Large-scale Solar and Agricultural Lands:

Balancing Clean Energy and Food Production in the San Joaquin Valley

Compiled by the Sustainable Energy Roadmap Project

For the California Strategic Growth Council

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Sustainable Energy Roadmap is an 18-month effort launched in early 2015 and is focused on supporting San Joaquin Valley communities to set and pursue goals related to water conservation, smart growth, transportation, land use, climate and energy. The program is sponsored by California's Strategic Growth Council through Proposition 84 funding, and led by a collective of partners. For more information, visit: www.SustainableEnergyRoadmap.com

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The San Joaquin Valley Regional Policy Council

The National Association of Regional Councils

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The Strategic Growth Council is a cabinet level committee comprised of representatives from the Governor's Office of Planning & Research; California Health and Human Services; California Natural Resources Agency; California State Transportation Agency; California Business, Consumer Services, and Housing Agency; California Environmental Protection Agency; California Department of Food and Agriculture; and a public member that coordinates the activities of state agencies and partners with stakeholders to promote sustainability, economic prosperity, and quality of life for all Californians.

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This white paper is provided as part of broader project to encourage and support municipal governments in planning for a more sustainable energy future. Initiated by the San Joaquin Valley Regional Policy Council, the SER Project offers local governments assistance in setting and pursuing policy and program goals related to energy efficiency, water efficiency, renewable energy, and transportation and land use planning, all while enhancing the role of environmental justice and social equity in the planning process. SER Project core team members and contributors to this document include the Madera County Transportation Commission, the National Association of Regional Councils (NARC), Optony, Inc., Strategic Energy Innovations, Inc.; Colorado Energy Group, and Sigala, Inc. While primarily intended for use in the San Joaquin Valley, this white paper can also be used by other local governments as the rush to build large-scale solar projects increasingly dominates public planning agendas.

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Cover Photo: Westlands Solar Park project outside of Mendota, CA provided by Joseph Oldham

I. Executive Summary

The San Joaquin Valley is home to some of America's most fertile and prized agricultural land. It is also a very attractive location for large-scale solar projects. As of August 2015 there were at least 120 large-scale solar projects completed or underway in the San Joaquin Valley alone, with some as large as 6,100 acres (See **Figure 1**) and more are expected in order to meet the State's appetite for clean energy. With roughly 4 million residents, more than 250 crops and a total annual agricultural market value of $30 billion representing 57-percent of the State's agricultural market, the stakes are high not only for the San Joaquin Valley but all Americans that depend upon the region's food production. Developers of large-scale solar facilities are drawn to the San Joaquin Valley because of its abundant solar resource, relatively flat land, proximity to transmission lines, and easier environmental impact assessments as the large majority of the land has already been utilized for farming purposes. A multi-year drought, poor air quality, population growth and prolonged economic challenges are prompting local leaders and land use planners to balance new energy production priorities with the conservation of farmland, cultural heritage, and a highly-valued sense of place.

The energy industry landscape has quite literally changed almost overnight and harmonizing land use planning objectives with new clean energy projects has become more complex for local government planners. The change underway is significant. Land owners and public officials are now comparing the income, tax revenues and infrastructure requirements of a 30-year large-scale solar project to a traditional almond orchard with the same life expectancy and this type of analysis is expected to increase in number. Likewise, new concepts of how to build large-scale solar projects while simultaneously farming productive agricultural land such as raising panels higher off of the ground (up to twelve-feet) and creating more space between them that allow blueberries, wine grapes, raspberries and vegetables to be grown *under* the panels are gaining momentum.[i] Domestic research on this new higher array configuration is virtually non-existent so no large scale solar developer has proposed such a "win-win" scenario for food and solar production in the San Joaquin Valley to date. The impact of chemical spray and increased dust on solar panel performance, crop shading and adverse wind conditions are but a few issues of importance. Therefore, there is likely to be some concern over the use of any agricultural land for solar production alone into the foreseeable future.

The long-held assumption that solar energy is universally considered of value to the community because it fundamentally serves the public good and promotes the general welfare—also known as "inherently beneficial use" in the legal field—is under examination in many public forums. Thanks mostly to a 73-percent decline in the cost of providing electricity from solar since 2008[ii], the expected decline of lucrative federal solar tax incentives and a push by state policymakers to increase the amount of electricity produced by renewable energy resources through the state Renewable Portfolio Standard (RPS), solar developers are rushing to propose large-scale installations on cherished California farmland.

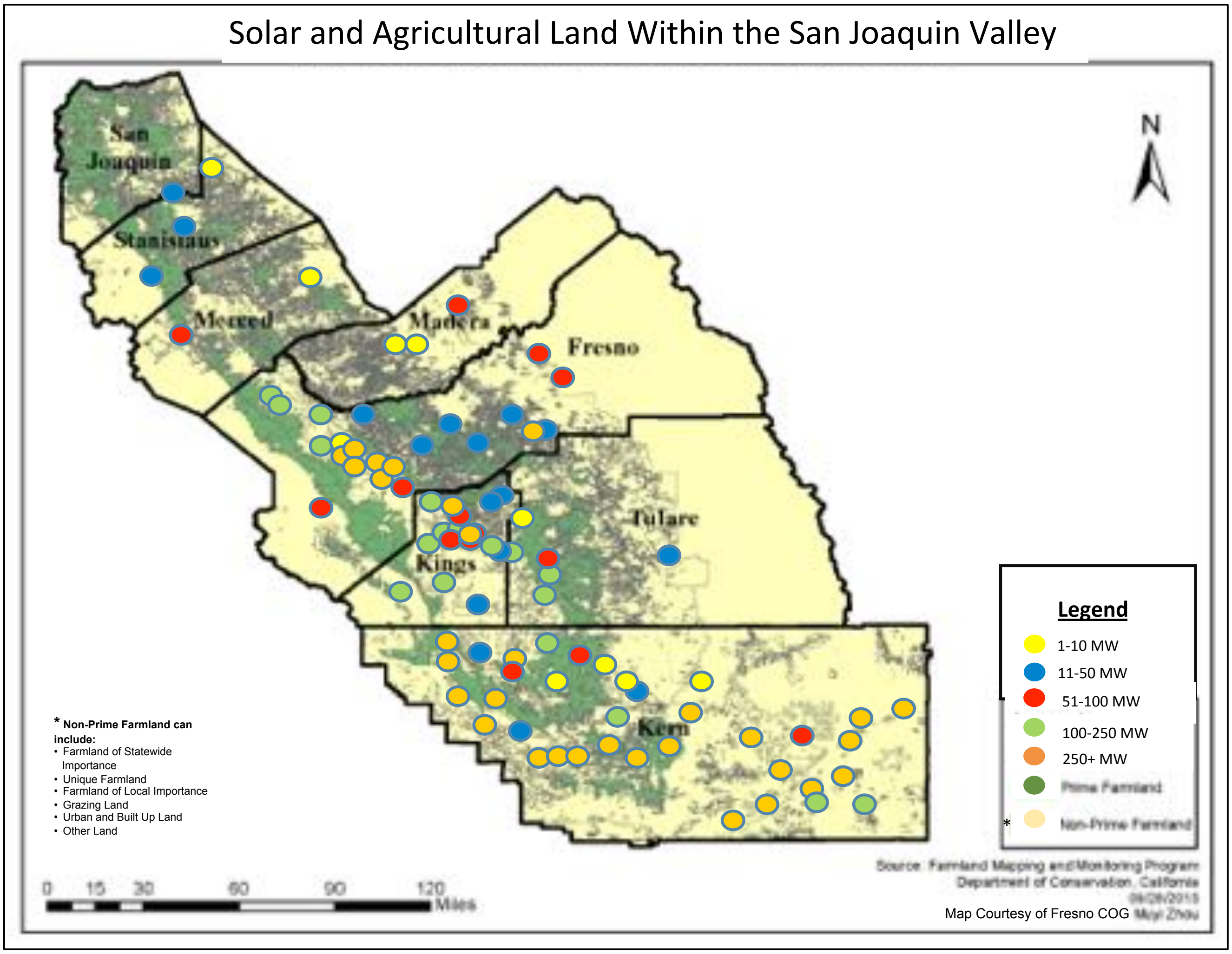
Without question, the primary drivers of the dramatic deployment of solar – whether large, utility-scale or smaller "behind the meter" rooftop installations—have been California's existing 33-percent Renewable Portfolio Standard (RPS) for utilities by 2020 and Assembly Bill 32 which mandated a 15-

percent reduction of greenhouse gas emissions by 2020 from 1990 levels. Governor Brown signed legislation (SB 350, DeLeon) on October 7, 2015 that will increase the RPS mandate to 50-percent by 2030. This change formally adopts a goal he first stated in his 2015 inaugural address, and it is important to note that changes enacted by SB 350 will need to be implemented by the California Public Utilities Commission (CPUC) or the California Energy Commission (CEC) before the new RPS can take effect. Senate Bill 32 (Pavley) would have raised GHG reductions to 80-percent by 2050 but will be revisited in the 2016 legislative session. There is also pressure from federal government policies. The U.S. Environmental Protection Agency's Clean Power Plan released in August 2015 promotes renewable energy resource development as a compliance option to offset desired future carbon reductions from power plants also contributes significantly to this relative rush to build large-scale solar projects.

As shown in **Figure 1**, there are already at least 120 solar energy facilities in the San Joaquin Valley that are operational or in the planning process. Projects average 67 megawatts (MW) in capacity (enough to power 16,750 homes) and 509 acres in size, the largest with 1,000 MW of capacity on 6,100 acres. **Appendix A** presents a larger version of this map along with a corresponding list of solar energy facilities by county as well as their acreage and generating capacity. It also provides county-specific maps further highlighting the location of large-scale solar projects, land designated as prime agricultural land, and electrical transmission lines.

Figure 1: Large-Scale Solar Energy Facilities in the San Joaquin Valley

After reviewing solar policies across more than one-hundred local governments it is very clear that handling requests for large-scale solar projects individually through variances or ad-hoc planning



meetings can be economically wasteful for both government and the solar developer. This independent, stove-piped approach also risks going astray of codified values contained in multiple other environmental and energy-related plans, which can expose jurisdictions to unnecessary and expensive legal battles. One solution to this risk is to adopt large-scale solar policies and general principles as part of General Plan updates. For example, Inyo County, California updated its 2011 Renewable Energy General Plan Amendment (REGPA) in March 2015 to address the projected rapid growth of large-scale renewable energy and solar facilities in the County, while Imperial County, California adopted a Renewable Energy Resources Ordinance and updated he Renewable Energy and Transmission Element of its General Plan in October 2015 specifically to address large-scale solar projects and transmission capacity.

Purposes of This White Paper

General Plans, farmland and open space plans may be undermined by haphazardly allowing more prime agricultural space to solar development. Because of the importance of municipal government control of land use and ensuring appropriate siting requirements for large-scale solar, this white paper looks at how some San Joaquin Valley municipalities and other local governments within and outside of California are already addressing large-scale solar development. It is written to assist policymakers and provide more information about what impacts are important to evaluate with large-scale solar projects and provide options that will help municipal government planners implement large-scale solar projects while concurrently protecting and conserving valuable farm land. It outlines major land use issues to consider when permitting large-scale solar projects while also providing examples of how other local governments approach the issue, and suggests guidelines for future solar energy facility development. This white paper also provides the first comprehensive look at solar energy facility development across the San Joaquin Valley, documenting the total acreage and the generating capacity (in megawatts) of these large-scale photovoltaic (PV) solar projects.

Some jurisdictions have taken broad approaches when it comes to large-scale solar facilities. Among those highlighted in this paper or in Appendix C are:

Inyo County, California recently adopted a Renewable Energy General Plan Amendment (REGPA) that utilized an overlapping mapping process in its public review process to designate areas for solar projects and caps the size of individual projects and prevents them from sharing common borders

Yolo County, California encourages solar facilities to be sited on land that is more than 60-percent on-prime farmland, and requires mitigation for wildlife and permanent loss of agricultural land, along with public outreach and technical committee approval

Clarke County, Virginia requires facilities to be in close proximity to transmission lines and documentation of impacts when applying for a conditional use permit, and limits projects to 20 acres in size

Pima County, Arizona bars the development of agricultural land for large-scale solar projects and requires site maintenance, reclamation and formal closure plans for deployment of large-scale solar on other land uses such as ranches

A host of energy, environmental, economic development, and community cultural issues have been triggered by the growth of large-scale solar energy projects. Consideration of some of the salient issues together demonstrates how complex decisions regarding solar energy facilities on agricultural land can be for public officials. Among other issues mentioned in this paper, proponents of large-scale solar projects point out that the facilities are necessary to meet the state-mandated Renewable Portfolio Standard, address long-term air quality goals, and makes it easier for utilities to manage electricity loads on the grid compared to thousands of rooftop installations. Critics are quick to point out that high-quality agricultural land is far too valuable over the long-term to be taken out of production; comprehensive plans are undermined by allowing the solar energy facilities to proliferate without a new, revised General Plan; and that the solar energy facilities threaten the region's rich agricultural history and sense of community for residents.

There are no State, County, or regional targets of how much solar-generated electricity should be developed nor are there directives on where to build large-scale solar projects. The state agency responsible for tracking development on privately held farmland, the California Department of Conservation, has not had the resources to do so because of budget shortfalls. This effectively leaves local governments on their own to track this development.[iii]

While watching large-scale solar development activity, San Joaquin Valley local government officials are holding on to their land use authority and are having to ask complex questions such as:

- What are the common criteria that can define suitable agricultural land for solar energy facilities?
- What land should be used for solar energy facilities, and what policies are already in place that help determine this?
- What agricultural land should be avoided, and why?
- Should agricultural land be excluded from solar development?
- If a proposed project on agricultural land that is under a Williamson Act contract, should it not be allowed, should it be cancelled or should it be converted to a Solar Use Easement? What is the role of water, or lack of water in these considerations?
- How do we balance developing land for solar with projected population growth demands?
- How does a public official decide if approving a large-scale solar energy project is a wise public decision?
- What are the long-term factors that need to be considered with large-scale solar projects?
- How much land does a typical solar energy facility tend to use and how much water is needed during the life of project to keep the panels clean in order to maintain efficiency?
- Should we begin identifying and planning area for consideration of future large-scale solar energy facilities?
- How are other jurisdictions permitting large-scale solar projects?

The authors address and attempt to answer these questions by giving new guidance to public policymakers about large-scale solar projects.

Selected Recommendations

Some of the recommendations for municipal leaders and planning officials included in this document that are the result of our research:

1. Add large-scale solar language to existing General Plans and other planning documents
2. Identify potential large tracts of municipal land such as local airports, landfills, wastewater treatment plants, fair grounds, and brownfields suitable for large-scale solar development and develop these first through individual projects (while also considering aggregation of solar projects among jurisdictions)
3. Perform a solar policy gap analysis to identify discrepancies with existing best practices
4. Target specific areas of concern through local ordinances

5. Perform a solar resource assessment and map ideal large-scale project locations
6. Assess fees on land developed for large-scale solar projects and dedicate this funding stream to agricultural land conservation and community education
7. Establish detailed mitigation plan requirements for projects on agricultural land, especially decommissioning requirements
8. Exhaustively identify least conflict areas and priority criteria for solar development by creating or using similar tools to those available through the San Joaquin Valley Gateway project
9. Review and include select recommendations of recently released policy papers about renewable energy on agricultural lands in relevant planning documents
10. Dedicate funding for a more detailed, comprehensive look at the costs and benefits associated with large-scale solar on or near prime agricultural lands

II. Introduction

The San Joaquin Valley and the larger Central Valley are increasingly hosting large-scale solar facilities, requiring public policy makers to carefully balance the interests of solar developers, landowners, environmentalists and agricultural land preservationists. Proponents and opponents have equally valid arguments relating to solar project impacts on land use, the local economy, economic development, environmental quality and climate change.

Public policy makers in the San Joaquin Valley and elsewhere are wrestling almost daily with how to deliver cleaner electricity while also protecting the fertile, productive farmland. Solar energy projects are an increasingly important component of economic development planning and as such sometimes have complicated costs and benefits. In the pages that follow we attempt to bring light to these layers to better inform governments, *most which do not yet have formal policies in place related to solar energy facilities.* The policies and practices described in this white paper can help avoid time-consuming and expensive legal battles and piecemeal approaches to energy planning for both governments and solar developers.

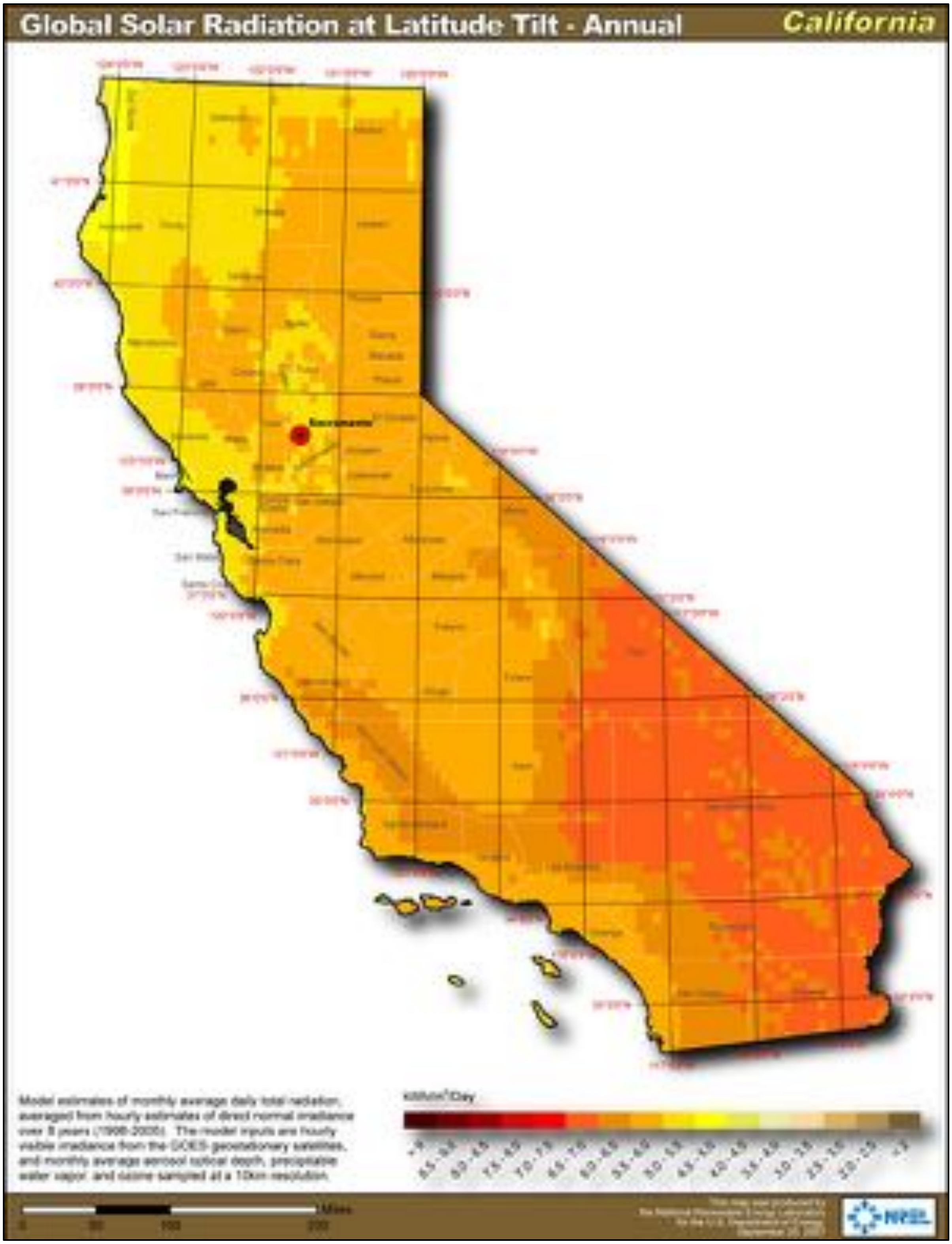
A. The San Joaquin Valley

The San Joaquin Valley consists of eight counties -- Stanislaus, San Joaquin, Fresno, Kings, Tulare, Merced, Madera and Kern – covering 27,000 square miles and home to one of the most agriculturally fertile areas in the world and cultivator of more than 250 crops. Approximately 10.5 million acres or 60-percent of the Valley's land area is in agricultural use and it is one of the most productive agricultural regions on the continent.[iv]

The broader Central Valley, which includes the San Joaquin Valley and the 11 county Sacramento Valley to the north, is recognized as one of only seven places on earth that provide the soil, water, and climate that can produce 350 different crops and agricultural products.[v] The San Joaquin Valley is the undisputed leader in agricultural production, supplying one quarter of the nation's fruits and vegetables. In 2012, the San Joaquin Valley's total agricultural market value was $30 billion or 57-percent of the State's agricultural market value.[vi] Nationally, the region's fertile soil accounts for 97-percent of melon production, almost 95-percent of tomato, 94-percent of cotton, 85-percent of all citrus and cherry production, 81-percent of alfalfa, 80-percent of almonds and 79-percent of grape production.[vii]

In addition to vast agricultural resources, the San Joaquin Valley is also rich in energy resources. The region is home to more than 250 electrical generating facilities that accounts for 80-percent of the State's oil production (6-percent nationally) and has more than 63,000 active oil and gas wells, most of which are located in Kern County. Add to that its vast wind and solar energy resources and the extensive transmission infrastructure already delivering electricity from solar energy facilities in the Mojave Desert and Arizona, and the San Joaquin Valley is a key player in the generation and transmission of electricity. Large-scale solar facilities require level land, proximity to transmission lines and a high solar insolation rating (intensity of solar radiation). The San Joaquin Valley provides all of these. The map below **(Figure 2)** represents solar insolation values for the State.

Figure 2: California Solar Insolation Values



Source: National Renewable Energy Laboratory

Despite this wealth of energy and economic resources, the San Joaquin Valley is also home to high unemployment, chronic poverty, and low educational attainment. For example,[viii]

- Per capita income in the San Joaquin Valley is nearly 30-percent below the state average;
- Median household income ranges from $42,600 in Merced County to $53,400 in San Joaquin County which is 15- to 30-percent below the California median in 2013 and up to 15-percent below the U.S. median household income;
- About 26-percent of southern San Joaquin Valley residents had incomes below the federal poverty line, compared to 16-percent in California as a whole;
- Since 2010, the labor force in the Central Valley has stopped growing, even as population grows and employment growth has resumed; and
- Wages in the Central Valley in *every* industry are lower than the state average.

These figures are significant as local leaders work to address these large disparities in the region and balance economic development and job creation, preserve agricultural land, and improve public services and infrastructure. The issues discussed in the next session fuel the complexity of how decision makers must balance competing priorities.

B. The Growth of Large-Scale Solar and What is at Stake in the San Joaquin Valley

Large-scale solar systems designed for electricity sales directly to utilities generally can deploy solar technologies far faster than numerous residential and commercial rooftop projects with the same amount of generating capacity. Large-scale solar projects are typically ground-mounted and thereby take up many acres of land with the power generated fed directly into the electricity grid versus smaller rooftop applications which generally produce power mostly for on-site use and are designed to offset retail loads.

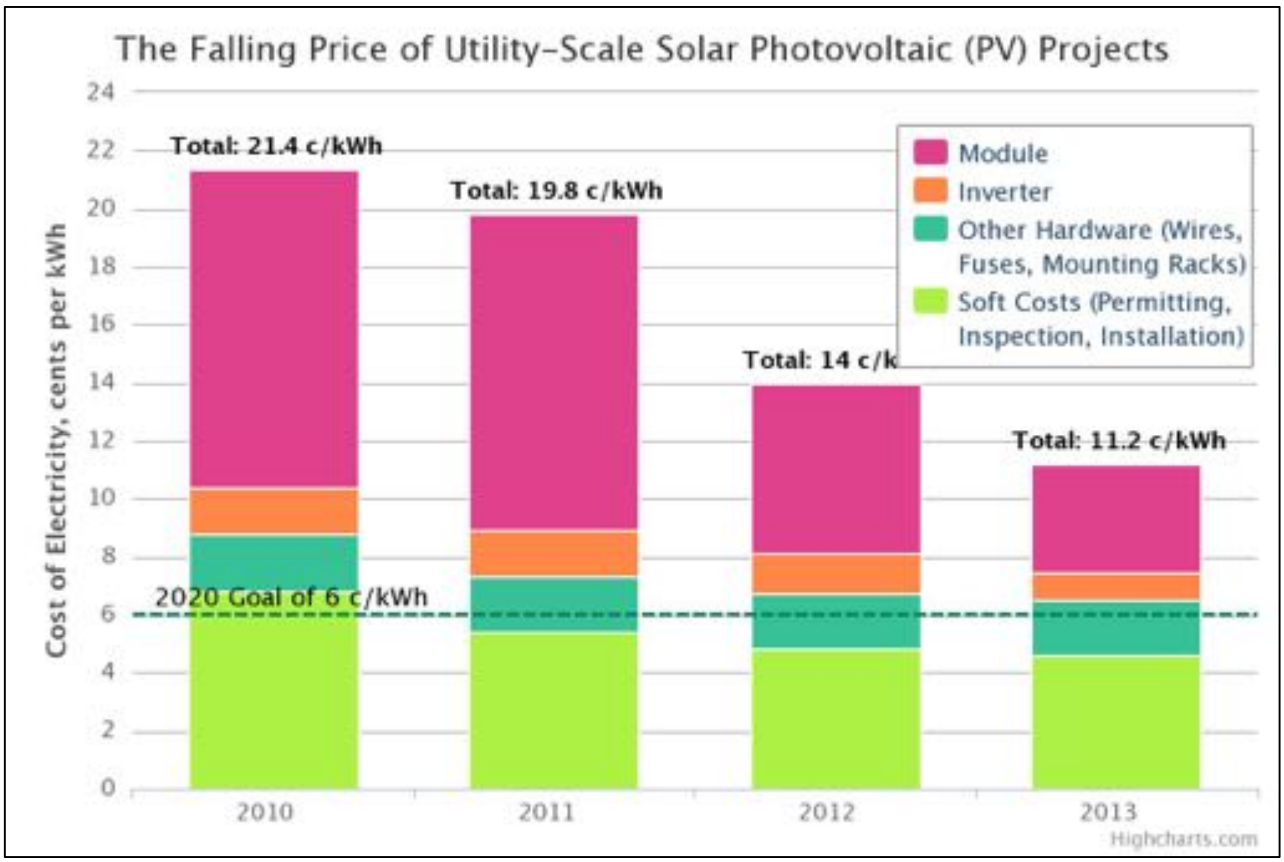
The stakes for the roughly 4 million residents of the San Joaquin Valley and the Americans who benefit from its agricultural production are high. Furthermore, 10.5 million acres or 60-percent of the San Joaquin Valley is agricultural land, making it very difficult to develop a large-scale solar facility without impacting land zoned for agricultural use.[ix]

> *To meet the nation's demand for electricity exclusively with solar, the National Renewable Energy Laboratory (NREL) estimates that solar installations would have to occupy the equivalent of 0.6 percent of the country's total land area. That's equivalent to less than 2-percent of U.S. land now in crop production, but it's still a big stretch of terrain, almost the size of West Virginia. While this is far more solar than a balanced renewable energy economy would require, it is a useful gauge of solar power's land needs.*
>
> Environment 360, "In Clash of Greens, A Case for Large Scale U.S. Solar Projects," August 24, 2015 Yale University.

As early as 2011 more than 33,000 acres worth of solar projects had been proposed to the California Energy Commission in the Central Valley[x]. More than 100,000 acres of solar arrays with current technology were estimated to be needed to meet the state mandated 33-percent RPS, and the move to 50-percent by 2030 would require as much as 150,000 acres of the arrays. The California Climate Change and Agricultural Network identified 45 approved large-scale-solar projects in January 2012 that would cover about 17,570 acres the San Joaquin Valley's most productive farming and grazing land and an additional 59 were under consideration[xi].

Nationally, construction of large-scale solar facilities has soared since 2010 accounting for almost two-thirds of all newly installed photovoltaic capacity in 2014. Economies of scale accrue to large-scale solar projects because of the installation of a large number of solar arrays and infrastructure that become operational in a relatively short time. As shown in **Figure 3**, the cost of large-scale solar projects dropped almost 50-percent between 2010 and 2013 alone and is projected to continue to decline. The dotted line indicates the Department of Energy goal of 6¢ per kWh for the year 2020.

Figure 3: Declining Cost of Large-scale Solar PV Projects



Source: Energy.gov chart with data provided by National Renewable Energy Laboratory

In the first quarter of 2015, large-scale solar photovoltaic (PV) power plants cost less than half as much per installed watt as residential rooftop PV, and 29-percent less than solar power installed on commercial buildings.[xii] Because they are installed on the ground as opposed to thousands of rooftops, large-scale solar energy facilities necessarily require much more land area but they also provide utilities better cost-certainty when it comes to managing the levels of electricity fed into the grid.[xiii] California is now home to six out of ten large-scale solar energy facilities in operation (7,382) or under construction (2,073) in the United States[1]. Electricity produced in 2014 from California's large-scale solar energy facilities was more than three times the output of the next-highest state (Arizona) and more than all other states combined. In the first quarter of 2015 alone, California installed 718 MW of solar energy technologies, 55-percent of it from utility-scale solar.[xiv] Experts say that approximately five to six acres of land are required for each MW of installed solar arrays[xv], so the acreage totals of land lost to large-scale solar projects can climb quickly. To put this in context, the Solar Energy Industry Association (SEIA) estimates that based on 2013 average annual household electricity consumption and PV system performance, 1 MW of solar PV will meet the electrical needs of 250 California homes.[xvi]

Californians are overwhelmingly supportive of more solar power, so the pressure for larger solar projects is likely to remain. A July 2015 survey of 1,700 California residents found that 82-percent were supportive of increasing the state's Renewable Portfolio Standard (RPS) from 33-percent to 50-percent by 2030, and 88-percent of respondents favored building more solar power plants in the state.[xvii]

C. What is a Large/Utility-Scale Solar Energy Facility?

Even before agricultural land was used for these large-scale solar facilities the term "solar farm" was chosen to describe larger solar installations that generally were comprised of many acres of land. Solar proponents grabbed onto the concept of harvesting the sun and the term stuck, especially in Europe. However, due to the controversial nature of the term it is not used in this report, except when specifically identified in the local ordinances cited in this document. The authors understand and appreciate that the term "solar farm" is not embraced by all, especially some farm advocates that equate solar with an industrial use and see no actual crop harvested.

What distinguishes large-scale solar facilities from smaller residential rooftop arrays are that they:

(1) Deliver electricity directly into the existing utility transmission and distribution grid;
(2) Are subject to Federal (when provided to the wholesale market or on Federal land), California Energy Commission (solar thermal facilities over 50 MW), California Public Utilities Commission (for interties, reliability and rate structure issues), and local land use regulations; and
(3) Are designed and built, for the sale of electricity to a utility and/or large customer through a long-term Power Purchase Agreement (PPA). Ownership of the solar energy facility is held by the developer or may be owned solely by a utility. A PPA is a financial arrangement in which a third-party developer owns, operates, and maintains the solar photovoltaic (PV) system, and a host customer agrees to site the system on their property. This financial arrangement often allows the host customer to receive lower cost electricity while the solar services provider or

[1] Based on data provided by the Solar Energy Industries Association (August 11, 2015) which consists of publicly-available information only. This SEIA data is the most current and most comprehensive list available of domestic ground-mounted solar power plants 1 MW or larger that are completed or under construction.

another party acquires valuable financial benefits such as tax credits and income generated from the sale of electricity.

Many of the largest solar energy facilities in the southwestern United Sates are built with concentrated solar panel (CSP) technologies that track the sun and concentrate the heat onto receivers filled with liquid which is boiled to generate steam that powers turbines to generate electricity. The only large-scale solar energy facility in the San Joaquin Valley equipped with CSP technology is the 5 MW Kimberlina Solar Thermal Plant in Bakersfield completed in 2008.

More common in the San Joaquin Valley are solar photovoltaic (PV) technologies which have matured tremendously with improved overall efficiency. The Solar Energy Industries Association (SEIA) estimates that 89-percent of the large-scale generation facilities utilize the ground-mounted solar PV panels. Crystalline silicon cell panels dominate the PV market with single crystalline silicon (c-Si) and multi-crystalline (mc-Si) technologies. Thin film PV technology is one or more layers that are at least 10 times thinner than c-Si increasing the flexibility and making them weigh less. The thin film technology, layered within panes of glass is the most common in large-scale solar energy projects. Research into land use for utility-scale PV systems ranges from 3.5 to 10 acres per megawatt for a variety of technology and site-specific reasons but 5 to 6 acres per MW is considered the norm.

D. Solar Energy Facility Infrastructure Requirements

There are important infrastructure-related decisions to consider with every large-scale solar project. In 2010 the County of Santa Clara found that their existing land use policies and regulations did not address solar power generation as a land use separate from other major utility facilities. At the time, major utilities (power generation plants, substations, and refuse collection, transfer and disposal facilities) were allowed in most zoning districts with a Use Permit. Use Permit requirements do not apply to investor owned utilities (IOUs) which are under California Public Utilities Commission (CPUC) jurisdiction. Local governments are preempted from regulating electric facilities under CPUC jurisdiction. However, the County of Santa Clara wanted to exercise their discretionary land use authority and help decide where large-scale solar facilities are located. The County published a report [xviii] where it outlined the four main land use related resources needed to develop a solar electric generating facility. These resources (which apply to most governments) included:

1. **An appropriate site** (ideally with low land costs, mostly flat land, high solar radiation potential, not prime agricultural land, and with little to no habitat value),
2. **A power purchase contract** (profitability hinges on contract negotiations with power buyers),
3. **Entitlement permits** (land use policies and regulations are central to the development of solar power. Solar developers prefer clear regulations and expectations, and predictable fees), and
4. **Adequate transmission and distribution (T&D) infrastructure** (Profitability also hinges on limiting expenditures needed to connect to and upgrade the power infrastructure. Therefore, easy access to high voltage power lines is important for most projects).

While these resources are important, they are only one part of the equation in the San Joaquin Valley. To design effective ordinances and related policies, local governments in the San Joaquin Valley also need to be aware of the typical physical characteristics and equipment that accompanies large-scale solar projects. The protection of public health and safety falls upon local government officials, and local governments can regulate the location, scale and character of large-scale solar facilities based on these concerns alone. Other concerns, such as aesthetics, need to be considered when permitting large-scale solar projects. While every solar site is unique, most large-scale solar projects will include the following major components:

- Photovoltaic panels
- Footings and support structures
- Wiring
- Inverters
- Access Roads
- Electrical substations
- Transmission lines
- Perimeter fencing
- Administrative buildings

Source: National Renewable Energy Laboratory

Photovoltaic (PV) Panels

Siting considerations for solar panels tend to focus primarily on visual impacts. Regardless of their location, the large-scale, ground-mounted solar panels are considered by many to have an industrial character. The panels themselves may take many acres of land but will generate no noise, no light and no emissions. Depending upon the location and angle of the sun they can produce a minor glare or sheen that should be considered, especially as it impacts abutting landowners and roadway traffic. Panels generally include a least one anti-reflective layer to maximize absorption and minimize glare.[xix] For example, the municipal code in Lincolnshire, Illinois requires that solar systems "Shall be designed and installed to prohibit sun reflection toward vehicular traffic and any habitable portion of an adjacent structure."[xx] The panels are usually washed at least once per year just prior to the summer to maximize the efficiency of the panels during peak production months. Washing panels can be expensive. A recent study involving a 20-megawatt solar energy facility in California's Central Valley estimated the annual cost of washing the solar panels at $60,000.00.[xxi] Sites near dusty farmlands or other areas with larger particles blowing (as in the San Joaquin Valley) have a greater impact and thus greater need for cleaning.

Footings and Support Structures

Footings are used to anchor the solar panels to the ground. If the land used for the solar facility is to be used for agriculture in the future permanent footings should be avoided generally. Contaminated land also should not be penetrated by footings. In some cases, ballast systems are used to minimize the disturbance of the soil. The solar panels are anchored by, and tied into, the ballast system. Ballast systems consist of large boxes filled with rocks or precast concrete that can be emptied and moved easily without harming the soil. Acid-producing deposits, depth to bedrock and high water tables need to be considered when approving footings.

Wiring

Solar panels generate electricity that feeds into the grid, so wiring is a major component. Wiring is usually buried in underground trenches or run in conduits on the surface. If the soil is contaminated or used for agricultural purposes it often makes sense to minimize digging and avoid disturbing the soil through underground trenches. Pre-construction technical reports need to address wire-related issues such as depth of water table, soil types and depth of bedrock.

Inverters

Inverters are a part of every solar system and are needed to convert the DC output from the panels to usable AC current by the electricity distribution system. Inverters can be contained in large boxes or integrated into the system, depending upon their size. They are heavy and require footings like the panels themselves. As such, they are considered impervious cover. They require routine access and are cooled by fans, which tend to run most while power is produced and they operate less after sunset.[xxii] Ordinances can specify acceptable noise levels and require inverters to be set back from property lines to avoid disturbing neighboring properties.

Access Roads

Access roads are sometimes overlooked with solar energy projects. They may be paved, grassed or covered with crushed road bed material. All access roads are generally considered impervious, and as such impact storm water runoff patterns. Generally, access roads should be limited in width and length since most are impervious surfaces.

Electrical Substations

Each large-scale solar energy facility will need to be safely connected to the electricity grid. Connecting this new solar power to the distribution system may require the construction of substations, electrical lines and the clearing of right-of-ways to accommodate the new electricity source. Connecting to transmission lines is usually governed by federal, state and regional power entities which require feasibility studies, impact studies and detailed cost analysis. The solar developer has this information since the project investment is contingent upon making money through the sale of electricity. Local governments need access to these studies to help calculate what it may take to mitigate the construction of new solar energy facilities. Therefore, requiring access to these studies as a condition of approval can be useful.

Transmission Line Connectivity

All large-scale solar facility applicants should be required to provide an explanation of all existing transmission lines impacted by the solar energy facility and any new lines required for the project, and the status of any applications to regulatory authorities regarding these lines. A map or document describing the route, capacity descriptions, conductor configurations, pole design and right-of-way width needs to be required by local governments at a minimum.[xxiii]

Perimeter Fencing

Perimeter fencing can be a major aesthetic issue for neighboring property owners. For security reasons (chiefly vandalism), perimeter fencing is often 7 to 10 feet high, often with barbed wire on the top. This style of fence in a rural area may not be the most pleasing aesthetically to people. Appropriate types of fences should be specified for varying locations, based on the needs of the local government. Applicants should also be required to address displacement and movement of wildlife due to any perimeter fencing.[xxiv] Before construction began on its California Valley Solar Ranch on the semi-arid Carrizo Plain, sometimes referred to as California's Serengeti, San Jose, California-based Sunpower, biologists hired by San Luis Obispo County officials and a trio of national environmental organizations negotiated a rigorous set of environmental safeguards for the project. This collaborative created new dens for the San Joaquin kit fox, temporary "condos" for giant kangaroo rats, and wildlife corridors allowing pronghorn and Tule elk to pass easily through the solar fields.[xxv] This type of wildlife and habitat mitigation is likely to typify future large-scale solar projects in California.

Administrative Buildings

Many large-scale solar energy facilities have administrative buildings on the land which are often used for supplies and administrative work. Most buildings tend to be prefabricated and small (10' x 20') and some may require footings depending upon their size. The size allowed and aesthetics of these buildings should be addressed within project applications, and local governments may want to require specific building types (including colors allowed) as part of the application.

E. Competing Perspectives on the Large Scale Solar Issue—Pros and Cons

A host of energy, environmental, economic development, and community culture issues have been triggered by the growth of large-scale solar energy projects. Consideration of some of the salient issues together demonstrates how complex public decisions regarding solar energy facilities on agricultural land can be in 2015. The following arguments for and against large-scale solar energy projects were selected chiefly from public hearings in California and are provided to give the reader a feel for the technical and emotional issues involved with the issue.

Proponents of large-scale solar on agricultural lands point out that:

- They are necessary to help meet the state mandated Renewable Portfolio Standard (RPS);
- Total megawatts installed can be achieved faster and more cost-effectively with large-scale solar projects than with numerous distributed generation and "behind the meter" onsite (rooftop) installations;
- Transmission lines are readily available near prime agricultural lands;
- Long-term air quality goals are met sooner through renewable-generated electricity;

- Controlling the flow of electricity onto to the expansive utility grid is better-managed with large-scale solar energy facilities, and other distributed generation resources, compared to thousands of individually-owned rooftops generating a comparable amount of power across the grid;
- Agricultural land can be more easily converted to host an solar energy facility than constructing a facility on land where endangered species are found, such as the Mojave Desert;
- Large-scale solar energy facilities can be very compatible with existing land uses such as ranching (raised solar panels provide can shade and protection from adverse weather for livestock, and these facilities tend to be much quieter than other electricity sources);
- Strong planning tools are already in place to protect prime agricultural land;
- The California Department of Conservation encourages counties who meet the criteria for converting prime agricultural land to solar to utilize its Solar Use Easements mechanism.
- Projects create short- and long-term jobs for local communities;
- Projects represent time-limited, reversible land use and provide an increased, diversified and stable source of income for landowners;
- They have lower visual and environmental impacts than other forms of power;
- Land owners may be charged an annual assessment/impact fee (per acre or per panel) as part of a county Conditional Use Permit.

Source: National Renewable Energy Laboratory

Critics of large-scale solar on agricultural lands point out:

- Prime agricultural land is too valuable over the long-term, and large-scale solar facilities should only be allowed on lands with more marginal quality;
- If prime agricultural land is converted to solar it can result in more water and fertilizer on marginal lands or impacted soil in order to make growing and selling crops profitable;
- Access to fresh, locally grown food is jeopardized by shifting from agricultural to energy production;
- A "sense of place" is lost for the community as farmland is replaced by unsightly equipment and infrastructure;
- Storm water and runoff patterns are impacted with large-scale solar energy facilities and need to be better evaluated;

- Comprehensive Plans are undermined by allowing solar energy facilities to proliferate without a new, revised General Plan;
- Species habitat on the ground and in the air is destroyed and there is no long-term research available yet with respect to solar energy facilities;
- Local governments are setting aside state laws (such as the Williamson Act) that are meant to protect prime soils in a rush to lure development;
- Large-scale solar energy facilities will result in more dust being blown into the air and will consume precious water for cleaning the solar panels to maintain efficiency;
- Since the power is exported to the grid, the local community does not receive any direct benefit of the clean energy being produced;
- Projects don't generate enough employment or economic development for the local municipality; and
- There is a history of project developers going bankrupt, and decommissioning plans for large-scale solar may fall upon the local government if the developer cannot return the property to its original state.

III. Major Economic Issues Impacting the San Joaquin Valley and Large-Scale Solar Energy Facilities

A. Population Growth

The San Joaquin Valley is home to a culturally diverse population of close to 4 million people, with more than 70 different ethnicities and 105 spoken languages. California's population is projected to grow at a rate of 350,000 people annually between now and 2025. Growth rates in the San Joaquin Valley and other inland regions will be higher than the population centers along the coast and by 2050 the region's population will grow by almost 70-percent, more than twice as much as the entire state (See **Table 1**). With these growth projections comes an obvious increased demand on public infrastructure and services.

Table 1: San Joaquin Valley and State of California Population Projections.

County	Population 2010	Projected 2050	Increase 2010-2050	% change 2010-2050
Stanislaus	515,459	783,005	267,546	52%
Kings	154,276	240,599	86,323	56%
Fresno	932,969	1,464,413	531,444	60%
Tulare	443,487	715,722	272,235	61%
San Joaquin	687,095	1,171,439	484,344	71%
Merced	256,800	439,075	182,275	71%
Madera	151,466	272,384	120,918	80%
Kern	846,568	1,604,371	757,803	90%
San Joaquin Valley	3,988,120	6,691,008	2,702,888	68%

California	37,341,978	49,779,362	12,437,384	33%

Source: California Department of Finance, State and County Population Projections, Report P-1 (Total Population) July 1, 2010 - 2060. December 15, 2014.

B. Urban Sprawl

Urban sprawl is one of the greatest long-term issues facing local communities, land preservationists, environmentalists, planners, and decision makers in the region. The state of California lost more than 200,000 acres of irrigated farmland to development between 2006 and 2008 during the housing boom and 1.3 million acres since 1984.[xxvi] Population growth in the region will also be influenced by the completion of the California high-speed rail system by 2029, drawing more and more people from the cities in search of more land and a rural lifestyle, while still being able to travel to and from work. Of particular concern is how individual jurisdictions would be able to effectively balance priorities for economic development, transportation, and quality of life. One 2014 report found that nearly 25-percent of urban and built-up land use has occurred since 1984, one sixth of all the land developed since the Gold Rush[xxvii]. It has been estimated that since 1990, more than a half-million acres of California farmland have been paved over and the shifting of land use from agriculture to urban uses continues to grow at 30,000 acres per year.[xxviii] The American Farmland Trust reports that one acre of farmland is developed for every 6.4 new residents of the San Joaquin Valley and projects that urban sprawl will result in up to 500,000 additional acres of farmland being will be lost 2050 and have an estimated $100 to $190 million impact to the local economy[xxix].

Largely to address urban sprawl, individual Councils of Governments (COGs) in the SJV developed a regional approach to managing growth. The San Joaquin Valley Blueprint is the result of a four-year regional effort completed in 2009 and provides a vision for urban growth in the eight counties for the next 50 years. The Blueprint established 12 Smart Growth principles for local jurisdictions, some of which also address large-scale solar facilities, including: encouraging community and stakeholder collaboration; distinctive, fostering attractive communities with a strong sense of place; making development decisions predictable, fair and cost effective; providing a mix of land uses; and preservation of open space, farmland, natural beauty and critical environmental areas.[xxx]

To complement implementation of the Blueprint, the San Joaquin Valley Greenprint was launched in 2011 to focus on the land use planning challenges and opportunities in the region's vast rural areas by identifying gaps in information and data. The University of California-Davis manages these resources and has compiled a host of data and findings on water, agriculture, biodiversity and energy. Current projects are centered on developing a region-wide vision for resource conservation and management.

American Farmland Trust, the leading proponent of agricultural land conservation, has also advocated its guidelines for minimizing the conversion of agricultural land to urban uses, including (1) identifying percentage prime, unique, and other "high quality farmland" that would be converted in General Plan; (2) increasing urban population densities for more efficient land use; (3) ensuring development stays within municipal zones of influence; (4) minimizing rural residential development; (5) promoting conservation easements by landowners; and (6) facilitating the favorable development of the agricultural industry.[xxxi]

C. Air Quality

San Joaquin Valley residents have experienced some of the worst air pollution in the country for decades. Given its unique geography -- 250 miles long and bordered by mountains -- the region endures poor air quality year-round. According to the American Lung Association's 2015 State of the Air report, the region's largest cities top the most polluted list:

Table 2: California Cities with the Most Air Pollution

Rank	By Ozone	By Year Round Particle Pollution	By Short-Term Particle Pollution
#1	Los Angeles-Long Beach	Fresno-Madera	Fresno-Madera
#2	Visalia-Porterville-Hanford	Bakersfield	Bakersfield
#3	Bakersfield	Visalia-Porterville-Hanford	Visalia-Porterville-Hanford
#4	Fresno-Madera	Modesto-Merced	Modesto-Merced
#5	Sacramento-Roseville	Los Angeles-Long Beach	Los Angeles-Long Beach

Source: "State of the Air 2015", American Lung Association

A 2006 study by the University of California Davis found that nearly one-third of the four million residents of the San Joaquin Valley face higher degrees of air and water pollutants than elsewhere in the state. Health-related impacts of air pollution alone are estimated to total $3 billion annually, averaging $1,000 per person.[xxxii]

While the region's air quality has been ranked as one of the worst in the nation for many years, significant improvements have been made. Since 1992, the San Joaquin Valley Air Pollution Control District has developed and implemented numerous attainment plans, adopted more than 500 of the most stringent rules in the nation and promoted the use of alternative energy resources[xxxiii] to obtain the significant emission reductions needed to demonstrate attainment. The region has been in attainment for Carbon Monoxide (CO) since 1994, reached attainment for the federal PM-10 standard in 2008 and is near attainment for Ozone and PM2.5.[xxxiv]

D. The Drought

Agriculture accounts for a substantial portion of the state's water use. Extensive and prolonged agricultural production losses from the drought threatens the strength and vitality the local economies. As shown in **Table 3** below, agricultural production in the San Joaquin Valley comprises the majority of the state total.

Table 3: Value of San Joaquin Valley Agriculture Production

2012 County Ranking by Gross Value of Agricultural Production (not including Timber) in $1,000

Fresno (1)	$6,586,523
Kern (2)	$6,211,987
Tulare (3)	$6,210,479
Merced (5)	$3,259,866
Stanislaus (6)	$3,069,823
San Joaquin (7)	$2,237,024
Kings (8)	$2,220,640
Madera (12)	$1,739,186
San Joaquin Valley	$31,535,528
California	$55,392,479

Source: Agricultural Statistics Review, 2013-2014, California Department of Food and Agriculture, 2014.

Therefore, any discussion of energy technologies within the San Joaquin Valley must take into account the water related requirements. Areas with the greatest potential for solar energy project deployments also tend to have the driest climates so water availability is vital. Solar PV systems do not require much water beyond what is needed is need for maintenance, namely, washing the panels to maintain efficiency. Therefore, there is a significant reduction in water use when land is converted from agriculture to a large scale solar system. The concentrated solar panel (CSP) systems, on the other hand, require large amounts of water and face a host of supply and acquisition barriers because of their remote locations often require a deep ground water resource. Currently operating CSP plants use an estimated 620 acre-feet of water (more than 200 million gallons) each year. The federal Bureau of Land Management estimates that by 2030 water demand for CSP and PV projects in the Southwest could total over 221,000 acre-feet and almost 18,000 acre-feet of water per year, respectively. [xxxv]

E. High Speed Rail

By 2029 high speed rail will connect San Francisco and Los Angeles by traversing through the San Joaquin Valley. Upon completion, it will stretch from Sacramento to San Diego and consist of 800-miles of railway with up to 24 stations. The project is anticipated to result in substantial reductions in greenhouse gases from vehicle transportation and economic benefits in the SJV. Despite these economic and environmental benefits, San Joaquin Valley communities are also faced with the prospect of losing more farmland to the project.

It is estimated that the system will require an electrical load of approximately 20 MW and will be supplied by power sources spaced approximately 30-miles apart to maintain reliability[xxxvi]. There is a net zero energy commitment that energy used by the rail system will be met by providing an equal amount of energy fed into the grid through the purchase of renewables generated electricity and the use of renewable energy on-site when it is feasible to do so. Planners acknowledged recently that there are neither adequate financial and spatial resources, nor infrastructure available to power the train directly with 100-percentrenewable energy.[xxxvii]

IV. Large-Scale Solar Energy Facilities in the San Joaquin Valley

A. The Status of Large-Scale Solar Energy Facilities in the San Joaquin Valley

In addition to the comprehensive eight-county map (see **Figure 1**) we also provide in **Appendix A** individual San Joaquin Valley County maps that make locating individual large-scale solar projects easier for the reader, a corresponding list that identifies their generating capacity and total acreage, and a map of electrical transmission lines in the San Joaquin Valley. The list of solar energy facilities is the most comprehensive and up-to-date accounting of large-scale solar facility projects in the San Joaquin Valley to date.

A number of conclusions can be drawn by reviewing the maps and this new research, including:

1. The extensive solar energy facility construction that has taken place to date has occurred near, but not necessarily on, the San Joaquin Valley's most fertile soil. This should provide a sigh of relief to conservationists and others concerned that this activity was taking place on this valued soil and we believe that it is a demonstration of the commitment of San Joaquin Valley communities to preserve their agricultural resources.
2. As pressure increases to develop more large-scale solar projects in the San Joaquin Valley to meet the likely increase in the State's Renewable Portfolio Standard (RPS), the locations likely to be considered will be increasingly close to the Valley's most fertile soils. Therefore, energy policies involving agricultural lands are likely to become more important.
3. The average size of a large-scale solar energy facility in the San Joaquin Valley is 508 acres and 67 MW. This is neither unusually large nor small when compared to other projects in California, or for that matter, across the country.
4. Given that 1 MW of capacity provides power for 250 homes[xxxviii], the average solar energy facility in the San Joaquin Valley generates enough electricity for 16,750 homes (67 MW x 250 homes). With 8,264 MW of installed or planned capacity the 120 large-scale solar facilities provide enough electricity to power more than 2 million homes.
5. Within the San Joaquin Valley, Kern County seems to be constructing large-scale solar facilities noticeably distant from their prime agricultural soil, perhaps showing other Valley governments effective criteria to use when siting these power plants.
6. Most large-scale solar energy project construction has occurred near major electricity transmission lines, which is to be expected.
7. The largest solar energy projects (greater than 250 acres) tend to be located in Kern and Fresno counties; 19 of 41 solar facilities in Kern County and 15 of 42 facilities in Fresno County are above 250 acres.
8. There is minimal large-scale solar energy project development in the northern portion of the Valley (San Joaquin, Stanislaus, Merced and Madera Counties), and extensive solar activity in the southern portion of the Valley (Fresno, Tulare, Kings and Kern Counties). This can be partially explained by the geographic sizes of the smaller northern counties. We speculate that since major transmission lines run through each of these counties that the planning environment has also contributed to the large volume of solar projects underway in the four southernmost

counties. Solar isolation potential is roughly the same for all eight counties, so we expect it plays a relatively minor role in this phenomenon.

9. While it is the largest in size of the eight San Joaquin Counties, Kern County's population is projected to grow 90-percentover the next 35 years which will create a host of challenges and opportunities for it to balance energy resource development with population growth.
10. With the population of each County in the San Joaquin Valley growing by at least 50-percent over the next 35 years, long-term planning that balances population growth, economic development, and increasing demand for solar and agricultural resources will continue to require smart planning by local leaders.

B. Relevant Legislation, Policies and Regulations Impacting Large-Scale Solar

There are numerous local, state and federal policies and regulations that come into play when permitting large-scale solar projects. A short summary of each is provided below. Please see **Appendix B** for a more detailed description of each.

The Renewable Portfolio Standard (RPS)

California's Renewable Portfolio Standard (RPS) is the primary driver behind large-scale solar energy project development. Adopted in 2002 and amended in 2006, 2011, and 2015 the state's RPS requires that investor owned utilities (IOUs), electric service providers, and community choice aggregators (CCA) increasingly add renewable energy resources to their electricity generation mix. By 2020, at least 33-percent of their electricity is to be generated from a wide variety of resources including solar, wind, geothermal, hydro, biomass, and municipal solid waste among others. Legislation signed on October 7, 2015 raises the RPS mandate to 50-percent by 2030, the regulations for which are now being developed by the California Public Utilities Commission.

The Williamson Act and Farmland Security Zones

Source: National Renewable Energy Laboratory

The California Land Conservation Act of 1965, commonly known as the Williamson Act, was designed to protect farmers from the economic pressures of encroaching development. It reduced property taxes on agricultural lands to dissuade landowners from converting their productive land to other uses. If a solar energy facility is to be developed it must be out of the Williamson Act agreement. Under the Williamson Act, a private landowner enters into a 10-year contract with the local city or county jurisdiction guaranteeing that the land -- which must be in areas designated by that jurisdiction -- will remain for agricultural uses or open space. In return, the land will be taxed based on the income it could generate from agriculture and other compatible uses instead of its market value. The Williamson Act is a permissive program that established a three-way partnership between the

California Department of Conservation, the participating local government, and landowners. Each partner receives the benefits of agricultural land conservation and the certainty provided by agricultural preserve zoning in return for a modest monetary sacrifice. Landowners give up their development rights and some speculative value in the property; local governments give up a portion of their property tax base; and the state, for its part, provides open-space subventions to participating counties to replace foregone property tax revenue.[xxxix] However, the state has not reimbursed local governments for their loss of property taxes since 2009. This lack of funding has caused turmoil in the Williamson Act program in California. For example, as a result of this development Imperial County “non-renewed” every parcel in their program in 2010 effectively phasing out the Williamson Act Program in that county in eight years.

The California Environmental Quality Act (CEQA)

To be certain, the RPS mandate is a state issue with major consequences for local land use. Local governments are well familiar with complying with the California Environmental Quality Act (CEQA), which protects biological resources, plant life, water, air, noise, traffic, visual and other areas. A formal policy or ordinance covering large-scale solar projects can help local governments meet CEQA goals while also helping meet the state RPS mandate. CEQA regulations come into play with virtually all large-scale solar projects and will continue to be a major factor when evaluating these projects. Pre-planning areas using a solar overlay strategy, for example, for large scale solar and addressing CEQA needs at a programmatic level is thought to be a wise General Plan land use strategy for a County.

Cap-and-Trade

California’s Cap-and-Trade legislation routes funds for agricultural land conservation. The California Air Resources Board’s Fiscal Year 2014-15 budget contained a portion of revenues from the Cap-and-Trade monies for making strategic investments that protect agricultural lands to reduce greenhouse gases emissions.[xl] With the help of these funds California recently took action to protect some of the state’s most threatened agricultural lands by investing in conservation easements and better land use planning. These tools have been used for many years by land trusts and local governments to permanently protect farmland from development.

Climate Change Policies

As mentioned earlier, greenhouse gas (GHG) emission policies in the state are major issues. UC-Davis researchers recently found that one acre of urban land emitted 70-times more greenhouse emissions compared to an acre of irrigated cropland. That number climbs to 100-times more emissions when comparing urban land to rangeland. Sustainable farm management practices can further remove carbon from the atmosphere, thus enhancing the benefits of agricultural land conservation. Despite these benefits, California continues to lose farmland at alarming rates. Between 1984 and 2010 the state lost an average of over 50,000 acres of agricultural land annually.[xli]

Desert Renewable Energy Conservation Plan (DRECP)

The Desert Renewable Energy Conservation Plan (DRECP) was initiated in 2008 due to the anticipated large increase in renewable energy technologies being installed on biologically-sensitive lands in southeastern California to help meet the RPS. The overall purpose of the DRECP is to expedite the siting and construction of these technologies and infrastructure through streamlined environmental review and permitting while conserving and managing plant and wildlife communities. The area covered under the DRECP includes 22.6 million acres of public (10 million of which is managed by the BLM) and private lands across Imperial, Inyo, Los Angeles, Riverside, San Bernardino, San Diego and Kern Counties.

The BLM released the Final Environmental Impact Statement for Phase 1 of the DRECP in November 2015[xlii] which proposes development on 388,000 acres of public land primarily in Riverside and Imperial Counties along with several areas in Kern County. Phase 2 of the DRECP is ongoing and includes critical work with local governments, local planners and the various local renewable energy development and conservation plans.

Community Solar

California joined a growing number of states in January 2015 that are implementing a new model for customer access to solar generated electricity called Community Solar. For utilities, a Community Solar program allows them to offer another electrical supply option for its consumers and helps them to meet their individual state RPS requirements. Estimates are that as much as 75-percent of residential and 70-percent of commercial ratepayers nationwide are not able to benefit from installing rooftop solar PV systems on their buildings because of the poor solar orientation, little to no space to install PV panels, financial restrictions, or simply because they don't own the property in which they live or work.[xliii]. Community Solar programs allow consumers like these to purchase allocated shares of solar generated electricity from arrays located nearby.

Community Choice Aggregation[xliv]

Communities across California are innovators in implementing programs to address the impacts of climate change and to enhance their local economies. One approach being considered by many jurisdictions is the establishment of a Community Choice Aggregation (CCA) arrangement whereby local governments choose to aggregate their residential, commercial, and electricity customers and themselves and, as their representative, purchase and develop power as well as administer energy programs. When a CCA is in place, the existing electric utility continues to deliver power to the consumers regardless of its source, maintain the grid, and provide consolidated billing and other customer services. Therefore, a CCA can purchase electricity on the wholesale market at a rate lower than the current utility rate, purchase

Source: National Renewable Energy Laboratory

electricity generated from renewable resources, and/or generate build their own large-scale solar energy facility. Once formed, customers within the CCA service area are automatically enrolled, but may opt out of the CCA and continue to receive bundled electricity service from the local electric utility as before.

California and five other states have authorized the establishment of local CCAs. The first CCA program to operate in California, Marin Clean Energy, was formed in Marin County and began serving customers in May 2010. Most recently, Sonoma County launched Sonoma Clean Power in 2014 and the City of Lancaster, through Lancaster Choice Energy, began offering service to select customers in May 2015, with broad public enrollment in late 2015.

V. Solar Energy Project Related Planning Tools and Options

A. Guiding Principles

Integrating large-scale solar into existing land use frameworks without compromising other planning objectives that relate to agricultural resources presents challenges and requires specific guidance for developers. Along with the land use planning guidelines detailed in the San Joaquin Valley Blueprint, overall planning objectives that can help guide large-scale solar development in a community include:

- Encouraging solar siting on existing rooftops, impervious surfaces, brownfields, and other previously disturbed or marginalized land;
- Exploring the feasibility of developing large-scale solar facilities along aqueducts and canals;
- Encouraging development of solar facilities on municipal land such as landfills and waste water treatment plants; and
- Identifying key locations to avoid, even prohibit, large-scale solar installations including:
  - Open space, parks and preserved lands;
  - Environmentally critical areas;
  - Affordable housing areas;
  - Wildlife habitats;
  - Stream corridors, wetlands, and other riparian lands;
  - Historic districts;
  - Scenic vistas (and if permitted for these areas, establishing conditions to mitigate impacts); and
  - Prime farmland designated by the U.S. Department of Agriculture or Natural Resources Conservation Service or the California Department of Conservation's Farmland Mapping and Monitoring Program.

B. General Plans

General Plans (also known as Comprehensive Plans in some other parts of the country) present a vision of the physical and economic characteristics of a city or county while specifying goals and policies to achieve that vision. State law requires that every local jurisdiction assemble one in California, and update it regularly. As such, General Plans are one of the best tools to support the development of large-scale solar. The American Planning Association[xlv] maintains that two primary ways that General Plans can help with the large-scale solar issue are to document local solar resources and articulate the solar policies that can guide decision-making.

Local governments can assemble a solar resource map that shows specific areas within the jurisdiction which receive the most amount of annual sunlight. It is increasingly common for jurisdictions to use software to digitize residential and commercial rooftops in neighborhoods to help quantify solar potential. It is far less common to quantify the potential for large-scale solar on raw land. Local governments can identify marginal agricultural, blighted areas and brownfields, digitize their solar potential and include these as potential energy resources in General Plan updates. General Plans should be closely linked to a separate Energy Element if one exists. For example, Pleasanton, California's General Plan for 2005-2025 references solar within their Energy Element, so the documents are effectively linked.[xlvi]

C. Local Ordinance Options

A review of how local jurisdictions in the San Joaquin Valley and elsewhere are addressing solar energy facilities on agricultural land reflects a number of commonalities. Many local jurisdictions effectively address small scale solar energy projects – typically rooftop or near buildings – for the primary use of consuming generated electricity on site. Some communities permit accessory solar energy systems by right in all districts, while others will have special permitting processes that take into account design and impacts to adjacent properties. California recently passed legislation (AB 2188) requiring all local governments to adopt an ordinance by September 30, 2015 that streamlines the permitting process for small residential rooftop solar (PV panels and solar hot water) installations. Dual purpose solar facilities generally allow *both* on-site electricity use, and for excess electricity to be credited (or effectively sold) back to the utility grid. A large, utility-scale solar energy facility, on the other hand, reflecting the primary focus of this white paper, is a solar facility which generates electricity exclusively for sale to off-site users.

Source: National Renewable Energy Laboratory

Some San Joaquin Valley jurisdictions address these large-scale solar projects in their zoning regulations, and some more comprehensively than other. A central tenet of every zoning ordinance we found in our research is that large-scale solar energy facilities on agricultural lands are allowed as a conditional use over a period of time, and thereby stipulate the conditions that must be met by the developer and/or owner during that time. Discussed in greater detail below, these stipulations usually address land conservation and preservation first and foremost, and also address requirements from maintaining a certain level of aesthetic quality to preserving conditions for wildlife that live there or migrate through that area. Therefore, where solar energy facilities are allowed in specified agricultural, industrial, and/or open space zoning districts they come with a variety of specific standards and requirements for approval, construction, operation, and decommissioning.

One of the key issues for local governments with large-scale solar projects has been the evaluation of projects based on the quality of agricultural land at risk. Generally speaking, local planners are directing developers to use low-grade, inferior land first and prioritizing prime agricultural land last. If prime land is used, additional mitigation and decommissioning steps are often required. Likewise, it is typical for a jurisdiction to require that no system is allowed on land subject to the Williamson Act unless it is permitted as a compatible use or converted to a Solar Use Easement if the criteria met. Kings County has an excellent ordinance in place[xlvii] which follows this logic and requires that large-scale solar development will occur only on agricultural land designated as “Very Low Priority,” “Low Priority,” or “Low-Medium Priority” in the General Plan, and also requires stricter mitigation requirements for higher quality land.

Allowing for ongoing beneficial uses of the land at the end of a conditional use permit period is typically important when high value agricultural land is used for large-scale solar energy facilities. The need for decommissioning large-scale solar energy facilities after they are no longer in operation is of particular importance in a region like the San Joaquin Valley which has a strong reliance on its land for economic growth. While most jurisdictions require decommissioning at the end of the conditional use permit period (which usually runs for 20 or more years), some jurisdictions more closely monitor the issue and require decommissioning sooner if the project ceases operation early. For example, Erie, Pennsylvania requires that the site be returned to its original use immediately if the facility is out of operation for at least six months.

Additional large-scale solar ordinance requirements representative of other jurisdictions across the country include:

- Ground cover(s) such as native, shade-tolerant vegetation under and around solar panels to mitigate dust and soil erosion;
- “Screening” such as a variety of styles and colors of fences, trees, or other vegetation to restrict access, minimize glare, and/or limit soil erosion from the wind;
- Specify minimum setbacks and buffers from adjacent farming operations or other land uses;
- Require that solar energy facility infrastructure is consistent with surrounding land uses;
- Require acknowledgment of local “Right to Farm” ordinances;
- Require approval of plans that detail how the site will be managed during the development (grading and storm water management), construction (noise, roads, location of all wiring underground), operation (glare, lighting, cleaning chemicals and water use), removal (when required and time frame in addition to other requirements presented here) and restoration of the land (vegetation, water supply, soil management) once the conditional use permit expires with particular attention to the preservation of soils;
- Demonstration of financial assurances to mitigate concerns over bankruptcy (and subsequent abandoned projects), a signed power purchase agreement for the sale of

electricity generated at the site, and compliance/approval with all relevant regulatory requirements such as interties to the grid;

- Require geotechnical reports related to soil, water and bedrock and the design and construction of foundation systems to address a facility's unique conditions; and
- Define Community Solar projects and identify related planning and permitting requirements as they can be as large as 20 MW under California's new program.

Appendix C includes additional examples of large-scale solar local government ordinances.

It is instructive here to review how one jurisdiction, Clarke County, Virginia handles multiple issues through one ordinance. A zoning ordinance there requires large photovoltaic solar energy facilities to be located within one-mile of a pre-existing electrical substation of 138 kV or higher voltage, be on at least 20-acre lots, and address public safety, noise, landscaping, and electrical interconnection issues. Applications for a special use permit stipulate 12 additional requirements: project description and rationale; economic analysis; simulations of visual impacts, appearance, and scenic views impacts; wildlife habitat areas and migration patterns; environmental analysis (historic, cultural, archeological resources, soil erosion, flora, water quality and water supply, dust from project activities and cumulative impacts of other adjacent power plant); solid and hazardous waste generation and disposal at the site; lighting impacts; a transportation plan during construction and operation; public safety; noise levels; impacts to telecommunications (including electromagnetic fields from the plant); and a description of decommissioning and final land reclamation.

Since most governments have *not* passed comprehensive zoning ordinances that specifically condition or limit large-scale solar projects, variance requests are quite common. With variances, each case is typically heard individually so that decisions made by zoning authorities do not set precedent for future cases. The American Planning Association cites a few disadvantages of using the variance process to consider large-scale solar applications:[xlviii]

- Projects may be proposed in any zone, resulting in a potentially chaotic mixture of solar projects and other uses;
- The projects may clash with other municipal planning objectives, particularly agricultural preservation; and
- (Local boards)…have less experience evaluating comprehensive impacts of such large-scale applications, because site plans usually go to the planning board.

Source: National Renewable Energy Laboratory

These disadvantages are especially applicable in the San Joaquin Valley, and frankly, are part of the reason the authors call for advance planning and more thoughtful analysis of large-scale solar projects in the area.

To this point we have looked at how local jurisdictions have been managing the deployment of large-scale solar energy facilities and their infrastructure. It is worthwhile noting that some jurisdictions are promoting these projects to access the economic development opportunities as they also balance land preservation and traditional community industries such as agriculture and farming. One regulatory tool that can help accomplish these goals is a Renewable Energy Overlay Zone which is frequently used to expedite the planning and approval process. Implemented by amending the existing zoning code (and possibly the General Plan), an overlay zone provides a supplemental layer of regulations "over" the existing base zone (such as agriculture) and identifies additional regulations or benefits available to developers for the purposes of renewable energy development. The overlay district can share common boundaries with the base zone or cut across base zone boundaries.

Renewable Energy Overlay Zones are common in other states (for example, Washington and Arizona), saving significant time and expense, and adding certainty to the permitting process for both developers and government. Advocates for renewable energy overlay zones also include wildlife organizations which call for "smart from the start" renewable energy development.[xlix] To be certain, Renewable Energy Overlay Zones can help speed-up the permitting process by saving time for both developers and County staff. However, developers will still need assurance that their submittals meet the requirements of underlying zones. Without this feedback, Renewable Energy Overlay Zones can have the opposite effect on developers by creating more administrative requirements.

It is not uncommon for jurisdictions to outright prohibit the development of agricultural lands for large-scale solar energy project development. In addition to many that exclude any lands that are subject to the Williamson Act, a number of municipal zoning ordinances prohibit solar energy facilities on agricultural land, highly-valued agricultural lands, historic districts, wetlands, scenic view sheds, or other environmentally sensitive areas. Santa Clara County prohibits commercial solar farms on land zoned for large-scale agricultural uses as well as two designated view sheds. While Pima County, Arizona allows for large-scale solar farms in industrial areas, they simply are not allowed in agriculturally-zoned districts. Please see **Appendix C** for additional information about these and other examples of local government ordinances.

VI. Conclusions and Recommendations

Fortunately, dozens of California local governments, U.S. cities and European communities already have valuable experience with large, utility-scale solar energy projects. The authors gathered information for this white paper from people involved in many of these projects. During the research for this white paper a number of existing strategies and approaches rose to the surface which can help other local governments negotiate future solar energy project development, especially on or near agricultural lands.

1) Add Large-Scale Solar Language to Existing General Plans and Other Planning Documents

After reviewing solar activity across more than one-hundred local governments it is very clear that handling requests for large-scale solar projects individually through variances or ad-hoc planning meetings can be economically wasteful for both government and the solar developer. This independent, stove-piped approach also risks going astray of codified values contained in multiple other environmental and energy-related plans, which can expose jurisdictions to unnecessary and expensive legal battles.

One solution to this risk is to adopt large-scale solar policies and general principles as part of General Plan updates or adding a new Energy Element. When this new language is in place in General Plans, Sustainability Plans, Land Management Plans and other government planning documents these principles can help guide farmland-friendly solar development while also meeting CEQA requirements. We present 10 potential guiding principles below:

1) Develop formal criteria for the most suitable agricultural lands for future renewable energy development. Potential criteria include previously disturbed land, land with poor agricultural and biological value, and marginal land with excellent access to electricity transmission lines.
2) Focus on non-agricultural land first, or land which is less valuable and of a lower agricultural quality (for example, salt- and selenium-laden soils that will probably never be farmed again and are classified by the U.S. government as "retired" are good candidates).
3) Pay special attention to environmental justice communities and the impacts of proposed solar energy facilities, such as industrial-like aesthetics, on them.
4) Engage the public early in the planning process and incorporate their input as appropriate. This potentially charged issue requires that a wide net be thrown early to involve as much of the public as is feasible. For example, do not underestimate public opposition to visual impacts.
5) Structure all agreements with developers with decommissioning in mind and the goal of returning the land to its former use (minimal disruption of the soil over time is an important concept to remember).
6) Pay special attention to biodiversity and promoting diversification of land supply within each jurisdiction.
7) Carefully consider endangered species and mitigation measures for flora and fauna from the beginning of each project proposal.
8) To the extent possible identify local solar resources, prime agricultural land, blighted and less desirable land, and all existing transmission lines and map these for better decision making.
9) Ensure adequate government oversight during construction, operation and decommissioning of all solar energy facility properties.
10) Quantify the water use requirements, and consider likely groundwater runoff patterns of all proposed large-scale solar energy projects.

By following these principles, community leaders can promote renewable energy development that results in the fewest possible impacts on important agricultural and biological resources.

2) Identify Potential Large Tracts of Municipal Land Such as Local Airports, Landfills, Wastewater Treatment Plants, Fair Grounds, and Brownfields Suitable for Large-Scale Solar Development and Develop These First through Individual Projects (While Also Considering Aggregation of Solar Projects among Jurisdictions)

Developing non-prime farmland first is an obvious yet sometimes overlooked strategy. Some local governments have considerable acreage at their disposal which can be used for large-scale solar projects. Resources directed at identifying this acreage are relatively easy to deploy and defend given the potential community benefits that can accrue. Local airports and county fairgrounds are two examples of typically large tracts. Some right-of-ways can be used for large-scale solar projects also, depending upon the location. The Brownfields Center at the Environmental Law Institute claims there are at least 425,000 brownfields[l] in the U.S. so the chances are good that you can find one near you that may be worthy of development. Where individual solar projects may not be attractive to one developer, local jurisdictions are urged to consider joint municipal aggregation of solar purchases. By creating one entity that convenes and coordinates multiple local government solar projects, huge economies of scale are possible. For example, local governments that are involved in recent solar aggregation efforts typically report transaction cost savings greater than 50-percent.[li]

3) Perform a Solar Policy Gap Analysis to Identify Discrepancies with Existing Best Practices

One innovative way to ensure that local ordinances are structured and coordinated to assist with solar development is to commission a gap analysis of a municipal code to see how well it complies with best management practices. The City of Seattle did this in 2010.[lii] Permitting process improvements and new policies can easily be identified through this exercise. A gap analysis can also identify barriers and workarounds for local solar policies. Many communities will discover the need to refine definitions related to solar energy use through a gap analysis, as well as the need to increase solar staff training, and new opportunities to streamline solar processes related to interconnections and general permitting. Allow three months for this gap analysis if done internally; add more time if it is done through a contractor.

4) Target Specific Areas of Concern through Ordinances

As evidenced by the dozens of ordinances referenced earlier in this white paper, communities have chosen to specify conditions of use to protect fertile farmland. Ordinances can address virtually all of the major land use-related issues of concern to most government officials. It is possible through an ordinance to:

- Require native, shade-tolerant vegetation under and around solar panels
- Require decommissioning within a set time period of inactivity (typical solar equipment lasts around 25 years)
- Require specific perimeter fencing style
- Require that prime soils receive higher protection and stronger mitigation measures
- Define setbacks and buffers from adjacent farming operations

- Require geotechnical reports related to soil, water and bedrock
- Limit impervious cover
- Limit removal of vegetation and soil
- Require soil restoration

The American Planning Association and many other sources identified in the Bibliography and Resources section can help provide specificity where required.

5) Perform a Solar Resource Assessment and Map Ideal Locations along with Prime Farmland

During the research for this white paper the authors came across at least seven companies that will quantify the solar irradiation potential of entire counties, cities and neighborhoods. Some of these services are for-profit, and some are paid for through federal or state grants. By identifying those locations in your jurisdiction that are ideal from a solar energy perspective, it is possible to get educated and ahead of the issue by having more facts at your disposal. It is possible to use a solar inventory map in combination with prime farmland maps, transmission line maps, and key economic development zones to identify the best areas to avoid, and to target, for large-scale solar project development. Santa Clara County, California has some of the best maps that prove the value of this exercise. They can be found at https://www.sccgov.org/sites/dpd/DocsForms/Documents/Solar_AnalysisStepMaps.pdf. (See Recommendation number 8 for other map-related tools.)

6) Assess Fees on Land Developed for Large-Scale Solar Projects and Dedicate this Funding Stream to Agricultural Land Conservation and Community Education

Local governments can also take advantage of their taxing authority and assess fees on parcels of property that are likely to be developed and in turn dedicate the funds collected strictly to land conservation and community education efforts. This tactic can effectively allow governments to educate specific, targeted population centers, groups or the public at large.

7) Establish Detailed Mitigation Plan Requirements for Projects on Agricultural Land, Especially Decommissioning Requirements

Mitigation for large-scale solar projects typically takes place across three primary areas, construction, operation and decommissioning. Typical mitigation measures for some of the major issues include[liii]:

> **For ecological resources:** conduct pre-disturbance surveys to identify and delineate the boundaries and buffers for important, sensitive, or unique habitats in the project vicinity. These surveys should be conducted by qualified biologists following accepted protocols established by the U.S. Army Corps of Engineers (USACE), U.S. Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (USFWS), or other federal or state regulatory agencies.
>
> **For environmental justice concerns:** as part of siting and design considerations locate facilities to minimize contrast with scenic views and use construction materials that minimize scenic contrast, and avoid traditional and cultural sites important to low-income and minority populations.

For air pollution: limit all soil-disturbing activities and travel on unpaved roads under high wind, and keep soil moist while loading.

For noise: limit noisy activities (including blasting) to the least noise-sensitive times of day (weekdays only, between 7 a.m. and 10 p.m.), and schedule different noisy activities (e.g., earthmoving) to occur at the same time.

For cultural resources: locate the facility on previously disturbed lands, and lands determined by archeological inventories to be devoid of historic properties.

One of the most important principles to remember with large-scale solar energy project development is to use inferior farmland or previously disturbed land first. For example, there are an estimated 35,000 acres of suitable, closed landfill sites throughout the state of California, with the potential to generate up to 7,000 megawatts of solar energy while avoiding sensitive biological resources.[liv] However, if more valuable farmland is to be used for development, then it makes sense to require extensive mitigation measures to protect the land. As Kings County, California does, require 2:1 mitigation versus 1:1 when prime farmland is used. Prime farmland in the San Joaquin Valley deserves special treatment, generally. Conservation easements have been proven to be valuable mitigation measures in the California court system. In one case (Save Panoche Valley versus San Benito County)[lv] the court found sufficient evidence to support the county's determination that biological and agricultural impacts would be adequately mitigated by measures that included conservation easements.[lvi] When part of a comprehensive strategy, conservation easements can give added assurance that a mitigation plan is relatively secure.

8) Exhaustively Identify Least Conflict Areas and Priority Criteria for Solar Development by Creating or Using Similar Tools to that Available through the San Joaquin Valley Gateway Project

There is a recent web-based San Joaquin Gateway project (http://sjvp.databasin.org/) that provides relevant conservation-oriented maps to complement any solar mapping exercises that you may be doing in the San Joaquin Valley. Notably, this San Joaquin Valley effort can be replicated in other regions. Essentially, the San Joaquin Gateway project assembled and overlaid conservation, energy, environmental, known sensitive habitat and wildlife locations, and through a collaborative stakeholder process identified least conflict areas that would be better for large-scale solar development. A similar process can be started by choosing the most relevant criteria to a region and overlaying known maps related to the criteria. Theoretically, this allows more certainty and expedient permitting for developers and local governments responsible for large tracts of valuable land. We urge the reader to explore the potential behind this innovative concept.

9) Review and Include Select Recommendations of Recently Released Policy Papers about Renewable Energy on Agricultural Lands in Relevant Planning Documents

The UCLA and UC-Berkeley Law Schools recently released a joint paper[lvii] with excellent recommendations on large-scale solar projects on appropriate farmland including:

- Develop criteria for the most suitable agricultural lands for renewable energy development, including impaired lands with poor agricultural and biological value that possess strong renewable energy generation potential;
- Expedite the permit process for projects on these impaired lands; and
- Plan and develop electricity infrastructure upgrades and interconnection processes to accommodate increased energy production from impaired agricultural sites.

A Nature Conservancy report on land conservation and solar energy facilities in the western San Joaquin Valley identified the need for coordinated regional conservation planning since there is effectively little to no guidance from the state on this issue. The report had three important recommendations on policy and process that local governments can follow.[lviii]

1. Coordinated Energy and Conservation Planning: There is no coordinated energy and conservation planning process underway in this part of the state, but there are many proposed projects. Where there are renewable energy planning processes (e.g., general plan amendments, Habitat Conservation Plans, etc.) within this region, best available scientific information should be incorporated into evaluation, planning and decision-making.

2. Interconnection: Access to available transmission and distribution capacity is an important development factor in siting renewable energy projects. Within the WSJV transmission and distribution investments should be prioritized to areas that present lower risk to biodiversity and agricultural resource values.

3. Cumulative Impacts: Ensure that the cumulative impacts of all development in the region are taken into account; plan for and implement regional mitigation efforts that combine resources that address offsets from multiple projects and direct those resources to priority conservation areas, as developed under Regional Advance Mitigation Planning (RAMP).

Keeping these recommendations in mind as local governments deal with large-scale solar development can help lead to better decisions and less confrontation.

10) Dedicate Funding for a More Detailed, Comprehensive Look at the Costs and Benefits Associated with Large-Scale Solar On or Near Prime Agricultural Lands

This white paper was written in part to start a more thoughtful conversation about the crucial public policy issues involved when constructing large-scale solar projects on or near prime agricultural lands. It is designed to be an *initial primer* that identifies important issues for the San Joaquin Valley and other local California jurisdictions. Given the lack of state guidance in this area (admittedly, this is changing at the time of publication) local governments will be forced to continue to weigh the costs and benefits of large-scale solar development on an individual or regional level in the near future. Clearly, additional long-term economic and fiscal impact analyses are needed. The best scientific information available on the topic is *not* making it to local governments at this time. However, the authors and many of the reviewers of this white paper believe that the San Joaquin Valley is farther along than most. Our team repeatedly heard requests for an economic analysis that goes 20 to 30 years beyond today (to 2035, or 2045). There is also considerable uncertainty surrounding the coexistence of large-scale solar and farming. Due to the nascent status of elevated large-scale solar PV panels and the crops that can be grown under or along-side them (for example, wine grapes, blueberries and raspberries) there is a dearth of research related to this important topic. While useful and needed by Valley governments, this type of analysis is far outside the scope of the project responsible for publishing this white paper. We point out here that there is a real need for this analysis, and hope that organizations and funders in the near future will step in to fill this gap.

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VIII. Appendices

Appendix A –Large-Scale Solar Facilities in the San Joaquin Valley

The data gathered and presented here for the 120 large-scale solar facilities was collected and assembled by Fresno, California-based Sigala Inc. on behalf of the Colorado Energy Group, Inc. and the SER Team in late 2015. This detailed research was performed largely through personal visits, email correspondence and phone calls with staff from the eight counties in the San Joaquin Valley, and was supplemented by reviewing numerous solar project websites, principally the respected Solar Energy Industries Association (SEIA) website (http://www.seia.org/).

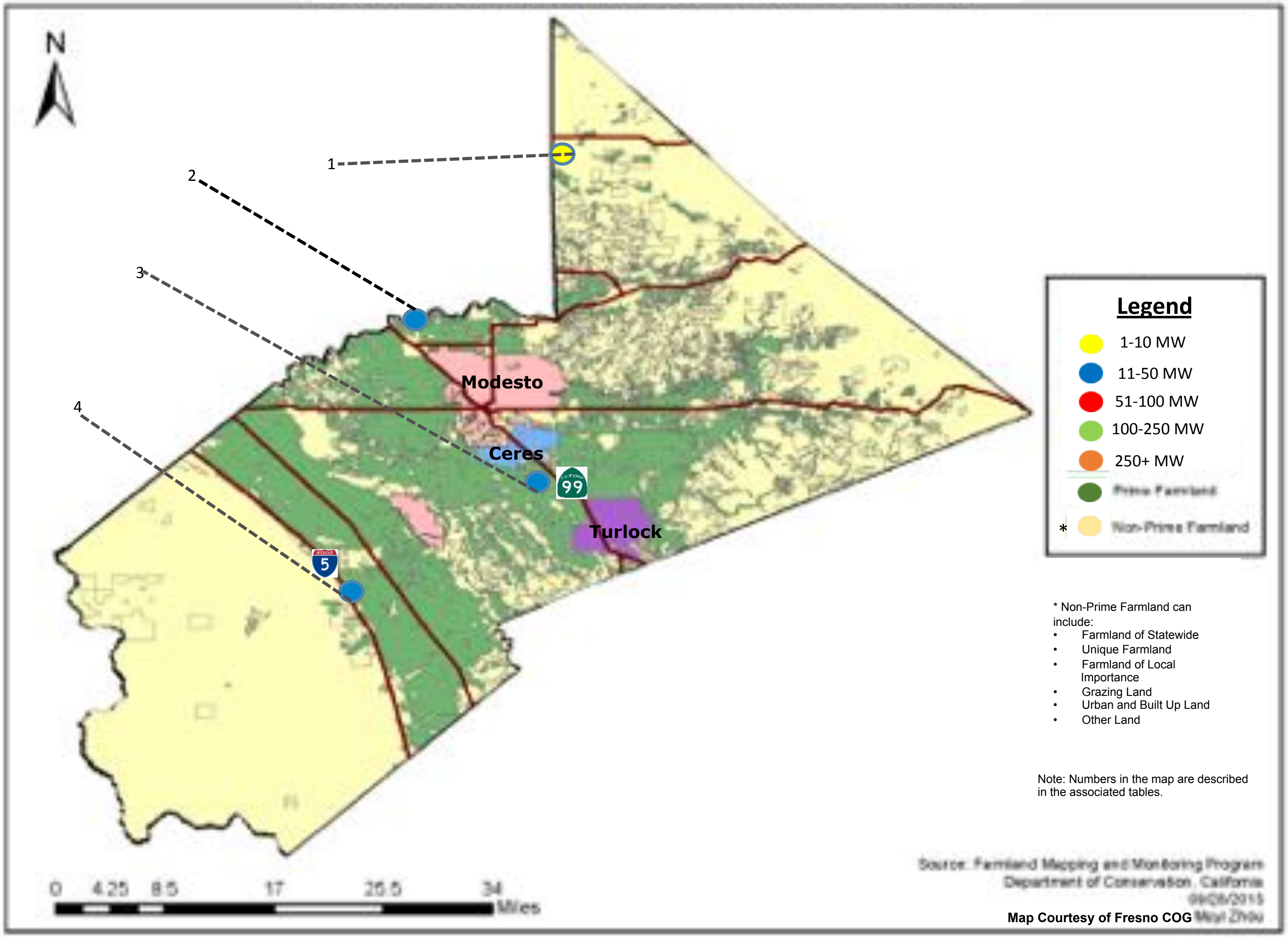
The list includes dozens of projects that were slated for construction but were later withdrawn as indicated by each local government. The names, status, online date, acreage, and generating capacity reflect what was provided by the respective local governments at the request of researchers. Therefore, some project names list the project developer and some online date information is not listed despite being approved years earlier. Despite this relatively minor issue, we are highly confident in the location of these projects (as their coordinates were provided) and their respective generating capacities as indicated by their color on the map.

For a greater appreciation of the role of transmission lines in project planning and siting, a map identifying the location and ownership of electricity transmission lines is also provided at the end of this appendix.

STANISLAUS COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
1	Robert O Schulz Solar Farm	Operating	2008	13	1
2	McHenry Solar Farm	Operating	2012	160	25
3	Frontier Solar	Under Development	null		20
4	Westside Solar Ranch	Under Development	null		50

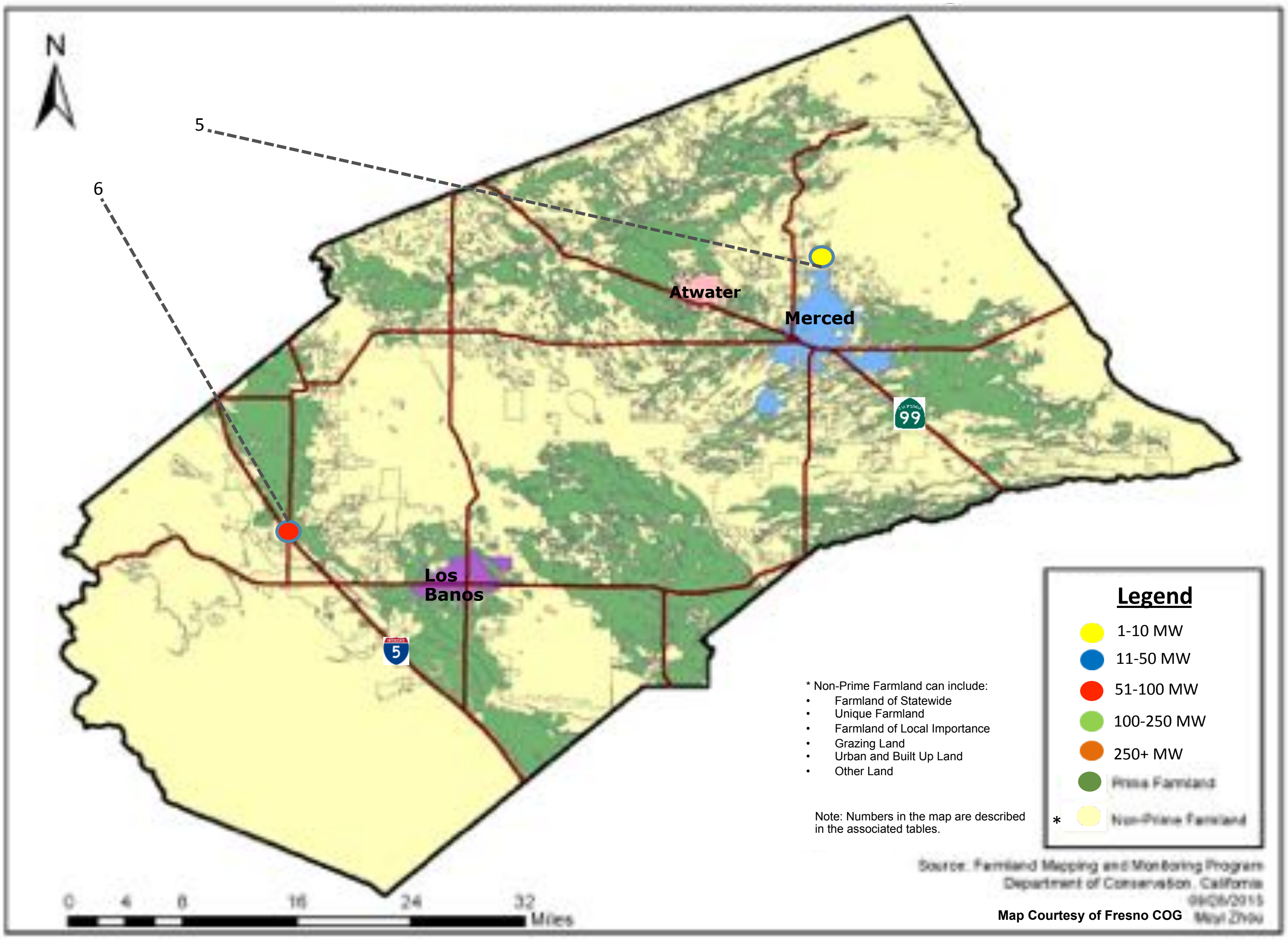
Solar and Agricultural Land Within Stanislaus County



MERCED COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
5	UC Merced, Solar Farm	Operating	2009	8.5	1
6	Quinto	Under Construction	null	1000	110

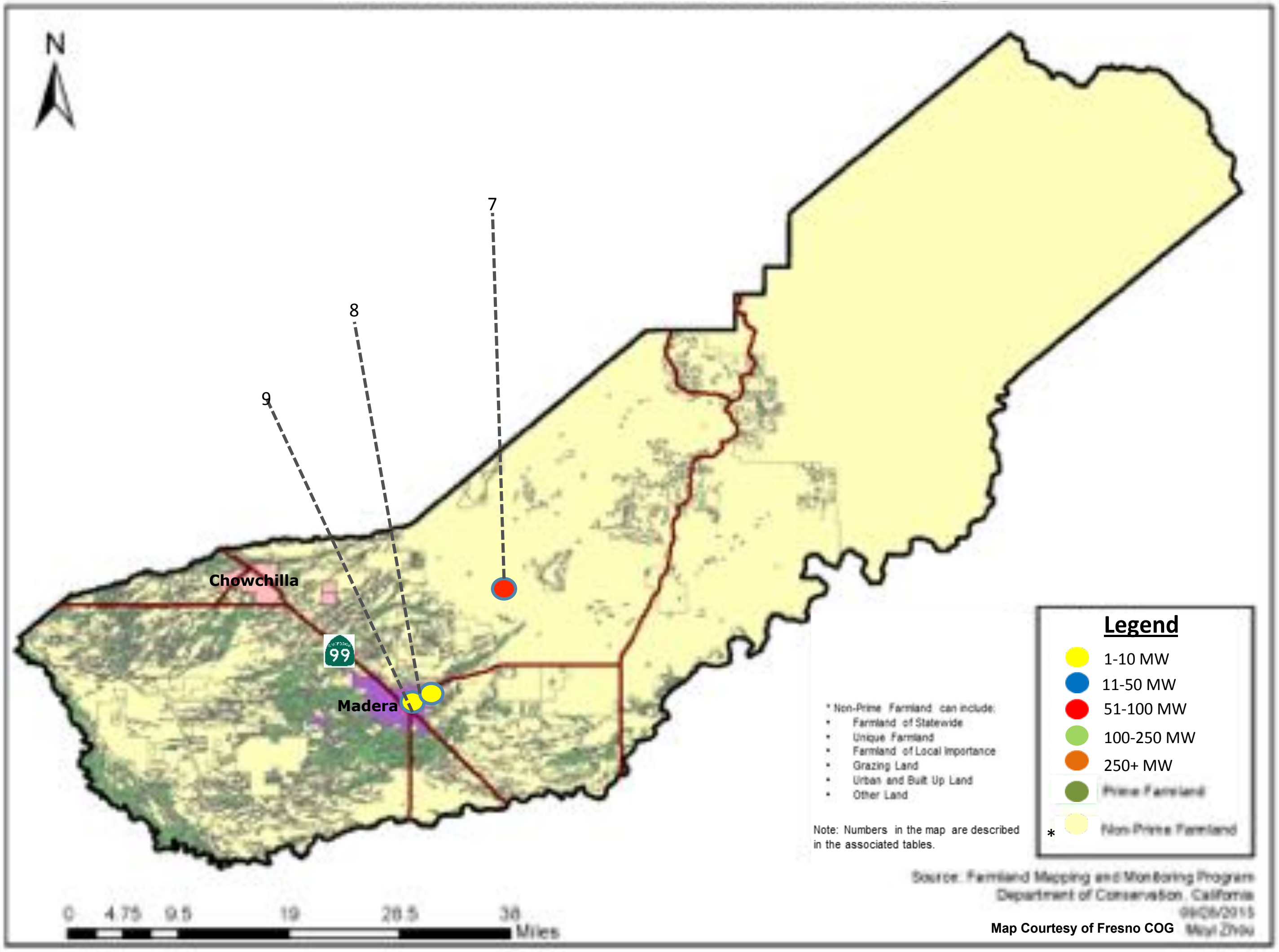
Solar and Agricultural Land Within Merced County



MADERA COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
7	Lotus Solar Farm	Operating	07/2014	459	67
8	Madera Community Hospital	Operating	2011	8	1
9	City of Madera Wastewater Solar Farm	Operating	2010	9	1

Solar and Agricultural Land Within Madera County

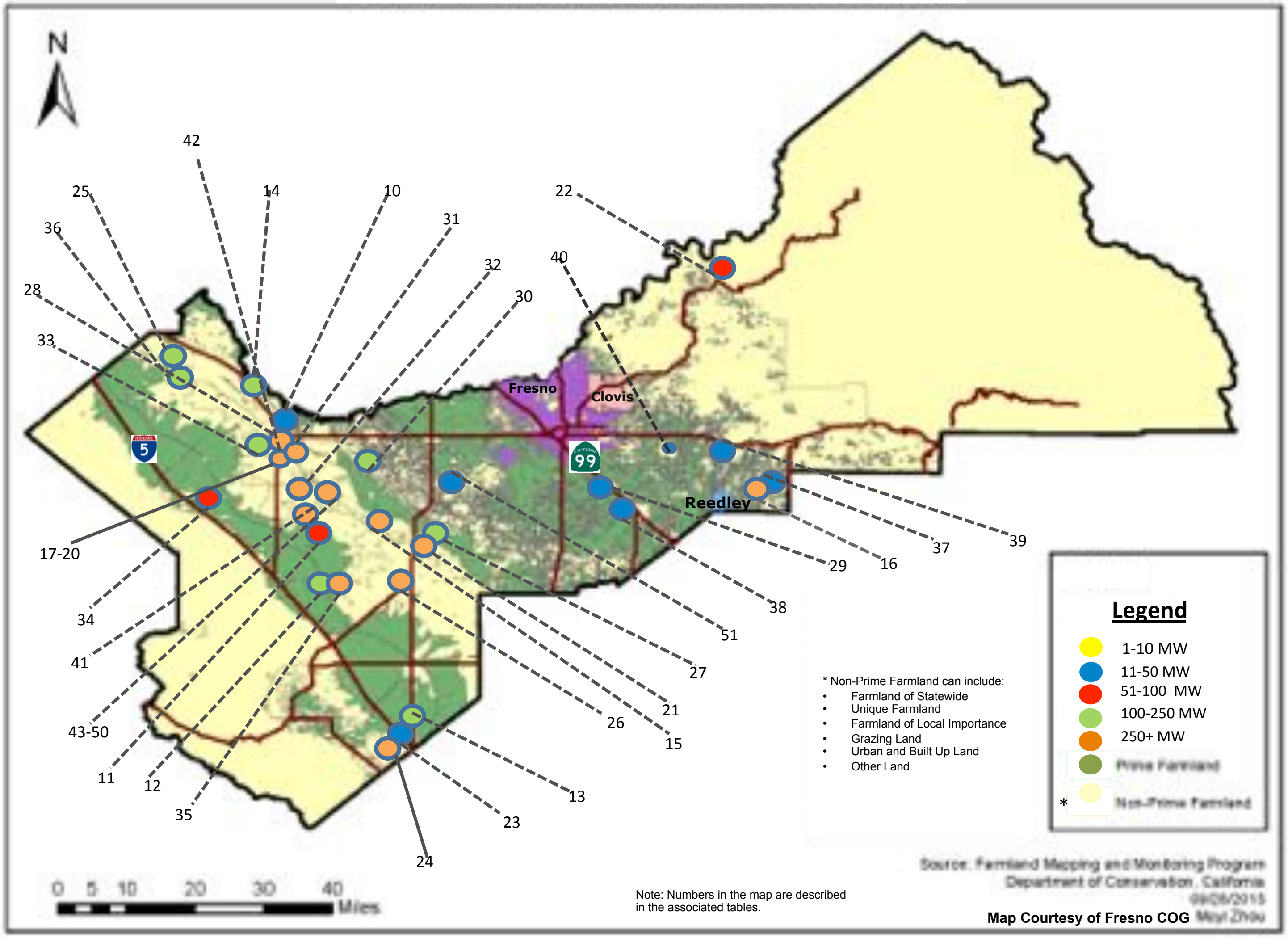


FRESNO COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
10	North Star Power 1	Under Construction	null	45	60
11	Giffen	Operating	06/2012	77	10
12	Cantua	Operating	07/2012	130	20
13	Huron Solar Farm	Operating	06/2012	213	20
14	SunPower	On hold indefinitely per Applicant		1890	200
15	Pristine Sun LLC	BOS Approved 08/2015		20	1
16	Little Bear Solar 1, LLC	In Process		630	20
17	Little Bear Solar 2, LLC	In Process		631	20
18	Little Bear Solar 3, LLC	In Process		632	20
19	Little Bear Solar 4, LLC	In Process		633	20
20	Aspiration Solar G, LLC	In Process		121	9
21	GA Solar	Plan. Comm. Approved 11/2011		318	1
22	Joe Contreras (GA Solar)	Plan. Comm. Approved 11/2011		318	1
23	Westlands Solar Farms LLC	Plan. Comm. Approved 10/2011		91	18
24	Whitney Point Solar LLC	Plan. Comm. Approved 7/2011		320	20
25	Sr Solis Oro Loma LLC	Plan. Comm. Approved 11/2011		156	20
26	Boulevard Associates LLC	Plan. Comm. Approved 10/2011		320	40
27	RE Kamm LLC	Planning Commission Denied 04/2013		240	20
28	NorthLight Power LLC	Plan. Comm. Approved 4/12/12		640	60
29	GASNA 16P LLC	Plan. Comm. Approved 10/2011		19	2.5
30	Placer Solar LLC	Planning Commission Denied 08/2012; BOS Approved 10/2012, Rescinded 10/2014		165	20
31	RE Adams East, LLC	Plan. Comm. Approved 10/2012		319	37
32	Silverado Power LLC	Plan. Comm. Approved 12/2012		321	70
33	Silverado Power LLC	Plan. Comm. Approved 12/2012		161	40
34	Three Rocks Solar LLC	BOS Approved 06/2013		100	13
35	Frontier Renewables LLC	Plan. Comm. Approved 04/2014		300	50
36	Gestamp Solar	Plan. Comm. Approved 07/2012		167	20
37	Cenergy Power	Plan. Comm. Approved 06/2012		19	3
38	Jeff Gatzka	Plan. Comm. Approved 06/2012		17	2.3
39	Stan Battersby	Plan. Comm. Approved 04/2013; BOS Approved 06/2013		44	1.25
40	Kara Haugen	Plan. Comm. Approved 11/2012		14	1
41	Giffen Solar Park LLC	Planning Commission Recommended Denial 04/2014; BOS Approved 06/2014		317	20
42	SH3 Solar LLC	Plan. Comm. Approved 04/2013		68	4
43	Tranquillity Solar #1	Plan. Comm. Approved; EIR Certified 10/2014		600	50
44	Tranquillity Solar #2	Plan. Comm. Approved; EIR		500	50

		Certified 10/2015			
45	Tranquillity Solar #3	Plan. Comm. Approved; EIR Certified 10/9/16		200	20
46	Tranquillity Solar #4	Plan. Comm. Approved; EIR Certified 10/9/17		200	20
47	Tranquillity Solar #5	Plan. Comm. Approved; EIR Certified 10/9/18		200	20
48	Tranquillity Solar #6	Plan. Comm. Approved; EIR Certified 10/9/19		200	20
49	Tranquillity Solar #7	Plan. Comm. Approved; EIR Certified 10/9/20		400	20
50	Tranquillity Solar #8	Plan. Comm. Approved; EIR Certified 10/9/21		1432	200
51	FPC Solar	Plan. Comm. Approved 9/18/14		50	7.5

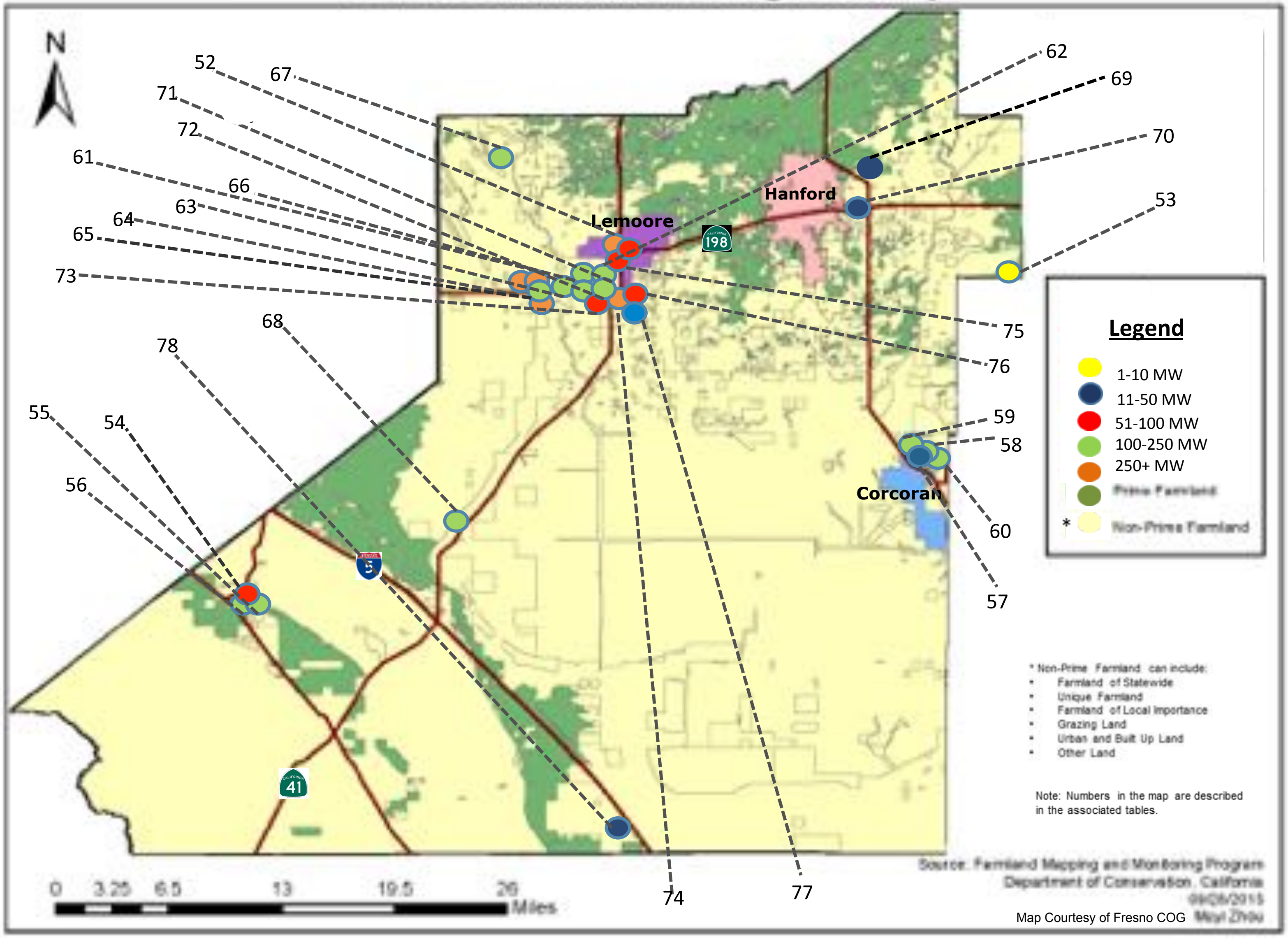
Solar and Agricultural Land Within Fresno County



KINGS COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
52	Henrietta Solar Project	Under Development	Null	836	136
53	Nichols Farm	Operating	04/2011	6	1
54	Avenal Park	Constructed	CUP: 09/2010	86	9
55	Sand Drag	Constructed	CUP: 03/2010	240	19
56	Sun City	Constructed	CUP: 03/2010	180	20
57	CED Corcoran Solar 2	Not Constructed	CUP: 09/2014	40	11
58	Corcoran	Constructed	CUP: 11/2011	228	20
59	CED Corcoran Solar 3	Not Constructed	CUP: 09/2014	138	20
60	Corcoran Irrigation District	Not Constructed	CUP: 05/2013	200	20
61	American Kings	Not Constructed	CUP: 12/2010	978	125
62	Mustang	Not Constructed	CUP: 08/2012	1422	160
63	Orion	Not Constructed	CUP: 08/2012	200	20
64	Kent South	Constructed	CUP: 08/2012	200	20
65	Westside Solar	Not Constructed	CUP: 05/2015	287	22
66	Strafford Land	Not Constructed	CUP:	212	20
67	Grangeville	Not Constructed	CUP: 04/2012	200	20
68	Kettleman Solar	Not Constructed	CUP: 05/2013	220	20
69	Gales 3 MW Solar Project	Not Constructed	CUP: 06/2014	22	3
70	Hanford 12	Constructed	CUP: 01/2014	19	3
71	Kansas	Constructed	CUP: May 2012	200	20
72	Kansas South	Constructed	CUP: 11/2011	230	20
73	Lincoln	Not Constructed	CUP: 11/2011	93	15
74	Sunpower Henrietta	Not Constructed	CUP: 08/2012	836	136
75	Lemoore 14	Not Constructed	CUP: 11/2014	60	8
76	Aurora Solar	Not Constructed		186	20
77	2275 Hattesen	Not Constructed		16	2
78	Quay Valley Solar One	Not Constructed		1500	150

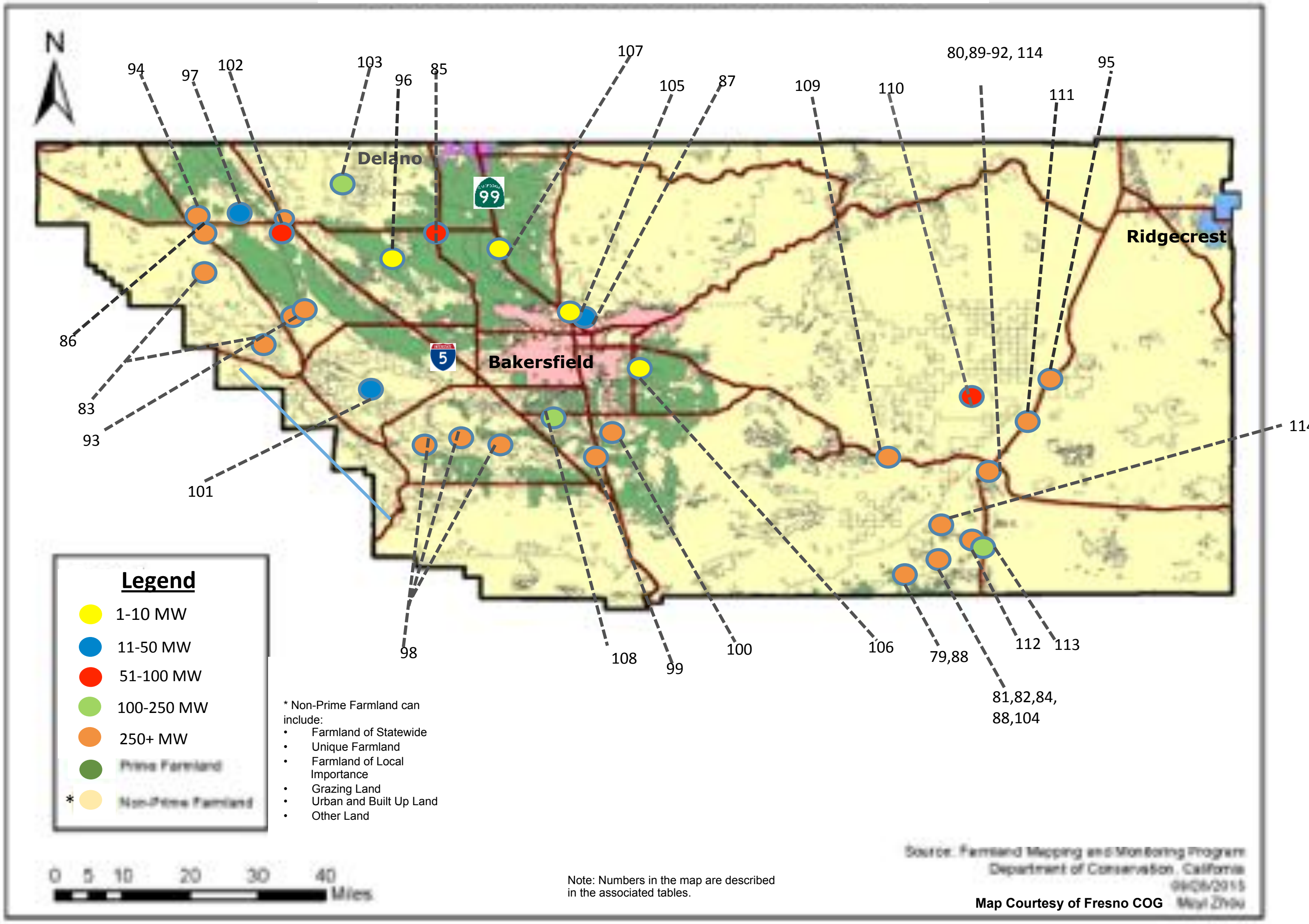
Solar and Agricultural Land Within Kings County



KERN COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
79	RE Astoria Solar	01/2013		1501	175
80	Monte Vista Solar Array	08/2009		1040	126
81	Rosamond Solar Array	12/2009		1177	155
82	Willow Springs Solar Array	12/2009		1402	160
83	Kern Solar Ranch			6100	1000
84	Rosamond Solar	03/2013		230	40
85	Wasco-Charca Solar	03/2012		72	8
86	Fremont Valley Preservation Water Bank & Solar Project	03/2012		4806	1008
87	FRV Mojave Solar Project	04/2011		174	20
88	RE Columbia and RE Columbia 2	03/2013		476	40
89	Blackwell Solar Park	11/2012		476	20
90	Chevron Energy Solutions Company	n/a		18	2
91	Antelope Valley Solar Project	n/a		5698	650
92	RE Columbia One	n/a		165	20
93	RE Columbia Two	n/a		132	20
94	RE Columbia Three	n/a		68	10
95	RE Rio Grande	03/2010		47	5
96	Pioneer Green Energy Solar (3 sites: Wildwood, Pumpjack & Rio Bravo)	03/2011		480	125
97	Lost Hills Solar	n/a		307	33
98	Beacon Solar	08/2011		2320	250
99	Cenergy Power	n/a		29	3
100	Maricopa Sun Solar Complex Project	n/a		6046	700
101	FRV Valley Solar Project (Regulus)	05/2011		160	20
102	FRV Valley Solar Project (Adobe)	07/2011		810	75
103	FRV Orion Solar	10/2011		265	20
104	Elk Hills Solar by enXco	n/a		47	7
105	Goose Lake Solar by enXco	n/a		94	15
106	Smyrna Solar by enXco	n/a		125	12
107	Rosamond Solar Project	n/a		960	120
108	Vaquero Energy	n/a		10	1
109	SKIC Development Inc	n/a		321	20
110	RE Old River One by RE Old River One LLC	03/2010		105	16
111	GE Energy LLC	n/a		337	40
112	LADWP	n/a		75	10
113	RE Barren Ridge 1	n/a		588	74
114	RE Rosamond One	n/a		320	20

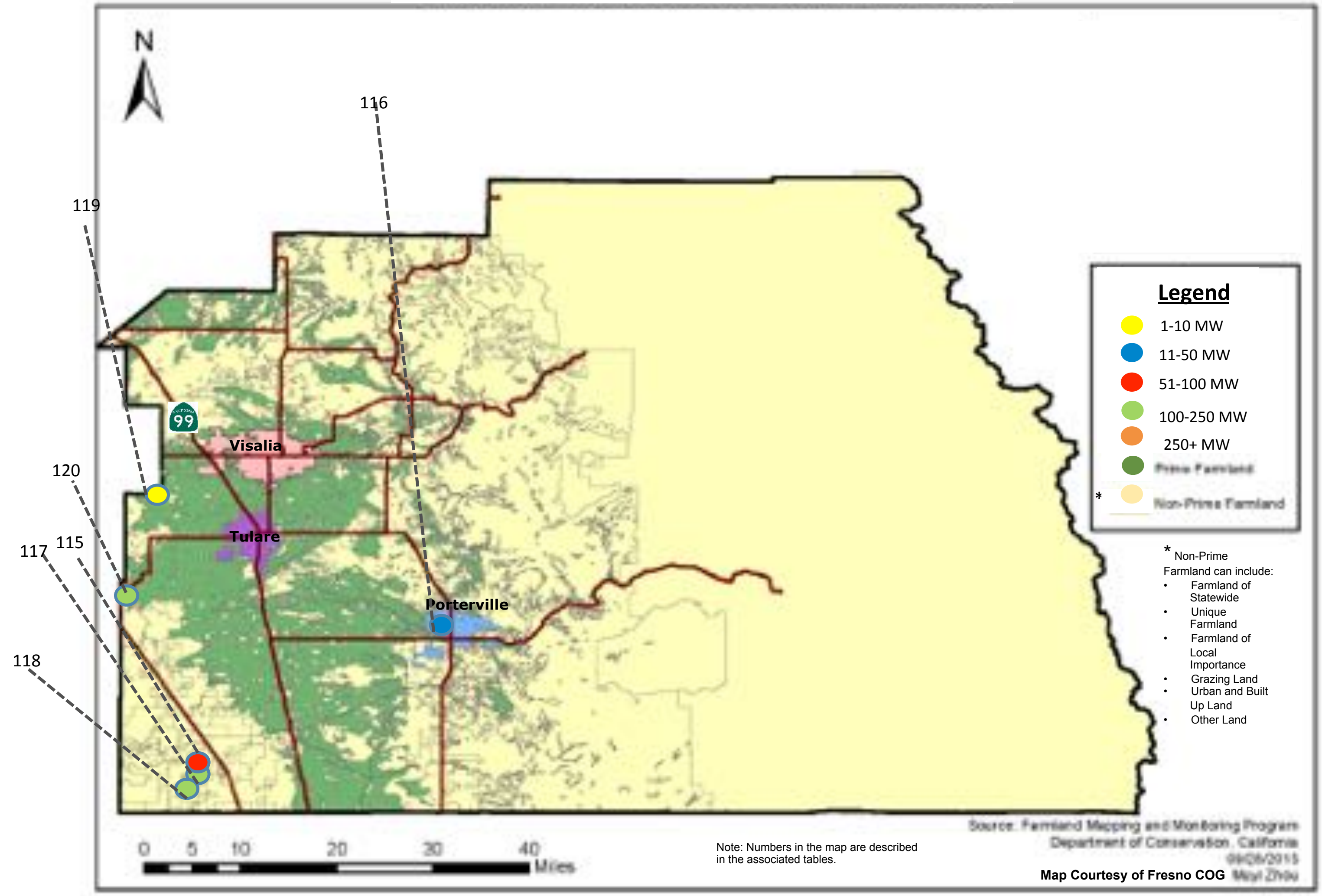
Solar and Agricultural Land Within Kern County



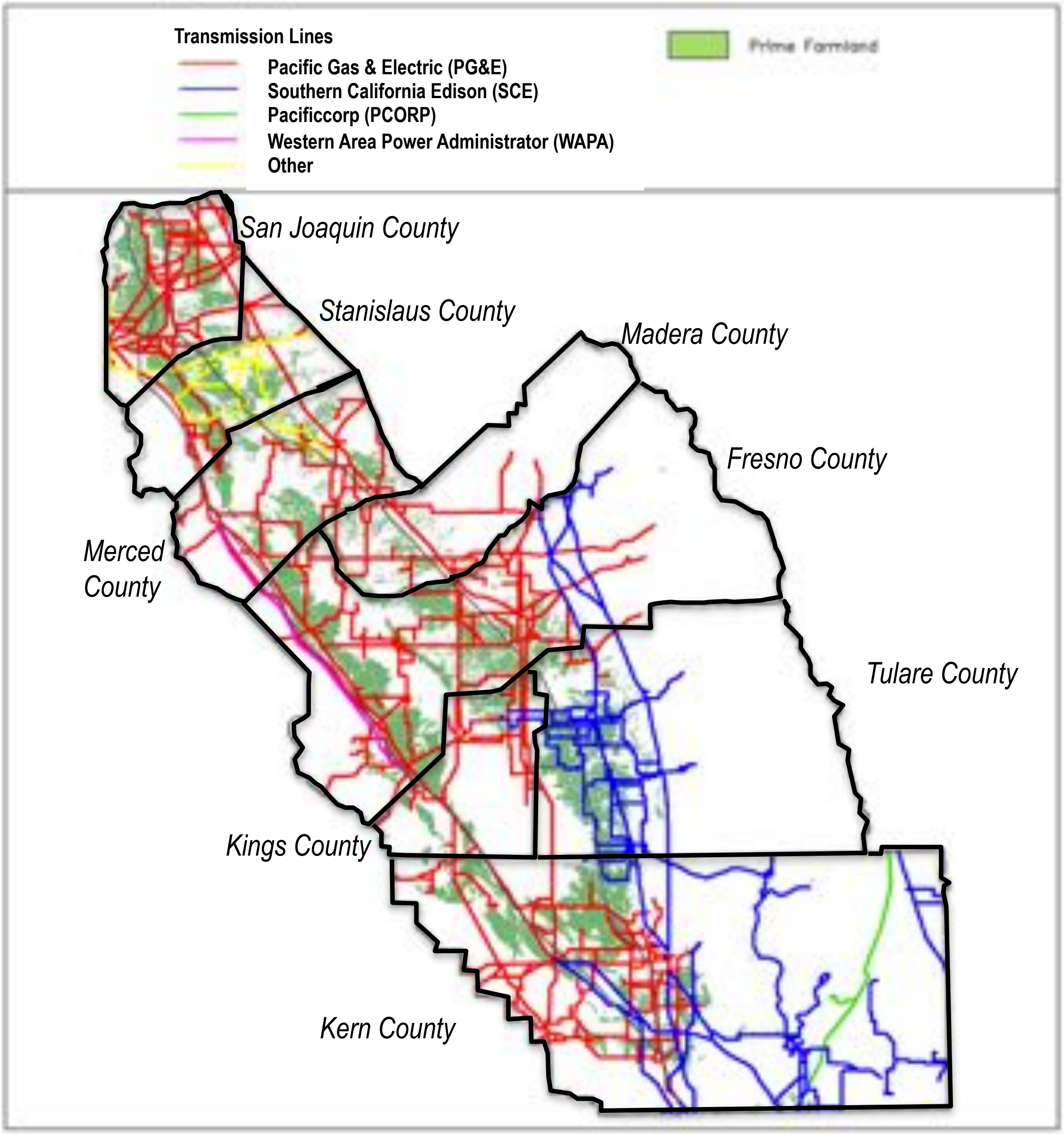
TULARE COUNTY

#	PROJECT NAME	STATUS	ONLINE DATE	ACREAGE	CAPACITY (MW)
115	RE Rosamond Two	n/a		160	20
116	Catalina	n/a		1223	150
117	Alpaugh	Operating	12/2012	92	550
118	Porterville Solar Plant	Operating	02/2011	30	5
119	White River	Operating	11/2012	170	20
120	Atwell Island	Operating	03/2013	165	20

Solar and Agricultural Land Within Tulare County



Electric Utility Transmission Lines in the San Joaquin Valley



Appendix B - Extended Descriptions of Relevant Legislation, Policies and Regulations Impacting Large Scale Solar

The Renewables Portfolio Standard (RPS)

As mentioned earlier, the state Renewable Portfolio Standard (RPS) is the primary driver behind California large-scale solar energy facility development. Adopted in 2002 and amended in 2006 and 2011, the state's RPS requires that investor owned utilities (IOUs), electric service providers, and community choice aggregators (CCA) increasingly add renewable energy resources to their electricity generation mix. By 2020, at least 33-percent of their electricity is to be generated from a wide variety of resources including solar, wind, geothermal, hydro, biomass, and municipal solid waste among others. Investor owned utilities (IOUs) were on already well on track by surpassing the required 20-percent targets in 2013. Furthermore, the CPUC reports in May 2015[lix] that the IOUs are close to achieving the 33-percent requirement based on purchases under contract in 2020. San Diego Gas and Electric has nearly 39-percent of mix of generation resources coming from renewables by 2020, followed by Pacific Gas & Electric (31-percent) and Southern California Edison (24-percent). In January 2015, Governor Jerry Brown proposed that the RPS requirement be increased to 50-percent by 2030. Again, that legislation was signed.

The Williamson Act and Farmland Security Zones

The California Land Conservation Act of 1965, commonly known as the Williamson Act, was designed to protect farmers from the economic pressures of encroaching development. It modified property taxes on agricultural lands to dissuade landowners from converting their productive land to other uses. The Williamson Act's voluntary property tax incentives are credited with the preservation of more than 16.6 million acres (nearly one-third of all of the private land in the state) of agricultural land from urban sprawl and other uses. If a solar energy project is to be developed it must be out of the Williamson Act agreement.

Under the Williamson Act, a private landowner enters into a 10-year contract with the local city or county jurisdiction guaranteeing that the land -- which must be in areas designated by that jurisdiction -- will remain for agricultural uses or open space. In return, the land will be taxed based on the income it could generate from agriculture and other compatible uses instead of its market value. The Williamson Act is a permissive program that established a three-way partnership between the state and the participating local government and landowners. Each partner receives the benefits of agricultural land conservation and the certainty provided by agricultural preserve zoning in return for a modest monetary sacrifice. Landowners give up their development rights and some speculative value in the property; local governments give up a portion of their property tax base; and the state, for its part, provides open-space subventions to participating counties to replace foregone property tax revenue.[lx] The

Recent legislative amendments to the Williamson Act provide for Farmland Security Zones (FSZ) which creates a 20-year automatically renewed contract, providing even protections for agricultural land. The changes authorize landowners to petition the county board of supervisors to rescind their existing Williamson Act contract in favor of a new "FSZ Contract".[lxi] The landowner must have an existing

Williamson Act contract before the Board can approve a FSZ Contract. The property tax incentives are also greater with a FSZ and require that a contract cancellation must also be approved by California Department of Conservation. The contract between the landowner and the municipality is extended automatically each year past the original contract time frame and land can only be removed from the contract by a notice of nonrenewal (by land owner or municipality) or cancellation of the contract by the land owner. In recognition of the longer term FSZs land restricted by a FSZ contract is valued for property assessment purposes at 65-percent of its Williamson Act restricted valuation, or 65-percent of its Proposition 13 valuation, whichever is lower.[lxii]

The California Environmental Quality Act (CEQA)

To be certain, the RPS mandate is a state issue with major consequences for local land use. Local governments are well familiar with complying with the California Environmental Quality Act (CEQA), which protects biological resources, plant life, water, air, noise, traffic, visual and other areas. A formal policy or ordinance covering large-scale solar projects can help local governments meet CEQA goals while also helping meet the state RPS mandate. CEQA regulations come into play with virtually all large-scale solar projects and will continue to be a major factor when evaluating these projects.

Cap-and-Trade

California's Cap-and-Trade legislation routes funds for agricultural land conservation. The Air Resources Board's Fiscal Year 2014-15 budget contained a portion of revenues from the Cap-and-Trade monies for making strategic investments that protect agricultural lands to reduce greenhouse gases emissions.[lxiii] With the help of these funds California recently took action to protect some of the state's most threatened agricultural lands by investing in conservation easements and better land use planning. These tools have been used for many years by land trusts and local governments to permanently protect farmland from development.

Under Governor Brown's leadership, the Sustainable Agricultural Lands Conservation (SALC) Program was created with the first round of Cap-and-Trade revenue investments in FY 2014-15. SALC, implemented by the Strategic Growth Council in partnership with the Resources Agency, is the country's first climate change and farmland conservation program aimed at reducing greenhouse gas emissions associated with sprawl development. During the summer of 2015 the Strategic Growth Council approved seven conservation easement projects covering a little more than 14,000 acres for a total of $4.1 million. The Council also approved five Agricultural Land Strategies planning grants to support local governments in identifying critical agricultural lands at risk of development and to develop strategies to protect those lands.[lxiv] The demand for SALC funding far exceeds the program's current very modest annual funding of $5 million. The Governor recently proposed $400 million in Cap-and-Trade funds for the Strategic Growth Council's smart growth programs, including SALC.[lxv]

Climate Change Policies

UC Davis researchers recently found that one acre of urban land emitted 70-times more greenhouse emissions compared to an acre of irrigated cropland. That number climbs to 100-times more emissions when comparing urban land to rangeland. Sustainable farm management practices can further remove carbon from the atmosphere, thus enhancing the benefits of agricultural land conservation. Despite these benefits, California continues to lose farmland at alarming rates. Between 1984 and 2010 the state lost an average of over 50,000 acres of agricultural land annually. [lxvi]

Desert Renewable Energy Conservation Plan (DRECP)

The Desert Renewable Energy Conservation Plan (DRECP) was initiated in 2008 due to the anticipated large increase in renewable energy technologies - solar thermal, utility-scale solar photovoltaic (PV), wind, geothermal and high-voltage transmission facilities – being deployed on the biologically-sensitive lands in the in order the meet the RPS. The purpose of the DRECP is to expedite the siting and construction of these technologies and infrastructure through streamlined environmental review and permitting while conserving and managing plant and wildlife communities in the desert regions of southeastern California.

Implementation of the DRECP is managed by representatives from the California Energy Commission, California Department of Fish and Wildlife, U.S. Bureau of Land Management, and U.S. Department of Fish and Wildlife. The area covered under the DRECP includes 22.5 million acres (10 million of which is managed by the BLM) across Imperial, Inyo, Los Angeles, Riverside, San Bernardino, San Diego and Kern Counties.

The BLM released the Final Environmental Impact Statement for Phase 1 of the DRECP in November 2015 and proposes development on 388,000 acres of public land primarily in Riverside and Imperial Counties and a few areas in Kern County. The 388,000 acres addressed in Phase 1 is only 15-percent of the 22.5 million acres of public and private lands initially identified in the DRECP. Phase 2 of the DRECP will include critical work with local governments, local planners and the various local renewable energy development and conservation plans.

Community Solar

California joins a growing number of states in January 2016 that are implementing a new model for customer access to solar generated electricity called Community Solar. For utilities, a Community Solar program allows them to offer another electrical supply option for its consumers and helps them to meet their individual state RPS requirements. Estimates are that as much as 75-percent of residential and 70-percent of commercial ratepayers nationwide are not able to benefit from installing rooftop solar PV systems on their buildings because of the poor solar orientation, little to no space to install PV panels, financial restrictions, or simply because they don't own the property in which they live or work.[lxvii] Community Solar programs allow consumers like these to purchase allocated shares of solar generated electricity from arrays located nearby.

Pursuant to state legislation (SB 43) enacted in 2013, the state's three investor-owned utilities (IOUs) will together generate an additional 600-MW of new capacity from renewables through 2019. Pacific Gas and Electric (PG&E) and Southern California Edison (SCE) are each responsible for approximately 45-percent of that total. Importantly, each IOU is required to dedicate 20-percent of their portion to the most disadvantaged communities in their service territories. The capacity of individual projects will range from 500-kilowatts (kW) to no more than 20-megawatts (MW), which mirrors the capacity of several existing large-scale solar projects in the San Joaquin Valley. For perspective, an average single-family home would offset 100-percent of its electricity usage with about 2 to 5 kilowatts of solar power.

Community-Choice Aggregation[lxviii]

In 2002, the California Legislature, through Assembly Bill 117, enacted legislation permitting the creation of CCA programs (2002). Under the legislation, codified as Public Utilities Code § 366.2, a city, county, or Joint Powers Authority (JPA), comprised of two or more cities and counties, may implement a CCA program. Governor Jerry Brown signed California Senate Bill 790 in October 2011, which also allowed a CCA to be formed by the Kings River Conservation District, the Sonoma County Water Agency, and any California public agency possessing authority to generate and deliver electricity at retail within its designated jurisdiction (2011). In January 2012, the authority to form a CCA was furthered expanded when Governor Brown signed California Senate Bill 4 into law, providing that special districts may also become community choice aggregators.

Once formed, customers within the CCA service area are automatically enrolled, but may opt out of the CCA and continue to receive bundled electricity service from the investor owned utility (IOU). Customers that do not opt out will have their electricity supplied by the CCA entity. The IOU continues to provide and bill CCA customers for electricity transmission and distribution, as well as other services, such as meter reading, billing, efficiency incentives, and such. Only the electricity generation portion of electricity service can be provided by the CCA entity. Customers of a CCA continue to pay the same charges for the delivery of the power—transmission and distribution—as customers that remain with the IOU. The CCA entity must pay the IOU for other services provided to the CCA (e.g., billing services).

[lix] California Public Utilities Commission, April 29, 2015, “Actual RPS Procurement Percentages in 2013” and “Percentage of RPS Procurement Currently Under Contract for 2020,” http://www.cpuc.ca.gov/PUC/energy/Renewables/

[lx] California Farm Bureau Federation, 2015, The FSZ: Preserving California’s Prime Agricultural Farmland. http://www.cfbf.com/CFBF/Issues/Issue_and_Regulations/CFBF/Issues/The_FSZ__Preserving_California_s_Prime_Agricultural_Farmland.aspx

[lxi] California Farm Bureau Federation, 2015. The FSZ: Preserving California’s Prime Agricultural Farmland. http://www.cfbf.com/CFBF/Issues/Issue_and_Regulations/CFBF/Issues/The_FSZ__Preserving_California_s_Prime_Agricultural_Farmland.aspx

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Appendix C – Additional Summary Information of Key Local Land Use Planning and Zoning Ordinances from Outside of the San Joaquin Valley

Information here is based largely on a compilation of research into land use planning for large-scale solar energy facilities in areas outside of the San Joaquin Valley and information provided by the American Planning Association's searchable Solar Planning and Zoning Data website. For more details on each of these jurisdictions and additional excellent resources on planning for large-scale solar projects, please visit https://www.planning.org/solar/data/.

Santa Clara County, California

A Santa Clara County ordinance prohibits commercial solar energy conversion systems in two designated view sheds and on land zoned for large-scale agricultural use. Solar systems may be allowed on agricultural land determined to be marginal because of poor soil type, lack of water availability, or an abundance of surrounding incompatible non-agricultural uses. No system is allowed on land subject to the Williamson Act unless permitted as a compatible use. Developers are required to gain approval of a Closure and Rehabilitation Plan that provides for the removal, recycling, and disposal of all aboveground structures and facilities to a depth of three feet below grade, the restoration of graded areas to original contours, re-vegetation of all disturbed areas, and recycling of materials where possible. Additional criteria require 30-foot setbacks, public information and warning signage, allowing for the passage of wildlife, minimization of soil disturbance during construction and operation, and removal of all equipment if the facility has not operated for 12 months.

Butte County, California

An amendment to the Butte County zoning ordinance in 2012 created four tiers of solar energy systems. Utility-scale solar systems fall under Tier 4 (ground-mounted and electricity is delivered off-site) and are allowed on "Grazing land" and "Other Land" as identified by the state agricultural mapping and monitoring program and are free of conflicts with the Williamson Act. Requirements include height limits that increase with parcel size, acknowledgement of the County's Right to Farm Ordinance, aesthetics requirements in designated scenic areas, determination that the project is abandoned if it does not produce electricity for 24-months, removal of all equipment and restoration of the site to original condition at the end of its use.

Yolo County, California

Yolo County's 2014 solar energy systems ordinance identifies (1) Medium and (2) Large/Very Large solar energy systems. Medium-sized systems are 2.5 to 30 acres in size, are encouraged to be located on more than 60-percent non-prime farmland, are not be covered by Williamson Act contract, and require 50-foot setbacks and mitigation if more than 2.5 acres is foraging habitat for the Swainson's Hawk. Large/Very Large solar systems occupy between 30 and 120 acres of land and must mitigate for the permanent loss of agricultural land in accordance with the Agricultural Conservation and Mitigation Program, and developers must perform public outreach and obtain approval from a technical review committee as well as the Board of Supervisors.

Yuba County, California

Yuba County, California allows solar farms as conditional uses in agricultural districts with a conditional use permit (which determines the number of solar panels and generating capacity) but requires mitigation for the conversion of prime agricultural soils. When a system is no longer operable the owners are responsible for removing all the equipment within 120-days of the day on which the system last functioned. The owner is solely responsible for removal of the system and all costs, financial or otherwise, of system removal.

Inyo County, California

To address the projected rapid growth of large, utility-scale renewable energy development in the region, Inyo County adopted a Renewable Energy General Plan Amendment (REGPA) in March 2015 which identifies four categories of solar facilities: Utility-Scale (more than 20 MW), Commercial-Scale (20 MW or less), Community-Scale (those that are built to supply electricity to specific communities and are capped at 36 acres in size) and Small-Scale (those that are for on-site use, such as rooftop installations). Through the use of overlay mapping in the public participation and review process, the final document designates six separate Solar Energy Development Areas (SEDA). Each SEDA has a cap on how much acreage can be developed for solar PV facilities and when combined the REGPA sets a limit of 5,100 acres for development and 850 MW of capacity. The REGPA also sets aside one area containing 62-percent of County's land zoned for agricultural uses for additional study of its biological, cultural, visual resources and analysis of potential mitigation approaches.

The REGPA directs development of large-scale solar facilities to the SEDAs [or outside the SEDAs if it is "over or along the Los Angeles Aqueduct," and is allowed within any zoning district within the SEDA. Negative social, economic, visual and environmental impacts are to be avoided, minimized, or mitigated and the County is encouraged to avoid the use of productive agricultural land for solar facility development.

Lastly, the REGPA establishes several County policies and land use measures that further control development including that the County does not support new transmission lines beyond what is needed to meet the capacity cap of each SEDA and does not support projects other than those using solar PV technology. The County is to encourage projects on disturbed lands (such as solid waste and wastewater treatment facilities and brownfields); encourage the development of the smaller Commercial-, Community-, and Small-Scale facilities; offset costs to County from the facilities; encourage the employment of the local labor force; encourage compensation to impacted communities through reduced rates; work with developers to maintain native vegetation and/or plant new vegetation or agricultural crops to control dust; and encourage the development of energy storage technologies, minimize water use among others.

Imperial County, California

Rich in solar, wind, and geothermal energy resources and transmission lines, Imperial County formally updated the Renewable Energy and Transmission Element of its General Plan in October 2015 which establishes eight goals to manage the development of these resources including the use of overlay zones to facilitate development while preserving agricultural resources, construction of transmission lines in designated corridors, and overall safe and orderly development that will result in economic and fiscal benefits in the County. At the same time the County also adopted a Renewable Energy Resources Ordinance, codifying key aspects of the Renewable Energy and Transmission Element and multiple regulations including, but not limited to, requiring that projects may only be located in the Renewable Energy Overlay Zone (while allowing for some exceptions), Conditional Use Permits will not exceed 30 years (an additional 10 years allowed if there are no cases of noncompliance), and protection of surface and groundwater quality.

Developers are further required to carry at least $1 million in liability insurance; notify the County in cases of pending bankruptcy or foreclosure; offset County costs to conduct inspections and review reports or other documents; adopt an Emergency Response Plan in case of fire, flood, earthquake, fluid spills, etc.; and the decommissioning of the site and restoration of the land to its original condition.

Stearns County, Minnesota

Stearns County defines solar farms as providing for the wholesale sales of electricity and thereby includes community solar gardens, which may be either an accessory or a principal use. Detailed design and development standards address storm water management, erosion and sediment control, foundations that meet local soil and climate conditions, underground location of power and communication lines, minimum setbacks for the zoned district, as well as a site plan, manufacturer specifications and installation methods, a copy of the interconnection agreement with local utility, a decommissioning plan (removal if not in use for 12 consecutive months) including restoration of land and removal/disposal of all structures and foundations, analysis of glare if located within two miles of an airport, and an analysis of potential visual impacts (aesthetics and fencing/screening).

Pima County, Arizona

Pima County does not allow utility-scale solar on agricultural lands and different requirements apply to their use in different districts (mixed use, local business, industrial campus, and residential/ranch zones), but all are to address fencing, coloration, glare, warning signage, site maintenance, and abandonment. Any renewable energy system which becomes inoperable shall at the owner's expense be made operational or shall be removed from the property within one year of the date the system became inoperable. An appropriate reclamation and closure plan, including recycling, subject to the planning director's approval shall be required prior to removal.

Chandler, Arizona

The City of Chandler establishes standards for utility-scale solar systems including screening such that the solar farm should not be visible from the ground floor of any dwelling unit (exemptions can apply), be weed free and maintained landscaping, be trash and debris free at all times, direct no glare onto nearby properties or roadways, be equipped with surveillance systems and personnel, and meet applicable setbacks.

Marion County, Oregon

Marion County allows for solar PV generating facilities with conditional uses in the Special Agriculture and Exclusive Farm Use zones. Detailed standards for conditional use include maximum acreage, determination of no other suitable site, no negative impacts on agricultural production, no unnecessary soil erosion or compaction, and wildlife impact mitigation where identified are established for high-value farmland soils, arable lands, and non-arable lands.

Iron County, Utah

Iron County zoning code allows for concentrated solar thermal and solar PV power plants on agricultural land with a conditional use permit. Standards for PV include a minimum of five acres in size, 30-foot minimum setbacks, signage and fencing, noise levels, aesthetics (colors blend into surroundings, landscaping/screening, limited lighting to necessary for use and no lighting on structures unless required by FAA), underground electrical interconnection and distribution lines (except for requirements set by utility regulations, and fire protection.

Gem County, Idaho

Gem County zoning regulations allow for electricity generating facilities, including solar, in agricultural zones and establishes standards such as a 2,500-foot setback from residences, and submittal of a plan to address landscaping, screening, provision for fire protection, and noise control, as well as requiring two public hearings before issuance of a final permit.

City of Sparks, Nevada

The City of Sparks zoning code requires solar power generating stations for utilities to obtain building and special use permits. Standards address height, fencing, warning signs, no glare onto property, public roads or other public areas, approval of the use of chemicals for cleaning the solar equipment, roads built for installation and construction are to be revegetated at completion, and no system will be operable until a PPA or net metering agreement is in place and the interconnection with the utility is approved.

Clarke County, Virginia

A Clarke County zoning ordinance requires large photovoltaic solar plants to be located within one-mile of a pre-existing electrical substation of 138 kV or higher voltage, be on at least 20-acre lots, and address public safety, noise, landscaping, and electrical interconnection issues. Applications for a special use permit stipulate 12 additional requirements: project description and rationale; economic analysis; simulations of visual impacts, appearance, and scenic views impacts; wildlife habitat areas and migration patterns; environmental analysis (historic, cultural, archeological resources, soil erosion, flora, water quality and water supply, dust from project activities and cumulative impacts of other adjacent power plant); solid and hazardous waste generation and disposal at the site; lighting impacts; a transportation plan during construction and operation; public safety; noise levels; impacts to telecommunications (including electromagnetic fields from the plant); and a description of decommissioning and final land reclamation.

Worcester County, Maryland

Worcester County municipal code allows utility-scale (greater than 2.5 MW) in agricultural districts with a minimum parcel size of 50-acres. A two-step approval process by a technical review committee, the planning commission and County Commissioners, is required with concept plan approval preceding master plan approval; concept plan must include a sketch plan, designation of sensitive areas, drainage/storm water management plan, decommissioning plan, and operations and maintenance plan.