UTILITY SCALE SOLAR PROJECTS IN CALIFORNIA:
AN INITIAL SURVEY

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ABSTRACT

Utility Scale Solar Projects in California: An Initial Survey

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The lack of a comprehensive database for both concentrating and photovoltaic utility-scale solar power projects, those with a generation capacity of greater than 50 MW, hinders the ability of researchers and policy makers to examine the state of solar development in the state of California. This research project seeks to fill this gap in understanding by creating a database of proposed and developed projects in order to examine trends in proposals, process time, approvals, and construction starts. Existing literature was evaluated to determine potential factors for project success in approval and construction. Upon determination of these factors, the project database was developed through use of publicly available data and extensive Internet searches of planning documents, industry releases, and articles on existing and proposed projects. The completed database, containing eighty projects, was analyzed to provide an initial look at the overall state of solar project development in California. This report details these early findings as well as areas for further research. The analysis indicates that, while California has a high amount of proposed projects and generation capacity, many projects do not reach the end of the public approval process and fewer still enter construction and operation.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The siting of large energy production facilities is not a new issue in the state of California, literature as far back as the 1970s examines the planning and effect of these projects (Ball et al., 1972; Papetti, Dole, & Hammer, 1973). The planning and development of these facilities is a complex issue that requires balancing the public need for increased energy production with the potential adverse health and quality of life effects on the local population. California's planning policies, including the California Environmental Quality Act (CEQA), require substantial public involvement in the review process as a way of ensuring the local communities have a voice in the process.

Renewable energy (RE) facilities are no exception to the consideration of the greater public good versus adverse local effects. The state has a vested interest in encouraging increased production of energy from RE sources in order to reduce green house gas (GHG) emissions and mitigate climate change. Energy production contributes a substantial proportion of the GHG emissions in the United States and, in order for California to meet its emission reduction goals, RE must play a role. California has enacted numerous policies, including the Renewable Portfolio Standard (RPS), aimed at increasing the proportion of energy obtained through RE sources.

The ambitious California RPS, created by Senate Bill 1078 in 2002, sets some of the highest renewable energy (RE) targets for power companies in the nation (CEC, 2010)). The original RPS mandated that RE comprise 33% of the energy produced in the state and was designed to reduce the state's dependence on natural gas (California Public Utilities Commission, 2009). The initial standard was successful in encouraging a range of RE development in the state including wind and solar energy (California Public Utilities Commission, 2009). Additional legislation, such as Assembly Bill 32 which mandated California reduce carbon emissions to 1990 levels by 2020, supported this trend. Due to this success, Governor Jerry Brown further

challenged utility companies by raising the RPS standard to 50% renewable energy by 2030. Assembly Bill 197, introduced in January of 2015, formalizes this increase.

While a range of RE sources are being developed in the state, solar energy has the largest potential for growth (Stillwell, 2011). According to the California Energy Commission (CEC), 99% of the technical growth potential for RE in the state is solar energy, with photovoltaic energy representing the majority of that potential (CEC, 2011b). Large-scale solar developments are not new to California. The first large-scale solar concentrating solar projects were built in the state in the 1980s. Despite the early beginning, the state did not see many new developments in projects of this scale until the passage of RPS.

Despite the increased RE requirements, the positives of any specific development must be weighed against the substantial impacts these large-scale facilities have on the landscape and lives of those who live near them. RE facilities face unique issues during their siting and development that differ from those faced by traditional power plants (Carlisle, Kane, Solan, Bowman, & Joe, 2015; Heras-Saizarbitoria, Cilleruelo, & Zamanillo, 2011). While RE energy has generally wide-spread public acceptance, there is often significant opposition to specific projects at the local level and considerable research has been conducted on bridging this gap (Bell, Gray, & Haggett, 2005).

Solar power is not immune from this effect. Solar facilities differ from traditional power generation facilities in terms of the amount required land, location specificity, and the types of impacts on the site (Chiabrande, Fabrizio, & Garnero, 2009; Pasqualetti, 2011). Project sites often require hundreds of acres of land in often rural or under developed areas, and the projects are large new industrial construction with the potential for high visual impact. As a result, new solar facilities have faced strong challenges to their location on private, state, or federal lands from local residents, activists, and environmental organizations (Groom & Chan, 2011; Peter Maloney, 2008; Sahagun, 2014; Woody, 2011).

With the substantial state interest in expanding RE development, the state and local agencies have sought to minimize challenges to these projects by creating streamlined processes to move projects through the planning process quickly. Governor Jerry Brown signed into law

legislation that acts to limit CEQA legal challenges to RE projects as well as exempting projects from certain types of environmental assessments (Grueneich, Gold, Imwalle, & Esformes, 2011). The California Energy Commission (CEC), which oversees the development of concentrating solar projects (CSPs) over 50 MW in size, has a fast track approval process for these developments with the goal of 1 year from application to final hearing (CEC, 2007). While local county processes differ greatly across jurisdictions, several have attempted to shorten the process time for these projects either through zoning changes or through exempting projects from a full CEQA review through the use of a mitigated negative declaration.

Despite the significant push to develop RE projects and the measures enacted to ensure a speedy planning process, no research has been conducted to determine whether these measures have been effective in promoting project approval and construction. State documents focus primarily on the number of projects and generation capacity proposed, while academic research has focused on the public acceptance of projects (CEC, 2012a; Stillwell, 2011; Weil, 2009). This research project seeks to fill this gap in understanding by creating a database of proposed and developed projects in order to examine trends in proposals, process time, approvals, and construction starts.

1.2 PROJECT SCOPE

This project focuses on utility scale solar projects in the state of California. Utility scale is defined for the purpose of this research as those projects with a proposed generation capacity of 50 MW or greater. This criterion reflects the standard that the California Energy Commission uses to determine its jurisdiction over large solar thermal projects (CEC, 2007). This research project sought to develop an exhaustive database of proposed and existing solar projects, both photovoltaic and concentrating solar, after research found that no comprehensive database was publicly available. Existing literature was reviewed to determine potential factors for project success in approval and construction. Upon determination of these factors, the project database was developed through use of publically available data and Internet searches of planning documents, industry releases, and articles on existing and proposed projects.

CHAPTER 2: LITERATURE REVIEW

Because this project creates a database to serve as the basis for further research into State of California utility-scale solar development, it is necessary to place this research in the context of the factors influencing project development and approval. This section begins by examining the growth of renewable energy (RE) globally and that is followed by a discussion of the role California policy has played in encouraging renewable expansion at the state level. The two main solar technologies used at the utility scale and their impact on their surrounding landscape and environment are then examined. Public acceptance of RE is analyzed and the current public planning processes for solar power plants within the state is examined. This chapter concludes with a look at what is currently known about the components of a successful RE project.

2.1 STATUS OF RENEWABLE ENERGY DEVELOPMENT

Worldwide demand for energy is projected to increase 60% from 2002 to 2030 (Solangi, Islam, Saidur, Rahim, & Fayaz, 2011). Within the United States demand is expected to rise 1.5% per year until 2030 while production per capita is expected to fall during the same period (Felder & Haut, 2008). Policymakers have recognized the need for secure, dependable sources of energy that are sensitive to the environment to meet this demand (Sissine, 2007; Stillwell, 2011). RE sources represent a potential solution to meet the rising global and national energy needs (Gatrell & Jensen, 2009; Sayigh, 2009).

Current State of Renewable Energy Development

Despite the wide range of RE sources, it is underutilized and accounts for only a fraction of worldwide and national energy production (Pimentel et al., 2002). Approximately 70 percent of the electricity in the United States is produced from coal, natural gas, or petroleum powered plants compared to four percent produced by non-hydroelectric renewable energy sources (Center for Climate and Energy Solutions, 2011). Globally, the numbers are similar: 68 percent of electricity is generated using coal/peat, oil, and natural gas sources, and approximately 3 percent

comes from renewable, non-hydroelectric sources (Center for Climate and Energy Solutions, 2011). Hydroelectric power is often grouped separately from other RE due to its higher rate of development, as well as its unique environmental impacts.

In 2003, the countries with the highest proportion of RE generation were those in Latin America and Canada at 70.9% and 59.2%, respectively, due to a focus on hydropower (Baratta, 2011). The United States (2.4%) and Europe (3.6%) lead global production for non-hydro RE and also are among the leaders in utility or grid connected solar (Baratta, 2011). Currently, the primarily RE resources used globally are biomass, hydropower, with geothermal a distant third place, and solar and wind lagging far behind (Resch et al., 2008). See Figure 2.1 for a breakdown of world energy production by source and Figure 2.2 for the United State's electricity production by energy source.

Figure 2.1 World Electricity Production from All Energy Sources in 2012 (TWh) ("World Electricity Production from All Energy Sources in 2012 (TWh)," 2012)

Figure 2.2 United States Energy Production by Source in 2014 (EIA, 2014)

One of the main factors responsible for keeping RE an underutilized resource is the cost of developing these facilities compared to traditional hydrocarbon based energy production. In recent years, prices for RE technologies have fallen, particularly for photovoltaic cells, and fossil fuel based energy costs have increased. However, RE has yet to become fully competitive with traditional modes of electricity generation, even when environmental effects are considered (Timilsina, Kurdgelashvili, & Narbel, 2012). Other factors contributing to the low use of renewable energy include political, institutional, and acceptance barriers (Timilsina et al., 2012). RE, as with traditional energy resources, also has geographical limitations, with higher levels of suitability for different RE resource use in specific regions as well as variable regional costs for development (Baratta, 2011; Gatrell & Jensen, 2009; Pimentel et al., 2002; Resch et al., 2008).

Potential for Renewable Energy Growth

While the current utilization of RE resources is low compared to more traditional energy sources, renewables remain a strong potential source for future energy needs (Baratta, 2011;

Resch et al., 2008). There is a wide range of the estimated generation potential from RE up to 100 percent of global energy requirements if these resources were more developed (Baratta, 2011; Jacobson & Delucchi, 2011; Resch et al., 2008). Other authorities suggest that renewable energy sources could potentially provide for current and future demand several times over (Resch et al., 2008). Policy makers are increasingly encouraging this growth due to concerns with climate change and energy security (Gatrell & Jensen, 2009; Sayigh, 2009).

Because traditional fossil fuel is used for the largest proportion of energy generation, electricity production accounts for 33-percent of the total greenhouse gas emissions (GHG) in the United States, making the U.S. one of the largest global CO₂ emitters (Center for Climate and Energy Solutions, 2011). Energy and climate policies have identified RE development as a viable strategy for reducing greenhouse gas emissions from electricity and energy generation (American Planning Association, 2011; Baratta, 2011; Carley, 2011; Sen, 2008). Within the US, researchers believe that it will be possible to meet the strictest GHG reduction goals through the replacement of fossil fuel energy sources with renewable sources, particularly solar (Fthenakis, Mason, & Zweibel, 2009; Jacobson & Delucchi, 2011).

In addition to concerns about GHG emissions, countries have been aware of the need to have secure and independent sources of energy (Gatrell & Jensen, 2009; Sayigh, 2009). Countries have sought ways to reduce dependence on foreign energy imports since the oil embargos of the 1970s. These embargos caused an early shift towards coal and nuclear energy for electricity production (Hughes, 2009). The continuing instability in the Middle East makes this a continuing issue in energy policy. In the United States, this has translated into legislation with the Energy Independence and Security Act of 2007 (P.L. 110-140, H.R. 6). This bill specifically focuses on shifting energy development priorities to RE as a way to reduce foreign oil dependence.

In response to rising demand, climate change and other motives, including energy independence, countries around the world are utilizing a variety of policies to encourage RE development. This includes feed-in-tariffs, tax policies, energy portfolio requirements, and cap and trade laws (Solangi et al., 2011). While the true effectiveness of these policies is unknown, it

is likely they will encourage RE development. Local conditions including availability of resources, availability of financing, and public acceptance or opposition, will determine the form RE development will take.

2.2 STATUS OF RENEWABLE ENERGY IN CALIFORNIA

History

California has a long history of encouraging renewable energy development through policy decisions. As early as the 1970s, the California Energy Commission (CEC) was working to create opportunities for renewable energy (Weil, 2009). The CEC projected in a 1983 report that by year 2000 50- to 60-percent of the state's energy would come from renewable sources (CEC, 1983). While the state did not meet these early projections, it did remain a strong force in the renewable energy market. In 1991, 99-percent of global, utility-scale solar generation facilities were located within California (CEC, 1992).

The driving force behind California's dominance in RE has been state policies that provide incentives for homeowners and utility providers to move towards renewable energy. During the late 1970s and early 1980s, California instituted over 20 renewable energy policies including tax incentives, solar access protection, and a variety of research and development projects (Weil, 2009). This early creation of pro-renewable policies slowed during the late 1980s and early 1990s due to an increasingly contentious political atmosphere and a reduction in the price of natural gas compared to renewable technologies (Weil, 2009). This trend continued during the years following the passage of AB 1090 that deregulated the electricity utilities in the state.

It is possible that this shift away from RE would have continued if conditions had remained stable. However, following the 2001 California energy crisis with its rolling black outs and energy shortages, the state returned to a focus on renewable energy as an important part of energy policy. The ambitious California Renewable Portfolio Standard (RPS), created by Senate Bill 1078 in 2002, set the highest renewable energy targets in the nation for utility companies (CEC, 2011a). The original RPS standard required that 33-percent of energy procurement was to

come from RE sources by 2020. The California Public Utility Commission (CPUC) is responsible for monitoring compliance with this standard. In 2013, California's three largest utility companies provided 22.7-percent of their retail electricity through RE (CPUC, 2015).

Besides the RPS standard, the CEC in the 2003 Energy Action Plan identified renewable energy as the preferred method to meet future state energy needs (CEC, 2003). This document outlines an aggressive strategy for encouraging renewable energy development with the goal of reaching the RPS standard by 2010. To do this, the CEC created "market price benchmarks, standard contract terms, flexible compliance and penalty mechanisms, and bid ranking criteria under the "least cost-best fit" rubric" (CEC, 2003, p. 6).

California has continued to propose and enact legislation aimed at simplifying the development process for RE power plants to help meet the RPS standard. In 2011, Governor Jerry Brown signed several pieces of legislation to this end including the Renewable Energy Siting Act that expanded the ability to pay a fee to the Department of Fish and Game in lieu of developing traditional mitigation strategies for the impact of proposed RE project to state-listed endangered and threatened species (Grueneich et al., 2011). Another piece of legislation that affected RE development is AB 900, the Jobs and Economic Improvement through Environmental Leadership Act of 2011. This legislation streamlines and limits California Environmental Quality Act (CEQA) legal challenges, which have often been used to challenge RE and other project construction (Groom & Chan, 2011; Roth, 2014; Sahagun, 2014; Woody, 2011). Governor Brown also signed into law Senate Bill 267, the Renewable Energy Project Water Supply Assessments Act, which exempts photovoltaic and wind energy developments from a water supply assessment if the project requires less than 75 acre-feet of water per year (Grueneich et al., 2011).

Additional programs have encouraged renewable energy development through rebates and tax incentives (CEC, 2011a). Many of these policies focus on creating a distributed energy system through small to medium sized RE installations by businesses and individual homeowners. The Feed-in Tariff (FIT) program is an example of such policies. Originally enacted by Assembly Bill 1969 in 2006, FIT allowed for RE facilities of up to 3 MW to contract

with utility providers to export energy into the grid. The original FIT program replaced by the AB 1969 version in 2013.

Potential for Renewable Energy Development in the State

The policies enacted over the last several years recommit the state to leading the renewable energy switch. As of June 30, 2010, there were 939 facilities in the state with a renewable energy portfolio designation (CEC, 2011a). By 2013, 57 percent of the global solar energy installations for the year were within the state (Sherwood, 2014). This trend will only continue as Governor Brown seeks to raise the RPS goal to 50% by 2030 and as climate change becomes an increasing focus of public policies.

California has tremendous potential for RE power development. According to the CEC, the state has the technical potential for 1.8 million MW above the currently developed 10,000 MW of production (CEC, 2011b). This estimate includes wind, solar, geothermal, hydroelectric resources. See Table 2.1 for specific potential by resource. Of these resources, solar energy, both concentrating and photovoltaic, represents the largest potential at 18,061,362 MW or 99 percent of all RE potential in the state (CEC, 2011c). The majority of this potential is located in southeastern California in the Mojave Desert and Central Valley areas. Figures 2.2 and 2.3 provide a visual of the areas of solar potential in the United States.

Trends in Solar Development in the State

As the RPS rises, solar energy will remain an important component for utility companies seeking to remain compliant due to the large growth potential for this resource in the state. Concentrating solar power (CSP) projects have historically dominated the utility scale solar developments proposed and approved in the state, but this may change as PV increases in efficiency and decreases in price (Dinçer, 2011; Jackson & Oliver, 2000). The CEC reviewed nine CSP projects in 2010 representing 4,180 MW of energy production and local California jurisdictions approved approximately 300 additional MW of PV projects (CEC, 2011a). Development will likely continue to increase based on the previous studies, indicating that RE will continue to make inroads on

energy generation (Baratta, 2011; Jacobson & Delucchi, 2011; Resch et al., 2008; Wiser, Barbose, & Holt, 2011)

Currently, solar projects are concentrated in the southeastern portion of the state, in and near the Mojave Desert, and with a cluster of projects in the Central Valley area. These areas are likely to remain the prime areas for solar power development due to the high amounts of solar radiation they receive. See Figure 2.5 for a map of current power plant locations from the CEC.

2.3 SOLAR TECHNOLOGIES

Utility scale solar developments are based on two main technologies: photovoltaic (PV) and concentrating solar power (CSP), also known as solar thermal. These two technologies differ in how they convert solar energy into electrical energy. PV directly changes solar energy to electricity within PV cells, while CSP uses the thermal energy from sunlight in a thermodynamic process for production of electricity (Azoumah, Rambe, Tapsoba, & Thiam, 2010). This difference leads to vastly different forms of infrastructure between the two technologies.

Table 2.1 California's Renewable Energy Potential (CEC, 2011c)

California's Renewable Energy Potential	
	Technical Potential (MW)
Biomass	3,820
Geothermal	4,825
Small Hydro	2,158
Solar (total)	
Concentrating Solar	1,061,362
Photovoltaic	17,000,000
Wave and Tidal	3,2763
Wind (total)	
On-shore	3,400
Off-shore	75,400
Total Technical Potential	18,183,728

Figure 2.3 Concentrating Solar Resource of the United States (NREL, 2010a)

Figure 2.4 Photovoltaic Solar Resource of the United States (NREL, 2010b)

Figure 2.5 Existing Renewable Facilities in California (CEC, 2011c, p. 40)

Photovoltaic Systems

PV systems are comprised of cells with light absorbing qualities that use solar radiation to produce free electrons that are used to create voltage (Hosenuzzaman et al., 2015). The generation capacity of a PV development is directly related to the efficiency of the PV cells, the design of the system, and the amount of solar radiation available (Chiabrando et al., 2009). There are two main types of cells, crystalline silicone and thin film, which can be further broken down into specific types (Hosenuzzaman et al., 2015). These cells are organized into modules, and the modules are arranged into arrays. The arrays are installed generally around one meter above ground on a flat site (Turney & Fthenakis, 2011). During operation, the cells are periodically cleaned to remove accumulated dust that can impair energy absorption. Cleaning is generally accomplished with water at a rate of approximately 500-1000 gallons per megawatt peak (MWp) of panels per year (Turney & Fthenakis, 2011). With large projects, this can lead to a significant water requirement. Figure 2.6 shows an example of a photovoltaic development.

Figure 2.6 Example of a photovoltaic development (SOLAREIS, 2015)

Historically, the main barriers to PV power plant development and construction were the efficiency and cost of the PV cells compared to other technologies. In recent years, the price for cells has fallen while the efficiency has increased, which may lead to an increase in proposed PV developments (Dinçer, 2011; Hosenuzzaman et al., 2015; Jackson & Oliver, 2000). However, the

PV supply chain remains complex, making clear cut predictions on the effect of price changes difficult to predict (Hosenuzzaman et al., 2015).

Concentrating Solar Power

CSP projects use mirrors to reflect light onto specialized receivers in order to heat the receiver to between 400-1000 degrees Celsius (Desideri, Zepparelli, Morettini, & Garroni, 2013). Solar thermal systems “consist of a large reflective surface collecting the incoming solar radiation and concentrating it onto a solar receiver with a small aperture area” (Romero & González-Aguilar, 2014, p. 43). Reflectors are curved around one axis where the solar beams are focused to transfer heat to a fluid (Mills, 2004).

Figure 2.7 Example of a CSP development (Mingasson, 2015)

The majority of projects are designed using parabolic trough technology in which parabolic mirrors arranged in arrays around the receiver or the power tower design where sun tracking reflectors (heliostats) focus light on the main tower. In both technologies, the reflectors heat the fluid, generally water, synthetic oil, or a molten salt, in the receiver (Desideri et al., 2013). In designs using oil and salt, the heat from these liquids is used to create steam. In the receivers where the liquid is water, the steam is generated directly. The steam is then used to turn a

turbine generator to produce electricity (Desideri et al., 2013). The arrays are installed above the ground on a flat site. The receiver, depending on site conditions, may be in the center of the mirror field or simply the focus point of the mirrors. The receiver itself is generally a tower several hundred feet tall either centered in the field of arrays or at the reflection's focal point. The water requirements for CSP projects can be significant since, in addition to the water used to clean the mirrors, the towers require water to generate steam. The amount of water required can range between 1,500-3,000 L/MW per hour. See Figure 2.7 for an example of a CSP development.

2.4 LANDSCAPE IMPACTS

Locating a site for a renewable energy facility, particularly large scale wind or solar power plants, cannot be regarded as a simple geographic exercise due to the impacts on the surrounding landscape (Chiabrande et al., 2009). Impacts include visual intrusion, plant degradation, ecosystem disruption, loss of arable land, land use change, and glare (Chiabrande et al., 2009; Tsoutsos, Frantzeskaki, & Gekas, 2005; Turney & Fthenakis, 2011). While authors note that the impacts for wind facilities exceed that of both CSP and PV installations due to the large size and inability to effectively mitigate the visual effects of the large turbines, both CSP and PV have significant consequences on the local environment (Hunold & Leitner, 2011; Tsoutsos et al., 2005; Turney & Fthenakis, 2011).

PV and CSP technologies impact the local landscape in distinct ways due to their differing infrastructure requirements. In PV systems, the specific impacts are to land use due to the large area required for systems. These include a reduction of arable land, reduced visual aesthetics, ecosystem disruption, and health impacts (Tsoutsos et al., 2005). For CSP systems, land use, visual impacts, ecosystem disruption, particularly of birds, as well as water usage and contamination are the main changes caused by these facilities (Tsoutsos et al., 2005). It is noted, however, that the negative effects of CSP and PV plants could be minimized through proper siting and design (Tsoutsos et al., 2005).

In California, the landscape impacts of these projects is compounded by the rural and undeveloped nature of land suitable for solar developments, including portions of the Central

Valley and the Mojave Desert, which are considered some of the best locations for solar energy developments in the world (Hunold & Leitner, 2011). These areas have relatively low density of development, sensitive ecosystems, and small local water supplies, making it vital to properly site and design any proposed project. Of particular concern in the Mojave are endangered species such as the desert tortoise and the Mohave ground squirrel. It is unclear whether mitigation is effective for protecting these species or reducing human opposition in the case of large projects (Hunold & Leitner, 2011).

2.5 PUBLIC ACCEPTANCE OF UTILITY SCALE SOLAR ENERGY

While there appears to be a high level of support for renewable energy development in the abstract on a local level, the public often voices swift and strong opposition to individual projects (Swofford & Slattery, 2010). Those in opposition are often labeled as NIMBYist (Not in My Back Yard) and dismissed from the discussion and decision making process (K. Burningham, J. Barnett, & D. Thrush, 2006; Devine-Wright, 2011). NIMBY refers to those who contest locally unwanted land uses such as power plants, sewage plants, and similar based on their desire to avoid negative impacts to their home ground. This label is logical to describe attitudes of resistance to local projects, but supportive of the abstract ideal.

However, several authors have noted that this is an overly simplistic label to apply to opposition to renewable energy siting and that often detractors have legitimate concerns about project effects (Devine-Wright, 2011). Burningham, Barnett, and Thrush (2006, p. 7) note that while “opposition to proposed land uses is often crudely summarized as selfish or ignorant NIMBYism, empirical studies of the reasons people give for their opposition to proposed land uses tend to reveal a wide range of motivations and explanations for opposition which cannot be adequately characterized in this way”. These authors go on to further state that the perception of NIMBYism may be a result of the structure of the participation and decision making process (K. Burningham et al., 2006).

Burningham, Barnett, and Thrush also note that other authors argue that perceived NIMBYism can also stem from those in opposition questioning whether the proposed solution is

the appropriate or best alternative to achieve the desired result (K. Burningham et al., 2006). In the case of renewable energy development, they attempt to frame NIMBYism as the solution to the energy industry conducting business as usual in the face of scarcity and expense of energy resources. The authors note that alternative solutions include energy conservation measures, but that this may “challenge industrial profits and even the existence of particular industries” (K. Burningham et al., 2006, p. 11). However, the authors also point out that this argument is weakened by the role that consumer choice affects continuing industrial production patterns (K. Burningham et al., 2006).

While wind developments have been widely studied in terms of public opinion (Jobert, Laborgne, & Mimler, 2007; Phadke, 2011), research studies of public response to solar developments are scarce and mostly focus on the European experience with these technologies (Fleishman, De Bruin, & Morgan, 2010; Simon, 2009). This is perhaps due to the relative recent development of large utility scale PV and CSP developments or because these projects are perceived to have fewer impacts on the landscape than wind turbines. While academic papers are rare, the news media has documented both the opposition to and the potential support for these projects, particularly in California (Anonymous, 2007; The Vote Solar Initiative, 2009; Zweibel, Mason, & Fthenakis, 2008)

Utility scale solar developments, defined for this study as those with a generation capacity of greater or equal to 50 mega watts of power, have faced stiff public opposition within the state of California (Groom & Chan, 2011; Hunold & Leitner, 2011; P. Maloney, 2008; Roth, 2014; Woody, 2012). Peter Maloney, writing for the New York Times, described the resistance to large solar developments among southern California desert residents. He noted that resident opposition may stem from a wide range of sources including potential environmental effects, the large number of proposed projects, the perception of the desert as a lifeless landscape, and environmental justice concerns (P. Maloney, 2008).

A common thread in the opposition is support for renewable energy development but only in those locations needing the energy (P. Maloney, 2008). Residents perceive that the same results, solar energy production, could just as easily be reached through large rooftop solar

installations rather than through ecosystem damaging desert installations (P. Maloney, 2008). This seems to support the assertion that Burningham, Barnett, and Thrush dismissed in their 2006 article: that some NIMBY attitudes may simply reflect concerns about the solution to a perceived societal problem, rather than the characterized knee jerk reaction.

Despite the clear media documentation of opposition, there may be an argument to be made that resistance to these projects is not as strong as it may appear in print (The Vote Solar Initiative, 2012). A study by Vote Solar, a non-profit solar advocacy group, polled southern California residents and found that “nearly four out of five citizens polled believe that the California desert is a great resource and should be used to develop solar projects” (The Vote Solar Initiative, 2012). However, as described by research on wind developments, general voiced support for development of a renewable energy facility does not preclude strong opposition to a specific project (K. Burningham et al., 2006; Devine-Wright, 2011; Phadke, 2011; Swofford & Slattery, 2010).

2.6 FACTORS FOR SUCCESSFUL DEVELOPMENT

Multiple barriers to solar project development exist including socio-political, market, and community based challenges (Wüstenhagen, Wolsink, & Bürer, 2007). Authors have sought to determine the factors that cause certain RE projects to succeed through the planning and development process while other projects fail to reach operation (Anderson, Schirmer, & Abjorensen, 2011; Besley, 2010; K Burningham, J Barnett, & D Thrush, 2006; Devine-Wright, 2007, 2011; Dütschke, 2011; Eltham, Harrison, & Allen, 2008; Kontogianni, Tourkolias, Skourtos, & Damigos, 2014; Nadaï & van der Horst, 2010; Wolsink, 2000; Zoellner, Schweizer-Ries, & Wemheuer, 2008). There has been research done on the range of RE technologies and, while there are unique issues to each technology, there are commonalities in terms of successful projects. These can be divided into financial, governmental, and public factors.

Financial Factors

For any development to be successful, the project must have a positive financial outlook, which for RE projects is difficult since traditionally they have been less viable than traditional energy sources (Timilsina et al., 2012). Financial barriers that can impact Californian RE development include missing market infrastructure, high investment requirements, economic viability of technology, lack of access to credit, high up-front capital costs for investors, and lack of financial institutions to support RE developments (Carlisle et al., 2015; Painuly, 2001). To overcome these issues, government policies, such as financial incentives, are required to increase the viability of RE relative to traditional power sources and guarantee markets through policies like the Renewable Portfolio Standard (RPS) to provide insurance for investors (Painuly, 2001). Both California and the United States have passed policies in line with these guidelines (Del Chiaro & Gibson, 2010). These actions, according to research, should lead to a “robust, self-sufficient solar market” and provide projects the backing to succeed financially (Del Chiaro & Gibson, 2010).

Governmental Factors

Governmental actions, policies, and procedures have a definite effect on RE development (Del Chiaro & Gibson, 2010; Doris, Busche, Hockett, & Loring, 2009; Taylor, 2008; Wiser et al., 2011). However, three government factors stand out in the research for successful projects: streamlined regulations, efficient development and approval process, and transparency (Martin & Rice, 2015; Zoellner et al., 2008). Streamlined regulations and an efficient process both serve to improve project viability by reducing the time a project is in development which decreases costs and uncertainty (Martin & Rice, 2015; Painuly, 2001). Transparency, both in requirements, approvals, and information, serves to encourage public trust in the project (Carlisle et al., 2015; Zoellner et al., 2008). In California, the extent that these factors are met varies greatly across jurisdictions and from project to project. The California planning processes are detailed below.

Public Factors

Despite the public acceptance and approval of RE projects in general, there is often opposition to specific projects. This “social gap” has been a significant area of research as early projects failed to take this dichotomy into account, often leading to failure ((Bell et al., 2005; van der Horst, 2007). Five primary public factors for successful projects can be identified from this research: public involvement in a fair process, a sensitivity to visual impacts, an awareness of place attachment, and a focus on the positive community impacts (Carlisle et al., 2015; Cowell, Bristow, & Munday, 2011; Devine-Wright, 2007; Kontogianni et al., 2014; Wolsink, 2000; Wüstenhagen et al., 2007; Zoellner et al., 2008). While it is often easy to dismiss public concerns such as NIMBYism, there are often valid reasons for local opposition to a proposed project (Bell et al., 2005; Devine-Wright, 2007; van der Horst, 2007). Taking into account public viewpoints, including concerns on changes to the landscape and the sense of place, in a process that allows these ideas to influence project outcome greatly improve the chance of success (Carlisle et al., 2015). A focus on the economic benefits, added jobs, increase in revenue, and other positive factors for the local community will also endear the project to the community (Carlisle et al., 2015).

2.7 SOLAR POWER PLANT PUBLIC PLANNING APPROVAL PROCESS

In the state of California, jurisdiction over a solar power plant is determined by the size and type of technology proposed in the development. CSP plants over 50 MW in size are subject to CEC and the United States Bureau of Land Management (BLM) review. To streamline the process, these two agencies have entered a Memorandum of Understanding that outlines a joint process for these projects to follow (CEC, 2007). Photovoltaic projects, regardless of size, are subject to the planning agency with jurisdiction over the proposed development site. Generally based on the rural nature of the proposed sites, this will be a California county jurisdiction. In all cases, once the project is approved it may still be subject to litigation due to environmental concerns or other actionable issues.

California Energy Commission Process

The CEC public planning and siting process is the application for certification that is equivalent to and replaces the CEQA review process for CSP projects greater than 50 MW (CEC, 2000). The application process is generally the same for both traditional power plants and RE projects, though there is a fast track process for CSP projects. The process is designed to take six to 18 months from when the CEC deems the application complete and allows for public participation through a formalized process (CEC, 2000). The process, according to the CEC, is designed to “provide a consolidated state permit, an established timeline, an open process, and legally sound decisions” (CEC, 2006, p. 11).

The public is invited to participate either informally or formally in the CEC process. Informal participants may attend public meetings and comment on the project either orally at the meetings or in writing. However, comments cannot alone support a decision or a finding by the CEC Commissioners. Formal participation requires an application to intervene in the siting process. Interveners can be agencies, organizations, or members of the general public. If the application is granted, interveners become full parties to the process with equal rights and obligations to other parties such as the applicant and CEC staff (CEC, 2006). Interveners can provide testimony that unlike commentary can be used as a basis for a CEC decision. They can also cross-examine witnesses, place requests for information, and receive all documents (CEC, 2006). However, they are also subject to the same rules including Ex Parte communication rules and must send copies of filings to all other participants and answer data requests (CEC, 2006). Petitions for intervention must be submitted before the first pre-hearing conference, though it is recommended to apply as early as possible.

The fast track process for CSP projects is similar to the Small Power Plant Exemption (SPPE) process and is expected to take approximately twelve months compared to 12-18 for a normal CEC siting process (See Figure 2.8 for the SPPE process; CEC, 2006). It is comprised of six phases: pre-filing, filing, discovery, analysis, hearing, and decision. The fast track process does not remove any procedural requirements from the process but simply expedites the phases (CEC, 2006). The public is primarily involved in the discovery, analysis, and hearing phases,

though may also be involved in the pre-filing phase if there are public workshops. The Energy Commissioners make the final determination on project approval based on the formal testimony and data for the project, and construction on the project must commence within 12 months of approval (CEC, 2006).

<u>SMALL POWER PLANT EXEMPTION (SPPE)</u>					
PURPOSE:	EXEMPT FROM STATE'S POWER PLANT SITING PROCESS				
QUALIFYING PROJECT:	ANY THERMAL POWER PLANT 50 - 100 MW				
QUALIFYING CRITERIA:	1. NO SUBSTANTIAL ADVERSE ENVIRONMENTAL IMPACT 2. NOT SIGNIFICANTLY IN EXCESS OF THE DEMAND FORECAST				
TYPICAL TIME:	SIX MONTHS				
PHASE:	PREFILING	DISCOVERY	ANALYSIS	HEARING	DECISION
TIME (MONTHS):	0	2	4	5	6
ACTIVITY/PRODUCTS:	☐ WORKSHOPS	☐ WORKSHOPS ☐ DATA REQUEST ☐ INFORMATION HEARING ☐ SITE VISIT	☐ STAFF ANALYSIS ☐ WORKSHOPS ☐ INITIAL STUDY	☐ HEARINGS	☐ PROPOSED DECISION ☐ DECISION

Figure 2.8 California Energy Commission Small Power Plant Exemption Process (CEC, 2006, p. 17)

Public participation in the county planning process is less formalized than in the CEC process. Interested community members can attend and speak in public meetings and workshops as well as provide commentary on draft documents. There is no distinction between testimony and commentary as in the CEC process and there is no restriction on the use of public comments. Public comments should be documented and addressed in the final EIR document.

As there is no standard process from county to county, the timeframe for approval can vary greatly based on procedure as well as political interest. One of the main factors in determining process length and cost is whether the project will need to complete an EIR. The public process begins with a permit application to the appropriate jurisdiction's planning department. If the project does not require an EIR due to either a negative declaration or a

mitigated negative declaration, the project moves onto an administrative approval process such as the planning commission or board of supervisors. See Figure 2.9 for a sample county planning process.

Otherwise, a notice of preparation (NOP) for a draft EIR is released and is followed by a public comment period. This notice may be released at the same time as the initial application was filed or later if the determination for environmental review did not occur prior to filing. After comments are collected and reviewed, the draft EIR is completed. This may include public meetings and workshops. Once completed, the draft is submitted for public comments and then these are reviewed and answered. The draft, comments and revisions are reviewed and, if approved, the project moves onto the planning approval process including public hearings and workshops. If the planning authorities approve the project, construction must start before the permit expires which varies from county to county. See Figure 2.10 for an example of the EIR approval process.

Figure 2.9 Sample County Planning Process Adapted from Riverside County Development Process (Riverside County Planning Department, 2015)

Figure 2.10 Sample EIR Process Adapted from San Diego County EIR Flowchart (County of San Diego Department of Planning and Land Use Regulatory Planning Division, 2003)

CHAPTER 3: METHODOLOGY

3.1 PROJECT RATIONAL

Within the state of California, there are two main planning processes a utility scale solar project may be subject to depending on technology type and location: California Energy Commission (CEC) application for certification or local county planning approval. Utility scale solar projects are defined for this discussion as those with a proposed generation capacity of 50 MW or greater. The CEC holds jurisdiction over concentrating solar thermal (CSP) projects with of 50 MW or greater capacity, which is the basis for the definition of utility scale solar for this paper (CEC, 2007). Photovoltaic (PV) projects are subject to the local county planning approval process. To date, there has been no comparative analysis published on these two different processes. This may be due to the lack of sufficient data in a usable format or it not being aggregated in a single database. The objective of this project is to provide a database with that information and to provide some initial qualitative analysis of the data.

Prior to this project, no comprehensive list of utility scale solar projects in the State of California was compiled. Partial or specialized lists exist, developed primarily by government agencies tracking their own, or related, projects or industry associations. The CEC and the Solar Energy Industries Association (SEIA) maintain the two primary databases found during research for this project. However, these lists have limitations that make them unsuitable for research on the state of large-scale solar development in the state.

The currently available project databases suffer from several limitations including narrow focus, inaccessibility, or insufficient data. Many databases focus on a small subset of all the projects in the state. For example, the CEC database provides information only on projects within their jurisdiction, CSPs greater than 50 MW in size. Likewise, many local counties maintain databases of proposed projects in their area and potentially surrounding counties, but no data on projects across the state (County of San Bernardino Land Use Services and Planning Division, 2015; Kern County Planning Department, 2013). Other databases, such as the SEIA database, are inaccessible to the general public. Access to the SEIA database requires organization membership (SEIA, 2015). Many of the databases have insufficient data to provide a basis for

research analysis and are primarily a list of project names, acreage, capacity, and status (County of San Bernardino Land Use Services and Planning Division, 2015).

The CEC maintains a listing of all solar thermal projects that have started the application for certification process (CEC, 2012b). The list itself provides minimal data: project name, location, lead agency, size and technology, and status. Additional information is found through the links the list provides to the individual project application sites, where the documentation for the project application is stored. The project documentation includes all planning documents, responses from information requests from all official project participants, public comments, and transcripts of public meetings. However, the focus of this database is extremely narrow and unable to provide a complete understanding of solar development in the state due to the lack of inclusion of PV projects.

In comparison, the Solar Energy Industries Association, a US trade organization focused on the solar industry, has a frequently updated large list of projects that it develops based on “public announcements of solar projects in the form of company press releases, news releases, and, in some cases, conversations with individual developers” (SEIA, 2015). This list is more comprehensive in nature but is primarily made available only to SEIA members in a database format. A PDF is available on their website but limits the ability of the public to search and compile information in a usable format to look at projects only in their state or area. It may also miss projects that are not self-reported or widely publicized.

Other lists of projects exist in many other locations with varying coverage, updates, and focus. Local and county governments and planning departments often maintain lists of relevant projects to their jurisdictions (County of San Bernardino Land Use Services and Planning Division, 2015; Kern County Planning Department, 2013). Project proposals and environmental review documentation often include partial lists of projects that are either precedents or in nearby jurisdictions in order to explain project context or cumulative impact (“Desert Renewable Energy Conservation Plan Environmental Impact Report: Cumulative Impacts Analysis,” 2014; ESA, 2012). These lists focus on renewable energy or solar projects in a limited geographical scope and provide few details such as project name, size, or capacity. Lobbying and environmental

groups maintain or publish lists of projects of interest to their specific groups (SEIA, 2015). While these lists are useful for the organizations creating and publishing them, they are not good research tools for academics and planners looking for a broader picture of development.

3.2 COMPLICATIONS TO CREATING DATABASE

There were many complications to creating a comprehensive list of utility scale solar projects in California. These included fragmented data, lack of readily available information, unclear data, and out of date information. These issues often highlighted issues with the development process, such as litigation or politically controversial projects, but more than anything reinforced the need for a comprehensive database.

One complication was fragmented data. While there is a large amount of data available on projects, it is widely dispersed across multiple agencies, developers, and organizations. Many projects only appeared in one location or list, with no further information found after extensive searching. Fragmented data slowed compilation. Often many days were spent back tracking projects through web searches or determining that there was not sufficient data for inclusion on the final list for analysis. However, in most cases, the issue was finding the information in multiple locations and then creating a cohesive picture of the state of a project.

The lack of readily available information was often unavoidable. Many projects are still in between completion of the planning process and the start of construction. Others are in litigation, or became too controversial to continue. In some cases, information may be proprietary to the development company. Sometimes the most information that could be found on a controversial project was a series of continuations at Board hearings followed by nothing, leaving no indication whether the project was completely abandoned or on hold. Other projects were announced in an industry or newspaper article but never began the public process. The lack of conclusive data on unfinished projects complicates determining the factors in their failure.

In many cases, if the data was available, it was unclear. This, in particular, hampered determination of project ownership and project status. Determining absolute ownership was

often impossible due to subsidiary companies or company name changes. Likewise, project status was often obscured by not only a lack of updates but also by conflicting messages.

3.3 PRIMARY SOURCES

The initial basis for this thesis was the databases maintained by the CEC, the SEIA, and the California Renewable Energy Action Committee (REAT). Of the project lists found in the initial research stages, these were the most comprehensive and up to date.

The CEC database provided information only on solar thermal projects that were either in the process of certification or had attempted certification (CEC, 2014). This included projects that switched technologies either to or from solar thermal during their development process. Along with the list of projects, the CEC site also maintains a public database of all project documents for each application for certification, which provided many of the additional details for these projects.

The SEIA database is a nationwide database of projects developed from public announcements and interviews (SEIA, 2015). The searchable database is only available to SEIA members; however, there is a PDF version free to the public. For this research, the PDF was converted to an Excel format in order to facilitate separating the California projects from the rest of the nation. The information provided by the SEIA database is more limited in scope compared to the CEC database, requiring further project information to be gleaned from additional Internet searches.

The REAT database is second to the SEIA in creating a comprehensive list of non-solar thermal projects in the state (CEC, 2013). As with the SEIA list, it is constrained in the amount of information provided with only the project name, county, developer, size, and technology type listed. More in-depth research was required for a full profile of the named projects.

3.4 DATABASE TOPICS

Determination of which subjects to compile in the database was an important facet of this research. There are limitless topics that could provide interesting and relevant results to understanding how projects of this nature are developed in California. However, due to time and

data limitations the topics and subjects needed to be restricted. Database topics and subjects were chosen based on general project characteristics, factors relevant to the California Renewable Portfolio Standard (RPS), from a literature review of factors influencing project acceptance and approval, and topics related to public approval process.

Base Topics

The base database topics were chosen primarily from general project characteristics. The base topics are project name, ownership, and power purchaser agreement. These factors represent the basic facts for each project, though not every project is expected to have a power purchase agreement. Table 3.1 provides the rational for choosing each base topic and Appendix A shows the base topics database.

Table 3.1 Rational for Base Topics

Rational for Base Topics	
Project Name	General Characteristic
Ownership	General Characteristic Literature Review
Transfer of Ownership	General Characteristic
Power Purchaser	RPS Interest
Project Status	General Characteristic

Projects are identified by their project names in most planning review and public hearing documentation. In the case of a name change, it was important to identify both the original and the final names to compile all project information. Name changes may reflect changes in technology or an attempt to rebrand a project after ownership change or controversy.

Project ownership and transfer of ownership may play an important role in project trajectory as each company has a differing technology focus as well as relationships with the public which was found in the literature to be an important factor in public acceptance for individual projects (Carlisle et al., 2015; Cowell et al., 2011; Devine-Wright, 2007; Kontogianni et

al., 2014; Wolsink, 2000; Wüstenhagen et al., 2007; Zoellner et al., 2008). The ownership of most projects is extremely fluid as one company may be responsible for handling the approval process, another for the construction, and another for the operation. Ownership may also be confused by the use of subsidiary companies under the heading of a larger corporation. Ownership information was found either through planning documentation or newspaper and industry articles.

Power purchase agreements are contracts between an electricity generator and a buyer, generally a utility company. They are not a required component of the planning process for solar projects but play an important role for utility companies seeking RPS compliance. By contracting with renewable energy (RE) companies who are developing these projects, the utility companies are able to increase the proportion of RE energy in their portfolio. Planning documentation, newspaper or industry articles, or publicly available contracts were the source for power purchase agreement details.

Project status provides a snapshot of the current state of the proposed project. For the purposes of this project, there are eight potential statuses: canceled, in litigation, on hold, operating, under construction, under development, under review, and under revision. The definition for each status is listed in Table 3.2. It is often difficult to determine when a project has been canceled, as many projects never finish the approval process and simply linger in the review process. These projects are listed in this database as in review, though they may be functionally canceled. Status information was determined through a variety of sources including planning commission meeting minutes, CEC notifications, and newspaper and industry articles.

Location Topics

Location plays an important role in any development and an even larger role in RE and solar developments. Multiple authors note that the RE developments are limited in location based on the availability of RE resources on the project site (Baratta, 2011; Gatrell & Jensen, 2009; Pimentel et al., 2002; Resch et al., 2008). Project concentration in or near a location may also affect public acceptance for a new project, particularly if the local residents will not receive

the benefits of the development (P. Maloney, 2008). Location information was found in the environmental review documents, or requests for zoning changes. Table 3.3 lists the location topics and their rational and Appendix B provides the location topics database.

Technology Topics

The technology topics were chosen primarily due to their effect on the public approval process and as general project characteristics. However, they are also supported by research on public acceptance for RE projects. The factors are original and current project technologies, switch from CSP/PV, and generation capacity. Table 3.4 provides the rational source for the technology topics and Appendix C shows the technology topics database.

Table 3.2 Project Status Definitions

Project Status Definitions	
Canceled	Project canceled
In Litigation	Project in litigation
On Hold	Project is on hold (CEC status)
Operating	Fully constructed and operating
Under Construction	Active construction
Under Development	Prior to public review process
Under Review	In public review process
Under Revision	Under going revision in review

Table 3.3 Rational for Location Topics

Rational for Location Topics	
County	General Characteristic Literature Review
Nearest City	General Characteristic Literature Review

Table 3.4 Rational for Technology Database Topics

Rational for Technology Database Topics	
Original Technology	Public Approval Literature Review
Current Technology	Public Approval Literature Review
Switch from PV/CSP	Public Approval Literature Review
Generation Capacity	General Characteristic RPS Interest

*PV: Photovoltaic

*CSP: Concentrating Solar Power

The choice of CSP and PV technology determines the public approval process, generation capacity, and the potential public acceptance of a project. In California, the jurisdiction for the public planning approval process for a utility scale solar project is determined first by technology type, then by location. If a project uses CSP technology, it falls under CEC jurisdiction. If a project is proposed using PV technology, the project is subject the county planning process where the proposed site is located. The visual and environmental impacts of these technologies differ greatly as well, potentially affecting public opposition to an individual project (Tsoutsos et al., 2005).

Projects that switch technologies during the approval process face a longer approval process due to the change in jurisdiction. Increased process time was recognized as a potential factor in projects failing to reach completion during the literature review and is an important factor to consider in these cases (Martin & Rice, 2015; Painuly, 2001). Technology information was found in project documentation or industry notices.

Generation capacity is both a general project characteristic, indicated by its inclusion on most project lists found during initial research, RPS requirements, and based on research on project acceptance. Generation capacity is affected by the technology of the project, the solar radiation received in the area, and project size. Larger projects generate more power and require substantial amounts of land. The landscape change required by these projects is noted as a factor affecting opposition to a project (Chiabrando et al., 2009; Tsoutsos et al., 2005; Turney & Fthenakis, 2011). Additionally, generation capacity is of interest to the RPS in order to meet the

33%-50% RE generation required by the statute. Generation capacity was primarily found in planning documents or in project news releases.

Land Use Topics

Land use topics focus on the original site characteristics and the size of the proposed development. These represent both basic project characteristics, particularly in terms of site size, as well as recognized factors in the literature for acceptance. Table 3.5 lists the land use topics, definitions, and rational for their inclusion while Appendix D provides the database for the land use topics.

The size of the solar projects examined in this project requires significant investments of land area ranging from hundreds to thousands of acres. Increasing the size of the project may have a negative effect on public support due to an increase in environmental, visual, and cultural impacts (Chiabrando et al., 2009). Project size was found in environmental review documentation, zoning requests, or news releases.

Table 3.5 Rational for Land Use Topics

Definitions and Rational for Land Use Topics		
	Definition	Rational
Land Ownership	Public or Private Land	Literature Review
Original Land Use	Original Site Zoning	Literature Review
Total Site Acreage	Entire Project Site	General Characteristic Literature Review
Developed Site Acreage	Developed Site	General Characteristic Literature Review

Jurisdiction Topics

Utility scale solar projects are not subject to a uniform planning process in the state of California. It is therefore important to examine how the success of the projects is determined by jurisdiction. Jurisdiction is determined by the technology of the project followed by the location of the project. CSP proposals greater than 50 MW in size fall under the CEC certification process

while PV projects are subject to the site's local county planning process. Besley (2010) notes the importance of a fair and involved planning process to public acceptance of individual projects. Table 3.6 lists the jurisdiction topics and rational while Appendix E provides the jurisdiction topics database.

Table 3.6 Rational for Jurisdiction Topics

Rational for Jurisdiction Topics	
Jurisdiction at Initiation	Public Approval
Current Jurisdiction	Public Approval

Process Topics

Process topics focus primarily on the planning documentation the project was required to complete. In the case of the CEC process, all projects are subject to the same steps and requirements including a full environmental review process. The county process is much more variable as the California Environmental Quality Act (CEQA) allows jurisdictions leeway in determining the amount of environmental review a project is subject to. A county may require the completion of an initial study and environmental impact report (EIR) or move directly into the EIR. Local agencies may also allow projects to complete a shorter process through the use of a mitigated negative declaration. As large-scale solar projects can create massive landscape and environmental change on the development site, understanding how the environmental review process has been applied to the projects may provide insight on both approval and completion of construction (Chiabrande et al., 2009; Webler & Tuler, 2000). Table 3.7 shows the rational for the process topics and Appendix E has the database for process topics.

An initial study provides a method to determine whether a project will need a full environmental impact report. It is not required to be completed and, often in the case of large projects, is skipped in favor of starting a full EIR. In cases where a full EIR is not required, the initial study process may be the best chance for public involvement in the project beyond appearing at planning commission meetings. In the case of CEC projects, the process requires a

full EIR; therefore an initial study is not necessary. Initial study information was found through public notices and planning documentation.

Table 3.7 Rational for Process Topics

Rational for Process Topics	
CEQA/NEPA Initial Study Completed	Public Approval
EIS/EIR Required	Public Approval Literature Review
Negative Declaration	Public Approval Literature Review
Approval Status	General Characteristic

The EIR process is an in-depth look at the impacts a project may have on the surrounding environment including visual, environmental, plus air and water quality. It involves significant public involvement and review. As public involvement has been shown to improve the public acceptance of projects, the requirement to complete an EIR may improve project success (Gross, 2007; Webler & Tuler, 2000). However, the EIR process is considered to be an expensive and uncertain process for developers, which may hinder project proposals (Barbour & Teitz, 2005; Olshansky, 1996). EIR data was found through public notices and planning documentation.

Mitigated negative declarations are often used as a streamlined environmental review process by local jurisdictions due to their lower cost and shorter public involvement (Barbour & Teitz, 2005). However, these may be subject to litigation if substantial evidence is found that the declaration was issued arbitrarily and capriciously (Varner, 1991). As noted previously, project acceptance is also predicated on a publically perceived fair and open process which may be adversely affected by the quick timeframe of the mitigated negative declaration process (Gross, 2007; Webler & Tuler, 2000). Negative declaration information was found through public notifications and planning documentation.

Approval status describes the current status of the project in the public review process. For this project, there are four potential statuses: in process, no, yes, and unknown. The definition for each status is found in Table 3.8. The approval status for projects was found through planning documentation, planning commission meeting minutes, and newspaper articles.

Table 3.8 Approval Status Definitions

Approval Status Definitions	
In Process	In the Review Process
No	Project Not Approved
Yes	Project Approved
Unknown	Unknown, Process Not Started

Process Time Topics

Process time is often cited as a negative to project completion by developers and industrial advocates while the public may appreciate longer processes (Barbour & Teitz, 2005; Hall, Ashworth, & Devine-Wright, 2013; Martin & Rice, 2015). In order to compare time spent in the public review process, dates were chosen from the initial public review meeting based on the determined public process. The first notice of preparation or initial public notice was chosen as the initial start date for the public process time. The approval or disapproval of the highest review committee such as the planning commission or the county board of supervisors determined the public review end point. This may not truly be the end of the public process due to litigation and appeals but it serves as the end of the general planning process. The dates were found in planning documents or through newspaper articles on the status of a project. Table 3.9 provides the process time topics and rational and Appendix F has the data for the process time topics.

Table 3.9 Rational for Process Time

Rational for Process Time Topics	
Public Process Used for Dates	General Characteristic Public Approval
Total Process Time	Public Approval, Literature Review
Public Review Start	General Characteristic
Public Review End	General Characteristic

Construction Topics

Project approval is the first step in creating a fully functioning solar power plant. After approval, a project must start construction before the approval expires after facing potential protests and litigation. Due to the complexities of completing a project, the construction data is the least complete section of the database. It is an attempt to understand how many of the proposed projects have begun or completed construction. Completed projects are of particular interest when viewed through the RPS as they increase the RE capacity in the state. This data was the most difficult to find with the primary sources being newspaper or industry news releases. Most projects either had no information on construction status or have not begun construction. Table 3.10 shows the construction topics and rational and Appendix G has the construction topics database.

3.5 CRITERIA FOR DATABASE INCLUSION

Due to the complications in creating the database, not every project found was included in the final database. To be included, a project needed to have more than the base data of project name, owner, and location. Projects were not required to have started the public process but there needed to be sufficient documentation to determine technology, generation capacity, jurisdiction, and site size.

Table 3.10 Rational for Construction Topics

Rational for Construction Topics	
Construction Start	General Characteristic, RPS Interest
Estimated Online Date	General Characteristic, RPS Interest
Online Status	General Characteristic, RPS Interest
Online Start Date	General Characteristic
Complete Online Date	General Characteristic, RPS Interest

CHAPTER 4: ANALYSIS

Prior to this research, no comprehensive database of large-scale solar projects existed for the state of California. There was also little to no published qualitative research completed on comparing the California Energy Commission (CEC) application for certification process and the local county planning processes. Analysis of the final database was conducted to determine the current state of utility scale solar project development in the state, while also comparing project details for CEC and county projects. Additional analysis was completed to identify trends in California solar development to determine how the industry is changing over time.

4.1 BASIC PROJECT NUMBERS

The final database includes a total of ninety-five total projects. Eighty projects had sufficient data for analysis. Eighteen of these projects were proposed as solar thermal, and sixty-one were proposed as photovoltaic systems. Five projects switched from solar thermal (CSP) to photovoltaic (PV) technology during the planning process. The public process environmental review process is complete for forty-eight projects, with forty-six receiving approval. Eighteen projects started construction, and six projects are complete. See Table 4.1 for list of basic project numbers and Figure 4.1 for a view of number of projects by county.

In terms of original jurisdiction, 56 projects were under local county planning control, the CEC had sole jurisdiction in 13 projects, 3 projects were joint between the CEC and the BLM, and the rest of the projects were either under state control prior to the CEC process or solely in federal jurisdiction. See Table 4.2 for listing of original jurisdictions. Because 5 projects switched from solar thermal to photovoltaic (PV) technology during the planning process, the CEC has only eight projects remaining under its jurisdiction. The five projects that switched to PV moved to local county control for final public approval. See Table 4.2 for listing of current jurisdiction numbers. Figure 4.2 provides a visual comparison of the jurisdiction project numbers.

Table 4.1 Project Numbers

Project Numbers	
Total Number of Projects	80
Projects Proposed as Concentrating Solar Thermal (CSP)	19
Projects Proposed as Photovoltaic (PV)	61
Number of Projects Switched from CSP to PV	5
Number of Projects with Complete Public Process	48
Number of Approved Projects	46
Number of Projects with Construction Starts	18
Number of Online Projects	6

*CSP: Concentrating Solar Power

*PV: Photovoltaic

Figure 4.1 Total Projects by Count

Table 4.2 Projects by Jurisdiction

Projects by Jurisdiction		
	Original	Current
Army	1	1
Bureau of Land Management (BLM)	5	7
California Energy Commission (CEC)	13	8
CEC and BLM	3	3
County	56	59
State	2	2
Grand Total	80	80

*BLM: Bureau of Land Management

*CEC: California Energy Commission

Figure 4.2 Projects by Jurisdiction

Table 4.3 Projects by Project Status

Projects by Project Status			
	Total	County Jurisdiction	CEC Jurisdiction
Operating	10	7	1
Under Construction	8	6	2
Canceled	5	2	3
In Litigation	1	1	0
Under Revision	2	0	2
Under Review	22	18	1
On Hold	6	1	3
Under Development	26	21	4
Grand Total	80	56	16

*CEC: California Energy Commission

Of the eighty projects, ten projects are in the operation phase either fully completed or partially complete and eight are under construction. Five projects have been canceled and at least one project is in litigation. There are two projects under revision, twenty-two in planning review, and six on hold during the planning process. Twenty-six are in development prior to entering the public review process. See Table 4.3 for project status numbers and Table 4.4 for operational status.

Table 4.4 Projects by Operational Status

Projects by Operational Status			
	Total	County Jurisdiction	CEC Jurisdiction
No	70	50	15
Partial	4	3	1
Yes	6	4	0
Grand Total	80	57	16

*CEC: California Energy Commission

As noted previously, forty-seven projects received approval during the planning process. Only three projects were denied approval, one project was canceled, and four projects are on hold. Twenty-two projects remain in process. In process projects may or may not ever complete the planning process and, in some cases, may represent a passive denial of approval. See Table 4.5 for the approval status numbers.

Table 4.5 Projects by Approval Status

Projects by Approval Status			
	Total	County Jurisdiction	CEC Jurisdiction
Approved	47	34	9
Denied	3	0	4
Canceled	1	0	0
In Process	22	21	1
On Hold	4	0	2
Unknown	3	1	0
Grand Total	80	56	16

*CEC: California Energy Commission

Forty-five projects had a designated power purchase agreement. The projects with an agreement are split fairly evenly between Pacific Gas and Electric, San Diego Gas and Electric, and Southern California Edison. The US Army and the Los Angeles Department of Power and Water each have one known agreement each. See Table 4.6 for power purchaser numbers.

Table 4.6 Projects by Power Purchaser

Projects by Power Purchaser			
	Total	County Jurisdiction	CEC Jurisdiction
Los Angeles Department of Power & Water	1	0	1
Pacific Gas & Electric	18	14	5
San Diego Gas & Electric	13	12	1
Southern California Edison	12	6	4
U.S. Army	1	0	0
(blank)	35	24	5
Grand Total	80	56	16

*CEC: California Energy Commission

The total proposed site area for all projects encompasses 197,179 acres or approximately 308 square miles, while the developed site (land disturbed for project development) area for all projects is 175,350 acres or approximately 273 square miles. For projects within the county jurisdiction, the total proposed site area is 120,771 acres with 105,384 acres for development. CEC jurisdiction projects comprise a proposed total area of 70,202 acres and 59,128 acres developed. See Table 4.7 for site acreage numbers

The average project size varies greatly between the county and CEC jurisdictions. The overall average total project area is 2,528 acres for all projects, 2,965 acres for county projects, and 4,388 acres for CEC projects. The average developed site land area is 2,248 acres across the entire database, 2,361 acres for county specific projects, and the CEC projects have an average size of 2,942 acres. See Table 4.7 for average and median site acreage numbers and Figure 4.3 for a visual comparison of average and median site sizes by jurisdiction.

Table 4.7 Site Acreage

Site Acreage			
	Total	County Jurisdiction	CEC Jurisdiction
Total Proposed Site	197179	120771	70202
Total Proposed Developed Site	175350	105384	59128
Average Total Site Proposal	2528	2965	4388
Average Developed Site Proposal	2248	2361	3942
Median Total Site Proposal	1367	1100	3362
Median Developed Site Proposal	1140	1002	3324

*CEC: California Energy Commission

*CEC: California Energy Commission

Figure 4.3 Average and Median Proposed Total and Developed Site Acreage

The majority of the proposed project land is zoned for agricultural uses or managed by the BLM. There are small amounts of land that were previously zoned for landfill, military and residential uses. County projects primarily were proposed on agricultural land while due to the nature of the CEC jurisdiction the majority of the original land use for their jurisdiction's proposed projects was BLM land. See Table 4.8 for the total site acreage by original land use numbers, and Figure 4.4 for graphic illustration of site acreage by original land use.

Table 4.8 Total Site Acreage by Original Land Use

Total Site Acreage by Original Land Use			
	Total	County Jurisdiction	CEC Jurisdiction
Agriculture	119215	141925	11764
BLM	68753	8230	55114
Landfill	1687	1687	0
Military	3324	0	3324
Residential	3200	6400	0
Unknown	1000	0	0
Grand Total	197179	158242	70202

*BLM: Bureau of Land Management

*BLM: Bureau of Land Management

Figure 4.4 All Projects: Total Proposed Site Acreage by Land Use

The proposed generation capacity of all projects in this study is 23,313 MW, with projects in county jurisdiction contributing 17,555 MW, and 7,225 MW for CEC projects. The average generation capacity is 291.41 MW for all projects, 307.98 MW for county projects, and 451.56 MW for CEC projects. In comparison, the median proposed generation capacities are 160 MW for all projects, 150 MW for county jurisdiction, and 493 MW for CEC jurisdiction. The variance between the average and median values for the county projects is likely due to several very large proposed county projects, while the slight difference in CEC average and median proposed generation capacity could be attributed to the low sample size for these projects. See Table 4.9 for details on the proposed generation capacity based on jurisdiction.

Table 4.9 Proposed Generation Capacity (MW)

Proposed Generation Capacity (MW)			
	Total	County Jurisdiction	CEC Jurisdiction
Total Proposed Generation Capacity	23313	17555	7225
Average Proposed Generation Capacity	291	308	452
Median Proposed Generation Capacity	160	150	493

*CEC: California Energy Commission

The average public process time across all projects is 520 days or 1.42 years across all jurisdictions and technologies. The average for CSP projects, with no switch in technology, is 655 days or 1.79 years, while the average for PV is 453 days (1.24 years). The average time for projects that switched technology is significantly longer at 1,052 days (2.96 years). The length of process time in this category may be due to the small sample size (5), but also is likely reflective of the fact that these projects go through a second planning process. See Table 4.10 for the average process time by technology and Figure 4.5 for a visual version of this data.

Table 4.10 Average Public Process Time by Technology

Average Public Process Time by Technology		
	Days	Years
All Projects	520	1.42
CSP (No Switch)	655	1.79
PV (No Switch)	453	1.24
CSP to PV Switch	1082	2.96

*CSP: Concentrating Solar Power

*PV: Photovoltaic

*CSP: Concentrating Solar Power

*PV: Photovoltaic

Figure 4.5 Average Public Process Time (Days) by Technology

Looking at average public process time from the perspective of jurisdiction, the average public process time for all county projects, including technology switches, is 480 days (1.42 years). For projects in county jurisdiction without a switch from CSP to PV, the average time is 388 days (1.06 years). In the CEC jurisdiction, the average process time for a project including those that switched technologies is 845 days (2.32 years) compared to 676 days or 1.85 years for those that remained CSP projects. See Table 4.11 for average public process time by jurisdiction.

Table 4.11 Average Public Process Time by Jurisdiction

Average Public Process Time by Jurisdiction		
	Days	Years
Total	520	1.42
County Jurisdiction (including switches)	480	1.31
County Jurisdiction (no switch)	388	1.06
CEC Jurisdiction (including switches)	845	2.32
CEC Jurisdiction (no switch)	676	1.85

*CEC: California Energy Commission

4.2 CALIFORNIA ENERGY COMMISSION JURISDICTION

Of the eighty total projects in the database, sixteen are or were subject to the CEC's jurisdiction. These sixteen projects include the five projects that switched technologies as they were affected by the CEC process despite ending in county jurisdiction. The sixteen projects are located in six California counties, with the majority of the proposed sites located in Riverside and San Bernardino counties (see Table 4.12). Nine projects received approval from the CEC certification process and three have started construction. The three projects that have started construction are in either Riverside or San Bernardino counties. It is also of interest to note that, while Riverside County has the largest number of projects and approvals, it still has only one construction start. See Table 4.12 for the specific county breakdown of projects, approvals and construction starts and Figure 4.6 for a graphic view of this data.

As noted earlier, the CEC projects are proposed to cover a land area of 70,202 acres. Due to the discrepancy in project numbers, Riverside and San Bernardino Counties have the largest proportion of the proposed area. Due to the small sample size, it is impossible to make any judgments on the average site size for these projects as several counties have only a single project proposed in their area. However, it is important to note that these are extremely large projects generally averaging several thousand acres. See Table 4.13 for the specific data for the total proposed, the proposed total developed, and the averaged total and developed site size area by county.

Table 4.12 California Energy Commission Jurisdiction: Number of Projects, Approvals, and Construction Starts

California Energy Commission Jurisdiction: Number of Projects, Approvals, and Construction Starts			
	Total Projects	Approved Projects	Construction Starts
Imperial	1	0	0
Inyo	1	0	0
Kern	2	1	0
Riverside	6	5	1
San Bernardino	5	3	2
San Luis Obispo	1	0	0
Grand Total	16	9	3

Figure 4.6 California Energy Commission Jurisdiction: Number of Projects, Approvals, and Construction Starts

Table 4.13 California Energy Commission Jurisdiction: Site Area

California Energy Commission Jurisdiction: Site Area				
	Total Site Area	Total Developed Area	Average Total Site Area	Average Developed Area
Imperial	6360	6360	6360	6360
Inyo	3277	3277	3277	3277
Kern	6007	2000	3003.5	2000
Riverside	33833	30383	5638.83	5064
San Bernardino	20085	16468	4017	3294
San Luis Obispo	640	640	640	640
Grand Total	70202	59128	4388	3942

When comparing the average process time by county and the number of project approvals, there appears to be a correlation between shorter time and number of approvals (see Figure 4.7). This supports the theory that a lengthy planning process inhibits project completion due to cost to the developer (Barbour & Teitz, 2005). However, statistically there is a very low factor of correlation, -0.264, when calculated. This may be due to a lack of data but there also may not be a direct correlation between time and approval due to the complicated nature of the public planning process. See Table 4.14 for the average process time data and Figure 4.7 for visual comparison of average process time and project approvals.

4.3 COUNTY JURISDICTION

There are fifty-six projects in the database that are or were under county jurisdiction in one of the fifteen counties with proposed projects. Kern County has the largest number with fourteen projects, followed by Imperial Valley County with eight, Fresno County with seven, and Los Angeles County with five. This contrasts with the prime counties for CEC projects, which were Riverside County, and San Bernardino County. Riverside County has no proposed PV projects and San Bernardino County has two compared to six CSP projects in Riverside and five CSP projects in San Bernardino. This may be due to differences in land availability, zoning law, or environmental factors. See Table 4.15 for a breakdown of the project numbers for those in county jurisdiction.

Table 4.14 California Energy Commission Jurisdiction: Average Public Process Time

California Energy Commission Jurisdiction: Average Public Process Time		
	Days	Years
Imperial	827	2.27
Inyo	0	0
Kern	1740	4.77
Riverside	608	1.67
San Bernardino	1058	2.90
San Luis Obispo	755	2.07
Grand Total	845	2.32

Figure 4.7 California Energy Commission Jurisdiction: Average Process Time Compared to Number of Projects and Approvals by County

Table 4.15 County Jurisdiction: Total Number of Projects, Approved Projects, Mitigated Negative Declarations, and Construction Starts

County Jurisdiction: Total Number of Projects, Approved Projects, Mitigated Negative Declarations, and Construction Starts				
	Total Projects	Approved Projects	Mitigated Negative Declarations	Construction Starts
Alameda	1	0	0	0
Fresno	7	1	4	0
Imperial	3	3	0	2
Imperial Valley	8	5	0	1
Kern	14	6	0	1
Kings	4	3	3	1
Los Angeles	5	3	1	3
Madera	1	1	1	0
Merced	1	1	0	0
Panoche Hills	1	1	0	0
San Benito	1	1	0	0
San Bernardino	2	1	0	0
San Diego	2	0	0	0
San Luis Obispo	3	2	0	2
Stanislaus	3	3	3	0
Tulare	1	1	1	1
Grand Total	56	32	13	11

Thirty-two of the fifty-six county jurisdiction projects have been approved and eleven projects have started construction. Kern and Imperial Valley Counties have the most approvals, which is likely a function of the number of projects in these jurisdictions. However, Imperial Valley and Kern only have one construction start each. Los Angeles County has the largest number of construction starts (3), which that equal the number of approvals in that county. See Table 4.15 for the project approval and construction start numbers.

A difference between the CEC projects and the county projects is the ability of counties to grant a negative declaration during the planning process to reduce the environmental and public review process. Thirteen county projects out of fifty-six were granted mitigated negative declarations. Ten of these projects are in three counties. Fresno County has the most mitigated negative declarations at four, while Kings County and Stanislaus County have three each. Despite the potential reduction in process time, the mitigated declarations have not necessarily

translated into construction starts as these three counties have only a total of two construction starts. See Table 4.15 for project numbers and Figure 4.8 for a visual of these numbers.

The total proposed land area for county jurisdiction projects is 120,771 acres with a total developed site area of 105,383.5 acres. Kern, Kings, and San Bernardino counties have the largest proposed project land areas. While this was expected for Kern County due to its large number of proposed projects, San Bernardino County has only two projects and Kings County has only four proposed projects. The average total site size has a wide range from 459 acres in Madera County to 6,581 acres in Kings County. The average developed site acreage ranges from 390.5 acres in Tulare County to 6,564.5 acres in Kings County. See Table 4.16 for the site area data including total and averages for total proposed site area and proposed developed site area.

Figure 4.8 County Jurisdiction: Projects, Approvals, Mitigated Negative Declarations, and Construction

Table 4.16 County Jurisdiction: Site Area

County Jurisdiction: Site Area				
	Total Site Area	Total Developed Area	Average Total Site Area	Average Developed Area
Alameda	2000	2000	2000	2000
Fresno	6933	6933	990	990
Imperial	3940	3865	1313	1288
Imperial Valley	8049	8049	1006	1006
Kern	32195	20836	24767	1603
Kings	26325	26258	6581	6565
Los Angeles	7456	7236	1491	1447
Madera	459	459	459	459
Merced	1012	1012	1012	1012
Panoche Hills	4885	2437	4885	2437
San Benito	4717	4717	4717	4717
San Bernardino	9730	6113	4865	3057
San Diego	1185	1185	592.5	593
San Luis Obispo	6606	12105	4883	4183
Stanislaus	4539	1788	1513	596
Tulare	740	391	740	391
Grand Total	120771	105384	2965	2361

There is a wide range of process times across the counties from 79 days in Tulare County to 891 days in San Luis Obispo County. In the case of Tulare County's low number, this is likely due to the single project in this county receiving a mitigated negative declaration. As with the CEC project data, while there may seem to be a correlation between average process time and project approvals, statistically the correlation is only -0.068. See Table 4.17 for process times by county and Figure 4.9 for a visual of process time compared to approvals by county.

4.4 TRENDS OVER TIME

In addition to looking at the project data based on jurisdiction, analysis was also conducted to determine any time trends in the gathered information. The most immediate finding is that there was a clear decline in project proposals between 2010 and 2011 (see Table 4.18 and Figure 4.10). CSP projects have a slightly earlier drop off between 2009 and 2010 while PV projects drop off sharply after 2011. A potential reason for this trend is that the 1603 Treasury Program, which provided a source of financing for large solar projects, expired in 2011.

Table 4.17 County Jurisdiction: Average Total Process Time (Days)

County Jurisdiction: Average Total Process Time		
	Days	Years
Alameda	0	0
Fresno	441	1.21
Imperial	313	0.86
Imperial Valley	341	0.93
Kern	606	1.66
Kings	292	0.80
Los Angeles	452	1.24
Madera	210	0.58
Merced	691	1.89
Panoche Hills	225	0.62
San Benito	245	0.67
San Bernardino	1661	4.55
San Diego	0	0
San Luis Obispo	891	2.44
Stanislaus	369	1.01
Tulare	47	0.13
Grand Total	480	1.32

Figure 4.9 County Jurisdiction: Average Process Time Compared to Number of Projects and Approvals

As opposed to the clear trend in project proposals, there was no clear pattern in the average project proposed generation capacity. Average capacity across all projects and PV decreases between 2008 and 2012, but there is a spike in CSP capacity in 2011. There is a large jump for total and PV in 2013 but this is primarily due to the lower project count for that year. There is no clearly apparent reason for this drop in average proposed capacity. There was no legislation or financial change during this time frame that stands out as a potential reason for the trend. Additional research would be needed to determine the cause. See Table 4.19 and Figure 4.11 for the data on average generation capacity over time.

The average total proposed site acreage had similar trends as the average generation capacity. Project acreage peaked in 2008 and then steadily declined until 2013. There is a spike in CSP project size in 2011 but otherwise the trend is towards gradually smaller projects. As noted previously, there is no readily apparent cause for this shift. More research is needed in this area. See Table 4.20 and Figure 4.12 for the data pertaining to average site size compared to process start year.

From the perspective of when projects complete their public process as opposed to start the process, there is a slight increase in the number of approved projects between 2010 and 2012 followed by a decrease in 2013. There is a slight dip in approvals in 2012 due to the fact that there were no CEC approvals that year. A likely cause for the drop in 2013 is lag from the drop in project proposals in 2011, as the public process averages over a year at minimum. See Table 4.21 and Figure 4.13 for additional data on approved projects by process end year.

Table 4.18 Proposed Projects by Process Start Year

Proposed Projects by Process Start Year			
	CSP	PV	Grand Total
Before 2006	2	0	2
2007	3	0	3
2008	3	1	4
2009	7	3	10
2010	0	18	18
2011	3	22	25
2012	0	7	7
2013	0	5	5
(blank)	1	5	6
Grand Total	19	61	80

*CSP: Concentrating Solar Power

*PV: Photovoltaic

*CSP: Concentrating Solar Power

*PV: Photovoltaic

Figure 4.10 Proposed Projects by Process Start Year

Table 4.19 Average Proposed Generation Capacity by Process Start Year

Average Proposed Generation Capacity by Process Start Year			
	CSP	PV	Grand Total
Before 2006	200	0	200
2007	516	0	516
2008	526	550	532
2009	329	171	282
2010	0	240	240
2011	600	155	208
2012	0	123	123
2013	0	880	880
(blank)	500	226	272
Grand Total	427	249	291

*CSP: Concentrating Solar Power

*PV: Photovoltaic

*CSP: Concentrating Solar Power

*PV: Photovoltaic

Figure 4.11 Average Proposed Generation Capacity (MW) by Process Start Year

Table 4.20 Average Proposed Total Site Acreage by Process Start Year

Average Proposed Total Site Acreage by Process Start Year			
	CSP	PV	Grand Total
Before 2006	700	0	1000
2007	3057	0	3057
2008	5534	4000	5151
2009	5075	1722	4069
2010	0	1721	1721
2011	2969	1224	1434
2012	0	1127	1127
2013	0	10771	10771
(blank)	0	1505	1505
Grand Total	3978	2093	2523

*CSP: Concentrating Solar Power

*PV: Photovoltaic

*CSP: Concentrating Solar Power

*PV: Photovoltaic

Figure 4.12 Average Proposed Total Site Acreage by Process Start Year

Table 4.21 Total Approved Projects by Process End Year

Total Approved Projects by Process End Year			
	CSP	PV	Total
Before 2009	1	0	2
2009	0	0	0
2010	7	6	13
2011	0	10	10
2012	2	14	16
2013	1	5	6
2014	0	1	1
Grand Total	11	36	47

*CSP: Concentrating Solar Power

*PV: Photovoltaic

*CSP: Concentrating Solar Power

*PV: Photovoltaic

Figure 4.13 Approved Projects by Process End Year

CHAPTER 5: CONCLUSIONS

Utility-scale solar projects will likely remain an important facet of California's energy development as the state moves towards meeting the Renewable Portfolio Standard (RPS). Solar projects differ from traditional energy developments due to their widespread general support, potential local opposition, and site requirements. Understanding the factors that improve project acceptance, approval, and complete development will be vitally important as California moves towards increasing renewable energy generation.

The purpose of this project was to develop a database and provide initial analysis on utility-scale solar projects, those with a proposed generation capacity of 50 MW or greater, in California. The database was developed through public document searches with the final database including eighty projects. Analysis focused around understanding the current makeup of large-scale solar projects, an analysis of the different jurisdiction's projects, and a quick look at trends over time.

5.1 GENERAL FINDINGS

The majority of projects are proposed use photovoltaic (PV) technology not concentrating solar power (CSP). Twenty-four percent of the total projects were proposed with CSP technology while seventy-six percent of projects used PV as the original technology (see Table. 5.1). There are a very limited number of projects that reached construction start, twenty-three percent of all projects, while fewer still (13%) became operational. Due to the preliminary nature of this project, there is no clear reason for the low number of fully operational projects. Additional research is needed in this area.

Table 5.1 Percent Projects by Initial Technology

Percent Projects by Initial Technology		
	Number of Projects	Percent of Total Projects
Concentrating Solar Thermal	19	24
Photovoltaic	61	76

Projects were concentrated in six California counties out of the eighteen represented in the database: Kern, San Bernardino, Riverside, Imperial Valley, Fresno, and Imperial. These counties represent seventy percent of all proposed projects with fifty-six total projects, sixty-six percent of all approvals, and sixty-one percent of all construction starts. This cluster of development may be caused by a variety of factors including a positive political atmosphere for development, strong solar radiation, or availability of land. It also may be problematic for these jurisdictions moving forward if the local public begins to feel that they are receiving an unfair burden for the benefit of other cities (Carlisle et al., 2015; Hall et al., 2013).

5.2 COMPARING THE CALIFORNIA ENERGY COMMISSION AND COUNTY JURISDICTIONS

Due to the large proportion of proposed PV projects, the CEC has a minority of all projects in its jurisdiction. However, neither process is more effective in project approvals or construction. In fact, for each process fifty-six percent of projects received approval and nineteen percent started construction (see Table 5.2). Despite the CEC having a streamlined process with a twelve month timeline, the average process time for the CEC is twenty-two months with no technology switches which is greater than the twelve to eighteen month timeframe proposed for traditional power plants (CEC, 2006). This contrasts with the average county process time of 13 months with no switch from CSP to PV that is still longer than the CEC's goal of twelve months but still nine months faster than the CEC average time. Despite this difference, process length was not found to be a significant factor in project approval for either the CEC or the counties. More research is needed to determine both the factors for project approval as well as what is causing the CEC process to be dramatically longer than its designed timeline.

Table 5.2 Comparison of Percent Projects Approved and Constructed by Jurisdiction

Comparison of Percent Projects Approved and Constructed by Jurisdiction		
	Percent of Projects Approved	Percent of Projects Constructed
County	56	19
California Energy Commission	56	19
Grand Total of All Jurisdictions	59	23

5.3 TRENDS OVER TIME

The most important finding in the analysis of trends over time was the dramatic decrease in project proposals in 2011, with a slightly earlier decrease in CEC proposals in 2009. This trend was further supported by a decrease in project approvals in 2012, which would account for the average process of approximately eighteen months. An initial hypothesis on the cause of this decrease is the expiration of the Federal 1603 Treasury Program, which provided a source of financing for large solar projects. However, there may be other causes for this shift in project proposals including other financial or political factors. Additional research will be needed to determine the specific causes of this change.

5.4 FURTHER RESEARCH

The findings of this research are preliminary in scope and require additional fact finding and analysis to create a clear picture of the utility-scale solar environment in California. In particular, determination of the factors of project success for approval, construction, and operation will be vital as increasing numbers of projects are proposed to meet the RPS standard. While most research has focused on the public acceptance of projects, the financial and political aspects of the planning process should receive further attention.

The dual approval process that currently is used in California for utility-scale solar projects is also an area for further study. While the early findings indicated that there is no significant difference in project success under either system, further research should be conducted to verify this. Investigation should also focus on the need for these two separate approval paths and whether it may be more useful to have one unified planning path.

Additionally, research into these two processes may yield information on methods to improve the effectiveness and efficiency of the review process.

A final area of concern for further analysis is the effect of site characteristics on project approval rates. The areas where utility-scale solar projects are proposed are often rural, undeveloped or underdeveloped, contain endangered or threatened species, and have little to no access to water. Due to time constraints, these factors were not fully considered in the database. However, they remain a cause for concern in the planning, construction, and operation of these facilities. Specifically, species including the desert tortoise, golden eagle, and several plant varieties have been impacted by current developments and will also be by future developments. Whether site-specific environmental concerns, such as adverse effects on local wildlife and changes to local water resources, affect project success are areas for further study.

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APPENDIX A: DATABASE BASE TOPICS

BASE TOPICS						
Project Name	Org. Project Name	Current Owner	Change of Ownership	Original Owner	Power Purchaser	Project Status
Abengoa Mojave Solar		Abengoa	No		Pacific Gas & Electric	Under Construction
Adame 1		Gestamp Asetym Solar North America, Inc.	No			Under Review
Alpaugh 50		Consolidated Edison Development	Yes	Solar Power Solutions	Pacific Gas & Electric	Operating
Alpine Solar Project		First Solar	No		Pacific Gas & Electric	Operating
AV Solar Ranch One		First Solar	No		Pacific Gas & Electric	Operating
Avenal Photovoltaic Solar Farm		NRG Solar	No		Pacific Gas & Electric	Operating
AVSP 1 &2		MidAmerican Solar	Yes	SunPower	Southern California Edison	Under Construction
Barren Ridge Solar		Recurrent Energy	No			Under Development
Barren Ridge Solar		enXco	No			Under Review
Beacon Photovoltaic Project	Beacon Solar Energy Project	Beacon Solar LLC	No		Los Angeles Department of Power & Water	Under Revision
Bechtel Soda Mountain Solar Project		Caithness	No			Under Review
Beltran Ranch Solar Facility		Alternative Energy Group, Inc.	No			Under Development
Blythe Solar Power Project		NextEra Energy Resources	Yes	Solar Millennium	Southern California Edison	Under Revision
Broadwell SEGS	Siberia SEGS	BrightSource Energy	No			On Hold
Cal City Solar		enXco	No			Under Review
Calexico Solar Farm 1		8minuteenergy	No		San Diego Gas & Electric	Under Development
Calexico Solar Farm 2		8minuteenergy	No		San Diego Gas & Electric	Under Development
Calico Solar Project I	SEGS Solar Three	K Road Solar	Yes	Tessera Solar	Southern California Edison	Canceled
California Valley Solar Ranch		NRG Energy	No		Pacific Gas & Electric	Operating
Calipatria Solar Farm I		8minuteenergy	No		San Diego Gas & Electric	On Hold
Campo Verde		Southern Power and Turner Renewable Energy	Yes	First Solar	San Diego Gas & Electric	Under Construction
Carrizo Energy Solar Farm		First Solar	Yes	Ausra CA II,LLC		Canceled
Catalina Solar Project		EDF Renewables	No		San Diego Gas & Electric	Operating
Centinela Solar Energy		LS Power	No		San Diego Gas & Electric	Under Construction
Central Antelope Dry Ranch	Antelope Solar Greenworks	Silverado Power	No		Pacific Gas & Electric	Under Review
Desert Harvest		EDF Renewables	No			Under Development
Desert Sunlight		First Solar	No		Southern California Edison	Under Construction
Fink Road Solar Farm		Golden Hills Solar	No			Under Development
Five Points Solar Park		Frontier Renewables, LLC	No		Pacific Gas & Electric	Under Review
Fort Irwin Solar Power Project		Acciona	No		U.S. Army/surrounding utilities	Under Review
Gateway Solar Project		East Kern Properties, LLC	No			Under Review
Genesis Solar Energy Project		NextEra Energy Resources	No		Pacific Gas & Electric	Under Construction
Gray Butte Solar Array Project		Gray Butte Solar, LLC	No			Under Review
Harper Lake Solar Plant	SEGS IX & X	NextEra Energy Resources	Yes	Luz	Southern California Edison	Operating
Henrietta Solar Project		SunPower	No		Pacific Gas & Electric	Under Development
Hidden Hills Solar Electric Generating System		BrightSource Energy	No		Pacific Gas & Electric	On Hold
Imperial Solar Energy Center South		Tenaska	No		San Diego Gas & Electric	Operating
Imperial Solar Energy Center West		Tenaska	No		San Diego Gas & Electric	Under Development
Imperial Valley Solar Project	SES Solar Two	AES Solar	Yes	Tessera	San Diego Gas & Electric	Under Development
Inspiration Solar Generation Farm		Silverado Power	No			Under Review
Ivanpah Solar Electric Generating System		BrightSource Energy	No		Pacific Gas & Electric	Operating

BASE TOPICS						
Project Name	Org. Project Name	Current Owner	Change of Ownership	Original Owner	Power Purchaser	Project Status
Johnson Valley SEGS		Johnson Valley SEGS, LLC	No			Under Review
Kern Solar Ranch		Kern Solar, LLC	No		Pacific Gas & Electric	Under Review
Kramer Junction SEGS	SEGS III, IV, V, VI, VII	NextEra Energy Resources	Yes	Luz	Southern California Edison	Operating
Liberty Solar Generation Project		Silverado Power	No			Under Review
Lotus Solar Farm		8minuteenergy	No			Under Development
McCoy Solar Energy Center		NextEra Energy Resources	No			Under Development
Midway Solar Farm 1		8minuteenergy	No			Under Development
Midway Solar Farm 2		8minuteenergy	No			Under Development
Monte Vista Solar Array		First Solar	No			Under Review
Mount Signal Solar Farm		AES Solar	Yes	8minuteenergy	San Diego Gas & Electric	Under Construction
Mountain House Solar Farm		Pegasus Energy Partners	No			Canceled
Mustang		Recurrent Energy	No			Under Development
North Star Power 1	North Star Solar Array Project	First Solar	Yes	North Star Solar	Pacific Gas & Electric	Under Development
North Valley Solar Generation Project		Silverado Power, LLC	No			Under Development
Oro Verde Solar		Sun Edison	No			Under Review
Palen Solar Power Project		BrightSource Energy	No		Southern California Edison	Under Development
Panoche Valley Solar Farm		PV2 Energy	Yes	Solargen		Under Development
Quinto Solar Photovoltaic Project		SunPower	No		Southern California Edison	Under Development
Regulus Solar	FRV Valley Solar Project	SunEdison	No		Southern California Edison	Canceled
Rice Solar Energy Project		SolarReserve	No		Pacific Gas & Electric	Under Development
Ridgecrest		Solar Trust America	Yes	Solarhybrid		On Hold
Rio Mesa Solar Electric Generating Facility		BrightSource Energy	No			Canceled
Riverbluff Solar Energy Park		TerraGen	No			Under Development
Rosamond Solar		Sempra Generation	No			Under Development
Rosamond Solar Array		First Solar	No			Under Review
Rugged Solar Farm		Soitec	No		San Diego Gas & Electric	Under Review
Salton Sea Solar Farm 1		8minuteenergy	No			On Hold
Salton Sea Solar Farm 2		8minuteenergy	No			On Hold
Silverleaf		Agile	Yes	Tenaska	San Diego Gas & Electric	Under Review
Solargen Panoche Valley Solar Farm		PV2 Energy	Yes	Solargen	Pacific Gas & Electric	In Litigation
Sonoran West		BrightSource Energy	No		Southern California Edison	Under Development
Springbok Solar		8minuteenergy	No			Under Development
Stateline Solar Farm		First Solar	No		Southern California Edison	Under Development
Tierra del Sol		Soitec	No		San Diego Gas & Electric	Under Review
Topaz Solar Farm		First Solar	No		Pacific Gas & Electric	Under Construction
Tranquillity Solar Generating Facility		RE Tranquillity LLC	No			Under Review
Westlands Solar Park		Westside Holdings	No			Under Review
Westside Solar Ranch		Frontier Solar, LLC	Yes	Scatec Solar	Pacific Gas & Electric	Under Development
Willow Springs Solar Array		First Solar	No		Southern California Edison	Under Review

APPENDIX B: DATABASE LOCATION TOPICS

LOCATION TOPICS		
Project Name	County	Nearest City
Abengoa Mojave Solar	San Bernardino	Lockhart
Adame 1	Fresno	Mendota
Alpaugh 50	Tulare	Alpaugh
Alpine Solar Project	Los Angeles	Rosamond
AV Solar Ranch One	Los Angeles	Antelope Valley
Avenal Photovoltaic Solar Farm	Kings	Avenal
AVSP 1 &2	Los Angeles	Los Banos
Barren Ridge Solar	Kern	California City
Barren Ridge Solar	Kern	California City
Beacon Photovoltaic Project	Kern	Cantil
Bechtel Soda Mountain Solar Project	San Bernardino	Baker
Beltran Ranch Solar Facility	Stanislaus	Newman
Blythe Solar Power Project	Riverside	Blythe
Broadwell SEGS	San Bernardino	Broadwell Dry Lake
Cal City Solar	Kern	California City
Calexico Solar Farm 1	Imperial Valley	Calexico
Calexico Solar Farm 2	Imperial Valley	Calexico
Calico Solar Project I	San Bernardino	Barstow
California Valley Solar Ranch	San Luis Obispo	California Valley
Calipatria Solar Farm I	Imperial	Calipatria
Campo Verde	Imperial	El Centro
Carrizo Energy Solar Farm	San Luis Obispo	Simmler
Catalina Solar Project	Kern	Bakersfield
Centinela Solar Energy	Imperial Valley	El Centro
Central Antelope Dry Ranch	Los Angeles	Lancaster
Desert Harvest	Riverside	Desert Center
Desert Sunlight	Riverside	Desert Center
Fink Road Solar Farm	Stanislaus	Newman
Five Points Solar Park	Fresno	Five Points
Fort Irwin Solar Power Project	San Bernardino	Ft. Irwin
Gateway Solar Project	Kern	California City
Genesis Solar Energy Project	Riverside	Blythe
Gray Butte Solar Array Project	Los Angeles	Palmdale
Harper Lake Solar Plant	San Bernardino	Harper Dry Lake
Henrietta Solar Project	Kings	Stratford
Hidden Hills Solar Electric Generating System	Inyo	Tecopa
Imperial Solar Energy Center South	Imperial	Mount Signal
Imperial Solar Energy Center West	Imperial	Ocotillo
Imperial Valley Solar Project	Imperial	Ocotillo
Inspiration Solar Generation Farm	Fresno	Kerman
Ivanpah Solar Electric Generating System	San Bernardino	Barstow
Johnson Valley SEGS	San Bernardino	
Kern Solar Ranch	Kern	Blackwells Corner
Kramer Junction SEGS	San Bernardino	Kramer Junction

LOCATION TOPICS		
Project Name	County	Nearest City
Liberty Solar Generation Project	Fresno	Mendota
Lotus Solar Farm	Madera	Madera
McCoy Solar Energy Center	Riverside	Blythe
Midway Solar Farm 1	Imperial Valley	Calipatria
Midway Solar Farm 2	Imperial Valley	Calipatria
Monte Vista Solar Array	Kern	California City
Mount Signal Solar Farm	Imperial	Calexico
Mountain House Solar Farm	Alameda	Mountain House
Mustang	Kings	Lemoore
North Star Power 1	Fresno	Mendota
North Valley Solar Generation Project	Fresno	Fresno
Oro Verde Solar	Kern	Mojave
Palen Solar Power Project	Riverside	Desert Center
Panoche Valley Solar Farm	San Benito	Soledad
Quinto Solar Photovoltaic Project	Merced	Los Banos
Regulus Solar	Kern	Bakersfield
Rice Solar Energy Project	Riverside	Vidal Junction
Ridgecrest	Kern	Ridgecrest
Rio Mesa Solar Electric Generating Facility	Riverside	Blythe
Riverbluff Solar Energy Park	San Bernardino	Newberry Springs
Rosamond Solar	Kern	Rosamond
Rosamond Solar Array	Kern	Rosamond
Rugged Solar Farm	San Diego	Boulevard
Salton Sea Solar Farm 1	Imperial Valley	Calipatria
Salton Sea Solar Farm 2	Imperial Valley	Calipatria
Silverleaf	Imperial Valley	El Centro
Solargen Panoche Valley Solar Farm	Panoche Hills	San Benito
Sonoran West	Riverside	Palo Verde Mesa
Springbok Solar	Kern	Cantil
Stateline Solar Farm	San Bernardino	Primm, NV
Tierra del Sol	San Diego	
Topaz Solar Farm	San Luis Obispo	California Valley
Tranquillity Solar Generating Facility	Fresno	Tranquillity
Westlands Solar Park	Kings	Lemoore
Westside Solar Ranch	Stanislaus	Newman
Willow Springs Solar Array	Kern	Willow Springs

APPENDIX C: DATABASE TECHNOLOGY TOPICS

TECHNOLOGY TOPICS				
Project Name	Original PV/CSP	Current PV/CSP	Switch CSP/PV	Generation Capacity
Abengoa Mojave Solar	CSP	CSP	No	250
Adame 1	PV	PV	No	119
Alpaugh 50	PV	PV	No	50
Alpine Solar Project	PV	PV	No	66
AV Solar Ranch One	PV	PV	No	115
Avenal Photovoltaic Solar Farm	PV	PV	No	600
AVSP 1 &2	PV	PV	No	579
Barren Ridge Solar	PV	PV	No	74
Barren Ridge Solar	PV	PV	No	100
Beacon Photovoltaic Project	CSP	PV	Yes	250
Bechtel Soda Mountain Solar Project	PV	PV	No	350
Beltran Ranch Solar Facility	PV	PV	No	140
Blythe Solar Power Project	CSP	PV	Yes	486
Broadwell SEGS	CSP	CSP	No	1000
Cal City Solar	PV	PV	No	100
Calexico Solar Farm 1	PV	PV	No	200
Calexico Solar Farm 2	PV	PV	No	200
Calico Solar Project I	CSP	PV	Yes	618
California Valley Solar Ranch	PV	PV	No	250
Calipatria Solar Farm I	PV	PV	No	70
Campo Verde	PV	PV	No	139
Carrizo Energy Solar Farm	CSP	PV	Yes	177
Catalina Solar Project	PV	PV	No	143
Centinela Solar Energy	PV	PV	No	275
Central Antelope Dry Ranch	PV	PV	No	52
Desert Harvest	PV	PV	No	150
Desert Sunlight	PV	PV	No	550
Fink Road Solar Farm	PV	PV	No	80
Five Points Solar Park	PV	PV	No	69

TECHNOLOGY TOPICS

Project Name	Original PV/CSP	Current PV/CSP	Switch CSP/PV	Generation Capacity
Fort Irwin Solar Power Project	CSP	CSP	No	500
Gateway Solar Project	PV	PV	No	350
Genesis Solar Energy Project	CSP	CSP	No	125
Gray Butte Solar Array Project	PV	PV	No	150
Harper Lake Solar Plant	CSP	CSP	No	250
Henrietta Solar Project	PV	PV	No	136
Hidden Hills Solar Electric Generating System	CSP	CSP	No	500
Imperial Solar Energy Center South	PV	PV	No	130
Imperial Solar Energy Center West	PV	PV	No	150
Imperial Valley Solar Project	CSP	PV	Yes	709
Inspiration Solar Generation Farm	PV	PV	No	60
Ivanpah Solar Electric Generating System	CSP	CSP	No	370
Johnson Valley SEGS	CSP	CSP	No	800
Kern Solar Ranch	PV	PV	No	1000
Kramer Junction SEGS	CSP	CSP	No	150
Liberty Solar Generation Project	PV	PV	No	60
Lotus Solar Farm	PV	PV	No	90
McCoy Solar Energy Center	PV	PV	No	750
Midway Solar Farm 1	PV	PV	No	50
Midway Solar Farm 2	PV	PV	No	155
Monte Vista Solar Array	PV	PV	No	126
Mount Signal Solar Farm	PV	PV	No	200
Mountain House Solar Farm	PV	PV	No	400
Mustang	PV	PV	No	160
North Star Power 1	PV	PV	No	60
North Valley Solar Generation Project	PV	PV	No	90
Oro Verde Solar	PV	PV	No	450
Palen Solar Power Project	CSP	CSP	No	500
Panoche Valley Solar Farm	PV	PV	No	420
Quinto Solar Photovoltaic Project	PV	PV	No	110

TECHNOLOGY TOPICS

Project Name	Original PV/CSP	Current PV/CSP	Switch CSP/PV	Generation Capacity
Regulus Solar	PV	PV	No	75
Rice Solar Energy Project	CSP	CSP	No	150
Ridgecrest	CSP	CSP	No	250
Rio Mesa Solar Electric Generating Facility	CSP	CSP	No	500
Riverbluff Solar Energy Park	PV	PV	No	230
Rosamond Solar	PV	PV	No	300
Rosamond Solar Array	PV	PV	No	155
Rugged Solar Farm	PV	PV	No	80
Salton Sea Solar Farm 1	PV	PV	No	50
Salton Sea Solar Farm 2	PV	PV	No	100
Silverleaf	PV	PV	No	160
Solargen Panoche Valley Solar Farm	PV	PV	No	400
Sonoran West	CSP	CSP	No	540
Springbok Solar	PV	PV	No	150
Stateline Solar Farm	PV	PV	No	300
Tierra del Sol	PV	PV	No	60
Topaz Solar Farm	PV	PV	No	550
Tranquillity Solar Generating Facility	PV	PV	No	400
Westlands Solar Park	PV	PV	No	2400
Westside Solar Ranch	PV	PV	No	50
Willow Springs Solar Array	PV	PV	No	160

APPENDIX D: DATABASE LAND USE TOPICS

LAND USE TOPICS

Project Name	Original Land Ownership	Original Land Use	Total Site Acreage	Developed Site Acreage
Abengoa Mojave Solar	Public	Agriculture	1765	1765
Adame 1	Private	Agriculture	960	960
Alpaugh 50	Public	Agriculture	740	390.5
Alpine Solar Project	Private	Agriculture	800	580
AV Solar Ranch One	Private	Agriculture	2100	2100
Avenal Photovoltaic Solar Farm	Private	Agriculture	420	420
AVSP 1 &2	Private	Residential	3200	3200
Barren Ridge Solar	Private	Agriculture	588	588
Barren Ridge Solar	Private	Agriculture	647	611
Beacon Photovoltaic Project	Private	Agriculture	2012	N/A
Bechtel Soda Mountain Solar Project	Public	BLM	4397	2700
Beltran Ranch Solar Facility	Private	Agriculture	1720	606
Blythe Solar Power Project	Public	BLM	9400	5950
Broadwell SEGS	Public	BLM	5130	5130
Cal City Solar	Private	Agriculture	638	548
Calexico Solar Farm 1	Private	Agriculture	1332	1332
Calexico Solar Farm 2	Private	Agriculture	1465	1465
Calico Solar Project I	Public	BLM	8230	4613
California Valley Solar Ranch	Private	Agriculture	1966	4365
Calipatria Solar Farm I	Private	Agriculture	609	582
Campo Verde	Public/Private	Agriculture	1900	1852
Carrizo Energy Solar Farm	Private	Agriculture	640	640
Catalina Solar Project	Private	Agriculture	4571	900
Centinela Solar Energy	Public /Private	Agriculture	2067	2067
Central Antelope Dry Ranch	Private	Agriculture	256	256
Desert Harvest	Federal	BLM	1208	1208
Desert Sunlight	Federal	BLM	4090	4090
Fink Road Solar Farm	Public	Landfill	1687	800
Five Points Solar Park	Private	Agriculture	499	499

LAND USE TOPICS

Project Name	Original Land Ownership	Original Land Use	Total Site Acreage	Developed Site Acreage
Fort Irwin Solar Power Project	Federal	Military	N/A	N/A
Gateway Solar Project	Private	Agriculture	3066	3066
Genesis Solar Energy Project	Federal	BLM	1800	1800
Gray Butte Solar Array Project	Private	Agriculture	1100	1100
Harper Lake Solar Plant	Public	Agriculture	400	400
Henrietta Solar Project	Private	Agriculture	903	836
Hidden Hills Solar Electric Generating System	Private	Agriculture	3277	3277
Imperial Solar Energy Center South	Private	Agriculture	946	946
Imperial Solar Energy Center West	Private	Agriculture	1103	1103
Imperial Valley Solar Project	Public	BLM	6360	6360
Inspiration Solar Generation Farm	Private	Agriculture	292	292
Ivanpah Solar Electric Generating System	Public	BLM	3400	3400
Johnson Valley SEGS	Public	BLM	1560	1560
Kern Solar Ranch	Private	Agriculture	14400	6100
Kramer Junction SEGS	Private	Unknown	1000	1000
Liberty Solar Generation Project	Private	Agriculture	321	321
Lotus Solar Farm	Private	Agriculture	459	459
McCoy Solar Energy Center	Public	BLM	2259	2259
Midway Solar Farm 1	Private	Agriculture	326	326
Midway Solar Farm 2	Private	Agriculture	803	803
Monte Vista Solar Array	Private	Agriculture	1040	1040
Mount Signal Solar Farm	Private	Agriculture	1431	1431
Mountain House Solar Farm	Private	Agriculture	2000	2000
Mustang	Private	Agriculture	1002	1002
North Star Power 1	Private	Agriculture	640	640
North Valley Solar Generation Project	Private	Agriculture	489	489
Oro Verde Solar	Public	Military	4000	2750
Palen Solar Power Project	Public	BLM	2970	2970
Panoche Valley Solar Farm	Private	Agriculture	4717	4717
Quinto Solar Photovoltaic Project	Private	Agriculture	1012	1012

LAND USE TOPICS

Project Name	Original Land Ownership	Original Land Use	Total Site Acreage	Developed Site Acreage
Regulus Solar	Private	Agriculture	743	743
Rice Solar Energy Project	Private	Military	3324	3324
Ridgecrest	Public	BLM	3995	2000
Rio Mesa Solar Electric Generating Facility	Private	Agriculture	4070	4070
Riverbluff Solar Energy Park	Private	Agriculture	1500	1500
Rosamond Solar	Private	Agriculture	960	960
Rosamond Solar Array	Private	Agriculture	1177	1177
Rugged Solar Farm	Private	Agriculture	765	765
Salton Sea Solar Farm 1	Private	Agriculture	320	320
Salton Sea Solar Farm 2	Private	Agriculture	640	640
Silverleaf	Private	Agriculture	1096	1096
Solargen Panoche Valley Solar Farm	Private	Agriculture	4885	2437
Sonoran West	Private	BLM	12269	12269
Springbok Solar	Private	Agriculture	951	951
Stateline Solar Farm	Private	BLM	1685	2385
Tierra del Sol	Private	Agriculture	420	420
Topaz Solar Farm	Private	Agriculture	7800	4000
Tranquillity Solar Generating Facility	Public/Private	Agriculture	3732	3732
Westlands Solar Park	Private	Agriculture	24000	2400
Westside Solar Ranch	Private	Agriculture	1132	382
Willow Springs Solar Array	Private	Agriculture	1402	1402

APPENDIX E: DATABASE JURISDICTION AND PROCESS TOPICS

	JURISDICTION TOPICS		PROCESS TOPICS			
Project Name	Original Jurisdiction	Current Jurisdiction	Initial Study Completed	EIR/EIS Required	Negative Declaration	Approval Status
Abengoa Mojave Solar	CEC	CEC	CEC	Yes	No	Yes
Adame 1	County	County	Yes	No	Mitigated	In Process
Alpaugh 50	County	County	Yes	No	Mitigated	Yes
Alpine Solar Project	County	County	Yes	No	Mitigated	Yes
AV Solar Ranch One	County	County	Yes	Yes	No	Yes
Avenal Photovoltaic Solar Farm	County	County	Yes	No	Mitigated	Yes
AVSP 1 &2	County	County	Yes	Yes	No	Yes
Barren Ridge Solar	County	County	Yes	Yes	No	Yes
Barren Ridge Solar	County	County	No	Yes	No	In Process
Beacon Photovoltaic Project	CEC	County	No	Yes	No	Yes
Bechtel Soda Mountain Solar Project	BLM	BLM	NEPA	EIS	No	In Process
Beltran Ranch Solar Facility	County	County	Yes	No	Mitigated	Yes
Blythe Solar Power Project	CEC	BLM	CEC/NEPA	EIS	No	Yes
Broadwell SEGS	CEC/BLM	CEC/BLM	NEPA	EIS	No	On Hold
Cal City Solar	County	County	No	Yes	No	In Process
Calexico Solar Farm 1	County	County	Yes	Yes	No	Yes
Calexico Solar Farm 2	County	County	Yes	Yes	No	Yes
Calico Solar Project I	CEC	County	CEC	Yes	No	Yes
California Valley Solar Ranch	County	County	Yes	Yes	No	Yes
Calipatria Solar Farm I	County	County	Yes	Yes	No	Yes
Campo Verde	County	County	Yes	Yes	No	Yes
Carrizo Energy Solar Farm	CEC	County	CEC	Yes	No	No
Catalina Solar Project	County	County	Yes	Yes	No	Yes
Centinela Solar Energy	County	County	Yes	Yes	No	Yes
Central Antelope Dry Ranch	County	County	Yes	Yes	No	In Process
Desert Harvest	BLM	BLM	NEPA	EIS	No	Yes
Desert Sunlight	BLM	BLM	NEPA	EIS	No	Yes
Fink Road Solar Farm	County	County	Yes	No	Mitigated	Yes

	JURISDICTION TOPICS		PROCESS TOPICS			
Project Name	Original Jurisdiction	Current Jurisdiction	Initial Study Completed	EIR/EIS Required	Negative Declaration	Approval Status
Five Points Solar Park	County	County	Yes	N/A	N/A	In Process
Fort Irwin Solar Power Project	Army	Army	NEPA	EIS	No	In Process
Gateway Solar Project	County	County	N/A	Yes	N/A	In Process
Genesis Solar Energy Project	CEC/BLM	CEC/BLM	CEC/NEPA	Yes	No	Yes
Gray Butte Solar Array Project	County	County	Yes	Yes	No	In Process
Harper Lake Solar Plant	State	State	State	N/A	No	Unknown
Henrietta Solar Project	County	County	Yes	No	Mitigated	Yes
Hidden Hills Solar Electric Generating System	CEC	CEC	CEC	Yes	No	On Hold
Imperial Solar Energy Center South	County	County	No	Yes	No	Yes
Imperial Solar Energy Center West	County	County	No	Yes	No	Yes
Imperial Valley Solar Project	CEC	BLM	No	Yes	No	Yes
Inspiration Solar Generation Farm	County	County	Yes	No	Mitigated	In Process
Ivanpah Solar Electric Generating System	CEC	CEC	CEC	Yes	No	Yes
Johnson Valley SEGS	CEC/BLM	CEC/BLM	CEC/NEPA	Yes	No	In Process
Kern Solar Ranch	County	County	Yes	Yes	No	In Process
Kramer Junction SEGS	State	State	N/A	N/A	No	Yes
Liberty Solar Generation Project	County	County	Yes	No	Mitigated	In Process
Lotus Solar Farm	County	County	Yes	No	Mitigated	Yes
McCoy Solar Energy Center	BLM	BLM	NEPA	EIS	No	Yes
Midway Solar Farm 1	County	County	Yes	Yes	No	Yes
Midway Solar Farm 2	County	County	Yes	Yes	No	Yes
Monte Vista Solar Array	County	County	Yes	Yes	No	In Process
Mount Signal Solar Farm	County	County	Yes	Yes	No	Yes
Mountain House Solar Farm	County	County	N/A	Yes	N/A	Canceled
Mustang	County	County	Yes	No	Mitigated	Yes
North Star Power 1	County	County	Yes	No	Mitigated	Yes
North Valley Solar Generation Project	County	County	N/A	Yes	N/A	Unknown
Oro Verde Solar	County	County	Yes	Yes	No	In Process
Palen Solar Power Project	CEC	CEC	CEC	Yes	No	Yes

	JURISDICTION TOPICS		PROCESS TOPICS			
Project Name	Original Jurisdiction	Current Jurisdiction	Initial Study Completed	EIR/EIS Required	Negative Declaration	Approval Status
Panoche Valley Solar Farm	County	County	No	Yes	No	Yes
Quinto Solar Photovoltaic Project	County	County	No	Yes	No	Yes
Regulus Solar	County	County	Yes	Yes	No	Yes
Rice Solar Energy Project	CEC	CEC	CEC	Yes	No	Yes
Ridgecrest	CEC	CEC	CEC	Yes	No	No
Rio Mesa Solar Electric Generating Facility	CEC	CEC	CEC	Yes	No	No
Riverbluff Solar Energy Park	County	County	Yes	Yes	No	Unknown
Rosamond Solar	County	County	Yes	Yes	No	Yes
Rosamond Solar Array	County	County	Yes	Yes	No	In Process
Rugged Solar Farm	County	County	Yes	Yes	No	In Process
Salton Sea Solar Farm 1	County	County	N/A	N/A	N/A	On Hold
Salton Sea Solar Farm 2	County	County	N/A	N/A	N/A	On Hold
Silverleaf	County	County	Yes	Yes	No	In Process
Solargen Panoche Valley Solar Farm	County	County	Yes	Yes	No	Yes
Sonoran West	CEC	CEC	CEC	Yes	No	Yes
Springbok Solar	County	County	Yes	Yes	No	Yes
Stateline Solar Farm	BLM	BLM	NEPA	EIS	No	Yes
Tierra del Sol	County	County	Yes	Yes	No	In Process
Topaz Solar Farm	County	County	Yes	Yes	No	Yes
Tranquillity Solar Generating Facility	County	County	Yes	Yes	No	In Process
Westlands Solar Park	County	County	Yes	Yes	No	In Process
Westside Solar Ranch	County	County	Yes	No	Mitigated	Yes
Willow Springs Solar Array	County	County	Yes	Yes	No	In Process

APPENDIX F: DATABASE PROCESS TIME TOPICS

PROCESS TIME TOPICS					
Project Name	Public Process Used For Dates	Total Process Time (Days)	Total Process Time (Years)	Public Review Process Start	Public Review Process End
Abengoa Mojave Solar	CEC	394	1.08	8/10/2009	9/8/2010
Adame 1	EIR			11/9/2011	
Alpaugh 50	EIR	47	0.13	8/6/2010	9/22/2010
Alpine Solar Project	EIR	301	0.82	12/21/2010	10/18/2011
AV Solar Ranch One	EIR	603	1.65	5/14/2009	1/7/2011
Avenal Photovoltaic Solar Farm	EIR	42	0.12	8/2/2010	9/13/2010
AVSP 1 & 2	EIR	736	2.02	3/8/2010	3/13/2012
Barren Ridge Solar	EIR	336	0.92	1/4/2011	12/6/2011
Barren Ridge Solar	EIR			3/8/2010	
Beacon Photovoltaic Project	CEC/EIR	1740	4.77	3/14/2008	12/18/2012
Bechtel Soda Mountain Solar Project	NEPA			10/22/2012	
Beltran Ranch Solar Facility	EIR	532	1.46	11/3/2011	4/18/2013
Blythe Solar Power Project	CEC/NEPA	427	1.17	8/24/2009	10/25/2010
Broadwell SEGS	NEPA			1/23/2007	
Cal City Solar	EIR			3/8/2010	
Calexico Solar Farm 1	EIR	257	0.70	7/21/2011	4/3/2012
Calexico Solar Farm 2	EIR	253	0.69	7/25/2011	4/3/2012
Calico Solar Project I	CEC/EIR	1661	4.55	12/2/2008	6/20/2013
California Valley Solar Ranch	EIR	812	2.22	1/27/2009	4/19/2011
Calipatria Solar Farm I	EIR	397	1.09	7/27/2011	8/27/2012
Campo Verde	EIR	286	0.78	11/15/2011	8/27/2012
Carrizo Energy Solar Farm	CEC	755	2.07	10/25/2007	11/18/2009
Catalina Solar Project	EIR	291	0.80	2/18/2011	12/6/2011
Centinela Solar Energy	EIR	404	1.11	11/18/2010	12/27/2011
Central Antelope Dry Ranch	EIR			6/13/2012	
Desert Harvest	NEPA	541	1.48	9/19/2011	3/13/2013
Desert Sunlight	NEPA	573	1.57	1/13/2010	8/9/2011
Fink Road Solar Farm	EIR	469	1.28	1/6/2011	4/19/2012

PROCESS TIME TOPICS					
Project Name	Public Process Used For Dates	Total Process Time (Days)	Total Process Time (Years)	Public Review Process Start	Public Review Process End
Five Points Solar Park	EIR			11/29/2012	
Fort Irwin Solar Power Project	NEPA				
Gateway Solar Project	EIR				
Genesis Solar Energy Project	CEC/NEPA	429	1.18	8/31/2009	11/3/2010
Gray Butte Solar Array Project	EIR			11/24/2009	
Harper Lake Solar Plant	State	718	1.97	2/27/1988	2/14/1990
Henrietta Solar Project	EIR	454	1.24	5/10/2011	8/6/2012
Hidden Hills Solar Electric Generating System	CEC	608	1.67	8/5/2011	4/4/2013
Imperial Solar Energy Center South	EIR	390	1.07	6/11/2010	7/6/2011
Imperial Solar Energy Center West	EIR	438	1.20	6/11/2010	8/23/2011
Imperial Valley Solar Project	CEC/NEPA	827	2.27	6/30/2008	10/5/2010
Inspiration Solar Generation Farm	EIR			7/20/2011	
Ivanpah Solar Electric Generating System	CEC	1118	3.06	8/31/2007	9/22/2010
Johnson Valley SEGS	CEC/NEPA			5/23/2011	
Kern Solar Ranch	EIR			1/25/2013	
Kramer Junction SEGS	State	505	1.38	1/6/1987	5/25/1988
Liberty Solar Generation Project	EIR			6/22/2011	
Lotus Solar Farm	EIR	210	0.58	6/12/2012	1/8/2013
McCoy Solar Energy Center	NEPA	560	1.53	8/29/2011	3/11/2013
Midway Solar Farm 1	EIR	396	1.08	7/28/2011	8/27/2012
Midway Solar Farm 2	EIR	396	1.08	7/28/2011	8/27/2012
Monte Vista Solar Array	EIR			3/8/2010	
Mount Signal Solar Farm	EIR	257	0.70	7/21/2011	4/3/2012
Mountain House Solar Farm	EIR				
Mustang	EIR	379	1.04	7/24/2011	8/6/2012
North Star Power 1	EIR	441	1.21	1/27/2011	4/12/2012
North Valley Solar Generation Project	EIR			6/20/2011	
Oro Verde Solar	EIR			5/23/2013	
Palen Solar Power Project	CEC	478	1.31	8/24/2009	12/15/2010

PROCESS TIME TOPICS					
Project Name	Public Process Used For Dates	Total Process Time (Days)	Total Process Time (Years)	Public Review Process Start	Public Review Process End
Panoche Valley Solar Farm	EIR	245	0.67	3/1/2010	11/1/2010
Quinto Solar Photovoltaic Project	EIR	691	1.89	12/16/2010	11/6/2012
Regulus Solar	EIR	582	1.59	5/9/2011	12/11/2012
Rice Solar Energy Project	CEC	420	1.15	10/21/2009	12/15/2010
Ridgecrest	CEC			9/1/2009	
Rio Mesa Solar Electric Generating Facility	CEC	634	1.74	10/14/2011	7/9/2013
Riverbluff Solar Energy Park	EIR				
Rosamond Solar	EIR	248	0.68	3/8/2010	11/11/2010
Rosamond Solar Array	EIR			3/8/2010	
Rugged Solar Farm	EIR			12/6/2012	
Salton Sea Solar Farm 1	EIR				
Salton Sea Solar Farm 2	EIR				
Silverleaf	EIR			3/21/2012	
Solargen Panoche Valley Solar Farm	EIR	225	0.62	3/1/2010	10/12/2010
Sonoran West	CEC	1262	3.46	5/12/2009	10/25/2012
Springbok Solar	EIR	438	1.20	1/13/2013	3/27/2014
Stateline Solar Farm	NEPA	582	1.59	8/4/2011	3/8/2013
Tierra del Sol	EIR			12/6/2012	
Topaz Solar Farm	EIR	1105	3.03	7/2/2008	7/12/2011
Tranquillity Solar Generating Facility	EIR			10/16/2013	
Westlands Solar Park	EIR			3/12/2013	
Westside Solar Ranch	EIR	105	0.29	7/22/2010	11/4/2010
Willow Springs Solar Array	EIR			3/8/2010	

APPENDIX G: DATABASE CONSTRUCTION TOPICS

CONSTRUCTION TOPICS					
Project Name	Construction Start	Estimated Online Date	Online	Start Online Date	Complete Online Date
Abengoa Mojave Solar	2011	2014	No		
Adame 1			No		
Alpaugh 50	2012	2012	Yes	2013	2013
Alpine Solar Project	2011	2012	Yes	2013	2013
AV Solar Ranch One	2011	2013	Partial	2013	
Avenal Photovoltaic Solar Farm	2010	2011	Yes	2011	2011
AVSP 1 &2	2013	2014	No		
Barren Ridge Solar			No		
Barren Ridge Solar			No		
Beacon Photovoltaic Project		2011	No		
Bechtel Soda Mountain Solar Project			No		
Beltran Ranch Solar Facility			No		
Blythe Solar Power Project		2015	No		
Broadwell SEGS			No		
Cal City Solar			No		
Calexico Solar Farm 1			No		
Calexico Solar Farm 2			No		
Calico Solar Project I			No		
California Valley Solar Ranch	2011	2012	Partial	2012	
Calipatria Solar Farm I			No		
Campo Verde	2013	2013	No		
Carrizo Energy Solar Farm			No		
Catalina Solar Project	2012	2012	Yes	2012	2013
Centinela Solar Energy	2012	2014	No		
Central Antelope Dry Ranch		2014	No		
Desert Harvest		2014	No		
Desert Sunlight	2011	2015	No		
Fink Road Solar Farm			No		

CONSTRUCTION TOPICS					
Project Name	Construction Start	Estimated Online Date	Online	Start Online Date	Complete Online Date
Five Points Solar Park			No		
Fort Irwin Solar Power Project		2013	no		
Gateway Solar Project			no		
Genesis Solar Energy Project	2011	2013	No		
Gray Butte Solar Array Project			No		
Harper Lake Solar Plant	pre 2000		Yes	1991	1991
Henrietta Solar Project		2016	No		
Hidden Hills Solar Electric Generating System		2016	No		
Imperial Solar Energy Center South	2011	2013	Partial	2013	
Imperial Solar Energy Center West		2016	No		
Imperial Valley Solar Project		2015	No		
Inspiration Solar Generation Farm			No		
Ivanpah Solar Electric Generating System	2010	2013	Partial	2013	
Johnson Valley SEGS			No		
Kern Solar Ranch			No		
Kramer Junction SEGS	pre 2000		Yes	1987	1989
Liberty Solar Generation Project			No		
Lotus Solar Farm			No		
McCoy Solar Energy Center			No		
Midway Solar Farm 1			No		
Midway Solar Farm 2		2013	No		
Monte Vista Solar Array			No		
Mount Signal Solar Farm	2012	2014	No		
Mountain House Solar Farm			no		
Mustang			No		
North Star Power 1			No		
North Valley Solar Generation Project			No		
Oro Verde Solar			No		
Palen Solar Power Project			No		

CONSTRUCTION TOPICS					
Project Name	Construction Start	Estimated Online Date	Online	Start Online Date	Complete Online Date
Panoche Valley Solar Farm			No		
Quinto Solar Photovoltaic Project		2014	No		
Regulus Solar		2013	No		
Rice Solar Energy Project		2013	No		
Ridgecrest			No		
Rio Mesa Solar Electric Generating Facility			No		
Riverbluff Solar Energy Park			no		
Rosamond Solar			No		
Rosamond Solar Array			No		
Rugged Solar Farm			No		
Salton Sea Solar Farm 1			no		
Salton Sea Solar Farm 2			no		
Silverleaf		2016	No		
Solargen Panoche Valley Solar Farm			No		
Sonoran West			No		
Springbok Solar			No		
Stateline Solar Farm			No		
Tierra del Sol			No		
Topaz Solar Farm	2011	2014	No		
Tranquillity Solar Generating Facility			No		
Westlands Solar Park			No		
Westside Solar Ranch			No		
Willow Springs Solar Array			No		