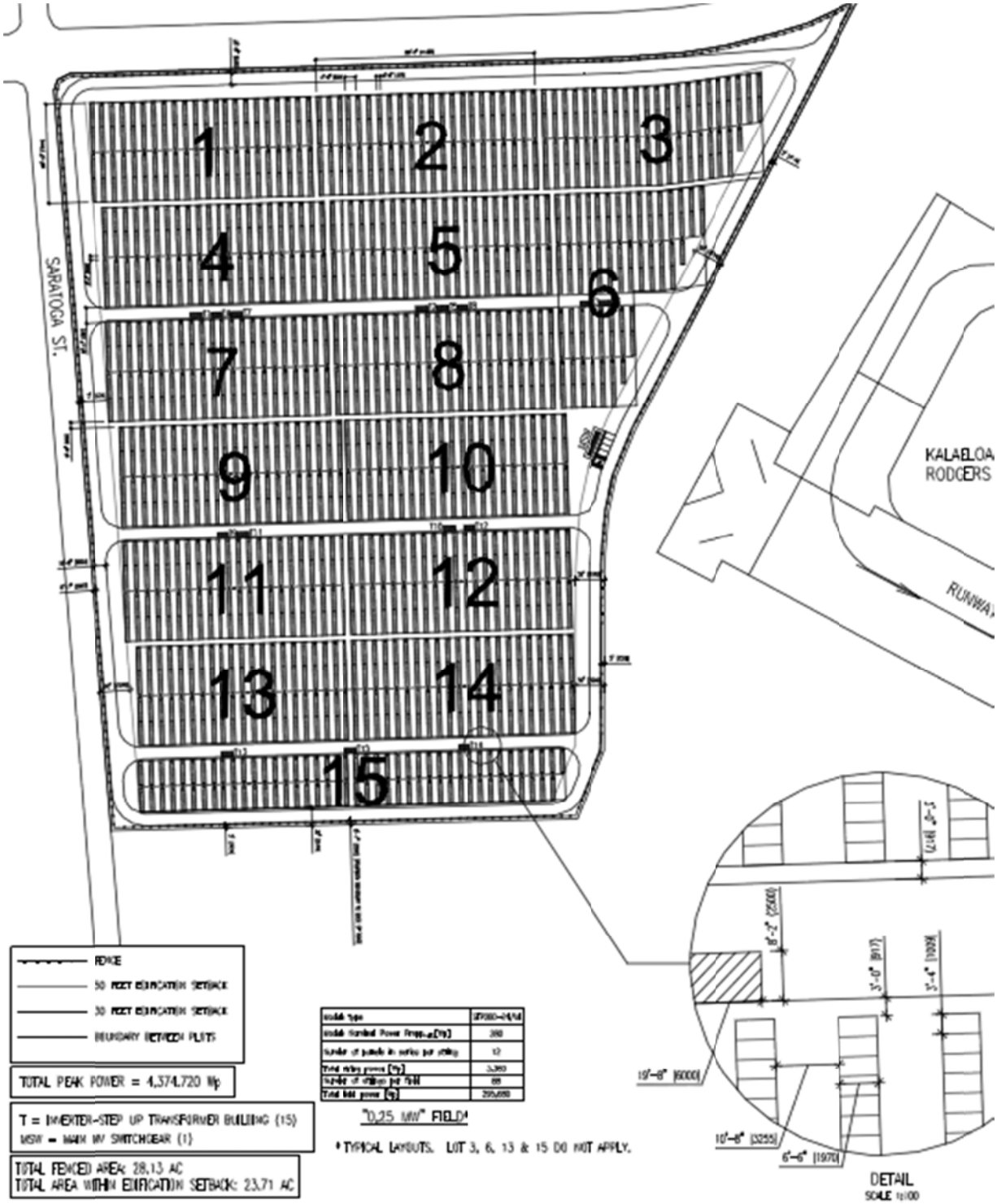
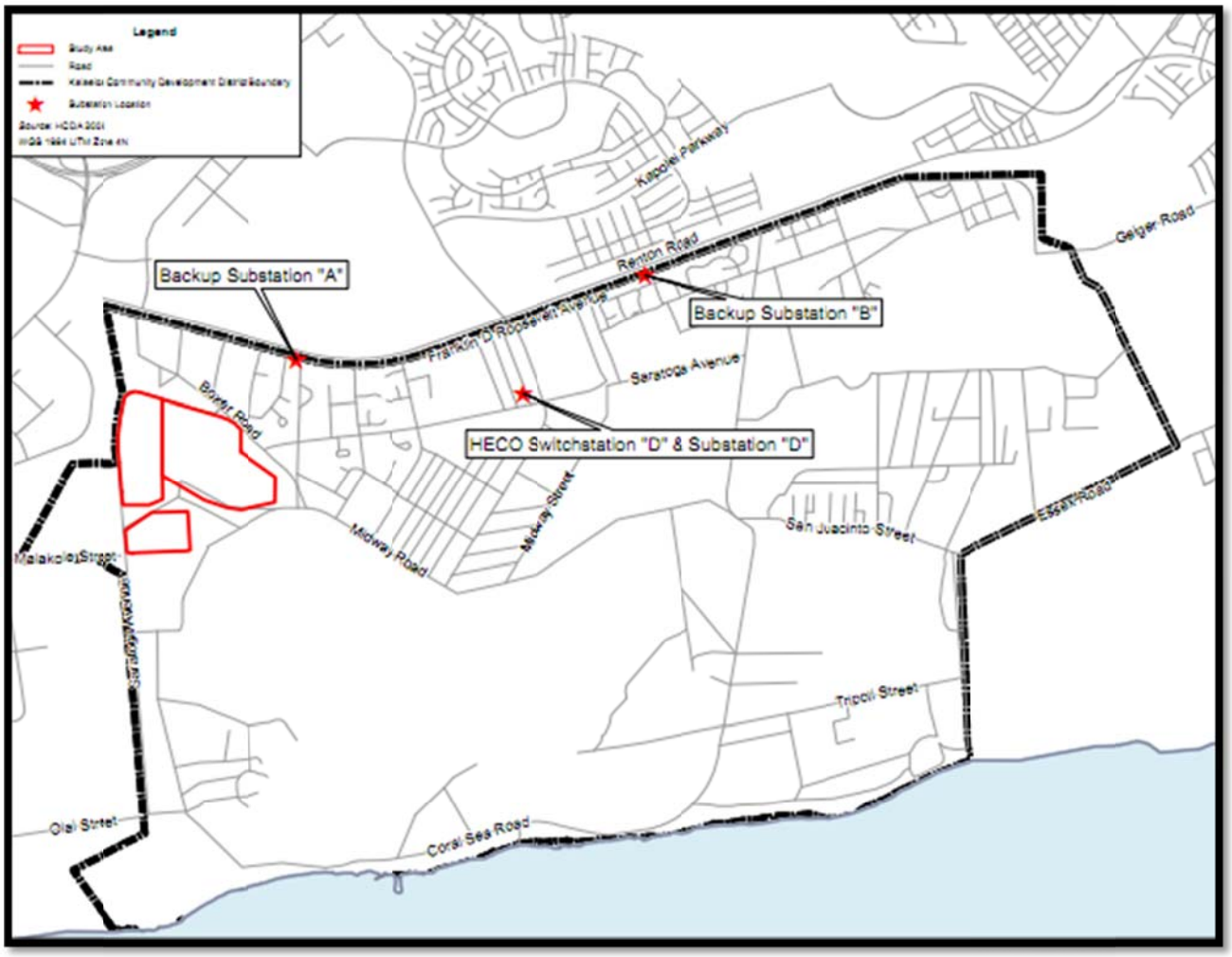


Figure 2-2: Photograph of a PV Park at Denver International Airport

Figure 2-3: An example of Solar Trackers

Figure 2-4: Potential location of Substations



2.2.1 Alternative Locations

Hawaii's energy costs are currently the highest in the United States (HCEI 2010). These rates have made alternative energy production profitable in Hawaii, and profitable enough to attract almost all of the national and international alternative energy providers to come to the State. High islands located in low temperate latitudes create a complex climatic condition that can change within a matter of a few miles. Solar photovoltaic energy production is directly related to the amount of sunlight received over a long term basis. Solar irradiation is variable throughout the annual cycle in almost all locations, and there is quite a wide variation in the amount of solar energy based on the angle of the sun and the amount of cloud cover characteristic to a particular site. Figure 7 shows a map of solar irradiation for the Island of Oahu. As a rule solar providers are restricted to areas with solar irradiation above 400 kW/m^2, and prefer those areas that are within the 450 to 500 watt range (Figure 2-5). Competition for suitable sites between alternative energy providers is brisk.

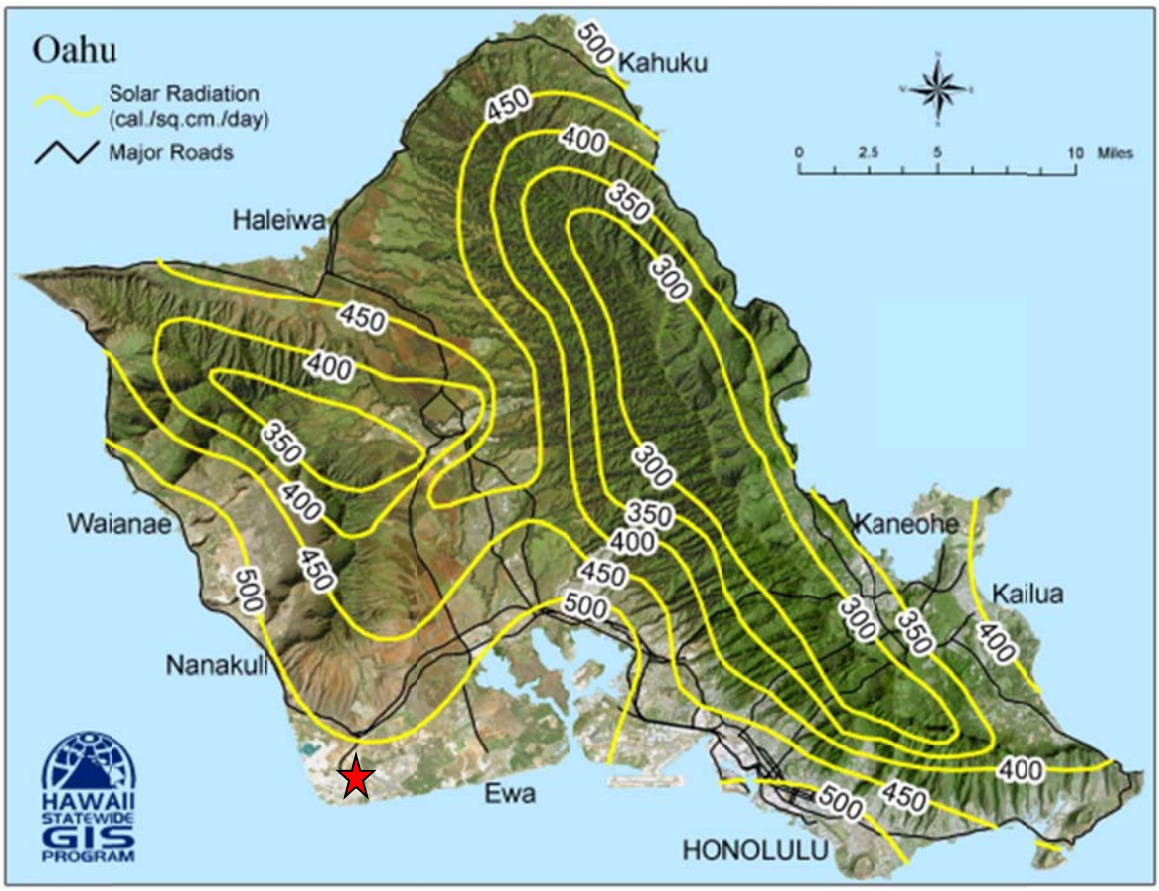


Figure 2-5: Map of solar radiation on the Island of Oahu

Alternative sites considered include The Coral Sea Road Coral Pit located within the retained military area of Kalaeloa. This land is within the 450 Watt/m2 irradiance area and is currently unused. This site was rejected due to the steep sides of the pit, which would block the sun during morning and evening hours, and because it has restricted use due to soil and groundwater contaminants which were discovered upon closure of the Barbers Point Naval Air Station.

The second alternative site considered was immediately adjacent to the north of the subject parcel. TMK # 9-1-013: 028 is also a vacant parcel owned by DHHL and within a favorable solar irradiation area. AES Solar was preempted from further consideration of the site because it was leased to a cooperative consisting of a solar PV and a solar thermal provider. The second alternative site is rejected because it is unavailable.

2.2.2 Alternative Technologies

Choosing which alternative generating technology to use in a specific location is quite difficult using generalizations because not all technologies are appropriate in every location and the cost-benefits analysis suffer from the inability to define the limits of the project impacts. Several comparative measures are useful in assessing the advantages of various technologies. Levelized energy cost (LEC) is a measure often used for financial analysis and project planning. LEC is the price at which electricity must be generated from a specific source to break even. It is an economic assessment of the cost of the energy-generating system including all the costs over its lifetime: initial investment, operations and maintenance, cost of fuel, cost of money, and is very useful in calculating the costs of generation from different sources.

Typically LECs are calculated over different lifetimes depending on the useful life expectancy for a particular technology, and are given in the units of currency per megawatt-hour. For example, Table 2 shows the anticipated cost of electricity during 2016 published from the US Energy Information Administration (US EIA, 2010).

Table 2-1: Levelized cost for various energy generators estimated for plants starting service in 2016. Costs are reported in dollars per Megawatt hour.

Plant Type	**Total System Levelized costs ($/MWh)**
Conventional Coal	94.8
Natural Gas combustion Turbine	124.0
Advanced Nuclear	114
Wind (on-shore)	97
Geothermal	101
Solar PV	211
Solar Thermal	311
Biomass	112
Hydro	86

Source: US Energy Information Administration Annual Report, December 2010.

LEC does not include lifecycle costs for environmental compliance or secondary costs of infrastructure and environmental degradation; nor does it include current tax incentives or subsidies. Per the information above, solar PV is projected to produce power at around 21 cents per Kilowatt-hour (kWh) in 2016. It is worth noting that diesel electric generation is not common enough to be considered in the Energy Information Administration's Annual Report. Current electric rates on Oahu are in the range of 22 - 23 cents per kWh for residential customers. Although solar PV costs twice that of wind and coal, we suspect that the energy resource on Oahu is significantly better than

the irradiance standard used above. It is also notable that between federal and state tax incentives the capital cost of purchase and installation for solar PV is reduced by 40%. Capital costs represent the majority of the LEC for solar PV.

Another popular attribute of a prospective generating system is the greenhouse gas footprint. The lifecycle greenhouse gas emissions include those generated during manufacture, transportation, assembly, operation and decommissioning (Table 2-2).

Table 2-2: Lifecycle greenhouse gas emission estimates for electricity generators

Technology	Description	Estimate (g CO2/kWh)
Wind	2.5 MW offshore	9
Hydroelectric	3.1 MW reservoir	10
Wind	1.5 MW onshore	10
Biogas	anaerobic digestion	11
Hydroelectric	300 kW run-of-river	13
Solar thermal	80 MW parabolic trough	13
Biomass	various	14-35
Solar PV	polycrystalline silicon	32
Geothermal	80 MW hot dry rock	38
Nuclear	various reactor types	66
Natural gas	various combined cycle turbines	443
Diesel	various generator and turbine types	778
Heavy oil	various generator and turbine types	778
Coal	various generator types with scrubbing	960
Coal	various generator types without scrubbing	1050

Source: Sovacool, 2010

Manufacturing apparently pushes solar PV higher than some other alternative technologies; however the anticipated greenhouse gas emissions are 1 order of magnitude less than any of the traditional sources.

2.2.3 No Action Alternative

Under the No-Action Alternative, the PV solar energy farm would not be constructed. 5.0 MW of renewable energy would not be provided to the public. This energy would be generated by the existing portfolio of generating equipment which is 90% fossil fueled. There would be a lost opportunity to assist in meeting the state's current goal of 70 percent renewable energy. The No Action Alternative does not meet the purpose and need it represents existing conditions. Although the no action alternative is rejected, the existing condition is used throughout this document to comparison to impacts resulting from the existing condition.

2.2.4 Selection of Project Alternative

Two alternative locations were reviewed and rejected for reasons discussed above. Alternative technologies were considered; however, the proponent has expertise in the development of photovoltaic installations. Photovoltaic generation will be part of the mix of alternative energies currently being developed to replace imported fossil fuels. This project will not use a significant fraction of the variable wind/solar capacity for stable grid operation. Finally PV is one of the few appropriate land uses for the proposed location near the end of an airport runway. On this basis the proposed alternative is selected and will be discussed further in this document.

3.0 ENVIRONMENTAL SETTING AND IMPACTS

3.1 Physical Environment

3.1.1 Geology and Soils

Soil in the Kalaeloa area is limited to a thin layer of topsoil and is reddish in color (U.S. Department of Agriculture 1972). The site is covered predominantly by soil categorized as Coral outcrop (10%) and Mamala stony silty clay loam (90%) (USDA, 2010). Coral outcrop consists of calcareous sand and coral sand. Mamala stony silty clay loam consists of coral stones in the reddish-brown loam surface, underlain by coral limestone. Run-off is slow, infiltration is rapid, and the erosion rate of Mamala stony silty clay loam is low. Neither of the types of soil found on the proposed site qualifies as Prime Farmland (USDA 2010).

According to "Agricultural Lands of Importance to the State of Hawaii" (ALISH, Hawaii Department of Agriculture, 1977), the project site is not classified as prime or unique agricultural land. The site has not been used for agriculture since before the 1930s and is unsuitable for agriculture due to the paucity of water and undesirable soil conditions. Much of the project site is apparently filled with sand and coral rubble.

3.1.2 Surface Water Quality

The project site is close to one mile north of the nearest surface water at the coastline of southwest Oahu. Coastal waters are classified as Class A Open Coastal Marine waters.

The Hawaii Revised Statutes (HRS 11-54) states:

It is the objective of Class A Marine Waters that their use for recreational purposes and esthetic enjoyment be protected. Any other use shall be permitted so long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters.

These waters shall not act as receiving waters for any discharge that has not received the best degree of treatment and control compatible with the criteria established for this class.

A normally dry drainage canal forms the western border of the property and connects to the ocean near the southwest corner of Oahu. The canal floods on spring tides and during rare heavy rains. This portion of the Island receives an average of 20 inches of rain per year (Atlas of Hawaii 1992). Soils are relatively porous and surface water runoff conditions are limited to heavy rain events. The site is located in FEMA flood zone D and is outside the 100-year floodplain. It is also outside the Oahu Civil Defense Tsunami inundation zone.

3.1.3 Groundwater Resources

The groundwater at the site is within the Ewa aquifer system of the Pearl Harbor Aquifer sector. There is a deeper confined aquifer in a deep layer of basalt and a shallow unconfined aquifer in the overlying caprock. The groundwater in the confined aquifer is brackish with a chloride content ranging from 250 to 1,000 milligrams per liter. In the Kalaeloa area, the underlying aquifer meets Federal but not State of Hawaii drinking water standards, thus it is not used for potable water. The shallow aquifer in the Kalaeloa area is also brackish with chloride content ranging from 1,000 to 5,000 milligrams per liter. The water is not suitable for consumption or irrigation without desalination (TEC Inc. 2010a and b). Groundwater depth at the project site is undetermined, but assumed to be near mean sea level. The elevation beneath ground surface may vary with tidal conditions. Groundwater flow is generally assumed to be from north to south toward the ocean beneath the site.

The boundary between non-drinking water aquifers and underground sources of drinking water is generally referred to as the "UIC Line". Restrictions on injection wells differ, depending on whether the area is inland (*mauka*) or seaward (*makai*) of the UIC line. The subject property is seaward of the UIC line. UIC maps are available on the DOH website at:
(http://hawaii.gov/health/environmental/environmental/water/sdwb/uic/pdf/oahuic.pdf).

3.1.4 Climate and Air Quality

The project site has a mild, semi-tropical climate of characteristic of most leeward regions of Oahu. The average maximum daily temperature ranges from 78 °F to 87 °F, with an average minimum temperature ranging from 60 °F to 68 °F (Atlas of Hawaii 1992). Rainfall for this area is averages 20 inches annually, with most of it occurring between November and April. Winds from the northeast, known as trade winds, are the most predominant over the Hawaiian Islands. Typical wind velocities range from 3 to 14 knots. There is an occasional shift in the wind patterns to the westerly “Kona” winds which are sometimes quite strong.

In Hawaii, both federal and state environmental health standards pertaining to outdoor air quality are generally met due to prevalent trade winds. The adjacent Campbell Industrial Park is likely the largest source of stationary air emissions on the Island of Oahu, yet due to the consistent winds, the regulated air pollutants in the area are within the air quality limits established by the Clean Air Act. Air quality monitoring stations operated by the Hawaii Department of Health are located in Kapolei, and Campbell Industrial Park.

There are no significant stationary air emissions sources associated with the proposed project. During construction there may be temporary contributions to air pollution from fugitive dust and automobile emissions. Automobile and fuel power construction equipment will be limited to that necessary to build the project, and fugitive dust will be managed under best management practices as defined by the State of Hawaii.

3.1.5 Noise and Odor

Existing sources of noise near the project site include the Kalaeloa Airport, Tesoro Refinery, and various construction equipment baseyards. Noise associated with vehicular traffic is minimal.

Odors within the project area are minimal. Northeasterly tradewinds normally blow emissions from nearby refineries and power generators out to sea. Transient fuel and exhaust odors may be present from aircraft operations and refueling; however, the site is not expected to have background odors associated with adjacent land uses.

The proposed project will not generate noise or odors during operations. Construction equipment and vehicular traffic may contribute relatively small amounts of both noise and odor which are consistent with surrounding industrial land use.

3.1.6 Scenic Value and View Plane

The topography of the area is relatively flat and there are no ocean views. The Waianae range may be seen roughly 2 miles to the north. View planes to the west are occluded by the Tesoro Refinery and other industrial businesses within Campbell Industrial Park. Construction baseyards and the Kalaeloa airport are visible to the west. Scrub vegetation dominates the scenery to the south. The project area is relatively flat and undistinguished with no discernible gradient.

The proposed development will have a relatively low profile. At peak elevation the panels will be no more than 8 feet above ground level. This is approximately the same height as the Airport perimeter fence. The PV Park will not be visible from any major roadway and will not obstruct view from aircraft operating in and out of Kalaeloa Airport (Figure 3-2).

3.1.7 Hazardous Substances

Photovoltaic panels and their associated electrical equipment do require the use of hazardous materials while in operation. Electrical transformers are all PCB-free. Leaching from the equipment due to corrosion and rainwater is expected to be undetectable.

Construction equipment using fossil fuels and hydraulic power will be used in grading and building the facility. There is some possibility of leaks, spills or accidents during construction. The construction contractors will be required to develop and maintain an emergency action plan for management and recovery of any release to the environment.

3.2 Biological Environment

3.2.1 Vegetation

Two federally listed endangered plant species exist at Kalaeloa. The endemic akoko shrub (*Chamaesyce skottsbergii var. skottsbergii*) occurs in at least three separate locations, including the area east of the airfield. A single colony of endemic round-leafed chaff-flower shrubs (*Achyranthes splendens var. rotundata*) is found at the southwest corner of Kalaeloa. Neither of these species was observed on or near the subject property during field reconnaissance performed by North Shore Consultants.

During the period when the airport was operated by the Navy, the subject property was regularly graded. Vegetation on the subject property is characteristic of dry land areas that have been recently disturbed. The dominant vegetation types observed on the subject property are koa haole with an understory of various introduced grasses. A few scattered kiawe trees are also present. Koa haole (*Leucaena leucocephala)* and kiawe (*Prosopis pallida)* are both introduced and considered invasive species. This was confirmed in a site visit conducted for the proposed project area in July 2010. Either one or a mix of the two dominant tree species, kiawe and koa haole, was observed throughout the entire parcel. The understory was dominated by the nonnative Buffelgrass (*Cenchrus ciliaris*). The primary native understory species present were the shrub ilima (*Sida fallax*) and the vine *Cassytha filiformis.*

3.2.2 Wildlife

Twenty-three (23) species were identified during a survey of Barbers Point Naval Air Station in 1984, of which 17 were ubiquitous, introduced species; five were indigenous; and one, the Oahu elepaio (*Chasiempis sandwichensis ibidis*), was endemic (Botanical Consultants 1984). The 1984 survey reported that the elepaio was found in an area of mangrove forest. The elepaio is no longer present in the area (USFWS 2006). Species common to the area include northern cardinal (*Cardinalis cardinalis*), spotted dove (*Streptopelia chinensis*), red-vented bulbul (*Pycnonotus cafer*), Indian myna (*Acridotheres tristis*) and gray francolin (*Francolinus pondicerianus*).

Kalaeloa Airport has a formal agreement with the U.S. Department of Agriculture which allows for the controlled eradication of birds that create a hazard to planes. Airport personnel actively control birds and keep records of all bird strike incidences.

Ordy Pond, an anchialine pond east of the airfield, the coastal salt flats between Runway 4R-22L and Taxiway K, and also the western boundary of Kalaeloa are frequented by the federally listed endangered Hawaiian black-necked stilt (*Himantopus mexicanus knudseni*) and migratory bird species. The state-listed endangered Hawaiian short-eared owl (*Asio flammeussandwichensis*), federally listed as a species of concern, may occur or range over Kalaeloa.

Mammals likely to be found at the proposed project site are the introduced Indian mongoose (*Herpestes auropunctatus*), rodents and feral cats.

3.2.3 Special-Status Species

The Hawaii Biodiversity and Mapping Program (HBMP) provided information for occurrences within one-half mile of the proposed site. Past reports have indicated that the general area may contain two varieties rare plants, the Ewa Plains Akoko and Red Ilima. The known locations of these plants are away from the subject property. A letter to the US Fish and Wildlife Service in June 2010 did not identify any special-status species with exception to those discussed above or critical habitats located on or near the subject property (Appendix B).

3.3 Socioeconomic

The population of the State of Hawaii was 1,360,301 in 2010, which represents an average annual growth rate of 1.2% from 2000 to 2010 (US Census Bureau 2010). This compares with an average annual growth of 0.9% for the remainder of the nation. The vast majority of Oahu neighborhoods lost population over the past decade; however, Ewa gained 34% which is third behind Kapolei/Makakilo at 37% and Mililani Mauka at 73%. The southwestern corner of the island near the subject property is a primary growth and employment center due to public and private developers filling in the dry areas of Oahu.

3.3.1 Social Factors and Community Identity

Employment in the region is largely industrial, commercial and retail. Approximately 15,000 jobs were in the Ewa Region in 2000 and that number is projected to grow to 64,000 in 2020 (HCDA 2010). Median personal income for Ewa was estimated at $27,742; and for Makakilo $38,836.

The project site is undeveloped and located on land that has quite restricted use due to airport operations. The site is owned by DHHL, but does not provide revenue to support DHHL's mission. It is unsuitable for housing development, since it is located immediately adjacent to the end of an active runway. There are no recreational facilities at the site and no evidence of recreational activities (i.e., hiking trails, baseball fields) was observed during the site reconnaissance. No traditional (or modern Hawaiian) cultural activities were identified that occur at the project site today.

3.3.2 Public Services, Facility, and Utility

Much of the infrastructure in the vicinity of the subject property, with the exception of the roads, is still owned by the US Navy. The wastewater collection system is being conveyed to the City and County of Honolulu (US Navy, 2008). The Hawaii Community Development Corporation (HCDA) is reportedly preparing an infrastructure master plan that would address roadways and utility service for the area.

3.3.2.1 Electricity

The existing electrical distribution system at Kalaeloa is owned and operated by the Navy. Electrical power is provided through a Hawaiian Electric Company (HECO) substation located near the main gate along the northern property line. Secondary substations reduce the 46-kilovolt (kV) power for local distribution stations. Substation A is closest to the project site and steps the power down to 11.5 kV. It is a back-up substation for emergency use (US Navy, 2008). The distribution is through a combination of 11.5 kV and 46 kV overhead and underground power lines.

The proposed PV Park would provide a total of up to 5.0 MW of electricity to HECO's existing power grid. This quantity of solar power will contribute an insignificant fraction of the island demand, estimated at 1.3 GW. The proposed action will not significantly affect the stability of the grid due to the small contribution.

3.3.2.2 Telecommunications

Telephone systems in Kalaeloa are currently owned by the Navy. No telephone service will be provided to the project site. Sandwich Isle Communications will be utilized for cable or communications service if required.

3.3.2.3 Potable Water

Potable water source and distribution system at Kalaeloa is currently owned and operated by the Navy. No potable water will be provided to the project site.

3.3.2.4 Wastewater

The existing wastewater collection system is owned by the Navy and operated under license by the County Department of Environmental Services and is in the process of being transferred to the county as a public benefit conveyance. No wastewater services will be provided to the project site.

3.3.2.5 Solid Waste

Construction debris and grubbing spoils will be generated during the construction period. No solid waste will be generated or disposed from the site following construction. Solid waste will be disposed at a licensed and permitted disposal facility on Oahu in accordance with State and County requirements.

3.3.2.6 Drainage

Infiltration of stormwater at the project site is rapid. There are no natural drainage ways in southwest Oahu due to the high permeability of the soil and paucity of rainfall. The area is subject to heavy rainfalls on occasion. Stormwater from the site will drain toward the west into a man-made drainage ditch which is designed for the purpose. As discussed in Section 3.1.2 the ditch is normally dry but conveys stormwater to the ocean approximately 1.5 miles to the south.

Stormwater generated on site will be contained during small storm events. Best management practices will be employed to reduce soil erosion. These practices may include soil mats, gravel or silt fences. The proposed action is not required to obtain an NPDES industrial stormwater permit, but will obtain a construction stormwater permit in advance of site grading. New impervious surfaces will consist of footings for the panels and are not expected to be a large fraction of the total area. The proposed action would not have a major impact on stormwater drainage at the site or in the vicinity.

3.3.3 Roads and Access

Access to the site is through the Kalaeloa Main Gate, west down Midway Street to its end. Midway serves numerous public and private users in the west portion of Kalaeloa, but after the divergence with Hornet Street the level of usage drops substantially. Midway Street ends on the subject property. Saratoga Avenue is the western perimeter road for Kalaeloa, and forms the western boundary of the subject property. Either street could be used for access.

Construction related traffic will be light over a period of up to 12 months. Construction-related traffic is expected to be within the capacity of existing service roads, which are now little utilized. Following construction, the proposed project will require less than one car per day for on-site management and no full-time employees. The proposed action will not contribute significantly to local traffic impacts.

3.3.4 Archaeological and Historic Resources

A review of the records on file at the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) revealed that numerous archaeological studies have been conducted in the Barbers Point vicinity, however the current parcel does not appear to have been subject to prior archaeological study and there are no archaeological resources known to exist on the parcel. Archival documents, records, and maps indicate that the parcel was historically used as an extension of the adjacent Naval Air Station runway. This can be seen on the Tax Map as an easement area and is clearly indicated in an aerial photograph.

A physical inspection revealed that the boundaries of the subject property are easily identifiable and the currently vacant property is covered with moderately dense grasses and *koa haole* (*Leucaena leucocephala*) with occasional *kiawe* (*Prosopis pallida*) trees. The ground surface across the entire parcel appears to have graded in the past, and where visible through the exhibits a mixture of soil and limestone cobbles. No archaeological resources were observed during the field inspection, and given

the extensive grading that has no doubt occurred, no such resources are expected to remain intact if any were ever present. Based on the archival research, the documented extensive land alteration, and a physical inspection of the property, Rechtman Consulting, LLC concluded that there are no archaeological resources within the subject parcel that would present any significant development constraints (Appendix C).

3.3.5 Cultural Impacts

There is a long history of Native Hawaiian occupation on the Ewa Plain. The Ewa Plain was part of the ahupuaa`a of Honouliuli, and the population likely settled around the mouth of Honouliuli Stream, inland and up the coastline of Pearl Harbor. There are quite a few excellent studies on the cultural history of the Ewa Plain and Kalaeloa. Among those reviewed in preparation of this document were those of Tuggle (2008), Kelly (1991), and Kamakau, (1964). Interviews were conducted with historically and culturally knowledgeable individuals from the area including those with the Hawaii Army National Guard, and Shad S. Kane. These studies relate the distinct importance of Ewa and in particular Pearl; Harbor and Pu`u Kapolei to the origins of humans on Oahu and show the character of the region in the not so distant past.

Honouliuli is the largest Ahupuaa on Oahu (43,000 acres). Its name literally means "Dark Bay". It is thought that little agricultural activity occurred on the dry Ewa Plain (Athens et al. 1997).

According to one legend the Ewa district received its name from two Hawaiian gods, Kane and Kanaloa who came to Oahu to survey the land.

They reached red hill and saw below them the broad plains of what is now Ewa. To mark the boundaries they would throw a stone and where the stone landed would be the boundary. When they saw the beautiful land below them it was their thought to include as much of the flat land as possible. They hurled the stone as far as the Waianae range and it landed somewhere in the Waimanalo section. When they went to find it they could not locate the spot where the stone fell. So Ewa (strayed) became known by that name; the stone that strayed (Sterling and Summers, 1978).

Other authorities recognize `Ewa with an initial glottal stop as the district name, which means crooked, but ewa without the glottal stop means strayed (Pukui and Elbert, 1964).

Ka-lae-loa is literally translated as, "the-distant-point". This is descriptive of the point as seen when walking the ancient foot trail across the Ewa plain between the Waianae and Kona Districts of Oahu.

Kalaeloa is a place where turtles used to inhabit. According to another legend Pohaku-O-Kauai, near Kalaeloa was the home of the giant magical fish Uhumakaikai. Uhumakaikai taught Kawelo, a local chief in the 16th century the art of fighting (Sterling and Summers, 1978).

A heiau atop Pu`u o Kapolei marked the movements of the sun in the heavens above. By these movements ancient Hawaiians noted the changing seasons between summer and winter.
Between Pu`u o Kapolei and Kalaeloa are arid and less hospitable kula lands called
The Plain of Kaupe`a region was also described as the "ao kuewa" a land over which spirits roamed in an effort to depart this world to the next. When people died and had no rightful place to go, their

souls wandered among the wiliwili in Kaupe'a (Kamakau, 1964). These were people who had no family to help them, or had not found the leaping places to get to the nether world. The wandering souls would travel to the Plain of Kaupe`a to catch moths and spiders in the hope that helpful *aumakua* would save them (Judd and Barrere, no date).

Near the shore of Kalaeloa were once found places of fame in the traditions of Hi`iaka-i-ka-poli-o-Pele, youngest sister of the Pele clan, who traveled across the Kalaeloa lands while on her return trip to Hawaii Island, from Kauai. While traveling along the shore between Kalaeloa and Kualaka`i, Hi`iaka was adorned with blossoms of the lehua trees which grew in the vicinity. At the place called Hilo One, she found the spring Hoakalei, where she stopped and looked at the water. Upon looking in the water, she saw her own reflection, adorned with the lei of lehua blossoms, thus the name Hoakalei (reflections of the garland). The spring of Hoakalei was still known to kama`aina of the region through the early 1900s. It had been covered over as a result of development at Barbers Point, in the period around World War II (HCDA 2006).

S.M. Kamakau reports several different legends that indicate that Honouliuli was the residence of original inhabitants of Oahu. In one, the hairless humans (`olohe) who first inhabited Oahu lived in the coral caves that abound in the vicinity of Kalaeloa. In another *Pu'u o Kapolei (1.7 miles northeast of the subject property).* was the home of Ka`mau-nui, the deified grandmother of Kamapua`a, a child with human, pig and other natural body-forms. Ka-mau-nui also known as Kamaunua-niho was a sorceress and alii who sailed to Oahu from Kahiki in a canoe, and from whom the people of Oahu, Kauai, and Hawaii descend (Beckwith, 1940). For this reason the Ewa District is called the "celebrated land of ancestors" (Kamakau, 1964).

Kalaeloa was first renamed in 1786 to be Point Banks in honor of Sir Joseph Banks, the naturalist on Captain Cook's first voyage into the Pacific. However, in 1796 the ship Arthur, under the command of Captain Henry Barber, ran aground at Kalaeloa (the northern section of the point). This being the first foreign vessel to wreck on Hawaiian shores, the name of Captain Barber was noted on the charts of other foreign vessels (Kamakau, 1961).

During the reign of Kamehameha I Pu'aloa was the home of two of Kamehameha's most powerful *alii*. Ke`kua`manoha and Ka`uhi`wawae`ono, the latter is known as the chief who murdered people and used their bodies as shark bait, and was later caught plotting against Kamehameha. Kamehameha III (Liholiho) also lived near Pua`loa with his wives for a short period (Kamakau, 1964).

In 1839, Missionary E.O. Hall described the area between Pearl Harbor and Barbers Point as follows:

Passing all the villages (after leaving the Pearl River) at one or two of which we stopped, we crossed the barren desolate plain the termination of which is Barbers Point. (Hall, 1839).

Captain Vancouver recorded similar observations from his 1798 voyage, noting that no villages were observed between Pu`uloa (Pearl Harbor) and the mid coast of Waianae.

By the late 1840s, when native tenants of the land were allowed to make claims for private property rights, no claims were made for property in the vicinity of Kalaeloa. While the fisheries of the Kalaeloa region remained important to Hawaiians and have been used regularly through the present it

was the inland section of Honouliuli, with its watered taro pond-fields and fishponds that was sought out by native tenants. Despite the cultural significance of the area it seems that Kalaeloa, in the dry areas away from the shoreline were never heavily populated, due primarily to the dry conditions and lack of good soil.

In the 1880s, the lands of the Kaupe`a-Kalaeloa region were being turned over to cattle grazing. This use of the land continued through the early 1900s. Additional activities in the early 1900s included radio communications facilities, the expansion of sugar cultivation, and the transport of water and soil to the near shore flats. In the late 1930s, the US Navy leased a strip of land that was 3,000 feet by 3000 feet to build a mooring mast for the dirigible Akron. There is no evidence that the mast was ever built. In early 1940 when the lease expired, 3,500 acres of land was purchased from Campbell Estate to build the Ewa Marine Corps base, later renamed NAS Barbers Point (Collins, 1977).

Anecdotal information from several sources indicate that the Kalaeloa region was a very good place for fishing and shoreline collecting until it was restricted by the federal reservation (HCDA, 2006). Shad Kane reports that there is one living Kupuna who recalls riding the train to the vicinity of the site to buy fish, lobster, and limu. There were structures near the rail lines where one could buy fish and lobster. Apparently there was no station, but the train would slow down so that people could jump on and off with their purchases (Kane, Personal communication, 2012).

Construction on the base began in November 1941, but the Navy revised the building plans to make the buildings bombproof following the Japanese attacks on Pearl Harbor December 7, 1941. The Navy commissioned BPNAS on April 15, 1942, and the 3,700-acre installation was manned by 12,000 Navy servicemen. BPNAS's primary mission was to support the naval operations in nearby Pearl Harbor, but its role quickly expanded to include aircraft repair and maintenance for carrier-based aircraft for the duration of the war. After World War II ended, BPNAS became the primary naval air station for naval operations in the Pacific throughout the Cold War era until its close in 1989. BPNAS closed in 1999 in accordance with a recommendation from Base Realignment and Closure Committee (BRAC). Since then, the former BPNAS installation has had ongoing redevelopment by federal, state, and county agencies, as well as military and private organizations.

The subject property was extensively graded and built up as a run-out for the crosswind runway during the 1940s. There are no known sink holes, caves, sacred sites or traditional cultural resources currently in proximity to the site (Rechtman 2012). Although the area is rich in tradition and cultural history, the proposed project is unlikely to have a discernible impact on traditional practices or Native Hawaiian beliefs.

3.3.6 Land Use

The City and County of Honolulu officially designate the project site as F1- Military and Federal Preservation, but the site is no longer federal land. Lands taken out of the federal category are normally changed to P-2 General Preservation zone unless a zone change application is made.

The proposed action would conform to the County's P-2 General Preservation. The County has determined this project is considered a power generation project, which is considered a "Utility Installation, Type B" and subject to a minor conditional use permit.

The Hawaiian Homes Commission Act of 1920 is the enabling legislation for the Hawaiian Homes Commission and the Department of Hawaiian Home Lands. Section 206 releases Hawaiian home lands from the control of State and County regulations including zoning regulations, land-use permits.

§206. Other officers not to control Hawaiian Home Lands; exception.
The powers and duties of the governor and the board of land and natural resources, in respect to lands of the State, shall not extend to lands having the status of Hawaiian home lands, except as specifically provided in this title. (Exceptions are for criminal violations.)

Although the Act seems clear, we understand that by convention The Department declares its lands exempt on a project by project basis. The requirement for environmental permits such as NPDES may remain intact because they are generally mandated by federal regulations. In July 2002, Act 184 of the 2002 Hawaii State Legislature transferred redevelopment responsibility from the NASBP Redevelopment Commission to the HCDA. The Kalaeloa Master Plan was prepared in 2006 (HCDA 2006), and designated land to be used for residential, light industrial, eco-industrial, military, and parks and recreation purposes. Neither the Master Plan nor administrative rules for development standards have been officially adopted.

Under the proposed Kalaeloa Master Plan, the project site is located on lot # 2J, designated for eco-industrial land use (HCDA 2006). The 2006 Master Plan defines Eco-industrial as:

For the purposes of the Master Plan, Eco-industrial uses are defined as environmentally compatible industries that benefit the entire population of Oahu. Potential industries such as solar or hybrid energy, or other such technologies are compatible in these parcels. These industries require large land areas and are located within the airport's accident potential zones where height restrictions limit development.

Properties to the north will also be developed for PV and other solar use (DHHL, 2011). State-retained lands associated with the airport are on the east boundary. Vacant land used by the Navy for baseyards and composting lies to the south, and the industrial properties of Campbell Industrial Park are to the west. The proposed action is consistent with the Ewa Development Plan, Kalaeloa Community Redevelopment Plan, Special Area Plan, Light Industrial zoning designation and the HCDA Kalaeloa Master Plan, land use designation. But these zoning designations have not been adopted and administrative rules for the HCDA Kalaeloa Community Development District are pending (Figure 3-1).

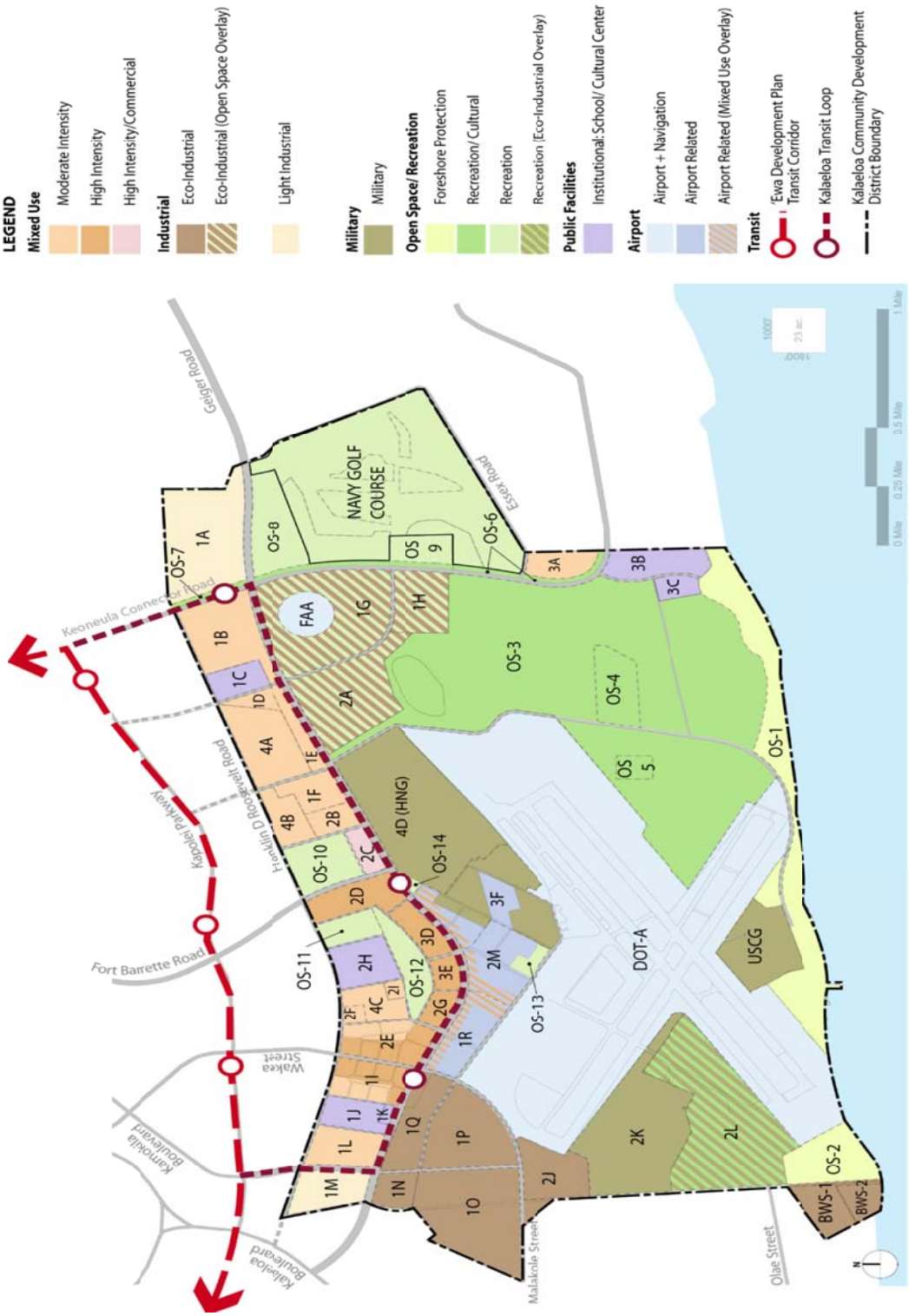


Figure 3-1: Land Use Plan from the Kalaeloa Master Plan. Hawaii Community Development Authority, 2006. Subject Property is designated 2J.

3.3.6.1 Land Use Constraints

Airports have a primary mission to serve the flying public and facilitate safe and convenient air travel. All activities in proximity to airports must be compatible with this mission.

The proposed project site is approximately 1200 feet west of the end of the cross wind runway (11-29). A taxiway, blast pad and perimeter buffer lie between Runway 11 and the project site. Historically Runway 11 has been used for departures only and Runaway 29 arrivals only. The State Department of Transportation is in the process of relaxing that restriction for smaller aircraft. The use restriction is intended to minimize noise impacts to residential areas and schools located north and east of the airport (FAA, 2010a). Runway 11-29 is used infrequently by both private aircraft and the Coast Guard. Kalaeloa Airport is retained as an alternate to Honolulu International Airport, and is the Coast Guard's primary aviation Search and Rescue facility for the Central Pacific Region.

All solar projects must submit to the FAA a notice of proposed construction Form 7460 to ensure that the proposed project is not located in areas or engage in activities that will impact the safety of airport operations. An Obstruction Evaluation /airport airspace analysis is performed to ensure that the proposed activity does not penetrate imaginary surfaces around an airport, cause interference with communications systems, or create glint and glare. The three primary aspects of the Obstruction analysis are discussed below.

Airspace Penetration: 14 CFR Part 77 establishes standards for determining obstructions in navigable airspace. Imaginary surfaces are defined that extend out from the runway at locations where aircraft are likely to fly. This imaginary surface is called the Runway Protection Zone (RPZ). The height above ground of the RPZ is lowest and narrowest near the runway increasing in width and altitude with distance from the runway. The imaginary surface is different for different types of airports. Kalaeloa Airport does not now have instrument landing capacity, thus the angle of the RPZ is 50:1 (H/V). Figure 3-4 shows the components of restricted surfaces and Figure 3-5 shows the slope position of the RPZ and Figure 3-6 shows the approximate location of the RPZ with respect to the project site.

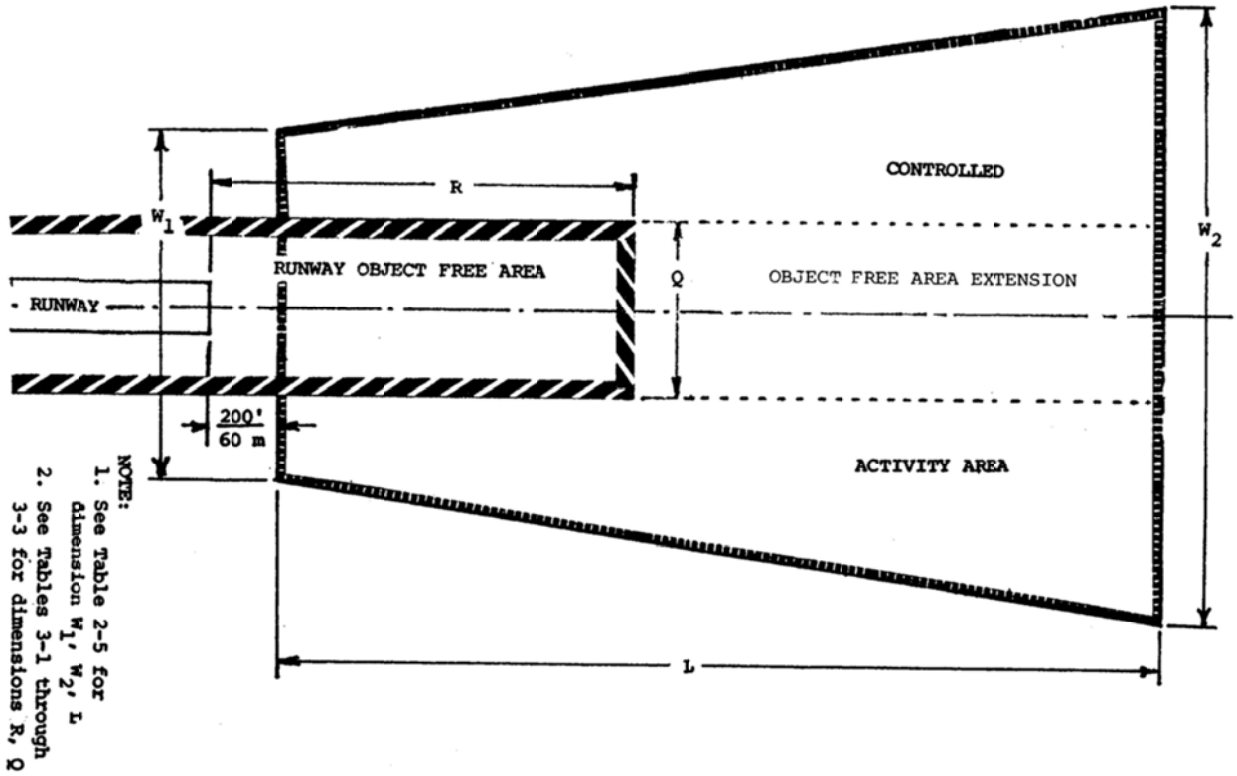


Figure 3-2: General component of restricted areas surrounding an airport. From Advisory Circular 150/5300-13 1989

Table 3-1 Dimensions of the RPZ

Airport Service	**Length (L)**	**Inner Width (W1)**	**Outer Width (w2)**
Small Aircraft only	1,000	250	450
Approach Category A&B	1,000	500	700
Approach Category C&D	1,700	500	1010

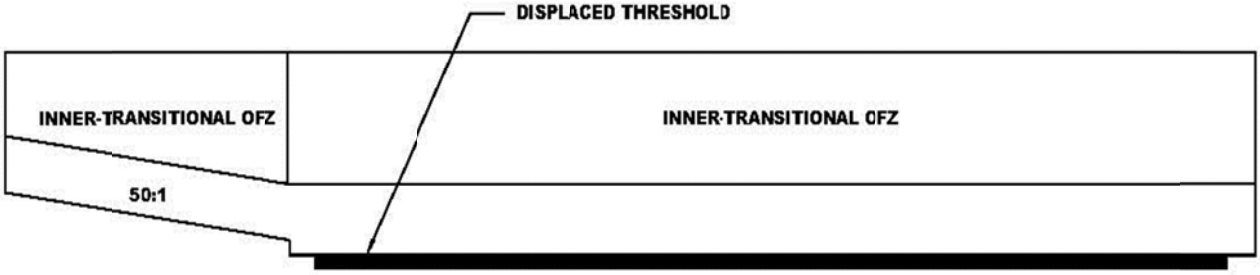


Figure 3-3: Diagrammatic representation of the RPZ slope. All structures must be below the RPZ plane to avoid being an obstruction to aircraft navigation. From FAA Advisory Circular 150/5300-13, 1989

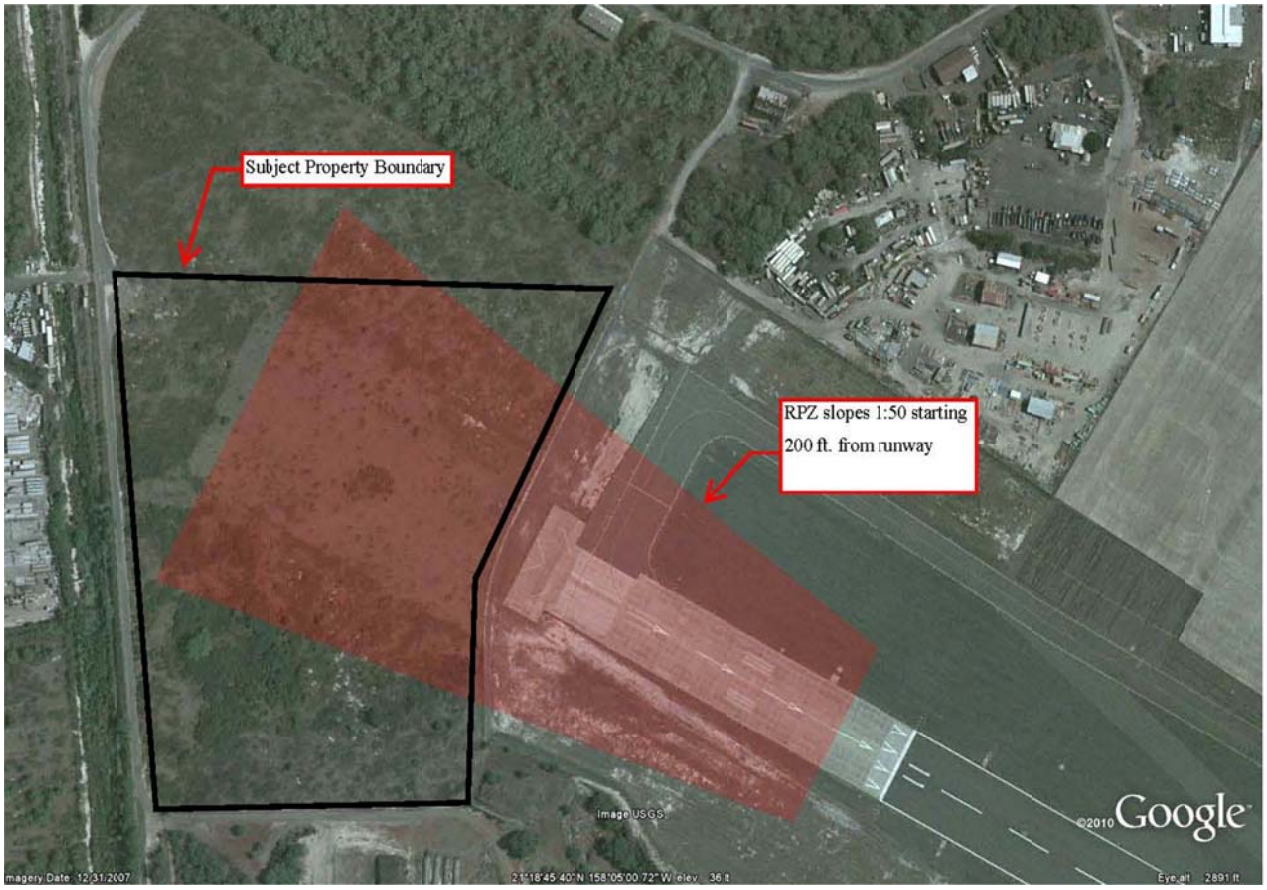


Figure 3-4: RPZ dimensions and slope in relation to the subject property boundaries. The RPZ starts 200 feet from the end of the runway and slopes upwards and outwards. For Kalaeloa Airport the slope angle is 50:1

As the project site is approximateley1200 feet from the end of Runway 11, and the RPZ slope is 50:1 angle starting 200 feet from the end of the runway, the altitude of the RPZ where it enters the project site is approximately 20 feet above ground level. The maximum elevation of the proposed PV panels is 8 feet above ground level which is approximately the level of the airport perimeter fence, and 10 feet below the RPZ.

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Communications systems Interference: Communications interference includes negative impacts on radar, navigational aids and infrared instruments. Radar interference occurs when objects are placed too close to radar antennae and reflect or block the transmission of signals between the transmitter and receiver such as an aircraft. It is possible for interference to be caused by other communications signals, but more commonly it is caused by a physical structure placed between the transmitter and receiver. Navigational aids (NAVAIDS) are passive systems with no transmitted signal. These can be impacted by objects within the line of sight between aircraft and the NAVAID. Infrared (IR) communications systems can be impacted by objects that retain heat after dark creating false signals in the IR communications systems (FAA 2010b).

Glint and Glare: Glint and glare are components of reflectivity, or light reflected off of surfaces which can cause temporary visual interference even after the source of illumination has ceased. Glint is defined as an instantaneous flash and glare is a more steady reflection.

The amount of reflectivity varies greatly among solar technologies with concentrated solar power (CSP) technologies being highly reflective and Photovoltaic (PV) technologies being primarily absorptive rather than reflective (Figure 3-7). Because solar projects will introduce new visible, potentially reflective surfaces in proximity to the airport, the siting and design of these facilities require assessment and approval by the FAA. Existing conditions surrounding most airports include a number of reflective surfaces. In the case of Kalaeloa there are large metal warehouses with reflective roofs, and the Pacific Ocean in close proximity to the runways. The property is near 21 degrees north latitude, which implies that the sun is normally to the south of the site. Panels would be expected to have a slight angle facing south, and will track the movement of the sun as it moves from southeast to southwest.

Solar installations are presently operating at a number of airports. Project managers and air traffic controllers from six airports where solar facilities had been operating for one to three years were contacted regarding complaints about reflectivity. To date there have been no serious complaints from air traffic controllers or pilots due to glare impacts from existing airport solar PV installations. Anecdotal evidence suggests that either significant glare is not occurring during times of operation or if glare is occurring it is a minor part of the landscape to which pilots and tower personnel are exposed (FAA, 2010b).

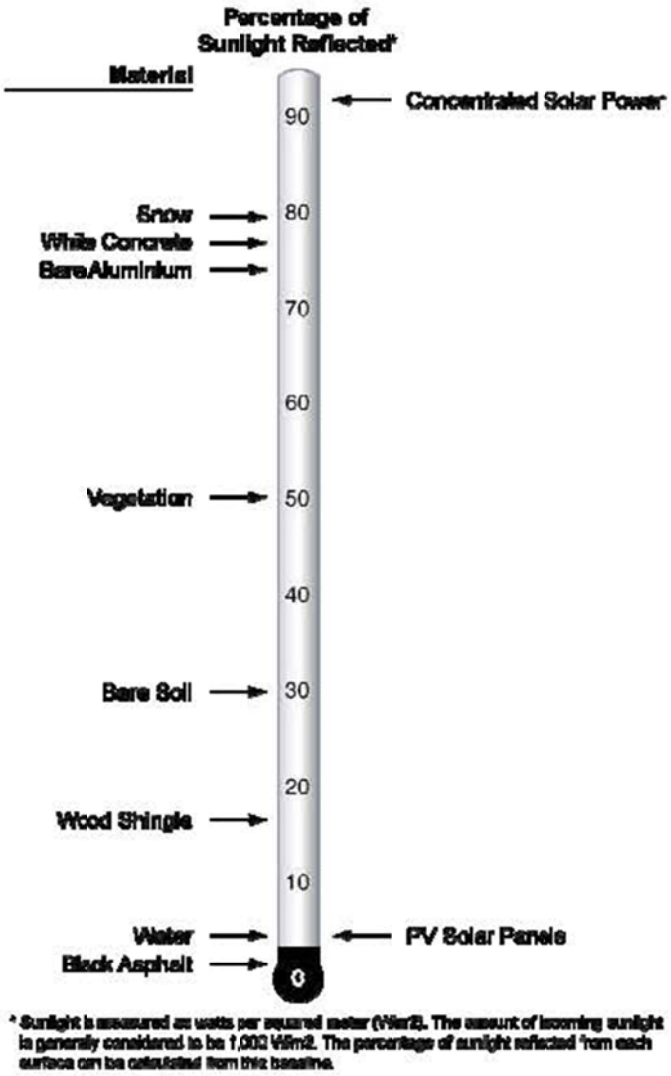

Figure 3-5: Relative reflectivity of various surfaces. Note that CSP technologies are toward the top of the reflective scale and PV is toward the bottom. (Technical Guidance for Evaluating Selected Solar Technologies on Airports. Federal Aviation Administration 2010b)

Kalaeloa Home Lands LLC commissioned a glint and glare study for the proposed development. The Study is appended to this document as Appendix D. In its conclusion the reflectivity study states:

> *It has been demonstrated that, in the few cases when there is some risk of eventual glint by PV modules, the airplane will also be directly facing the sun and the corresponding reflections from the ocean, so it can be concluded that glint from PV modules will not have any relevant effect on airplanes' visibility, nor deteriorate the actual approaching flight conditions. Risk is also diminished by the monthly distribution of predominant wind direction in Kalaeloa when superimposed to the calendar days glint might occur.*

AES solar prepared a Form 7460-1 with attachments and submitted them to the FAA in January 2011. A notice of determination was received on March 8, 2011 which approved the proposed action to proceed. A further discussion of the Obstruction analysis is presented in Section 3.5.

3.4 Growth-Inducing, Cumulative, and Secondary Impacts

Indirect effects may include other impacts related to changes induced by the proposed action such as growth-induced changes in land-use patterns, or air and water quality impacts associated with population growth. Cumulative impacts may be defined as impacts on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes the action. A secondary impact is one that is caused by the proposed action but is removed in time or space from the project (Council on Environmental Quality, 1997).

The proposed action is to build and operate a 29 acre photovoltaic park on currently unused land that has significant use restrictions imposed by its proximity to Runway 11 of the Kalaeloa Airport.

The proposed action does not increase population or traffic. During operation the project will not contribute hazardous waste, air emission, or surface water contamination associated with its operation. The proposed PV park does not utilize any potable water, or sewer. No growth inducing factors, cumulative impacts, or secondary impacts associated with the proposed action have been identified.

The project is one of two planned for the vicinity. Kalaeloa Solar One and Two will consist of 5 MW of PV panels and 5 MW of Concentrated Solar Power (CSP) park is planned for the adjacent parcel to the north of this project site. The proponent, Keahole Solar Power, Inc. published a Draft Environmental Assessment in January 2011. No Final Environmental Assessment has been accepted at the time of this writing, and there is no evidence presented that the proposed facility has completed the Obstacle Evaluation by the FAA.

The cumulative impacts of both solar projects and other planned for central Oahu may include flooding the power market with non-base load power sources. Hawaiian Electric has set a maximum of 7% of its base load to be supplied by wind and solar-type projects. The known solar projects are less than 80 MW on Oahu and do not approach the limits for variable sources.

At full development the subject property will consist of 29 acres of PV and the adjacent parcels to the Northwest will contain approximately 80 acres of PV and CSP facilities. The PV facilities will also be located under a portion of the RPZ, while the CSP facilities will be displaced to the north by several hundred feet. Together the facilities will create a solar farm of slightly over 100 acres.

Together the proposed projects will create approximately 14.0 MW of non-base load power. This quantity does not create a significant excess of electrical power as it is only a small fraction of the island's total demand, and is not likely to lower the cost of energy at the retail level.

3.5 Required Permits and Approvals

Discussion follows for of the major permit approvals required prior to the start of construction.
City and County of Honolulu, Building and Grading. The proposed project will be required to obtain all building and grading permits from the City and County of Honolulu.

City and County of Honolulu, Conditional Use Permit (minor). As discussed previously, the default zoning for this parcel is P-2. Type A utilities, such as the proposed action, require a conditional use (minor) permit prior to approval of building and grading permits. Minor CUP permits do not require public hearings; however, public hearings were held in connection with this Environmental Assessment.

State of Hawaii NPDES Construction Stormwater Permit. The Clean Water Act regulates discharge of all types of water from industrial and construction sites as well as discharge of process waters of all types. An NPDES Construction Stormwater Discharge Permit is required of construction projects that are grading areas greater than one acre. The majority of the 29 acres included in the project site will be graded. An NPDES Notice of Intent and Form C will be prepared and approved prior to grading at the project site.

There are no industrial discharges or construction dewatering associated with the project. A PV park is not required to obtain an industrial stormwater permit. The facility will not generate domestic wastewater and does not require a wastewater connection or individual wastewater permit.

State Historic Preservation Division of DLNR. An approval for grading the site will be obtained from the State Historical Preservation Division prior to the start of construction.

The proposed project does not involve stationary sources or air pollution and is not required to obtain Clean Air Act permits.

Federal Aviation Administration, Obstacle Evaluation/ Airport Airspace Analysis. Because the proposed project is in close proximity to the Kalaeloa Airport, AES Solar is required to obtain approval from the FAA. In administering Title 14 of the Code of Federal Regulations CFR Part 77, the prime objectives of the FAA are to promote air safety and the efficient use of the navigable airspace. To accomplish this mission, aeronautical studies are conducted based on information provided by proponents on an FAA Form 7460-1, Notice of Proposed Construction or Alteration.

Advisory Circular 70/7460-1K states that any person/organization who intends to sponsor any of the following construction or alterations must notify the Administrator of the FAA:

- any construction or alteration exceeding 200 ft. above ground level
- any construction or alteration:
    - within 20,000 ft. of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft.
    - within 10,000 ft. of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft.
    - within 5,000 ft. of a public use heliport which exceeds a 25:1 surface

- any highway, railroad or other traverse way whose prescribed adjusted height would exceed the above noted standards
- when requested by the FAA
- Any construction or alteration located on a public use airport or heliport regardless of height or location.

As part of the airspace analysis, FAA's regional offices process the 7460 data and conduct the aeronautical studies to ensure the project will not penetrate the imaginary surfaces or interfere with radar or create a potential glare hazard. The aeronautical studies will be conducted by the following offices:

- Air Traffic Obstruction Evaluation Office (AT OES) – Responsible for evaluating Part 77 requirements.

- Air Traffic Operation Service Group (AT OSG) – Responsible for coordinating with air traffic control to identify any operation impacts.

- Technical Operations (Tech Ops) – Responsible for evaluating the case for impacts to NAVAIDs, conducting electromagnetic and line-of-sight shadow studies, and highlighting frequency problems.

- Flight Standards (FS) Responsible for reviewing proposals to determine the safety of aeronautical operations, and of persons and property on the ground.
- Flight Procedures (FP) - Responsible for evaluating proposals to determine impacts on instrument procedures and whether aircraft instrument operations can be conducted safely.

- Airports (ARP) – Identify the structure's effect on existing airports and planned improvements based on airport design criteria including assessing potential impacts on airport operations, capacity, efficiency, and development, and making recommendations for eliminating adverse effect.

The Form 7460 included a discussion of consistency with the ALP, and address airspace issues of physical penetration, communications systems interference, and reflectivity. It included the following information:

- Location of panels
- Location of radar facilities
- Location of Control Tower
- Verification that panels are located outside of airport design prohibited areas
- Verification that panels will not physical penetrate airport imaginary surfaces
- Verification that solar facilities will not block radar communications
- Assessment of reflectivity including time periods when reflection may contact Control Tower and aircraft

The FAA completed the aeronautical study, and determined that no impacts to air navigation would occur as a result of the proposed action. In issuing the negative determination the FAA has approved the project and allowed it to move forward. A copy of the Notice of Determination is included in Appendix E.

The proponent may submit one additional application for Obstacle Evaluation and Airport Airspace Analysis to cover equipment to be present during construction of the facility. Construction equipment and dates are not sufficiently known at this time. Construction equipment may include a drilling rig to install footings. Any equipment that is higher than the 8 feet allowed under the approved 7460-1 assessment will require a new study. The expiration date for the OEAAA study is September 2012. An extension will be filed with the FAA prior to expiration of the determination.

Kalaeloa Solar will minimize the incidence of aircraft obstruction by notifying JRF Tower personnel as to the dates of operation, and will work with site personnel to make Runway 11-29 accessible when needed for aircraft operations. The proponent has the ability and intention to stop work during periods when the cross-wind runway is needed.

4.0 CONSISTENCY WITH PLANS, POLICIES, AND REGULATIONS

4.1 Federal Policies Supporting Renewable Energy

In the U.S. most energy policy incentives take the form of financial incentives. Examples of these include tax breaks, tax reductions, tax exemptions, rebates, loans, and specific funding. Throughout U.S. history there have been many incentives created through U.S. energy policy. Most recently the Energy Policy Act of 2005, Energy Independence and Security Act of 2007, and Emergency Economic Stabilization Act of 2008, each promote various energy efficiency improvements and encourage development of specific energy sources. U.S. Energy policy incentives can serve as a strategic manner to develop certain industries that plan to reduce America's dependence on foreign petroleum products and create jobs and industries that boost the national economy. The ability to do this depends upon which industries and products the government chooses to subsidize. The federal government provided substantially larger subsidies to fossil fuels than to renewables in the 2002-2008 period. Subsidies to fossil fuels totaled approximately $72 billion over the study period, representing a direct cost to taxpayers. Subsidies for renewable fuels, totaled $29 billion over the same period (Environmental Law Institute, 2009).

The Energy Policy Act of 2005, signed into law by President George Bush on August 8, 2005, was the product of over four years of congressional consideration. Among the many provisions of the Energy Policy Act of 2005 were renewable energy production tax credits**.** The act provided tax credit extensions for wind and biomass for two more years and additional tax credits were made available for other renewables including solar, geothermal, and ocean energy.

The energy policy of the Obama Administration, lists the guiding principles of the administration regarding energy and the environment. They are: creating new clean energy jobs and technologies, making America more energy independent, and reducing carbon emissions. Many of the Obama Administration's initiatives were undertaken as a result of the American Recovery and Reinvestment Act of 2009 and many of those investments were specifically in clean energy. The White House website states that the Recovery Act provided over $80 billion in clean energy investments. The president and Congress have dramatically increased funding for the U.S. Department of Energy's wave and tidal technologies program. In addition, President Obama has advocated that by 2012, 10 percent of our domestic energy supply should come from renewable resources, increasing to 25 percent by 2025. Also, now that federal regulation of greenhouse gas emissions is increasingly likely, the focus is on the lack of CO2 emissions in the renewable energy sector.

4.2 Hawaii State Policies Supporting Renewable Energy

Act 234, Session Laws of Hawaii 2007, established the State's policy framework and requirements to address Hawaii's greenhouse gas emissions, recognizing the potential adverse effects of the recent climate change and global warming to Hawaii's economy, public health, natural resources, and environment (http://hawaii.gov/dbedt/info/energy/greenhouse/). The general purpose of Act 234 is to establish and cost-effectively achieve state policy of greenhouse gas (GHG) emissions reductions and limits at or below the best estimates and updates of the inventory of Hawaii's greenhouse gas emissions estimates of 1990 emissions levels by January 1, 2020.

Hawaii's energy policies have gone through a major advance within the past 5 years. The Hawaii Clean Energy Initiative (HCEI), which has set the goal of transforming Hawaii's energy use to 70% clean energy by 2030. Hawaii's dependence on imported oil creates vulnerability for the state's economy which is greatly affected by the price volatility of this finite energy source. Recognizing the detrimental effects this oil dependency has on Hawaii's environment and local economy, the state signed a Memorandum of Understanding (Hawaiian Electric, 2008) with the U.S. Department of Energy (DOE) in January 2008, which established HCEI as a partnership bringing together local business leaders, policymakers, and industry experts to guide the Hawaii's transition to a clean energy economy.

The Memorandum of Understanding states:

Signaling agreement on key actions, the Hawaiian Electric Co. (HECO) family of utilities voluntarily agreed to a number of actions after extensive discussions with DBEDT and the USDOE. In the Energy Agreement, HECO and the state agreed to move from central-station, oil-based power to a more renewable, distributed- and intermittent powered system while preserving the stability of the grid, minimizing disruption, and keeping the utilities financially sound.

The Energy Agreement includes the following significant goals:

• Increasing Renewable Portfolio Standard goals to 25% by 2020 and 70% by 2030.
• Developing an Energy Efficiency Portfolio Standard.
• Accelerated addition of clean energy resources on all islands.
• Laying an undersea cable linking Oahu and wind farms on Molokai and/or Lanai.
• Establishing feed-in tariffs to standardize rates for utilities' purchase of renewable power.
• Decoupling utility revenue from electricity sales.
• Removing system-wide caps on net energy metering.
• New programs for solar water heating and photovoltaics.
• Aggressively supporting alternative fuel and electric vehicles.
• Installation of advanced meters for customers who request them.

A significant piece of legislation was passed in the 2009 under Act 190 that alters the state's permitting process. First, renewable energy facilities greater than 5 MW are now able to apply for the Renewable Energy Facility Siting (REFS) process from HB2971 HD1—a permitting and regulatory framework for the construction of renewable energy facilities in the state (this was formerly only offered to renewable energy facilities greater than 200 MW). Additionally, while the decision to award or deny permits is retained by the state or county agencies, new legislation allows the Energy Resource Coordinator in DBEDT to force a decision to either grant or deny permits by no later than 18 months after the approval of a complete permit application. A third step that was taken in the 2009 Hawaii Legislature was the passage of Act 155, which requires DBEDT to identify Renewable Energy Zones (REZ)—areas that are rich in renewables, cost effective, and environmentally benign—and encourage development of these REZs for transmission of renewable energy. DBEDT is in the process of determining these zones, which will foster much quicker land-use permitting processes (DBEDT, 2010).

About 90% of Hawaii's energy comes from crude oil and petroleum imports. Disruptions in the world oil market have a considerable impact on Hawaii's economy. Also, Hawaii utilities do not have interconnections with utilities in other states and cannot rely on utilities from other states to provide back-up power to them when needed. Development of Integrated Resource Planning and Renewable Portfolio Standards are thus important for Hawaii in an effort to reduce oil imports, increase diversity of energy sources and provide reliable electricity to end users.

In 2006 Act 162 granted the PUC may establish standards for each utility that prescribe what portion of the RPS shall be met by specific types of renewable electrical energy resources. RPS standards may be met through production of electricity by fuels as well as implementation of conservation measures that save energy

To address these issues The State of Hawaii adopted four statutory energy objectives (HRS § 226-18a):

> *(1) Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;*
> *(2) Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased;*
> *(3) Greater energy security in the face of threats to Hawaii's energy supplies and systems; and*
> *(4) Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use.*

The first Renewable Portfolio Standard (RPS) was enacted into law in Hawaii in 2001 (Act 272). The RPS law established the percentage of electricity sales that should come from renewable energy sources. It established the goal of 7% of electricity sales from renewable energy sources by December 31, 2003, 8% by December 31, 2005, and 9% by December 31, 2010. The Hawaii State Legislature revised the State's RPS law in 2004 with Act 95, which required each electric utility company to establish a renewable energy portfolio standard of 10% of its net electricity sales by December 31, 2010; 15% by December 31, 2015; and 20% by December 31, 2020. The RPS law allowed an electric utility company and its electric utility affiliates to aggregate their renewable portfolios in order to achieve the RPS.

(HRS § 269-91) defines renewable energy as: energy generated or produced utilizing the following sources:

(1) Wind;
(2) Sun;
(3) Falling water;
(4) Biogas (including landfill and sewage-based digester gas);
(5) Geothermal;
(6) Ocean water, currents, and waves;
(7) Biomass (including biomass crops, agricultural and animal residues and wastes, and municipal solid waste);
(8) Biofuels; and
(9) Hydrogen produced from renewable energy sources.

4.3 City and County of Honolulu Policies Supporting Alternative Energy

At the City and County level, land use guidelines are defined in a three-tiered system. The basis of the other guidelines is defined in the County General Plan which contains simple broad concepts that are further interpreted in the subsequent tiers. Four objectives in the Honolulu General Plan support the proposed action:

Objective A: Maintain an adequate, dependable, and economical supply of energy for residents.
Objective B: To conserve energy through the more efficient management of its use.
Objective C: To fully utilize proven alternative sources of energy.
Objective D: To develop and apply new, locally available energy resources.

The second level of policy is the Sustainable Communities Plan or Development Plan. Sustainable Communities Plans are prepared in districts that do not wish to be heavily developed. These plans generally describe more land uses that are not acceptable that uses that are acceptable. Only Urban Honolulu and Ewa have Development Plans indicating that they are more suitable for development. The proposed action is located in the Ewa District.

Ordinances and regulations pertaining to power generating and other land uses are contained in the Land-Use Ordinance (LUO) prepared by the Department of Planning and Permitting. The LUO regulates land use in a manner that will encourage orderly development, while also providing more specific development and design standards. Permitting requirements for compliance with the LUO include building, grading and Special Management Area (SMA) permits, which will be required for the proposed action.

5.0 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Affected Environment	Level of Concern	Impact and Mitigation
Water Resources and Drainage	low	*Impact:* Potential stormwater runoff during construction *Mitigation:* NPDES construction permitting with best management practices
Seismic and Geological	No	*None*
Soils and Agriculture	Low	*Impact:* Soil erosion during construction *Mitigation:* Grading permit to include Erosion Control Plan
Flora and Fauna	No	*None:* Area is previously disturbed and dominated by invasive species
Air Quality	Low	*Impact:* Fugitive dust during construction *Mitigation:* Grading Permit to include Dust Control Plan
Visual Character	No	The area is industrial and currently has no scenic vistas or unique view planes
Noise	No	Noise negligible during operation and consistent with surrounding during construction.
Odor	No	None
Social	No	*None:* area is vacant with use restrictions.
Historical and Archaeological	Low	*Impact:* Possible discovery during construction, but not likely due to previous grading and fill *Mitigation:* Employee training in the event of a discovery
Economic	Positive	*Impact:* reduces dependence on foreign oil and provides power at a stable, known cost.
Public Facilities and Services	Low	*Impacts:* Potential impacts on use and utility of Kalaeloa Runway 11 *Mitigation:* All studies indicate that glint/glare will not impact use. Structures beneath RPZ to be designed and operated in a manner that will promote aircraft safety. Construction to be halted when Runway 11 is needed.
Roads and Traffic	No	*Impact:* Traffic volumes will be negligible during both construction and operation.
Public Utilities	Positive	Proposed action provides power and does not utilize potable water, wastewater, or other services.
Consistency with Govt. Plans and Policies	Consistent	Eco-industrial designation in HCDA Kalaeloa Master Plan
Irretrievable Commitment of Resources	Positive	Does not utilize public funds and conserves fossil fuels.

5.1 Determination of Significance

In determining whether an action may have a significant effect on the environment under HRS 11-200, the proponent must consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action.

An action shall be determined to have a significant effect on the environment if it:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*

   The proposed action would not result in an irrevocable commitment, loss or destruction of any protected natural resource. No threatened or endangered species were identified within the development area. An archaeological reconnaissance conducted for the benefit of this EA concluded that there is no evidence of cultural or historical artifacts within the area of the proposed action.

2. *Curtails the range of beneficial uses of the environment;*

   The property has been previously graded and the land that would be used is currently vacant. In addition, the site is designated for development and eco-industrial use in the Kalaeloa Master plan. The proposed renewable energy project is an eco-industrial use. The site is beyond the end of a crosswind runway at Kalaeloa Airport, and therefore has restricted uses due to aircraft operations. It will separated by 1,200 feet and a fence from the end of the nearest runway. The fence and panels themselves will act as arresting gear in the event of an emergency landing that overruns the end of the runway. Instances that bring aircraft over the subject property at the critical time during takeoff are extremely rare due to prevailing wind and airport circulations patterns. The General Aviation Council of Hawaii (GACH) has concluded that the proposed action will not have an adverse impact on airport operations.

3. *Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;*

   The purpose of HRS 344 is to establish a state policy which will encourage productive and enjoyable harmony between people and their environment, promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, and enrich the understanding of the ecological systems and natural resources important to the people of Hawaii. The renewable energy project would potentially reduce Hawaii's reliance on fossil fuels to produce energy and reduce the amount of greenhouse gases generated from energy production. It would not have direct adverse impacts land, water, mineral, visual, air and other natural resources. The

proposed action will provide services to benefit the health and welfare of the population and DHHL beneficiaries.

4. *Substantially affects the economic welfare, social welfare, and cultural practices of the community or State;*

   The proposed action has beneficial impacts on socioeconomics during construction related to employment opportunity and purchase of materials. During operations, the benefit to social welfare of the community and State would be realized cumulatively as other renewable energy projects are developed decreasing the State's reliability on fossil fuels for energy production. There would be new fulltime jobs created.

5. *Substantially affects public health;*

   During both construction and operation of the proposed project, no adverse impacts to public health are anticipated. Construction and operation would be compliance with all federal, state, and county regulations. The proposed project would not have any significant adverse effects on public health and welfare and would contribute to decreasing greenhouse gas emissions, a positive effect on public health.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities;*

   Secondary impacts are defined as those displaced in time or space from the proposed action, yet resulting directly from the action. No substantial changes in population, traffic or land-use are envisioned. The potential effect on airport operations at JRF are found to be minor and restricted to periods of construction. These potential impacts will be mitigated by removing work crews and equipment during periods when the runway is needed.

7. *Involves a substantial degradation of environmental quality;*

   Temporary impacts associated with construction will be mitigated through best management practices. These impacts ambient noise and fugitive dust are not expected to be substantial or lasting. During operations the level of use is not expected to result in degradation of the quality of life or the environment within the community.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;*

   Photovoltaic installations are becoming more common on Oahu, but the proposed action is not part of a larger development. Construction of the facility implies commitment of personnel and funding to support its operation.

9. *Substantially affects a rare, threatened, or endangered species, or its habitat;*

A letter to the US Fish and Wildlife Service in June 2010 did not identify any special-status species or critical habitats located on the subject property.

10. *Detrimentally affects air or water quality or ambient noise levels;*

    Temporary impacts associated with construction will be mitigated through best management practices. These impacts ambient noise and fugitive dust are not expected to be substantial or lasting. During operations the level of use is not expected to result in degradation of the quality of life or the environment within the community

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;*

    The site is located in FEMA flood zone D and is outside the 100-year floodplain. It is also outside the Oahu Civil Defense Tsunami inundation zone. Soils are relatively porous and surface water runoff conditions are limited to heavy rain events. The project site is close to one mile north of the nearest surface water at the coastline of southwest Oahu. No sensitive environments were discovered on or near the subject property.

12. *Substantially affects scenic vistas and view planes identified in county or state plans or studies; or,*

    No scenic vistas or unique view planes will be affected by the proposed action.

13. *Requires substantial energy consumption.*

    The proposed project would require some electrical consumption during construction. However, it would not require substantial energy consumption, but in fact would provide a total of 5.0 MW of electricity to HECO's existing power grid, thus contributing to the trend of decreasing Hawaii's dependence on petroleum based electricity.

Based on analysis of the 13 significance criteria listed above, the proposed action is not expected to result in significant adverse environmental impacts when conducted within the constraints of the required plans and permits. Comments received from the public and various agencies during this DEA review period, did not provide new information to conflict with this conclusion. Based on the assessment conducted in consideration of HRS 343, the Department of Hawaiian Home Lands (approving agency) concludes that a Finding of No Significant Impacts (FONSI) is appropriate.

6.0 COMMENTS AND COORDINATION

6.1 Agencies and Organizations Contacted

The following agencies were contacted for assistance during preparation of the Draft Environmental Assessment.

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Mr. Robert Mills
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City and County of Honolulu
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6.2 Public Coordination and Individuals Consulted

The following individuals and public interest groups were contacted for assistance during preparation of the Draft Environmental Assessment.

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Ms. Shirley Swinney, President
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Ms. Michelle Kauhane, President
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Ms. R. Homelani Schaedel, President
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Mr. Shad S. Kane
Cultural Resources Specialist

Ms. Beth Law
Cultural Resources Specialist
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6.3 Comments Received on the Draft Environmental Assessment

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Mr. Brian Daniel, Pilot (3)

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Mr. Robert Van Wagoner
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Colin K. Perry
91-215 Ewa Beach Rd.
Ewa Beach, HI 96706

Mr. Henry Greene via email
Mr. Bill Plum via email

Letter responses have been prepared and sent to each commenter. These responses appear in Appendix A. A meeting was held on May 5 for the benefit of the General Aviation Council of Hawaii and other interested parties. Email invitations were sent to all respondents and known stakeholders. As a result of the meeting the GACH prepared a letter stating that there were no objections to the project subject to further cooperation with Tower personnel to avoid unnecessary shutdown of Runway 11 during construction and maintenance.

7.0 LIST OF DOCUMENT PREPARERS

Kalaeloa Home Lands Solar, LLC Ms. Jody Allione, Project Development Manager and staff of AES Solar, LLC supplied information and technical details that were invaluable for preparation of this Environmental Assessment.

Document preparation and technical research was done by:

North Shore Consultants, LLC David Robichaux, Project Manager
Ming-Li Wang and Janine K. Seymour, Contributing Authors.
Archaeological review was done by Rechtman Consulting, LLC; Bob Rechtman, Principal

8.0 BIBLIOGRAPHY

Athens, J.S., J. Ward, H.D. Tuggle, and D.J. Welch. 1997. Environment, Vegetation Change, and Early Human Settlement on the Ewa Plain: A Cultural Resource Inventory of Naval Air Station Barbers Point, Oahu, Hawaii, Part III: Paleoenvironmental Investigations. Prepared for the Department of Navy, Pacific Division, Naval Facilities Engineering Command.

Environmental Law Institute (2009) Adenike Adeyeye, James Barrett, Jordan Diamond, Lisa Goldman, John Pendergrass, and Daniel Schramm. Estimating U.S. Government Subsidies to Energy Sources: 2002-2008"

Federal Aviation Administration (1999) Advisory Circular. 150/5300. Airport Design Paragraph 5.b Appendix 14

Federal Aviation Administration (2010a) Airport Information Effective June 30, 2011 http://www.airnav.com/airport/PHJR

Federal Aviation Administration (2010b) Technical Guidance for Evaluating Selected Solar Technologies on Airports. FAA Airport Planning and Environmental Division (APP-400) 800 Independence Avenue SW, Washington D.C. 20591

Hawaii Community Development Authority (2006). Kalaeloa Master Plan. Prepared by Belt Collins, EDAW, SMS, BAE, and Ebisu. March 2006.

Hawaii Department of Agriculture (1977) Agriculture Lands of Importance, State of Hawaii.

Hawaii Department of Business, Economic Development, and Tourism (2010a). Hawaii Proposed and Existing Renewable Projects, PowerPoint presentation. December 2010.

Hawaii Department of Business, Economic Development, and Tourism (2010b), Progress Report to the Governor and the Legislature Pursuant to SECTION 196-41, Hawaii Revised Statutes (HRS) Submitted by The State of Hawaii Department of Business, Economic Development and Tourism January 4, 2010. http://hawaii.gov/dbedt/main/about/annual/2010-reports/rps2010.pdf

Hawaii Department of Hawaiian Home Lands (2011), Draft Environmental Assessment Kalaeloa Solar One and Two. Prepared by TEC, Inc. 1003 Bishop St, Suite 1550 Honolulu, HI 96813

Hawaiian Electric, 2008 Energy Agreement among the State of Hawaii, division of Consumer Advocacy of the Department of Commerce and Consumer Affairs and The Hawaiian Electric Companies. http://www.heco.com/vcmcontent/StaticFiles/pdf/HCEI.pdf

Sovacool, Benjamin K. (2010). A Critical Evaluation of Nuclear Power and Renewable Electricity in Asia, *Journal of Contemporary Asia*, Vol. 40, No. 3, August 2010

TEC Inc. 2010b. Phase 1 Environmental Site Assessment (ESA) for 56 Acres of Land within TMK: [1]9-1-13: Parcel 28, Kapolei, Hawaii. December 2010.

US Energy Information Administration (2011). Annual Energy Outlook, 2011; DOE/EIA-0383 2010. December 2010.

US Navy (2008). Final Environmental Impact Statement. Conveyance of Navy Retained Land and Utility Systems, Kalaeloa, Oahu, Hawaii, dated July 2008

Appendix A

Comments received from Agencies and Interested Parties During and after Preparation of the DEA

NORTH SHORE CONSULTANTS, LLC

Participant

Dear Participant:

The purpose of this letter is to inform you of a proposed Photovoltaic Park to be constructed in your community, and to request information that is relevant to potential environmental impacts or issues that may affect your quality of life. This proposed development will be the subject of an Environmental Assessment required by HRS 343. The Draft Environmental Assessment (DEA) will be published within the next few months. Following publication there will be a 30-day official comment period; however, because you have participated in previous community outreach efforts, I ask that you assist with the development of the DEA by providing comments or questions early in the process. You will receive a copy of the DEA and have a second chance to comment at that time.

Project Location and Description

AES Solar Power, LLC has proposed to build a 3.75 MW solar power photovoltaic system on approximately 29 acres located at the end of the cross-wind runway at John Rogers field (Kalaeloa airstrip) as shown in Figure 1. The photovoltaic system will be a series of ground supported flat panels mounted on tracking mechanisms which allow the panels to follow the sun in order to maximize power output. Each panel is 39 inches wide and 66 inches long dark in color and stand between 4 and 8 feet above ground level. The maximum height varies throughout the day as panels move to maintain the best sun angle. Similar tracker-mounted panels are shown in Figure 2. Approximately 15,840 panels will be required to produce an average of 3.75 MW of peak power. The glass on each panel is treated with a coating to absorb most glint and glare. Studies have shown that the reflectivity of this type of PV panel is acceptable for installation near airports.

All-weather gravel roads will be constructed around the site perimeter and between rows of solar panels. The facility will be unmanned except for regular maintenance activities such as mowing or landscaping. No employee housing or other habitable structures will be constructed on the site. The installation does not emit noise, dust, or odors during operation. Electrical power is produced during daylight hours; however, in the traditional sense the hours of operation cannot be determined without instrumentation. Alternating Current (AC) electric power will be transmitted to the nearby JRF substation on the north boundary of the subject property using underground transmission lines.

Each written comment will be reproduced and addressed in the DEA. If you would like to discuss the proposed project or provide less formal comments please call or email me at your convenience.

Thank You,

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

Agency

AES Solar Power, LLC Proposed PV Park
TMK# 9-1-013:029 Kalaeloa, Hawaii

North Shore Consultants is beginning an Environmental Assessment under HRS 343 for a proposed photovoltaic park to be located near the west end of Runway 11/29 Kalaeloa Airport (JRF). As a user or stakeholder in JRF, we request your participation with the development of the Draft Environmental Assessment (DEA) through consultation or by providing comments early in its development.

Project Location and Description

AES Solar Power, LLC has proposed to build a 3.75 MW solar power photovoltaic system on approximately 29 acres located at the end of the cross-wind runway at John Rogers field (Kalaeloa airstrip) as shown in Figure 1. The photovoltaic system will be a series of ground supported flat panels mounted on tracking mechanisms which allow the panels to follow the sun in order to maximize power output. Each panel is 39 inches wide and 66 inches long dark in color and stand between 4 and 8 feet above ground level. The maximum height varies throughout the day as panels move to maintain the best sun angle. Similar tracker-mounted panels are shown in Figure 2. Approximately 15,840 panels will be required to produce an average of 3.75 MW of peak power. The glass on each panel is treated with a coating to absorb most glint and glare. A glint/glare study has been performed and is available upon request. It concludes that the reflectivity of this type of PV panel is acceptable for installation near airports.

All-weather gravel roads will be constructed around the site perimeter and between rows of solar panels. The facility will be unmanned except for maintenance activities such as mowing or electrical maintenance. No employee housing or other habitable structures will be constructed on the site. The installation does not emit noise, dust, or odors during operation. Alternating Current (AC) electric power will be transmitted to the nearby JRF substation on the north boundary of the subject property using underground transmission lines.

Each written comment will be reproduced and addressed in the DEA. If you would like to discuss the proposed project or schedule a meeting, please call or email me at your convenience.

Thank You,

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

GACH AIR SCOOP
THE NEWSLETTER OF

General Aviation Council of Hawaii
WWW.GACH.US.COM

90 Nakolo Place
Suite 117
Honolulu, Hawaii 96819

August 17, 2011

North Shore Consultants, LLC
PO Box 790
Haleiwa, Hawaii 96712
Attn.: David M. Robichaux

Dear Mr. Robichaux,

Thank you for giving the pilots of the General Aviation Council of Hawaii (GACH) an opportunity to comment on the AES Solar Power, LLC Proposed PV Park at TMK# 9-1-013:029 at Kalaeloa Airport. The General Aviation Council of Hawaii is made up of pilots and businesses that support and participate in general aviation throughout the Hawaii Islands. The greatest share of our membership is from Oahu. We asked our membership for comments on your project based upon the information that you provided us in your June 2011 letter and subsequent email with project specifics attached.

GACH is very supportive of renewable energy projects that assist Hawaii in becoming less energy dependent. However, two concerns were highlighted by our aviation community. The first concern is the location of the project in reference to Runway 11/29 at Kalaeloa Airport. The project appears to be in line with the runway's centerline which seriously impacts the runway's safety area. The RSA is an area of an airport where out buildings, facilities, and other structures are not built in order to improve pilot/airplane survivability in case of an off –runway landing or overshoot. The proposed structures by AES Solar Power at or near the Runway 11/29 RSA would be a detriment to aviation safety. Secondly while even the provided study appears very through, the aviation community expressed concern with the glint and glare of the panels when on takeoff, approach or landing at Kalaeloa Airport. More information needs to be provided to the aviation community before a final determination can be made.

Again, thank you giving the general aviation community an opportunity to address your project. Please keep us informed of project changes that could mitigate our concerns or that change or expand the project which would cause a new review. If you would like to discuss our comments, please email me at info@gach.us.com or call me at 808-223-9991.

Thank you,

Robert P. Moore, President
General Aviation Council of Hawaii

GACH AIR SCOOP
THE NEWSLETTER OF
General Aviation Council of Hawaii
WWW.GACH.US.COM

Post Office Box 75623
Kapolei, Hawaii 96707

March 23, 2012

North Shore Consultants, LLC
PO Box 790
Haleiwa, Hawaii 96712
Attn.: David M. Robichaux

Dear Mr. Robichaux,

Thank you for giving the General Aviation Council of Hawaii (GACH) again an opportunity to comment on the AES Solar Power, LLC Proposed PV Park at TMK# 9-1-013:029 at Kalaeloa Airport. The General Aviation Council of Hawaii, made up of pilots in Hawaii, is still very supportive of solar production as an alternate energy source. However, we are very concerned with the proposed location of your PV field at the end of an active runway.

Your report states that the PV panels due not interfere with the runway's protection zone (RPZ). The RPZ computation was based upon the current runway displaced threshold and not the end of the runway which may be reclaimed for runway use. Also the 10 foot PV panel height was used in the computation but no reference was made to a facility (building) in your plat view that is shown directly in line with the runway centerline. Neither the design nor the report gives any specific information regarding this facility. Also a misstatement is made in your report that Kalaeloa's runway 11 is used for departures and runway 29 is for arrivals only. This was changed last year to a fully active runway 11/29 use; both arrivals and departures are made from both runway directions. Having these structures directly in line and next to an active runway severely reduces aviation safety in case of an airplane undershoot or overshoot. I would imagine that the solar PV panel owners, designers, and others could be liable for any aircraft accident that would occur with these panels.

Secondly while even the provided study appears very through, the aviation community expressed concern with the glint and glare of the panels when on takeoff, approach or landing at Kalaeloa Airport. The references in your report for PV panel installation at other airports do not state where on/near the airport the panels are located. The Denver airport array is not in line and at an approach/departure end of an active runway. Further, your report does state that there is a glare from the panels, albeit minor. Building a known reflector on the approach of a runway while the pilot is making critical maneuvers for landing again opens up the PV panel owners to possible liability if an aircraft accident is caused directly or indirectly due to panel glare.

Also raised by pilots reviewing the report is the concern that heat is generated by these PV panels. GACH does not have any data concerning this but would be interested if there is any data on how much heat is generated above the PV panels.

Airplanes while landing are trying to decrease lift on their wings. A strong heat source on the short approach to a runway could have consequences for an airplane trying to land (losing lift) while heat rising from PV panels have the affect of lifting the airplane when it should it descending. Any information on this possible phenomenon would be appreciated.

With all the concern raised by the aviation community, request you consider moving this PV panel field away from the approach to any runways for safety. If you would like to discuss our comments, please email me at info@gach.us.com or call me at 808-223-9991.

Thank you,

Robert P. Moore, President
General Aviation Council of Hawaii

cc: Todd V. Gray, Land Agent
Department of Hawaiian Home Lands
PO Box 1879
Honolulu, Hawaii 96805

Office of Environmental Quality Control
235 South Beretania Street
Suite 702
Honolulu, Hawaii 96813

GACH AIR SCOOP
THE NEWSLETTER OF

General Aviation Council of Hawaii
WWW.GACH.US.COM

Post Office Box 75623
Kapolei, Hawaii 96707

May 17, 2012

North Shore Consultants, LLC
PO Box 790
Haleiwa, Hawaii 96712
Attn.: David M. Robichaux

Dear Mr. Robichaux,

Thank you for the opportunity for the General Aviation Council of Hawaii (GACH) to participate in your presentation and discussions on the purposed solar project adjacent to Runway 11/29 at Kalaeloa Airport on May 5, 2012. You will recall that our Board of Director member Joseph Kiefer attended on behalf of GACH. We wished that there were more members at your meeting and again I apologize that I could not be there due to another aviation commitment.

Based on the information you presented at that meeting, the General Aviation Council of Hawaii has no objection to the purposed project as described. This position assumes that you will follow through with your expressed intention to work closely with the General Aviation Council of Hawaii, the Airports Division, Department of Transportation, State of Hawaii and the FAA Air Traffic Control personnel to insure that construction and operation of the solar facility will have the least reasonably possible impact on Runway 11/29 operations.

If you would like to discuss our comments, please email me at info@gach.us.com or call me at 808-223-9991.

Thank you,

Robert P. Moore, President
General Aviation Council of Hawaii

NORTH SHORE CONSULTANTS, LLC

Mr. Rob Moore, President GACH
c/o Gavin Flight Services Hawaii
91-1259 Midway Road
Hanger 111
Kapolei, Hawaii 96707

May 18, 2012

Dear Mr. Moore:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands have considered your concerns over glint and glare as well as compatible land uses and have modified the Final Environmental Assessment (FEA) to respond to your comments.

Contrary to popular belief there is not much land available for development of utility-scale PV parks, and demand for these sites is relatively high. The proposed location near the end of Runway 11-29 is restricted to unmanned passive uses for which photovoltaic installations are among the few that are compatible.

Concerns over glint and glare have been addressed by a professional engineering company and are understood to occur over a quite limited range of space and time and be overshadowed by glare from the ocean and other existing structures. Glass used in PV installations is quite different from window glass in the amount of light reflected instead of absorbed. PV panels absorb almost all incident light.

Collision hazards are reduced by the distance from the end of the runway, the existing perimeter fence, and the frequency that Runway 11-29 is utilized. Fences at the end of the airport property now serve as arresting gear for an emergency overrun on takeoff. Upon completion of the PV Park the truss structures supporting the panels will be made of light gage galvanized steel that is designed to serve a similar function. The proponent is also investigating the use of shear bolts in structures that are near the centerline of the runway. We understand that takeoffs toward the west from Runway 11-29 have been restricted until recently and are now allowed but used infrequently.

Our May 5, 2012 meeting with representatives of the General Aviation Council of Hawaii was very helpful in understanding each other`s concerns. Thank you for sending representatives and for preparing the letter stating that they were not opposed to the development contingent on the proponent cooperation with airport operators to keep the runway open during periods of construction and maintenance. Kalaeloa Homelands Solar will continue to work closely with pilots and airport personnel to keep Runway 11-29 open and available and to promote smooth and efficient airport operations.

Thank you again for elevating these issues during the public review process and representing your association with such diligence.

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

David Robichaux

From: Brian Daniel <nairb@lava.net>
Sent: Saturday, July 16, 2011 9:58 PM
To: robichaud001@hawaii.rr.com
Cc: Coiln Perry; Colby Jones; Anthony Ferrara; Rob Moore
Subject: Photovoltaic panels and supporting structures in harm's way

Dear Dave Robichaux;

At every other airport in this state, and nationwide, there is a grass buffer zone on the approach end of every runway for a very good reason. Why put the solar panel farm directly in line with and very close to an active runway? There is lots of Keawe bush all around Kaleloa, can't the solar panel farm be located off to the side, a safe distance from landing and takeoff air traffic? My concern is not only for myself and my airplane, but also for the solar panels, they are expensive, if they are so expendable as to put them directly in the sights of fast aluminum hurtling down a runway, then why not put them on my roof where they will be protected from such hazards?

Brian Daniel
3031 Manoa Road
Honolulu, Hawaii 96822

Dave Robichaux

From: Brian Daniel <nairb@lava.net>
Sent: Sunday, March 18, 2012 10:07 PM
To: Robichaud001@hawaii.rr.com; Todd.v.gray@hawaii.gov; oeqc@doh.hawaii.gov; info@gach.us.com; Colin Perry
Subject: Kaleloa Runway 29 Obstruction

Hello:

The Environmental Impact Statement for this project does not adequately address the danger of placing solar panels, supporting structures, inverters, transformers, and their cabinets in the crosshairs of high speed aluminum. Why couldn't this tiny solar farm be placed off to the side of this long preexisting active runway? Why design it so that the 5 megawatt inverter cabinet is located dead center where every runway 29 landing and takeoff is pointed directly at it?
Heavy military aircraft routinely land and take off at Kaleloa, a runway overrun could wipe out your project and lead to property damage, injury and possible loss of life, and this EIS will be referred to in the following legal proceedings. Please locate your solar panels and especially the inverter cabinet off to the side and not directly and deliberately in harm's way.

Brian Daniel
3031 Manoa Road
Honolulu, Hawaii 96822

NORTH SHORE CONSULTANTS, LLC

Mr. Brian Daniel,
3031 Manoa Road
Honolulu, Hawaii 96822

May 18. 2012

Dear Mr. Daniel:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands have considered your concerns over glint and glare as well as compatible land uses and have modified the Final Environmental Assessment (FEA) to respond to your comments. As a result of your letter the site layout has been changed to move the transformer cabinets to the edge of the property, out of the centerline area.

Contrary to popular belief there is not much land available for development of utility-scale PV parks, and demand for these sites is relatively high. The proposed location near the end of Runway 11-29 is restricted to unmanned passive uses for which photovoltaic installations are among the few that are compatible.

Concerns over glint and glare have been addressed by a professional engineering company and are understood to occur over a quite limited range of space and time and be overshadowed by glare from the ocean and other existing structures. Glass used in PV installations is quite different from window glass in the amount of light reflected instead of absorbed. PV panels absorb almost all incident light.

Collision hazards are reduced by the distance from the end of the runway, the existing perimeter fence, and the frequency that Runway 11-29 is utilized. Fences at the end of the airport property now serve as arresting gear for an emergency overrun on takeoff. Upon completion of the PV Park the truss structures supporting the panels will be made of light gage galvanized steel that is designed to serve a similar function. The proponent is also investigating the use of shear bolts in structures that are near the centerline of the runway. We understand that takeoffs toward the west from Runway 11-29 have been restricted until recently and are now allowed but used infrequently.

Our May 5, 2012 meeting with representatives of the General Aviation Council of Hawaii was very helpful in understanding each other`s concerns. As a result of that meeting the GACH prepared a letter stating that they were not opposed to the development contingent on the proponent cooperation with airport operators to keep the runway open during periods of construction and maintenance. Kalaeloa Homelands Solar will continue to work closely with pilots and airport personnel to keep Runway 11-29 open and available and to promote smooth and efficient airport operations.

Thank you again for elevating these issues during the public review process.

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

Dave Robichaux

From: harry greene <kamikazeman2002@yahoo.com>
Sent: Monday, April 02, 2012 1:34 PM
To: Robichaud001@hawaii.rr.com; Todd.v.gray@hawaii.gov; oeqc@doh.hawaii.gov
Subject: Comment- Kalaeloa Home Lands Solar Project

Comment- Kalaeloa Home Lands Solar Project

To whom it may concern,

Aloha and thank you for taking a green initiative to help sustain Oahu's ever growing power demand. I have a few concerns and possible solutions for the project as currently proposed:

1. By putting the project in close proximity to the runway overrun there is nowhere for an aircraft to go in an emergency except for through the solar array. This creates an extremely life threatening situation for aircraft passengers and the would be crash/fire rescue team having to work inside a live electrical grid to extract anyone involved in an accident at the end of the runway.
2. By putting the project so close to the runway the entire array will be subjected to hurricane force winds on every takeoff and landing due to the aerodynamic wing tip vortices generated by the aircraft using the runway as well as prop/rotor wash from the aircraft's power plant.
3. Putting a non-compatible land use project so close to the runway may void federal standards for aviation funding that the airport currently receives. Losing the airport funding could have dire consequences to the future viability of the airport which would have a direct impact on Honolulu International's only Oahu back up airport, thus impacting statewide aviation activities.

Possible solutions:

1. Move the array laterally so as not to be directly in line with the runway.
2. Move the array back at least 2000 feet from the end of the runway to help allow a safety zone for aircraft and to reduce array damage due to vibration and wing tip vortices from aircraft operating on the runway.
3. Contact the Federal Aviation Administration to ensure their input regarding compatible land use policy. They also can assist with the planning process.

Again I really like the idea of Oahu moving towards a more sustainable energy policy but I would hate to lose the use of this runway after years of trying to regain access to it because of a minor oversight.

Sincerely,

Harry Greene
650-863-6366

David M. Robichaux
PO Box 790
Haleiwa, HI 96712

Robichaud001@hawaii.rr.com

Todd V. Gray, Land Agent
Department of Hawaiian Home Lands
PO Box 1879
Honolulu, HI 96805
Todd.v.gray@hawaii.gov

Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813
oeqc@doh.hawaii.gov

NORTH SHORE CONSULTANTS, LLC

Mr. Henry Greene
via email

May 18, 2012

Dear Mr. Greene:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands have considered your concerns over glint and glare as well as compatible land uses and have modified the Final Environmental Assessment (FEA) to respond to your comments.

Contrary to popular belief there is not much land available for development of utility-scale PV parks, and demand for these sites is relatively high. The proposed location near the end of Runway 11-29 is restricted to unmanned passive uses for which photovoltaic installations are among the few that are compatible.

Concerns over glint and glare have been addressed by a professional engineering company and are understood to occur over a quite limited range of space and time and be overshadowed by glare from the ocean and other existing structures. Glass used in PV installations is quite different from window glass in the amount of light reflected instead of absorbed. PV panels absorb almost all incident light.

Collision hazards are reduced by the distance from the end of the runway, the existing perimeter fence, and the frequency that Runway 11-29 is utilized. Fences at the end of the airport property now serve as arresting gear for an emergency overrun on takeoff. Upon completion of the PV Park the truss structures supporting the panels will be made of light gage galvanized steel that is designed to serve a similar function. The proponent is also investigating the use of shear bolts in structures that are near the centerline of the runway. We understand that takeoffs toward the west from Runway 11-29 have been restricted until recently and are now allowed but used infrequently.

Appendix C of the FEA shows a letter from the FAA office of Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) stating that the proposed project does not constitute a hazard to airport operations.

Our May 5, 2012 meeting with representatives of the General Aviation Council of Hawaii was very helpful in understanding each other`s concerns. Thank you for sending representatives and for preparing the letter stating that they were not opposed to the development contingent on the proponent cooperation with airport operators to keep the runway open during periods of construction and maintenance. Kalaeloa Homelands Solar will continue to work closely with pilots and airport personnel to keep Runway 11-29 open and available and to promote smooth and efficient airport operations.

Thank you again for elevating these issues during the public review process.

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

Dave Robichaux

From: Colin K. Perry <perryc001@hawaii.rr.com>
Sent: Saturday, March 17, 2012 7:36 AM
To: Robichaud001@hawaii.rr.com; Todd.v.gray@hawaii.gov; oeqc@doh.hawaii.gov
Cc: 'James Pratt'; robert.ramos@hawaii.gov
Subject: Proposed PV Project on the Approach End of RWY 11 at JRF

Sirs,

I am a retired airline pilot and active general aviation pilot and tenant at Kalaeloa Airport. I consider myself an active conservationist and am generally in favor of alternative energy sources for Hawaii. After reading your report in its entirety,

I believe you are taking a huge risk trying to place a PV farm so close to the approach and departure end of RWY 11/29.

Kalaeloa airport is used extensively for student pilot training and general aviation currency training in ***single*** engine aircraft. The likelihood of an engine failure after takeoff or during approach is much greater than with multi the engine aircraft that will be using the RWY 4/22 parallels. The recent opening of RWYs 11/29 for both takeoffs and landings will provide a dramatic increase in the use of these runways. A lot of local pilots have fought for years trying to open these runways for unrestricted light aircraft use because of prevailing winds. Not only the aircraft survivability and pilot safety issues are involved with your venture, but the likelihood of economic loss and liability claims are a real possibility for your entity. Glare issues addressed in your report while possibly not a flying safety concern, could well be, considering the multiple aircraft in the pattern flying on different headings and at different altitudes at any one time. It wouldn't take too many pilot reports/complaints to the FAA to cause them to take action against you. I would suggest that you seriously consider moving your project off the centerline, or at least provide a extended runway clear zone in between your panel placement. The clear zone should be at least the runway width. Alternatively, you could move the entire project to a less controversial site, as did the PV developers at the old MCAS Ewa for historical reasons

Respectfully,

Colin K. Perry

91-215 Ewa Beach Rd.

Ewa Beach, HI 96706

ewakahuna@gmail.com

808-689-3055

Cell 271-3960

NORTH SHORE CONSULTANTS, LLC

Colin K. Perry
91-215 Ewa Beach Rd.
Ewa Beach, HI 96706

May 18, 2012

Dear Mr. Perry:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands have considered your concerns over glint and glare as well as compatible land uses and have modified the Final Environmental Assessment (FEA) to respond to your comments.

Contrary to popular belief there is not much land available for development of utility-scale PV parks, and demand for these sites is relatively high. The proposed location near the end of Runway 11-29 is restricted to unmanned passive uses for which photovoltaic installations are among the few that are compatible.

Concerns over glint and glare have been addressed by a professional engineering company and are understood to occur over a quite limited range of space and time and be overshadowed by glare from the ocean and other existing structures. Glass used in PV installations is quite different from window glass in the amount of light reflected instead of absorbed. PV panels absorb almost all incident light.

Collision hazards are reduced by the distance from the end of the runway, the existing perimeter fence, and the frequency that Runway 11-29 is utilized. Fences at the end of the airport property now serve as arresting gear for an emergency overrun on takeoff. Upon completion of the PV Park the truss structures supporting the panels will be made of light gage galvanized steel that is designed to serve a similar function. The proponent is also investigating the use of shear bolts in structures that are near the centerline of the runway. We understand that takeoffs toward the west from Runway 11-29 have been restricted until recently and are now allowed but used infrequently.

Our May 5, 2012 meeting with representatives of the General Aviation Council of Hawaii was very helpful in understanding each other`s concerns. Thank you for sending representatives and for preparing the letter stating that they were not opposed to the development contingent on the proponent cooperation with airport operators to keep the runway open during periods of construction and maintenance. Kalaeloa Homelands Solar will continue to work closely with pilots and airport personnel to keep Runway 11-29 open and available and to promote smooth and efficient airport operations.

Thank you again for elevating these issues during the public review process. I was disappointed that you could not attend the GACH meeting.

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

Dave Robichaux

From: Bill Plum <wplum@plumlaw.com>
Sent: Monday, April 02, 2012 5:35 PM
To: Robichaud001@hawaii.rr.com; oegc@doh.hawaii.gov; Todd.v.gray@hawaii.gov
Subject: PV System - Kalaeloa Airport, Kapolei, HI

Dear Mr. Robichaux, Mr. Gray and the Office of Environmental Quality Control:

I write in opposition to the placement of photo voltaic panels ("PV Panels") at the immediate end of runway 11 at the Kalaeloa Airport, Kapolei, Hawaii. I am a private pilot and while I support the concept of alternative energy sources, the current location of the proposed project could not be more ill planned. More specifically, it is critical that the areas at each end of a runway be kept free of manmade obstructions, even low level ones, whenever possible. The reason for this is simple, if an airplane loses power in one or more of its engines during the takeoff or landing phase of a flight, the pilot usually has one option, and that is to put the aircraft down in the area in straight front of him or her. If the area is reasonably clear and level, a safe landing can accomplished. If the area is not, death or serious injury is likely to occur. Put another way, the last thing a pilot wants see when facing having to land a disabled aircraft is a field of metal framework supporting hundreds of solar panels. On the other hand, the situation is quite different if a plane loses power at cruising altitude. In the later situation, the pilot usually has more options, due to that extra altitude, to choose from.

Furthermore, this airport is used as a *training* airport, with many of the airplanes staying in the traffic pattern to practice repeated landings and takeoffs. That means the field's use is at a very low altitude with many new pilots or pilots learning to fly new types of planes. Should a plane in the pattern lose power, a quick turn to runway 11 could very well be in order to save the life of the pilot and/or passenger. Please keep in mind; even if the pilot has practiced power off landings a hundred times, judging a power off rate of decent is still a tricky thing to do. It would be of no surprise to hear that a pilot making an emergency turn to runway 11 ended up landing short of the runway threshold and crashed into the PV Panels.

Even if a mechanical failure does not come into play, a human failure may. For instance, a simple error in calculating a rate of decent or length of a roll out in a non-emergency landing could make those extra few hundred feet at the end of the runway priceless. Do some simple research and you will find that landing and takeoff phases of aviation are where the majority of the injury related accidents occur. In comparison, what do you think the odds are that these same panels would be approved at the immediate ends of any of the runways at Honolulu International Airport?

From a legal prospective, if a family came to me with the loss of a loved one, whether it be a pilot or a passenger(s), who died during a landing because the decedent was in a plane that hit the PV Panels, I would find it most interesting to learn that comments made by people familiar with aviation warned the state of exactly this outcome. The local press may also find the same information of interest.

Lastly, while the studies presented say glare from the PV Panels will be little to no problem, I am not so easily convinced. If the panels are installed and they create a glare problem, is the state willing to pay to have the panels removed?

In closing, I offer a flight in my plane to anyone who is part of the decision making process to see firsthand what I, and others pilots in opposition to this plan, are talking about.

Thank you.

Bill Plum
The Plum Law Office, ALC
(808) 528-0050 (direct)
(808) 282-0636 (c)
(808) 524-3355 (fax)

NORTH SHORE CONSULTANTS, LLC

Mr. Bill Plum
The Plum Law Office, ALC
Via email

May 18, 2012

Dear Mr. Plum:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands have considered your concerns over glint and glare as well as compatible land uses and have modified the Final Environmental Assessment (FEA) to respond to your comments.

Contrary to popular belief there is not much land available for development of utility-scale PV parks, and demand for these sites is relatively high. The proposed location near the end of Runway 11-29 is restricted to unmanned passive uses for which photovoltaic installations are among the few that are compatible.

Concerns over glint and glare have been addressed by a professional engineering company and are understood to occur over a quite limited range of space and time and be overshadowed by glare from the ocean and other existing structures. Glass used in PV installations is quite different from window glass in the amount of light reflected instead of absorbed. PV panels absorb almost all incident light.

Collision hazards are reduced by the distance from the end of the runway, the existing perimeter fence, and the frequency that Runway 11-29 is utilized. Fences at the end of the airport property now serve as arresting gear for an emergency overrun on takeoff. Upon completion of the PV Park the truss structures supporting the panels will be made of light gage galvanized steel that is designed to serve a similar function. The proponent is also investigating the use of shear bolts in structures that are near the centerline of the runway. We understand that takeoffs toward the west from Runway 11-29 have been restricted until recently and are now allowed but used infrequently. Your point on emergency landings is well taken and is placed in the record for consideration.

Our May 5, 2012 meeting with representatives of the General Aviation Council of Hawaii was very helpful in understanding each other`s concerns. Thank you for sending representatives and for preparing the letter stating that they were not opposed to the development contingent on the proponent cooperation with airport operators to keep the runway open during periods of construction and maintenance. Kalaeloa Homelands Solar will continue to work closely with pilots and airport personnel to keep Runway 11-29 open and available and to promote smooth and efficient airport operations.

Thank you again for elevating these issues during the public review process.

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

Dave Robichaux

From: Robert Van Wagoner <scatbat@me.com>
Sent: Sunday, March 18, 2012 12:00 PM
To: Robichaud001@hawaii.rr.com
Cc: Todd.v.gray@hawaii.gov; oeqc@doh.hawaii.gov
Subject: Feared hazard to flight by Kapolei PV farm

Rob,

I have been giving your campaign a lot of thought.

In my opinion the reduction in pollutants and savings of fossil fuels far outweighs any annoyance from possible "glint and glare", etc. We have 14 PV panels that power our home and reduce our bill from MECO to $17/mo. The glass is purposefully non-glare to absorb as much light as possible. There is very little reflection. The solar installations in the area of KOA create far more reflection than will be produced by this proposed installation, and his has never been much of an annoyance or hazard to flight. We can choose to move forward in energy self sufficiency and sustainability of the planet or we can move backward and continue pump garbage into our skies and oceans to prevent fear form "glint and glare".

I will pass this on to the offices listed below.

Aloha,
Bob

Robert Van Wagoner
PO Box 837
Haiku, HI 96708
(808) 573 4845
bob@mauigems.com

NORTH SHORE CONSULTANTS, LLC

Mr. Robert Van Wagoner
PO Box 837
Haiku, HI 96708

May 18, 2012

Dear Mr. Van Wagoner:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands appreciate your letter of support for the proposed PV Park at Kalaeloa.

Contrary to popular belief there is not much land available for development of utility-scale PV parks, and demand for these sites is relatively high. The proposed location near the end of Runway 11-29 is restricted to unmanned passive uses for which photovoltaic installations are among the few that are compatible.

Concerns over glint and glare have been addressed by a professional engineering company and are understood to occur over a quite limited range of space and time and be overshadowed by glare from the ocean and other existing structures. Glass used in PV installations is quite different from window glass in the amount of light reflected instead of absorbed. PV panels absorb almost all incident light.

Collision hazards are reduced by the distance from the end of the runway, the existing perimeter fence, and the frequency that Runway 11-29 is utilized. Fences at the end of the airport property now serve as arresting gear for an emergency overrun on takeoff. Upon completion of the PV Park the truss structures supporting the panels will be made of light gage galvanized steel that is designed to serve a similar function. The proponent is also investigating the use of shear bolts in structures that are near the centerline of the runway. We understand that takeoffs toward the west from Runway 11-29 have been restricted until recently and are now allowed but used infrequently.

Our May 5, 2012 meeting with representatives of the General Aviation Council of Hawaii was very helpful in understanding each other`s concerns. Thank you for sending representatives and for preparing the letter stating that they were not opposed to the development contingent on the proponent cooperation with airport operators to keep the runway open during periods of construction and maintenance. Kalaeloa Homelands Solar will continue to work closely with pilots and airport personnel to keep Runway 11-29 open and available and to promote smooth and efficient airport operations.

Thank you for elevating these issues during the public review process.

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Telephone: 808.368.5352
robichaud001@hawaii.rr.com

Dave Robichaux

From: Gordon.Wong@faa.gov
Sent: Thursday, April 19, 2012 10:15 AM
To: robichaud001@hawaii.rr.com; todd.v.gray@hawaii.rr.com; oeqc@hawaii.gov
Cc: henry.p.bruckner@hawaii.gov; james.pratt@hawaii.gov; Lynette.Kawaoka@hawaii.gov; robert.ramos@hawaii.gov; Roy.Sakata@hawaii.gov; kimberly.k.evans@hawaii.gov; Steve.Wong@faa.gov; Kandyce.Watanabe@faa.gov
Subject: Draft EA - Kalaeloa Home Lands Solar Farm within RPZ
Attachments: JRF Solar Farm NORTH SHORE CONSULTANTS Ltr.pdf; DHHL DEA final 022512.pdf

Reference the Draft EA for Kalaeloa Home Lands Solar Farm dated February 2012.

An FAA airspace study for the proposed development was conducted in 2011 and a determination of no hazard to air navigation issued on 3/8/2011.

However, we would recommend the area within the Runway Protection Zone remain clear of any objects as cited in FAA Advisory Circular AC
150/5300-13 Airport Design (excerpts below).

Also, the Airport Layout Plan for Kalaeloa Airport indicates a future avigation easement to be acquired from State Department of Hawaiian Homelands.

FAA ADVISORY CIRCULAR 150/5300-13 AIRPORT DESIGN 212. OBJECT CLEARING CRITERIA

(7) Runway Protection Zone (RPZ). The RPZ requires clearing of incompatible objects and activities as specified in paragraphs 212a(1)(a) and 212a(2).

(8) General. Other objects which require clearing are those which generally can have an adverse effect on the airport. These include objects in the inner part of the approach area (coinciding with the RPZ) such as fuel handling and storage facilities, smoke and dust generating activities, misleading lights, and those which may create glare or attract wildlife.

212. RUNWAY PROTECTION ZONE (RPZ). The RPZ's function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZs. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through the acquisition of sufficient property interest in the RPZ.

a. Standards.
(1) RPZ Configuration/Location. The RPZ is trapezoidal in shape and centered about the extended runway centerline. The central portion and controlled activity area are the two components of the RPZ (see Figure 2-3). The RPZ dimension for a particular runway end is a function of the type of aircraft and approach visibility minimum associated with that runway end. Table 2-4 provides standard dimensions for RPZs.
Other than with a special application of declared distances, the RPZ begins 200 feet (60 m) beyond the

end of the area usable for takeoff or landing. With a special application of declared distances, see Appendix 14, separate approach and departure RPZs are required for each runway end.

(a) The Central Portion of the RPZ. The central portion of the RPZ extends from the beginning to the end of the RPZ, centered on the runway centerline. Its width is equal to the width of the runway OFA (see Figure 2-3). Paragraph 307 contains the dimensional standards for the OFA.

(b) The Controlled Activity Area. The controlled activity area is the portion of the RPZ to the sides of the central portion of the RPZ.

(2) Land Use. In addition to the criteria specified in paragraph 211, the following land use criteria apply within the RPZ:

(a) While it is desirable to clear all objects from the RPZ, some uses are permitted, provided they do not attract wildlife (see paragraph 202.g., Wildlife Hazards, and Appendix 17 or dimensional standards), are outside of the Runway OFA, and do not interfere with navigational aids. Automobile parking facilities, although discouraged, may be permitted, provided the parking facilities and any associated appurtenances, in addition to meeting all of the preceding conditions, are located outside of the central portion of the RPZ. Fuel storage facilities may not be located in the RPZ.

(b) Land uses prohibited from the RPZ are residences and places of public assembly. (Churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of persons typify places of public assembly.) Fuel storage facilities may not be located in the RPZ.

b. Recommendations. Where it is determined to be impracticable for the airport owner to acquire and plan the land uses within the entire RPZ, the RPZ land use standards have recommendation status for that portion of the RPZ not controlled by the airport owner.

c. FAA Studies of Objects and Activities in the Vicinity of Airports. The FAA policy is to protect the public investment in the national airport system. To implement this policy, the FAA studies existing and proposed objects and activities, both off and on public-use airports, with respect to their effect upon the safe and efficient use of the airports and safety of persons and property on the ground. These objects need not be obstructions to air navigation, as defined in 14 CFR Part 77. As the result of a study, the FAA may issue an advisory recommendation in opposition to the presence of any off-airport object or activity in the vicinity of a public-use airport that conflicts with an airport planning or design standard or recommendation.

Gordon Wong
FAA Honolulu Airports District Office
T: 808-541-3565
F: 808-541-3566
E: gordon.wong@faa.gov

(See attached file: JRF Solar Farm NORTH SHORE CONSULTANTS Ltr.pdf)(See attached file: DHHL DEA final 022512.pdf)

This document is intended for the use of the individual or entity to whom it is addressed and may contain information that is privileged, confidential, and exempt from disclosure under applicable law. Release to third parties must be determined under the provisions of the Freedom Of Information Act (5 U.S.C. Section 552 et seq.).

NORTH SHORE CONSULTANTS, LLC

Mr. Gordon Wong, Lead Program Manager May 18, 2012
Federal Aviation Administration
Honolulu Airports District Office
Via e-mail

Dear Mr. Wong:

Thank you for sending your comments on the proposed development of the Kalaeloa Home Lands Solar Park. The Proponent and the Department of Hawaiian Home Lands have considered your concerns over compatible land uses and have modified the Final Environmental Assessment (FEA) to respond to your comments. The proponent has reviewed the relevant recommendations, which are discussed below in the context of the advisory circular referenced in your email.

FAA ADVISORY CIRCULAR 150/5300-13 AIRPORT DESIGN

(8) General. Other objects which require clearing are those which generally can have an adverse effect on the airport. These include objects in the inner part of the approach area (coinciding with the RPZ) such as fuel handling and storage facilities, smoke and dust generating activities, misleading lights, and those which may create glare or attract wildlife.

The proposed PV facility does not contain fuel storage or handling, generate smoke or dust, has no misleading lights and has been show to not create significant glint and Glare (See Appendix C FEA)

212. RUNWAY PROTECTION ZONE (RPZ). The RPZ's function is to enhance the protection of people and property on the ground. This is achieved through airport owner control over RPZs. Such control includes clearing RPZ areas (and maintaining them clear) of incompatible objects and activities. Control is preferably exercised through the acquisition of sufficient property interest in the RPZ.

The property has not been acquired and is owned by DHHL who are the lessee and approving agency.

(2) Land Use. In addition to the criteria specified in paragraph 211, the following land use criteria apply within the RPZ:

(a) While it is desirable to clear all objects from the RPZ, some uses are permitted, provided they do not attract wildlife (see paragraph 202.g., Wildlife Hazards, and Appendix 17 or dimensional standards), are outside of the Runway OFA, and do not interfere with navigational aids. Automobile parking facilities, although discouraged, may be permitted, provided the parking facilities and any associated appurtenances, in addition to meeting all of the preceding conditions, are located outside of the central portion of the RPZ. Fuel storage facilities may not be located in the RPZ.

The proposed action does not attract wildlife, is within the dimensional standards, and is not within the OFA of Runway 11-29. Placement of automobile parking areas near the end of the runway would create much more glint and glare than PV panels due to the non-reflective glass used on PV. See figure 3-5 Page 27 of the FEA).

P.O. Box 790 Telephone: 808.637.8030
Hale'iwa, Hawai'i 96712 Telephone: 808.368.5352
robichaud001@hawaii.rr.com

(b) Land uses prohibited from the RPZ are residences and places of public assembly. (Churches, schools, hospitals, office buildings, shopping centers, and other uses with similar concentrations of persons typify places of public assembly.) Fuel storage facilities may not be located in the RPZ.

The proposed action does not include places of public assembly or fuel storage.

b. Recommendations. Where it is determined to be impracticable for the airport owner to acquire and plan the land uses within the entire RPZ, the RPZ land use standards have recommendation status for that portion of the RPZ not controlled by the airport owner.

The proposed action is compliant with the land use standards set forth in Advisory Circular *150/5300-13 AIRPORT DESIGN.*

c. FAA Studies of Objects and Activities in the Vicinity of Airports. The FAA policy is to protect the public investment in the national airport system. To implement this policy, the FAA studies existing and proposed objects and activities, both off and on public-use airports, with respect to their effect upon the safe and efficient use of the airports and safety of persons and property on the ground. These objects need not be obstructions to air navigation, as defined in 14 CFR Part 77. As the result of a study, the FAA may issue an advisory recommendation in opposition to the presence of any off-airport object or activity in the vicinity of a public-use airport that conflicts with an airport planning or design standard or recommendation.

The proposed PV Park has been reviewed and approved by the FAA office responsible for Obstruction Evaluation and Airport Airspace analysis (OE/AAA).

Our assessment finds that should the proposed action be developed, the area within the Runway Protection Zone will remain clear of any objects as cited in FAA Advisory Circular AC 150/5300-13 Airport Design and is compliant with the standards presented above.(excerpts below).

Thank you again for elevating these issues during the public review process and contributing to our understanding of the regulations.

NORTH SHORE CONSULTANTS, LLC

David M. Robichaux, Principal

P.O. Box 790
Hale‘iwa, Hawai‘i 96712

Telephone: 808.637.8030
Telephone: 808.368.5352
robichaud001@hawaii.rr.com

FRESNO YOSEMITE
INTERNATIONAL AIRPORT

City of Fresno Airports Department

February 22, 2010

Tanya Martinez
US Solar
PO Box 44485
Phoenix, AZ 85064

SUBJECT: Photovoltaic System at Fresno Yosemite International Airport (FAT)

Dear Ms. Martinez:

In 2008 a 2 megawatt PV system was brought on line at FAT. The system is located on a 20 acre parcel of airport land approximately 1500 feet from and within the approach zone of our primary runway. During the design process the issue of reflectivity was vetted to the fullest extent possible at that time. The research involved (i) discussions with various PV manufacturers, (ii) study of other PV systems in close proximity to an airport, and (iii) a complete FAA 7460 airspace review of our PV project. Our research, which was supported by the FAA through the 7460 process, determined that PV panels do not create glare or any other hazard to aircraft. The PV system at FAT was one of the first and is the largest single installation at any airport in the United States. To date, there have been no complaints from any pilot or the FAA Tower. In addition, a second 1 megawatt PV system was installed off airport (approximately 3000' north and abeam the primary runway). This system also went through the FAA 7460 process and has now been operational for over 12 months with no pilot or FAA Tower complaints. These installed systems have reaffirmed our finding that reflectivity is not an issue for aviation and dispels the common misconception that PV panels create glare.

From an airport perspective, we have enjoyed the benefit of using renewable power for 58% of our total demand and have realized financial savings within the first year of operation. The PV system at FAT is big part of our ability to remain self sustaining and meet the financial obligation of our federal grant assurances.

Please feel free to forward this letter on to whomever you feel can benefit from this information. If there are any further questions regarding our solar PV installation, feel free to contact me at 559-621-4536 or kevin.meikle@fresno.gov.

Sincerely,

Kevin Meikle,
Airports Planning Manager

Cc: Riverside County ALUC
Kimchi Hoang, FAA Western Pacific Region

J:\Land Use 2010\PV Reflectivity Letter.doc

4995 E. Clinton Way · Fresno CA, 93727-1525 · (559) 621-4500 · www.flyfresno.com

Appendix B

Letter from USFWS regarding Threatened and Endangered Species

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2010-TA-0329

JUL 2 2 2010

Mr. David M. Robichaux
North Shore Consultants, LLC
P.O. Box 790
Haleiwa, Hawaii 96712

Subject: Species List for a Photovoltaic Installation at Kalaeloa Airport, Oahu

Dear Mr. Robichaux:

Thank you for your letter received July 13, 2010, requesting information regarding the presence of threatened and endangered species or federally designated critical habitat located near the Kalaeloa Airport on the island of Oahu [TMK(1) 9-1-013:033]. The proposed project consists of grading and spot foundations.

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program and the Hawaii GAP Program. Land cover information indicates that the proposed project area is classified as high- and low-intensity development. To the best of our knowledge, no federally listed or proposed threatened or endangered species, or proposed or designated critical habitats occur within the project footprint.

If you have any additional questions, please contact Aaron Nadig, Fish and Wildlife Biologist, Consultation and Habitat Conservation Planning Program (phone: 808-792-9400; fax: 808-792-9581). Please also note that Patrick Leonard no longer works in our office; all written correspondence should be addressed to me.

Sincerely,

for Loyal Mehrhoff
Field Supervisor

TAKE PRIDE® IN AMERICA

Appendix C

Archeological Reconnaissance Report
Rechtman Consulting, LLC

RECHTMAN CONSULTING, LLC
507-A E. Lanikaula St. Hilo, Hawaii 96720
phone: (808) 969-6066 fax: (808) 443-0065
e-mail: bob@rechtmanconsulting.com
ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL STUDIES

July 5, 2010 RC-0695

David M. Robichaux
North Shore Consultants, LLC
P.O. Box 1018
Haleiwa, HI 96712

Dear Dave:

At your request, Rechtman Consulting, LLC conducted a due diligence archaeological study of a roughly 30 acre parcel (TMK: 1-9-1-13:029) owned by the Department of Hawaiian Home Land and situated immediately adjacent to the Barbers Point airstrip in Honouliuli Ahupua‘a, ‘Ewa District, Island of O‘ahu (Figure 1). This parcel is to be leased by AES Solar and used for the development of a solar panel collection grid, which will cover most of the parcel. The purpose of this study is to ascertain whether or not significant archaeological features exist or are likely to exist on the study property. To that end, in addition to a brief archival review, I conducted a field inspection of the subject parcel.

A review of the records on file at the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) revealed that numerous archaeological studies have been conducted in the Barbers Point vicinity, however the current parcel does not appear to have been subject to prior archaeological study and there are no archaeological resources known to exist on the parcel. Archival documents, records, and maps indicate that the parcel was historically used as an extension of the adjacent Naval Air Station runway. This can be seen on the Tax Map (Figure 1) as an easement area and is clearly indicated in an aerial photograph (Figure 2).

On July 1, 2010, Robert B. Rechtman, Ph.D. conducted a physical inspection of the study parcel, the boundaries of which were clearly identifiable in the field. The currently vacant property is covered with moderately dense grasses and *koa haole* (*Leucaena leucocephala*) with occasional *kiawe* (*Prosopis pallida*) trees (Figure 3). The ground surface across the entire parcel appears to have graded in the past, and where visible through the exhibits a mixture of soil and limestone cobbles (Figure 4). No archaeological resources were observed during the field inspection, and given the extensive grading that has no doubt occurred, no such resources are expected to remain intact if any were ever present. Based on the archival research, the documented extensive land alteration, and a physical inspection of the property, I would conclude that there are no archaeological resources within the subject parcel that would present any significant development constraints.

Regulatory permitting may require a formal archaeological report to satisfy DLNR-SHPD rules. If such work is required, I will suggest to DLNR-SHPD that they accept a “request for determination of no historic properties affected” given the former documented land use of the area. If they agree, such a written request can be prepared for a minimal fee.

Thank you for the continued opportunity to provide you with our services. Should you have any questions, or would like further information please feel free to contact me.

Regards,

Bob Rechtman, Ph.D.
Principal Archaeologist

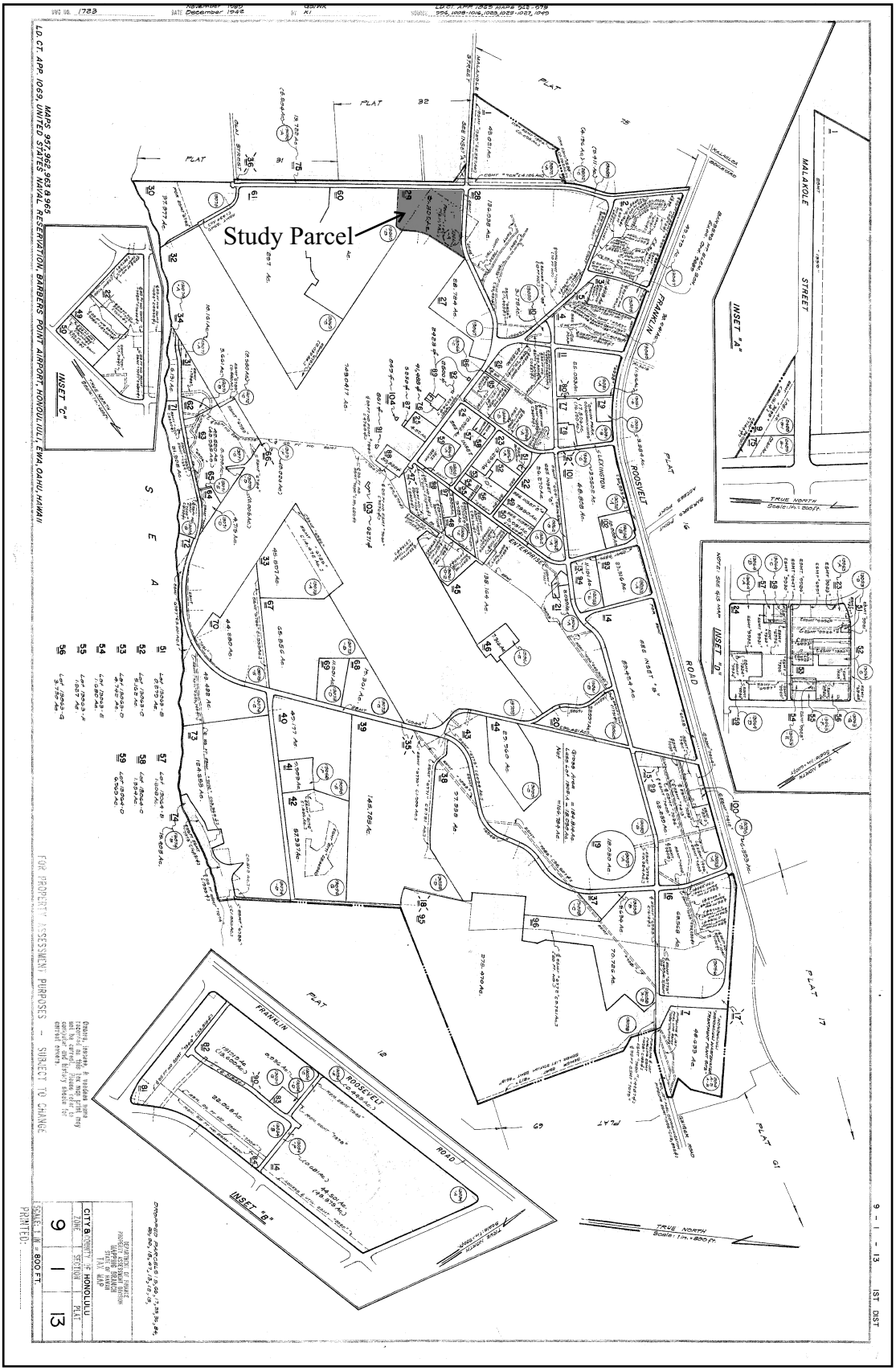
Study Parcel
MALAKOLE STREET
FRANKLIN ROOSEVELT ROAD
LEXINGTON
ENTERPRISE
INSET "A"
INSET "B"
INSET "C"
INSET "D"
TRUE NORTH
Scale: 1 in. = 800 ft.
FOR PROPERTY ASSESSMENT PURPOSES - SUBJECT TO CHANGE
CITY & COUNTY OF HONOLULU
ZONE 9 SECTION 1 PLAT 13
SCALE: 1 IN. = 800 FT.
PRINTED:
9 - 1 - 13 1ST DIST

Figure 1

Figure 2.

Figure 3.

Figure 4.

Appendix D

Reflectivity Study for JRF

KALAELOA – 4.25 MW PHOTOVOLTAIC POWER PLANT

REFLECTIVITY ANALYSIS

REVISION INDEX

Page/Reason	REV	Date	PROD	CHECK	APRV
All	0	10/11/2010	JDL	LOC	LTA
Updated with horizontal single axis trackers	1	05/02/2012	JDL	JDL	JDL

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1 Introduction 3
2 Definitions 4
3 Mathematical analysis 6
3.1 Reference coordinate system 6
3.2 Sun position 7
3.3 PV modules and reflection equations with trackers 9
3.4 Approaching flight plane and reflectivity at Runways 04R & 22L 14
3.5 Reflectivity at Runways 11 and 29 18
4 Conclusion 22

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1 Introduction

This document analyzes the risk of sun reflectivity due to a future photovoltaic (PV) power plant being developed by AES Solar Power, LCC. Project location is nearby the Kalaeloa (John Rodgers Field) airport in Kapolei, Hawaii. Reflectivity events due to the presence of PV modules might affect airplane visibility while approaching the corresponding airport runways, if reflected sun light beam intersects the flight path.

Fig. 1 shows the location of the future PV plant relative to Kalaeloa airport:

Fig 1.- Location of PV Project

To evaluate the risk of direct sun light reflection events a mathematical (geometric) model has been developed. The model predicts when in the year there is a possibility for approaching airplanes to suffer direct reflection.

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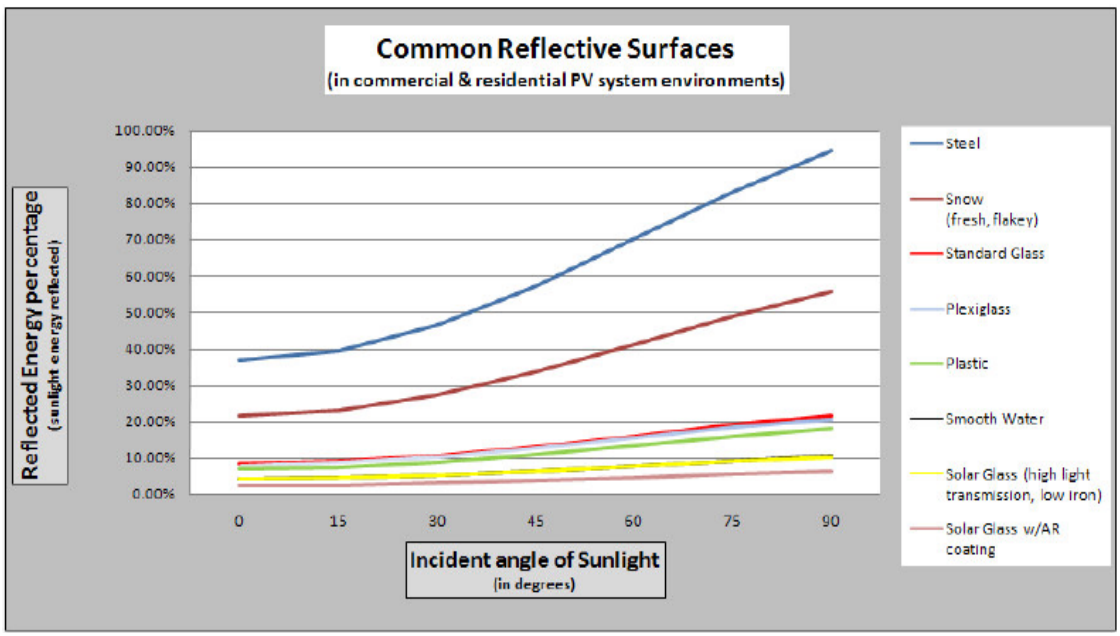
2 Definitions

The following definitions and descriptions are key to understanding the methodology and results of the study:

Photovoltaic Module – Photovoltaic panels, also known as PV modules. By nature, PV panels are designed to absorb as much of the solar spectrum as possible in order to convert sunlight to electricity. Reflectivity levels of solar panels are decisively lower than standard glass or galvanized steel, and should not pose a reflectance hazard to viewers. The next graph relates the reflectivity properties of solar modules in function of the incidence angle, and compares with other common reflecting surfaces in an airport environment:



Reflected light from PV modules' surface is just between 10% - 20% of the incident radiation, as low as water surfaces, while galvanized steel (used in industrial roofs) is between 40% and 90%. It should also be noted that high incidence angles are always related to low sun elevation angles (i.e, the sun beams are close to be tangent to the reflecting surface) and, in this case, the intensity of incident light is much lower than -say- noon time.

Glint – Also known as a specular reflection, produced by direct reflection of the sun in the surface of the PV solar panel. This is the potential source of the visual issues regarding viewer distraction.

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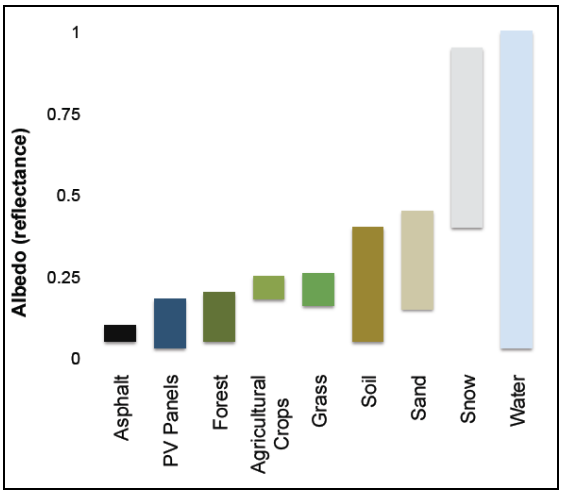
Glare – A continuous source of brightness, relative to diffused light. This is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun. Technically this is described as the reflection of the circumsolar diffuse component. Glare is significantly less intense than glint and have negligible effects. As Glare is the reflection of diffuse irradiance is not directional. Other glare sources in the nature (often called Albedo reflectance) are much more intense that glare from PV modules, as sown in graph below. It can be seen that even agricultural environment has higher Glare effect than PV modules.



Key View Point (KVP) – KVPs are viewpoints used in the glint and glare study, and serve as the offsite viewpoint locations for photo simulations. In this analysis, KVP can be any point in the most probable airplane approaching path to the airport runways.

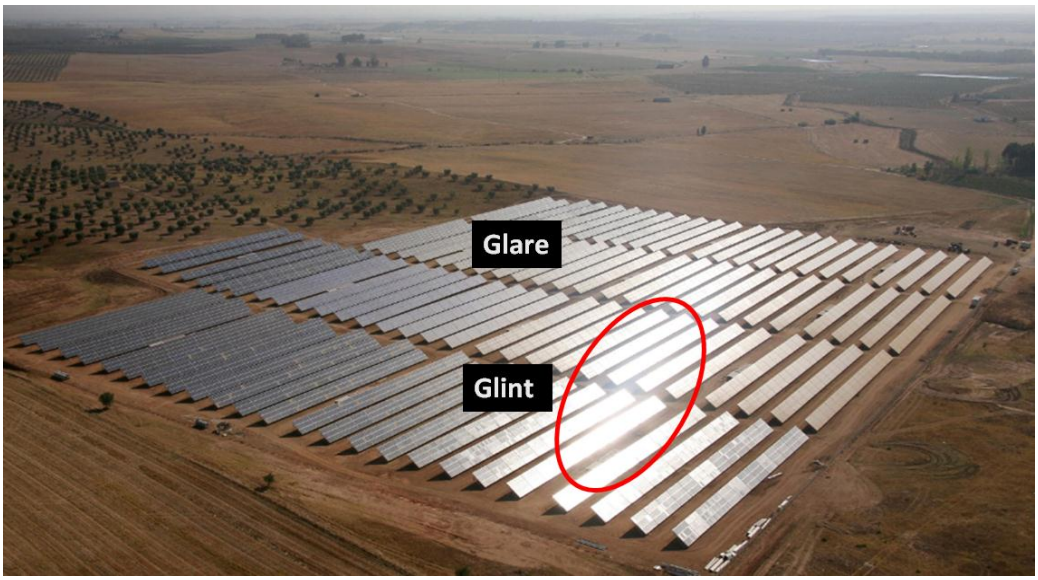


Fig 2 .- Glint and Glare

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3 Mathematical analysis

3.1 Reference coordinate system

Solar reflection from flat surfaces is a mathematical problem that can be solved by means of 3D geometry concepts. In order to properly relate sun position, PV modules position and orientation, and KVP location; is necessary to define a global coordinate system to which the previous position and orientation will be referred to.

In this analysis, the 3D Cartesian coordinate system is defined as follows:

Positive X-Axis	Pointing South
Positive Y-Axis	Pointing East
Positive Z-Axis	Pointing upwards

Origin of the coordinate system is chosen at the future PV plant location, as shown in Fig. 3 below:

Fig 3 .- Reference coordinate system

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3.2 Sun position

Instantaneous sun position is defined by two angular (spherical) coordinates. These angles are Azimuth (φ) and Elevation (θ). Azimuth is the deviation of sun's horizontal projection from South, while elevation is the angle between the horizontal plane and sun's position. The following graphs illustrates above definitions, and criteria for positive values:

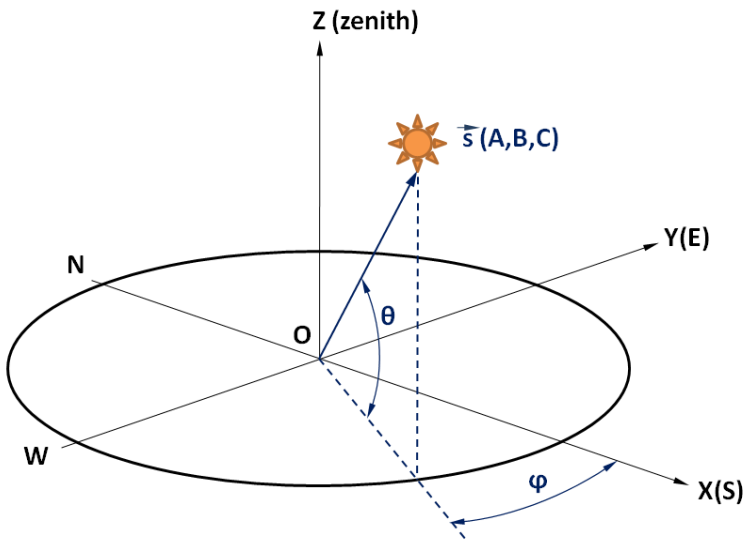

Fig 4.- Sun position coordinates

Sun position can be also defined by a unit-length pointing vector s = (A, B, C). Cartesian coordinates of the sun position vector are written in terms of the azimuth and elevation angles as follows:

$$A = \cos\theta \ \cos\varphi$$
$$B = -\cos\theta \ \sin\varphi$$
$$C = \sin\theta$$

Azimuth and elevation angular coordinates (φ, θ) are both function of:

- Earth latitude (L) at the origin
- Day of the year (i) and hour of the day (H)

and can be calculated as per the following equations:

Earth declination:

$$D = 23.45 \ \sin(0.986[284 + i])$$

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Azimuth and elevation angles:

$$\sin\theta = \sin D \sin L + \cos D \cos L \cos H$$
$$\cos\varphi = \frac{\sin D \cos L - \cos D \sin L \cos H}{\cos\theta}$$

In the above expressions the day of the year (i) is following a Julian day convention (January, 1st is i=1; February, 1st is i = 32,… until i =365). The hour of the day (H) is referred to noon time (12:00 is H = 0; 10:00 is H = -2; 14:00 is H = +2; … etc).

As an example, the calculated values for azimuth and elevation angles for the equinox (March, 21st, i = 80) are plotted in function of the hour of the day in the next graph:

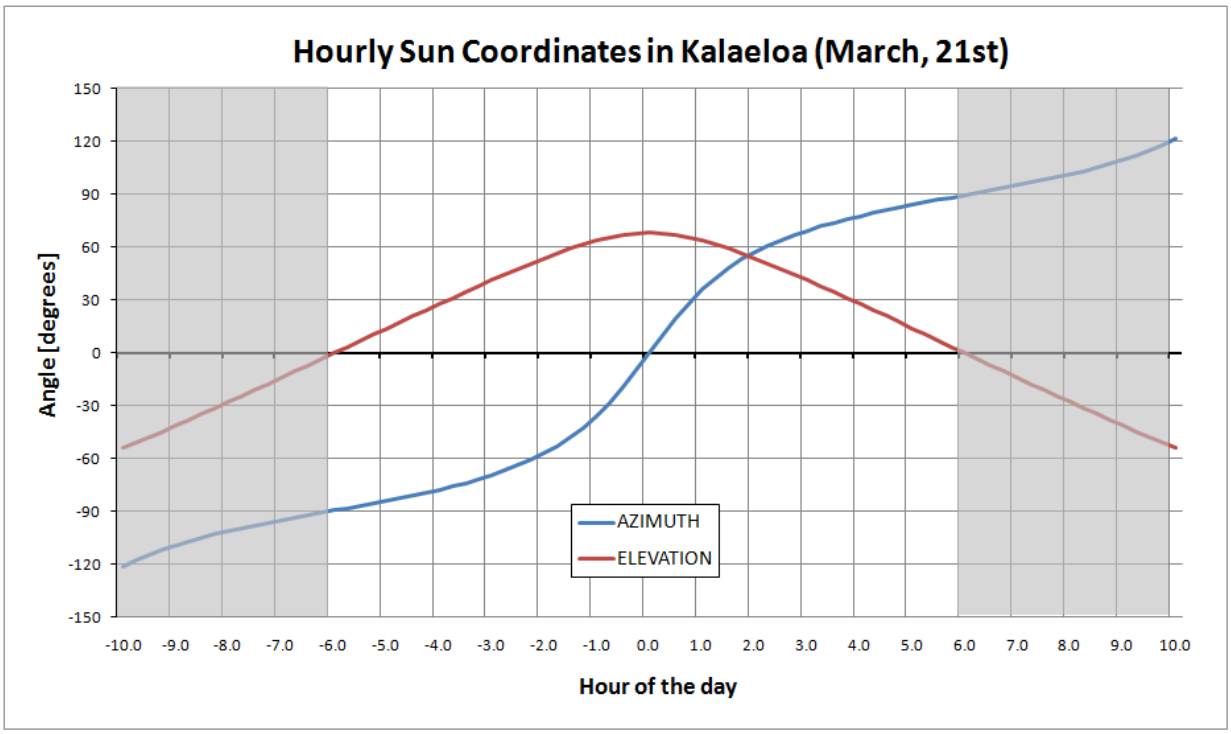

Fig 5.- Sun position coordinates

Negative values of the elevation angle means night time (the sun is below the horizon). In the above example the daylight period is 12 hours and the azimuth at sunrise is -90° (pure East), as expected for the equinox. Maximum elevation angle (at noon) is 68.24° for this latitude and particular day.

For the purpose of geometric calculations later in this report, the relevant results are the Cartesian coordinates of the sun position vector (A, B, C). For the sample day above, these are plotted in Fig. 6:

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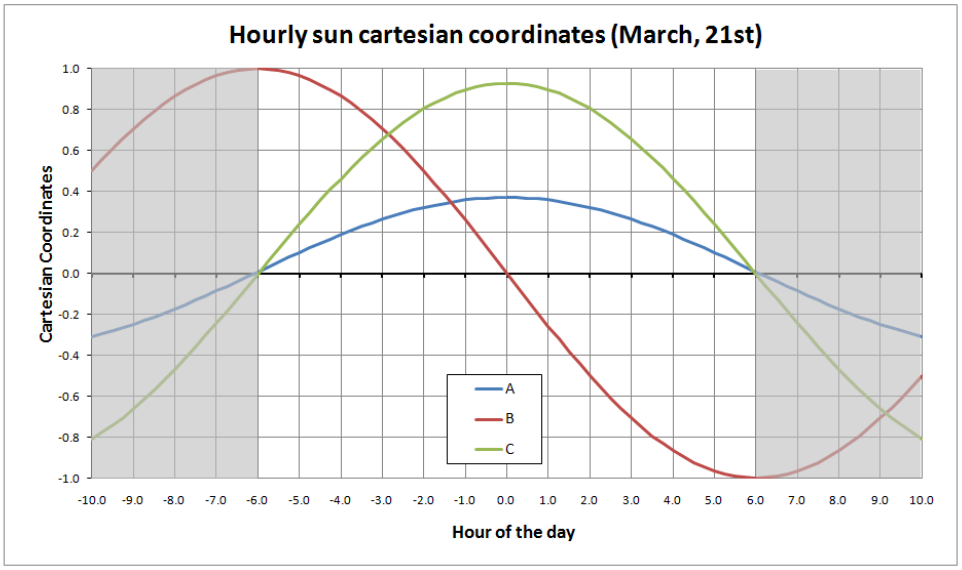
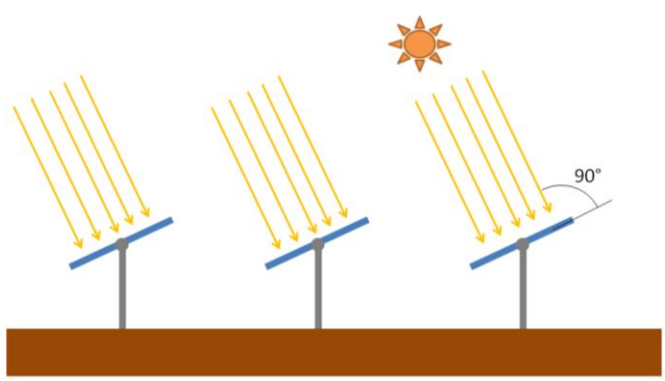


Fig 6.- Sun position Cartesian coordinates

3.3 PV modules and reflection equations with trackers

PV modules are considered reflecting planes located at the origin of the coordinate system (O). A plane is geometrically defined by its perpendicular (normal) unit vector [n]. Notation for Cartesian coordinates of this fixed vector is n = (Ap, Bp, Cp).

From the PV plant design, the PV modules are mounted on horizontal single axis trackers. Tracker systems are mechanical devices that continuously change the PV modules orientation with sun position, so to obtain the maximum irradiance at any time during the day. In particular, the horizontal axis trackers are oriented in North-South direction, so the modules attached to the horizontal rotating axis are inclined towards East during sunrise and are rotated towards West as the earth rotates.



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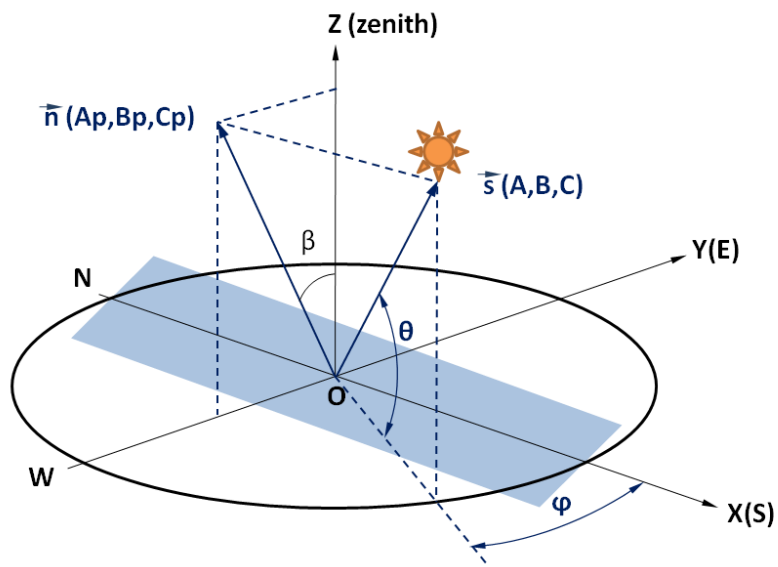

Fig 17.- Normal vector to PV modules in an horizontal axis tracker

Given the instantaneous rotation of the tracker as an angle (β), the normal vector n=(Ap, Bp, Cp) perpendicular to the plane of the modules is

$$A_p = 0$$
$$B_p = -\sin\beta$$
$$C_p = \cos\beta$$

The objective is to track for the minimum incidence angle (γ). This will occur also if the cosine of the incidence angle (γ) is a maximum:

$$\cos\gamma = \vec{s}\ \vec{n} = A\,A_p + B\,B_p + C\,C_p$$

this can be written as

$$\cos\gamma = -B\sin\beta + C\cos\beta$$

The minimum incidence angle occurs when

$$\frac{d\,(\cos\gamma)}{d\beta} = -B\cos\beta - C\sin\beta = 0 \qquad \tan\beta = -\frac{B}{C}$$

Which describes the rotation angle of the tracker in function of sun position, and hence the coordinates for the vector perpendicular to the plane of the PV modules.

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Backtracking

At low sun elevation angles (i.e., sunrise and sunset), the trackers would be fully deployed and mutual shading between successive rows of modules will occur. To avoid this situation, the tracking control system has the so called backtracking algorithm, which defines the tracker rotation angle so to avoid this mutual shading. When the backtracking is active, the tracker will not rotate to follow the sun path, but to avoid mutual shading between rows. This occurs every day early in the morning and late in the evening, and depends on the PV plant geometry, day of the year, and latitude.

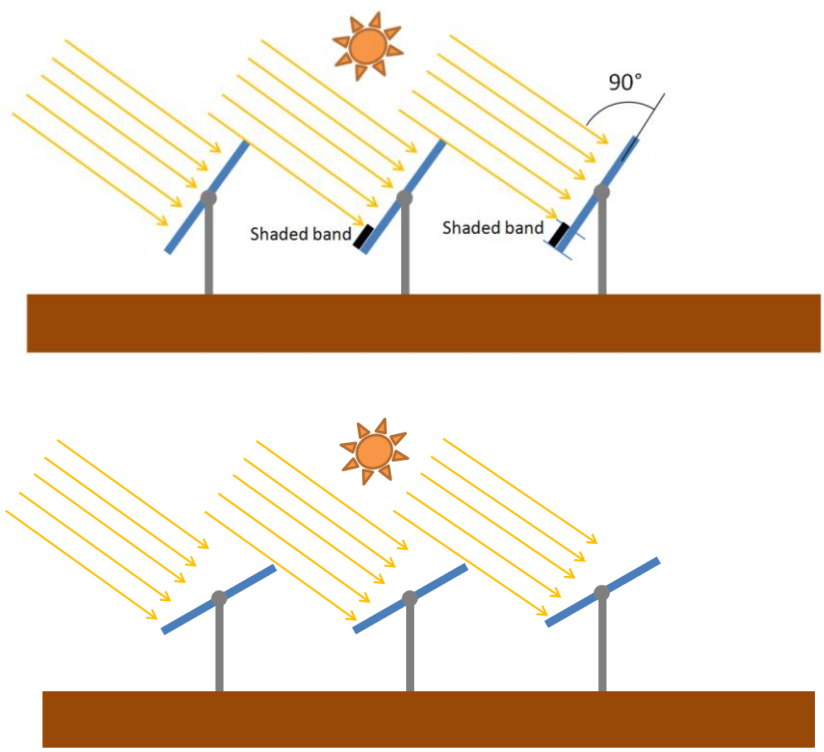

Fig 18.- Above: Mutual shading without backtracking.
Below: Backtrackin corrected incidence angle to avoid mutual shading

The tracker angle when the backtracking is active is given by the following equation:

$$\tan\theta = \frac{L\ sin\beta}{p - Lcos\beta}$$

Where [L] is the length of the modules (9.89 ft) and [p] is the pitch between tracker rows (20 ft). Maximum tracker angle is ±45° for mechanical and constructive reasons.

Fig. 19 shows the tracker angle, together with sun elevation angle for a sample day (March, 21st).

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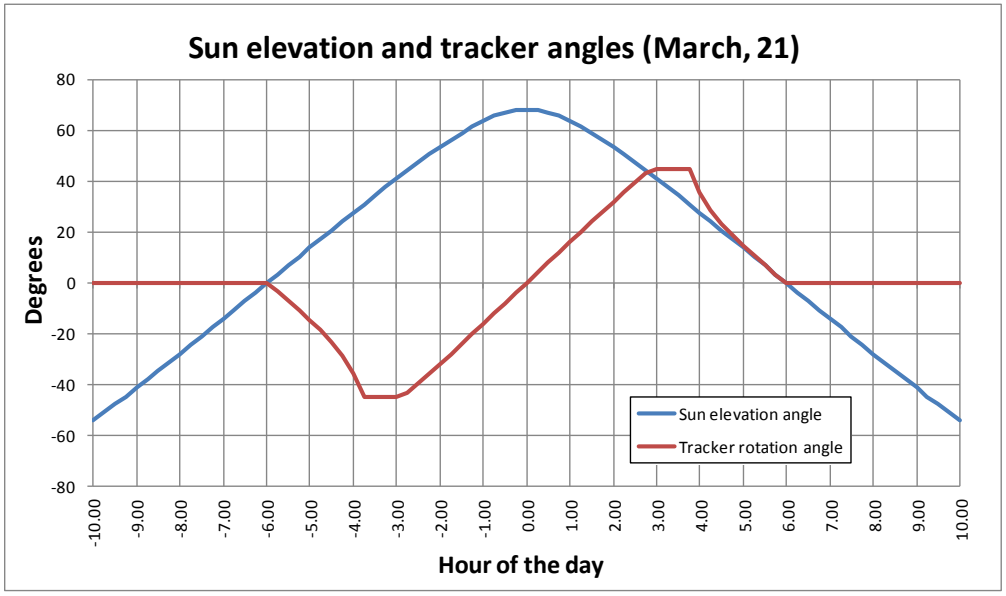

Fig 19.- Tracker angle on a sample day

Equations for the reflected beam

Reflection of sun beams by a given surface can be calculated once the direction of the incident beam and plane orientation is known.

Instantaneous solar beam direction vector s = (A, B, C) and reflecting plane normal vector n = (Ap, Bp, Cp) intersects at the origin, and both defines a new plane in the space. From reflectivity laws, the reflected beam vector r = (Ar, Br, Cr) will be contained in this plane and symmetric to the incident beam with respect to the reflecting surface vector, as shown in the next figure:

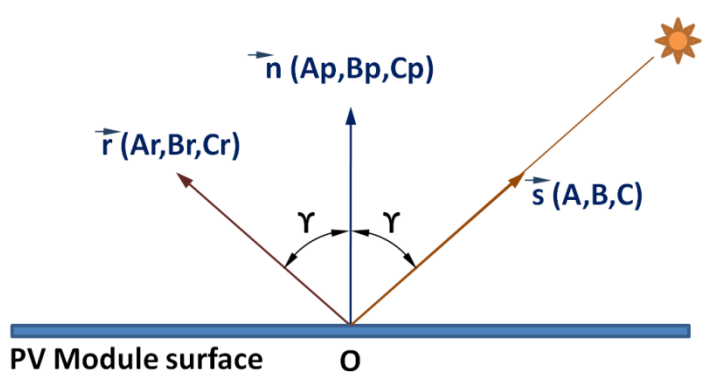

Fig 8.- Reflecting surfaces – Notation for reflected beam vector

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A relevant variable in this figure is the incidence angle [ϒ], which measures the angle between the incident sun beam vector and the surface normal. No reflection can occur when the incidence angle is equal or larger than 90°. This situation will occur whenever the sun is behind the PV modules surface. The incidence angle can be calculated as per the dot product of unit vectors [s] and [n]:

$$\cos\gamma = \vec{s}\ \vec{n} = A\ A_p + B\ B_p + \ C\ C_p$$

The symmetric-reflected vector [r] is calculated as

$$\vec{r} = 2\ \cos\gamma\ \vec{n} - \ \vec{s}$$

and its Cartesian coordinates given by:

$$A_r = 2\ \cos\gamma\ A_p - A$$
$$B_r = 2\ \cos\gamma\ B_p - B$$
$$C_r = 2\ \cos\gamma\ C_p - C$$

For example, for the equinox day chosen the results for (Ar, Br, Cr) are plotted below in function of the hour of the day. Incidence angle cosine also included.

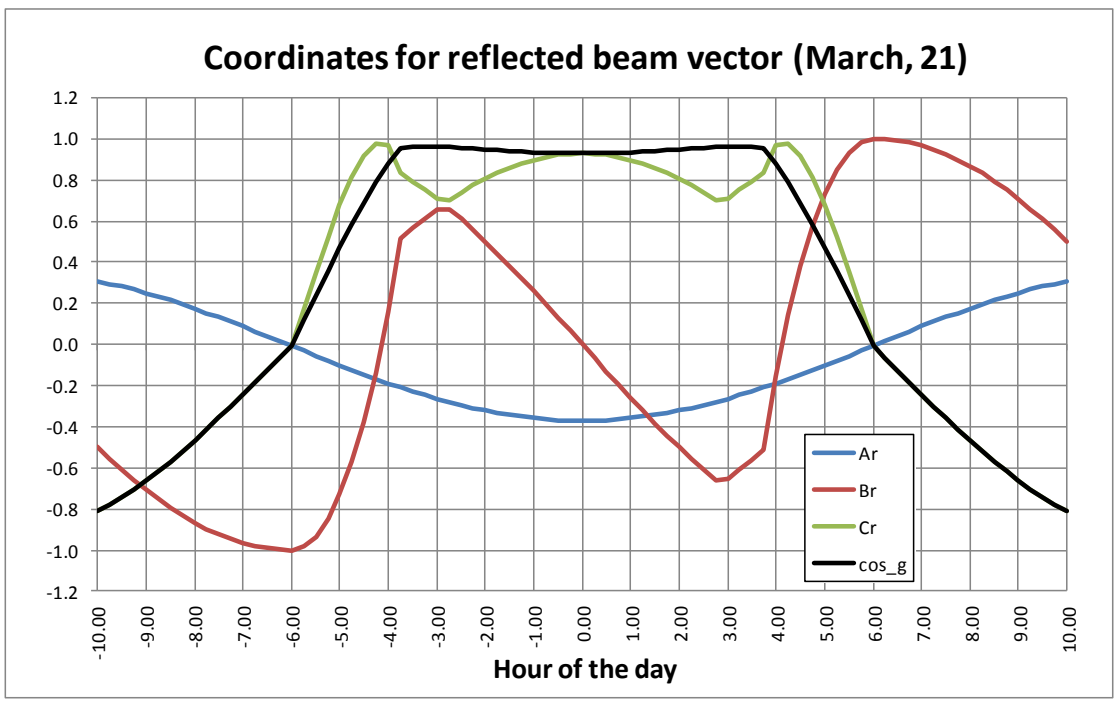

Fig 20.- Cartesian coordinates for reflected beam in a sample day. Incidence angle is very low, thus optimizing irradiance on PV modules with trackers.

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3.4 Approaching flight plane and reflectivity at Runways 04R & 22L

To define the location of relevant KVP it is hereby assumed that the approaching airplane follows a straight line contained in a vertical plane (the "flight plane") that also contains the runway axis (Fig. 10).

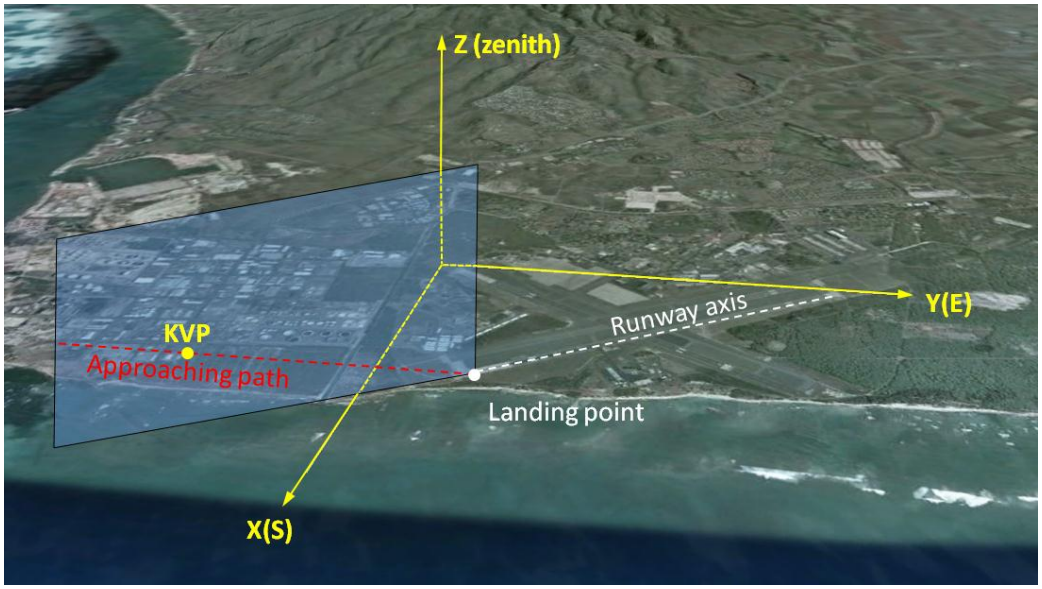
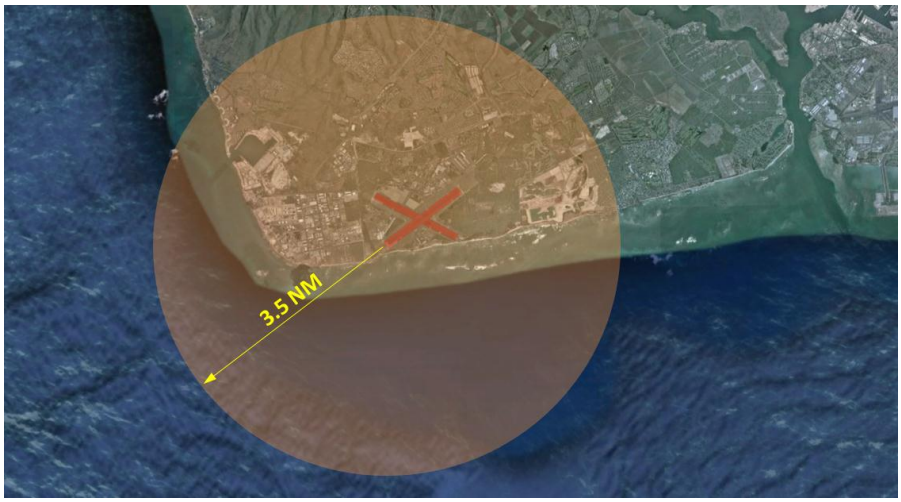


Fig 10.- Geometry of approaching path

The above assumption is valid whenever the airplane aligns the runway and faces the landing point, at the limit of the corresponding runway, which is the normal procedure for distances lower than 3.5 NM from the airport. It is considered that, at larger distances, reflection from the PV plant will not have any impact on visibility.



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The vertical flight plane, containing the approaching path, is defined by the following equation in the reference Cartesian axis system:

$$\Pi \equiv 0.81915\, x + 0.5736\, y - 4874 = 0$$

Where 4,874 ft is the distance from the origin (O) to the landing point (Q).

A reflected solar beam will intersect the above flight plane in a given point P_i, with coordinates relative to the reference systems being $P_i = (x_i, y_i, z_i)$. As the sun moves along its daily path and trackers rotate, the intersection point P_i will define a given trajectory curve in the flight plane.

Whenever the curve drawn by successive P_i intersects the landing path of the airplane, at point T_i, there is a risk of glint (Fig. 11).

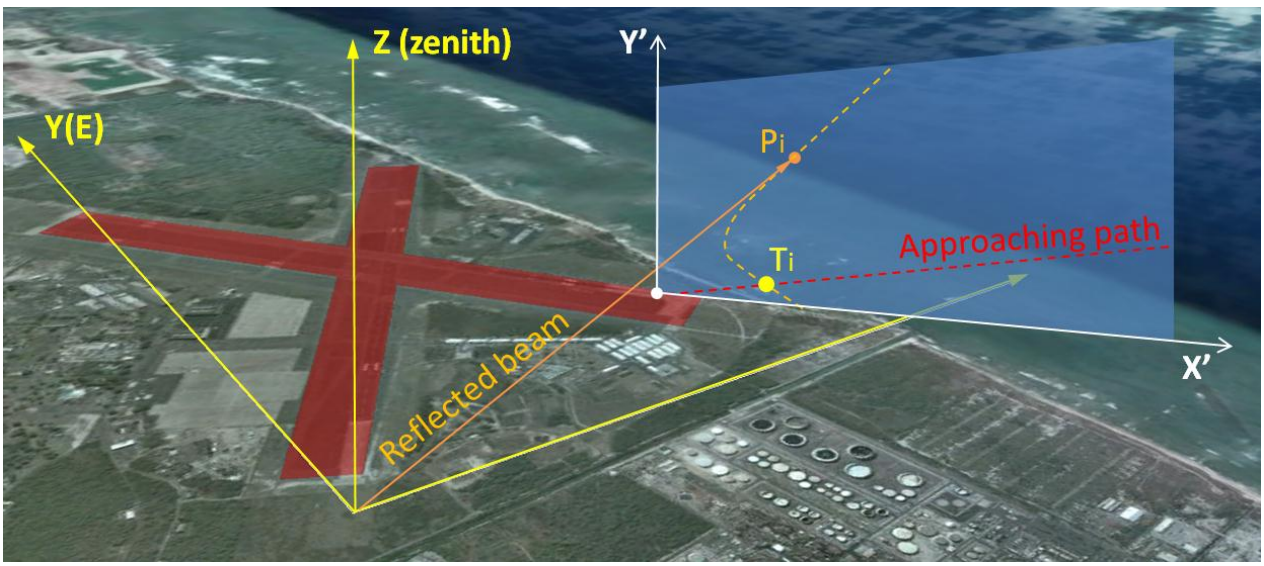

Fig 11.- Intersection of reflected beam with the flight plane(Runway 04R)

To calculate the position of the Ti points along the year, the following procedure applies:

Vector OP_i is an extension of the reflected beam unit vector r = (Ar, Br, Cr), so vector OP_i can be written as

$$\overrightarrow{OP_i} = t\, \vec{r}$$

where the proportionality factor [t] is given by the flight plane equation parameters as

$$t = \frac{-4{,}874}{0.81915\, A_r + 0.5736\, B_r}$$

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When calculating the intersection point coordinates (P_i), it is convenient to express them relative to a new coordinate system. The new coordinate system (X' , Y') contains the flight plane and the origin is located at the landing point, as shown in Fig. 11 above.

Position of point P_i referred to the new origin can be obtained with vector [L]:

$$\vec{L} = \overrightarrow{OP_i} - \overrightarrow{R_0}$$

Being vector [Ro] the position of the landing point in the original Cartesian coordinates:

$$R_{o,x} = 3{,}876\ ft \qquad R_{o,y} = 3{,}022\ ft \qquad R_{0,z} = 0$$

then

$$L_x = t\ A_r - 3{,}876\ ft \qquad L_y = t\ B_r - 3{,}022\ ft \qquad L_z = t\ C_r$$

Finally, the coordinates of the intersection point in the flight plane reference axis P_i = ($L_{x'}$, $L_{y'}$) are given by:

$$L_{x'} = \sqrt{L_x^2 + L_y^2} \qquad\qquad L_{y'} = L_z$$

Fig. 12 below shows the curve drawn by successive intersection points P_i in the flight plane for several distributed days along the year, together with the approaching landing cones by South (Runway 04R) and North (Runway 22L).

It can be seen that there is not interference with flight plane before day 75 (and symmetrically after day 290). For the rest of the days, there are two curves per day representing morning and everning interferences respectively. Interferences during morning hours occur always at altitudes over 6,000 ft, therefore there is not glint risk for airplanes approaching the airfield. The path curve of interferences during evenings might intersect the landing or takingoff cones at very late hours. This is cosistent with the fact that the trackers will go back to the horizontal position at dusk, so reflection beams will be nearly horizontal and aligned with the sun disk.

In all cases for evening interferences, the reflected beam will intersect the flight plane at some point over the runways, so risk of glint might happen when the airplane is taking-off or already landed from East to West. However, it shall be noted that the pilots will in all cases be facing the sun's disk directly. Clearly, bedazzle effect of direct exposure to sun's disk is much higher than any eventual glint from the PV modules. Also reflection form the ocean shall be considered, being this is much more noticeable than glint from the future PV plant.

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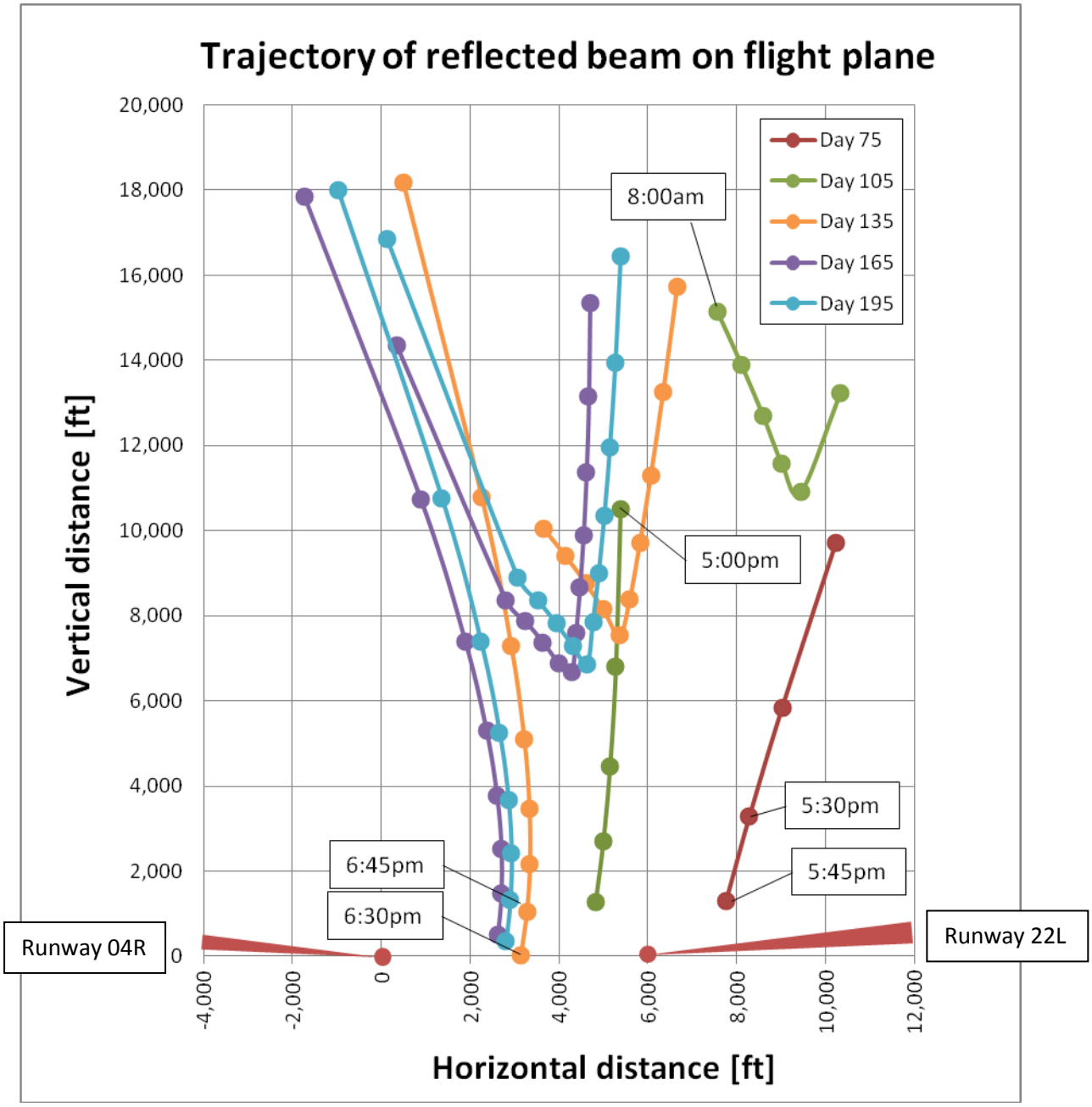

Fig 13.- Intersection of reflected beam with the flight plane at runways 22L & 22R

For example, in April 21st the following will be the projected angles at sunset (ground level):

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It can be concluded that the effect of glint from the proposed PV plant at runway 22 –whenever it might occur- is negligible when compared to the effect of direct light from the sun and the sun's reflection on the sea. Also reflected beam is not aligned with the Runway, so the pilots shall turn their view to right nearly 45° to see the PV modules and hence facing directly the sun's disk.

3.5 Reflectivity at Runways 11 and 29

The flight plane for runways 11 & 20 contains the PV plant, so the analysis is more straightforward than the previous case. Every day a reflected beam vector would be contained in the flight plane, but relevant glint might only occur if the elevation angle of the reflected beam is coincident with the flight approaching angle.

Runway 11 azimut is -62.0°. Cartesian coordinates for any reflected beam r = (Ar, Br, Cr), if contained in the flight plane, shall satisfy the following condition (beam azimuth):

$$\frac{B_r}{A_r} = \tan 62° = 1.8807$$

The angle between the horizontal plane and the reflected vector (reflection elevation angle) is given by

$$\tan \theta_r = \frac{C_r}{\sqrt{A_r^2 + B_r^2}}$$

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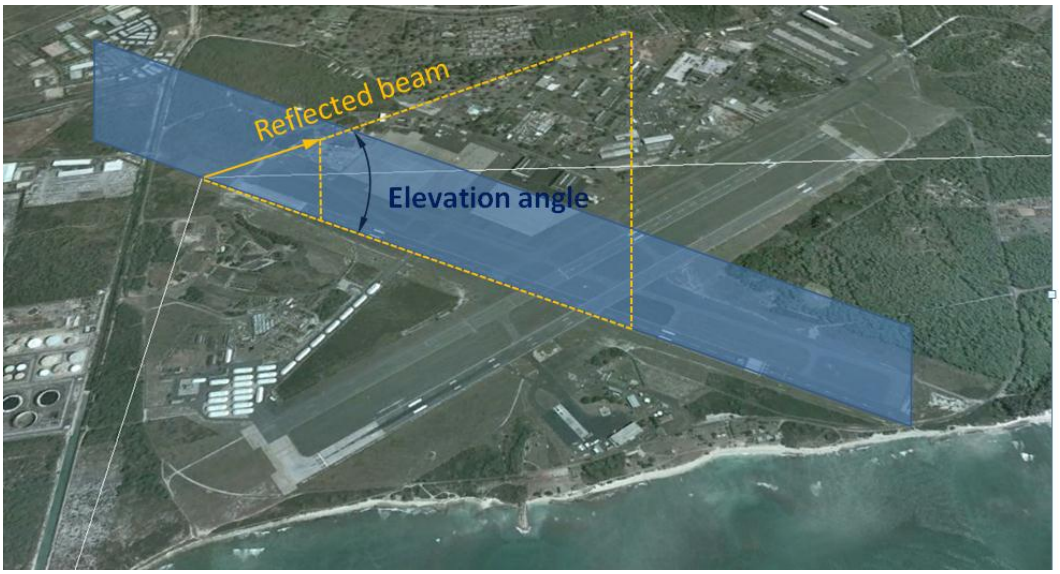

Fig 15.- Reflected beam elevation angle for Runway 29

The next table shows computed results for a complete year, when the azimuth of the reflected beam is ±5° aligned with the runway, and the elevation angle is between 0° and 10°:

day	hour	Azimuth Reflected Beam	Elevation Reflected Beam	Sun azimuth	Sun elevation
1	6.75	64.49	4.13	-64.55	1.44
2	6.75	64.56	4.17	-64.63	1.47
3	6.75	64.64	4.31	-64.71	1.51
4	6.75	64.72	4.45	-64.79	1.55
5	6.75	64.81	4.60	-64.88	1.59
6	6.75	64.91	4.64	-64.98	1.63
7	6.75	65.00	4.79	-65.09	1.68
8	6.75	65.11	4.95	-65.20	1.73
9	6.75	65.22	5.11	-65.31	1.78
10	6.75	65.34	5.27	-65.44	1.83
11	6.75	65.46	5.44	-65.56	1.89
12	6.75	65.59	5.60	-65.70	1.95
13	6.75	65.72	5.77	-65.84	2.01
14	6.75	65.86	5.95	-65.99	2.08
15	6.75	66.01	6.12	-66.14	2.14
16	6.75	66.16	6.41	-66.30	2.21
17	6.75	66.31	6.59	-66.46	2.29

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18	6.75	66.48	6.77	-66.63	2.36
19	6.75	66.64	7.07	-66.80	2.44
20	6.75	66.81	7.26	-66.98	2.52
21	6.75	66.99	7.45	-67.17	2.60
151	18.50	66.92	3.72	113.03	1.29
152	18.50	66.78	3.88	113.17	1.35
153	18.50	66.66	4.03	113.29	1.40
154	18.50	66.53	4.18	113.41	1.45
155	18.50	66.41	4.33	113.52	1.50
156	18.50	66.30	4.48	113.63	1.54
157	18.50	66.20	4.52	113.73	1.58
158	18.50	66.10	4.66	113.83	1.62
159	18.50	66.01	4.80	113.91	1.66
160	18.50	65.92	4.83	114.00	1.69
161	18.50	65.84	4.97	114.07	1.72
162	18.50	65.77	4.99	114.14	1.75
163	18.50	65.70	5.12	114.20	1.78
164	18.50	65.65	5.14	114.26	1.80
165	18.50	65.59	5.27	114.31	1.82
166	18.50	65.55	5.28	114.36	1.84
167	18.50	65.51	5.30	114.39	1.86
168	18.50	65.48	5.31	114.42	1.87
169	18.50	65.45	5.42	114.45	1.88
170	18.50	65.43	5.43	114.47	1.89
171	18.50	65.42	5.44	114.48	1.89
172	18.50	65.41	5.44	114.49	1.90
173	18.50	65.41	5.44	114.49	1.90
174	18.50	65.42	5.44	114.48	1.89
175	18.50	65.43	5.43	114.46	1.89
176	18.50	65.45	5.42	114.44	1.88
177	18.50	65.48	5.31	114.42	1.87
178	18.50	65.52	5.30	114.39	1.85
179	18.50	65.56	5.28	114.35	1.84
180	18.50	65.60	5.26	114.30	1.82
181	18.50	65.66	5.14	114.25	1.80
182	18.50	65.72	5.12	114.19	1.77
183	18.50	65.79	4.99	114.13	1.75
184	18.50	65.86	4.96	114.06	1.72
185	18.50	65.94	4.82	113.98	1.69

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186	18.50	66.03	4.79	113.89	1.65
187	18.50	66.12	4.65	113.81	1.61
188	18.50	66.22	4.51	113.71	1.57
189	18.50	66.33	4.47	113.61	1.53
190	18.50	66.44	4.32	113.50	1.49
191	18.50	66.56	4.17	113.38	1.44
192	18.50	66.68	4.02	113.26	1.39
193	18.50	66.81	3.87	113.14	1.34
194	18.50	66.95	3.71	113.00	1.28
324	6.75	66.95	7.43	-67.13	2.58
325	6.75	66.77	7.24	-66.94	2.50
326	6.75	66.60	6.94	-66.76	2.42
327	6.75	66.44	6.76	-66.59	2.34
328	6.75	66.28	6.57	-66.42	2.27
329	6.75	66.13	6.29	-66.26	2.20
330	6.75	65.98	6.11	-66.10	2.13
331	6.75	65.83	5.93	-65.95	2.06
332	6.75	65.69	5.76	-65.81	2.00
333	6.75	65.56	5.59	-65.67	1.94
334	6.75	65.43	5.42	-65.54	1.88
335	6.75	65.31	5.26	-65.41	1.82
336	6.75	65.20	5.10	-65.29	1.77
337	6.75	65.09	4.94	-65.17	1.72
338	6.75	64.98	4.78	-65.06	1.67
339	6.75	64.88	4.63	-64.96	1.62
340	6.75	64.79	4.48	-64.86	1.58
341	6.75	64.70	4.44	-64.77	1.54
342	6.75	64.62	4.30	-64.69	1.50
343	6.75	64.55	4.16	-64.61	1.47
344	6.75	64.47	4.12	-64.54	1.43
345	6.75	64.41	3.99	-64.47	1.41
346	6.75	64.35	3.96	-64.41	1.38
347	6.75	64.30	3.83	-64.36	1.36
348	6.75	64.26	3.81	-64.31	1.33
349	6.75	64.22	3.79	-64.27	1.32
350	6.75	64.19	3.67	-64.24	1.30
351	6.75	64.16	3.66	-64.21	1.29
352	6.75	64.14	3.65	-64.19	1.28
353	6.75	64.12	3.64	-64.17	1.27

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354	6.75	64.11	3.64	-64.16	1.27
355	6.75	64.11	3.64	-64.16	1.27
356	6.75	64.11	3.64	-64.16	1.27
357	6.75	64.12	3.64	-64.17	1.27
358	6.75	64.14	3.65	-64.19	1.28
359	6.75	64.16	3.66	-64.21	1.29
360	6.75	64.19	3.68	-64.24	1.30
361	6.75	64.22	3.79	-64.27	1.32
362	6.75	64.26	3.81	-64.32	1.34
363	6.75	64.31	3.84	-64.36	1.36
364	6.75	64.36	3.96	-64.42	1.38
365	6.75	64.42	3.99	-64.48	1.41

It can be seen that every day from days 151 to 194 (May and June) the reflected beam will be sometime contained in the flight plane at sunset, and from days 324 to 21 (October to January) at sunrise. In all cases the sun azimuth angle is nearly aligned with the runway, and the sun elevation angle is very low (below 2.6 degrees over the horizon). Therefore, planes approaching or taking-off from this runway will always be facing directly the sun disk during such events.

4 Conclusion

This report analyzes the risk of glint and glare for approaching airplanes eventually caused by a photovoltaic power plant located close to the Kalaeloa airport.

To analyze the possibility of glint events, a mathematical model has been developed. The model implements the reflection laws from corresponding moving surfaces and solar trajectories for a full year in 15-minutes periods. Interference between the reflected beams and the airplane trajectories are then calculated for both runways in Kalaeloa.

It has been demonstrated that, in the few cases when there is some risk of glint by PV modules, the airplane will also be directly facing the sun and the corresponding reflections from the ocean. It can be concluded that glint from PV modules will not have any relevant effect on airplanes' visibility, nor deteriorate the actual approaching or taking-off flight conditions.

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Appendix E

FAA Determination Regarding Hazards to Aircraft Operation

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Boulevard
Fort Worth, TX 76137

Aeronautical Study No.
2011-AWP-814-OE

Issued Date: 03/08/2011

Corinne Onetto
AES Solar Power, LLC
505 Montgomery Street
Suite 1023
San Francisco, CA 94111

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel PV panels
Location:	Kapolei, HI
Latitude:	21-18-48.79N NAD 83
Longitude:	158-05-14.29W
Heights:	6 feet above ground level (AGL) 28 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be completed and returned to this office any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part I)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part II)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory circular 70/7460-1 K Change 2.

ADVISORY RECOMMENDATION - While the structure does not constitute a hazard to air navigation, it would be located within the Runway Protection Zone (RPZ) of the JOHN RODGERS FIELD (JRF) RUNWAY 11.

Structures, which will result in the congregation of people within an RPZ, are strongly discouraged in the interest of protecting people and property on the ground. In cases where the airport owner can control the use of the property, such structures are prohibited. In cases where the airport owner exercises no such control, advisory recommendations are issued to inform the sponsor of the inadvisability of the project from the standpoint of safety to personnel and property.

Any height exceeding 6 feet above ground level (28 feet above mean sea level), will result in a substantial adverse effect and would warrant a Determination of Hazard to Air Navigation.

This determination expires on 09/08/2012 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates , heights, frequency(ies) and power . Any changes in coordinates , heights, and frequencies or use of greater power will void this determination. Any future construction or alteration , including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

Any failure or malfunction that lasts more than thirty (30) minutes and affects a top light or flashing obstruction light, regardless of its position, should be reported immediately to (877) 487-6867 so a Notice to Airmen (NOTAM) can be issued. As soon as the normal operation is restored, notify the same number.

If we can be of further assistance, please contact our office at (310) 725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2011-AWP-814-OE.

Signature Control No: 137143769-138382946 (DNE)
Karen McDonald
Specialist

Attachment(s)
Case Description
Map(s)

Construct PV park using polycrystaline Photovoltaic panels

Verified Map for ASN 2011-AWP-814-OE