ARUP

County of San Diego

County of San Diego Airports Sustainability Management Plan

Renewables, Resilience, and Incentives

Reference:

FINAL | May 4, 2023

Job number 289094

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Document Verification

Project title	County of San Diego Airports Sustainability Management Plan
Document title	Renewables, Resilience, and Incentives Report
Job number	289094
Document ref	
File reference	

Revision	**Date**	**Filename**			
	3/08/23	**Description**	Draft		
			Prepared by	**Checked by**	**Approved by**
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	05/04/23	**Filename**	Final		
		Description			
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		Filename			
		Description			
			Prepared by	**Checked by**	**Approved by**
		Name			
		Signature			

Issue Document Verification with Document ✓

Table of Contents

1.	Introduction	1
2.	Renewables	1
2.1	Onsite Solar Generation	2
2.2	Results	8
2.3	Methods	33
3.	Incentives	38
3.1	Net Energy Metering	38
3.2	Feed-In-Tariff	38
3.3	Federal Grants (IRA and IIJA)	39
3.4	Federal Tax Credits	39
3.5	Power Purchase Agreement (PPA)	39
3.6	Community Choice Aggregation (CCA)	40
3.7	Electric Program Investment Charge (EPIC) Grants	40
3.8	Self-Generation Incentive Program (SGIP)	40
3.9	Property Assessed Clean Energy (PACE)	40
3.10	Incentive selection	41
4.	Hazards Assessment	42
4.1	Natural and Climate Hazards Assessment	42
4.2	Managing impacts from natural hazards	54

Appendices

Appendix A - Environmentally Sensitive Areas (ESA) Maps 56
Appendix B - Site Boundaries 60
Appendix C – Solar Study Results Tables 64

1. Introduction

The County of San Diego seeks to develop and implement a detailed, comprehensive, coordinated, and ambitious Airport System Sustainability Management Plan (SMP) that describes how the County's eight airports will individually and collectively reduce natural resource consumption, environmental impacts, and greenhouse gas emissions, and become an industry leader in sustainability while promoting social responsibility. Renewable energy is one such opportunity explored throughout the development of the SMP because of its benefits in reducing greenhouse gas emissions.

With the progression of climate change, airports and their operations may be significantly impacted by climate hazards and natural hazards including increased temperatures, landslides, earthquakes, and flooding, resulting in increased need for replacement and repair, disruptions to operations, and need for additional capacity. Climate and natural hazards are considerations to include throughout the development of the SMP because they can have extensive ramifications on the triple bottom line of sustainability - the environment, the economy, and society. Creating a resilient airport could reduce operation and repair costs and increase occupant safety in the face of climate and natural hazards.

Solar generation systems can help make a site more resilient by providing a reliable and consistent source of electricity, even during power outages or grid failures. This is achieved by installing battery storage systems that allow the solar panels to store excess energy during times of peak generation and use it when needed. By incorporating energy storage batteries, monitoring and control systems (for real-time usage and storage levels), and redundancy (back up components) into the solar generation system, a site can achieve greater energy independence and resiliency, reducing its reliance on the grid and providing backup power during outages or emergencies.

This report introduces the four solar photovoltaic system types included in the study: rooftop, ground-mounted, parking cover, and agrivolatics (i.e., solar panels above agricultural land uses). The report then provides estimates of maximum solar potential for each airport and explains the methodology for arriving at these early-stage estimations of solar potential, and then dives into the incentives available for installing solar and storage onsite. Lastly, it also includes a natural and climate hazards assessment organized by each airport. This is a feasibility study and does not include recommendations to build specific solar projects, but is intended to serve as a guide to the opportunities that could be explored to reach goals around renewable energy generation that may be included in the upcoming Sustainability Management Plan.

2. Renewables

There are several types of renewable energy generation technologies available, including solar, wind, hydroelectric, geothermal, and biomass energy. However, in the case of the Airports SMP, onsite solar energy generation is the preferred option due to its numerous advantages. Solar energy is a reliable and consistent source of energy at all County Airports sites. Solar generation system types also include rooftop panels that require minimal land use impact and new infrastructure. And most importantly, Solar generation can be scaled up or down easily, depending on energy demand. In contrast, wind energy generation requires large wind turbines, which are typically not suitable for populated environments due to space limitations and potential noise pollution, and are incompatible with airport sites because their height. Hydroelectric energy requires water sources, which are not available airport sies, and dams can also negatively alter the hydrology and function river ecosystems. Both geothermal energy require considerable investment in drilling, exploration, and infrastructure and is not likely available on airport sites, while biomass energy releases air, water, and soil pollutants such as heavy metals, and creates an ash waste streams requiring disposal.

2.1 Onsite Solar Generation

Onsite solar power generation is becoming increasingly popular as a way to reduce businesses' energy bills and reduce their Scope 2 carbon emissions. It is estimated that industrial customers typically save 20-80% of their utility costs by integrating onsite solar into their operations.[1] Furthermore businesses can take advantage of many incentives including federal tax credits and state and utility incentives, to further reduce solar purchasing and installation costs (addressed in Section 3).

The four types of onsite solar we examined for this study include rooftop solar, ground mounted solar, parking cover solar (i.e., solar carport), and agrivoltaics (i.e., solar panels above agricultural land uses). Below is a quick description and comparison of the four types of solar studied here along with their pros and cons relative to each other.

[1] The Benefits to Onsite Solar Energy for Industrial Companies | Knobelsdorff Enterprises

2.1.1 Rooftop Solar

A rooftop solar system is a photovoltaic (PV) system that has electricity generating panels mounted to the rooftop of a residential, commercial, or industrial building or structure. These systems can be mounted flush or angled along both flat and sloped rooftops. Rooftop solar sizing usually ranges from 5-20 kW on smaller residential buildings all the way to 100 kW-10 MW on larger commercial buildings.

Figure 1 Rooftop solar

Pros:

- Requires fewer materials to install than carports with steel structures
- Utilizes unused space
- Easier to permit as buildings already occupy the areas

Cons:

- Maximum potential limited by access needed for maintenance and cleaning
- Higher panel temperatures above roofs mean lower panel output
- Space constraints and roof penetrations limit the size of the system
- Replacing the roof within the panel’s lifetime can require reinstallation of the panels
- Installation can damage roof
- May require a glare study for FAA review due to possible glare impacts to pilots and/or Air traffic Control Tower

2.1.2 Ground Mounted Solar

Ground mounted solar can be flush mounted, standard angled mounted, or pole mounted. Ground mounted solar can also allow for solar tracking whereby the solar panels move throughout the day following the sun, in order to optimize light capture and energy generation. Ground mounted solar sizing can range anywhere from 100 kW for smaller applications all the way to 2,000 MW for the largest solar farms (typically 1-50 MW).

Figure 2 Ground mounted solar

Pros:

- Easy to access
- Easy to clean
- Easier to troubleshoot
- System is not confined to the dimensions of the roof
- Cooler panel temperatures mean higher energy output
- No need to remove panels if roof is replaced

Cons:

- May require more parts and pieces
- Permitting process can be more complex
- Takes up land that might have other uses
- Not aesthetically pleasing to everyone
- May require a glare study for FAA review due to possible glare impacts to pilots and/or Air traffic Control Tower

2.1.3 Parking Cover Solar (Solar Carport)

A solar parking canopy is a double-duty elevated structure located in a paved area that not only provides shade for cars but also hosts solar panels. A parking canopy is taller than a typical ground mount installation to provide space for a car to park beneath, and support structure locations must be located to avoid the loss of parking spaces.[2] Parking cover solar is common across airports, malls, stadiums, hospitals, grocery stores, universities, and even homes in California. Parking cover solar sizing can range anywhere from 10 kW for smaller residential applications all the way to 10 MW for large industrial/commercial parking complexes

Figure 3 Parking cover solar

Pros:

- Utilizes unused space
- Improves customer parking experience by offered shade from the sun and protection from rain
- Can be easily paired with electric car charging
- System is not confined to the dimensions of the roof
- No need to remove panels if roof is replaced
- Easier to access and clean than rooftop solar

Cons:

- While cost of solar photovoltaic materials continue to drop, the cost of the steel structural support is considerable
- More difficult to access and clean than ground mounted solar
- May require a glare study for FAA review due to possible glare impacts to pilots and/or Air traffic Control Tower

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[2] Solar Parking Canopy: Does It Make Sense? | KMB Design Group (kmbdg.com)

2.1.4 Agrivoltaics

Agrivoltaics, also called agrovoltaics or dual use solar, is the simultaneous use of land area for solar photovoltaic power generation and agriculture. Panels are typically positioned about 7-10 feet above the ground, with some spacing to provide a mix of sun and shade to the plants below. Agrivoltaics can help shield plants from excessive heat and UV radiation and help retain soil moisture, increasing crop yields.[3] Alternately, when paired with raising livestock, agrivoltaics can provide shade for grazing animals (e.g. goats, sheep, chickens, cows). However, agrivoltaics can be complex to manage since different crops require varying amount of sunlight, shade, space, and moisture. Extra consulting and planning between farmers and solar designers is needed before installation. Agrovoltaic sizing can range anywhere from 100 kW for smaller applications up to 700 MW for the largest dual agricultural and solar farms.

Figure 4 Agrivoltaics

Pros:

- Increases land productivity with dual agricultural and energy use
- Reduces water use by decreasing plant transpiration and providing shade to keep moisture locked in the soil
- Increases solar PV output by reducing solar panel temperature (Plants grown beneath PV modules help decrease the ambient temperature by 3 – 4 degrees Fahrenheit)[4]
- Can provide shade to livestock when paired with grazing pastures
- Improvement to farmer's/agriculture worker's health via increased shade

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[3] The Pros and Cons of Agrivoltaics | Earth.Org

[4] Agrivoltaics Advantages & Disadvantages - Climatebiz

- System is not confined to the dimensions of the roof
- No need to remove panels if roof is replaced

Cons:

- The most expensive of the four options to install and maintain
- Permitting process may be more expensive
- Not tested or compatible with all crops
- More difficult to access and clean than the other four systems, and might require more frequent cleaning and maintenance
- Increased consulting costs due to necessary research, planning, and collaboration between farmers and solar designer
- May require a glare study for FAA review due to possible glare impacts to pilots and/or Air traffic Control Tower

Crops Suitable to Agrivoltaics

Suitable crops shown in green, neutral in yellow, and unsuitable in red.[5]

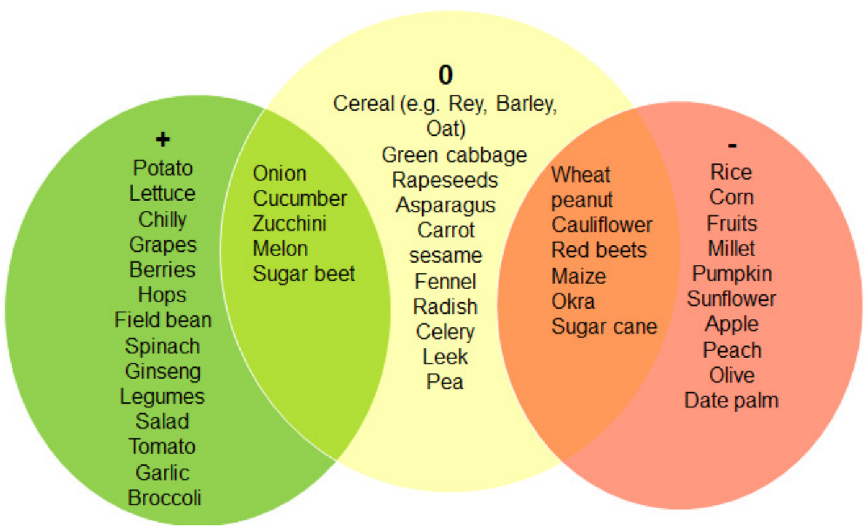


Figure 5 Crops suitable to Agrivoltaics

5 Agronomy | Free Full-Text | Economic Feasibility of Agrivoltaic Systems in Food-Energy Nexus Context: Modelling and a Case Study in Niger (mdpi.com)

2.2 Results

2.2.1 Overview

The results presented in this report are feasibility study findings of the rough maximum solar potential and promising areas of opportunity for further study of renewable energy generation at the County of San Diego Airports system. Across the airports system, ground-mounted solar has the largest potential followed by rooftop solar, parking solar, and agrivoltaics. Solar potential by mount type varied greatly from location to location based off of land available, usable rooftop space, future development plans, environmentally sensitive areas (ESA), and many other factors. The tables and graphs below present the overall solar potential (annual energy generation and capacity) broken down by airport location, mount type, and ownership type.

Figure 6 shows the annual energy generation potential by location and mount type for each airport. Borrego Valley Airport, Gillespie Field, and Ocotillo have the highest solar potential of the eight airports, and Agua Caliente Springs has no solar potential due to the lack of county-owned space outside of the runway and immediately adjacent area. Furthermore, ground-mounted solar has the largest potential of 119,000 MWh/year followed by rooftop at 68,000 MWh/year, parking solar at 40,000 MWh/year, and agrivoltaics at 21,000 MWh/year.

Figure 6 – Potential annual energy generation by location and mount type (MWh/year)

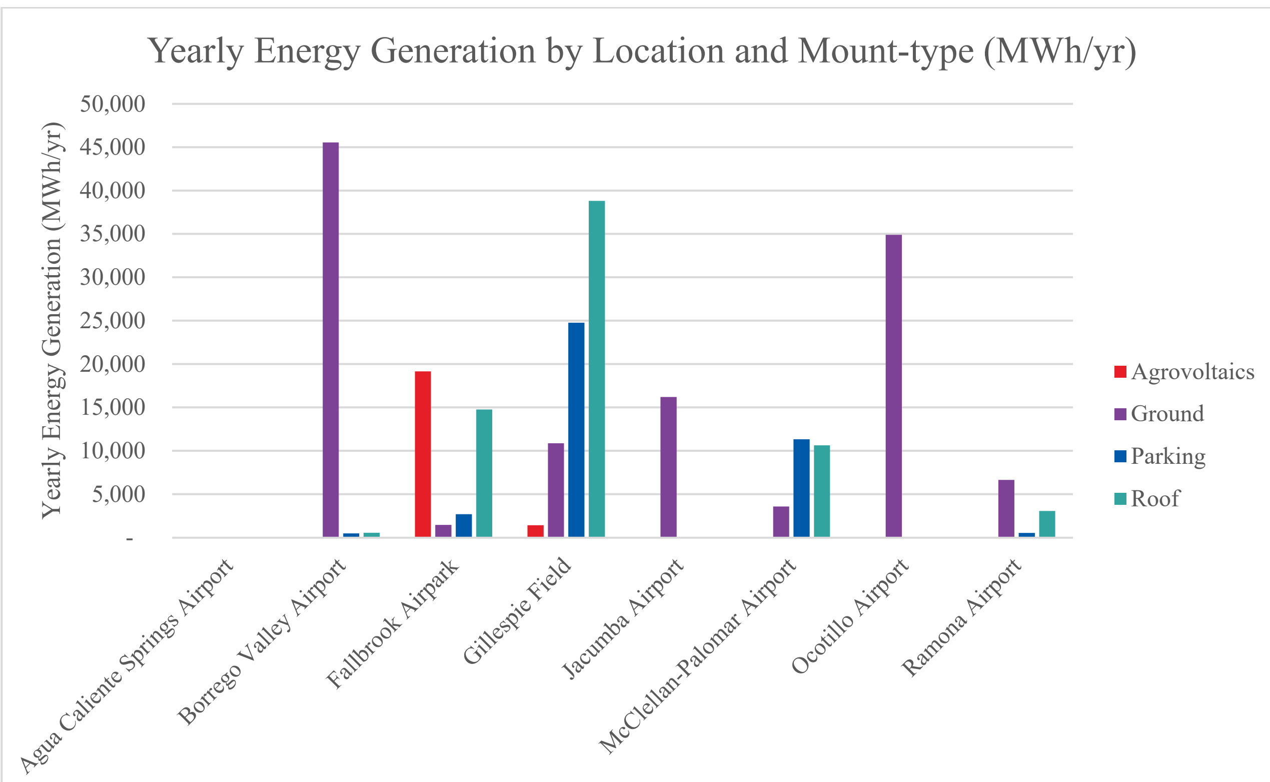


Figure 7 shows the annual energy generation by location and ownership type. The county owned and occupied space makes up the largest portion of 129,000 MWh/year, followed by county owned and lessee occupied at 69,000 MWh/year, and lessee owned and occupied (i.e., ground-leased) at 52,000 MWh/year.

Figure 7 – Potential annual energy generation by location and ownership type (MWh/year)

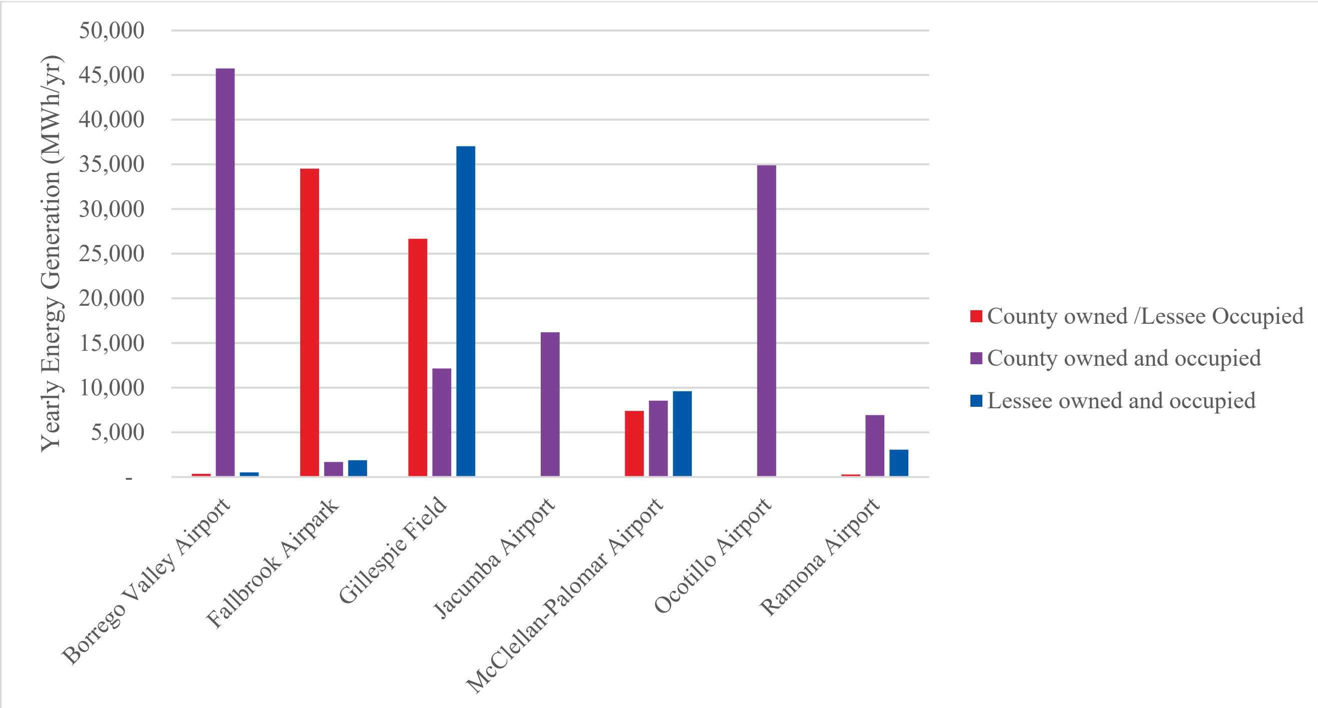


Figure 8 shows the annual energy generation by location, mount type, and ownership type. All agrivoltaics would be on county owned and lessee occupied land, all ground-mounted solar would be on county owned and occupied land, parking mostly consists of county owned and lessee occupied land, and rooftop spaces mostly consist of lessee owned and occupied buildings (except for Fallbrook Airpark).

Figure 8 – Potential annual energy generation by location, mount type, and ownership type (MWh/year)

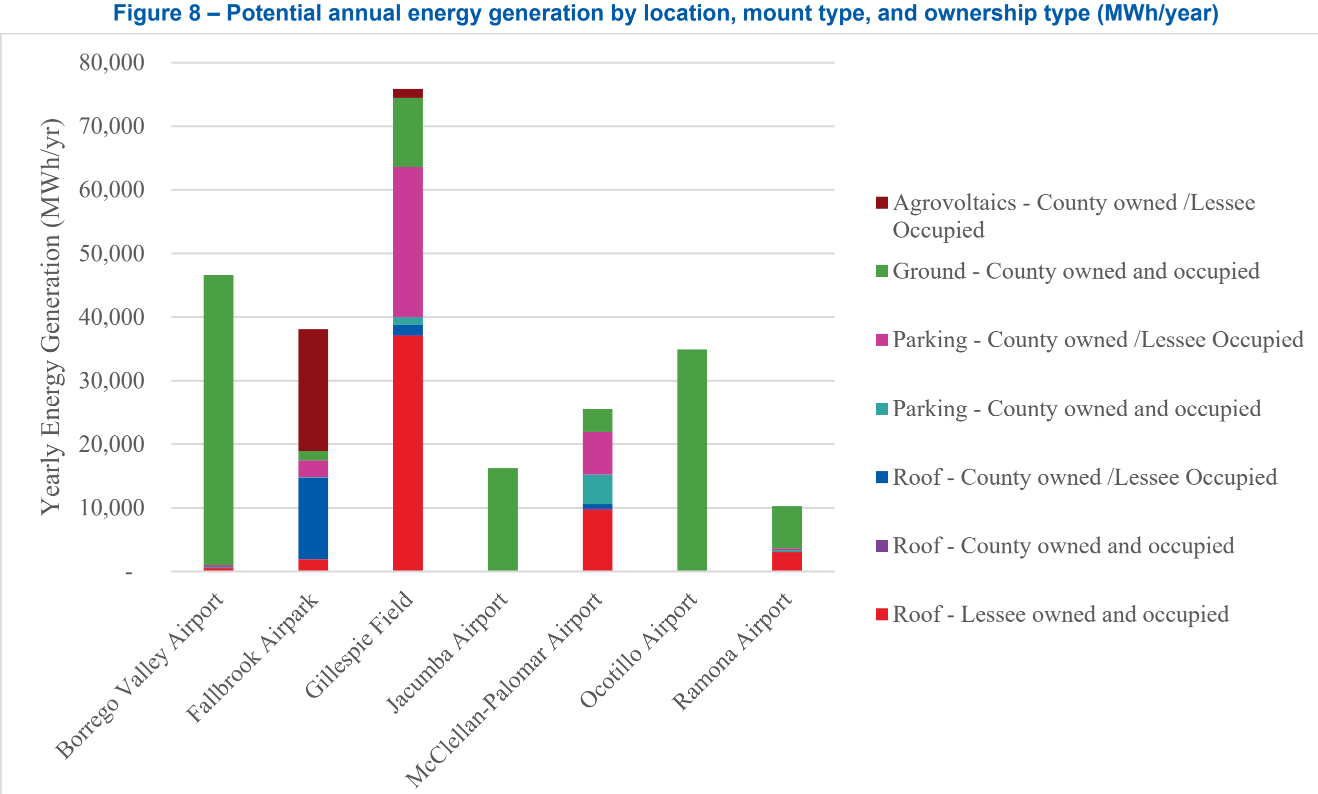
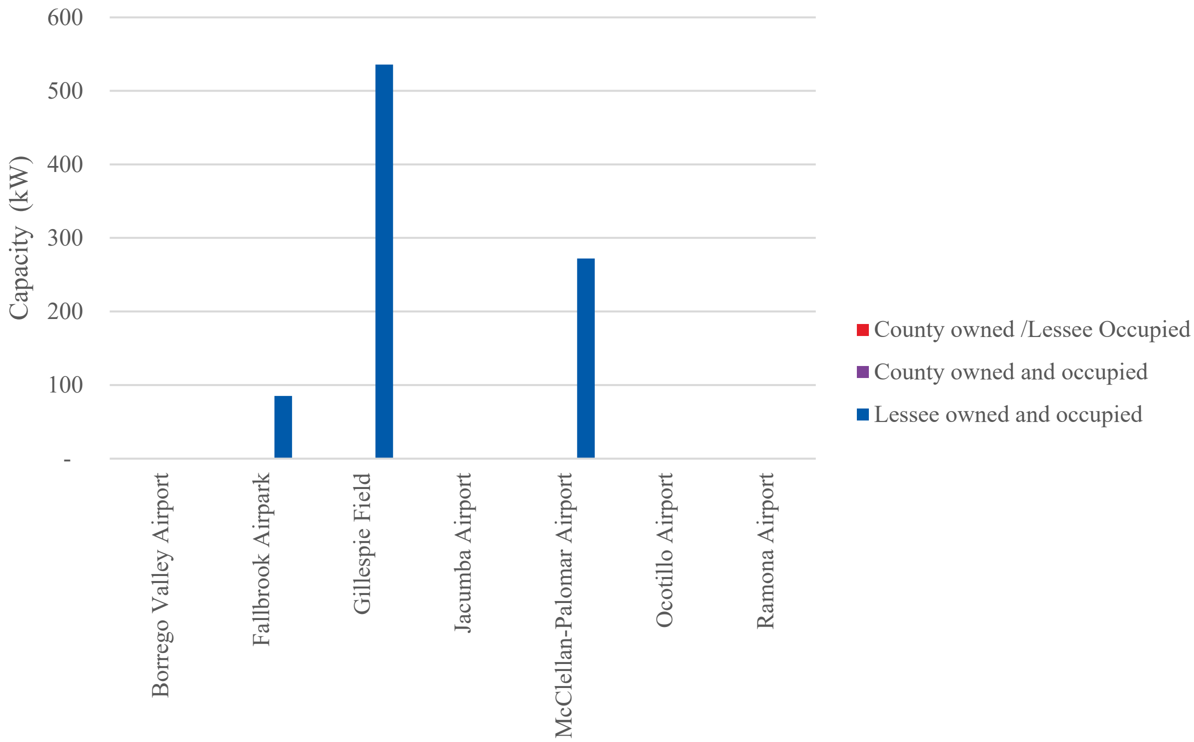


Figure 9 depicts the existing onsite solar generation at the eight airports, which was estimated from visual analysis of the eight airports using Google Earth and Google Maps. All the existing solar is rooftop solar on lessee owned and occupied buildings. The estimate of existing solar of 900 kW is less than 1% of the potential solar capacity of all 8 airports of 129,000 kW or about 2% of the rooftop solar capacity of all 8 airports of 37,000 kW. This means that there is a huge untapped solar potential across the eight airports.

Figure 9 - Existing rooftop solar capacity



Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

2.2.1.1 Environmentally Sensitive Areas (ESA) Maps

These ESA maps (dated November 2022) were provided by County Environmental Services Unit (ESU) staff for Borrego Valley, Fallbrook, Gillespie, Palomar, and Ramona Airports. There were no first-hand data or information about ESAs at Jacumba, Ocotillo, or Agua Caliente airports. However:

- This report is not a CEQA analysis. Future CEQA analysis would be required for any future County-initiated or County-approved development. In other words, if certain areas were not flagged as ESAs, this should not be interpreted to mean that no further CEQA investigation is needed. Through the CEQA review process, additional surveys and studies may be warranted (e.g., bio, cultural or other CEQA resources), depending on the location, scale, methods of construction, time period and other variables.
- These ESA maps and files are meant to guide future development to avoid known ESAs. They are not meant to capture every possible environmental resource at the airports. There could be other resources that ESU is not aware of. The ESA information provided (or lack of) is based on ESU's historical knowledge and past survey data.
- The ESA files only address Biological Resources. Some less intensely developed airports in the dessert have the potential to contain cultural or other resources. The best way to ascertain this data would be to conduct a site-specific review once individual sites are proposed for development.

See Appendix A for images of the ESA Maps.

2.2.2 Agua Caliente Airstrip

Agua Caliente has zero potential for solar since the site is limited to the footprint of the airstrip and does not include any buildings, parking areas, or land outside of the airstrip itself. It is operated by the County but is owned by the State of California and located in the middle of a state park.

Figure 10 Agua Caliente Airstrip solar potential

See Appendix B for the site boundary.

2.2.3 Borrego Valley Airport

Borrego Valley has large amounts of land studied for ground mounted solar at about 45,000 MWh/year and has a very small amount of rooftop and parking cover solar potential at less than 1,000 MWh/year combined.

For this site, solar was considered across all available buildings and parking structures. Ground mounted solar was not considered in Runway Protection Zones (RPZ), Environmentally Sensitive Areas (ESA), or in between runways. Furthermore, for this site, solar was not considered on the east side due to future approach areas (FAA) extension nor directly north or south along the runway areas.

Figure 11 Borrego Valley Airport solar potential

See Appendix B for the site boundary.

Figure 12 shows the annual energy generation by mount type and ownership type for Borrego Valley Airport. Most of the solar potential is ground mounted and county owned and occupied.

Figure 12 - Borrego Valley: Annual energy generation by mount type and ownership type

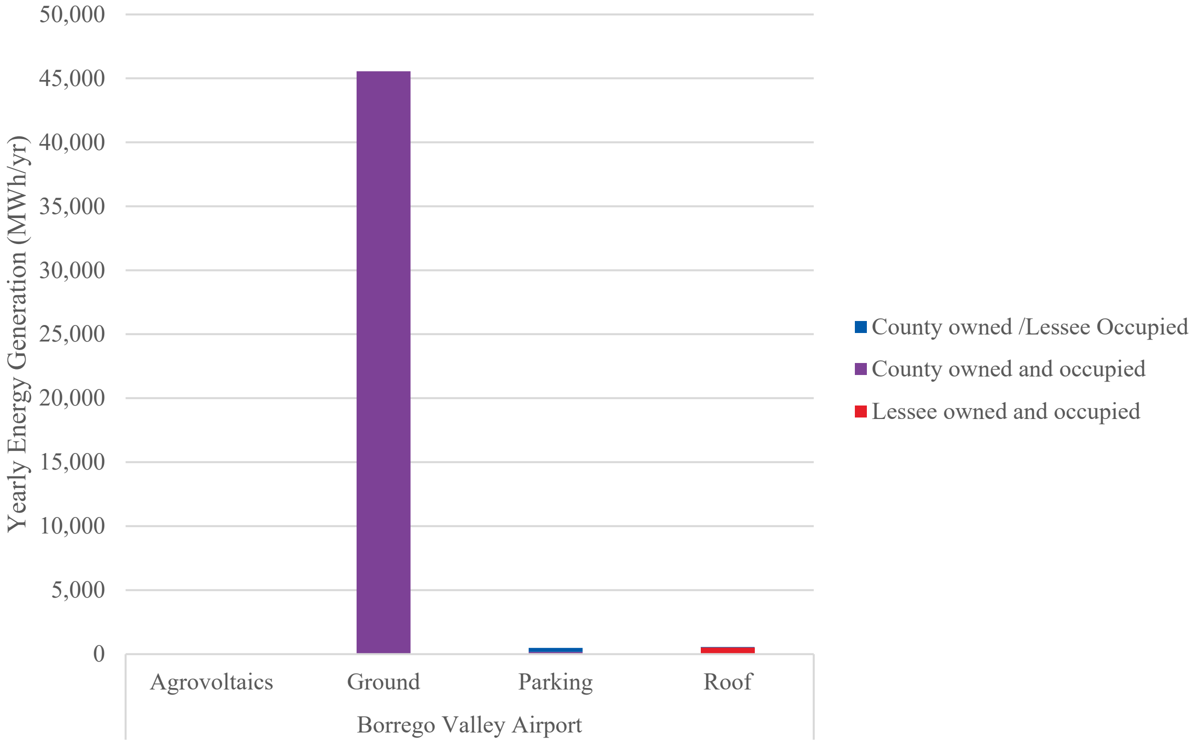


Table 1 compares solar potential by mount type and ownership time with system size, annual generation potential, and peak generation potential. The grid availability of 0.1 MW is much smaller than onsite solar potential peak generation of 23.4 MW.

Since Borrego Valley Airport is small and has low energy uses, it would presumably be exporting most of electricity generated to the grid. The initial grid capacity screening, however, indicates an available grid capacity of 0.1 MW for new solar PV installations on the circuit serving the airport, much too limited to accommodate the solar potential available to the site and for exporting to the grid, as shown in Table 2.

Desktop research and review of aerial images from Google Maps reveal that a solar field north of the airport is the Borrego Springs Microgrid project. Borrego Springs has a history of frequent outages because of severe environmental conditions and being located at the end of a single transmission line. The microgrid project was funded through the California Energy Commission (CEC) Electric Program Investment Charge (EPIC) program6, described in Section 3.7, and could serve as a model or parent project to solar installations at Borrego Valley Airport.

[6] Borrego Springs: California's First Renewable Energy- Based Community Microgrid (energy.ca.gov)

Table 1 - Borrego Valley: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	-	-
Ground	County owned and occupied	22,900	45,600
Parking	County owned & lessee occupied	160	310
	County owned and occupied	90	170
Roof	County owned & lessee occupied	20	40
	County owned and occupied	5	10
	Lessee owned and occupied	250	500
	Total	23,425	46,630

Table 2 - Grid Availability: Borrego

	Capacity (kW)
Solar potential capacity	23,425
Baseline electricity consumption during peak generation	215
Solar potential to feed to grid / battery storage	23,210
Grid capacity	100
Excess generation over grid capacity	23,110

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

Overall, the feasibility study results show that the installation of a new solar generation project within the current grid capacity would not be beneficial beyond offsetting the onsite demand. This is because the current grid capacity is not sufficient to accommodate excess electricity generated by the potential solar project. In the case of Borrego Airport there is very little onsite demand, and while there are benefits to offsetting any onsite demand (reducing greenhouse gas emissions and resilience), without grid capacity upgrades, any surplus electricity produced by the solar panels would not be able to be fed back into the grid, which limits the potential benefits of the project. If solar is to be pursued, it would need to be done in conjunction with grid upgrades.

2.2.4 Fallbrook Airpark

Fallbrook Airpark has a small amount of land studied for ground mounted solar at 1,500 MWh/year and parking cover solar potential at 3,000 MWh/year The potential for rooftop solar is 15,000 MWh/year and 19,000 MWh/year for agrivoltaics. For this site, solar was considered across all available buildings and parking structures and in agricultural areas. The generation potential for rooftops includes some buildings that are assumed to be greenhouses from satellite imagery. Some of these structures may not be suitable for rooftop solar. Ground mounted solar was not considered in Runway Protection Zones (RPZ) or Environmentally Sensitive Areas (ESA).

Figure 13 Fallbrook Airpark solar potential

See Appendix B for the site boundary.

Figure 14 shows the annual energy generation by mount type and ownership type for Fallbrook Airpark. Most of the solar potential is county owned and lessee occupied, a majority of which is across agrivoltaics and rooftop solar.

Figure 14 – Fallbrook Airpark: Annual energy generation by mount type and ownership type

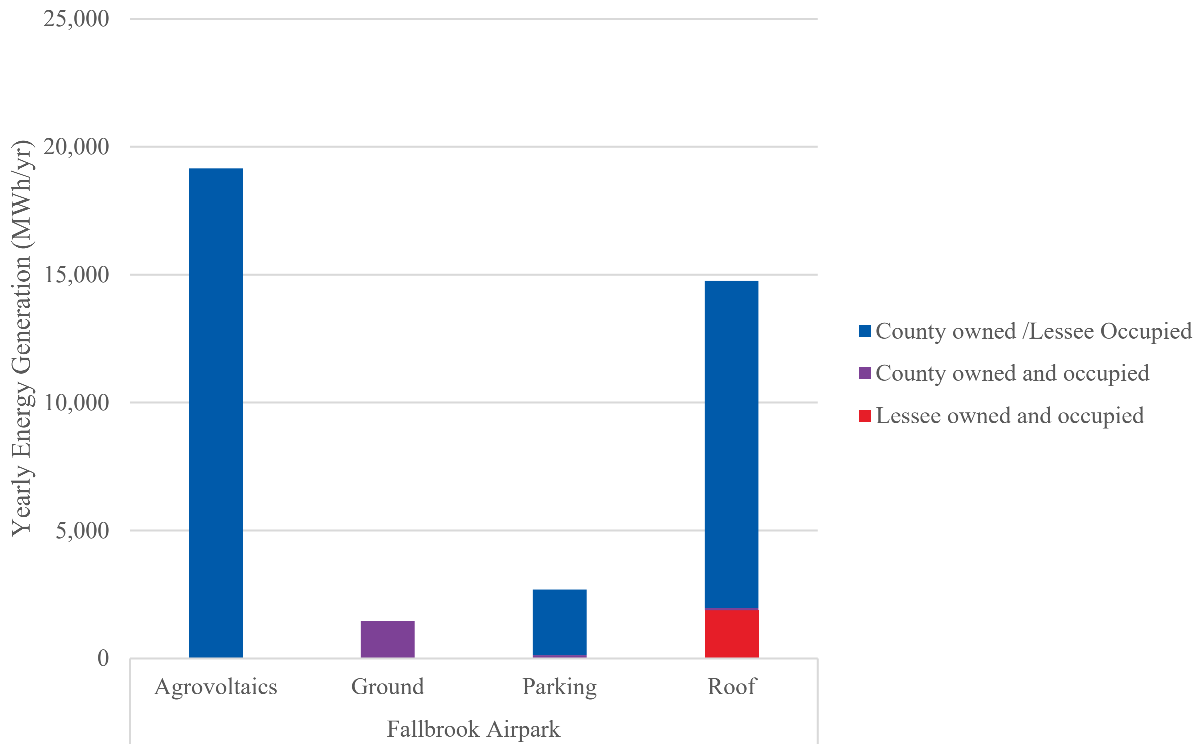


Table 3 compares solar potential by mount type and ownership time with system size, annual generation potential, and peak generation potential. The grid availability of 0.1 MW is much less than onsite solar potential peak generation of 20.6 MW, as shown in Table 4.

Since the initial grid capacity screening indicates limited grid capacity for new solar PV installations on the circuit serving the airport, a portion of the electricity generated can be used on site for buildings and airport operations before exporting any remaining electricity to the grid.

Table 3 – Fallbrook Airpark: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	10,400	19,200
Ground	County owned and occupied	790	1,500
Parking	County owned & lessee occupied	1,400	2,600
	County owned and occupied	60	120
Roof	County owned & lessee occupied	6,900	12,800
	County owned and occupied	50	90
	Lessee owned and occupied	1,000	1,900
	Total	20,600	38,210

Table 4 – Grid Availability: Fallbrook

	Capacity (kW)
Solar potential capacity	20,600
Baseline electricity consumption during peak generation	976
Solar potential to feed to grid / battery storage	19,624
Grid capacity	100
Excess generation over grid capacity	19,524

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

Overall, the feasibility study results show that the installation of a new solar generation project within the current grid capacity would not be beneficial beyond offsetting the onsite demand. This is because the current grid capacity is not sufficient to accommodate excess electricity generated by the potential solar project. While there are benefits to offsetting the onsite demand (reducing greenhouse gas emissions and resilience), without grid capacity upgrades, any surplus electricity produced by the solar panels would not be able to be fed back into the grid, which limits the potential benefits of the project. If solar is to be pursued, it would need to be done in conjunction with grid upgrades.

2.2.5 Gillespie Field

Gillespie Field airport has a moderate amount of land studied for ground mounted solar (11,000 MWh/year) a very large amount for rooftop solar (39,000 MWh/year) and parking (25,000 MWh/year), and a small amount for agrivoltaics (1,000 MWh/year). For this site, solar was considered across all available buildings and parking structures. Ground mounted solar was not considered in Runway Protection Zones (RPZ) or Environmentally Sensitive Areas (ESA) or in the infield area between the runways. Furthermore for this site, ground-mounted solar was not considered in the northwest and southeast corners which do have large land areas available but are designated for future parking, building, and hangar development. Also parts of the hilly areas on the southwest corner which are facing north were also not included in this study due to too much shading and reduced solar output.

Figure 15 Gillespie Field solar potential

See Appendix B for the site boundary.

Figure 16 shows the annual energy generation by mount type and ownership type for Gillespie Field. There is a mix between all three ownership types with a majority of solar potential from rooftop solar and parking solar. The rooftop solar is mostly comprised of lessee owned and occupied buildings and the parking solar is mostly County owned and lessee occupied.

Figure 16 - Gillespie Field: Annual energy generation by mount type and ownership type

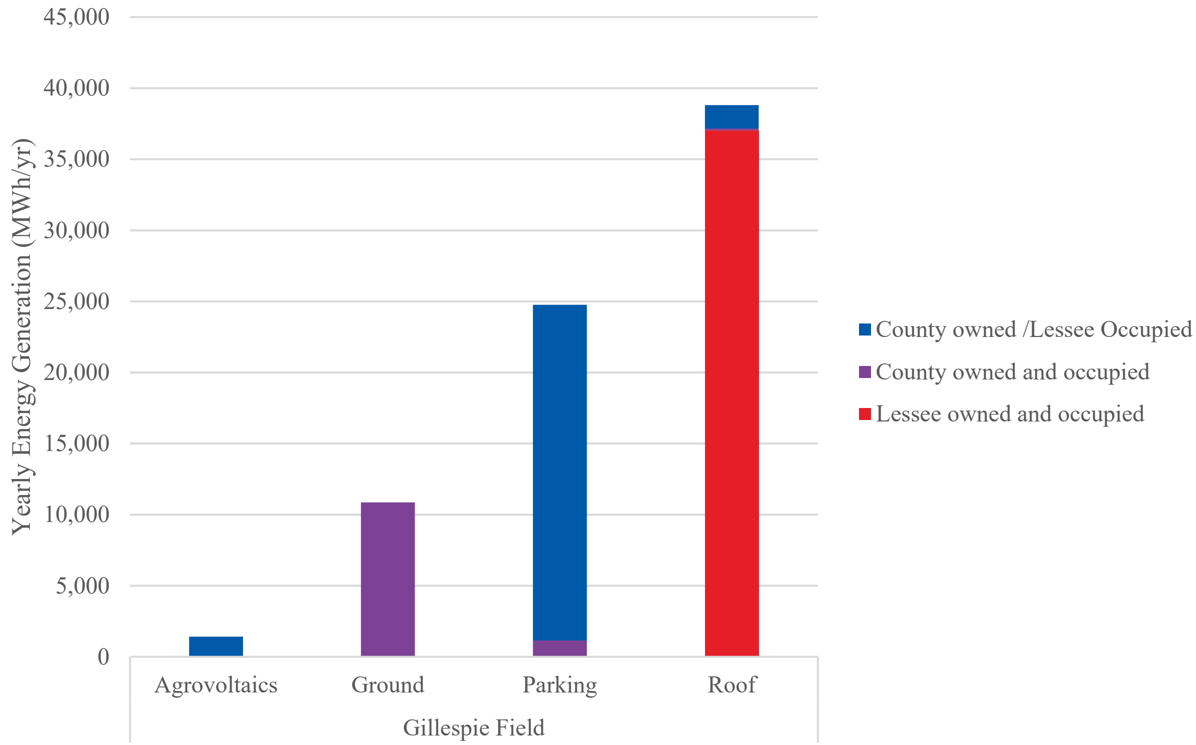


Table 5 compares solar potential by mount type and ownership type with system size, annual generation potential, and peak generation potential. The grid availability of 3.9 MW is less than onsite solar potential peak generation of 40.0 MW, as shown in Table 6, however there is more grid availability at Gillespie Field compared to most other airports in the County of San Diego Airports system.

The demand for energy is high at Gillespie Field so the renewable energy generated onsite can be used by the facilities before being exported to the grid.

Potential solar projects could be designed and sized in a way that meets the forecasted electrical demand of the site. In the event of over-generation, the surplus electricity generated by the solar panels could either be exported back to the grid or stored in batteries for future use. By implementing a properly sized solar PV system, it is possible to ensure that the site's electricity needs are met while also taking advantage of any additional energy produced by the system. This approach would not only increase the site's energy independence but also provide the opportunity for potential cost savings on energy bills.

Table 5 - Gillespie Field: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	750	1,400
Ground	County owned and occupied	5,700	10,900
Parking	County owned & lessee occupied	12,500	23,600
	County owned and occupied	610	1,100
Roof	County owned & lessee occupied	870	1,600
	County owned and occupied	70	140
	Lessee owned and occupied	19,500	37,000
	Total	40,000	75,740

Table 6 - Grid Availability: Gillespie

	Capacity (kW)
Solar potential capacity	40,000
Baseline electricity consumption during peak generation	9,517
Solar potential to feed to grid / battery storage	30,483
Grid capacity	3,900
Excess generation over grid capacity	26,583

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

Overall, the feasibility study results show that implementing a portion of the solar potential relative to the available grid capacity, with battery storage, is a viable approach to offset the on-site electricity demand while also generating some excess electricity that can be fed back to the grid within the current grid capacity. A battery storage system could provide the means to store any surplus electricity produced during peak solar generation periods and discharge it during times of low solar generation or high electricity demand, such as during peak hours. This approach would allow for a more efficient use of solar energy and maximize the benefits of a system within the current grid capacity limitations.

2.2.6 Jacumba Airport

Jacumba Airport has large amounts of land studied for ground mounted solar (about 16,000 MWh/year) and has a very small amount of rooftop solar potential (about 50 MWh/year) and no parking cover solar potential or agrivoltaic potential. For this site, solar was considered across all available buildings. Ground mounted solar was not considered in Runway Protection Zones (RPZ). Furthermore, for this site, solar was not considered on the northwest corner due to the possibility of future construction for a fire station.

Figure 17 Jacumba Airport solar potential

See Appendix B for the site boundary.

Figure 18 shows the annual energy generation by mount type and ownership type for Jacumba Airport. Most of the solar potential is ground mounted, and county owned and occupied with a tiny sliver of rooftop potential which is lessee owned and occupied.

Figure 18 - Jacumba Airport: Annual energy generation by mount type and ownership type

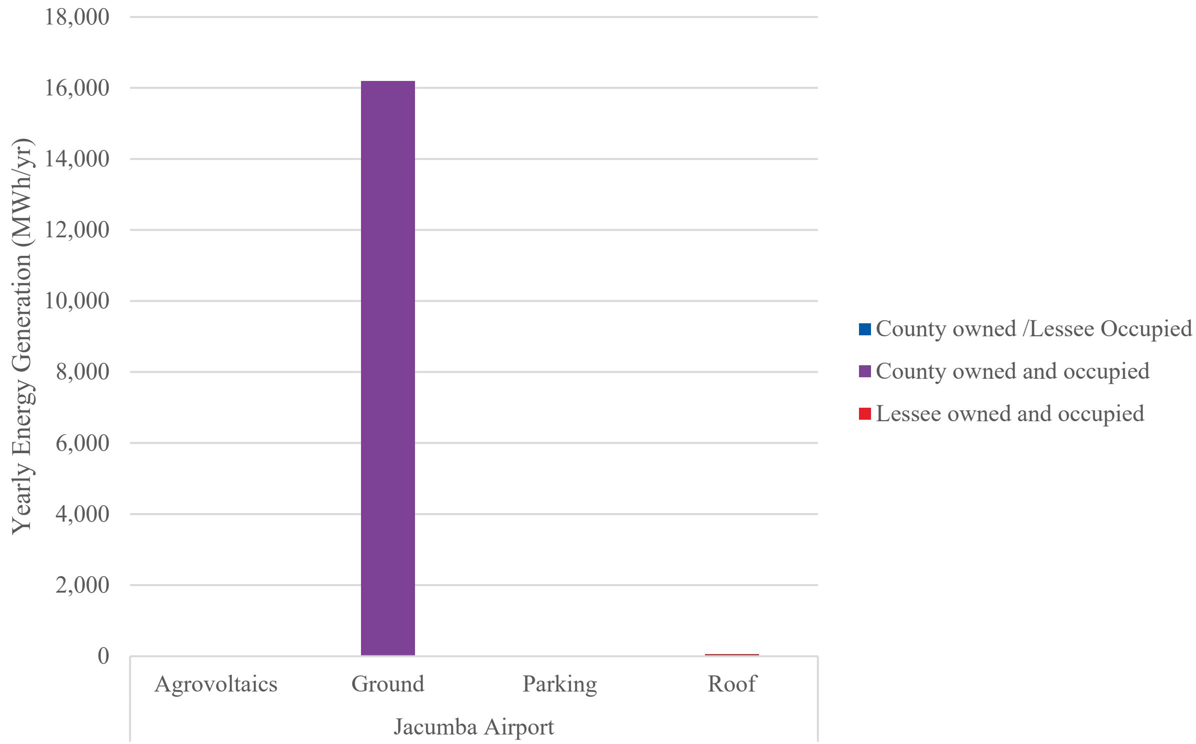


Table 7 compares solar potential by mount type and ownership time with system size, annual generation potential, and peak generation potential. The grid availability is unknown until data is requested for future solar projects. The circuit serving the site falls under what SDG&E calls the 15/15 rule[7], meaning the information is redacted from the ICA map because either one customer uses 15% or more of the total circuit load or the circuit holds 15 customers or less. Data is available upon request by the County if solar projects are intended for the circuit serving the site.

Since Jacumba airport itself is small and has low energy uses, it would most likely be exporting most of this electricity instead of using it all onsite. There is already an existing solar farm two miles east of the airport, not owned by the County of San Diego, which shows there is good potential to build ground mounted solar if infrastructure is in place and the local grid is not at overcapacity.

[7] SDG&E Interactive Map and Integration Capacity User Guide (sdge.com)

Table 7 - Jacumba Airport: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	-	-
Ground	County owned and occupied	8,100	16,200
Parking	County owned & lessee occupied	-	-
	County owned and occupied	-	-
Roof	County owned & lessee occupied	-	-
	County owned and occupied	-	-
	Lessee owned and occupied	30	50
	Total	8,130	16,270

Table 8 - Grid Availability: Jacumba

	Capacity (kW)
Solar potential capacity	8,130
Baseline electricity consumption during peak generation	26
Solar potential to feed to grid / battery storage	8,104
Grid capacity	unknown
Excess generation over grid capacity	8,104

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

2.2.7 McClellan-Palomar Airport

McClellan Palomar airport has a moderate amount of land studied for ground mounted solar (3,500 MWh/year) a moderate amount for rooftop solar (11,000 MWh/year), and a moderate amount for parking (11,000 MWh/year). For this site, solar was considered across all available buildings and parking structures. Ground mounted solar was not considered in Runway Protection Zones (RPZ) or Environmentally Sensitive Areas (ESA) or infield areas in between the runways. Furthermore, for this site, ground-mounted solar was not considered in a majority of the property on the northeast, which is a hilly ecological area designated as an ESA by County staff.

Figure 19 McClellan-Palomar Airport solar potential

See Appendix B for the site boundary.

Figure 20 shows energy generation by mount type and ownership type just for McClellan-Palomar Airport. Most of the solar potential is ground mounted and rooftop solar, and most of the rooftop solar is lessee owned and occupied, while the parking solar is split between county owned and lessee occupied and county owned and occupied space.

Figure 20 - McClellan Palomar Airport: Annual energy generation by mount type and ownership type

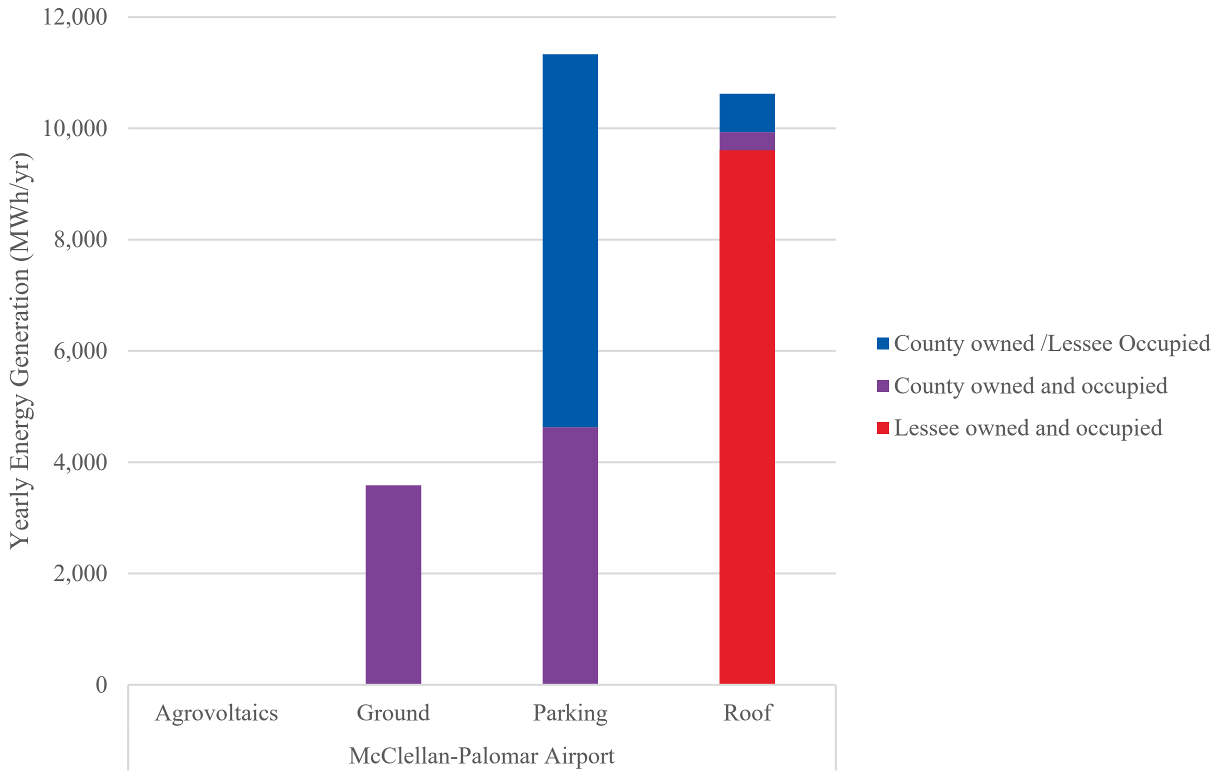


Table 9 compares solar potential by mount type and ownership time with system size, annual generation potential, and peak generation potential. The grid availability of 7.3 MW, shown in Table 10, signifies the best opportunity among the County of San Diego Airports for selling solar-generated electricity to the utility grid.

McClellan Palomar airport has a large number of buildings and high energy usage. Therefore, electricity generated through solar could be used for onsite buildings before being exported to the grid.

Potential solar projects could be designed and sized in a way that meets the forecasted electrical demand of the site. In the event of little over generation, the surplus electricity generated by the solar panels could either be exported back to the grid or stored in batteries for future use. By implementing a properly sized solar PV system, it is possible to ensure that the site's electricity needs are met while also taking advantage of any additional energy produced by the system. This approach would not only increase the site's energy independence but also provide the opportunity for potential cost savings on energy bills.

Table 9 - McClellan Palomar Airport: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	-	-
Ground	County owned and occupied	2,100	3,600
Parking	County owned & lessee occupied	3,900	6,700
	County owned and occupied	2,700	4,600
Roof	County owned & lessee occupied	400	690
	County owned and occupied	190	330
	Lessee owned and occupied	5,500	9,600
	Total	14,790	25,520

Table 10 - Grid Availability: McClellan-Palomar

	Capacity (kW)
Solar potential capacity	14,790
Baseline electricity consumption during peak generation	4,000
Solar potential to feed to grid / battery storage	10,790
Grid capacity	7,300
Excess generation over grid capacity	3,490

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

Overall, the feasibility study results show that implementing the full potential of solar PV, with battery storage, is a viable approach to offset the onsite electricity demand while also generating some excess electricity that can be fed back to the grid within the current grid capacity. A battery storage system could provide the means to store any surplus electricity produced during peak solar generation periods and discharge it during times of low solar generation or high electricity demand, such as during peak hours.

2.2.8 Ocotillo Airport

Ocotillo Airport has large amounts of land studied for ground mounted solar (about 35,000 MWh/year) and has no rooftop solar and no parking cover solar potential. For this site, ground mounted solar was not considered in Runway Protection Zones (RPZ), in between the runways, or on the dry lake bed.

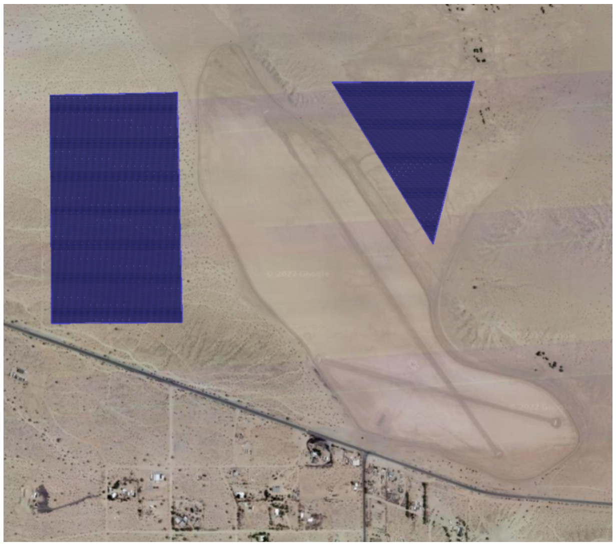


Figure 21 Ocotillo Airport solar potential

See Appendix B for the site boundary.

Figure 22 shows the annual energy generation by mount type and ownership type for Ocotillo Airport. All of the solar potential is ground mounted, and county owned and occupied.

Figure 22 - Ocotillo Airport: Annual energy generation by mount type and ownership type

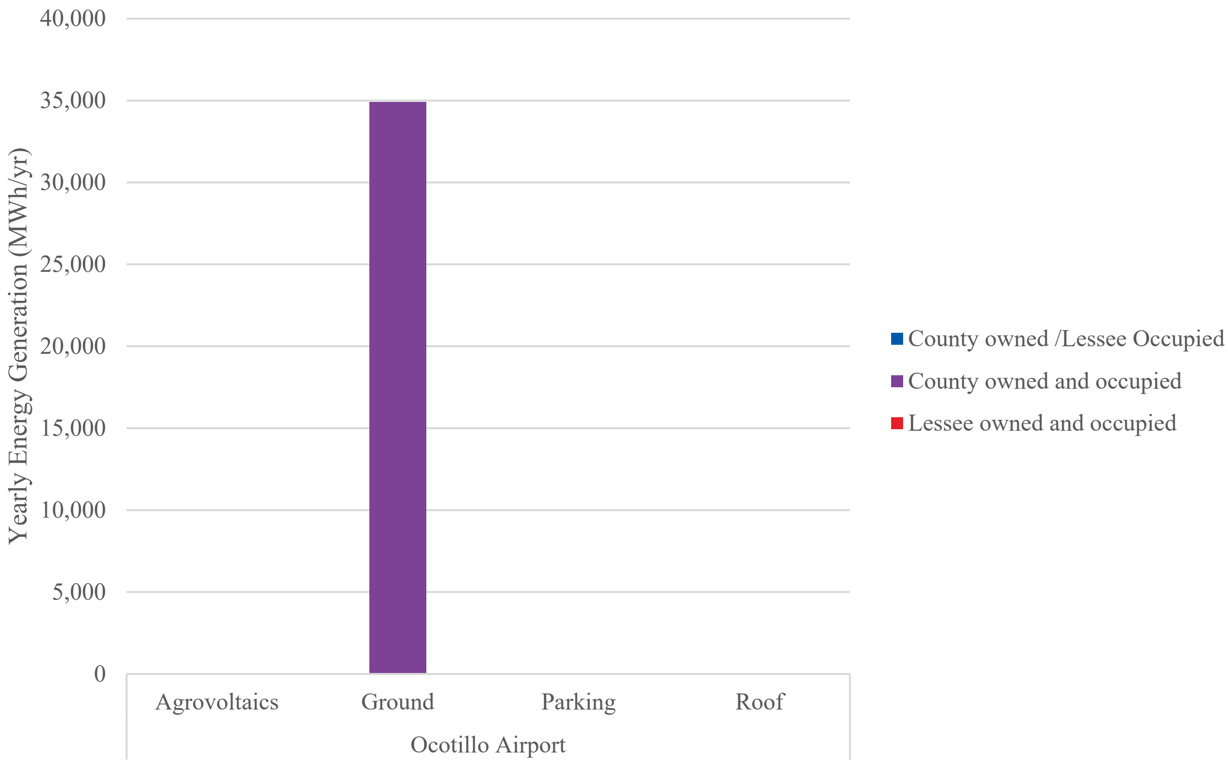


Table 11 compares solar potential by mount type and ownership time with system size, annual generation potential, and peak generation potential. The initial grid availability screening indicates no grid capacity is available (0.0 MW). Ocotillo Airport itself is small and has low energy uses since it has no buildings, so it would most likely be exporting most of this electricity instead of using it all onsite.

There is an existing solar farm 10 miles southeast of the airport, not owned by the County of San Diego, which might indicate there is good potential to build ground mounted solar, however an initial grid capacity screening suggests that existing infrastructure would require updates because there is currently no grid capacity available for new solar PV installations.

Table 11 - Ocotillo Airport: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	-	-
Ground	County owned and occupied	17,500	34,900
Parking	County owned & lessee occupied	-	-
	County owned and occupied	-	-
Roof	County owned & lessee occupied	-	-
	County owned and occupied	-	-
	Lessee owned and occupied	-	-
	Total	17,500	34,900

Table 12 - Grid Availability: Ocotillo

	Capacity (kW)
Solar potential capacity	17,500
Baseline electricity consumption during peak generation	0
Solar potential to feed to grid / battery storage	17,500
Grid capacity	0
Excess generation over grid capacity	17,500

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

Overall, the feasibility study results suggest that the installation of a new solar generation project within the current grid capacity would not be a worthwhile investment. This is because the current grid capacity is not sufficient to export any electricity generated by a potential solar project and there is no onsite demand.

2.2.9 Ramona Airport

Ramona Airport has a large amount of land studied for ground mounted solar (7,000 MWh/year), a moderate amount for rooftop solar (3,000 MWh/year), and a small amount for parking (500 MWh/year). Correspondingly, it has a moderate number of buildings and energy usage. For this site, solar was considered across all available buildings and parking structures. Ground mounted solar was not considered in Runway Protection Zones (RPZ) or Environmentally Sensitive Areas (ESA). Furthermore, ground-mounted solar was not considered in the infield between the runway and taxiway, and for property areas in the north and southeast which are planned for future development for aviation services, parking, business areas, hangars, and expansion areas. Also, the area directly south of the runway was not considered for ground-mounted solar for this site.

Figure 23 Ramona Airport solar potential

See Appendix B for the site boundary.

Figure 24 shows the annual energy generation by mount type and ownership type for Ramona Airport. Most the solar potential is ground mounted, and county owned and occupied, with some rooftop solar potential which is lessee owned and occupied, and a very small amount of parking solar potential.

Figure 24 – Ramona Airport: Annual energy generation by mount type and ownership type

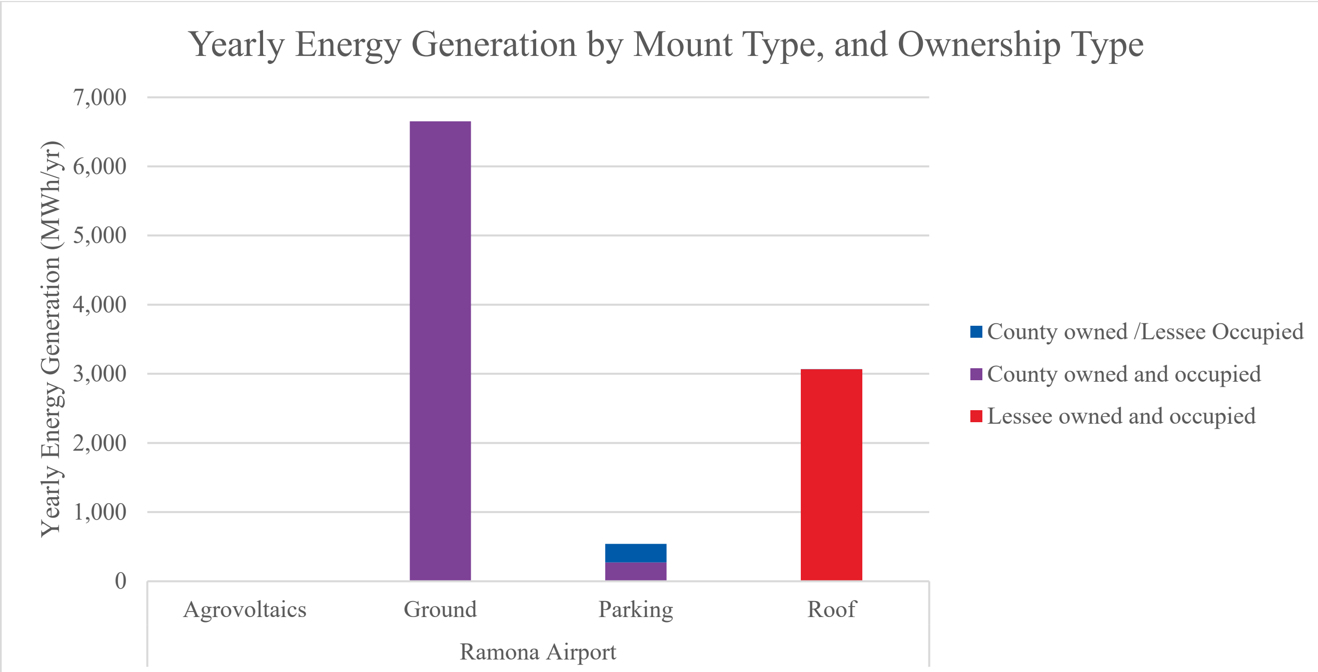


Table 13 compares solar potential by mount type and ownership time with system size, annual generation potential, and peak generation potential. The grid availability of 0.3 MW is less than onsite solar potential peak generation of 5.2 MW.

As previously mentioned, Ramona Airport has a moderate number of buildings and energy usage so some energy would be used onsite but most of the solar potential would need to be exported. Desktop research and review of aerial images from Google Maps reveal that there is also a moderately sized existing solar farm 3 miles southeast of the airport, not owned by the County of San Diego Airports, named Ramona Microgrid that serves as backup power for the Ramona Air Attack Base, home to CAL FIRE and U.S. Forest Service's aerial firefighting assets dedicated to protecting rural communities at the Ramona Airport. Even with an initial grid capacity screening is showing limited grid availability (0.3 MW), Ramona Airport is adjacent to a large residential zone, therefore electricity generated through solar can be used for onsite buildings and sports facilities.

There is enough electricity consumption onsite to consume an appropriately scaled solar generation project, and enough grid capacity so that in the event of over-generation, the surplus electricity could either be exported back to the grid or stored in batteries for future use. By implementing a properly sized solar PV system, it is possible to ensure that the site's electricity needs are met while also providing a small or occasional contribution to the grid. This approach would not only increase the site's energy independence but also provide the opportunity for potential cost savings on energy bills.

Table 13 - Ramona Airport: Solar Potential by Mount Type and Ownership Type

Mount Type	Ownership Type	System size (kW)	Annual Generation (MWh/year)
Agrivoltaics	County owned & lessee occupied	-	-
Ground	County owned and occupied	3,300	6,700
Parking	County owned & lessee occupied	140	270
	County owned and occupied	140	270
Roof	County owned & lessee occupied	2	3
	County owned and occupied	-	-
	Lessee owned and occupied	1,600	3,100
	Total	5,226	10,260

Table 14 - Grid Availability: Ramona

	Capacity (kW)
Solar potential capacity	5,226
Baseline electricity consumption during peak generation	1,225
Solar potential to feed to grid / battery storage	4,001
Grid capacity	300
Excess generation over grid capacity	3,701

Additional capacity graphs and corresponding tables are presented in Appendix C – Solar Study Results.

Overall, the feasibility study results show that implementing a portion of the solar potential relative to the available grid capacity, with battery storage, is a viable approach to offset the on-site electricity demand while also generating some excess electricity that can be fed back to the grid within the current grid capacity.

2.3 Methods

2.3.1 Solar Study

This solar potential study began with a workshop with the managers of each airport. During the workshop, we identified the buildings, parking, agricultural, and land areas that were applicable to include in the study, and identified which areas were not applicable including environmentally sensitive areas, infield areas in between runways, areas in Runway Protection Zones (RPZ), or areas bookmarked for future development.

Figure 25 of Borrego Valley Airport is shown an example of the workshop results. Throughout the worshop participants placed sticky notes on areas that were deemed as avaliable or not availbale for solar installations. The area outlined in yellow is the total site area for Borrego Valley Airport. Areas in between runways and areas within a Runway Protection Zone (RPZ) were not considered. Extremley rough terrain or hilly areas facing north were also not considered. The remaining rooftop, parking, and land areas were considered, however some site-specific exclusions were incorportated, as in the case of Borrego Valley Airport, for which the areas directly north and south of the runway were excluded as result of worshop discussions.

Figure 25 Workshop Example: Borrego Valley

Through coordination with County staff after the initial workshops, the locations of environmentally sensitive areas (ESAs) were confirmed and excluded from the solar study areas as well. An example of an environemntally senistive areas (ESAs) map is shown below, which was used to inform and guide potential installation locations within this solar study. Simply put, no ground mounted solar was considered on any of the ESAs.

See Appendix A for the November 2022 ESA Maps

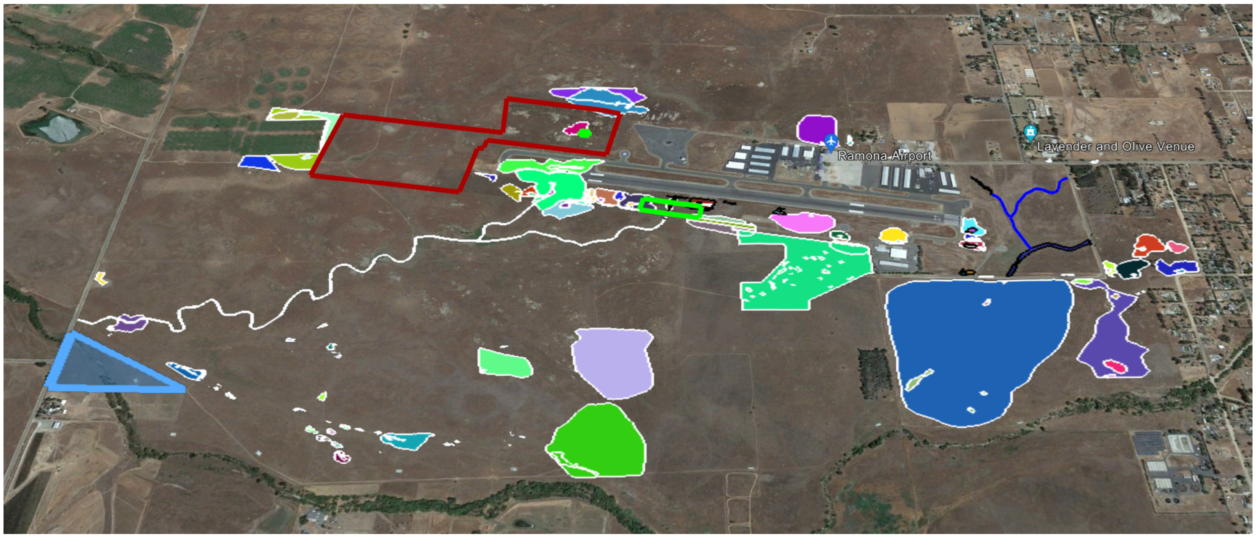


Figure 26 Map of Environmental Sensitive Areas (ESA) for Ramona Airport (created by County staff), November 2022

After the initial spatial orientation workshop and coordination, we then proceeded to create a solar model with Helioscope solar power modeling software to determine the maximum solar potential across the 8 airport sites. This high level analysis uses simple and mostly uniform assumptions to generate estimates of the solar capacity and annual electricity generation for each airport. In actual design the assumed factors such as solar panel azimuth, tilt, racking type, or shading might vary airport to airport or even building to building. Furthermore, no rooftop structural analyis was conducted which is an important step before solar design, to determine if rooftops have the capacity to suppport the weight of new panels and no rooftop lifetime anlaysis was completed as a part of this study. As a result the expected level of accuracy of this preiliminary analysis is estimated to be around ± 40%. We used the following modelling specfications across all 8 airports:

- Panel Manfuacturer & model: Sunpower, SPR-X21-470-COM (470 W panels)
- Racking: Fixed Tilt
- Height: 0 ft
- Azimuth: 180º
- Tilt: 20 º
- Orientation: Landscape (Horizontal)

Table 15 - Solar Assumptions by Mount Type

	Agrivoltaics	Ground	Parking	Roof
Row Spacing (ft)	6	6	0	2
Module Spacing (ft)	0.041	0.041	0.041	0.041
Frame Spacing (ft)	0	0	0	0
Setback (ft)	4	4	0	4

In addition to the assumptions stated above, the following approximated factors (by mount type) are incorporated in the solar capacity calculations to account for rooftop obstructions, possible shading from buidlings and trees, ground obstructions, and additional equipment. The percentages represent the amount of area covered in solar photovoltaics for this analysis. They are based on a portfolio of project experience to inform this preliminary estimate.

Table 16 - Solar Reduction Factors by Mount Type

Mount Type	System Capacity Factors	Notes
Agrivoltaics	35%	Largely overestimated due to uniqueness in agrivoltaics possibilities; however shown to increase efficiency (10-15%) due to added coolness from crops
Ground	55%	Largely overestimated due to ground obstructions, uneven ground, need for increased row spacing and car access alleys, and increased equipment needs for large ground-mounted solar arrays
Parking	80%	Slightly overestimated due to shading from buildings and trees
Roof	65%	Moderately overestimated due to rooftop obstructions, rooftop equipment, lack of information on structural integrity of rooftops, and possible shading

In order to estimate annual energy generation, samples of each airport were taken to estimate approximate annual kWh outputs per kWp capacity, and then used to represent the whole airports kWh/kWp annual rate. This rate (kWh/kWp) factors in the location, azimuth, tilt, as listed above as well as standard system losses.

2.3.2 Glare

While glare from solar panels can be an issue for incoming aircraft and air traffic controllers, glare impacts can almost always be easily mitigated with proper planning in the design phase. Minor changes in solar panel orientation and tilt can be made to reduce glare and maintain high energy generation potential. Furthermore, for large ground mounted solar panel arrays, all of the panels can be installed at slightly varying degrees of tilt so that the glare associated with it becomes diffuse and negligible instead of one large beam of light.

To provide an example of how the orientation of solar photovoltaic panels impacts the generation potential, a south facing array has a higher daily peak than the east west orientations. However, the east and west orientations capture the sun for a wider range of time throughout the day (Figure 27). At 100 kWp, a south facing array generates approximately 172,000 kWh/yr, an east facing array generates approximately 145,000 kWh/yr, and a west facing array generates approximately 152,000 kWh. This is change in generation potential at 12-16% across the three orientations.

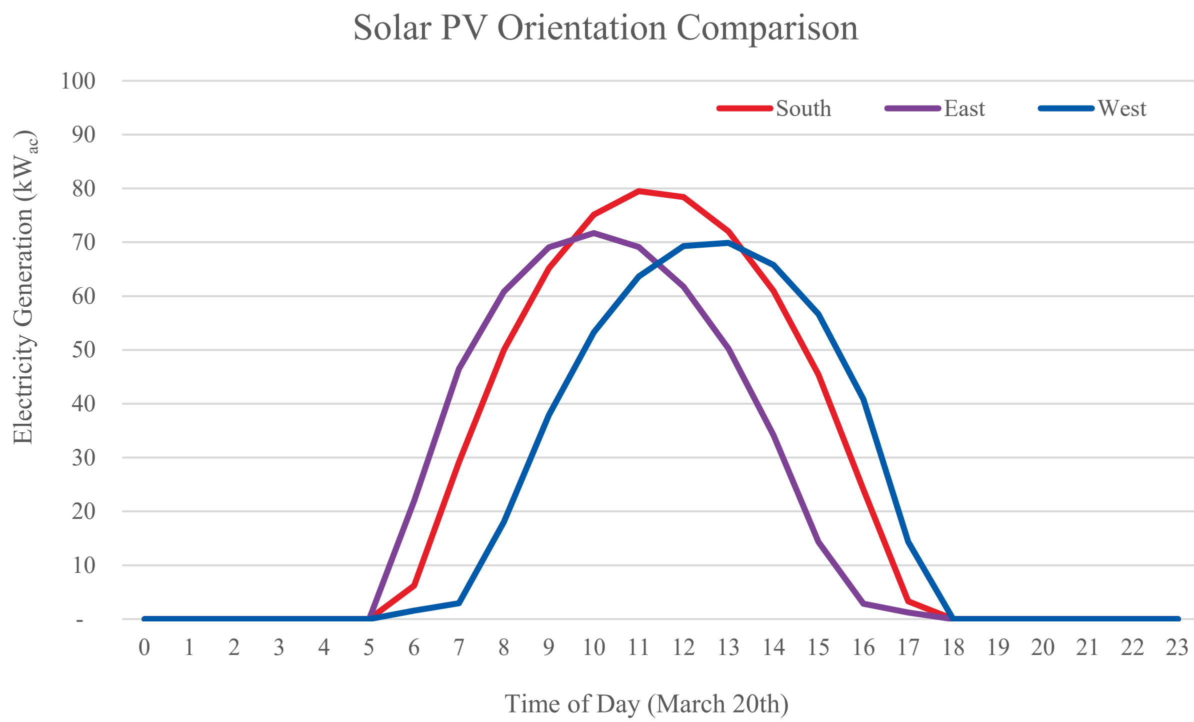


Figure 27 Solar PV orientation comparison

For this reason, we included all buildings in the study of maximum potential for each airport assuming they are viable locations that will be designed at the most suitable orientation. Since this study assumed a south-facing orientation, shifting orientations to reduce glare may result in 15% less generation than reported due to less optimal solar exposure. Detailed design of any solar installation at an airport must consider the approach of pilots and ensure that any solar installation that is developed is placed such that they will not have to face glare that is straight ahead of them or within 25 deg of straight ahead during final approach.[8] FAA may also require a glare study for locations in line of sight of control towers.

2.3.3 Grid availability

The California Public Utilities Commission (CPUC) requires San Diego Gas & Electric (SDG&E) and other utilities to publish an Integration Capacity Analysis (ICA)map to locate potential sites for distributed energy sources (DERs) including solar power. This report's initial screening for grid availability using SDG&E's ICA map9 shows that there is limited grid capacity for connecting solar generation to the grid at all County Airports System sites. The SDG&E ICA map meets CPUC requirements, however SDG&E makes no warranties regarding the accuracy or quality of these maps or the frequency at which these maps are updated. The data provided is for informational purposes only, and even if the values indicate sufficient grid capacity it does not guarantee that no distribution upgrade would be required when adding capacity at an available site. The ICA map is a helpful first pass but leaves more detailed study requirements to solar developers as part of the process of installing grid-scale solar power systems.

2.3.4 Baseline electricity peak load consumption, grid availability, and solar excess

Because grid capacity to absorb excess solar is limited on airport sites, it is valuable to consider how much of a site's solar generation capacity during peak hours can be utilized onsite by existing buildings. If solar energy can

[8] Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach (faa.gov)

[9] SDG&E Integration Capacity Analysis (sdge.com)

be used by current uses before it hits the grid, then an expensive grid capacity addition might not be required. To estimate energy demand (rather than annual energy consumption) at the time of peak generation, this study used NREL's Renewable Energy Integration & Optimization ("REopt") tool.[10] Using the estimated annual electricity consumption by airport a 6 am-10pm load profile from REopt, we were able to estimate an estimated electricity demand during peak generation.

[10] https://reopt.nrel.gov/tool

3. Incentives

Cost is an essential consideration for implementing renewable systems. Happily, there are a host of tax credits and other incentives available to help offset the costs of installing solar photovoltaic (PV) systems, with or without battery storage, including and not limited to the opportunities summarized below.

3.1 Net Energy Metering

For utility customers with onsite solar, net energy metering tracks the difference between energy sent to the grid and energy used from the grid, known as 'net energy' and appropriately credits or charges according to the rate schedule.

The California Public Utilities Commission (CPUC) created the current NEM tariff, commonly known as "NEM 2.0," in 2016[11] , which made a few minor changes to the original net metering policy and preserves retail rate bill credits meaning businesses that enroll in NEM 2.0 receive per-kWh credits for their solar electricity that are equal to the value of a kWh of utility electricity.[12] This makes the economics of onsite solar favorable.

The CPUC finalized NEM 3.0 on December 15, 2022, which reduces compensation for excess power sent to the electric grid and establishes a new rate for crediting solar exports now known as "net billing.[13]" Since this structure is no longer a one-to-one credit and is instead based on avoided cost to the utility of buying clean energy elsewhere, the economics of onsite solar are expected to be less favorable.

Incentive viability and arrangements can vary depending on the user type. Traditional net metering allows system owners to receive credit for excess energy generated by their solar panels that is fed back into the grid. This credit can then be applied to offset the cost of energy used from the grid when solar production is low. The County and tenants could explore ways to share the cost of solar installations and cost-savings of solar on energy bills in the buildings that tenants occupy.

Virtual net metering, on the other hand, allows tenants to receive credits generated from panels installed on a different property typically owned by a third-party provider or a host property owner. By enrolling in a virtual net metering program, a tenant can use clean energy and reduce their electricity costs even if they are unable to install solar panels on the buildings they rent.

3.2 Feed-In-Tariff

Feed-In-Tariff (FIT) is an energy purchasing program that allows customers to sell energy from a small-scale, distributed renewable generating system within service territory. Programs available to airports within the County of San Diego Airports system include San Diego Gas and Electric (SDG&E)'s Renewable Market Adjusting Tariff (Re-MAT) and San Diego Community Power (SDCP). In 2023, the unincorporated communities of the County of San Diego will join SDCP as their power provider and will be eligible for programs they offer. Seven of the eight airports (all except McClellan-Palomar) are in the unincorporated communities of the County of San Diego.

Project size limits for SDCP programs is 1 MW and for Re-MAT is 3MW, which would be applicable to individual tenants or collections of tenants up to about 130,000 square feet of building rooftop area for 1 MW and 400,000 square feet for 3 MW.

The viability of FIT can depend on a variety of factors, including the ownership structure of the solar generation system. In general, FIT programs are designed to incentivize renewable energy generation by offering payments

[11] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/net-energy-metering

[12] https://news.energysage.com/net-metering-2-0-in-california-everything-you-need-to-know/

[13] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/net-energy-metering/nem-revisit/net-billing-tariff-fact-sheet

to owners of solar panels for the energy they produce and feed back into the grid. However, in some cases, tenants may also be able to benefit from FIT programs if they have a direct ownership stake in the solar panels or if they participate in a virtual net metering program.

Further confirmation of eligibility at each stage of investigation and design is recommended.

3.3 Federal Grants (IRA and IIJA)

Two recent landmark federal bills have significantly increased funding opportunities to transform the energy sector in the United States – the Infrastructure Investment and Jobs Act (IIJA) of 2021 and the Inflation Reduction Act (IRA) of 2022. Although funding available through the IIJA is not directly applicable the solar potential for the County of San Diego Airports system, some IIJA programs are designated to fund upgrades to the electrical grid will increase feasibility for future projects to connect to the grid, especially in areas where the grid currently does not have enough capacity.

The IRA offers grants managed by the Environmental Protection Agency (EPA) to invest in domestic energy production while promoting clean energy. Currently IRA programs are particularly lucrative for solar-powered battery storage projects because solar generation system batteries are considered renewable assets. Both IIJA and IRA are recent legislation and further programs and program details are forthcoming at the time of this writing. It is anticipated that that activities funded by IIJA will bolster the renewables infrastructure while the IRA grants would be the source of funding for solar installation projects within the County airports system. See Appendix D for more information.

In general, federal grants are available to both owners and tenants, however each award will depend on the ownership structure of the project and the specific eligibility criteria of the grant.

See Appendix D for more information on a shortlist of IRA and IIJA grant opportunities.

3.4 Federal Tax Credits

The Inflation Reduction Act (IRA) of 2022 has introduced large and flexible new incentives for renewable energy generation. IRA incentives include a "Direct pay" option meaning that cash payments in place of tax credits are now an option for tax exempt government entities like the County of San Diego. Transferability is also available so that tax credits may be transferred to a partner entity. Even though more guidance is pending from the IRS on how the credits may be transferred between partners and how it applies to tax exempt entities, the combination of direct pay and transferability expands revenue source opportunities for entities like the County of San Diego and its partners. The IRA amended credit-specific requirements as well to extend the tax benefits to standalone energy storage projects in addition to solar generation facilities.

See Appendix D for more information on IRA, ITC, and other federal tax credits.

3.5 Power Purchase Agreement (PPA)

A Power Purchase Agreement (PPA) is a contract between two parties, a seller that generates electricity and one a buyer that is looking to purchase electricity. With a physical PPA, the buyer receives the physical delivery of electricity from the seller through a dedicated transmission link, whereas with a financial or virtual PPA, a contract is made for lower electricity costs in exchange for support to bring new renewable energy sources onto the grid. Physical PPAs include onsite third-party PPAs, in which a third party owns, installs, and operates a solar PV system and sells the power output on a per kilowatt-hour (kWh) basis to the building owner of occupant over a fixed contract period.

A physical or virtual PPA can be a viable incentive option for both facility owners and tenants, depending on the ownership structure of the solar generation system and the specific terms of the PPA. Because a PPA is a contract between a solar power provider and a customer (either a facility owner or a tenant), it stipulates the price at which the solar power will be sold to the customer over a set period. In some cases, tenants may be able to enter a PPA with the solar power provider directly, or they may be able to participate in a PPA negotiated by the facility owner.

3.6 Community Choice Aggregation (CCA)

Community Choice Aggregators (CCA) are local government entities that sell buy wholesale power (typically renewable power) and resell it to local area customers while transmission and distribution are provided by the local utility company. San Diego Community Power (SDCP) is a CCA program that commenced service in March 2021 within the cities of Chula Vista, Encinitas, Imperial Beach, La Mesa, and San Diego and plans to expand to most of San Diego County in 2023[14]. SDCP has issued a "Local RFI" to inform future procurement of renewable energy sources of renewable energy from resources located near or within San Diego County and is accepting responses on a rolling basis[15].

The County airports system, tenants, or third-party system operators on county land or buildings could sell surplus power to SDCP. (They can also be CCA customers for power purchasing as well.)

3.7 Electric Program Investment Charge (EPIC) Grants

The California Energy Commission's (CEC) Electric Program Investment Charge (EPIC) program provides grants for electricity research, development, and demonstration projects to accelerate the transformation of the electricity sector to meet the State of California's energy and climate goals. The projects funded so far represent a range of innovation including transportation electrification, demand reduction, and microgrids. The California Public Utilities Commission (CPUC) renewed the EPIC for ten years, 2021 through 2030, so from 2012 through 2030, EPIC will have invested nearly $3.2 billion in clean energy technology innovation.[16]

In general, grants are available to both owners and tenants, however each award will depend on ownership structure of the project and the specific eligibility criteria of the grant.

3.8 Self-Generation Incentive Program (SGIP)

The Self-Generation Incentive Program (SGIP) is a California Public Utilities Commission (CPUC) program that provides rebates for installing energy storage technology (e.g solar storage batteries) at both residential and non-residential facilities to support existing, new, and emerging distributed energy resources. Although SGIP funding is becoming more limited, it is advisable to consider the context of each airport, because this funding includes prioritization of communities living in high fire-threat areas, communities that have experienced two or more utility Public Safety Power Shut-off (PSPS) events, and "critical facilities" that support community resilience in the event of a PSPS or wildfire. (The firefighting base at Ramona already has a microgrid to provide uninterrupted power.)

Overall, the SGIP is designed to help utility customers in California install renewable energy systems and reduce their dependence on fossil fuels, while also providing financial incentives to offset the upfront costs of these technologies. If they meet the eligibility criteria and the requirements, both facility owners and tenants can take advantage of the program.

3.9 Property Assessed Clean Energy (PACE)

Property Assessed Clean Energy (PACE) financing, which was first introduced in California in 2008, is a financing option for renewable energy, energy efficiency, and water conservation upgrades in certain locations

[14] Current Community Choice Providers (sdge.com)

[15] San Diego Community Power 2021 Request for Information for Local Renewable Energy and Energy Storage (sdcommunitypower.org)

[16] https://epicpartnership.org/

where the state has authorized, and local governments have implemented, PACE programs[17]. As authorized under California law, the County of San Diego currently participates in five different programs that allow for PACE financing for property owners[18]. Under PACE financing, a third entity finances a renewable energy or energy efficiency project on behalf of a property owner, and the property owner repays the improvement costs over a set time period, typically 10 to 20 years, through property tax bills. Attaching repayment to property taxes makes the renewable energy asset and the responsibility to pay for it transfer when property is sold, which could be attractive to airports system tenants with ground leases.

3.10 Incentive selection

As a solar generation project take shape, confirming appropriate and available financing project-specific options will inform its most beneficial path forward. For example, the existence of buildings onsite would mean that net metering is an option, whereas a site without buildings would likely pursue a Feed-In-Tariff. The eligibility for some incentives may also be specific to partnership type and other incentives pursued. For example, the credits received through the IRA Investment Tax Credit (ITC) reduce the potential incentive provided through SGIP.

Furthermore, incentive selection for solar generation projects can vary depending on the user group types. For instance, tax credits, net metering, and PACE financing are likely incentive types for the County, while virtual net metering, PPAs, and CCA programs may be more viable for airport tenants. Lastly, there may also be new incentives emerging as the renewable energy sector evolves quickly to meet the increasing awareness of climate change that urges an acceleration for transforming energy generation to renewables.

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[17] Guide to Purchasing Green Power - Appendix B. Commercial Solar Financing (epa.gov)

[18] Property Assessed Clean Energy (sandiegocounty.gov)

4. Hazards Assessment

4.1 Natural and Climate Hazards Assessment

Sustainable development and sustainability management practices seek to meet the needs of the present without compromising the ability of future generations to meet their own needs, and climate hazards and natural hazards can undermine this goal by disrupting ecosystems, causing damage to infrastructure, and jeopardizing human lives and livelihoods. Therefore, climate hazards and natural hazards are considerations to include throughout the development of the SMP because they can have extensive ramifications on the triple bottom line of sustainability - the environment, the economy, and society.

Airports and their operations may be significantly impacted by climate hazards and natural hazards that they are sensitive and exposed to including increased temperatures, landslides, earthquakes, and flooding, which may result in increased need for replacement and repair, disruptions to operations, and need for additional capacity. Sensitivity is defined here as the degree to which airport infrastructure, system components, or operations are affected by the hazard or stressor.[19] Exposure is defined as the presence of airports and their systems in places or settings that could be adversely affected. (See Section 4.1.2, Site Level Exposure Impacts, for exposure ratings.) Taken together, sensitivity and exposure create a potential impact, which may be mitigated by management, operational, or technical protocols (i.e., adaptive capacity).

4.1.1 Estimated Potential Impact Levels

Table 17 summarizes the degree of potential impact (exposure + sensitivity) to County airports for the associated natural hazards. Ratings for potential impacts consider exposure and sensitivity across the range of impacts identified in Table 18.[20] The greatest impacts across all County airports are likely to stem from extreme heat, earthquakes, and wildfires. All airports face high risk of at least two natural hazards. Fallbrook Airport and Borrego Airport only have one runway, increasing the threat of failure or disruption from extreme heat.

Table 17 - Estimated Degree of Potential Impacts (Airport Exposure + Airport Sensitivity) from Natural Hazards to County Airports

	Wildfires *(high airport sensitivity)*	**Landslides** *(medium airport sensitivity)*	**Heavy precipitation and riverine flooding** *(medium airport sensitivity)*	**Sea level rise, coastal erosion, and storm surge** *(medium airport sensitivity)*	**Droughts** *(low airport sensitivity)*	**Earthquakes** *(high airport sensitivity)*	**Heat/Extreme heat** *(high airport sensitivity)*	**Wind** *(medium airport sensitivity)*

[19] IPCC, 2022: Annex II: Glossary [Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger (eds.)]. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2897–2930, doi:10.1017/9781009325844.029.

[20] Sensitivity and exposure ratings consider degree of potential impacts given site-level exposure.

Agua Caliente Airstrip	Medium	Low	Low	Low	Low	High	High	Medium
Borrego Valley Airport	Medium	Low	High	Low	Low	High	High	Medium
Fallbrook Airpark	High	Medium	Low	Low	Low	Medium	High	Medium
Gillespie Field	High	Low	Medium	Low	Low	Medium	High	Medium
Jacumba Airport	High	Low	Low	Low	Low	Medium	High	Medium
McClellan-Palomar Airport	High	Medium	Low	Low	Low	Medium	High	Medium
Ramona Airport	High	Medium	Low	Low	Low	Medium	High	Medium
Ocotillo Wells	Medium	Medium	Low	Low	Low	High	High	Medium

Table 18 (below) shows qualitative descriptions of sensitivity of County airports to potential impacts driven by natural and climate hazards.

Section 4.1.2 discusses exposure for each airport and risk rating justifications based on consequence of impact (e.g., magnitude of impact) and likelihood (e.g., return periods of high impact events/chronic stressors).

Table 18 - Natural/Climate Hazards and Potential Impacts

Natural / Climate Hazard or Stressor	Sensitivity	Potential Impacts to Airport Infrastructure and Operations
Wildfires	High	Damage to buildings and equipment; reduced visibility from smoke; access restrictions; backup fuel required for pumping fuel during PSPS events
Landslides	Medium	Heaving foundations; physical damage to buildings, runways, or aircraft; limited airport access
Heavy precipitation and riverine flooding/ tsunamis	Medium	Heaving foundations; damage to buildings, navigational aids, and drainage systems; flight delays during rain events

Natural / Climate Hazard or Stressor	**Sensitivity**	**Potential Impacts to Airport Infrastructure and Operations**
Sea level rise, coastal erosion, and storm surge; tsunamis	Medium	Flooding of buildings, runways, and saltwater damage to aircraft or equipment; limited airport access
Droughts	Low	Damage to buildings and runways from soil contraction, subsidence
Earthquakes	High	Pavement and building damage; heaving foundations; high traffic from relief flights may damage runways or create congestion
Heat/Extreme heat	High	Melting pavement resulting in buckling and immediate failure; degradation of pavement, reduced lifespan; limits to aircraft operations due to runway length or pavement quality; increased stress on air conditioning systems; increased demand for cooling and risk of power outages; electrified aircraft particularly exposed to power outages
Wind	Medium	Damage to navigational aids; backup fuel required for pumping fuel during PSPS events

Table sources:

Airport Climate Risk Operational Screening Tool (ACROS), in: Climate Change Adaptation Planning: Risk Assessment for Airports. Transportation Research Board of the National Academies, Washington, D.C. http://www.trb.org/Publications/Blurbs/173554.aspx.

Mirzaiyanrajeh, D., Dave, E. V., Sias, J. E., & Garg, N. (2022). Exploration of Cracking-Related Performance-Based Specification Indexes for Airfield Asphalt Mixtures. Journal of Transportation Engineering, Part B: Pavements, 148(4). doi:10.1061/jpeodx.0000401

National Academies of Sciences, Engineering, and Medicine 2018. Using Existing Airport Management Systems to Manage Climate Risk. Washington, DC: The National Academies Press. https://doi.org/10.17226/25327.

San Diego Region Report. 2019. California's Fourth Assessment. https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-009_SanDiego_ADA.pdf

U.S. Department of Transportation (DOT). 2014. Transportation Climate Change Sensitivity Matrix. https://www.fhwa.dot.gov/environment/sustainability/resilience/tools/.

4.1.2 Site Level Exposure Estimates

According to the County's Climate Vulnerability assessment, airports within the unincorporated county are most sensitive to rising temperatures and severe weather patterns as they may affect flight take-off and in-air flight safety. Extreme heat projections show increases in the number of extreme heat days in which temperature is above 103.9 degrees Fahrenheit from a baseline (1961-1990) of 4 days per year to 18 days per year at mid-century (2035-2064) and to 24 days per year at end-century (2070-2099).

Though particulate matter concentration varies according to many factors, areas affected by wildfire-specific particulate matter have been defined in research by estimating a160 km buffer around wildfire plumes.[21]

[21] Aguilera, R., Corringham, T., Gershunov, A. *et al.* Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California. *Nat Commun* **12**, 1493 (2021). https://doi.org/10.1038/s41467-021-21708-0

However, in this assessment, exposure ratings are defined using Cal Fire, Fire Probability Viewer,[22] and Cal Fire, Fire Hazard Severity Zone.[23] Landslide exposure was assessed using California Geological Survey Deep-Seated Landslide. Flooding exposure was assessed using FEMA Flood Hazard Areas.[24] Tsunami exposure was assessed using Cal OES Tsunami Risk Map.[25] Drought exposure assessed using The Climate Explorer.[26] Earthquake exposure assessed using USGS Shaking Potential for California Map; Third Uniform California Earthquake, Rupture Forecast.[27] Heat exposure was assessed using California Heat Assessment Tool.[28] Wind exposure based on California 4th Climate Assessment, San Diego Region Report Susceptibility.[29]

[22] https://egis.fire.ca.gov/FireProbability/
[23] https://egis.fire.ca.gov/FHSZ/
[24] USA Flood Hazard Areas (arcgis.com)
[25] https://www.conservation.ca.gov/cgs/tsunami/maps/san-diego
[26] https://crt-climate-explorer.nemac.org/
[27] https://www.scec.org/ucerf
[28] https://www.cal-heat.org/
[29] https://maps.conservation.ca.gov/cgs/DataViewer/

Agua Caliente Airstrip

Table 19 - Agua Caliente Airstrip: Climate Hazards and Exposures

	Hazard	Exposure Rating	Exposure Description
	Wildfires	Low	No data in CAL FIRE, Fire Probability Viewer; Local Responsibility Area near areas of moderate FHSZ
	Landslides	Low	Low landslide susceptibility (Class 0)
	Heavy precipitation and riverine flooding	Low	Not located in FEMA Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario. Reference: The Climate Explorer
	Earthquakes	High	Located in an area with high shaking potential. The likelihood of moderate-sized earthquakes in the next 30 years along nearby fault lines is 1.15%
	Heat/Extreme heat	Medium	Number of 95^{th} percentile heat events in June, July, August annually (2021-2040): 2.5 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

Borrego Valley Airport

Table 20 - Borrego Valley Airport: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	Low	Annual probability of wildfire occurrence (2021-2050) is <0.25%; Local Responsibility Area
	Landslides	Low	Low landslide susceptibility (Class 0)
	Heavy precipitation and riverine flooding	High	Located in a FEMA 1% Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	High	Borrego Valley is located in an area with high shaking potential. The likelihood of moderate-sized earthquake in the next 30 years along nearby fault lines is 3.57%
	Heat/Extreme heat	High	Number of 95th percentile heat events in June, July, August annually: 3.2 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

Fallbrook Airpark

Table 21 - Fallbrook Airpark: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	Medium	Annual probability of wildfire occurrence (2021-2050) is 1-2%; Local Responsibility Area near moderate FHSZ
	Landslides	Medium	Medium landslide susceptibility (Classes III and VI)
	Heavy precipitation and riverine flooding	Low	Not located in FEMA Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	Medium	These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.
	Heat/Extreme heat	High	Number of 95^{th} percentile heat events in June, July, August annually: 3 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

Gillespie Field

Table 22 - Gillespie Field: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	High	Annual probability of wildfire occurrence (2021-2050) is <0.25%; Local Responsibility Area near VHFHSZ
	Landslides	Low	Low landslide susceptibility (Class 0)
	Heavy precipitation and riverine flooding	Medium	Located near FEMA 0.2% Annual Chance Flood Hazard
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	Medium	These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.
	Heat/Extreme heat	High	Number of 95^{th} percentile heat events in June, July, August annually (2021-2040): 2.5 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

Jacumba Airport

Table 23 - Jacumba Airport: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	High	Annual probability of wildfire occurrence (2021-2050) is 0.25 - 0.29%; High FHSZ
	Landslides	Low	Low landslide susceptibility (Class 0)
	Heavy precipitation and riverine flooding	Low	Not located in FEMA Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	Medium	These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.
	Heat/Extreme heat	High	Number of 95th percentile heat events in June, July, August annually (2021-2040): 3.2 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

McClellan-Palomar Airport

Table 24 - McClellan-Palomar Airport: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	High	No data in CAL FIRE, Fire Probability Viewer; Local Responsibility Area near VHFHSZ
	Landslides	Medium	Some Landslide Susceptibility Classes III and VI in the airport area
	Heavy precipitation and riverine flooding	Low	Not located in FEMA Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	Medium	These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.
	Heat/Extreme heat	Medium	Number of 95th percentile heat events in June, July, August annually (2021-2040): 2.75 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

Ramona Airport

Table 25 - Ramona Airport: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	Medium	Annual probability of wildfire occurrence (2021-2050) is 1-2%; High FHSZ
	Landslides	Medium	Some Landslide Susceptibility Classes III, V, and VII in the airport area
	Heavy precipitation and riverine flooding	Low	Not located in FEMA Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	Medium	These regions are distant from known, active faults and will experience lower levels of shaking less frequently. In most earthquakes, only weaker, masonry buildings would be damaged. However, very infrequent earthquakes could still cause strong shaking here.
	Heat/Extreme heat	Medium	Number of 95th percentile heat events in June, July, August annually (2021-2040): 1.95 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease.

Ocotillo Wells Airport

Table 26 - Ocotillo Wells Airport: Climate Hazards and Exposures

	Hazard	Exposure	Exposure Description
	Wildfires	Low	No data for annual probability of wildfire occurrence (2021-2050); Local Responsibility Area
	Landslides	Medium	Some Landslide Susceptibility Class VII in the airport area
	Heavy precipitation and riverine flooding	Low	Not located in FEMA Flood Hazard Area
	Sea level rise, coastal erosion, and storm surge; tsunamis	Low	Area not projected to be exposed under a maximum 100-year storm and inundation scenario for the 2020-2040 time period or for the 2080–2100 period Located outside of the Tsunami Hazard Area
	Droughts	High	Annual number of dry days projected to increase from 303 (1961-1990) to 310 days by mid-century under a higher emissions (RCP8.5) scenario.
	Earthquakes	High	Located in an area with high shaking potential. The likelihood of moderate-sized earthquake in the next 30 years along nearby fault lines is 3.79%
	Heat/Extreme heat	High	Number of 95th percentile heat events in June, July, August annually (2021-2040): 3.2 events
	Wind	Medium	Santa Ana winds produce some of the highest winds in San Diego County. Future projections indicate an increase in the driest of Santa Ana days (wind greater than to equal to 8 m/s with relative humidity less than or equal to 20%). However, the number of Santa Ana days and the days with the strongest winds are projected to modestly decrease. Reference: California 4th Climate Assessment, San Diego Region Report

4.2 Managing impacts from natural hazards

In general, hazard mitigation should aim to address all potential impacts but prioritize the highest potential impacts (see Table 17). The County can use the information in this assessment to conduct targeted, detailed hazard assessments for each airport and its critical assets, focusing on infrastructure, connections, or operations that may be disrupted by the identified impacts.

Minimizing disruptions to operations is important for airport tenants, especially those who perform emergency response. Therefore, it is essential to secure emergency power for control towers, landing lights, and other critical operations during wildfires, flooding, landslides, heat waves, and wind or PSPS events. Battery storage for critical loads is a primary defense against losses of service.

As the County evaluates hazard impacts on infrastructure and operations at more detailed level, the following actions can improve adaptive capacity for managing these impacts:

- Ensure that backup power options are available for use during wildfires, PSPS events, and extreme heat events
- Review emergency management plans to ensure adequate response protocols to reduced visibility and communications, reduced airport access, and damaged runways or buildings
- Review infrastructure (e.g., pavement) and equipment replacement plans to account for reduced lifespan of runways, cooling systems, etc.
- Identify any major gaps in existing or planned adaptive capacity

Appendices

Appendix A - Environmentally Sensitive Areas (ESA) Maps

These ESA maps (dated November 2022) were provided by County Environmental Services Unit (ESU) staff for Borrego Valley, Fallbrook, Gillespie, Palomar, and Ramona Airports. There were no first-hand data or information about ESAs on these airports Jacumba, Ocotillo, and Agua Caliente. However:

- This report is not a CEQA analysis. Future CEQA analysis would be required for any future County-initiated or County-approved development. In other words, if certain areas were not flagged as ESAs, this should not be interpreted as if no further CEQA is needed. Through the CEQA review process, additional surveys and studies may be warranted (e.g., bio, cultural or other CEQA resources), depending on the location, scale, methods of construction, time period and other variables.
- ESA maps and files are meant to guide future development to avoid known ESAs. They are not meant to capture every possible environmental resource at the airports. There could be other resources that ESU is not aware of, and the ESA information provided (or lack of) is based on ESU's historical knowledge and past survey data.
- The ESA files only address Biological Resources. Some less intensely developed airports in the dessert have the potential to contain cultural or other resources. The best way to ascertain this data would be to conduct a site-specific review once individual sites are proposed for development.

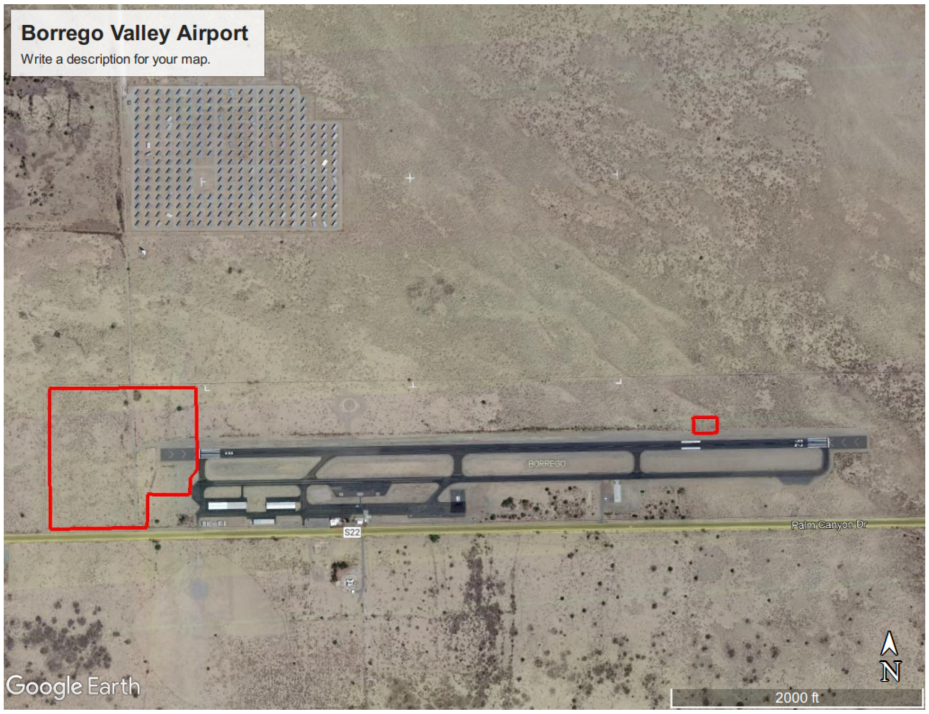


Figure 28 Map of Environmental Sensitive Areas (ESA): Borrego Valley Airport, November 2022

Figure 29 Map of Environmental Sensitive Areas (ESA): Fallbrook Airpark, November 2022

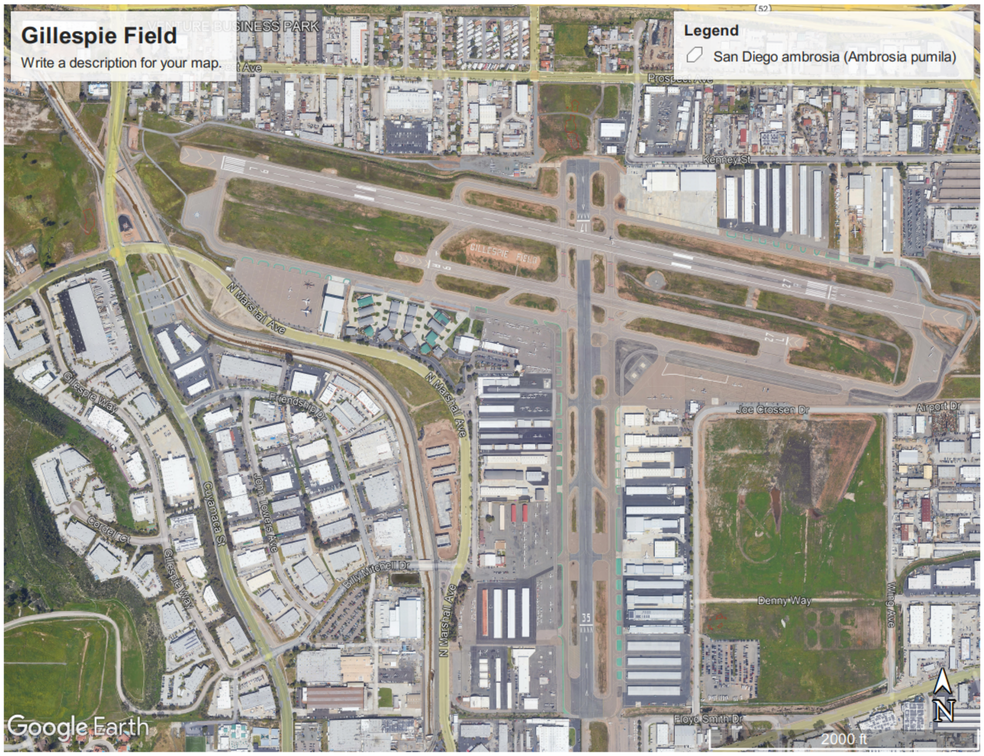


Figure 30 Map of Environmental Sensitive Areas (ESA): Gillespie Field, November 2022

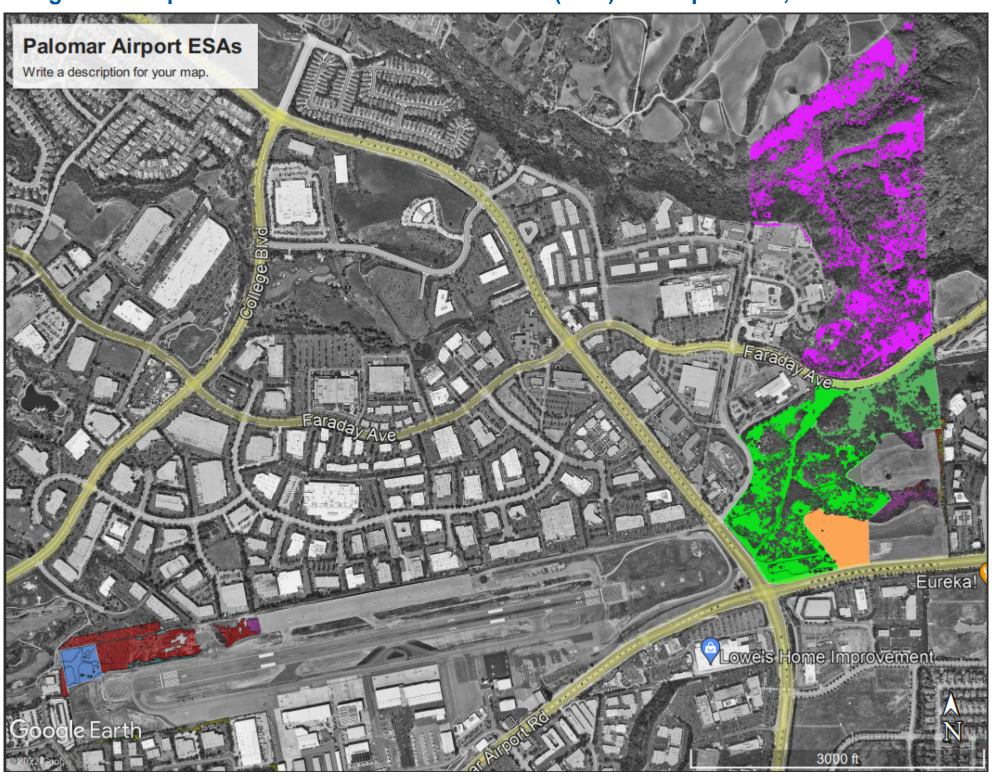


Figure 31 Map of Environmental Sensitive Areas (ESA): McClellan-Palomar Airport, November 2022

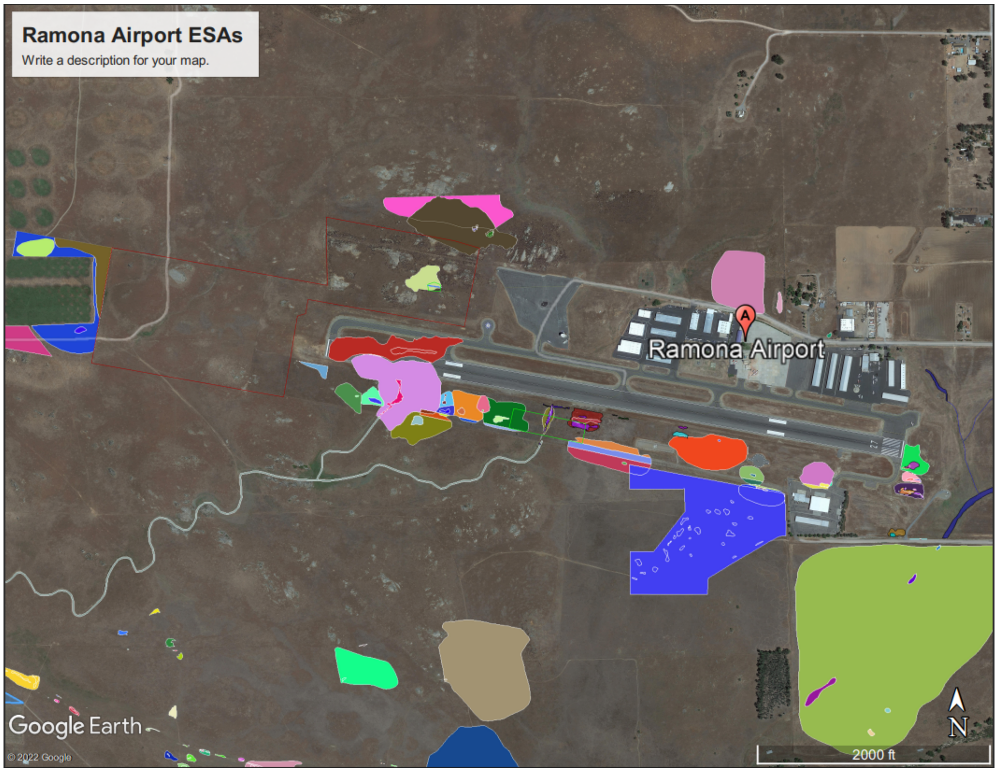


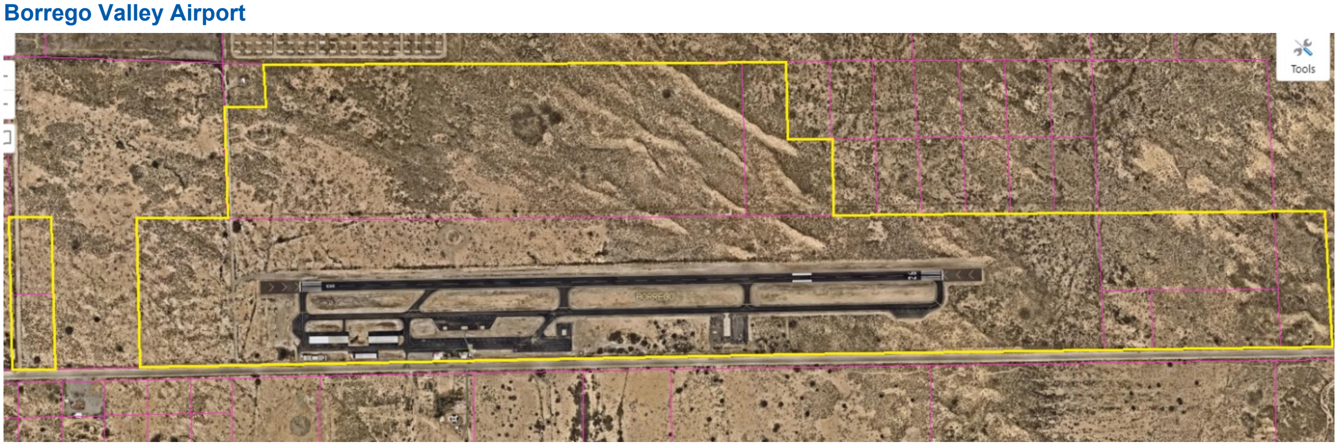
Figure 32 Map of Environmental Sensitive Areas (ESA): Ramona Airport, November 2022

Appendix B - Site Boundaries

The .shp files for airport site boundaries shown in this appendix were used in area calculations for the solar study.

Agua Caliente Springs

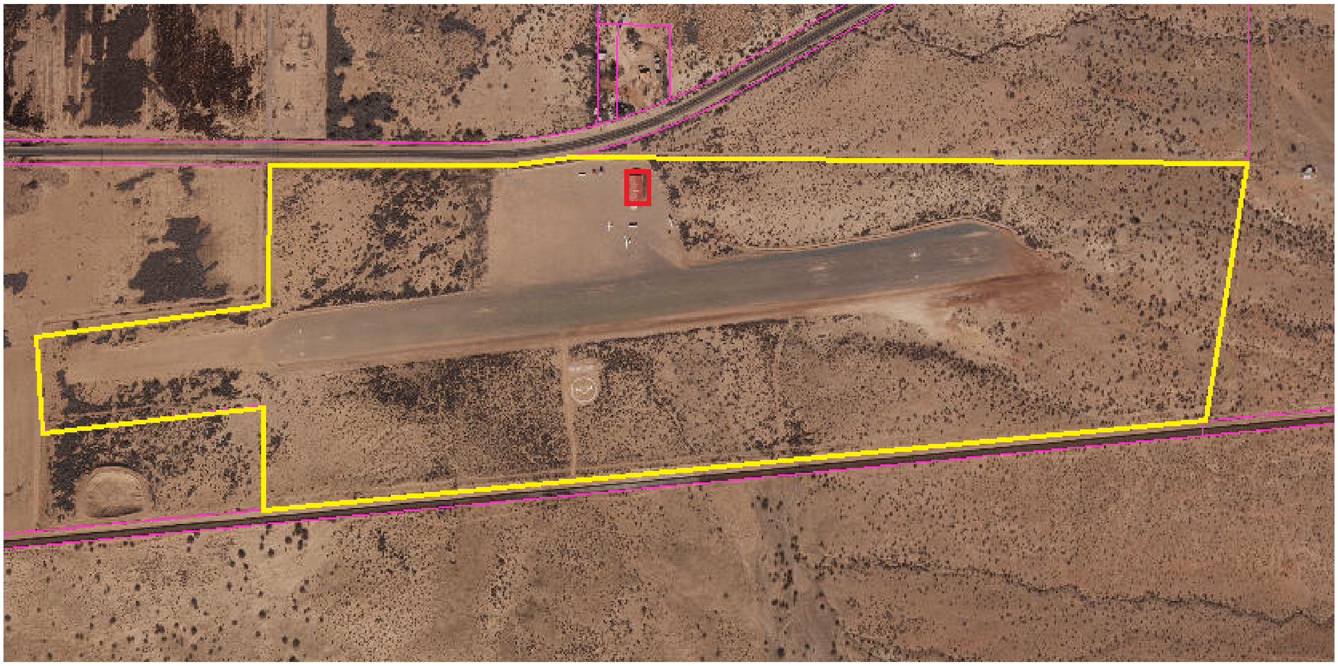
Borrego Valley Airport



Fallbrook Airpark

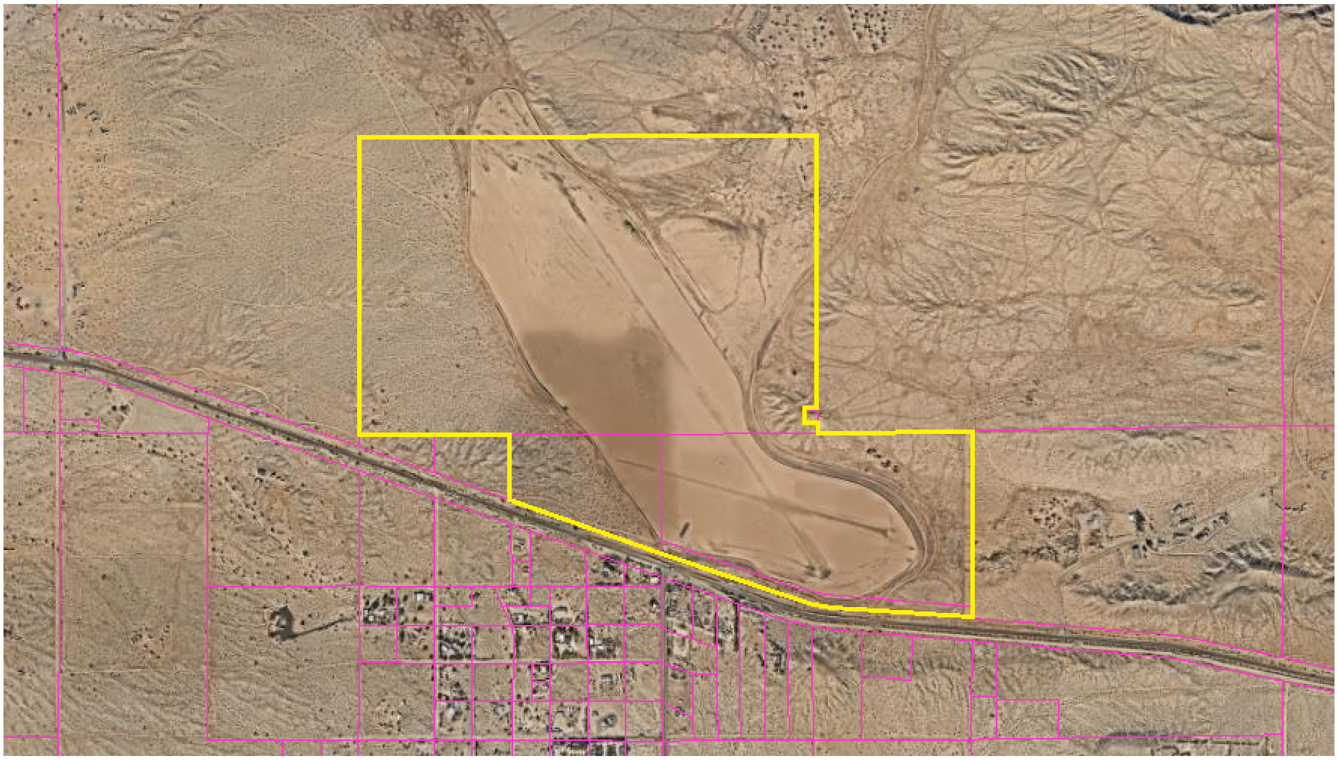
Gillespie Field

Jacumba Airport



McClellan-Palomar Airport

Ocotillo Airport



Ramona Airport

Appendix C – Solar Study Results Tables

The following graphs included in Section 2.2 Results have corresponding tables within this appendix.

Figure 33 - Annual Energy Generation by Location and Mount Type (MWh/year)

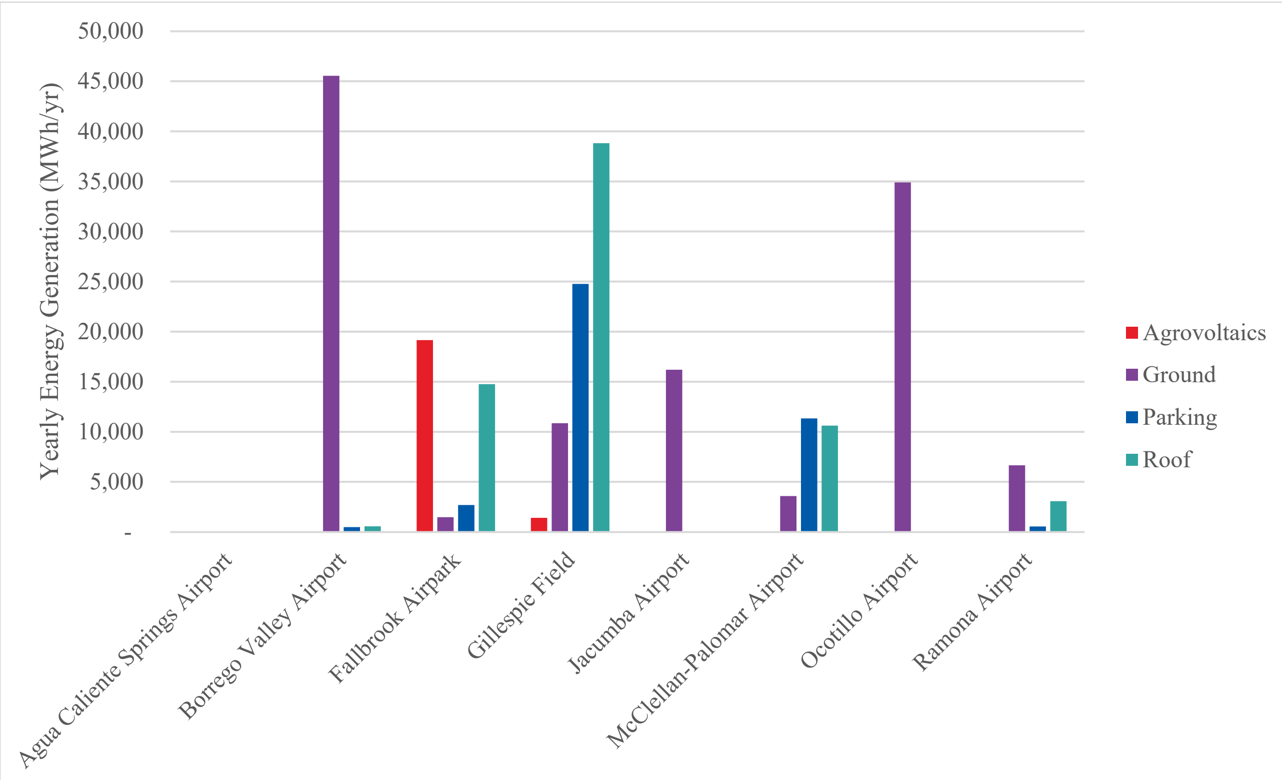


Table 27 - Annual Energy Generation by Location and Mount Type (MWh/year)

Annual Energy Generation (MWh/year)	Mount Type				
Location	**Agrivoltaics**	**Ground**	**Parking**	**Roof**	**Total**
Agua Caliente Springs Airport	-	-	-	-	-
Borrego Valley Airport	-	45,600	480	560	46,640
Fallbrook Airpark	19,200	1,500	2,700	14,800	38,200
Gillespie Field	1,400	10,900	24,800	38,800	75,900
Jacumba Airport	-	16,200	-	50	16,250
McClellan-Palomar Airport	-	3,600	11,300	10,600	25,500
Ocotillo Airport	-	34,900	-	-	34,900
Ramona Airport	-	6,700	540	3,100	10,340
Total	20,600	119,200	39,820	67,910	247,730

Figure 34 - Capacity by Location and Mount Type (kW)

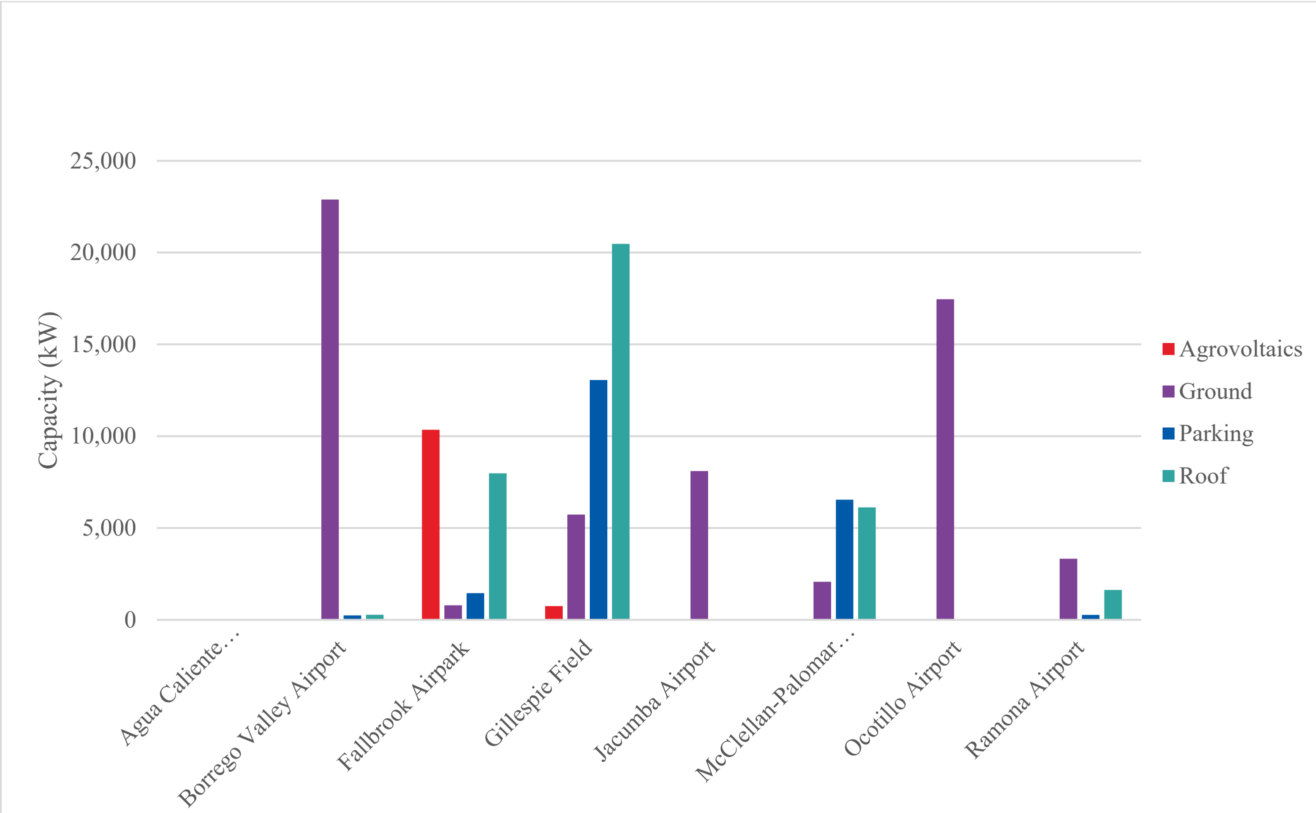


Table 28 - Capacity by Location and Mount Type (kW)

Solar Capacity (kW)	Mount Type				
Location	**Agrivoltaics**	**Ground**	**Parking**	**Roof**	**Total**
Agua Caliente Springs Airport	-	-	-	-	-
Borrego Valley Airport	-	22,900	240	280	23,420
Fallbrook Airpark	10,400	790	1,500	8,000	20,690
Gillespie Field	750	5,700	13,100	20,500	40,050
Jacumba Airport	-	8,100	-	30	8,130
McClellan-Palomar Airport	-	2,100	6,500	6,100	14,700
Ocotillo Airport	-	17,500	-	-	17,500
Ramona Airport	-	3,300	270	1,600	5,170
Total	11,150	60,390	21,610	36,510	129,660

Figure 35 - Annual Energy Generation by Location and Ownership Type (MWh/year)

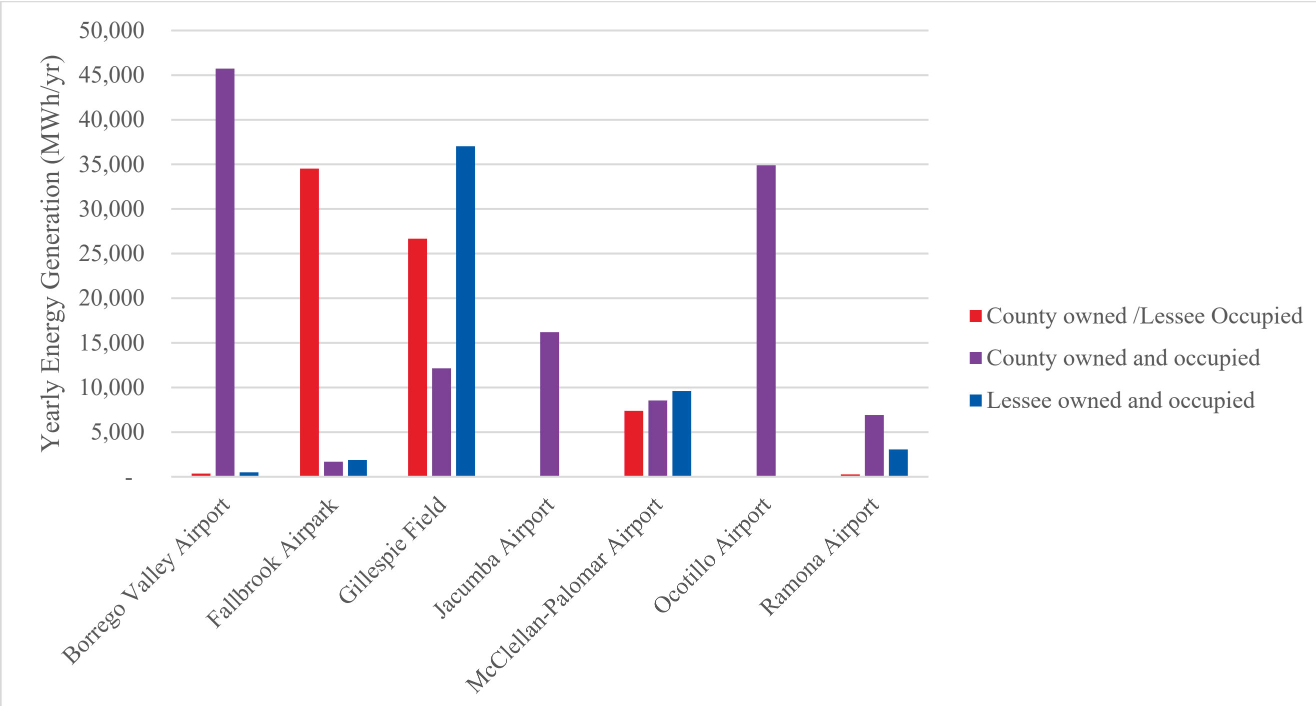


Table 29 - Annual Energy Generation by Location and Ownership Type (MWh/year)

Annual Energy Generation (MWh/year)	**Ownership Type**			
Location	**County owned /Lessee Occupied**	**County owned and occupied**	**Lessee owned and occupied**	**Total**
Agua Caliente Springs Airport	-	-	-	-
Borrego Valley Airport	350	45,700	500	46,550
Fallbrook Airpark	34,500	1,700	1,900	38,100
Gillespie Field	26,700	12,100	37,000	75,800
Jacumba Airport	-	16,200	50	16,250
McClellan-Palomar Airport	7,400	8,500	9,600	25,500
Ocotillo Airport	-	34,900	-	34,900
Ramona Airport	270	6,900	3,100	13,570
Total	69,220	126,000	52,150	247,370

Figure 36 - Capacity by Location and Ownership Type (kW)

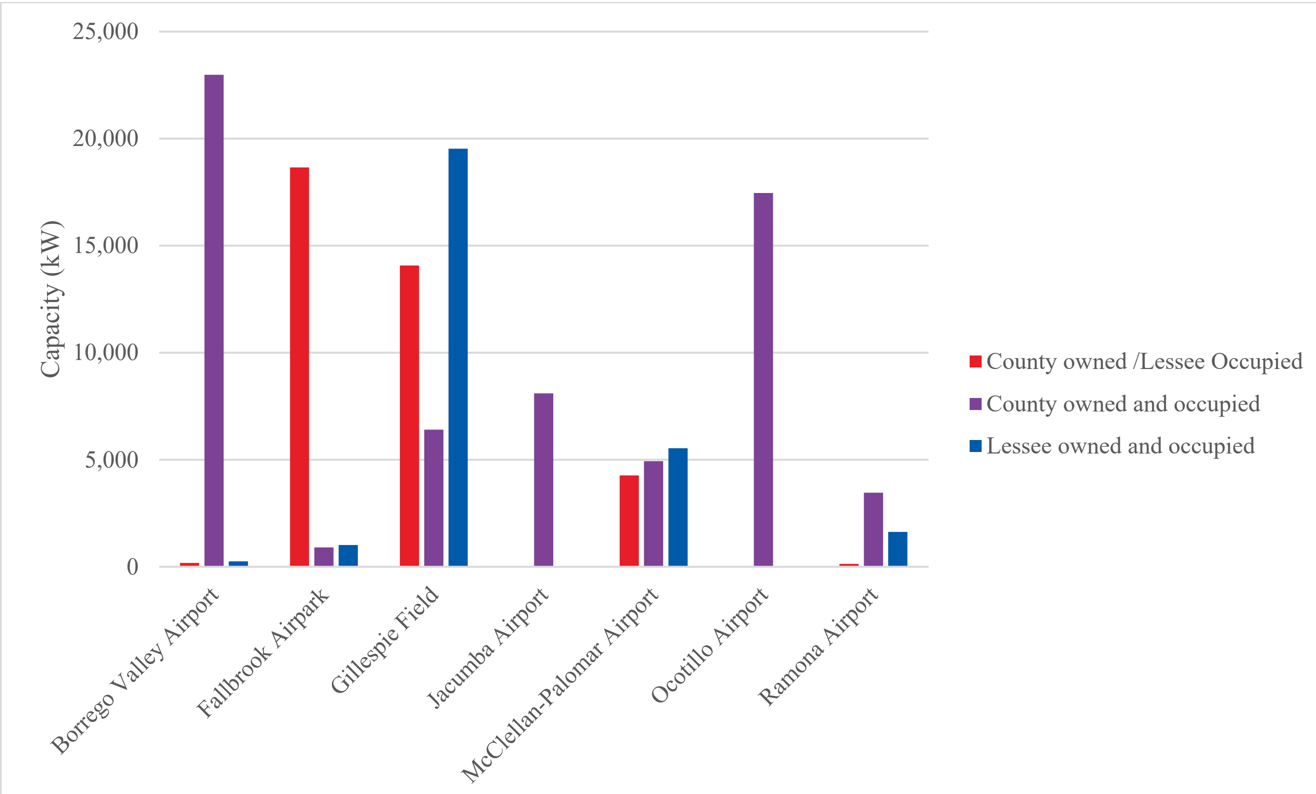


Table 30 - Capacity by Location and Ownership Type (kW)

Capacity (kW)	Ownership Type			
Location	**County owned /Lessee Occupied**	**County owned and occupied**	**Lessee owned and occupied**	**Total**
Agua Caliente Springs Airport	-	-	-	-
Borrego Valley Airport	180	23,000	250	23,430
Fallbrook Airpark	18,700	900	1,000	20,600
Gillespie Field	14,100	6,400	19,500	40,000
Jacumba Airport	-	8,100	30	8,130
McClellan-Palomar Airport	4,300	4,900	5,500	14,700
Ocotillo Airport	-	17,500	-	17,500
Ramona Airport	140	3,500	1,600	5,240
Total	37,420	64,300	27,880	129,600

Figure 37 - Annual Energy Generation by Location, Mount Type, and Ownership Type (MWh/year)

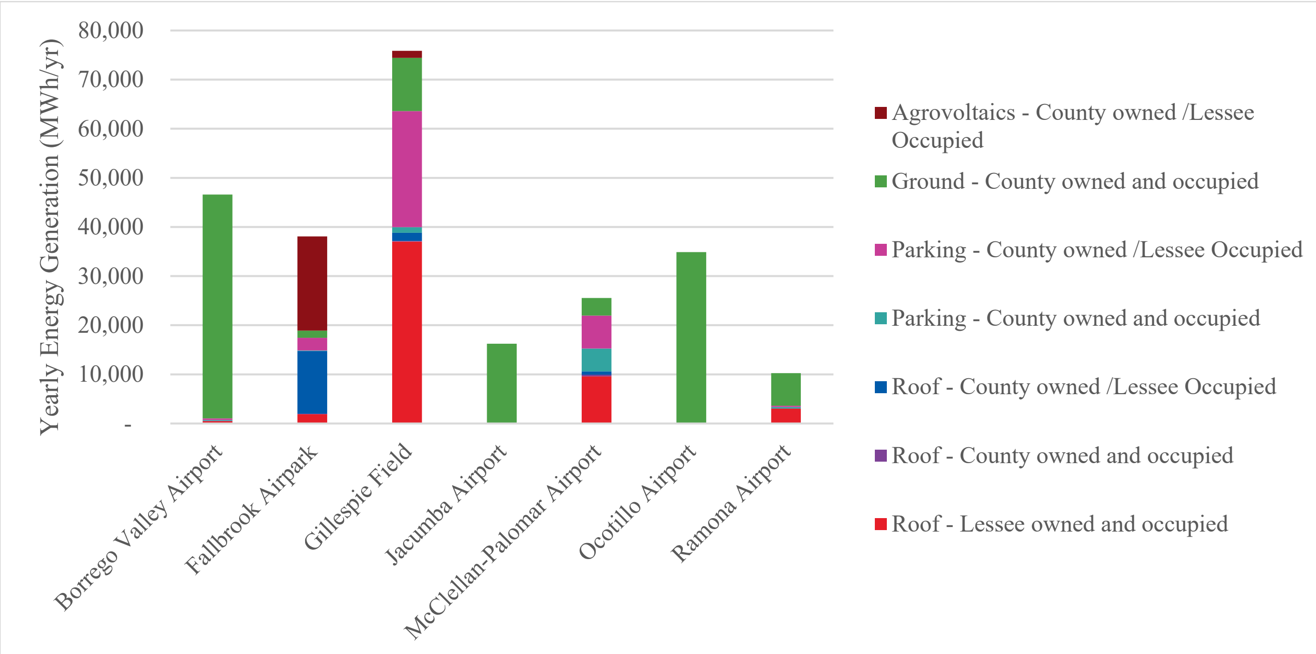


Table 31 - Annual Energy Generation by Location, Mount Type, and Ownership Type (MWh/year)

Annual Energy Generation (MWh/year)	Agrivoltaics	Ground	Parking	Parking	Roof	Roof	Roof	
Location	**County owned /Lessee Occupied**	**County owned and occupied**	**County owned /Lessee Occupied**	**County owned and occupied**	**County owned /Lessee Occupied**	**County owned and occupied**	**Lessee owned and occupied**	**Total**
Agua Caliente Springs Airport	-	-	-	-	-	-	-	-
Borrego Valley Airport	-	45,600	310	170	40	10	500	46,630
Fallbrook Airpark	19,200	1,500	2,600	120	12,800	90	1,900	38,210
Gillespie Field	1,400	10,900	23,600	1,100	1,600	140	37,000	75,740
Jacumba Airport	-	16,200	-	-	-	-	50	16,250
McClellan-Palomar Airport	-	3,600	6,700	4,630	690	330	9,600	25,550
Ocotillo Airport	-	34,900	-	-	-	-	-	34,900
Ramona Airport	-	6,700	270	270	3	-	3,100	10,343
Total	20,600	119,400	33,480	6,290	15,133	570	52,150	247,623

Figure 38 - Capacity by Location, Mount Type, and Ownership Type (kW)

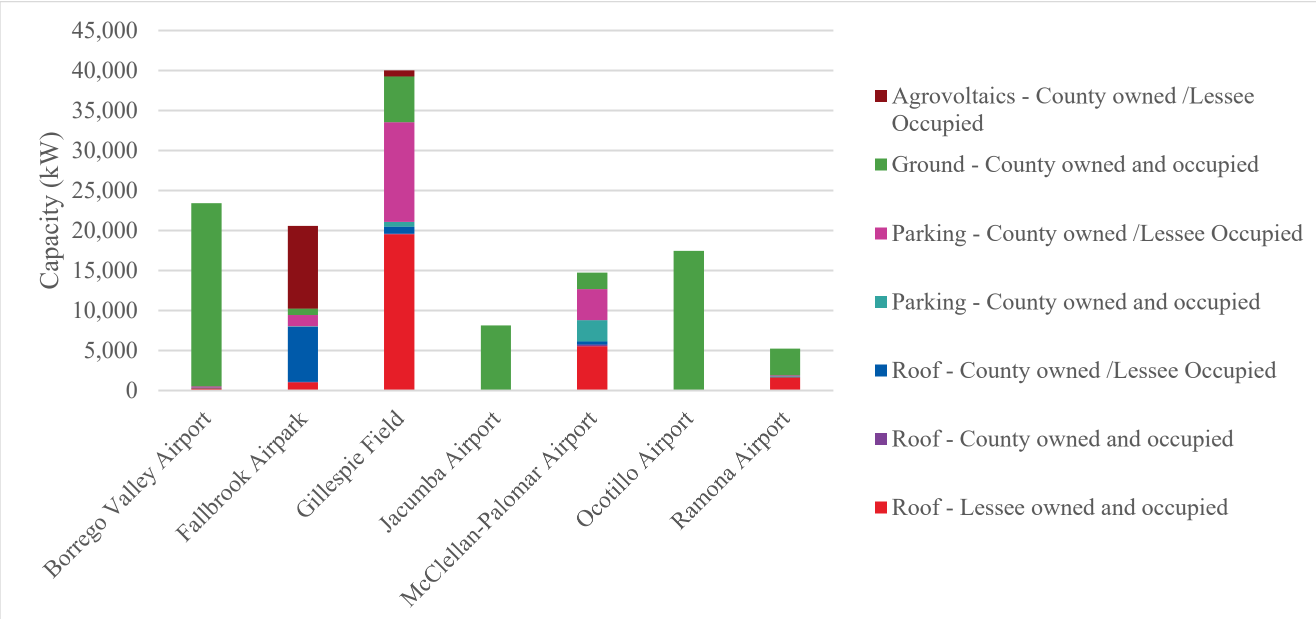


Table 32 - Capacity by Location, Mount Type, and Ownership Type (kW)

Capacity (kW)	Agrivoltaics	Ground	Parking	Parking	Roof	Roof	Roof	
Location	**County owned /Lessee Occupied**	**County owned and occupied**	**County owned /Lessee Occupied**	**County owned and occupied**	**County owned /Lessee Occupied**	**County owned and occupied**	**Lessee owned and occupied**	**Total**
Agua Caliente Springs Airport	-	-	-	-	-	-	-	-
Borrego Valley Airport	-	22,900	160	90	20	5	250	23,425
Fallbrook Airpark	10,400	790	1,400	60	6,900	50	1,000	20,600
Gillespie Field	750	5,700	12,500	610	870	70	19,500	40,000
Jacumba Airport	-	8,100	-	-	-	-	30	8,130
McClellan-Palomar Airport	-	2,100	3,900	2,700	400	190	5,500	14,790
Ocotillo Airport	-	17,500	-	-	-	-	-	17,500
Ramona Airport	-	3,300	140	140	2	-	1,600	5,182
Total	11,150	60,390	18,100	3,600	8,192	315	27,880	129,627

Figure 39 - Existing Rooftop Solar Capacity

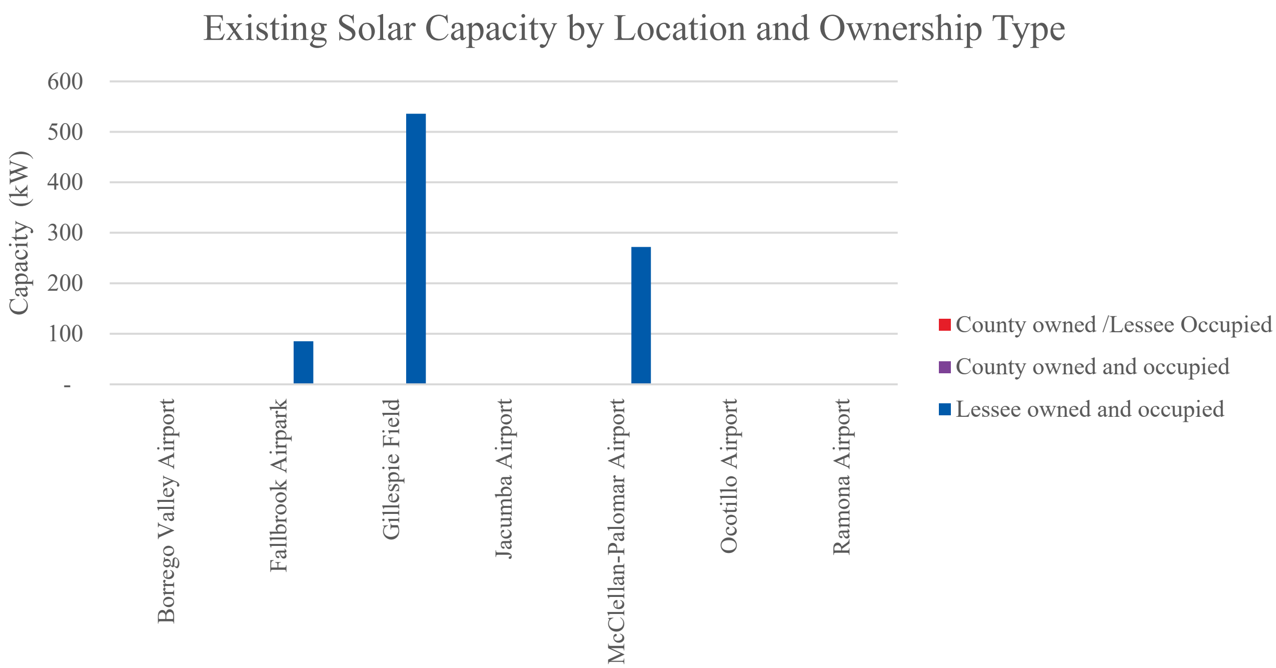


Table 33 - Existing Rooftop Solar Capacity

Existing Solar Capacity (kW)	Ownership Type			
Location	**Lessee owned and occupied**	**County owned and occupied**	**County owned /Lessee Occupied**	**Total**
Agua Caliente Springs Airport	-	-	-	-
Borrego Valley Airport	-	-	-	-
Fallbrook Airpark	-	-	90	90
Gillespie Field	-	-	540	540
Jacumba Airport		-	-	-
McClellan-Palomar Airport	-	-	270	270
Ocotillo Airport	-	-	-	-
Ramona Airport	-	-	-	-
Total	-	-	900	900