# PHOTOVOLTAIC DESERT: TAX REVENUE OUTCOMES OF SOLAR DEVELOPMENT IN FRESNO COUNTY

A Thesis

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Eli Waylon Harland

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Department of Public Policy and Administration

Abstract

of

PHOTOVOLTAIC DESERT: TAX REVENUE OUTCOMES OF SOLAR DEVELOPMENT IN FRESNO COUNTY

by

Eli Waylon Harland

California exempts most solar energy systems from paying property tax. Passed by the electorate in 1980, Proposition 7 excludes solar energy property improvements from the definition of new construction for property reassessment purposes. Under the umbrella of the Global Warming Solutions Act of 2006, in 2011 the legislature expanded California's Renewable Portfolio Standard (RPS) to 33 percent of all retail electricity sales. The combination of the RPS, California's rich solar resources, and decreasing development cost of solar photovoltaic (PV) technologiesapplies development pressure on local communities. Development approval for all sizes of solar PV systems rests in the hands of cities and counties, and at 8 to 10 acres of land per megawatt, counties are concerned that the RPS will displace valuable land resources. In response to solar PV development requests and the Proposition 7 new construction exclusion, some counties are imposing public fees on solar PV projects. County fees, which are intended to compensate counties for solar PV impacts, may slow investment in solar PV and the state's RPS goal. How much property tax goes unrealized under Proposition 7?

In this thesis, I estimate the 20 year present value ofthe amount of unrealized property tax revenue in Fresno County. Using a list of all assessor parcel numbers (APNs) proposed for solar PV development in Fresno County, I compare three taxing scenarios with the property taxes on the County's 2010-2011 Tax Roll. The first scenario is a base scenario and assumes that because of the new construction exclusion for solar PV, solar PV improvements will not increase property taxes. The second scenario assumes that the new construction exclusion does not exist and that the county will tax solar PV improvements at the Proposition 13 rate of 1 percent. The third scenario assumes that the new construction exclusion does apply and that Fresno County applies a $450 per acre fee on solar PV improvements. In each scenario I use three discount factors, which are equivalent to the range of Fresno County's cost of borrowing. Also, based on available development cost literature, in all of the scenarios I use a conservative capital investment estimate of $2 per watt for each project.

In the first scenario I find that over 20 years, Fresno County will collect a present value amount of $1.5 million ofrevenue. In the second scenario I find that over the same period, Fresno County will collect $209.8 million of revenue. Lastly, in the third scenario I find that Fresno County will collect $29.4 million of revenue. These findings suggest that under Proposition 7, large amounts of solar PV capital will go untaxed, which is a disincentive for counties to facilitate the development of solar PV installations. To remedy the disincentive, I offer ways to connect current revenue streams that benefit large solar PV projects to county development processes. Using the fiscalization of land

use as a framework, I present the idea of using revenues from the cap-and-trade market as well as Renewable Energy Credits (RECs) to promote local development processes that promote the de-carbonization of land use.

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_________________________
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# Chapter 1

# THE ELECTRIC POWER INDUSTRY, CLIMATE CHANGE, AND SOLAR ENERGY PROPERTY TAXES

*"Electricity is a superior energy form—clean at the point of use, capable of performing many tasks, and easily controlled. Such attributes have increased its share of total energy use over the past three decades from 25 percent to nearly 40 percent."*

*-Richard Munson, From Edison to Enron, 2005*

The overarching goal of this thesis is to add a unique perspective to the budding collection of knowledge that is shedding light on the relationship between utility-scale solar photovoltaic (PV) development and land use planning.[1] Historically, state agencies reserve authority for planning and permitting conventional power plants in California. However, counties and cities maintain land use authority for solar PV projects. As local governments begin the public process to incorporate solar PV development into their communities, some are beginning to worry that solar PV projects require hefty amounts of land and do not pay property taxes for added solar PV improvements. These worries are leading some county officials to ask: what's in it for us? Given the substantial property tax incentive and significant solar resource in California's San Joaquin Valley, these private lands are receiving significant development pressure. This thesis seeks to answer two questions: 1) How large is the solar PV property tax exemption, especially in areas with rich solar resources like the San Joaquin Valley? 2) Are there alternative

[1] This thesis defines utility-scale solar PV as systems with the primary purpose of generating and transmitting electricity to sell as opposed to solar PV systems with the primary purpose of serving on-site load, regardless of system size or type of grid interconnection.

taxation scenarios that offer solar rich local governments a fiscal incentive to host utility-scale solar PV development?

To achieve ambitious climate change goals, California plans to develop hundreds of utility-scale solar PV power plants. Utility-scale solar PV projects are capital intensive and add significant improvement value to parcels of land. Proposition 7, passed in 1980, precludes local governments from assessing the value of these improvements. I have yet to find an assessment of how much property improvement value goes un-assessed and untaxed. To fill this void I use Fresno County, a San Joaquin Valley community, as a case study for the property tax implications of solar PV development. In this thesis I compare property tax outcomes in three scenarios for projects currently proposed in Fresno County. The first scenario is a business as usual scenario, in which the property improvement value of each project is not captured in the property's fair market value. The second scenario assumes that the land improvement value of each solar PV project is included in the property's fair market value. And, the third scenario explores tax revenue from applying a per acre fee on projected revenue generated from each project.

The first portion of this introduction offers an abbreviated history of the electric power sector from a vertically integrated monopoly to a horizontal hybrid of monopolistic and competitive characteristics. Building from this abbreviated history, I discuss land use changes and growth in the solar PV market in light of California's attempts to curb climate change. Lastly, I describe the collision between state policies (renewable energy and property tax) with locally regulated land in counties throughout the state.  This last section also introduces Fresno County, the municipality I will use to illustrate the property tax implications of utility-scale solar PV.

*The Electric Power Industry from Edison to Renewable Generation*

In order to grasp the sudden collision of renewable energy generation and land use it is necessary to review the history of the electric power industry.Arguably, one of the greatest industrial achievements of modern society is our ability to generate, harness, and transmit electrons.  It is unfathomable to imagine going about our daily lives without abundant and limitless access to electricity.  Lindl (2009) refers to electricity as the “spinal column” of our economy and a critical input to our standard of living (p. 15). Nationally, electric utilities hold assets in excess of six hundred billion dollars, more than any other industry within the U.S, including the auto industry (Munson, p. 3). The Electric Consumer Research Council (ECRC) reports that the August 2003 blackout left 50 million people without electricity and cost the U.S an estimated $10 billion in lost economic activity.

Munson recounts that the earliest recorded history of electrons and magnetism come from Thales, an ancient Greek philosopher.  However, it was not until the later part of the nineteenth centurythat industrial innovations began to put electrons to industrial and household uses. According to Evans (2004), in October 1879, Thomas Edison’s corporation, the Edison Electric Light Company, succeeded in developing the first electric powered light bulb.  The light bulb marked a turning point for electric industry growth because it is one of the first commercially viable end use devices that connect generating electricity with consuming electricity.

In the early years, electricity was a commodity that only a handful of wealthy persons and curious inventors enjoyed. At the time, most consumers purchased electric generators for on-site use, rather than purchase electricity from a local utilities distribution grid (electricity grids were just starting to develop). Munson notes that in 1907, only one in eight households used electric power and only one in thirteen manufacturing motors depended on electricity. Because the electricity market was a niche market with numerous companies touting their products, it lacked the standardized characteristics we take for granted today. In fact, there was such variation in electrical components and the technologies delivering electricity, that a light bulb or appliance that worked in one home would usually not work in a neighboring home. Edison's assistant Samuel Insull saw the inefficiencies of this decentralized system and advocated for a centralized electric system in which large electrical generators connect and deliver power to multiple end users.

Insull was instrumental in establishing the Chicago Edison Company, an electric utility conglomerate, where his visions lead to a centralized electric system that exploited significant economies of scale and drove electricity prices down from twenty cents per kilowatt-hour in 1897 to two and one-half cents per kilowatt-hour in 1909. This dramatic price drop increased the number of Chicago Edison customers from 5,000 in 1892 to 200,000 in 1913 (Munson, p.46). As Hirsch (1999) notes, other metropolitan areas and electrical corporations invested in centralized electric systems and experienced similar price drops. Before long, electricity was powering the gears of commerce and improving the "drudgery" of household life (Lindl, p. 860).

From a land use perspective, the early shift to develop a centralized electric system powered initially by hydropower and eventually imported fossil fuels meant that most of the land use impacts associated with electrical generation were not internalized by most consumers. In California, the areas with significant land use impacts for power generation are the coalmines of Virginia, Montana, and Wyoming and natural gas fields of the Southwest, Rocky Mountains, and Canada. This distinction in where the land use impact occurs for different types of technologies generating electricity is important. Renewable technologies, solar PV in particular, require a significant amount of land. In 2010, the National Renewable Electricity Laboratory (NREL) found that solar PV requires on average eight acres of land per megawatt of electric capacity.[2] However, because solar PV *extracts* resources (sunlight) and generates electricity in the same footprint and the scarce resource that solar PV consumes is land. Interestingly, Fthenakis and Kim (2009) find that over a lifecycle solar PV uses less land than technologies requiring extraction of fossil resources.

Soon after Insull's model of central generation took hold, prices dropped to such a level that consumers came to expect a predictable and inexpensive supply of electricity. Demand for electricity became nearly as inelastic as food and water. As Hirsch notes,

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[2] One megawatt of capacity serves the electrical demand of approximately 750 homes.

electric service providers had an "obligation to serve" this public good (p. 6). This obligation placed private electric companies in the crosshairs of government takeover or relinquishing a portion of their private market control to public control in exchange for monopoly protection and government regulation. Threatened by municipal takeover, Lindl explains that private electricity companies opted for a monopolistic structure, and by 1914 forty-four states had adopted a public utilities commission to regulate electricity monopolies. In 1932, to garner support for protecting the public benefits of the pact reached between the government and private utilities President Franklin D. Roosevelt declared, "Electricity is no longer a luxury. It is a definite necessity…It turns the wheels of most of our transportation and our factories…and can become the willing servant of the family" (Russell and Russell, 1938, p.727). The public benefits described by Roosevelt served as the justification for protecting utilities from competition. Over the proceeding decades, electricity fueled significant economic prosperity for the United States.

As Lindl describes, the monopoly structure given to private electric utilities in the early twentieth century "entrenched itself as the back bone of economic growth in the United States" (p. 862). As the century progressed and the economy expanded following World War II, so did the monopoly protected electricitysector. Munson notes that this changed in the 1960s, when electrical generators peaked in their ability to increase efficiencies and reach scale economies while faced with increasing demand for electricity. According to Lindl, reduced efficiencies in the face of increasing demand is one of three significant events in the 1970s that "ended the utilities' monopoly on electricity generation" (p. 863). As Lindl describes, the energy crises of 1973 marks the second event. The peaking of domestic U.S. oil supplies led to phenomenal increases in demand for foreign petroleum supplies. As domestic oil supplies peaked, so did tensions in the Middle-East as Arabs and Israelis fought for 25 days in the Yom Kippur War. As an ally, the United States provided immediate military support to Israel. In response to United States support and diminishing global supplies of oil, OPEC cut exports, thus creating an energy crisis. Lindl identifies the environmental movement's call for using cleaner burning fuel to generate electricity as the final event responsible for stripping monopoly powers from electric utilities.

In 1978, the U.S. Congress passed the National Energy Act, which contained the Public Utility Regulatory Policies Act (PURPA). Section 210 of PURPA opened up a pent up electrical generation market by requiring utilities for the first time to purchase power generated by independent power producers. These new independent power producers operating in a newly created competitive market achieved innovations in commercializing efficient and cleaner burning electric generators. In 1992, Congress passed the Energy Policy Act (EPAct). As Lindl notes, the Federal Energy Regulatory Commission (FERC) Order 888, under EPAct, forced utilities to "separate their generation and transmission businesses" (p. 864).

PURPA and EPAct gutted utilities' monopoly control of electrical generation. Utilities still maintain highly regulated control of the transmission and distribution of electricity, but PURPA and EPAct unbundled electric generation from utility monopoly control and stimulated the creation of a new market of independent power producers. At the end of the twentieth century, Lindl notes, California's wholesale qualifying facility generators were supplying nearly 17 percent of the electricity sold by electric utilities.

Until recently, state and federal electricity regulators limited their concerns to ensuring grid stability, fair rates, competition among independent power producers, and a reasonable return on investment for electric utilities. Amid concerns of climate change, as expressed in AB 32, California regulators are broadening their concerns to the resource mix of electric utilities. Thirty-three years after PURPA placed electricity into the invisible hand of the free market, the Renewable Portfolio Standard (RPS) is directing thirty three percent of this free market to start developing the State's future renewable generating facilities. While signing the RPS into law, Governor Brown declared that thirty-three percent renewable energy generation is only a floor. According to early estimates from Vidaver (2011), to achieve the long-term GHG reduction goals of AB 32 and meet future electricity demands, the State will need 67 to 78 percent of renewable capacity in 2050. A lot of this new generating capacity will come from utility-scale solar PV projects.

### *Climate Change Policies are Changing Land Use and Development Patterns*

#### Changing Land Use Patterns

The laws California has and will adopt to reduce greenhouse gas (GHG) emissions are altering the State's developed, abandoned, and untouched land resources.

In 2006, California passed Assembly Bill (AB) 32—the Global Warming Solutions Act. As directed by AB 32, the Air Resources Board (ARB) adopted a Climate Change Scoping Plan aimed at reducing statewide GHG emissions to 1990 levels by 2020 and to 80 percent below 1990 levels by 2050. To implement the Scoping Plan and reduce GHG emissions from vehicle tailpipes, the legislature passed Senate Bill (SB) 375. SB 375 requires regional and local governments to coordinate land use decisions by integrating housing and transportation plans to encourage dense urban planning to reduce vehicle miles traveled. Changing land use patterns to promote sustainable communities lies at the heart of SB 375. Senate Bill 375 is not the only Scoping Plan measure changing land use patterns across the state.

In 2011, the legislature passed Senate Bill (SB) 1X 2, expanding the State's RPS to 33 percent by 2020. Like SB 375, the RPS is a vehicle to achieve the GHG reduction targets of the Scoping Plan. The RPS mandates that 33 percent of all electricity sold in the State in 2020 must originate from renewable resources. According to the Energy Commission (2011), based on current market trends and available technologies, a large share of the RPS will come from solar PV development. As shown in Table 1, of all available renewable energy resources in the State, solar PV leads with 93 percent of technical potential.

**Table 1. California's Renewable Energy Potential**

| Renewable Technology | Technical Potential (megawatts) | Share of Total Technical Potential |
|---|---|---|
| Solar | 18,061,362 | 99.16% |
| Concentrating Solar Power (CSP) | 1,061,362 | 5.83% |
| Photovoltaic (PV) | 17,000,000 | 93.33% |
| Wind | 109,400 | 0.60% |
| On-shore | 34,000 | 0.19% |
| Off-shore | 75,400 | 0.41% |
| Waves and Tidal | 32,763 | 0.18% |
| Geothermal | 4,825 | 0.03% |
| Biomass | 3,820 | 0.02% |
| Small Hydro | 2,158 | 0.01% |
| Total Technical Potential | 18,214,328 | 100.00% |

Source: California Energy Commission, 2011, *Renewable Power in California: Status and Issues*
*Note: Technical Potential is the amount of generating capacity theoretically possible given resource availability, geographical restrictions, and technical limitations, like energy conversion efficiencies.*

As SB 375 fills our urban cores with high-density housing and urban train tracks, the State's RPS will fill our Southeastern and Valley deserts with solar power plants and power lines. The Mojave Desert, Colorado Desert, and San Joaquin Valley *Desert* contain the State's most abundant mixture of renewable resources, especially solar insolation (National Renewable Energy Laboratory, 2010).[3] Most of the land in the Mojave and Colorado deserts is public and subject to state and federal jurisdiction, while most of the land in the San Joaquin Valley is privately held and subject to local control.

In 2008, California joined the federal government in a partnership to develop the Desert Renewable Energy Conservation Plan (DRECP). The DRECP is a multi-

[3] Insolation is the measure of solar radiation (energy) over a given surface. NREL publishes static maps and GIS data of solar insolation across the United States.

stakeholder effort to draft a Natural Communities Conservation Plan (NCCP) that will facilitate renewable energy development on environmentally preferable lands in the Mojave and Colorado Deserts. This unprecedented planning effort is one of the State's first attempts to bring renewable energy and local land use planning into the same conversation. Most, but not all of the land in the DRECP planning area is public, which leaves planning and permitting authority in the hands of the State and Federal government. Additionally, the DRECP only encompasses a small portion of private land in the San Joaquin Valley.

To achieve the RPS and ultimately reduce GHG emissions, California must begin working on planning for utility-scale solar PV development in the solar resource rich Valley. Because most of Valley land is privately held and locally regulated, local governments (especially counties) are at the forefront of implementing land use planning to meet the RPS. Public officials are beginning to translate the renewable energy mandates that are driving utility-scale solar PV development into land use needs, especially in the Central Valley.

To advance efforts to tap the desert sunshine, in 2011 Governor Brown signed AB X113. Mostly, AB X1 13 is an instrument to expedite renewable energy development by coordinating species taking permits between the state and federal government on public lands within the DRECP area. Tucked into Section 5 of AB X1 13 is an attempt to introduce RPS goals into the local land use planning process. Section 5 allocates a modest appropriation of $7 million to the Energy Commission to administer a planning grant program aimed at fourteen counties. These counties consist of the seven counties within the DRECP and seven counties in the San Joaquin Valley.[4] The grant funds aim to integrate the State's renewable energy development goals with local land use plans in these resource rich jurisdictions. As the state designs program guidelines for allocating AB X1 13 planning grants and other measures to encourage renewable resource development, especially utility-scale PV, it is necessary to fully understand local government concerns of such development.

Industry Growth and Local Government Concerns

In California, the utility-scale solar photovoltaic (PV) industry is developing at a rapid pace. A combination of aggressive climate change goals, technological gains, and restructuring of the electric power industry is driving this growth. As the State fosters cooperation within the electric utility industry to integrate utility-scale solar PV into the electric grid, it is becoming apparent that California must also begin integrating utility-scale solar PV development into the land use planning process. In 1974, California deemed electric energy development a matter of statewide importance. The state vested authority for permitting most electric power plantsin the California Energy Commission.[5] However, forty years later the electricity market is very different than what it was in the

[4] AB 13 defines qualified counties as the Counties of Fresno, Imperial, Inyo, Kern, Kings, Los Angeles, Madera, Merced, Riverside, San Bernardino, San Diego, San Joaquin, Stanislaus, and Tulare. The DRECP wholly encompasses Imperial County and partly encompasses the Counties of Inyo, Kern, Los Angeles, Riverside, San Bernardino, and San Diego. The remaining counties make-up the San JoaquinValley and are the Counties of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare.

[5] The Warren-Alquist Act established the Energy Commission in 1974 and made the Energy Commission the lead permitting agency for all thermal power plants—those using heat to generate electricity—50 megawatts and larger.

1970s. Today, local governments are at the forefront of creating markets to develop solar PV of all sizes.

As Harris (2011) notes, utility-scale solar PV power plants are increasingly becoming a cost effective and viable renewable power plant option. Regardless of project size, permitting authority for utility-scale solar PV developed on private property in California is a function of counties and cities and not the Energy Commission. As a consequence, the rapidly developing utility-scale solar PV industry is colliding with a semi-prepared planning and permitting paradigm at the local level. The California Energy Commission (2011) finds that varying land use standards across the State's 540 cities and counties creates considerable market variability for utility-scale solar PV development.

For the State to capitalize on expanding the solar PV market and reach aggressive climate change goals, it is necessary to ensure that local governments recognize and incorporate utility-scale solar PV as an economic use of land within their planning and development frameworks. Achieving statewide climate goals through local action is a formidable governance challenge. Nevertheless, as Salkin (2009) notes, factors contributing to global climate change and actions to shift such factors are inherently local. Salkin finds that coordination between state and local governments in the U.S. are leading efforts to address the nation's climate and energy challenges. The most recent climate and energy challenge facing California's local governments involves deciding where and how much land to devote for utility-scale solar PV projects. In response to the adoption of a statewide 33 percent RPS, requests to develop utility-scale solar PV are on the rise.  As local governments process these requests and begin making changes to their land use frameworks, some local officials are beginning to ask, what's in it for us?

The County of Riverside is exploring one controversial alternative to answer this question and adopted an annual $450 per acre fee on solar projects operating within the County.  Solar advocates call the Riverside exaction a *sun tax* and claim that it threatens the viability of the solar industry.  However, the Riverside Executive Office worries that the county is becoming a host for the State's large solar projects and that the community must receive compensation for local view sheds that are irreparably changed. Economists refer to Riverside's claim as a negative externality imposed on the county as a result of state law to develop solar PV.  Quantifying the costs of a negative externality stemming from loss of open space and view sheds is difficult and highly debatable. However, Riverside County does see the State's charge to develop utility-scale PV and the County's inability to collect property taxes from such development as unfair.  Hence, the County adopted an alternative mean to apply a locally assessed tax to utility-scale solar PV.

The fact is that in flat and sunny *desert like* counties, utility-scale solar PV development is economical.  Unless major technologies in renewable electricity generation emerge, California's desert regions will likely play host for a sizeable portion of the State's utility-scale solar PV needs.  Because of significant property tax incentives enacted by the State, local governments that rely on property taxes as an important source of revenue, must forgo taxing local investments in utility-scale solar PV.

*Property Tax Law and Utility-Scale Solar Photovoltaic Power Plants*

As the AB X1 13 grant administrator, the Energy Commission must allocate grant funds "to qualified counties for the development or revision of rules and policies…that facilitate the development of eligible renewable energy resources" (Assembly Bill 13, 2011, Section 5 [b]). As mentioned, the aim of this thesis is to provide decision makers with a clearer understanding of the tax relationship between utility-scale solar PV development and land use planning, as well as analyze alternative tax policy approaches to integrate utility-scale solar PV into locally controlled land use plans. Analyzing the property tax implications of developing utility-scale solar PV in Fresno County will shed light on the property tax implications as the Energy Commission begins to assist counties with making significant land use alterations to accommodate utility-scale solar PV projects. The remainder of this section describes the local government property tax structure by providing an overview of the laws (Proposition 13, Assembly Bill AB 8, and Proposition 7) that have a bearing on solar PV property taxation.

In 1978, voters approved Proposition 13 and fundamentally changed local government finance. As Coleman (2004) notes, Proposition 13 stripped local governments of their ability to independently assesses property value and establish property tax rates. Proposition 13 amends the California Constitution to limit ad valorem taxes on real property to one percent of the fair market value of a parcel of property. Proposition 13 also establishes a maximum two-percent increase in assessed property value per year from a property's base year value. Under Proposition 13, when property ownership changes or a property undergoes significant improvements (i.e., sale or new construction) property values are reassessed and a new base year value is determined. The base year value, also known as the fair market value, is the taxable value of property.

Coleman explains that Proposition 13 immediately cut property tax revenues by nearly 60 percent across the State. Local governments and special districts across the State shouldered most of the burden for sharp declines in property tax revenues. Following the shift from local control to state control for determining property valuation and property tax rates under Proposition 13, the State also faced the quandary of determining how to allocate property tax revenue among local governments. Prior to Proposition 13, local governments determined their own tax rates and methods for sharing in property tax revenue. As Elledge (2006) notes, once Proposition 13 replaced local tax levy control with state control, the state assumed responsibility for determining how to allocate incremental property tax revenues among local governments and special districts. In 1980, the legislature passed AB 8, which establishes the formula and procedures to allocate property tax revenues among local governments.

Studying the efficacy and explaining the intricacies of California's myriad property tax policies under Proposition 13 and AB 8 extends far beyond the purpose of this thesis. However, it is important to understand that local governments assess and tax property value under Proposition 13 and allocate property tax revenues according to AB 8. Upon construction, utility-scale solar PV development receives a new construction exclusion from property reassessment, and the property retains its current assessed value for tax purposes. Because the added value of utility-scale solar PV goes untaxed, local governments receiving tax revenues under the AB 8 allocation effectively subsidize utility-scale solar PV development.

In 1980, voters approved Proposition 7, which amends Article XIII A, Section 2(c)(1) of the California Constitution and "grants the Legislature authority to exclude active solar energy systems from the definition of new construction" (State Board of Equalization, 2011, p.1).[6] Following the passage of Proposition 7, the Legislature enacted SB 1306 (Alquist, 1980), which added Section 73 to the Revenue and Taxation Code. Section 73 is the implementing statute of the California Constitution for the exclusion of solar energy systems from the definition of new construction.

As shown in Table 2, since 1980 the legislature has enacted a series of bills to extend the sunset date of Section 73. In fact, since SB 1306 first codified the exclusion in 1980, the only time the legislature did not implement the exclusion was between 1994 and 1999. The most recent legislative act to implement Section 73 is AB 1451 (Leno, 2008), which extends the exclusion for active solar systems through January 1, 2017. Generally, this means that solar energy systems installed on buildings or developed as utility-scale solar PV facilities prior to the 2017 sunset date will not trigger a new construction property reassessment and the value of solar PV improvements go untaxed.

[6] An active solar energy system includes virtually all solar technologies that generate electricity regardless of system size or the primary purpose of the system. This thesis studies utility-scale solar PV, which is characterized as systems designed with a primary purpose to generate electricity to sell to the electric grid.

**Table 2. Legislative History of Solar Energy New Construction Exclusion**

| Proposition and Legislative Action | Description |
|---|---|
| Proposition 7 | Approved by voters in 1980 and amended the California Constitution by giving the Legislature the authority to exclude from property tax assessment the construction of active solar energy systems. |
| SB 1306 (Alquist, 1980) | Added Section 73 to the Revenue and Taxation Code to implement Proposition 7. Its provisions were operative for five fiscal years: 1981-82 through 1985-86. |
| AB 1412 (Wyman, 1985) | Extended the exclusion for another five fiscal years: 1986-87 through 1990-91. |
| AB 4090 (Wyman and Alquist, 1990) | In 1990 proposed extending the exclusion through the 1993-94 fiscal year. AB 4090 passed both houses, but was vetoed by Governor Deukmejian. The Governor's veto messages stated that he supported efforts to encourage the development of solar energy in California, but the bill would have resulted in millions of dollars of property tax revenue loss to local entities in the high desert region of the state. |
| SB 103 (Morgan, 1991) | Extended the exclusion for three more fiscal years - 1991-92 through 1993-94. SB 103 included a provision to automatically repeal its provisions on January 1, 1995 absent future legislative action. No legislation passed prior to the repeal date so the exclusion was not available for five fiscal years (1994-95 through 1998-99) until AB 1755 was enacted. |
| AB 1755 (Keeley, 1998) | Re-established the exclusion for six fiscal years: 1999-2000 through 2004-05. |
| AB 1099 (Leno, 2005) | Extended the exclusion for another three years: 2005-06 to 2008-09. |
| AB 1451 (Leno, 2008) | Extended the exclusion for another six years: 2009-2010 to 2016-2017. |

Source: California State Board of Equalization, Staff Legislative Bill Analysis, 2007.

Proponents of the new construction exclusion contend that Section 73 is a vital tax incentive to advance California's efforts to meet statewide energy and climate goals. But, who pays the cost for excluding utility-scale solar PV development from triggering property tax reassessments? As shown in Table 2, worried that a proposal to develop a solar generating facility in San Bernardino County would result in significant tax revenue losses for the county, Governor Deukmejian vetoed AB 4090 in 1990. In his veto message, the Governor stated that extending the new construction exclusion would result in significant tax revenue losses for local governments that permit solar electric generating facilities. Classifying forgone property taxes as losses is an overstatement. As Bob Dylan (1965) reminds us in *Like a Rolling Stone*, "when you ain't got nothing, you got nothing to lose". The significant tax revenue losses Deukmejian refers to are only losses if solar facilities demand more public services than the amount of public revenue they contribute for services. If solar facilities demand little public services, then counties *got nothing to lose*, and the solar property exclusion is correctly scored as unrealized revenues.

When Deukmejian vetoed AB 4090, there was only one proposal in the State to develop a utility-scale solar PV facility. Driven mostly by the RPS, there are currently hundreds of proposals across the state to develop utility-scale solar PV, twenty-nine of which are in Fresno County. If all of the projects currently proposed across the state are built before Section 73 sunsets in 2017, the cumulative property tax revenues that go uncollected because of the new construction exclusion are markedly greater than the single project that pushed Deukmejian to veto AB 4090.

This thesis uses Fresno County as a case study to explore the property tax implications of Section 73. The property tax implications are the same for all counties across the state facing solar PV development pressure. However, focusing on the twenty-nine projects in Fresno County I am able to explain in detail the mechanics of the new construction exclusion. A key policy advantage of focusing on Fresno County is that the County is one of the fourteen eligible AB 13 counties. Additionally, focusing on a single county allows me to illustrate which tax receiving agencies in the County forgo property tax revenues according to their county specific AB 8 allocation.

### *Overview of the Remainder of this Thesis*

Energy policy is a complex knot. There is a wide variation of political and economic interest that make up the strands of this knot. This is especially true in the emerging market for renewable electricity. The market for renewable electricity is laden with technical, legal, environmental, and financial challenges. These issues range from how to integrate intermittent renewable generation into the electric gird; solving legal issues surrounding how to define and establish credits for renewable energy; mitigating cumulative environmental impacts from large scale renewable energy development; and, developing investor confidence to attract capital for renewable energy investments. Exploring these issues, while critical to developing a renewable energy market, are beyond the scope of this thesis.

This thesis tackles the emerging policy problems associated with integrating the RPS into the local land use planning process. Specifically, this thesis explores the property tax implications to local governments that accommodate utility-scale solar PV projects. In Chapter 2, I present a review of literature relevant to understanding the macro development factors driving utility-scale solar PV. The intent of this review is to provide *context* to understand the types of land use patterns required to meet the future energy needs of Californians. This review begins by diverting from our current thinking of climate change to a discussion that *conceptualizes* our future energy supplies in the face of resource peaking. From the lens of resource peaking, it is apparent that land use changes are critically important to transition to renewable energy sources. One of these important changes is to develop a consensus based system for assigning private solar property rights to transition from a society powered by depleting resources to a society powered by renewable resources. The latter part of this review synthesizes the different ways in which others estimate utility-scale solar PV project costs. This description of costs is a critical component of estimating the inputs for the tax policy scenarios explored in Chapter 4 and the policy recommendations I offer in the last chapter.

Chapter 3 describes the study area (Fresno County) and presents a description of the data used to analyze tax outcomes resulting from utility-scale solar PV. In Chapter 3, I provide an overview of the San Joaquin Valley as a whole with a particular focus on Fresno County and its world-class agricultural industry. The review of the study area sets the stage for the land use trade-offs that Fresno County is balancing in light of proposals to develop utility scale solar PV on agricultural land. Following a description of the study area, I provide a description of the currently proposed solar PV projects within the county as well as the sources of data that I use to estimate the property tax outcomes of these projects. The data description closes with a summary of the AB 8 shares that each local government within the county receives from the one percent levy on property taxes.

Chapter 4 presents the methodology for the three tax policy scenarios as well as describes the outcomes of each scenario. The first taxation scenario is the business as usual scenario in which the currently proposed utility-scale solar PV projects receive property tax benefits made available by Proposition 7. The second scenario assumes that the new construction exclusion established in Proposition 7 does not apply to currently proposed projects. The last scenario explores the hypothetical outcome of Fresno County applying a two percent sun tax on the estimated annual revenue from each project. In each scenario I calculate the present value of twenty years of the estimated annual tax payments, including the allocation of those payments to local governments and special districts according to AB 8 distribution factors.

The final chapter offers a discussion of the present value outcomes of the differing tax policy scenarios. Additionally, Chapter 5 describes limitations within the analysis and assumptions in this thesis and identifies specific areas that necessitate further study. Lastly, in light of the state's renewable energy goals and the land use demands that these goals place on local communities I offer a set of policy recommendations that seek to integrate solar PV development into the local land use planning process.

# Chapter 2

## LITERATUE IN THE CONTEXT OF PLANNING: PEAKING RESOURCES, PROPERTY RIGHTS, AND PHOTOVOLTAICS

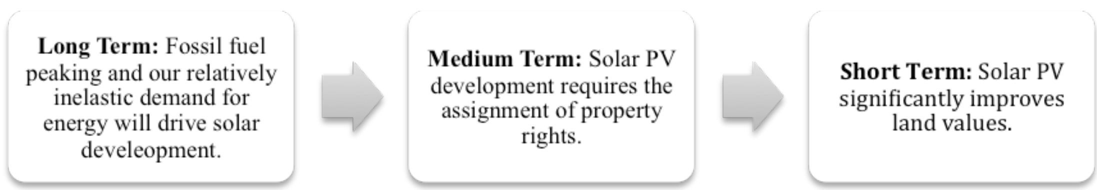
*"No amount of sophistication is going to allay the fact that all your knowledge is about the past and all your decisions are about the future."*

*- Ian E. Wilson, 1975*

In light of Wilson's observation about the future, in this chapter I discuss literature relevant to establishing a future *context* for land use planning and solar PV development. Context is an important basis of rational land use planning. Rational planning is a process in which generally agreed upon presumptions about the future—the context—inform decisions made today. One way to describe this context is to frame solar PV development into long-term energy trends, medium term planning responses, and immediate development impacts. What is the outlook for solar PV in our future energy supply? How will we assign property rights to extract the next generation of solar resources to meet our electric needs? What is the added property value of solar PV improvements? To answer these questions I analyze the literature describing the context of solar PV development. I organize the analysis into three themes, each of which represents a distinct timeline in the future.

Together these themes encompass the long-term, medium-term, and short-term time horizons. A rational model of these themes is shown in Figure 1. The first theme sets the stage for solar PV development over the long run. To establish this long-term perspective, I discuss the role of solar PV electricity in the context of fossil resource peaking.  The second theme discusses integrating solar PV development into the medium-term land use planning process.  To establish this midterm perspective, I discuss the role of property rights in the context of solar resources.  The last theme presents the property improvement value that solar PV development immediately adds to parcels of land.  This last theme is of particular importance in the tax policy scenarios I explore later in Chapter 4 as well as to the policy recommendations I present in Chapter 5.

**Figure 1. A Logical Model Describing the Context of Solar PV Development**




So far, I have discussed climate change mitigation as the force driving solar PV development.  No doubt, expanding solar PV will cleanse our electricity sector; however, solar PV also offers California an opportunity to buffer against the calamity of fossil fuel peaking.  As a result, solar PV development will continue to expand onto private land, and continue forcing a shift in governance of electric generation from the state to cities and counties.  Local land use planning will play an important role in developing the state's utility-scale solar PV infrastructure.  As Fulton and Shigley (2005) explain, land use planning is a process of plan "making" and plan "implementation" (p.11).  Plan making is the political and technical process that communities undertake to create broad policy tools (e.g. general plans, specific plans) to guide future development.  Plan implementation refers to the regulatory system (e.g. zoning, development agreements) that local governments use to shape future development. Context plays an important role in shaping these planning processes. To develop long-term plans and immediate regulations to guide utility scale solar PV, it is important to explore the context of solar PV.

*Solar Electricity is Inevitable in Light of Resource Peaking*

This first theme discusses one of the major drivers of renewable energy development: peak resources. Understanding current theories of resource peaking sets the stage for the need to undertake long term land use planning at all levels of government, especially the local level. So far I have framed the need for expanding solar PV development in terms of GHG reductions and the RPS. As Salkin and Hanaket al. (2008) note, this climate-change perspective aligns with the reasons that most government officials support sustainable planning. However, in the long run a much larger force—resource peaking—will drive the inevitable expansion of renewable resource extraction.

Grantham (2011) refers to this force as the phenomenon of “peak everything” (p. 2). As Grantham explains, the finite resources (mostly hydrocarbons) that propel economic growth and bolster our standard of living are facing increasing demand and their dense energy stores are beginning to show signs of depletion. As McKillop (2009) reports, investors around the globe are hedging their bets on finite resource depletion and are moving their investments toward renewable resource extraction. Newman (1991) reported 23 years ago that it is critical that urban planning processes incorporate assumptions of reduced oil use, especially within urbanized areas. Because we leverage land use planning decisions heavily on a handful of cheap fossil fuels, it is important to explore the future availability of these resources.

In terms of this analysis, the important energy supplies subject to future resource constraints are oil, coal, and natural gas. In this section, I explain our current demand for these resources and discuss the literature examining future supplies of these finite resources. This section closes with a description of the role that solar PV will play in meeting future demand for electricity in a fossil fuel constrained world.

Peak Oil: Electric Transport Once the Wells Run Dry

Hubbert (1949) is credited as one of the first researchers to describe the phenomenon of peak oil. As Hubbert notes, peak oil refers to the time at which known oil reserves reach their maximum output followed by a sharp decline in their production. The phenomenon is relatively simple. At some point in time, a finite resource like oil will deplete if the oil is extracted quicker than geologic processes create it. As Deffeyes (2001) notes, industry experts originally dismissed Hubbert's theory of domestic oil peaking in the United States. Yet in the early 1970s, the time Hubbert predicted that oil production in the United States would peak, it did.

The sudden decline of oil production in the United States added significant demand for oil from members of the Organization of Petroleum Exporting Countries (OPEC). The increased demand for oil coincided with the Unites States' decision in 1973 to provide support to Israel in the Yom Kippur War (United States Department of

State, 1973). In reaction to significant demand pressure and the United State's support for Israel, Arab member countries of OPEC initiated an embargo on petroleum exports to the oil-constrained United States. The embargo created a significant undersupply of oil, which Frum (2000) explains led to the 1973 Energy Crisis. As Frum notes, during the energy crisis the price of a barrel of oil rose from $3 per barrel to $12 per barrel. In reaction to abrupt oil scarcity, the federal and state governments urged citizens to conserve energy, even instituting a rationing system for gasoline sales and bans on Christmas lights. The social consequences of the energy crisis underscore the implications of Hubbert's peak oil theory.

Most peak oil literature centers on debates over when global peak oil will occur. A handful of predict that we have surpassed or are very near a peak, while others predict a peak is decades or even centuries away (United States Government Accountability Office [GAO], 2007, pp. 12-13). Mostly, the guessing game is the result of OPEC's cartel control, protecting OPEC nations from reporting quantities of most known and prospected oil reserves (GAO, 2007, p.14). Nevertheless, as Larson (2006) concludes, the timing of peak oil is less important than is planning to stave off the consequences of diminishing petroleum supplies. Larson finds consensus among most authors that peak oil is a fairly certain phenomenon in the future. In oil dependant California, the calamity of such an event is unthinkable.

According to the U.S. Energy Information Administration (EIA), in 2009 California consumed 657.2 million barrels of petroleum, of which motorists consumed

357.7 million barrels; an amount equivalent to eleven percent of national motor gasoline consumption. Absent the availability of alternative fuel sources, a decline in global petroleum supplies carries significant social consequences for California. Unfortunately, as Heinberg (2009) explains, petroleum is unmatched in energy characteristics and all viable alternatives to oil are inferior in terms of their energy efficiency. Further, worldwide demand for oil is placing significant strain on peaking supplies. In a 2007 report to Congress, the GAO explains that in 2005 the Department of Energy (DOE) understood that transportation fuel shortages would render untold economic adversity. The GAO finds that "most studies estimate that oil production will peak sometime between now and 2040" (GAO, p. 4).

Pimentel and Pimentel (2008) explain that the energy stored in a liter of oil is dense and equal to roughly the same amount of energy a worker expends every 100 hours. According to Heinberg, in addition to the advantages of its dense energy store, oil is also easily transported and stored. One fundamental consequence of oil's convenient consumption features is our historic development model that has designed a built environment under the presumption that oil is infinite. As Jackson (1985) explains, United States urbanization as we know it is predicated on the rapid expansion of automobile use. Heinberg explains there are no commercially available fuels with an energy store as dense or mobile as petroleum. However, electricity offers a new and viable alternative to power the next generation of transport systems.

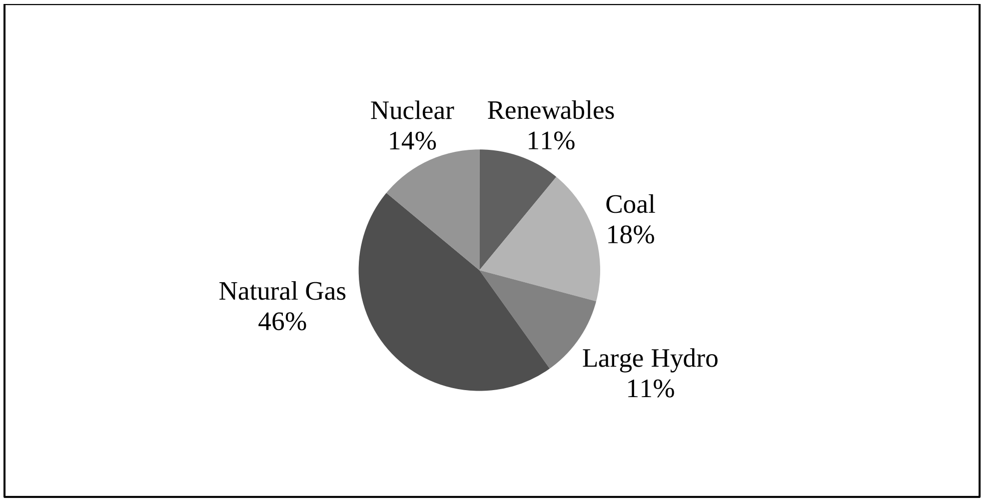
Next 10 (2011) notes replacing our current fossil fuel powered transportation fleet to an electric powered armada requires significant investment. Nevertheless, in March 2012 Governor Brown announced investment plans to add 1.5 million zero-emission vehicles by 2025. The Energy Commission (2010) expects the number of electric vehicles to grow exponentially through 2040. This expansion of electric vehicle use means that a growing number of tailpipes in California will emit zero emissions. So long as the fuel generating the electricity to power these vehicles is carbon-free, electric powered vehicles will contribute to reduced metropolitan area GHGs. Additionally, renewable powered electric vehicles are significantly more immune to fuel scarcity. However, two significant impediments exist to replacing our liquefied fossil powered fleet with a *renewable* electric powered armada.

First, as Next 10 notes, given current technologies electric cars have a poor range of distance. Second, little renewable capacity currently exists and in a peak oil scenario easily dispatch able conventional (fossil powered) power plants make financial sense, yet less and less fossil fuel resources are available. A land use shift, like SB 375, to planning denser urbanization to reduce vehicle miles traveled will help address the electric vehicle distance impediment. To address the second impediment to renewable energy expansion, in the next section I explore the future of two conventional fuel sources that electrify a significant portion of the California electric grid: natural gas and coal.

Coal and Natural Gas: All Fossil Resources Eventually Peak

As shown in Figure 2, 64 percent of California's electric supply comes from generating electricity from coal and natural gas. Though the Energy Commission (2011) reports that over 17,000 megawatts of renewable capacity are waiting to come on-line, only 11 percent of electricity comes from renewable sources. According to the EIA, unlike many of the large electricity consuming nations and states in the nation, coal powers a relatively small portion of California's electric needs. Like oil, global coal production also faces imminent peak. The Energy Watch Group of Germany (2007) reports that world coal production will peak between 2025 and 2030. However, the group also notes that continued economic expansion in China fueled by cheap coal will result in a quicker peak. Though coal supplies a fraction of California's electricity supply, in the face of peak coal production the state must ensure there are adequate supplies of fuels to compensate for the loss of coal.

**Figure 2. California's Electric Generation Mix, 2008**




Source: California Energy Commission, 2009 Integrated Energy Policy Report.

Natural gas and renewable energy will likely offset the loss of electricity generation from coal production peaking. Additionally, natural gas and renewable energy are likely to meet increasing electricity demand as California shifts from a liquid powered transportation system to an electric powered network. However, natural gas supplies are also finite. According to Heinberg, natural gas is depleting, though a peak in domestic natural gas supply is difficult to predict. Reynolds and Kolodziej (2009) estimate that natural gas production in the lower forty-eight states and Canada will peak in 2013. Other estimates (Goodstein, 2004) conclude natural gas production is past its peak, while others (Pritchard, 2009) project natural gas peaking further into the future; up to as late as 2035.

Advancements in resource scouting and extraction techniques make it difficult to estimate natural gas supply. Horizontal drilling, better known as hydraulic fracturing, allows natural gas developers to extract natural gas from previously unreachable and difficult to tap natural gas deposits. Historically, vertical natural gas wells extend to a modest depth of 50 to 300 feet, while horizontally drilled wells extend as deep as 5,000 to 20,000 feet (U.S Senate Committee on Environment and Public Works, May 24, 2011). Additionally, the process of creating veins in deep rock and shale formations through hydraulic fracturing allows natural gas developers to sequester larger amounts of natural gas than traditional vertical well drilling. However, the future of hydraulic fracturing is uncertain due in large part to the environmental consequences of hydraulic fracturing. The debate concerning such environmental consequences is highly polarized and the merits of both sides of the environmental debate extend beyond the scope of analyzing peak natural gas supplies in this thesis.

Guilford et al. (2011) and Heinberg report that in terms of energy output to energy invested, natural gas is in decline. Guilford et al. refer to this calculation as energy return on investment (EROI), which is the ratio of the amount of energy procured from natural gas extraction to the energy used to extract the natural gas. While there are several microeconomic factors affecting natural gas EROI, Guilford et al. find that at the macro level, EROI for natural gas continues to shrink. Given the complexities of estimating natural gas peaking, EROI serves as a proxy for describing such supply and given current technologies and known supplies, it is unlikely that natural gas EROI will improve much. The Institute for Energy Research (IER, 2010) estimates that the world spends 9 percent of GDP on energy expenditures. As EROI for natural gas declines, policy makers must continue to urgently pursue future energy resources to sustain economic growth.

Solar Energy: The Next Era of California's Electric Fuel Mixture

Heinberg explains, the amount of energy "transmitted to the Earth's surface in the form of solar radiation" is unmatched by all other energy sources and that "if only 0.025 percent of this [solar radiation] energy flow could be captured, it would be enough to satisfy world electricity demand" (p. 42). Fortunately, we have solar PV technologies that can capture some of this solar radiation. Unfortunately, there are several technical, economic, and political impediments to capturing solar radiation with solar PV technologies. One of these is finding the land area required to install solar PV panels to capture renewable solar radiation. Each megawatt of installed solar PV capacity requires seven acres on average (National Renewable Energy Laboratory [NREL], 2010). This acreage requirement means that if California met the entirety of its electric generating capacity (roughly 65,000 megawatts) with solar PV, the state would need more than a half-million acres of solar PV panels or one-tenth of an acre per resident. There are many technical reasons, notably the intermittency of the sun that will limit the share of total electric generating capacity from solar PV, and hence the land area. Nevertheless, in the face of fossil fuel peaking, solar PV will play an increasingly critical role in generating much needed electricity.

Fossil fuels are dense ancient stores of the sun's energy. They are products of geologic processes of organic decay that occur over a long period of time (Grantham, 2011, p. 2). Solar PV directly extracts and uses the suns energy, which effectively cuts out the 'decay' middleman. Del Chiaro and Gibson (2006) highlight that sunlight in

California is in abundant supply, yet it is also highly dispersed and current technologies are inefficient (as compared to our ability to capture energy stored in fossil resources) at capturing the sun's rays. Nevertheless, Leitner (2002) estimates that on average, most areas of California receive at least five kilowatt-hours (KWh) of solar insolation per square meter per day. Given that an average household consumes 16 kWhs of electricity per day, Del Chiaro and Gibson estimate that four square meters of sunny surface area is needed to meet a household's electricity demand from solar PV. Although residential electricity consumption makes up a sizable amount of California's electricity demand, 32 percent according to the Energy Commission, several sectors in the state's economy also depend on electricity (Integrated Energy Policy Report [IEPR], 2009).

Compared to most states, California generates a respectable amount of electricity from renewable resources. Nevertheless, most of the supplies of the state's current renewable resources—geothermal and hydroelectric—are nearing their peak generating availability. Further, the EIA reports that California imports more electricity from other state's than any other state. In the face of fossil fuel peaking, California must begin to develop in-State renewable resources to meet growing electricity demand. Declining petroleum supplies will drive electric vehicle deployment and place an increasing dependence on electricity. However, declining coal and natural gas supplies available to generate electricity face increasing demand for electricity and place the state into an energy predicament. To meet growing demand for electricity, the Golden State must begin planning for future solar resource extraction. As many stakeholders acknowledge, there are surmountable political and market issues associated with redeveloping the electric grid to accommodate solar powered electricity. Locating the land resources needed for utility solar PV is one such issue. As the state transitions to a world defined by an electric powered economy, land use planners and developers must locate land resources to extract renewable solar energy to generate electricity.

*Bundle of Sticks: Maturing From Ancient Lights to Solar Use Easements*

This second theme describes property rights and their application to solar PV development. In California, through the land use planning process, cities and counties assign (and restrict) property rights to certain uses of land. Higgins (2006) uses the metaphor “bundle of sticks” to describe property rights, where each stick in the bundle represents an explicit property right (p.12). For the most part, through their land use powers, cities and counties dictate which sticks private property owners’ hold in their bundles. In light of fossil resource peaking and growing demand for electricity generation from land consumptive utility scale solar PV, cities and counties must recognize new sticks for solar resource extraction.

The Tenth Article of the United States Constitution reserves land use control (referred to as police powers) to states. Higgins reminds us that California’s Constitution, legislative statutes, and court precedent clearly delegate these land use police powers to cities and counties. This land use authority, implemented by California cities and counties through the state’s Planning and Zoning Law (Government Code §65000, et seq.), “is the process by which our society decides what gets built where”

(Fulton and Shigley, p. 7). Mostly, conventional electricity planning is a function driven by utilities and state agencies (Outka, 2010, p. 1042). However, solar PV planning and permitting is a local government (cities and counties) function, guided by local government police powers.

In California, not all solar property right assignments are a local government police power function. Following the energy crisis of the 1970s, in 1978 the California legislature enacted the Solar Rights Act (SRA). According to Anders et al. (2010), SRA limits local government police power of solar energy systems by granting all citizens the right to install solar energy systems and receive solar access. Anders, Day, and Kuduk (2010) summarize that solar access rights originate from the English common law known as ancient lights. The intent of the ancient lights doctrine is to preserve property owners' continued access to direct sunlight by establishing a perpetual easement that bars neighboring property owners from blocking sunlight that shines through a window. In their review of SRA, Anders et al. conclude that the legislative intent of the SRA is to protect citizens from onerous property restrictions for small-scale distributed solar energy systems designed to serve on-site energy demand as opposed to systems designed to sell electricity to the electric grid. Thus, the SRA does not apply to large-scale utility size solar PV installations.

Utility scale solar PV development requires large tracts of land to capture highly dispersed solar resources. Because solar PV sequesters the sun's infinite supply of rays, in a fossil fuel-constrained world, Heal (2009) considers solar PV a superior technology.

However, rather than requiring continuing fuel resources to generate electricity, solar PV requires land resources for solar energy extraction. Thus, Klass (2010) emphasizes the need to develop a framework for assigning solar PV property rights. Further, Outka explains that renewable energy development requires vast land areas to meet renewable energy goals and she stresses the need to bridge a consensus between energy and land use law.

The remainder of this section describes the relatively new phenomenon of assigning property rights for solar resource extraction. Historically, ancient lights laws like the SRA were the result of the energy crises. And like the energy crises, once California secured new energy supplies, most local officials forgot about the SRA (Anders, Day, and Kuduk, p. 3). With the push towards climate change goals and another looming energy crisis, the SRA is once again receiving attention. However, the SRA protects solar resource access and does little to promote property rights for solar resource extraction. The distinction between access and extraction is important. Access refers to the right to receive sunlight, whereas extraction refers to the right to create a commodity (electricity) by capturing sunlight.

To address the need to establish property rights for solar resource extraction in this section I turn towards a discussion of California's latest law, SB 618 (Wolk, 2011), which creates a new property interest: solar use easements. SB 618 is one of California's few statewide policies directing land use decisions for solar resource extraction and it significantly revises contract rescission rules of the highly coveted Williamson Act. The

Williamson Act of 1965 is California's primary law protecting agriculturally productive land from urban development.[7] Because the general area of study in this thesis is the agriculturally productive San Joaquin Valley (specifically, Fresno County), exploring the application of SB 618 is timely and appropriate. Additionally, the land use rules governing the application of SB 618 offer a solid platform for counties seeking to integrate solar PV development into their land use planning processes, even on lands not under Williamson Act contract or in Williamson Act preserves.

Easements and the Right to Extract Solar Resources

As NREL reports, sunshine is ubiquitous in most of California. Hence, most land area receiving solar resources is favorable for "solar resource extraction from solar PV cells" (NREL, p.17). However, in a state as diverse as California, not all land is prime for solar resource extraction. According to the Association for Environmental Professionals (AEP, 2011) some of this land is better suited for future urbanization, agriculture, and open space (e.g. wetland and scenic areas). AEP notes that solar PV is increasingly applying development pressure on agricultural lands, especially those with Williamson Act contracts. Recognizing the need to balance competing land uses while also promoting the development of large-scale solar PV lawmakers passed SB 618. SB 618 allows a property owner with "marginally productive or physically impaired land"

[7] For a thorough description and current status of the Williamson Act program, see the California Department of Conservation's *2010 Williamson Act Status Report* at: http://www.conservation.ca.gov/dlrp/lca/stats_reports/Pages/index.aspx.

and a local government to rescind a Williamson Act contract and simultaneously enter into a solar use easement (Government Code 51191).

As Wassmer (2008) explains, the Williamson Act "allows the payment of lower local property taxes by farmers and ranchers for a 10-year renewable term in exchange for agreeing to keep their land in agricultural production or open space" (p. 2). The legislature passed the Open Space Subvention Act in 1972 as a system to reimburse counties for property tax revenues lost as a result of entering into a Williamson Act contract (Wassmer, p. 2). Because of significant budget constraints in recent years, the State stopped making subvention payments. As a result, some counties are choosing to non-renew or enter into new Williamson Act contracts, which the AEP reports threatens the "preservation of important agricultural lands in the State" (p. 4). Further, some counties receiving solar PV development requests for lands under Williamson Act contracts are making the public interest findings to cancel contracts and permit development of solar PV projects. However, Williamson Act contract cancellations for large tracts of land are expensive (equal to 12.5 percent of a property's market value) and legally vulnerable.

In his analysis of SB 618, Detwiler (2011) notes that a landowner for a single project in Kern County paid $755,714 in contract cancellation fees. Additionally, Adler (2011) reports that the California Farm Bureau Federation (CFBF) filed a lawsuit in November 2011 against the Fresno County Board of Supervisors for approving to cancel a Williamson Act contract on prime agricultural land to allow the development of a solar

PV project. Taking a public trust doctrine point of view, the CFBF argues that the Board of Supervisors must strike a balance between the public interest to protect farmland and the public interest to develop solar PV projects (California Farm Bureau Federation v. County of Fresno Board of Supervisors, 2011). The public-trust debate over farmland protection and food production versus solar PV development and renewable electricity generation is intriguing, yet complex. I do not intend to untangle this knotty public policy problem. My intent in this section is to set the land use criteria in SB 618 into the context of what others suggest for establishing a land use framework for solar PV development.

Framework for Assigning Solar PV Property Rights

SB 618 is one of the first statewide laws in California directing land use changes to accommodate solar PV. The law allows a landowner of certain parcels under a Williamson Act contract to rescind a contract and simultaneously enter into a solar use easement. Solar use easements restrict a property's use to solar PV development for a minimum of ten years, though most easements will run for at least twenty years. The definition of certain lands is the crux of this analysis. Article 2 of SB 618 specifies that lands under Williamson Act contracts are eligible for rescission and subsequently a solar use easement if the property meets particular land conditions and land designations. The condition of the land must meet either of the two conditions:

> (A) The land consists predominately of soils with significantly reduced agricultural productivity for agricultural activities due to chemical or physical limitations, topography, drainage, flooding, adverse soil conditions, or other physical reasons.

> (B) The land has severely adverse soil conditions that are detrimental to continued agricultural activities and production. Severely adverse soil conditions may include, but are not limited to, contamination by salts or selenium, or other naturally occurring contaminants.

In addition to meeting either of these two land conditions, the property must also meet the following property designation:

> The parcel or parcels are not located on lands designated as prime farmland, unique farmland, or farmland of statewide importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Natural Resources Agency, unless the Department of Conservation, in consultation with the Department of Food and Agriculture, determines that a parcel or parcels are eligible to be placed ina solar-use easement based on the information provided in subdivision (b)that demonstrates that circumstances exist that limit the use of the parcelfor agricultural activities [this includes a demonstrate able lack of irrigated water]. For purposes of this section, the important farmlanddesignations shall not be changed solely due to irrigation status.

According to the bill's own declaration, the legislature's intent is "toprovide an additional method for terminating a Williamson Act contract, inaddition to those methods already authorized by statute" to facilitate "solar photovoltaic facilities onmarginally productive or physically impaired farmland" (SB 618, Chapter 596, Statutes of 2011). Though SB 618 applies to a limited supply of particular Williamson Act land, the land conditions and property designation criteria of the bill are similar to those suggested in renewable energy and land use law literature.

In her policy recommendations for creating a nexus between energy and land use law, Outka (2011) suggests that land use planners reuse land to shift energy development "away from natural areas to previously disturbed land" (p. 48). In Mosey et al.'s (2007) landmark study of contaminated sites across the U.S, the authors find that significant brownfield and previously contaminated land resources exist throughout California with the potential to host utility scale renewable energy development. Though SB 618 does not apply to lands outside of Williamson Act contracts, land use planners can use this criterion to encourage solar PV development on similar low value lands. Elkind (2011) reports that in a University of California Berkley workshop discussing land use issues surrounding solar PV and farmland, members of the workshop recommended that counties use criteria similar to the criteria in SB 618 (p. 15).

Outka also suggests that energy infrastructure planning break from a reactive paradigm, “in which a developer proposes a project and the site is reviewed” to a paradigm in which land use planning informs project locations (p. 51). Outka argues that through their future energy resource procurement planning requirements, utilities know where their future supplies of electricity generation will come from. As Russell and Weissman (2012) report, integrating utilities’ renewable resource procurement planning with local land use planning offers an opportunity to pre-screen suitable sites for renewable energy development. Building on her suggestion to integrate land use planning earlier in the energy development process, Outka points to the smart growth context.

Smart growth, a theme embodied in SB 375, brings together transportation planning with housing planning to reduce metropolitan GHG emissions. Vajjhala et al. (2008) explain that land use planning offers a platform to integrate underutilized as well as new grid infrastructure with new renewable energy development. To bring smart growth principles into the energy and land use planning process, Outka argues that broad approaches for identifying appropriate land resources as they relate to grid infrastructure must accompany the discourse driving renewable energy development.

Increasingly, policy makers and land use planners recognize the critical role that land use planning and property rights will play to meet future electricity needs from solar PV. Appropriately assigning these property rights to protect agricultural and environmentally sensitive lands is crucial. Counties must begin a deliberate process of integrating appropriate land use criteria as they create new solar PV property right *sticks*. Once counties assign property rights for solar PV, what outcome will solar PV development have on property value? The next section explores this question.

*The Added Value of Photovoltaic Development*

The final theme of this literature review presents approaches to estimate utility scale solar PV development cost and projected revenues. As resource peaking continues to apply pressure on local governments to acknowledge property rights for solar PV development it is crucial to understand the added value of such development. As discussed further in Chapter 3 and presented in Chapter 4, understanding the capital costs and revenues associated with solar PV projects is important in determining the tax implications of solar PV development.

A utility scale solar PV project is capital intensive and generates very valuable electricity. Carley (2009) finds that state RPS policies and renewable resource quality induce much of the growth in renewable energy investments across states. The development cost, commonly referred to as installed cost of solar PV represents the improvement value that a utility scale solar PV project adds to a parcel of property. As the Energy Commission notes, the installed cost for solar PV plummeted nearly 86 percent from 1980 to 2011 (Draft 2011 IEPR, p.1). Branker, Pathak, and Pearce (2011) report that the installed cost of solar PV is reaching parity in terms of development cost competitiveness with other electric generating power plants. Yet, the technology is still expensive to develop and its future depends on policies like the RPS. However, just because a state has an RPS in place does not make solar PV projects viable investments.

Investors and project developers still expect a return on investment from solar PV projects. In the case of solar PV, developers and financers make investment decisions based on the revenue and added value that a project will generate. The revenue comes in the form of electricity sales to a local utility and additional value comes in the form of the green attributes of solar electricity. In California and in other states with renewable portfolio standards, green attributes are known as Renewable Energy Credits (RECs). For utilities subject to California's thirty-three percent RPS, RECs represent a utility's RPS compliance portfolio. The REC is a unit of renewable electricity (measured in terms of a megawatt hour) that regulated utilities demand in order to meet their portfolio requirements. Hence, RECs are an extremely valuable commodity, especially to utilities with large generating portfolios.

I have not found any literature that projects the cash value of electricity generation from solar PV development. Mostly, this is because the negotiated price that solar PV developers receive for selling electricity to a utility is confidential. Solar PV developers and electric utilities in California negotiate Power Purchase Agreements (PPA) for each hour of electricity delivered to the grid. For most utility-scale solar PV projects, the California Public Utilities Commission (CPUC) has oversight authority to approve or disapprove a negotiated PPA. To preserve competitiveness in the electric power generation market, the CPUC does not disclose PPA contract terms, including negotiated prices, for three years.

Unfortunately, most PPAs for utility scale solar PV power generation have yet to reach the three-year non-disclosure window. Without a contract price for solar PV projects, it is difficult to estimate potential revenue from electricity sales. Similarly, REC prices for each unit of solar electricity are part of a negotiated PPA, which makes estimating the cash value of a REC difficult. The remainder of this section reviews how installed capital costs of solar PV projects add value to parcels of property.

Installed Costs of Solar PV

Solar PV projects are markedly different than most conventional electrical generating facilities. In terms of project costs, solar PV projects do not require continuing fuel inputs to generate electricity. This lack of continuing fuel costs places most of the costs to generate electricity from solar PV into the initial development costs (i.e., installed cost). Estimating the installed cost of utility scale solar PV projects is tricky because solar PV technology varies and constantly evolves. And, like most developers, solar PV project developers do not readily make their development pro-formas public. However, Barbose et al. (2011) find that a handful of trade associations and some researchers report installed cost for utility scale solar PV. These estimates measure the total costs of solar PV development, which includes the materials installed into the ground as well as indirect costs, like labor and project planning.

Because I use the installed cost estimates to project property tax revenues, I focus the analysis of installed cost on the costs that represent property improvement values. Though ‘soft-costs’ such as labor, project design, and site preparation are important cost factors of developing solar PV, I focus on the hard cost of solar PV systems, which represent the real property improvement value of a parcel of property.

Most researchers and policy makers refer to the installed cost for electric generating facilities in terms of installed capacity on a per watt basis.[8] Installed capacity, or nameplate capacity, refers to the maximum electric output of a generating facility. For utility scale facilities, installed capacity is almost always reported in megawatts (MW). Thus, a utility scale solar PV system with a nameplate capacity of two-megawatts and an installed cost per watt of three dollars has a total installed cost of $6 million ($3/watt x 2 million watts). Although, there is little information regarding actual installed cost for utility scale solar PV, there is a subset of research that estimates installed cost of utility

[8] There are one million watts in a megawatt.

scale solar PV. The remainder of this section presents the varying installed cost estimates from this research.

Annually, Barbose et al. analyze the installed cost trends of solar PV for all types of PV technologies. Historically, their research centers on small solar PV systems installed on home and commercial rooftops. In their most recent analysis, the researchers include utility scale solar PV systems. The authors note that data for installed utility scale systems are arguably less reliable than data for much smaller systems, yet their costs estimates are similar to the cost estimates of Goodrich, James, and Woodhouse (2012). In their sample of 31 utility scale projects, Barbose et al. find that costs range widely between $2.9 to $7.4 per watt. The wide range mostly stems from differing PV technologies (e.g. thin film panels, fixed crystalline panels, and panels installed on trackers).

Utility scale systems installed in Fresno County are most likely to employ technologies that place them towards the lower end of Barbose et al. findings. Barbose et al. control for installation hard costs by using award amounts for solar PV projects from the U.S. Department of the Treasury's Section 1603 Program.[9] Because the 1603 reimbursements are for real property only, Barbose et al. conclude that the award amounts reported by the Treasury represent 30 percent of the hard cost of projects. Thus, the lower end of the installed cost Barbose et al. estimate offer a reasonable proxy for estimating the installed cost by watt for projects proposed in Fresno County.

[9] Born out of the Recovery Act, the 1603 Program offers renewable energy developers a cash reimbursement of 30 percent of their real property costs for new renewable projects.

Goodrich, James, and Woodhouse analyze the cost drivers of utility scale solar PV. The researchers organize their cost findings according to installation materials, installation labor, and indirect installation costs. To control for variations associated with differing project sizes and design, the researchers employ a cost model and apply a sensitivity analysis to their project cost outcomes for fixed axis utility scale systems. In their sample of 997 projects, the average installed cost is $4.09/watt, median installed cost is $4.13/watt and the standard deviation of the sample is $0.41/watt. Within their sample, the researchers find that installation materials (i.e., solar panels, inverters, and materials) represent roughly 50 to 70 percent of total development costs. This share of total development cost translates to hard costs of $2.40 to $2.60 per watt.

The Solar Electric Industries Association (SEIA) releases quarterly reports of the solar market. In *U.S. Solar Market Insight: Second Quarter, 2011*, SEIA finds that installed cost of solar PV fell from $3.85/watt in the first quarter of 2011 to $3.75/watt in the second quarter. SEIA does not detail the breakdown of its cost estimate, yet the installed cost SEIA claims are similar to Goodrich, James, and Woodhouse and Barbose et al. Beck et al. (2010) offer extensive insight into the capital cost of developing all major electric generation facilities, including solar PV. Most importantly Beck et al. incorporate regional differences associated with solar PV development. In Bakersfield, a region in close proximity to Fresno County, they estimate a capital cost of $6.35/watt for utility scale solar PV. Their estimate includes off-site and indirect cost, making it difficult to estimate the cost of real property improvements (i.e. hard costs). They base their estimates on 2010 project costs which do not capture the significant price declines of PV modules in 2011 that SEIA and Barbose et al. report. Nevertheless, the estimates from Beck et al. are similar to the range of costs that Barbose et al. report.

To estimate the potential tax revenues that result from property improved with solar PV, in Chapter 3 and 4 I will use a conservative estimate of $2/watt. This estimate assumes that all projects currently proposed in Fresno County are built as single fixed axis systems, with standard module technologies. It is likely that several projects will develop with lower cost thin film modules or higher cost tracking systems. Using $2 per watt as an estimate is conservatively realistic. Additionally, the goal of calculating property tax scenarios is to model the mechanics of property taxation and solar PV development and not to provide an exact calculation of tax revenues.

### *Final Thoughts and Decisions About the Future*

Most literature acknowledges that our federal government is far from establishing firm policy that redirects urbanization from a dependency on finite resources to a settlement pattern powered by renewable resources (Outka, 2010, p.12). While federal investment in sustainable development is sizeable, federal policy makers do not couple necessary policies with their substantial investment efforts. According to Salkin, state and local governments are outpacing the federal government in promoting sustainable development. This outpacing the federal government is not surprising. After all, solar resources are inherently local and subject to local control. Because renewable resources, like solar, are inherently local and subject to local control, California's cities and counties are at the forefront of implementing the land use framework for achieving broad renewable energy goals.

California's energy future is at a crossroads. Driven mostly by environmental goals, an energy transition to renewable resources offers an even greater opportunity to replace dwindling fossil resources with renewable resources. However, renewable resources like solar PV are unique because the primary resource that solar PV development consumes is land rather than fuel. This land resource requirement means that expanding electricity delivery through solar PV will increase California's energy "footprint" (Outka, p.2). As fossil fuel supplies dwindle and scarcity gives way to ever increasing energy prices, an economy as large as California will require significant renewable resources.

Upgrading California's energy infrastructure to meet increasing electrical demand requires local land use authorities to recognize property rights for solar resource extraction. Each community's land use needs differ and in the San Joaquin Valley, counties must balance land use needs with competing needs for agricultural production. In sunny and flat San Joaquin Valley counties like Fresno, solar PV has tremendous potential to meet growing demands for renewable electricity. As land use planners and local officials contemplate solar PV development, it is important to understand the property value impacts of such decisions. Using an estimate of $2 per watt of installed capacity for solar PV, in the proceeding chapters I estimate solar PV property tax outcomes.

# Chapter 3

# PHOTOVOLTAIC DESERT: THE SAN JOAQUIN VALLEY, FRESNO COUNTY, AND PHOTOVOLTAIC PROJECT DATA

*"Nowhere is the salinity problem more serious than in the San Joaquin Valley of California, the most productive farming region in the entire world."*

*-Marc Reisner, Cadillac Desert*

This chapter provides an overview of the geographic area under study as well as a description of the study data. Although the property tax outcomes that I explore in this thesis apply to solar PV projects in all cities and to conceptualize the tax outcomes I focus this thesis on proposed solar PV projects in Fresno County. Fresno County is my choice study jurisdiction because the county is an eligible recipient for AB 13 renewable energy planning grant funds. Fourteen counties are eligible to receive AB 13 planning grant funds, eight of which are in the San Joaquin Valley. Currently, counties in the San Joaquin Valley face pressure to approve renewable energy development. According to the Renewable Energy Action Team (REAT), in December 2011, of the 40,000 megawatts of proposed solar PV projects in California, almost half want to interconnect in the San Joaquin Valley. Once the Energy Commission allocates AB 13 planning grants and counties begin to update their land use development processes and plans to assign solar PV property rights, requests to construct solar PV projects will certainly grow.

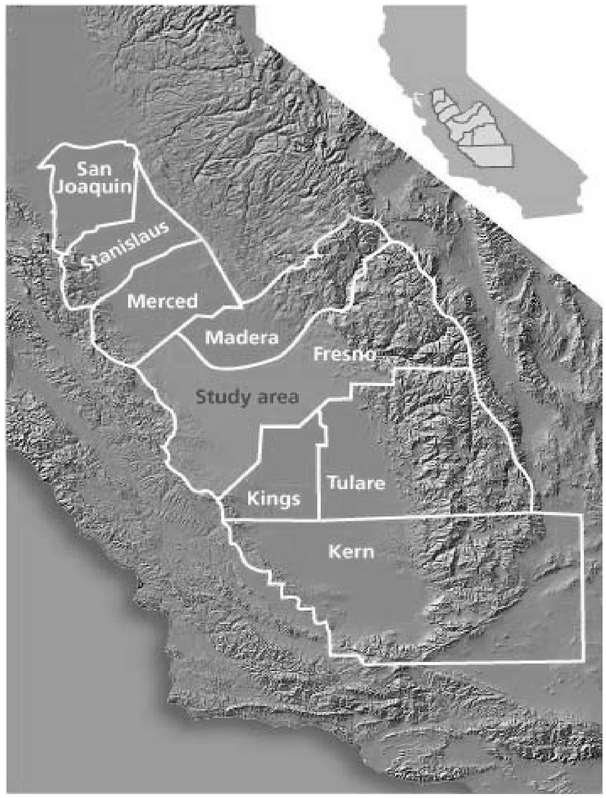
This chapter broadly describes the study area in terms of the San Joaquin Valley and specifically Fresno County. Lastly, this chapter describes the solar PV study data and property tax structure in Fresno County.

*The San Joaquin Desert and the Nation's Most Agriculturally Productive County*

The San Joaquin Valley

So far, I've called the San Joaquin Valley a desert, but to the uninformed eye, the Valley appears lush and productive and looks far from a desert. Compared to most deserts, the Valley's luscious agricultural bounty fools most outsiders into thinking that the valley is the recipient of a steady supply of precipitation. However, the San Joaquin Valley is by definition a semi-desert, receiving an annual average of 5 to 10 inches of rain. Most of this rain falls in the Valley between November and March (Oregon Climate Service, 1995). Despite a lack of rain, the Valley is an agricultural marvel, earning it the nickname 'The Salad Bowl of The World'. The eight Valley counties shown in Figure 3 represent slightly less than half of the reported income from farm related activities for California as a whole. As Fulton and Shigley note, the eight counties that make-up the San Joaquin Valley rank among the top fourteen counties in terms of agricultural production in the nation.

**Figure 3. Overview of San Joaquin Valley and Study Area**




Source: Schmidt, et al. (2010)

As shown in Table 3, the 2010 gross production value of agricultural commodities in the eight county Valley is nearly $25 billion. Fresno County agriculture contributes nearly one-quarter of the Valley's production value. Without a steady supply of rain, how does the farm industry in the Valley pull off such an impressive feat? The same way all great civilizations have done, through irrigation.

**Table 3. 2010 Gross Production Values of Agricultural Commodities in the San Joaquin Valley**

| County | 2010 Gross Production Value | Share of Total San Joaquin Production Value |
|---|---|---|
| Fresno | $5,944,758,000 | 24% |
| Kern | $4,757,260,700 | 19% |
| Tulare | $4,046,447,700 | 16% |
| Merced | $2,733,492,000 | 11% |
| Stanislaus | $2,312,669,000 | 9% |
| San Joaquin | $1,960,086,000 | 8% |
| Kings | $1,717,971,000 | 7% |
| Madera | $1,348,505,000 | 5% |
| Total San Joaquin Valley | $24,821,189,400 | 100% |

Source: The 2010 Gross Production Value for agricultural commodities comes from each county's 2010 Crop Report. Individual references for each report are available in the References section of this thesis.

Pumped water from underground aquifers and surface water deliveries from the Central Valley Project (CVP) and State Water Project (SWP) serve most of the agricultural water needs in the Valley. However, most of the aquifers are running low and urban demands for CVP and SWP water are placing significant strain on the Valley's water needs. In addition to dwindling water supplies, over irrigation of the Valley's desert soil creates salinity problems. As Reisner (1986) explains, the Valley floor is the "residual bottom of an ancient sea," made up mostly of impermeable Corcoran Clay (p.

8). The clay layer just below the surface of the Valley's rich soil blocks irrigated water from draining to the water table. As a result, the water quickly evaporates in the desert sun, leaving behind devastating amounts of salt and selenium. The consequences of less water and damaged farmland for food production are grave. For the solar PV industry, the consequences are propitious.

It is beyond the scope of this thesis to strike the public trust balance between food production and renewable energy. However, SB 618 specifies that lands under Williamson Act contract with adverse soil conditions (specifically selenium and salt build-ups) are candidates for contract rescission and a solar use easement. There is no current inventory of lands that may qualify for solar use easements, though as Elkind finds, it is likely that several Williamson Act contracts in the San Joaquin Valley will qualify. Regardless of soil conditions, given the relatively flat slope and abundant sunshine, solar PV development in the Valley is economical. As of December 2011, in the five most southern Valley counties, there are requests to develop 97 solar PV facilities on over 37,000 acres of land.

Fresno County

With 3.8 million acres of land and surface water area, Fresno County is the sixth largest county in California and the tenth most populous. In 1860, four years after the County formed, the U.S. Census reports the County's population was 4,065 persons. According to the Department of Finance (DOF), by 2010 the population grew to 930,450 persons; over two hundred and twenty eight times its original size. More than eighty percent of the county's population resides within the county's fifteen incorporated cities; the remaining twenty percent reside in the unincorporated area. Though most of the population resides in the incorporated area, the heart of the county's economy—an astounding agricultural industry—is located in its unincorporated area.

Fresno County is situated in the world's most agriculturally productive region. According to the Agriculture and Land Use Element of the county's General Plan, since the 1950s Fresno County has been the leading agricultural county in the United States. The 2007 Census of Agriculture reports that of the 3,079 counties in the United States, Fresno County's $3.7 billion agriculture industry is number one in total value of agricultural products sold. Over two-thirds of the county's total agricultural products sold are from crops and the other third is livestock and poultry. Despite its valuable soil, Schmidt et al. (2010) report that in Fresno County "between 1990 and 2004, 12,524 acres of high-quality land were converted to urban development...the third highest conversion rate in California" (p. 130). Further, the DOF (2011) reports that by 2050 Fresno County's population will reach 2 million, placing significant urban development pressure on the County's rich agricultural soil (DOF, P-3 Population Projections).

California's aggressive renewable energy goals add another form of development pressure to Fresno County's farmland. Solar PV is land consumptive. Fresno County's Planning Commission and Board of Supervisors are beginning to issue conditional use permits to the first of many solar PV development requests. As discussed in Chapter 2, the Board has shown support for solar PV development on prime agricultural lands under

Williamson Act contracts. The Board justifies its willingness to cancel contracts on prime soil by making the public interest finding that solar PV requests located near electric infrastructure is cost effective for electric ratepayers and in the best interest of the state.[10] As evidenced by the California Farm Bureau Federation's lawsuit against the Board, proximity to underused electric grid infrastructure is less beneficial than protecting food production. Aside from the food production versus solar PV development debate, there is little public discussion among the Board regarding the property tax implications of solar PV development. The County faces numerous requests for solar PV development, which I explore in the next section.

*Data Description*

This section describes the array of data sources that I used to estimate the outcomes of the new construction exclusion and alternative tax policy scenariosfor utility-scale solar PV projects in Fresno County.This section also describes how I use the data to calculate variables andconstruct a complete dataset. Later in Chapter 4, I present the methodology and tax policy scenarios that the data will feed into. I organize the data as follows: individual project information, parcel specific property assessed values, and applicable property tax rates and AB 8 distribution factors. Combined, these data serve as the basis for modeling the attributes driving property improvement value (project information), the method the improved value is assessed (property assessed values), and the procedures for taxing and disbursing the tax revenue among local governments

[10] It is generally agreed upon that siting new power plants near existing and underused electric infrastructure is a way to capture cost benefits to electric ratepayers.

(property tax and AB 8). Before describing each of these sources it is necessary to first describe the unit of analysis (individual solar PV projects) that these data apply to.

The intent of this thesis is to estimate Fresno County tax revenue outcomes resulting from development of utility-scale solar PV projects. As mentioned, I define utility-scale solar PV projects as projects with the primary purpose of generating and selling electricity directly to a local utility (Pacific Gas and Electric [PG&E] for projects in Fresno County) as opposed to solar PV projects designed to serve on-site electricity demand. Table 4 displays a summary of all solar PV projects proposed in Fresno County, as reported by the County's Division of Public Works and Planning.[11] See Appendix A for a complete description of each individual project and Appendix B for a map of proposed projects in the county.

As shown in Table 4, there are twenty-nine proposals to develop utility-scale solar PV projects. Cumulatively, these projects propose developing 9,883 acres and add 1,331 megawatts of solar PV capacity to PG&E's electric generation portfolio.[12] All of the projects are on lands in the County's Exclusive Agricultural District (AE-20 and AE-40). Over half of the projects, representing over one-third of proposed acres for development are on properties under Williamson Act contract.

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[11] Accessed on November 1, 2011 from the Fresno County Division of Public Works and Planning at: http://www2.co.fresno.ca.us/4510/4360/updates/current_plancom/misc.%20projects/solar/solar%20projects%20in%20process.pdf.
[12] One megawatt of capacity generates enough power for roughly 1,000 homes.

**Table 4. Summary of Solar PV Projects in Fresno County, Total**

| Number of Projects | Total Generating Capacity (megawatts) | Total Acres | Acres on Williamson Act Contracted Land |
|---|---|---|---|
| 29 | 1,331 | 9,883 | 3,652 |

Of the 94 parcels with development proposals, the County's 2011 Tax Roll does not include 56 of these parcels. As discussed below, the assessed value for each parcel originates from the 2011Tax Roll. Because the Tax Roll does not include these 56 parcels, I remove them from the analysis. This removal results in the elimination of six projects from the analysis. Publically available information describing the proposed projects does not provide an explanation of when these proposed parcels were created or from the parcels from which they were created.

Parcels in the 2011 Tax Roll represent the full inventory of parcels within the county on the January 1, 2011 lien date. Most likely, landowner requests to split portions of the proposed parcels after January 1, 2011 is why these project parcels are not included in the 2011 Tax Roll. Without an explanation of which parcels were split to create the new parcels, it is not possible to assign a current property value to parcels that make up the six proposed projects. Appendix C notes the parcels that are not included in the analysis. As shown in Table 5, the remainder of the analysis includes twenty-three projects with a combined capacity of 644 megawatts. The projects are proposed on 4,574 acres, 80 percent of which are on land under Williamson Act contract.

**Table 5. Summary of Solar PV Projects in Fresno County, Revised**

| Number of Projects | Total Generating Capacity (megawatts) | Total Acres | Acres on Williamson Act Contracted Land |
|---|---|---|---|
| 22 | 644 | 4,574 | 3,652 |

Individual Project Data

Fresno County makes available the development application for each proposed solar PV project. Each of these development applications includes important information detailing the current and proposed uses of the parcels. The information that I record from each of these development proposals includes the number of proposed acres, the specific parcels proposed for development, and the anticipated nameplate capacity (in megawatts) of each proposed solar PV facility. To estimate the value of improvements in Chapter 4 to each of the parcels proposed for development, I use the nameplate capacity as a proxy for the value of each solar PV project.

As discussed in Chapter 2, there is wide variation in the development costs of solar PV facilities. This variation is mainly because of the differing technologies of solar PV modules. Traditionally, thin-film modules are less expensive than fixed-axis mono/poly crystalline silicon modules. Fixed-axis modules are less expensive than modules mounted on systems designed to track the sun. Many of the development applications in Fresno County propose developing solar PV facilities with fixed-axis crystalline silicon modules, though some propose thin film and tracking systems. As presented in Chapter 2, in 2011 a reasonably conservative estimate for installed cost of utility-scale solar PV across module technologies averages $2 per watt. To project the cost of each of the individual proposed projects in Chapter 4, I multiply the nameplate capacity (in megawatts) of each by the 2011 installed cost that I describe in Chapter 2.

The cost of each project represents the value of property improvements resulting from solar PV development. Revenue and Taxation Code (RTC) Section 73 specifies that an assessor "shall determine the new base year value for theportion of any taxable real property which has been newlyconstructed." Further, Section 110 defines "fair market value" as the "amount of cash or itsequivalent that property would bring if exposed for sale in the openmarket" in an arm's length transaction. For properties that change ownership, the fair market value is typically the same as the sale price. However, for newly constructed property improvements, fair market value must equal the price that the newly constructed property would bring if sold in an arm's length transaction under normal market conditions. This rational assumption of fair market value means that the development cost of new improvements at the time of construction equals the fair market value of the cost to develop the property.

Parcel Specific Property Assessed Value

As shown in Appendix D, seven of the projects in this analysis consist of proposals to develop on more than one parcel. Most of these project proposals indicate that development will occur on two or three parcels. Two developers propose developing single projects on twenty or more parcels. Across all twenty-two projects, developers propose constructing solar PV facilities on thirty-eight parcels. Distinguishing the specific parcels as identified by the assessor parcel number (APN) for each project is important. Assessors determine property value for tax purposes at the parcel level. The net assessed value of each parcel is the sum of the land value, improvements, trade fixture improvements, personal property, manufactured housing, class exemption, and homeowner exemption. Assessors record the assessed value for each of these assessed classes by APN on an annual basis in the County Tax Roll.

In this thesis, the current assessed value of each APN originates from Fresno County's 2011 secured assessment roll. Appendix D displays the 2011 assessed value for each APN for each proposed project. Table 6 summarizes these projects. As shown in Table 6, the total assessed value of all parcels with development proposals is slightly more than $9.3 million. As shown in Table 6, the total value of assessed land is about $7.8 million and the total value of assessed improvements is slightly more than $1.5 million. The total land value of the parcels is 84 percent of the total assessed property for all projects. The land value represents a majority share of total property value because all of the land proposed for development is agriculturally zoned, with minimal improvements. Later, in Chapter 4, I analyze the property tax outcomes of an increase in the assessed value of improvements resulting from solar PV development.

**Table 6. Summary of Assessed Values for Properties with Solar PV Project Proposals in Fresno County**

| Number of Projects | Number of Parcels | Total Assessed Value of Property | Total Value of Land (% of total) | Total Value of Improvements (% of total) |
|---|---|---|---|---|
| 22 | 38 | $9,337,964 | $7,799,815 (84%) | $1,532,099 (16%) |

Note: The total value of land and improvements does not equal the total assessed value of land because some parcels include assessed values for personal property, manufactured housing, class exemption, and homeowner exemption.

Property Taxation and the AB 8 Distribution Factors

Proposition 13 limits the ad valorem property tax rate to one-percent of the total assessed value of property. As reported in the 2010-2011 Fresno County Schedule of Levies, the county collected a total of $544.9 million in secured property tax revenue from a net secured assessed value base of $54.5 billion. The current assessed value of property (about $9.3 million) shown in Table 6 and the one-percent tax limit, Fresno County currently collects roughly $90,000 in property taxes each year from the 38 parcels proposed for development. Once collected, where does the property tax revenue go?

Counties collect the one percent ad valorem property tax and allocate it among their local governments according to AB 8 distribution factors. On an annual basis, Fresno County updates its AB 8 distribution factors and reports the factors in the Schedule of Levies. As shown in Table 7, Fresno County shares the one-percent property tax revenue among twenty-four categories of agencies. The county government retains 13.88 percent of property tax revenues collected, and shares the remaining 86.12 percent with all other agencies. Schools receive the majority (63.4 percent) of property taxes collected. Each of the groups shown in Table 7 represents broad categories of agencies made up of many individual agencies. For example, the "Cities" category is made up of the fifteen incorporated cities within the County, each of which receives a portion of the 13.58 percent share. In Chapter 4, I calculate the AB 8 distribution of property taxes under different solar PV tax scenarios to the broad categories shown in Table 7.

**Table 7. Fresno County AB 8 Distribution Factors**

| Agency Category | Distribution Factor (%) | Agency Category | Distribution Factor (%) |
|---|---|---|---|
| Fresno County | 13.88 | Mosquito | 0.73 |
| Cemeteries | 0.31 | Park and Recreation | 0.27 |
| Community Service | 0.05 | Police | 0.04 |
| County Service Areas | 0.02 | Public Utility | 0.05 |
| County Water | 0.05 | Waterworks | > 0.01 |
| Fire Districts | 3.58 | Cities | 13.58 |
| Flood Control | 1.66 | Elementary Schools | 1.13 |
| Irrigation | > 0.01 | High Schools | 0.74 |
| Hospital | 0.34 | Unified Schools | 30.17 |
| Library | 1.53 | Colleges | 5.25 |
| Lighting | > 0.01 | Education Revenue Augmentation Fund | 22.96 |
| Memorial | 0.39 | County Office of Education | 3.16 |

Source: County of Fresno, Schedule of Levies 2010-2011
Note: Distribution Factors do not total to 100 percent due to rounding.

# Chapter 4

## METHODS AND OUTCOMES FOR THREE TAX POLICY SCENARIOS

*“I’d put my money on the sun and solar energy. What a source of power! I hope we don’t have to wait ‘til oil and coal run out before we tackle that. I wish I had more years left!”*

*-Thomas Edison, 1931*

California voters passed Proposition 7 in 1980. Proposition 7 authorizes the state legislature to extend a unique and valuable property tax incentive to property owners that improve their properties with active solar systems. In 2008, AB 1451 (Leno) became law, extending these property tax incentives through the end of 2016. Until AB 1451 sunsets at the start of 2017, beneficiaries of property tax revenues—local governments—will not receive an increase in tax revenue from solar PV property improvements.

This chapter estimates the unrealized property tax revenue from solar PV improvements for local governments in Fresno County. To date, we know little about community impacts (e.g. municipal services, neighboring property values, ecosystem outcomes) resulting from solar PV development. It is fair to assume that solar PV development will not demand traditional municipal services, like water for showers or teachers for classrooms. Nevertheless, utility-scale solar PV improvements add substantial capital value and consume large amounts of land. As solar PV development expands, the capital investments associated with solar PV will go unrealized on tax rolls under Proposition 7.

The rush to develop solar PV to meet California’s energy and climate goals continues to apply development pressure on local communities. As counties begin to prepare development standards for facilitating solar PV development, some counties are imposing public charges on solar PV. Critics argue that local charges on solar PV development are illegal under Proposition 26 (2010) and the Mitigation Fee Act. Proponents of local solar PV fees use the new construction exclusion in Proposition 7 and potential development impacts to justify fees on solar PV projects. In California, this state-local conflict is not unique to solar PV development; however, the hefty property tax break protected in Proposition 7 presents an interesting governance challenge.

Bardach (2009) describes this type of governance challenge as a problem in policy design. Bardach explains that conflicts associated with an upper level of government (states) applying "treatment" to a lower level of government (counties) render "special policy design" attention (p. 21). As California adopts policy and implements programs to expand utility-scale solar PV development, it is important to understand concerns from communities that host utility-scale solar PV. A quantifiable way to measure one of these concerns is to examine local tax revenue outcomes under Proposition 7 and AB 8 for utility-scale solar PV development.

Building on the project data and AB 8 distribution factors in Chapter 3, this chapter presents the methodology and tax outcomes under three taxing scenarios:

- *Nothing to Lose*- the present value of taxes accruing under Proposition 7's new construction exclusion, which means solar PV improvements are untaxed and revenues for Fresno County will not change after solar PV capital is installed.

- *Equal Treatment on the Tax Roll*- the present value of taxes that would accrue under Proposition 13 absent Proposition 7; and,
- *Sun Tax*- the present value of revenues under Proposition 7's new construction exclusion, but with a per-acre fee for land developed with solar PV.

The purpose of calculating each tax scenario is two-fold. First, it is important to determine the amount of unrealized property tax revenue resulting from utility-scale solar PV development and offer different revenue outcomes under alternative taxing amounts. Secondly, understanding how the land use planning process and taxation interact will help inform state and local government agencies with integrating land use and economic development efforts to further solar PV development. As more information on community impacts become available, a comparison of the cost of those impacts and the tax revenue outcomes described below will enhance public policy's understanding of an equitable balance of taxation and development impacts.

In the next section of this chapter I present the methodology and present value equation I use to calculate each of the tax outcomes. Following the description of the methodology, I present the three outcomes under each of the scenarios described above.

*Methodology: Present Value of Multiple Cash Flows*

To evaluate the tax implications of solar PV development, I calculate the present value of expected tax receipts over a 20-year time horizon to each of the tax receiving entities (per AB 8 allocations) in the three tax scenarios. Ross, Westerfield, and Jordan (2008) recommend using the present value of multiple future cash flows to calculate the present value of future payments that differ from payment period to payment period. Though property owners remit property tax payments biannually, for simplicity I assume annual property tax payments. Also, because property tax payments incrementally increase each year, I treat the value of each annual payment as a differing cash flow for each tax receiving entity in Fresno County.

The present value formula I use in each scenario for each project is,

$$PV_t = (R/(1+i)^1)+(R/(1+i)^2)+(R/(1+i)^3)+...+(R/(1+i)^{20})$$

where R is the annual tax payment, *d* is the discount rate, *i* is the tax receiving agency, and PV is the sum of the present value of future tax payments. I calculate the sum of the discounted annual tax payments to each tax receiving entity (according to the AB 8 distribution factors) for 20 years under the three tax scenarios. Each scenario assumes a different approach to valuing land with solar PV improvements; therefore the annual tax payment (R) under each scenario varies. Additionally, I inflate the annual base year values of each project by two percent. This inflation rate captures the maximum incremental property value growth allowed under Proposition 13.

In each of the scenarios I use a discount rate (*d*) of two, four, and six percent. According to the California Debt and Investment Advisory Commission (CDIAC, 2012) between 2005 and 2011 the average cost of long-term borrowing for public debt issued in Fresno County varies around four percent. According to Stokey and Zeckhauser(1978) and Bardach, discount rates for public money acquired through taxation should reflect the opportunity costs of money. The most reliable, albeit not perfect proxy for opportunity cost, is Fresno County's average cost of four percent to borrow money. Because future borrowing costs are sensitive to unpredictable economic factors I also use a two and a six percent discount rate.

The scenarios below assume that all projects in the study area develop concurrently. Given the complexity of building and brining on-line a solar PV project it is very likely that development will stagger and some of the proposed projects will never develop. Nevertheless, the scenarios below illustrate the broader tax outcomes of different tax policy approaches. The remainder of this chapter discusses the present value (PV) of annual tax payments for 20 years by tax receiving entities under each tax policy scenario.

*Nothing to Lose: Property Taxes and the Proposition 7 New Construction Exclusion*

Section 73 of the Revenue and Tax Code excludes development of all active solar energy systems from triggering a new construction property reassessment. In this scenario I assume that the assessed property value of the parcels of land proposed for solar PV development will not change once developers complete solar PV improvements. Table 8 summarizes the 2011 assessment value (shown previously in Table 5) and summarizes the solar PV project characteristics. As shown in Table 8, proposed projects in Fresno County will develop with an average capacity of 7.1 megawatts per acre. The total assessed value is roughly $9.3 million, of which the majority (84 percent) is made up of the assessed land value. The $9.3 million in total assessed value is less than one-one hundredth of one-percent of the county's $544.4 billion in net secured taxes in 2010-

11. The average tax per acre of improvements is $20 and the average tax per megawatt of generating capacity is $145. The total tax collected from property owners is $93,380, which the county assessor distributes according to AB 8 distribution factors.

**Table 8. Project Summary, Property Values, and Current Property Tax Paid**

| | |
|---|---|
| Total Acres | 4,574 |
| Total Capacity (MWs) | 644 |
| Megawatts per Acre | 7.1 |
| Total Assessed Value | $9,337,964 |
| Assessed Land Value | $7,799,815 (84%) |
| Assessed Improvement Value | $1,532,099 (16%) |
| Property Tax Paid | $93,380 |

As shown in Table 8, over the next 20 years, Fresno County will accumulate $93,380 to allocate to county agencies according to AB 8 distribution factors. As described, I apply a two percent inflation factor to the assessed value and a two-, four-, and six-percent discount rate for each year. Because the discount rate is either equal to or greater than the inflation adjustment, the present value of future tax payments either remain the same each year or slowly decline each year. As shown, the present value of 20 years of property taxes collected on land with solar PV improvements with a discount rate of two percent is nearly $1.9 million; with a discount rate of four percent is slightly more than $1.5 million; and with a discount rate of six percent is more than $1.2 million. Because Proposition 7 excludes solar PV improvements from reassessment for tax purposes, the present value tax payments shown in Table 9 reflect the tax payments that local agencies in the county can expect regardless of solar PV improvements or no land use change.

**Table 9. Present Value of Property Tax Revenue Allocations**

| Tax Receiving Entity | AB 8 Factor | Total Present Value (PV) of 20 Annual Tax Payments (2%) | Total Present Value (PV) of 20 Annual Tax Payments (4%) | Total Present Value (PV) of 20 Annual Tax Payments (6%) |
|---|---|---|---|---|
| Total | 99.92% | $1,829,510 | $1,501,431 | $1,251,861 |
| Unified Schools | 30.17% | $552,405 | $453,345 | $377,989 |
| Education Revenue Augmentation Fund (ERAF) | 22.96% | $420,392 | $345,005 | $287,657 |
| Fresno County | 13.88% | $254,139 | $208,566 | $173,897 |
| Cities | 13.58% | $248,646 | $204,058 | $170,139 |
| Colleges | 5.25% | $96,126 | $78,888 | $65,775 |
| Fire Districts | 3.58% | $65,549 | $53,794 | $44,852 |
| County Office of Education | 3.16% | $57,859 | $47,483 | $39,590 |
| Flood Control | 1.66% | $30,394 | $24,944 | $20,798 |
| Library | 1.53% | $28,014 | $22,990 | $19,169 |
| Elementary Schools | 1.13% | $20,690 | $16,980 | $14,157 |
| All Other Districts | 3.02% | $55,293 | $45,377 | $37,710 |

*Equal Treatment on the Tax Roll: Property Taxes Absent Proposition 7*

In this scenario I assume that the assessed property value of each solar PV project is not eligible for the new construction exclusion and is subject to traditional property tax rules under Proposition 13. Under Proposition 13, properties that change ownership or undergo significant construction are subject to reassessment for tax purposes. Absent the new construction exclusion, utility-scale solar PV development qualifies as new construction for property tax purposes and is subject to reassessment.

Using the development costs of $2 per watt for utility-scale solar PV presented earlier (Chapter 2), I estimate the total property value for projects in Fresno County. As shown in Table 10, the total assessed value of property is significantly increased following solar PV construction. In fact, the total assessed value of property increases over 138 times from $9.33 million to more than $1.2 billion. As shown earlier in Table 8, without solar PV improvements the assessed land value is the majority (84 percent) of the total assessed value. However, as shown in Table 10 with solar PV improvements the assessed improvement value is the majority (99 percent) of the total assessed value. The Proposition 7 new construction exclusion significantly distorts the real value of property improvements on the tax roll. The total assessed value for all projects is more than $1.2 billion, which is about one quarter of one percent of the county's $544.4 billion net secured assessed value in 2010-11. In this scenario, the average tax per acre is $2,830 and the average tax per megawatt of generating capacity is $20,105.

**Table 10. Project Summary, Property Values, and Estimated Property Tax Paid**

| | |
|---|---|
| Total Acres | 4,574 |
| Total Capacity (MWs) | 644 |
| Megawatts per Acre | 7.1 |
| Total Assessed Value | $1,294,799,815 |
| Assessed Land Value | $7,799,815 (1%) |
| Assessed Improvement Value | $1,287,000,000 (99%) |
| Property Tax Paid | $12,947,998 |

As shown in Table 11, over the next 20 years, absent the new construction exclusion Fresno County collects present value tax payments in excess of $254.5 million at a two percent discount rate; $209.8 million with a four percent discount rate; and

$175.9 million with a six percent discount rate. In terms of the present day value of tax revenue, the difference between assessing and not assessing solar PV improvements with a four percent discount rate is $208.3 million. For solar PV projects proposed in Fresno County, $208.3 million reflects the property tax revenue that traditional development activity generates. However, Proposition 7 excludes solar PV development from triggering a new construction reassessment and Fresno County will collect and distribute tax revenue in the amounts shown in the first scenario in Tables 8 and 9.

**Table 11. Present Value of Property Tax Revenue Allocations**

| Tax Receiving Entity | AB 8 Factor | Total Present Value (PV) of 20 Annual Tax Payments (2%) | Total Present Value (PV) of 20 Annual Tax Payments (4%) | Total Present Value (PV) of 20 Annual Tax Payments (6%) |
|---|---|---|---|---|
| Total | 99.92% | $254,579,537 | $209,871,519 | $175,947,747 |
| Unified Schools | 30.17% | $76,911,995 | $63,450,937 | $53,241,143 |
| Education Revenue Augmentation Fund (ERAF) | 22.96% | $58,531,634 | $48,287,488 | $40,517,621 |
| Fresno County | 13.88% | $35,238,866 | $28,919,627 | $24,112,549 |
| Cities | 13.58% | $34,619,320 | $28,560,282 | $23,964,691 |
| Colleges | 5.25% | $13,383,758 | $11,041,346 | $9,264,700 |
| Fire Districts | 3.58% | $9,126,448 | $7,529,147 | $6,317,643 |
| County Office of Education | 3.16% | $8,055,748 | $6,645,839 | $5,576,467 |
| Flood Control | 1.66% | $4,231,817 | $3,491,169 | $2,929,410 |
| Library | 1.53% | $3,900,409 | $3,217,764 | $2,699,998 |
| Elementary Schools | 1.13% | $2,880,695 | $2,376,518 | $1,994,116 |
| All Other Districts | 3.02% | $7,698,848 | $6,351,404 | $5,311,760 |

*Sun Tax: Per-acre Fees and the Proposition 7 New Construction Exclusion*

Some counties in California are contemplating or instituting fees on solar PV development. So far, Fresno County is not one of the counties exploring solar PV development fees. In February 2012, the Independent Energy Producers Association and the Large-scale Solar Association sued Riverside County for approving an annual $450 per acre fee on solar PV development. The development fee, dubbed a sun tax, is becoming a contentious fee for solar PV development on private lands in Riverside County. As a basis for adopting the solar PV development fee, the County claims that the fee will mitigate for the loss of open space, loss of desert view sheds, and loss of land supply. Typically, local governments will use an impact fee study to determine costs to provide municipal services to serve new development.

The basis for the Riverside County sun tax does not stem from an impact fee study. Rather, the basis for the sun tax stems from local official's concerns that Proposition 7's new construction exclusion will unfairly burden the County with playing host for solar PV investment. Additionally, local officials express concern with the unknown impacts that result from rapid and cumulative solar PV development. Given the growing solar PV interest in Riverside County, like in Fresno County, and Riverside's ensuing court case with the solar PV industry, I estimate the annual revenue for the Fresno County projects by applying the sun tax to each acre proposed for development.

All else equal, the larger the area that is put to use to capture solar energy the more electricity a solar PV facility generates and sells. Thus, for solar PV projects using similar technologies and design, the larger the solar PV project the more the renewable electric generation. However, not all solar PV projects are identical. Some projects maximize the amount of electric generation by taking advantage of solar PV components and project design that maximize technological efficiency. Nevertheless, in terms of energy conversion factors, even the most advanced solar PV developments are inferior to modern natural gas power plants. There is a close connection between the size of a solar PV project and the amount of land consumed as a function of the solar resource captured. The impetus for instituting a sun tax centers on local jurisdictions worry that the state's *need* for land consuming solar PV projects to meet statewide climate and energy goals will come at the expense of the conservation of private land resources.

This scenario assumes that Fresno County adopts an annual fee of $450 per acre on solar PV projects within the county. Using the same inventory of solar PV projects in the County and the size of each project in acres, I estimate the aggregate amount of the annual fee per project. I add the revenue from this annual fee to the estimated Proposition 7 property tax payment from the first scenario and shown in Table 9. As shown in Table 12, the County will receive annual development fees of over $2 million. In the first year, revenue from the annual development fee and property tax will equal $2.15 million. In this scenario the assessed value of land and improvements remain low. The cumulative tax per acre is $470 and the tax per megawatt is $3,340.

**Table 12. Project Summary, Property Values, and Estimated Property Tax Paid**

| | |
|---|---|
| Total Acres | 4,574 |
| Total Capacity (MWs) | 644 |
| Megawatts per Acre | 7.1 |
| Total Assessed Value | $9,337,964 |
| Property Tax Paid | $93,380 |
| Total Per Acre Development Fee | $2,058,179 |
| Total Property Tax and Per Acre Fee | $2,151,559 |

In this scenario, only the property tax revenue is shared according to AB 8 distribution factors (equal to those in the first scenario). The development fees, a Fresno County levy, will accrue to the county. For estimating the present value of property tax revenue I use the same methodology and assumption described in the first scenario. Building from the first scenario I add the $450 per acre fee to each of the annual revenue estimates for Fresno County. Because the fee does not increase with inflation, I do not apply an inflation adjustment and only apply the three discount rates to the development fee. At a two percent discount rate the total present value is more than $35.4 million, with a four percent discount rate the present value of payments is more than $29.4 million and with a six percent discount rate the present value of payments is almost $25 million. Compared to the outcomes shown in the prior scenarios, Fresno County is the beneficiary of the sun tax. As an entity, assuming a four percent discount rate, Fresno County will receive slightly more than $28 million of the $29.4 million of revenue generated.

**Table 13. Present Value of Property Tax Revenue Allocations**

| Tax Receiving Entity | AB 8 Factor | Total Present Value (PV) of 20 Annual Tax Payments (2%) | Total Present Value (PV) of 20 Annual Tax Payments (4%) | Total Present Value (PV) of 20 Annual Tax Payments (6%) |
|---|---|---|---|---|
| Total | 99.92% | $35,485,180 | $29,475,695 | $24,863,342 |
| Fresno County | 13.88% | $33,908,308 | $28,179,883 | $23,781,043 |
| Unified Schools | 30.17% | $552,957 | $454,428 | $379,583 |
| Education Revenue Augmentation Fund | 22.96% | $420,812 | $345,829 | $288,871 |
| Cities | 13.58% | $248,895 | $204,545 | $170,857 |
| Colleges | 5.25% | $96,222 | $79,077 | $66,053 |
| Fire Districts | 3.58% | $65,549 | $53,794 | $44,852 |
| County Office of Education | 3.16% | $57,917 | $47,597 | $39,757 |
| Flood Control | 1.66% | $30,425 | $25,003 | $20,885 |
| Library | 1.53% | $28,042 | $23,045 | $19,250 |
| Elementary Schools | 1.13% | $20,711 | $17,020 | $14,217 |
| All Other Districts | 3.02% | $55,341 | $45,472 | $37,847 |

Absent a development fee on solar PV and under current state law, if all proposed projects in Fresno County develop concurrently the taxes for property with projects will generate roughly $1.5 million in today’s dollars.  However, if solar PV improvements were treated the same as other property improvements, the projects proposed for development will generate a staggering $209.8 million in today’s dollars.  This calculation assumes taxable property improvements of $2 per watt.  Because Proposition 7 constitutionally protects the new construction exclusion for solar PV, it is not likely that solar PV improvements will result in increased amounts of property tax revenue in

Fresno County. Nevertheless, a fee similar to Riverside County's sun tax will yield roughly $29.4 million in revenue, of which $28.1 million will go to the County's general fund. As Riverside County can attest to, adopting such a development fee is politically and legally difficult.

Proposition 26 (2010) and the Mitigation Fee Act set legal boundaries on how far local communities can reach in terms of imposing taxes and fees on development. However, given the large property tax break to land-consuming solar PV projects, it is important to look at the applicability of Proposition 26 and the Mitigation Fee Act to solar PV projects. Establishing a nexus between a fee and the use of revenue from the fee is a criterion in both Proposition 26 and the Mitigation Fee Act. Finding consensus over the appropriate nexus is difficult. In the final chapter I explore the application of Proposition 26 and the Mitigation Fee Act to collecting local revenue from utility-scale solar PV development. Given the state's substantial renewable energy mandates to accomplish broad climate goals as well as an urgent need to kick fossil fuel habits, in the last chapter I offer a unique interpretation of a nexus for levying a fee on solar PV development.

# Chapter 5

## CONCLUDING DISCUSSION AND A FRAMEWORK FOR DE-CARBONIZATION

*"The state is finally getting serious about 'smart growth', including infill and higher density residential and mixed-use developments...Such developments will reduce greenhouse gases and protect our irreplaceable and finite supply of farmland. But we cannot at the same time simply look the other way and allow leapfrog solar sprawl on prime farmland..."*

*-John Gamper, California Farm Bureau Federation,*
*California Current, 2012*

In this thesis I estimate the present value of the new construction exclusion for solar PV development in Fresno County. My estimate is one of the first steps to respond to Oviatt's (2011, September 27) recommendation to phase out the property tax exemption in her testimony on energy governance to the Little Hoover Commission. The value of the exclusion is equal to the unrealized revenue on the Fresno County tax roll, and as Oviatt explains serves as a "fiscal disincentive" for "local governments" to "accept ground mount [solar] systems" (p. 4). In Chapter 4, I estimate that the value of the exclusion for proposed solar PV projects in Fresno County is $20,105 per megawatt or about $2,800 per acre. If all proposed projects develop concurrently, the unrealized tax revenue in the first year in Fresno County is $12.9 million.

Estimating the unrealized revenue is important because some counties are using the new construction exclusion as a pretext to impose county fees on solar PV development, and as Oviatt explains the exclusion is a disincentive for counties to accept solar PV systems. Critics of county fees on solar PV claim that fees are illegal and threaten the growth of solar PV and California's ability to achieve AB 32 goals.

However, the fees that counties are contemplating are modest compared to the value of the property tax exclusion. As shown in Chapter 4, if all of the proposed projects develop concurrently and Fresno County adopts a similar fee to Riverside County's sun tax ($450 per acre), in the first year Fresno County will collect $3,340 per megawatt or about $2.1 million, which is significantly less than the benefit of the new construction exclusion ($12.9 million). Permitting authority is in the hands of cities and counties, which gives local officials the responsibility of determining where and how much solar PV capital goes untaxed.

Miskell (2011) reminds us "decisions made by local government have a direct impact on the value of real property. A property tax gives the government a direct stake in the quality of those decisions, while leaving property ownership, management, and allocation in private hands" (p. 490). Given the large land area required for solar PV and the new construction exclusion, Miskell's observation of the relationship between land use decisions and property taxes is especially important in the context of utility scale solar PV. In his argument supporting local property taxation, Miskell also notes "fiscal autonomy means local property taxation" (p. 490). In California, Proposition 13 constrains local property taxation and local autonomy. Solar PV permitting is a responsibility of cities and counties, yet Proposition 7 decouples property taxation from the permitting autonomy of cities and counties. As Oviatt (2011) and Elkind (2011) note, the decoupling of property taxes from solar PV development is slowing county acceptance of solar PV, and both experts recommend removing or reforming the property tax exclusion.

In Chapter 4, I explain that removing the property tax exclusion will result in a tax of $20,105 per megawatt of installed capacity. Removing the exclusion and allowing counties to collect $20,105 per megawatt will certainly slow, if not halt, the maturation of the solar PV market at a time when solar PV requires nurturing. In this thesis, my intent is not to find ways to add unreasonable costs and slow utility scale solar PV development, but to offer solutions to help accelerate county approvals of solar PV. Given the concerns of the decoupled property tax from the permitting process, state and local policy makers must find common ground to facilitate further expansion of solar PV.

In the remainder of this section I revisit two important assumptions in my methodology to describe how to interpret the property tax scenarios I explore, especially as the solar PV market matures. In terms of project ownership, Proposition 7 does not treat all solar PV projects equal, so I also describe the caveats of solar PV development and property taxes. Given the rising interest in solar PV and the expected growth I also offer ideas for future research. The last part of this chapter presents policy recommendations for designing tax policies that couple with California's renewable energy goals and the state's loading order. In this final section I present recommendations for the state to design policies that will reward cities and counties for making land use decisions that further California's goal of reducing carbon dependency through the land use planning process.

*Assumptions, Caveats, and Ideas for Further Research*

In this section I revisit important assumptions underlying my estimates of solar PV capital costs and the rate of solar PV development in Fresno County. I also describe caveats to the property tax exemption for solar PV projects. Lastly, to add to our knowledge base of property taxes and solar PV I offer ideas for further research.

Assumptions

I rely on a host of assumptions to determine the unrealized revenues from solar PV. My findings are particularly sensitive to two of the assumptions. First, I assume that the value of property improvements for each project in the analysis is $2 per watt. In Chapter 2, I analyze available literature regarding installed costs for solar PV and find that current market trends for the capital portions of installed costs are about $2 per watt, but vary depending on solar PV project design. The assumption of $2 per watt is on the low end of capital costs. Because I base the value of solar PV improvements on the capital portions of installed costs, the value of the new construction exclusion is sensitive to changes in the capital cost for solar PV. As the literature describes, solar PV capital costs have steadily declined over the last several years and if solar PV capital costs continue their downward trend the present value of unrealized revenue shown in Chapter 4 will decrease.

Second, I assume that all solar PV projects requesting development approval will develop concurrently. However, it is not likely that all projects in Fresno County will develop at the same time. The purpose of calculating the value of the property tax exclusion for all projects is to use a robust sample to capture the present value of unrealized tax revenue for proposed development. As Fresno County continues to process development requests, the unrealized tax revenues shown in Chapter 4 provide the county with an estimate of the property tax benefit that results from approving solar PV projects.

Caveats

For purposes of property assessments, not all solar PV projects are equal. There are two instances in which solar PV projects generate property tax revenues from capital improvements. First, Proposition 7 excludes most solar PV from triggering a new construction property assessment, but not all. Utility-Owned-Generation (UOG) solar projects 50 megawatts and larger do not receive the benefits of a new construction exclusion. Instead, the Board of Equalization assesses the value of newly constructed UOG solar projects 50 megawatts and greater. Elledge explains that following the passage of AB 454 (Klehs, 1987), counties collect the tax on BOE assessed property and allocate the tax to taxing agencies within their counties. Fresno County is situated in PG&E’s service territory, so each solar PV facility greater than 50 megawatts that PG&E owns and operates generates property tax revenue. However, the deregulation of the electric industry limits the amount of UOG capacity that regulated utilities are allowed to own and operate. Because PG&E will only own and operate a limited amount of solar

PV facilities in Fresno County, most of which are smaller than 50 megawatts, UOG solar PV facilities in Fresno County will not generate significant tax revenue.[13]

Second, a change of ownership in a solar PV project will trigger a property reassessment. A change in ownership means that for the projects shown in the study area that are sold after construction is complete, a reassessment of the entire property occurs, including the solar PV improvements. For example, if a solar PV facility is operational for a year and the owner of the facility sells the property, a reassessment of the property will occur. The reassessment will include the value of the solar PV improvements, which are not captured at the time of construction. As shown in Chapter 4, solar PV improvements are valuable and when taxed, generate significant revenue. Because property taxes for solar PV facilities increase once realized with a change in ownership, it is likely that once operational, most owners will not sell their property.

Areas for Further Research

Admittedly, in this thesis I focus on one side of the debate concerning county imposed taxes and fees. I find that the new construction exclusion is very valuable for solar energy investors, but what is the cost of the exclusion to counties? Because we have little information on the costs that solar PV development imposes on local communities, it is difficult to determine the costs that the new construction exclusion

[13] In terms of generating property tax revenue from solar energy development it is in the interest of counties to promote UOG facilities greater than 50 MWs. However, promoting UOG development comes at the cost of giving up local land use authority. UOG development is subject to the land use authority of the CPUC and supersedes local land use authority. In fact, through the CPUC regulated utilities can exercise eminent domain, meaning regulated utilities can develop solar energy facilities anywhere regardless of local land use policies, including developing solar PV projects on Prime Farmland under Williamson Act contracts.

imposes on counties. As solar PV develops, the one sided perspective I present will benefit greatly from studying local impacts from solar PV development. Local impact research should include externality costs of solar PV, such as facility impact fee studies, impacts to the value of neighboring properties, the opportunity costs of converting open space, and the cost of losing productive agricultural land.[14] This list of research ideas is not an exhaustive list of potential research to estimate community impacts. However, estimates of impacts will contribute to determining reasonable and lawful fees on solar PV.

In addition to studying community impacts, there is an opportunity to study the relationship between state regulated taxes on solar PV development and renewable energy goals. In my review of renewable energy and land use law I did not find studies that explore the relationship of state property tax law and the achievement of state renewable energy goals. In their study for Virginia's Department of Tax and Department of Public Service, Encore Redevelopment (2011) find that states use a variety of methods to impose taxes on renewable energy development. Building on their review, public policy would benefit from research that explores the differing tax approaches in each state compared to state progress to achieve renewable energy goals. Measuring the relationship between taxing approaches and RPS outcomes will add to the understanding of the market response to solar taxes.

[14] When it comes to paying for infrastructure improvements, power plant developers find themselves in a unique position. Depending on how a power plant developer connects to the electric grid the developer either pays for all electric grid upgrades or pools the upgrade costs with other power plant developers. Developers pass on these costs to electric consumers through their wholesale contracts with electric service providers.

Public policy will also benefit from research that explores the relationship between property tax and land use law. As Fulton and Shigley note, property taxes and land use are powerful tools to guide where and how development occurs. As far as solar PV is concerned, some locations are more efficient than others. A property tax system that imposes greater taxes to develop on inefficient properties will ensure land resources are put to their most efficient use. For example, relaxing property taxes for solar PV projects proposed in the built environment near electric consumers, while increasing property taxes for projects developed on raw land far from energy consumers will help California achieve broader policy goals and reap benefits associated with expanding distributed generation (i.e., systems designed to serve on-site load, such as rooftop solar PV systems) solar deployment. An important consideration that public policy research should include is to better understand how solar energy property tax policy influences the permitting decisions of resource-constrained counties. For example, in a paradigm that imposes less tax on solar distributed generation than remote solar generation, some counties might show more willingness to accept remote projects that generate revenue over distributed projects, which generate less revenue.

### *Property Taxes to Limit Energy Sprawl and Achieve the De-Carbonization of Land Use*

McDonald et al. (2009) coin the term *energy sprawl* to describe the land consuming characteristics of alternative energy development. Their analysis of different alternative energy pathways highlights the need to carefully craft land use policies that minimize land use impacts from renewable energy development. Over the long run, as electricity demand from renewable energy sources increases, minimizing land impacts is especially important. Outka (2010) and McDonald et al. (2011) conclude that, as alternative energy markets expand, constricting electricity demand through energy efficiency translates to land use efficiency. The authors argue that land use planning with a focus on conserving land resources is an important criterion for policy makers that craft electric system planning. Should our tax policies spur solar development that promotes energy sprawl?

Currently, the new construction exclusion applies to nearly any solar PV improvement, regardless of solar PV system size. The exclusion treats solar PV systems installed on the roofs of existing homes and businesses the same as utility scale systems spread over thousands of acres. However, systems installed on rooftops with the primary purpose of providing on-site electricity are different than large systems with the primary purpose of selling electricity. On-site systems reduce energy consumption from the electric grid, which many experts consider energy efficiency. On the other hand, utility scale systems sell electricity to the electric grid and do little to reduce energy efficiency. California's loading order, the state policy prioritizing how future electric needs are met, prioritizes energy efficiency before building new electric generation, including renewable generation. However, the new construction exclusion does not differentiate between on-site and utility-scale systems. A shift in property tax policy to a model that fosters on-site solar development is consistent with the loading order and will conserve land by curbing energy sprawl.

One approach to using tax policy to conserve land is to apply the new construction exclusion to smaller systems installed in the built environment and not apply the exclusion to utility-scale systems. In Fresno County, absent the Proposition 7 new construction exclusion, utility scale owners would pay the Proposition 13 rate, or $20,105 per megawatt. Compared to Encore Redevelopment's findings, the Proposition 13 rate exceeds the average range of $4,000 to $8,000 per megawatt that other states impose on renewable energy development. However, applying Riverside County's sun tax to the projects in Fresno County will result in a tax of about $3,340 per megawatt. Proposition 13, which applies an *ad valorem* value based tax on property, requires taxing capital value of property improvements. Solar PV is capital intensive, so applying the Proposition 13 rate results in a considerable amount of tax revenue and burden on solar investment. Rather than applying an *ad valorem* tax on utility-scale solar PV, Encore Redevelopment finds that a capacity based fee is more efficient, especially if the capacity based fee is applied to large systems that sell electricity as opposed to small systems designed to serve on-site electricity demand.

To control energy sprawl while fostering investment in solar PV, capacity based fees offer three distinct advantages. First, a capacity based fee sends a clear message to solar PV investors because a capacity based fee can easily be forecasted within investment portfolios. Critics of Riverside County's sun tax lament that their investors score variation in taxation policies across jurisdictions as risky. A uniform capacity based fee offers an opportunity to instill investor confidence. Second, a capacity based fee infuses public assurance that obsolete solar PV systems will not litter the landscape. Some counties worry that over time owners of large solar PV systems that go mostly untaxed will have little incentive to keep defunct projects operational. A uniform capacity based fee will ensure that solar PV operators remain motivated to keep their power plants operational or decommission them and remove the capacity.

Third, and most importantly, a capacity based fee encourages solar PV developers to make the most of the land used to generate solar powered electricity. In the application of a capacity based fee, solar PV developers will employ the highest and most efficient technologies as a means to maximize their investments as a function of project capacity. Currently, solar PV is inefficient at converting solar energy into electricity. The conversion factor for solar PV varies by location, technology, and project design, yet even the most efficient systems convert 20 to 25 percent of solar energy into electricity and most convert 12 to 18 percent into electricity. The most efficient combined cycle natural gas turbines, convert almost all of the fuel consumed into electricity. Applying a capacity based fee will send a clear signal to the solar PV market that California's land resources are finite and technological efficiency is an important priority to conserve land.

Incorporating a capacity based fee for solar PV in the land development process is difficult given the constraints of Proposition 26 and the Mitigation Fee Act. Proposition 26 amended the constitution to limit the power of cities and counties by requiring a majority vote of an electorate to institute a general tax or a two-thirds vote to institute a special tax. This constitutional standard means that local political support is essential to establish a capacity based fee on solar PV. One way to muster political support for a capacity based fee is to dedicate capacity based fees on sprawling energy projects to local programs that promote deployment of energy efficiency and mitigate land resources needed to generate electricity. For example, a capacity based fee on a large-scale solar PV project can help pay for local installations of small-scale rooftop solar systems, thus controlling the amount of land converted to solar PV.

Developing a program to dedicate capacity based fees to curtail energy sprawl will also satisfy the nexus and disclosure requirements of the Mitigation Fee Act. The Mitigation Fee Act requires cities and counties to show the nexus between a fee and its mitigation. Cities and counties must also describe how they will spend the fee revenue to ameliorate impacts associated with a development's impact. A capacity based fee has a nexus with controlling energy sprawl and raises revenue to fund programs that increase on-site energy production.

The intent of the solar energy property tax exemption is to reduce solar PV development costs to accelerate progress toward achieving renewable energy goals. Deploying solar PV is a practical response to AB 32 as well as the urgent need to begin preparing for less fossil fuel. However, it is unfortunate that current policies favor consumption of California's land resources to meet a growing thirst for renewable electricity. Nevertheless, under the umbrella of AB 32, policies like the RPS and SB 375 will dramatically change California's land use patterns. Reducing carbon is at the heart of changing the state's land use patterns. The Proposition 7 new construction exclusion serves as a disincentive for cities and counties to accept solar energy development and make land use decisions that reduce our dependence on carbon. Because cities and counties will be at the forefront of fostering land use changes to reduce the carbon intensity of California's economy, the state must find ways to reward land use decisions that reduce carbon dependence.

In the post Proposition 13 era, cities and counties resort to a land use decision-making process that promises positive tax revenue, mostly generated from sales and use taxes. Misczynski (1986) refer to this decision making process as the *fiscalization* of land use. The fiscalization of land use is a powerful approach to induce particular land use decisions by cities and counties and is largely responsible for the organization of California's built environment. However, the fiscalization of land use all too often results in sub-optimal land use decisions, including those that increase carbon dependency. Nevertheless, the fiscalization of land use model offers insight into how to reward cities and counties for land use decision-making processes. Because of the important role cities and counties will play in meeting carbon reduction goals, the State should design policies that reward cities and counties by paying for the *de-carbonization* of land use.

In response to climate change and fossil resource depletion, some communities across the state are adopting and implementing climate action plans. The plans establish strategies for mitigating behaviors that contribute to climate change as well as prepare for adapting to a changing climate. The plans range from promoting all scales of renewable energy development to increasing density in built areas. The fiscalization of land use guided California's previous era of growth and now it is time for the de-carbonization of land use to foster a new paradigm of sustainable growth. AB 32 policies, like the RPS and cap-and-trade both offer financial vehicles to pay for the de-carbonization of land use.

Under the RPS, most developers of utility-scale solar PV generate Renewable Energy Credits (RECs), which are commodities representing the environmental attributes (the non-electric value) of solar electricity. Because solar PV developers consume finite land resources and utilities reward solar PV developers with contracts to purchase RECs, a portion of the REC value should be redirected to cities and counties that make land use decisions to accommodate utility-scale solar PV. Coupling the REC value with the land use decision-making processes creates a framework similar to the fiscalization of land use and rewards land development approvals that de-carbonize California's economy. Additionally, as California lawmakers continue to debate over a process for allocating cap-and-trade revenue, policy makers should start thinking about methods for allocating revenue to cities and counties to reward land use decisions that de-carbonize the economy.

Appendix A: Solar Photovoltaic Development Requests in Fresno County, Total

| Applicant Name | County ID | APN | Zone | Acres | Capacity (MW) | Williamson Act Contract Number |
|---|---|---|---|---|---|---|
| GA Solar | CUP 3291 | 040-080-15s | AE-20 | 318.18 | 55 | AP 1387 |
| GA Solar c/o Joe Contreras | CUP 3292 | 040-070-41 | AE-20 | 317.57 | 24 | AP 2105 |
| Westlands Solar Farms LLC | CUP 3294 | 085-040-21S | AE-40 | 90.5 | 20 | AP 365 |
| Sr Solis Oro Loma Teresina | CUP 3296 | 005-040-15s | AE-20 | 156 | 19 | AP 1305 |
| Sr Solis Oro Loma LLC | CUP 3297 | 005-040-17s | AE-20 | 156 | 19 | AP 1425 |
| Gestamp Solar c/o Francisco Sanchez | CUP 3299 - REVISED | 005-060-17s | AE-20 | 771 | 100 | AP 2043 (added 2047 and 2048 from application) |
| | | 005-060-19 | | | | same as above |
| | | 005-060-15 | | | | same as above |
| | | 005-060-14 | | | | same as above |
| | | 005-060-16 | | | | same as above |
| | | 005-060-20 | | | | same as above |
| Gestamp Solar c/o Francisco Sanchez | CUP 3300 | 005-040-18s | AE-20 | 270 | 44 | AP 2040 |
| | | 005-040-19s | | | | same as above |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 005-070-16s | | | | same as above |
| | | 005-070-18s | | | | same as above |
| Boulevard Associates LLC | CUP 3301 | 050-080-25s | AE-20 | 320 | 40 | AP 2123 |
| RE Jayne East c/o Seth Israel | CUP 3308 | 073-060-12 | AL-20 | 120 | 15 | None |
| | | 073-060-55s | | | | None |
| RE Kamm LLC c/o Seth Israel | CUP 3309 | 040-080-35S | AE-20 | 240 | 20 | AP 2093 |
| Gestamp Solar c/o Marco Lara | CUP 3313 | 055-240-05 | AE-20 | 120 | 14 | AP 3647 |
| | | 055-250-25 | | | | AP 7485 |
| NorthLight Power LLC | CUP 3314 | 019-050-55ST | AE-20 | 640 | 60 | None |
| | | 019-050-56ST | | | | None |
| Environmental Impact Report (EIR) No. 6343 - Recurrent Energy – RE Tranquillity | CUP to be assigned | 028-101-51 | AE-20 | 3,575 | 400 | None |
| | | 028-101-53 | | | | None |
| | | 028-101-70 | | | | None |
| | | 028-101-50 | | | | None |
| | | 028-101-22 | | | | None |
| | | 028- | | | | None |

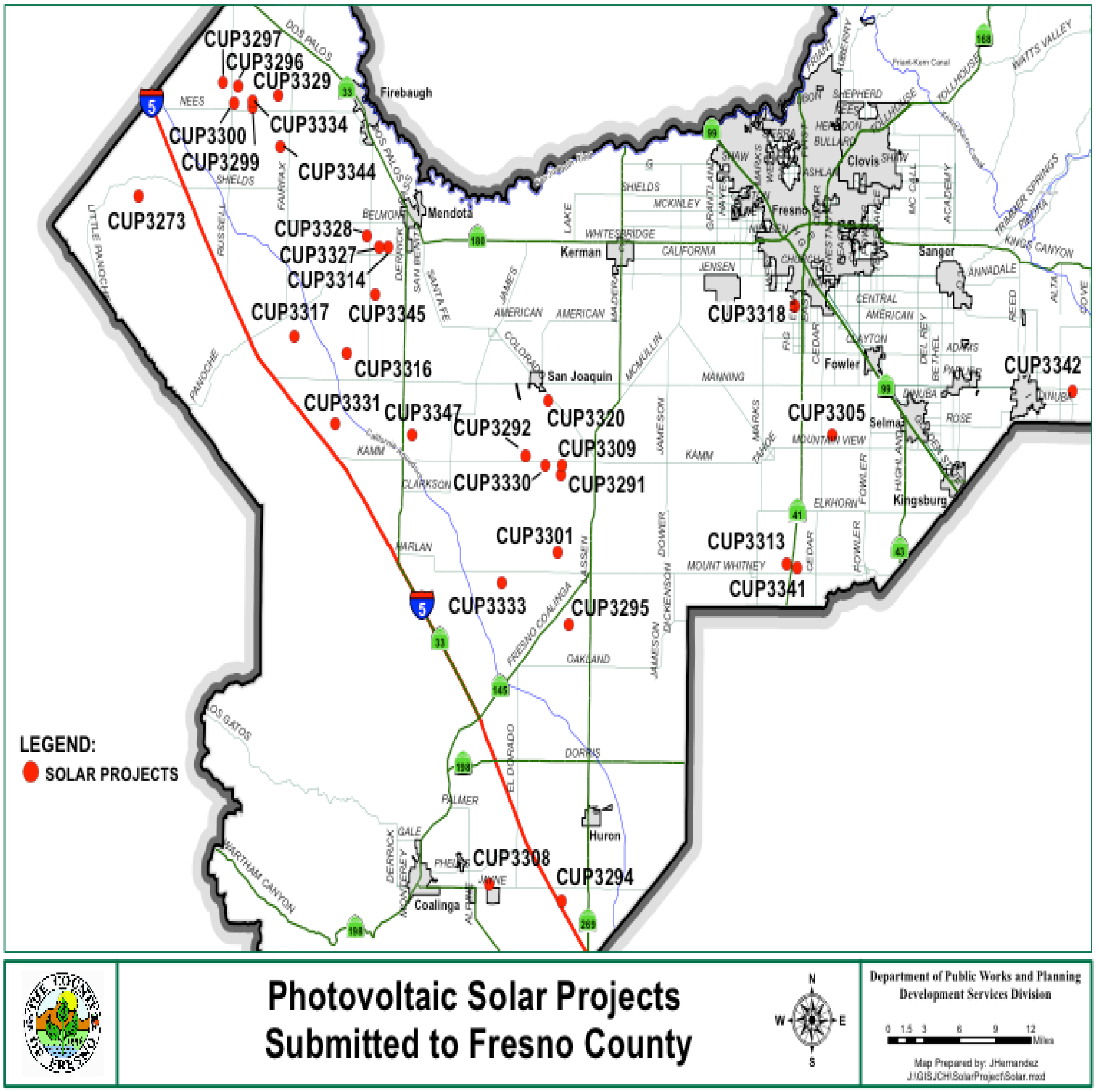
| | | | | | | |
|---|---|---|---|---|---|---|
| | | 101-23 | | | | |
| | | 028-101-45 | | | | None |
| | | 028-101-46 | | | | None |
| | | 028-101-47 | | | | None |
| | | 028-101-48 | | | | None |
| | | 028-111-07 | | | | None |
| | | 028-111-38 | | | | None |
| | | 028-111-60 | | | | None |
| | | 028-111-53 | | | | None |
| | | 028-111-52 | | | | None |
| | | 028-111-50 | | | | None |
| | | 028-111-47 | | | | None |
| | | 028-111-46 | | | | None |
| | | 028-111-45 | | | | None |
| | | 028-111-44 | | | | None |
| | | 028-111-43 | | | | None |
| | | 038-080-35 | | | | None |
| | | 038-080-03 | | | | None |
| | | 038-080-38 | | | | None |
| | | 038-080-05 | | | | None |
| | | 038-080-23 | | | | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 038-080-16 | | | | None |
| | | 038-080-17 | | | | None |
| | | 038-080-21 | | | | None |
| | | 038-080-22 | | | | None |
| Gestamp Solar c/o Francisco Sanchez | CUP 3316 | 028-050-03 | AE-20 | 80 | 19 | AP 1781 |
| Gestamp Solar | CUP 3317 | 027-060-33 | AE-20 | 80 | 9 | AP 1907 |
| GASNA 16P, LLC | CUP 3318 | 329-030-17 | AE-20 | 18.66 | 2.5 | AP 5446 |
| Rose Solar LLC c/o Dan Predpall | CUP 3320 | 033-020-23 | AE-20 | 66 | 20 | None |
| RE Adams East, LLC | CUP 3322 | 028-071-32ST | AE-20 | 319 | 37 | None |
| Placer Solar, LLC | CUP 3321 | 033-160-09S | AE-20/AL-20 | 164.52 | 20 | None |
| Silverado Power, LLC | CUP 3329 | 006-150-15S | AE-20 | 489 | 90 | AP 2699 |
| | | 006-160-17S | | | | AP 2628 |
| | | 006-160-25S | | | | AP 2700 |
| | | 006-160-26S | | | | AP 2700 |
| Silverado Power, LLC | CUP 3330 | 040-150-06T | AE-20 | 292.59 | 60 | None |
| | | 040-150-07 | | | | None |
| | | 040-150-08 | | | | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 040-150-11 | | | | None |
| | | 040-150-12 | | | | None |
| | | 040-150-13 | | | | None |
| | | 040-150-14 | | | | None |
| | | 040-150-15 | | | | None |
| | | 040-150-16 | | | | None |
| | | 040-150-18 | | | | None |
| | | 040-150-20 | | | | None |
| | | 040-150-22 | | | | None |
| | | 040-150-24 | | | | None |
| | | 040-160-03 ST | | | | None |
| | | 040-160-10 | | | | None |
| | | 040-160-11 | | | | None |
| | | 040-160-13 | | | | None |
| | | 040-160-14 | | | | None |
| | | 040-160-17 | | | | None |
| | | 040-160-18 | | | | None |
| | | 040-160-21 | | | | None |
| Silverado Power, LLC | CUP 3327 | 019-050-61ST | AE-20 | 321.04 | 70 | None |
| Silverado Power, | CUP 3328 | 019- | AE-20 | 161.06 | 60 | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| LLC | | 040-05ST | | | | |
| Three Rocks Solar, LLC | CUP 3331 | 038-060-03 | AE-20 | 100 | 13 | None |
| Frontier Renewables, LLC | CUP 3333 | 050-100-32S | AE-20 | 300 | 50 | None |
| Gestamp Solar | CUP 3334 | 005-060-18S | AE-20 | 167 | 20 | AP 2047 |
| | | 005-060-17S | | | | |
| Gestamp Solar | CUP 3341 | 055-380-02 | AE-20 | 58 | 7 | AP 3648 |
| Cenergy Power | CUP 3342 | 373-120-58 | AE-20 | 15 | 3 | None |
| | | 373-120-01 | | | | None |
| Brannon Solar LLC | CUP 3344 | 011-050-09ST | AE-20 | 156.3 | 20 | None |
| 29 Projects | | 95 parcels | | 9,883 acres | 1,331MWs | 7 projects not on and 22 projects on Williamson Act land |

Appendix B: Map of Solar Photovoltaic Development Requests in Fresno County, All




Source: Fresno County Department of Public Works and Planning. Retrieved on November 1, 2011 from http://www2.co.fresno.ca.us/4510/4360/updates/current_plancom/misc.%20projects/solar/MAP.pdf

Appendix C: Solar Photovoltaic Development Requests in Fresno County, Revised

| Applicant Name | County ID | APN | Zone District | Acres | Capacity (MW) | Williamson Act Contract Number |
|---|---|---|---|---|---|---|
| GA Solar | CUP 3291 | 040-080-15s | AE-20 | 318.18 | 55 | AP 1387 |
| GA Solar c/o Joe Contreras | CUP 3292 | 040-070-41 | AE-20 | 317.57 | 24 | AP 2105 |
| Westlands Solar Farms LLC | CUP 3294 | 085-040-21S | AE-40 | 90.5 | 20 | AP 365 |
| Sr Solis Oro Loma Teresina | CUP 3296 | 005-040-15s | AE-20 | 156 | 19 | AP 1305 |
| Sr Solis Oro Loma LLC | CUP 3297 | 005-040-17s | AE-20 | 156 | 19 | AP 1425 |
| Gestamp Solar c/o Francisco Sanchez | CUP 3299 - REVISED | 005-060-17s | AE-20 | 771 | 100 | AP 2043 (added 2047 and 2048 from application) |
| | | 005-060-19 | | | | same as above |
| | | 005-060-15 | | | | same as above |
| | | 005-060-14 | | | | same as above |
| | | 005-060-16 | | | | same as above |
| | | 005-060-20 | | | | same as above |
| Gestamp Solar c/o Francisco Sanchez | CUP 3300 | 005-040-18s | AE-20 | 270 | 44 | AP 2040 |
| | | 005-040-19s | | | | same as above |
| | | 005- | | | | same as above |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 070-16s | | | | |
| | | 005-070-18s | | | | same as above |
| Boulevard Associates LLC | CUP 3301 | 050-080-25s | AE-20 | 320 | 40 | AP 2123 |
| RE Jayne East c/o Seth Israel | CUP 3308 | 073-060-12 | AL-20 | 120 | 15 | None |
| | | 073-060-55s | | | | None |
| RE Kamm LLC c/o Seth Israel | CUP 3309 | 040-080-35S | AE-20 | 240 | 20 | AP 2093 |
| Gestamp Solar c/o Marco Lara | CUP 3313 | 055-240-05 | AE-20 | 120 | 14 | AP 3647 |
| | | 055-250-25 | | | | AP 7485 |
| Gestamp Solar c/o Francisco Sanchez | CUP 3316 | 028-050-03 | AE-20 | 80 | 19 | AP 1781 |
| Gestamp Solar | CUP 3317 | 027-060-33 | AE-20 | 80 | 9 | AP 1907 |
| GASNA 16P, LLC | CUP 3318 | 329-030-17 | AE-20 | 18.66 | 2.5 | AP 5446 |
| Rose Solar LLC c/o Dan Predpall | CUP 3320 | 033-020-23 | AE-20 | 66 | 20 | None |
| Placer Solar, LLC | CUP 3321 | 033-160-09S | AE-20/AL-20 | 164.25 | 20 | None |
| Silverado Power, LLC | CUP 3329 | 006-150-15S | AE-20 | 489 | 90 | AP 2699 |
| | | 006-160-17S | | | | AP 2628 |
| | | 006-160- | | | | AP 2700 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 25S | | | | |
| | | 006-160-26S | | | | AP 2700 |
| Three Rocks Solar, LLC | CUP 3331 | 038-060-03 | AE-20 | 100 | 13 | None |
| Frontier Renewables, LLC | CUP 3333 | 050-100-32S | AE-20 | 300 | 50 | None |
| Gestamp Solar | CUP 3334 | 005-060-18S | AE-20 | 167 | 20 | AP 2047 |
| | | 005-060-17S | | | | |
| Gestamp Solar | CUP 3341 | 055-380-02 | AE-20 | 58 | 7 | AP 3648 |
| Cenergy Power | CUP 3342 | 373-120-58 | AE-20 | 15 | 3 | None |
| | | 373-120-01 | | | | None |
| 22 Projects | 39 parcels | | | 4,574 acres | 644 MWs | 6 projects not on and 22 projects on Williamson Act land |
| **Projects Excluded from Analysis** | | | | | | |
| NorthLight Power LLC | CUP 3314 | 019-050-55ST | AE-20 | | 60 | None |
| Environmental Impact Report (EIR) No. 6343 - Recurrent Energy – RE Tranquillity | CUP to be assigned | 028-101-51 | AE-20 | 3,575 | 400 | None |
| | | 028-101-53 | | | | None |
| | | 028-101-70 | | | | None |
| | | 028- | | | | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 101-50 | | | | |
| | | 028-101-22 | | | | None |
| | | 028-101-23 | | | | None |
| | | 028-101-45 | | | | None |
| | | 028-101-46 | | | | None |
| | | 028-101-47 | | | | None |
| | | 028-101-48 | | | | None |
| | | 028-111-07 | | | | None |
| | | 028-111-38 | | | | None |
| | | 028-111-60 | | | | None |
| | | 028-111-53 | | | | None |
| | | 028-111-52 | | | | None |
| | | 028-111-50 | | | | None |
| | | 028-111-47 | | | | None |
| | | 028-111-46 | | | | None |
| | | 028-111-45 | | | | None |
| | | 028-111-44 | | | | None |
| | | 028-111-43 | | | | None |
| | | 038-080-35 | | | | None |
| | | 038-080-03 | | | | None |
| | | 038-080-38 | | | | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 038-080-05 | | | | None |
| | | 038-080-23 | | | | None |
| | | 038-080-16 | | | | None |
| | | 038-080-17 | | | | None |
| | | 038-080-21 | | | | None |
| | | 038-080-22 | | | | None |
| RE Adams East, LLC | CUP 3322 | 028-071-32ST | AE-20 | 319 | 37 | None |
| Silverado Power, LLC | CUP 3330 | 040-150-06T | AE-20 | 292.59 | 60 | None |
| | | 040-150-07 | | | | None |
| | | 040-150-08 | | | | None |
| | | 040-150-11 | | | | None |
| | | 040-150-12 | | | | None |
| | | 040-150-13 | | | | None |
| | | 040-150-14 | | | | None |
| | | 040-150-15 | | | | None |
| | | 040-150-16 | | | | None |
| | | 040-150-18 | | | | None |
| | | 040-150-20 | | | | None |
| | | 040-150-22 | | | | None |
| | | 040- | | | | None |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 150-24 | | | | |
| | | 040-160-03 ST | | | | None |
| | | 040-160-10 | | | | None |
| | | 040-160-11 | | | | None |
| | | 040-160-13 | | | | None |
| | | 040-160-14 | | | | None |
| | | 040-160-17 | | | | None |
| | | 040-160-18 | | | | None |
| | | 040-160-21 | | | | None |
| Silverado Power, LLC | CUP 3327 | 019-050-61ST | AE-20 | 321.04 | 70 | None |
| Silverado Power, LLC | CUP 3328 | 019-040-05ST | AE-20 | 161.06 | 60 | None |
| Brannon Solar LLC | CUP 3344 | 011-050-09ST | AE-20 | 156.3 | 20 | None |
| 7 Projects | 56 parcels | | | 5,309 acres | 687 MWs | 7 projects not on and 0 projects on Williamson Act land |

Appendix D: Assessed Values for Properties with Solar PV Project Proposals in Fresno County

| Applicant | County ID | APN | Land Value | Improvement Value | Total Value |
|---|---|---|---|---|---|
| GA Solar | CUP 3291 | 040-080-15s | $241,045 | $8,202 | $249,247 |
| GA Solar c/o Joe Contreras | CUP 3292 | 040-070-41 | $537,989 | $32,406 | $570,39$5 |
| Westlands Solar Farms LLC | CUP 3294 | 085-040-21S | $386,740 | $0 | $386,740 |
| Sr Solis Oro Loma Teresina | CUP 3296 | 005-040-15s | $839,840 | $97,331 | $937,171 |
| Sr Solis Oro Loma LLC | CUP 3297 | 005-040-17s | $177,102 | $18,875 | $195,977 |
| Gestamp Solar c/o Francisco Sanchez | CUP 3299 - REVISED | 005-060-17s | $184,959 | $259,259 | $444,218 |
| | | 005-060-19 | $27,272 | $0 | $27,272 |
| | | 005-060-15 | $181,818 | $0 | $181,818 |
| | | 005-060-14 | $179,750 | $3,156 | $182,906 |
| | | 005-060-16 | $179,409 | $13,350 | $192,759 |
| | | 005-060-20 | $305,500 | $7,954 | $313,454 |
| | | | $1,058,708 | $283,719 | $1,342,427 |
| Gestamp Solar c/o Francisco Sanchez | CUP 3300 | 005-040-18s | $88,636 | $1,195 | $89,831 |
| | | 005-040-19s | $34,613 | $123,655 | $158,268 |
| | | 005- | $484,495 | $18,398 | $502,893 |

| | | | | | |
|---|---|---|---|---|---|
| | | 070-16s | | | |
| | | 005-070-18s | $119,147 | $439,553 | $558,700 |
| | | | $726,891 | $582,801 | $1,309,692 |
| Boulevard Associates LLC | CUP 3301 | 050-080-25s | $363,636 | $0 | $363,636 |
| RE Jayne East c/o Seth Israel | CUP 3308 | 073-060-12 | $55,282 | $0 | $55,282 |
| | | 073-060-55s | $90,462 | $0 | $96,512 |
| | | | $145,744 | $0 | $151,794 |
| RE Kamm LLC c/o Seth Israel | CUP 3309 | 040-080-35S | $321,295 | $5,079 | $326,374 |
| Gestamp Solar c/o Marco Lara | CUP 3313 | 055-240-05 | $36,174 | $3,096 | $39,270 |
| | | 055-250-25 | $200,984 | $48,855 | $249,839 |
| | | | $237,158 | $51,951 | $289,109 |
| Gestamp Solar c/o Francisco Sanchez | CUP 3316 | 028-050-03 | $179,761 | $4,264 | $184,025 |
| Gestamp Solar | CUP 3317 | 027-060-33 | $90,909 | $0 | $90,909 |
| GASNA 16P, LLC | CUP 3318 | 329-030-17 | $108,663 | $49,447 | $158,110 |
| Rose Solar LLC c/o Dan Predpall | CUP 3320 | 033-020-23 | $159,760 | $0 | $159,760 |
| Placer Solar, LLC | CUP 3321 | 033-160-09S | $371,923 | $2,821 | $374,744 |
| Silverado Power, LLC | CUP 3329 | 006-150-15S | $41,454 | $0 | $41,454 |
| | | 006-160-17S | $222,727 | $0 | $222,727 |

| | | | | | |
|---|---|---|---|---|---|
| | | 006-160-25S | $322,863 | $0 | $322,863 |
| | | 006-160-26S | $32,272 | $0 | $32,272 |
| | | | $619,316 | $0 | $619,316 |
| Three Rocks Solar, LLC | CUP 3331 | 038-060-03 | $119,363 | $0 | $119,363 |
| Frontier Renewables, LLC | CUP 3333 | 050-100-32S | $542,693 | $41,829 | $584,522 |
| Gestamp Solar | CUP 3334 | 005-060-18S | $127,931 | $49,368 | $177,299 |
| | | 005-060-17S | $184,959 | $259,259 | $444,218 |
| | | | $312,890 | $308,627 | $621,517 |
| Gestamp Solar | CUP 3341 | 055-380-02 | $111,477 | $7,759 | $119,236 |
| Cenergy Power | CUP 3342 | 373-120-58 | $135,999 | $35,902 | $171,901 |
| | | 373-120-01 | $10,913 | $1,086 | $11,999 |
| | | | $146,912 | $36,988 | $183,900 |
| Brannon Solar LLC | CUP 3344 | 011-050-09ST | $0 | $0 | $0 |
| Total for All Projects | | | $7,799,815 | $1,532,099 | $9,337,964 |

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