

The Brattle Group

Economic and Fiscal Impacts of the Topaz Solar Farm

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Stephen F. Hamilton
Professor and Chair of Economics
California Polytechnic State University

Mark Berkman, Principal and Michelle Tran, Research Analyst
The Brattle Group

Prepared for



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EXECUTIVE SUMMARY

This report calculates the economic and fiscal impacts of the Topaz Solar Farm (TSF), a 550 megawatt (MW) solar photovoltaic plant proposed by First Solar, Inc. in San Luis Obispo County ("County"). The estimated value of the proposed project's material and equipment costs is \$1.2 billion (of which 80 percent is subject to state sales and use tax), with \$175 million projected to be spent locally on materials and labor in the initial (3-year) construction phase of the project, and an additional \$61.875 million spent locally on operations and maintenance over the minimum 25-year operating period that frames the report.

Table E1 shows the local economic output that results from the \$236.875 million of direct spending over the combined construction and operation period. The entries in the table include only the benefits resulting from local spending on labor, materials and services and do not include any additional benefits resulting from the value of the energy created.

The *direct impact* reflects the initial change in economic activity from local payroll and construction expenditures over the construction and operation period. The *indirect impact* results from local "business-to-business" transactions necessary to support the direct activity, for instance local purchase of building materials, engineering and consulting services, and other goods purchased from supporting industries. The *induced impact* results when the increased earnings generated by the direct and indirect economic activity is spent on local goods and services, for example when workers at the facility purchase food, clothing, automobiles, real estate, and education, health and social services.

Table E1. Local Economic Impact and Tax Benefits of the Topaz Solar Farm¹

Impact	Economic Activity	Job Years (FTEs) ²	Employee Compensation ³	Economic Output ⁴
Direct	Project Development	1,575	\$192,002,632	\$236,875,000
Indirect	Local Supply Chain	304	\$16,570,676	\$51,873,510
Induced	Employee Spending	862	\$42,883,375	\$127,886,312
Total Economic Impact		2,741	\$251,456,683	\$416,634,822
Tax Revenue				\$18,500,000
Government Expenditures ⁵				\$10,500,000
Net Fiscal Impact				\$8,000,000

[1] Impacts here represent the undiscounted total over the 3 year construction period and minimum 25 year operating period.

[2] Job estimates include part-time and full-time employment

[3] Employee compensation includes wages and fringe benefits paid for by employers

[4] Economic output includes all local spending on labor, materials, and services, and does not include the value of the energy created.

[5] Source: Aspen (2010). Government expenditures attribute all non-divisible public safety services for both the Sun Power and First Solar facilities to the project.

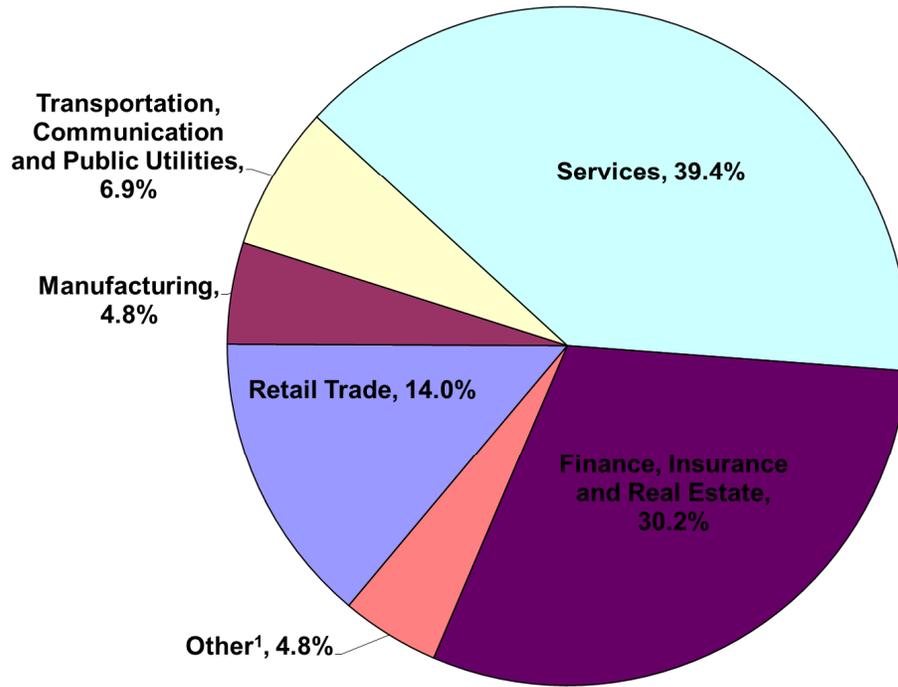
Based on the projected need for direct employment of 400 workers per year during the three-year construction period and 15 full-time employees for annual operations thereafter, it is estimated that the Topaz Solar Farm would create up to 2,171 job-years over the construction period and up to 570 job-years over the 25 year operating period in the County.¹ The total local economic impact of the Topaz Solar Farm is \$417 million. Of this total, over three quarters of the total impact (\$324 million) is generated during the construction period, with the remainder arising over the operating period. Between 60-100% of the local economic impact reported in the table is projected to arise in San Luis Obispo County, with the remaining benefit spilling over to workers in Kern County. The share of local benefits ultimately attributed to San Luis Obispo County will depend on the success of programs First Solar has put in place to emphasize employment in the County, for instance transportation provided for workers along the Highway 101 corridor.

In addition to the \$417 million local economic impact of the Topaz Solar Farm is expected to produce a net fiscal benefit for the County of \$8 million. The net fiscal impact on San Luis Obispo County includes \$9.1 million in sales and use tax revenues, \$9.4 million in property tax revenues, and \$10.5 million in projected government expenses. These fiscal impacts are conservative in the sense that they attribute all non-divisible government expenses that result from public safety services for two renewable energy projects, the recently approved Sun Power facility and the proposed First Solar facility, to the Topaz Solar Farm.

Figure E1 provides a breakdown of induced spending by Topaz Solar Farm project workers. The majority of induced spending is projected to occur in the finance, insurance, and real estate and service sectors of the local economy.

¹ A job-year or full-time equivalent (FTE) represents the equivalent of a single person employed for the entire fiscal year.

Figure E1. Induced Spending by TSF Project Workers



[1] Other includes Agriculture, Mining, Construction, Wholesale Trade and Government

I. INTRODUCTION

This report details the economic and fiscal impacts of the Topaz Solar Farm, a 550 megawatt solar photovoltaic plant proposed for San Luis Obispo County by First Solar, Inc.² The estimated value of the proposed project's material and equipment costs is \$1.2 billion dollars, with \$175 million being spent directly in San Luis Obispo and Kern counties on materials and labor in the initial (3-year) construction phase of the project, and an additional \$61.875 million spent locally on operations and maintenance (O&M) over the minimum 25-year operating period of the plant considered in this report. It is estimated that the proposed project will create up to 2,171 job-years³ over the three year construction period and up to 570 job-years over the 25 year operating period in the County.⁴

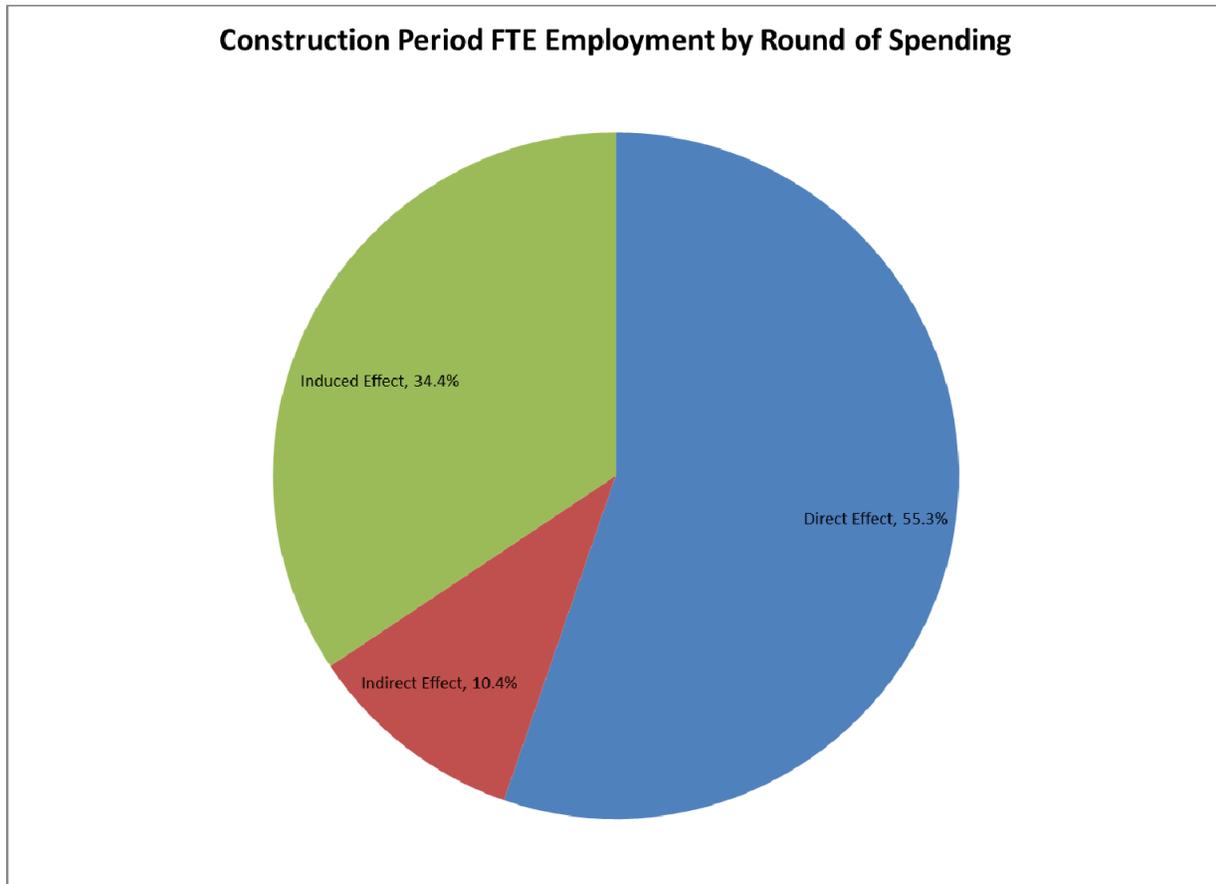
Figure 1.1 presents a breakdown of the construction period employment created by round of spending in the local economy. The distribution of this employment between San Luis Obispo County and Kern County depends on the success of First Solar, Inc. in targeting employment towards San Luis Obispo County with transportation programs designed to facilitate labor participation along the Highway 101 corridor in the County.

² The impacts measured here are based in large part on data and assumptions provided by First Solar. We have not made any independent verification of this information.

³ A job-year or full-time equivalent (FTE) represents the equivalent of a single person employed for the entire fiscal year, for instance 12 workers employed in one month or one worker employed an entire year.

⁴ As discussed in the body of the report, these figures reflect the assumption that approximately 100% of local spending occurs in San Luis Obispo County. Depending on the impact of First Solar's local jobs initiative, some impacts may be felt in neighboring Kern County.

Figure 1.1 Construction Period FTE Job Creation by Round of Spending



In total, employment generated by the Topaz Solar Farm corresponds to the creation of over \$217 million in earnings and \$324 million in output during the 3-year construction period and over \$33 million in earnings and \$92 million in output during the subsequent 25-year operating period. Earnings and output from the operating period will be larger in the event that the plant remains operational beyond the minimum 25 year period that frames the study.

The proposed Topaz Solar Farm is also projected to produce a net positive fiscal impact to San Luis Obispo County of \$8 million after government expenses, with the majority of this benefit arising from sales and use tax revenues.

II. BACKGROUND

Topaz Solar Farm is a 550 megawatt alternating current (AC) photovoltaic power plant currently being developed by First Solar, Inc. (First Solar). The proposed plant is located on approximately 4,000 acres in the northwestern corner of the Carrizo Plain in San Luis Obispo County. The project will be developed within one of two potential study areas covering either 7,800 or 6,300 acres, depending on the option chosen, with the remainder of the land area encompassed by the study areas set aside for mitigation.⁵ The study areas are larger than the acreage required for the

⁵ Aspen Environmental Group (October 2010), Draft Environmental Impact Report, p. B-1.

project site to allow for flexibility in the final project design to address issues identified in the planning process as well as to minimize the use of land covered by the Williamson Act. First Solar estimates that the plant will produce power output for about 160,000 average California homes.⁶ Based on a projected annual output level of 1.1 gigawatt-hours of renewable energy, the Topaz Solar Farm is capable of meeting 65 percent of the 1.7 gigawatt-hours of annual energy consumption in San Luis Obispo County.⁷ The energy generated by the plant will be sold to Pacific Gas & Electric (PG&E) under a long-term contract to help PG&E meet California's Renewable Portfolio Standard (RPS), which requires investor-owned utilities, electric service providers and community choice aggregators to increase procurement from eligible renewable energy resources by at least 1 percent of their retail sales annually to 33 percent by 2020.⁸ The Topaz Solar Farm relies on thin-film PV technology with 437 1.25 MW AC arrays.⁹ The energy produced at the plant will require interconnection to the transmission grid, an effort that will be undertaken by PG&E.¹⁰ The final project site will include the solar arrays, as well as an electric substation, learning center, and maintenance facilities.

The estimated value of the proposed project's material and equipment costs subject to County sales and use tax is \$960 million (80 percent of the \$1.2 billion in total project materials cost).¹¹ Construction of the Topaz Solar Farm is scheduled to take place over the period 2011- 2013. Subsequent to the construction period, the plant is expected to operate for "30 years or more, with an opportunity for a lifetime of 50 years or more with equipment replacement and repowering."¹² This report considers a minimum operating life of 25 years, which results in a conservative lower-bound on the economic benefits that will arise over the operating period of the project.

III. METHODOLOGY

The economic analysis relies on IMPLAN (Impact analysis for Planning), an input-output model developed and maintained by the Minnesota IMPLAN Group ("MIG") that is used for economic impact analysis by over 2,000 public and private institutions.¹³ The analysis draws on data collected from numerous state and federal sources, including the Bureau of Economic Analysis, Bureau of Labor Statistics (BLS), and the U.S. Census Bureau.

a. Description of IMPLAN

The IMPLAN modeling system relies on a matrix representation of the economy that describes the relationships among industries, consumers, government and foreign suppliers in order to

⁶ First Solar, Inc. (2010), Topaz Solar Farm Project Datasheet.

⁷ California Energy Commission; <http://www.ecdms.energy.ca.gov/elecbycounty.aspx>.

⁸ California Public Utility Commission; <http://www.cpuc.ca.gov/PUC/energy/Renewables/index.htm>.

⁹ Aspen Environmental Group (October 2010), Draft Environmental Impact Report, p. Ap. 15-8.

¹⁰ *Ibid.*, p. B-1.

¹¹ Personal Communication with Kathryn Arbeit.

¹² Aspen Environmental Group (October 2010), Draft Environmental Impact Report, p. B-42.

¹³ MIG; http://implan.com/V4/index.php?option=com_content&view=article&id=282:what-is-implan&catid=152:implan-appliance-&Itemid=2.

derive the economy-wide impacts of changes in a specific industry. This matrix representation is the so-called Leontief matrix, which contains average input (purchase) coefficients that describe the mix of goods, services and labor that are required to produce a unit of output; that is, how the output of one industry is used as an input in other related industries. The resulting input-output coefficients represent what economists refer to as production functions.¹⁴ The basic input-output model can be expressed in a straightforward equation: $X = (I - A)^{-1} * dY$ where $(I - A)^{-1}$ is the inverse of the Leontief matrix, dY is a change in final demand and X is output.

The IMPLAN model refines the US economy into 440 unique sectors and allows for regional disaggregation down to the county level. The model can be used to estimate the direct, indirect and induced impacts on employment, earnings and output as a result of final demand changes that result from a new investment in a particular industry or compilation of industries.¹⁵ The *direct effect* captures the initial change in economic activity resulting from the new investment. For example, the creation of 1,200 construction jobs over the 3-year construction phase of the Topaz Solar Farm is a direct employment effect of First Solar's investment. The *indirect effect* reflects new economic activity that is stimulated by the direct investment in industries that supply inputs to the sector of initial change. For example, increased spending on engineering consulting services to support the construction industry would be an indirect effect that arises during the construction phase of the plant. The *induced effect* captures the economic activity that results when the increased earnings generated by the direct and indirect economic activity is spent on local goods and services, for instance when construction workers hired to build the plant spend income on groceries, clothing, financial services, real estate, and healthcare. The economic impact of the project is the sum of these direct, indirect and induced effects.

b. IMPLAN Inputs

The county-level economic impacts of the proposed 550 MW Topaz Solar Farm are estimated using IMPLAN v3. To maintain consistency with the National Renewable Energy Laboratory's (NREL's) Jobs and Economic Development Impact (JEDI) model, the 440 IMPLAN industries are aggregated into 14 sectors that correspond to distinct areas of investment related to power generation projects.¹⁶ The aggregated sectors are as follows: Agriculture; Construction; Electrical Equipment; Fabricated Metals; Finance, Insurance and Real Estate; Government; Machinery; Mining; Other Manufacturing; Other Services; Professional Services; Retail Trade; Transportation, Communication and Public Utilities; and Wholesale Trade.

The JEDI framework provides guidance as to the breakdown of components that comprise a solar photovoltaic system. Specifically, for the construction and operating periods, Materials & Equipment are broken down into the following categories: Mounting (rails, clamps, fittings, etc.); Modules; Electrical (wire, connectors, breakers, etc.); and Inverters. In addition to these categories, economic value is generated from the direct labor requirement for both construction and operations and maintenance of the facility. Data provided by First Solar indicates that \$175

¹⁴ The production functions used in IMPLAN are based on the US Bureau of Economic Analysis' (BEA's) Benchmark Input-Output Accounts.

¹⁵ *Final Demand* is the demand of units external to the industrial sectors that constitute the producers in the economy, e.g., households, government and foreign trade. (Miller and Blair, 1985). Output represents the value of industry production.

¹⁶ NREL (2010), JEDI Photovoltaic Model PV1.10.03.

million will be spent in the local economy during the 3-year construction period, with an additional \$2.25 million of local spending per annum during the operating period.

The economic impact analysis considers the effect of construction and O&M spending on the local economy comprised of San Luis Obispo and Kern counties. First Solar projects that at least 60% of the aforementioned construction and O&M spending will take place in San Luis Obispo County, with the remainder taking place in Kern County.¹⁷ The construction and O&M period inputs outlined by these scenarios are summarized in Table 3.1.

Table 3.1 Topaz Solar Farm Project Spending in San Luis Obispo and Kern Counties

Phase	Materials & Supplies	Labor	Total
Construction (3 Year Period)	\$ 8,750,000	\$ 166,250,000	\$ 175,000,000
O&M (Annual)	\$ 225,000	\$ 2,250,000	\$ 2,475,000

Note: Assumes that during operating period, Materials & Supplies spending amounts to 10% of Labor spending.
Source: Data provided by First Solar, Inc.

The breakdown of Materials & Supplies into their component categories is displayed in Table 3.2. After consulting with First Solar about the economic make-up of San Luis Obispo County and surveying current trends in the solar PV industry, it was determined that of the four component categories, only mounting (predominantly fencing, posts and concrete), and electrical wiring are likely to be sourced locally. Hence local spending on construction materials and supplies is assumed to be split evenly between these two component categories, and that this spending allocation holds throughout the 25 year operating period as well.

Table 3.2 Cost Allocation of Materials & Supplies Components

Category	Construction (3 Year) Cost	O&M (Annual) Cost ¹	Sector
Mounting ²	\$ 4,375,000	\$ 112,500	Fabricated Metals
Modules ³	\$ -		Other Manufacturing
Electrical	\$ 4,375,000	\$ 112,500	Electrical Equipment
Inverter ³	\$ -		Electrical Equipment
Total Materials & Supplies	\$ 8,750,000	\$ 225,000	

[1] Assumes that during operating period, Materials & Supplies spending amounts to 10% of labor spending.

[2] Mounting includes rails, clamps, fittings, etc. Electrical includes wire, connectors, breakers, etc.

[3] Assumes that modules and inverter are imported from outside of the County.

Sources: Data provided by First Solar, Inc.; Sterzinger and Sveck (2005), "Solar PV Development: Location of Economic Activity," Renewable Energy Policy Project.

c. Fiscal Inputs

The fiscal impacts resulting from the project are derived using a standard net present value (NPV) calculation that relies on prevailing tax rates and tax-based information provided by First Solar. This includes revenues subject to sales and use taxes as well as property acquisition costs. For the purposes of the analysis, the land sale price of the project site is projected to be \$24,767,200 and the sale price of mitigation land is \$27,337,000.¹⁸ A discount rate of 2 percent

¹⁷ Personal Communication with Kathryn Arbeit.

¹⁸ Land sale prices based on data from First Solar, Inc.

is used to convert future revenues (in real dollars) into present value terms (2011 dollars) at the tax rates displayed in Table 3.3.

Table 3.3 Tax Rates Used in Fiscal Analysis

Tax Rate Category	Tax Rate
Property Tax	1.0023%
Property Transfer Tax	0.11%
County Sales and Use Tax	1.00%

Source: Data provided by First Solar, Inc.

IV. RESULTS

a. Economic Impacts

The results of modeling the inputs described in Tables 3.1 and 3.2 in IMPLAN are displayed in Tables 4.1 - 4.3. Tables 4.1 and 4.2, respectively, show the indirect and induced impacts of the Topaz Solar Farm on employment across the aggregated sectors underlying the study.

Table 4.1 Indirect Employment Generated by Direct Spending in the Local Economy

Industry/Sector	Construction Phase		Operation Phase	
	Jobs	% of Total	Jobs	% of Total
Agriculture	1	1%	0	1%
Mining	1	1%	0	1%
Transportation, Communication and Public Utilities	12	5%	4	5%
Construction (Maintenance & Repair)	2	1%	1	1%
Other Manufacturing	8	3%	3	4%
Fabricated Metals	1	0%	0	0%
Machinery	0	0%	0	0%
Electrical Equipment	0	0%	0	0%
Wholesale Trade	16	7%	6	8%
Retail Trade	59	26%	20	25%
Finance, Insurance and Real Estate	20	9%	7	9%
Professional Services	55	25%	19	24%
Services (except Public Administration)	48	21%	17	22%
Government	0	0%	0	0%
Total Induced Employment	225	100%	79	100%

Source: IMPLAN v3; and The Brattle Group.

Table 4.2 Induced Employment Generated by Direct and Indirect Spending in the Local Economy

Industry/Sector	Construction Phase		Operation Phase	
	Jobs	% of Total	Jobs	% of Total
Agriculture	3	0%	0	0%
Mining	1	0%	0	0%
Transportation, Communication and Public Utilities	19	3%	3	3%
Construction (Maintenance & Repair)	3	0%	1	0%
Other Manufacturing	7	1%	1	1%
Fabricated Metals	0	0%	0	0%
Machinery	0	0%	0	0%
Electrical Equipment	0	0%	0	0%
Wholesale Trade	21	3%	3	3%
Retail Trade	167	22%	26	23%
Finance, Insurance and Real Estate	118	16%	18	16%
Professional Services	26	4%	4	4%
Services (except Public Administration)	379	51%	59	51%
Government	1	0%	0	0%
Total Induced Employment	746	100%	116	100%

Source: IMPLAN v3; and The Brattle Group.

Note that the employment figures generated by IMPLAN are converted into full-time equivalent jobs to facilitate the comparison of employment effects across sectors for different compositions of part-time and full-time employees. The employment effects reported for the operating period represent the aggregate impacts of the project on local job creation in San Luis Obispo and Kern counties over the 25-year minimum operating horizon. Ultimately, the share of employment realized by the County depends on the distribution of direct employment across the two counties at the Topaz Solar Farm, as the indirect and induced effects generated by employee purchases and spending tend to arise in workers' home counties. First Solar projections indicate that between 60-100 percent of the construction and O&M employment will take place in San Luis Obispo County, and current labor market conditions in the County suggest that surplus labor conditions currently exist in the construction trades that support direct employment in the initial construction phase. The most recent employment statistics indicate an unemployment rate in San Luis Obispo County of 10.3 percent in January, 2011,¹⁹ with a proportionally larger level of unemployment in the construction trades as a result of the recent housing-driven economic downturn. Over the period 2008-2009 that marked the beginning of the housing downturn, employment in the construction and extraction industry in San Luis Obispo County decreased 31 percent (from 11,008 to 7,639 workers).²⁰ The Topaz Solar Farm will provide head-of-household jobs for electricians, carpenters, engineers, iron workers and other skilled labors in the construction industry. Surplus labor conditions in the construction and extraction industry in the County indicate the potential to fully accommodate the employment of 400 full-time construction workers (with a monthly peak of 540) over the 3-year construction phase of the project.²¹

¹⁹ State of California, Employment Development Department; <http://www.labormarketinfo.edd.ca.gov>.

²⁰ U.S. Census Bureau, American Community Survey (ACS); <http://factfinder.census.gov/>.

²¹ Data provided by First Solar, Inc.

Table 4.3 depicts the local economic impact of the Topaz Solar Farm in terms of employment, employee compensation, and total economic output.²² The entries in the table indicate that the proposed project will create 2,171 job-years over the 3-year construction period and an additional 570 job-years over the minimum 25-year operating period in the local economy, with a 60-100 percent share of local job creation anticipated for the County. The bulk of employment creation for both phases of the project arises through direct employment at the Topaz facility, with the largest share of job creation encompassed by the construction industry.

The resulting impact on local employee compensation and economic output are presented in the table in 2011 dollars. Development of the Topaz Solar Farm will generate \$217,698,948 in local earnings and \$324,041,852 in additional local output during the construction period and \$33,757,735 in earnings and \$92,592,970 in output during the operating period.

Table 4.3 Local Economic Impact of the Topaz Solar Farm

Impact	Economic Activity	Job Years (FTEs) ¹	Employee Compensation ²	Economic Output ³
Construction Phase (3 years)				
Direct	Project Development	1,200	\$168,321,888	\$175,000,000
Indirect	Local Supply Chain	225	\$12,250,380	\$38,317,796
Induced	Employee Spending	746	\$37,126,680	\$110,724,056
Total Construction Phase		2,171	\$217,698,948	\$324,041,852
Operating Phase (25 years)⁴				
Direct	Project Development	375	\$23,680,744	\$61,875,000
Indirect	Local Supply Chain	79	\$4,320,296	\$13,555,714
Induced	Employee Spending	116	\$5,756,695	\$17,162,256
Total Operating Phase		570	\$33,757,735	\$92,592,970
Total Economic Impact		2,741	\$251,456,683	\$416,634,822

[1] Job estimates include part-time and full-time employment

[2] Employee compensation includes wages and fringe benefits paid for by employers

[3] Economic output includes all local spending on labor, materials, and services, and does not include the value of the energy created.

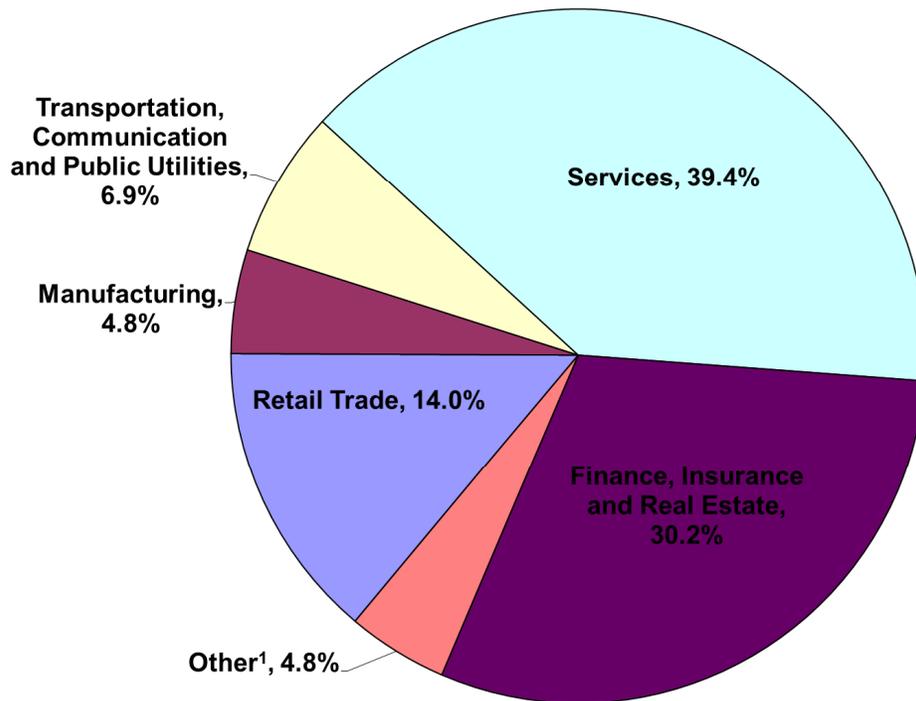
[4] Impacts here represent the undiscounted total over the 25 year operating period.

Source: IMPLAN v3 and The Brattle Group.

²² Local economic impacts reflect the assumption that all of the construction and O&M employment requirements are met by workers located in San Luis Obispo County. First Solar plans to encourage this with a transportation program. To the extent that workers commute from other counties, Kern County in particular, local impacts will be smaller. The reduction will be roughly proportional to the share of workers from outside San Luis Obispo although differences in county level economic structure will lead to deviations from exact proportionality.

Between the construction period and the O&M period, the project will create over \$127 million in induced spending. Figure 4.1 details the distribution of induced spending across industries. The largest share of induced spending is projected to occur in the service sector, finance, insurance and real estate industries, and retail trade, where service industries include administrative and waste services, educational services, health and social services, entertainment and recreation, professional services, and accommodation and food services. Other industries, which together account for 4.8 percent of induced spending, include agriculture, mining, construction and wholesale trade, with wholesale trade accounting for about two-thirds of spending in the category.

Figure 4.1 Induced Spending by Topaz Project Workers



[1] Other includes Agriculture, Mining, Construction, Wholesale Trade and Government

b. Fiscal Impacts

The results from the fiscal impact analysis are displayed in Table 4.4. All values in the table are in 2011 dollars, with revenues discounted at a net rate of 2 percent per annum. Development of the proposed Topaz Solar Farm will lead to sales and use tax revenues of \$9.1 million and property tax revenues of \$9.4 million. Government expenditures of \$10.5 million are projected in the Aspen report and encompass the total costs estimated by the managing County departments during the construction and operating period pertaining to multiple solar power projects proposed for development in the Carrizo Plain.²³ The Aspen report cites an earlier report by Town Hall Services that maintains that “costs would be the same for public safety

²³ Aspen Environmental Group (October 2010), Draft Environmental Impact Report, p. Ap. 15-15.

services whether there is one or three projects.”²⁴ Consequently, the estimate reported here for the net fiscal impact, which attributes all non-divisible public safety services to the Topaz Solar Farm, is conservative.

Table 4.4 Net Fiscal Impact of the Topaz Solar Farm on San Luis Obispo County

Fiscal Category	Present Value (2011 \$)
Sales and Use Tax Revenues ¹	\$9,100,000
Property Tax Revenues ²	\$9,400,000
Total Revenues	\$18,500,000
Government Expenditures ³	\$10,500,000
Net Fiscal Impact	\$8,000,000

[1] Sales and Use Tax Revenues based on 80% of \$1.2 billion in expenditure over two years

[2] Property Tax Revenues based on the increase in assessed land value for project and mitigation

[3] Source: Aspen (2010). Government expenditures attribute all non-divisible public safety services for two renewable energy projects (Sun Power and First Solar) to the Topaz facility.

²⁴ *Ibid.*

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