

**SOLAR POWER IN SANTA CLARA COUNTY
MARKETS AND DEVELOPMENT TRENDS**



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SANTA CLARA COUNTY'S PV PROGRAM,
CONTACT KATJA IRVIN, KATJA.IRVIN@PLN.SCCGOV.ORG

I. Introduction

This paper discusses the potential for utility-scale solar power generation in Santa Clara County in relation to land regulation and the state of the solar power industry. Section II provides background information on solar technology and State policies. Section III focuses on industry trends impacting solar development. Sections IV and V focus more specifically on Santa Clara County – with a discussion of issues, barriers and opportunities and recommended strategies to facilitate solar development in the County.

This report is the result of research and outreach conducted by the Santa Clara County Planning Office to better understand renewable energy policies and land use regulation trends. Outreach included meetings with solar industry representatives and environmental consultants.

II. Background

The following background information provides an introduction to the State renewable energy policy, solar technology, and land use factors for commercial solar power generation.

Policy

The solar power industry is developing rapidly in response to recent policies and programs for renewable power in the State of California. Established in 2002 under Senate Bill 1078 and accelerated in 2006 under Senate Bill 107, California's Renewables Portfolio Standard (RPS) requires Load-Serving Entities (LSEs) such as Pacific Gas and Electric Company (PG&E) to increase procurement from eligible renewable energy resources by at least one percent of retail sales annually, reaching twenty percent by 2010.

In 2009, Governor Schwarzenegger directed the California Air Resources Board (CARB) through Executive Order S-21-09 to promulgate a regulation requiring the state's LSEs to meet a 33 percent renewable energy target by 2020. CARB's Scoping Plan to implement the California Global Warming Solutions Act of 2006 (AB 32) also identifies the RPS program one of the measures that can help California reach its greenhouse gas reduction goals. As of April 2010, PG&E had not met the 2010 20 percent requirement – as of April, PG&E served only 14.4 percent of its retail electricity sales with renewable power.

Technology

The two primary types of solar power generation technologies are solar thermal trough or tower systems, and photovoltaic (PV) panel systems. A typical solar thermal power plant uses hundreds of mirrors to concentrate sunlight for boiling liquid to produce steam that spins a turbine. Solar thermal facilities have potential visual impacts from use of mirrors, and require intensive water use (to cool turbines). PV panels consist of a series of cells made from a semiconductor, usually silicon, which frees electrons to create an electric current. PV facilities cover a lot of land – over one hundred acres for large-scale projects generating more than twenty MW of electricity – raising concerns related habitat and agricultural lands, among other possible

impacts.¹ As of April 2010, no solar thermal facilities have been proposed in Northern California. A few smaller scale (one or two MW) PV facilities have been completed in Alameda and Sacramento Counties, and a number of larger-scale PV installations are under consideration, including one in San Benito County.

Land Use

The main land use related components needed to develop a solar electric generating facility are as follows:

- **An appropriate site.** The best site for a solar facility would have the following attributes: low land costs; mostly flat land; high solar radiation potential; not prime agricultural land; and no habitat value.
- **A power purchase contract.** Profitability hinges on contract negotiations with LSEs (for power purchase rates).
- **Entitlement permits.** Land use policies and regulations are central to the development of solar power. Solar developers prefer working in jurisdictions with clear regulations and processes and predictable fees for project entitlement.
- **Adequate transmission and distribution (T&D) infrastructure.** Profitability also hinges on limiting expenditures needed to connect to and upgrade power infrastructure. Therefore it is crucial that facilities be located near high-voltage power lines.

III. Solar Power Industry Sectors and Trends

Any solar power installation with the primary intent of selling power back to the grid is considered a commercial facility. A facility constructed and maintained by a private corporation that is not an investor-owned utility is sometimes referred to as a “merchant facility.” Merchant installations range from one megawatt (MW) facilities to facilities generating over 100 megawatts of electricity.² A solar installation is not categorized as a commercial facility, regardless of size, if it is primarily serving another use on a property that is hooked into the power grid as a utility customer. These installations are known in the electricity sector as “behind-the-meter” because the power is used entirely on site and is not sold back to the grid. The average size of a residential PV installation in Santa Clara County is about eight kilowatts (KW).

Solar power development is roughly divided into four industry sectors. These sectors are largely defined by State policies and local utility programs, which set megawatt thresholds and other limits for participation in specific programs. Table 1 on the following page describes the programs, policies, and trends for each sector.

¹ Current PV technologies require four to ten acres of land per MW of electricity generated.

² Facilities are rated by the amount of energy generated per hour at peak capacity. A megawatt is equal to one million watts, enough power for about 800 homes.

Table 1. Solar Power Industry Sectors and Trends

Sector / Characteristics	Programs and Policies	Trends
No Contract Required		
<p>Customer Generation: Project sized to meet on-site load</p> <p>Behind-the-meter Often 100-200 KW for business uses, but can be up to 1 MW</p>	<p>1 MW is the maximum threshold for participation in the California Solar Initiative. Through “net metering,” projects up to 1 MW get credit for electricity sent back to the grid. Interconnection to the grid is automatic.</p> <p>These systems usually do not require permits or approvals beyond building / electrical permits.</p>	<p>All rooftop and parking lot installations fall in this category.</p> <p>This is a growing sector with increasing interest from industrial, commercial, and agricultural landowners.</p>
Utility Contract Required		
<p>Feed-in Tariff (FIT): Project sized above on-site load for export</p> <p>Installations qualifying to sell excess energy back to the grid using a FIT rate structure</p> <p>Current limit of 1.5 MW, but will increase to 3 MW, and potentially to 10 MW</p>	<p>FITs are implemented by the California Public Utilities Commission (CPUC) according to legislative mandates.</p> <p>A CPUC rulemaking is underway to increase the size of projects eligible to participate in the FIT program to 10 MW, and implement a Reverse Auction Mechanism through which developers can bid for a limited quantity of FIT contracts.</p> <p>For more on FITs, see <i>Emerging Trends in the US Solar Market</i> (www.acwa.com/content/energy/emerging-trends-us-solar-market).</p> <p>For more information on PG&E programs see www.pge.com/b2b/energysupply/Wholesaleelectricssuppliersolicitation/.</p>	<p>Facilities on agricultural land could be a growing sector in this category. To date most agricultural installations stay under the 1-MW net-metering limit because that process is clear. However, according to industry representatives, farmers have shown interest in installing systems larger than 1 MW.</p>
<p>Wholesale Power Purchase Agreements (PPAs)</p> <p>Includes:</p> <ul style="list-style-type: none"> • PPAs with Renewables Portfolio Standard facilities up to 1.5 MW • PPAs resulting from PG&E PV program (1-20 MW) • Other wholesale PPAs (1+ MW) 	<p>The primary procurement vehicle for meeting RPS targets is signing wholesale PPAs with large renewable projects in California and the western US.</p> <p>In addition to ongoing renewable procurement through PPAs covering all eligible renewable technologies, the CPUC recently approved a PG&E PV Program to enter into contracts with small and medium solar PV facilities ranging from 1 to 20 MW in size. Up to 250 MW of new generation may be approved through this program. Projects of both types are selected through an annual solicitation. PG&E is targeting projects that can come online within 18 months of PPA execution.</p> <p>Silicon Valley Power (City of Santa Clara) is also interested in establishing PPAs for small and medium solar PV installations.</p> <p>Completing the California Independent System Operator’s (CAISO) Large Generator Interconnection Process (LGIP) and obtaining necessary state and federal environmental permits can be a lengthy process.</p>	<p>Procedures will be established for the PG&E PV Program by summer 2010 – when this happens, solar industry professionals expect to pursue small and medium PV projects more aggressively.</p> <p>Silicon Valley Power is not yet providing favorable rates to encourage solar/renewable power development.</p> <p>This sector is currently quite active in southern and central California with several developers pursuing both solar thermal and PV projects.</p> <p>Larger facilities offer the economies of scale necessary for profitability – such economies are currently necessary given the high upfront costs and the uncertainties associated with solar power development.</p>

Sector / Characteristics	Programs and Policies	Trends
Utility-Owned Generation 1+ MW	Utilities have the option of developing, owning and operating renewable generation facilities subject to CPUC approval for cost recovery. PG&E proposed to develop, own and operate up to 250 MW of solar PV generation as part of its overarching PG&E PV Program recently approved by the CPUC.	Utility ownership allows PG&E to leverage its financial strength and development experience to bring projects online expeditiously. Utilities are cautious due to high upfront costs and uncertainties.

This information on solar industry sectors and trends highlights the complexity and risk involved in development of merchant facilities at a time when both utility and land use regulations continue to evolve. Currently, the FIT and PG&E PV programs described above are not active because policies and procedures are not fully in place. In addition, at the current rates paid for electricity, it is difficult for solar developers to be confident about the return on investment. Among the many costs that must be considered are land purchase or lease agreements, land entitlement fees, infrastructure upgrade costs, and utility inter-connection fees. Nonetheless, in the next ten years industry professionals expect the market for one to twenty MW merchant solar facilities to become more active and there may be interest in building such facilities in rural Santa Clara County.

IV. Land Use and Solar Power in Santa Clara County

Current Land Use Regulations

Santa Clara County land use policies and regulations currently do not address solar power generation as a land use separate from other major utility facilities. Utilities – Major (e.g. power generating plants, substations, refuse collection, transfer, and disposal facilities) are allowed in most zoning districts with a Use Permit.³ On the other hand, there are no specific standards for the size of behind-the-meter (accessory) solar installations unless a parcel is under a Williamson Act contract or Open Space Easement. Open Space Easements allow a maximum of five percent coverage up to five acres, while parcels under Williamson Act contracts allow ten percent to be used for non-agricultural development, as long as the remainder of the parcel is used for commercial agriculture.

Issues and Barriers

Several barriers exist that tend to limit solar power development in Santa Clara County.

Solar resources. Santa Clara County has lower solar radiation potential than central and southern California⁴ with the same agricultural and environmental constraints. Solar power developers are thus focusing their efforts in these other areas.

³ Use Permit requirements do not apply to investor owned utilities which are under CPUC jurisdiction. Local authorities are preempted from regulating electric facilities under CPUC jurisdiction. (CPUC GO 131-D §XIV.B).

⁴ Most areas of southern and eastern California receive direct normal solar radiation ranging from 6.0 to greater than 8.00 kWh/m²/day. The southeast portion of Santa Clara County receives the highest solar radiation in this County, up to 6.25 kWh/m²/day, while most of the County receives less than 5.5 kWh/m²/day.

Property values. High property values compared to the inland areas of California are another barrier to solar power development in Santa Clara County.

Lack of power infrastructure. Santa Clara County has a limited number of substations and high-voltage lines to support new power generation facilities. Solar facilities need to be located very near the existing grid to avoid the expense of installing new infrastructure.

Habitat conservation requirements. Santa Clara County has many areas of high habitat value and environmental concern, which may reduce potential sites for solar development. The Santa Clara Valley Habitat Conservation Plan (SCVHCP) and the PG&E Bay Area Operations & Maintenance Habitat Conservation Plan do not specifically include large-scale solar facilities as a covered activity. Thus, such facilities may need to obtain separate permits from US Fish and Wildlife and create their own habitat conservation plan compatible with the SCVHCP. If a large-scale solar project was to be included within the SCVHCP, fees would be between \$12,900 and \$18,500 per acre, which would pose a significant financial constraint. Industry representatives reported that new design solutions (raised poles, wider spacing) are being explored that minimize habitat disturbance. However, it is unclear if these design alternatives will successfully prevent habitat loss.

Agricultural preservation constraints. Solar power developers avoid sites that are categorized as prime agricultural land. In addition, commercial solar installations are not compatible with the intent of Williamson Act laws. Many acres of land in the southern Santa Clara County agricultural zones are categorized as prime agricultural land, and much of the eastern part of the County in the Diablo Range is under Williamson Act contracts. These constraints limit the amount of suitable land for solar development.

Minimal slope requirements. Most solar developers prefer flat land (maximum three to five percent slope) although some will work with slopes up to a fifteen percent grade, depending on the technology used. Much of the rural land in Santa Clara County is mountainous, leaving few large tracts of relatively flat land available for solar development outside of valley agriculture areas.

Clear development standards and requirements. The County General Plan and Zoning Ordinance do not currently address commercial solar facilities since such facilities are a relatively new phenomenon. Solar developers prefer clearly documented policies, requirements, and standards that reduce the potential for surprises in the entitlement process.

Opportunities

As a result of these issues and barriers, there is limited likelihood in Santa Clara County for utility-scale solar power development. However, some opportunities do exist for smaller scale solar and renewable power development in the County.

Smaller facilities. Although large merchant facilities are not expected to occur in Santa Clara County due to the issues and barriers listed above, as the solar power market continues to mature, the County could anticipate proposals for facilities under feed-in tariffs or the PG&E PV Program.

Compatibility with agriculture. Areas designated as non-prime farm land could be suitable for solar development, if agricultural compatibility issues can be resolved. Industry professionals cited examples where dual use of land has been achieved if structures are tall enough and spaced appropriately – grazing of sheep under solar facilities is common in Europe, and panels have been installed between rows of crops or around the perimeter of vineyards.

Related opportunities. Industry representatives reported that their current business in Santa Clara County is limited to rooftop and other *behind-the-meter solar installations up to one MW*. They also indicated that other renewable energy opportunities such as *wind energy* (in the eastern part of the County) and *new fuel cell technologies* have potential.

V. Conclusion

Solar generation facilities larger than five MW are not likely in Santa Clara County in the near future due to a combination of barriers including lower solar radiation potential, higher land costs, and the potential for habitat and agricultural impacts. Despite these barriers, Santa Clara County can encourage smaller solar facilities by adopting specific policies and regulations and providing clear information to assist the solar industry. Five main strategies are recommended to further such commercial solar development in the County.

1. *Focus on net-metering applications and smaller-scale power purchase agreements.* Research and outreach indicates that developers are most likely to pursue these categories of solar facilities in the flat agricultural lands in South County. The County should anticipate that such facilities could cover ten or twenty acres, or more.
2. *Update land use policies and regulations with clear guidance for commercial solar facilities.* Define zoning use classification, sub-categories, and appropriate zoning districts for solar power generation facilities. Investigate lower requirements for smaller (less than ten-acre) facilities. Define clear zoning standards for setbacks, height, security, lighting, and landscaping that specifically address solar installations and facilities. Consider adding general plan policies to support renewable energy (making sure any new policies remain compatible with Williamson Act twenty percent use provision and other policies regarding agricultural mitigation). Coordinate with the Department of Conservation regarding Williamson Act Compatible Use Guidelines for solar facilities.
3. *Help solar developers identify appropriate sites.* Santa Clara County can provide assistance to developers by providing GIS maps to identify potential sites for one to five MW solar facilities. The Planning Office has already mapped factors such as solar resources, slope, and agricultural and habitat constraints. Additional useful factors that can be mapped include proximity to grid infrastructure and parcel size.
4. *Follow research on potential design solutions for constructing solar facilities* to be compatible with agriculture and wildlife habitat and adjust policies as appropriate.
5. *Help solar developers understand fees* and investigate ways to make fees more predictable for solar power facilities. *Clearly communicate requirements*, including conservation plan mitigation measures defined in the Santa Clara Valley Habitat Conservation Plan.

Proactive solar development policies will position Santa Clara County to take advantage of the renewable energy market and move towards a more sustainable energy future. Along with outreach and incentives, clear land use regulations can encourage renewable energy development and further State and County goals to reduce carbon emissions and address climate change.