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MEMORANDUM

To: Gerry Newcombe, County Administrative Office, San Bernardino Cou
Chief Peter Brierty, San Bernardino County Fire Department

From: Stan Hoffman, President, Stanley R. Hoffman Associates, Inc.

Date: June 30, 2010

Subject: Estimated Allocation of Fire Facility Costs to Proposed Solar Energy Installations

Project #: 1210

Overview

This memorandum presents an allocation of capital costs (fire station and equipment) for proposed County fire department facilities among the 14 proposed solar farm projects in San Bernardino County. The primary purpose of this analysis from the development impact fee (DIF) perspective is to allocate capital costs from new fire stations to provide coverage for the potential fire protection-related and emergency medical services needs of the proposed solar projects. In doing so, the allocation methodology assigns a 'fair share' cost to the proposed solar projects by establishing the nexus between their impact on fire protection-related and emergency medical services and capital improvement costs to provide these services. We also show, for comparison purposes, an allocation of ongoing operations and maintenance costs to the solar projects from upgrades to existing stations and the proposed new fire stations.

The general locations of these proposed County fire facilities and proposed solar farms are shown in Figure 1. As shown in Table 1, the allocation of capital costs, based on a weighted matrix that evaluates emergency response risk, is very much dependent upon whether the solar facilities are photovoltaic or the larger solar thermal systems, which use chemical substances such as Therminol and gaseous hydrogen to transfer heat. The higher allocated capital costs rounded to the nearest thousands are for Abengoa ($860,000), Ivanpah ($526,000) and Solar One ($1,187,000). In comparison, the photovoltaic systems are allocated lower capital costs ranging from about $67,000 to about $202,000. A similar allocation was performed for distributing estimated operations and maintenance costs for proposed upgrades and proposed new stations. As shown in Table 2, allocations of the annual operations and maintenance costs range from about $62,000 to $187,000 for the photovoltaic systems and about $485,000 to $1,095,000 for the thermal systems.

Overview of Solar Energy Technology

Solar energy technologies can be summarized under two general categories: photovoltaic (PV) and thermal. Photovoltaic systems generate energy directly from the sun, while thermal systems harness the sun's energy to heat transfer mediums like water or Therminol to drive steam-turbine generating plants. In the solar thermal hydrogen systems, the sun's energy causes the expansion and contraction of hydrogen to drive the turbine. In the United States, the power industry has focused on solar thermal technologies mainly because it is perceived as more commercially viable than solar PV technologies. However, PV systems are becoming more competitive as technological advancements allow manufacturers to increase panel efficiency and reduce costs. Appendix A provides a more detailed description of the technologies underlying PV and thermal solar energy systems. The advantages and disadvantages of thermal systems relative to photovoltaic systems are summarized below:

Advantages

- Thermal systems produce more energy than PV systems. As shown in Table 3, in San Bernardino County the three thermal systems range from 250 to 850 megawatts, while the PV systems range from 1.3 to 104.0 megawatts.
- Solar thermal systems can work in the shade for brief amounts of time, since the heated fluids they depend on can stay hot enough to generate electricity for some time without the sun.

Disadvantages

- Thermal systems present a much higher fire risk than PV systems. As shown in Table 4, the San Bernardino County Fire Department and California Energy Commission staff jointly ranked the three thermal projects as very high priorities for emergency fire response, while the 11 PV projects were ranked as only low to moderate priorities.
- Unlike PV systems, thermal systems require on-site staff to perform operations and maintenance. Because individuals are required to work on-site, these systems require additional public services such as fire protection, rescue, hazardous materials spill response and emergency medical response.
- Thermal systems are larger and require more land than PV systems. As shown previously in Table 3, the three proposed thermal systems in San Bernardino County have disturbed acreages ranging from 1,765 acres to 8,230 acres, while the 11 proposed PV systems have disturbed acreages ranging from 12 acres to 922 acres.

San Bernardino County Proposed Solar Projects

As shown in Table 3, a total of 14 solar energy projects are proposed for San Bernardino County (two projects shown in Table 3 are wind energy projects). Of the 14 total solar projects, 11 are based on PV technology and 3 are based on thermal technologies (1 each of water, Therminol and gaseous hydrogen). There is large disparity between the PV projects and the thermal projects in terms of size (disturbed acreage) and installed capacity (megawatts). As shown in Table 3, the 11 PV projects are smaller in acreage, with lower installed capacity compared to the 3 thermal projects. The PV projects range from Soltech Solar (12 acres, 1.3 megawatts) to Rabbit Springs Solar (922 acres, 104.0 megawatts), while the thermal projects range from Abengoa (1,765 acres, 250.0 megawatts) to Solar One (8,230 acres, 850.0 megawatts). As shown in Table 3, on a megawatts per 1,000 acres basis, the installed capacity of the PV projects range from Lucerne Valley Solar (87.2) to Axio Power Holdings, El Mirage (142.0), while the installed capacity of the thermal projects ranges from Solar One (103.3) to Abengoa (141.6).

The 14 proposed solar farm projects are located in the Desert region of San Bernardino County, which is comprised of three economic sub-areas (ESAs) – Morongo Basin, Outlying Desert, and Victor Valley-Barstow – as designated under the County General Plan. Shown in Table 5 are the concentrations of proposed solar projects by each of these geographic sub-areas. The Outlying Desert ESA, which contains one each of solar thermal-water and thermal-hydrogen projects and one PV project, has the largest aggregate installed capacity (1,255 megawatts) and disturbed acreage (11,910 acres). The Victor Valley-Barstow ESA has the most solar projects (eight PV and one thermal), totaling 583 megawatts and 4,496 disturbed acres. The Morongo Basin ESA contains two PV projects and no thermal projects, for a total of 65 megawatts and 673 disturbed acres. The estimated on-site employment for the thermal systems ranges from 80 employees for the Abengoa project to 164 employees for the Solar One project near Calico. The PV and wind projects are estimated to have insignificant full-time employment on-site.

Total Fire Facility Capital and Operations and Maintenance Costs

As shown in Table 6, the capital costs for both proposed ($12.5 million) and future fire stations ($14.1 million) total an estimated $26.6 million. Cost estimates for annual operations and maintenance costs are shown separately in Table 6. The capital cost estimates are for new fire facilities, and the operations and maintenance costs are for upgrades to existing stations as well as new facilities. In many cases, the existing stations in more remote areas are operated on a paid-call basis and do not have a full time fire personnel staff.

Methodology

The total megawattage output estimated for each solar farm facility, as shown in Table 1, is grouped into one of four megawattage categories: 1) less than 50 megawatts; 2) 50 to less than 100 megawatts; 3) 100 megawatts to less than 500 megawatts; and 4) 500 megawatts or greater. Power plants greater than 50 megawatts are under the authority of the CEC. For power plants between 50 and 100 megawatts, the CEC often grants a Small Power Plant Exemption (SPPE) which then allows for local enforcement; anything greater than 100 megawatts requires a full Application for Certification (AFC), an environmental review and continued enforcement by the CEC. A power plant of 500 megawatts or larger is considered a medium to large power plant.

These megawattage categories are then weighted according to an "emergency response matrix," as shown previously in Table 4. The emergency response rating for each solar farm project was developed by the San Bernardino County Fire Department in conjunction with staff from the California Energy Commission. Solar projects were rated based on five criteria to determine the urgency of the need for additional resources and mitigation, with a higher rating indicating greater emergency response urgency. The five criteria were: 1) Inspections; 2) Fire/Explosion risk; 3) HazMat risk; 4) Rescue First Alarm; and 5) EMS response of certified medic. Each factor was then weighted according to its estimated proportionate contribution to the composite ranking. As shown in Table 4, the weighting factors range from a low of 1.0 for several of the photovoltaic systems to a high to 4.4 for the Calico system.

<u>Establishing Development Impact Fee Nexus</u>

Following the 'nexus' criteria to allocate the fair share costs of potential capital improvements to new development, we first establish the impact of projected background demographic growth on demand for new fire services. This impact is established by applying a geographically appropriate per capita level of fire service to the projected population growth within the three ESAs where the solar projects are located. As shown in Table 7, based on information obtained from the San Bernardino County Fire Department, the population served per station facility varies greatly among the five County Fire Divisions, ranging from around 14,000 persons per station in the more urbanized areas of the Valley Division and the Victorville Division to only about 2,900 persons per station in the South Desert Division. An average level of service of about 5,400 persons per station for the North and South Divisions taken together was considered appropriate to apply to the background demographic growth projected to occur within the three Desert ESAs (Morongo Basin, Outlying Desert and Victor Valley-Barstow) over the 2008 to 2020 time period, where the solar projects are located.

As shown in Table 8, based on information obtained from the County Land Use Services Department, a total population growth of 9,457 persons is projected for the Desert Planning Area under the current County General Plan. Further, this growth was allocated down to the three ESAs – Outlying Desert, Victorville/Barstow and the Morongo Basin, as show in Table 8. The estimated projected growth within these areas results in a total demand for 1.75 new stations, applying the level of service factor of 5,400 persons per station. This projected residential demand comprises a share of 58.4 percent of the total 3 new fire stations proposed by the County Fire Department to potentially provide coverage for the solar projects. Following this method, it is estimated that the remainder 41.6 percent of net new demand for fire services originates from all other non-residential uses, including commercial activities and traffic-related calls.

In order to get a finer breakdown of all other non-residential calls, and as a check for the percent share attributed to projected new residential calls, we examined the County Fire Department call volume data for 2009 by different call origin types (residential, traffic and commercial) distributed by Urban, Rural and Remote areas within the County, as shown in Table 9. Given the location of the solar projects in the desert areas of the County, a weighted percent call distribution for the combined Rural and Remote areas was considered reflective of the possible call volume pattern serviced by the 3 proposed new stations. The weighted average call volume for 2009 in the Rural and Remote areas indicates 59.7 percent of all calls had residential origin, which is similar to the population growth projection-based estimate of 58.4 percent. Further, the call volume data indicates that of the remainder 40.3 percent of service calls, 28.8 percent were commercial-related and 11.4 percent were traffic-related, as shown in Table 9. Following from this, we assume a rounded factor of 29.0 percent for commercial-related calls as representative of the fair-share allocation of costs from new capital improvements to the solar projects, as shown in Table 9. Applying the 29.0 percent factor to the total capital improvement costs of $12.54 million from proposed new fire stations, results in a fair-share allocation of $3.64 million to the proposed solar projects. The above fair-share cost was then allocated to each solar project based on its composite weighting, as described next.

Allocation of Fair-share Capital Costs to Individual Solar Projects

As previously shown on Table 1, each project's emergency response rating (from Table 4) was then multiplied by its megawattage category to determine its weighted megawattage ranking. Each project's megawattage was obtained from the project's application as is shown on Table 3. Then, each project's individual share of total weighted megawattage ranking – expressed as a percentage – was then used to distribute fire facility capital cost responsibilities. As shown on Table 1, the total capital cost for proposed stations of $12.54 million was multiplied by the fair-share factor of 29.0 percent to estimate the proposed solar farms' aggregate capital cost responsibility of about $3.64 million.

This methodology spreads the costs proportionally among the stations in the Desert region of San Bernardino County even though some of the facilities are in more urbanized areas versus more remote areas within the Desert region. While one station may be the first responder to an emergency, the other stations will provide backup support depending upon the location and severity of the emergency.

Conclusions

Approximately $3.64 million of the $12.54 million required for proposed fire facility capital costs has been allocated to solar farms in the Desert region of San Bernardino County, as shown previously in Table 1. The distribution of capital costs to solar thermal projects ranges from about $526,000 to $1,187,000, while the distribution of capital costs to PV projects ranges from about $67,000 to $202,000 per project. This difference is the result of solar thermal projects having a significantly greater emergency response rating and size (as measured by megawattage), and therefore greater potential impacts on County fire services capabilities. While relatively little commercial growth is projected in the Outlying Desert area of San Bernardino County, if significant commercial growth does occur or other solar farms are proposed, then the County may consider a reallocation of the fire facility costs and reimbursement agreements in the future for projects that have already contributed toward off-setting those fire facility costs.

As discussed earlier, a similar allocation was performed for distributing estimated operations and maintenance costs for proposed upgrades and proposed new stations. As shown previously in

Table 2, allocations of the annual operations and maintenance costs range from about $62,000 to $187,000 for the photovoltaic systems and about $485,000 to $1,095,000 for the thermal systems.

A taxable Possessory Interest may exist whenever there is a private, beneficial use of publicly-owned, non-taxable real property. Such interests are typically found where private individuals, companies or corporations lease, rent or use federal, state or local government owned facilities and/or land for their own beneficial use. For those solar farm projects that have long-term leases, whatever future possessory interest property tax is collected by the County will be used to help off-set the annual fire facility operations and maintenance costs.

Figure 1
Proposed Solar Farms and San Bernardino County Fire Facilities

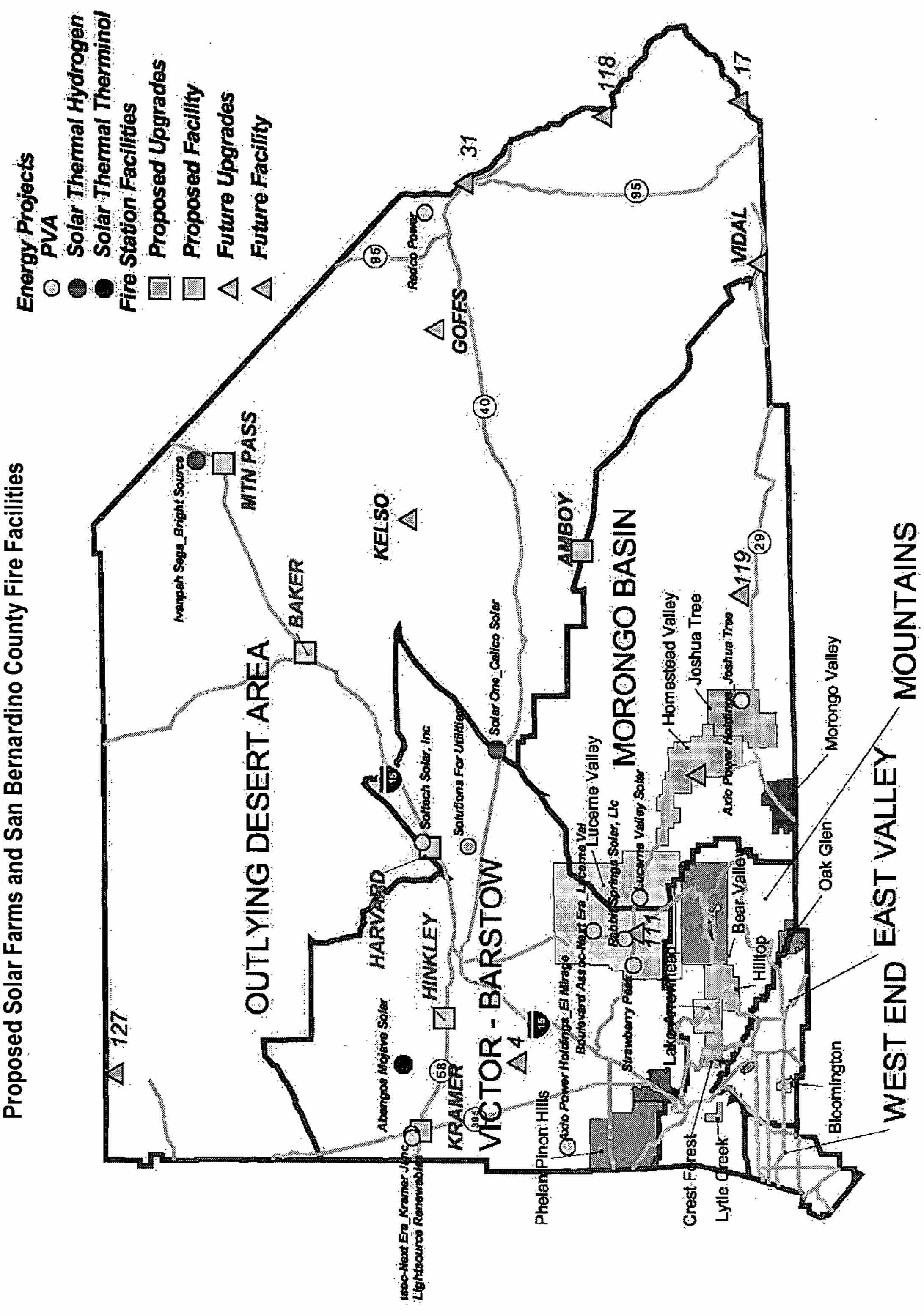


Table 1
Estimated Distribution of Capital Cost Responsibilities by Solar Farm Project

Serial Number	Project Name	Technology	Emergency Response Matrix Rating[1] (A)	Megawatts by Project[2]	Size Impact Rating[3] (B)	Weighted Composite Response and Size Rating[4] (A X B)	Percentage Distribution of Weighted Rating[5]	Allocation of Capital Costs by Project[6]	Rounded Allocation of Capital Costs by Project[7]
1	Soltech Solar, Inc	PVA	1.0	1.3	1.0	1.0	1.86%	$67,466	$67,000
2	Solutions For Utilities	PVA	1.0	3.0	1.0	1.0	1.86%	$67,466	$67,000
3	Strawberry Peak	PVA	1.0	15.0	1.0	1.0	1.86%	$67,466	$67,000
4	Boulevard Assoc-Next Era, Kramer Junction	PVA	1.0	20.0	1.0	1.0	1.86%	$67,466	$67,000
5	Lightsource Renewables	PVA	1.0	40.0	1.0	1.0	1.86%	$67,466	$67,000
6	Boulevard Assoc-Next Era, Lucerne Valley	PVA	1.0	60.0	2.0	2.0	3.71%	$134,933	$135,000
7	Rabbit Springs Solar, Llc	PVA	1.0	104.0	3.0	3.0	5.57%	$202,399	$202,000
8	Redco Power	PVA	1.0	5.0	1.0	1.0	1.86%	$67,466	$67,000
9	Axio Power Holdings, Joshua Tree	PVA	1.0	20.0	1.0	1.0	1.86%	$67,466	$67,000
10	Axio Power Holdings, El Mirage	PVA	1.0	90.0	2.0	2.0	3.71%	$134,933	$135,000
11	Lucerne Valley Solar	PVA	1.8	45.0	1.0	1.8	3.25%	$118,066	$118,000
12	Abengoa Mojave Solar	Solar Thermal Therminol	4.3	250.0	3.0	12.8	23.65%	$860,197	$860,000
13	Ivanpah SEGS, Bright Source	Solar Thermal Steam	2.6	400.0	3.0	7.8	14.47%	$526,238	$526,000
14	Solar One, Calico Solar	Solar Thermal Hydrogen	4.4	850.0	4.0	17.6	32.65%	$1,187,410	$1,187,000
			23.0	1,903.3		53.9	100.00%	$3,636,442	$3,632,000

TOTAL CAPITAL COST[8]	$12,539,455
COST SHARE OF SOLAR PROJECTS[9]	$3,636,442
ALLOCATION FACTOR[10]	29.00%

MEGAWATTAGE IMPACT CATEGORIES[11]

Megawatts	Rating
<50	1
50 to <100	2
100 to 500	3
Above 500	4

1. The emergency response weightings have been developed by the San Bernardino County Fire Department based on factors shown in Table 4.
2. This is the estimated total megawattage by project as provided by the project proponents applications.
3. See note 11.
4. Estimated weighted rating based on megawattage size category when multiplied by the emergency response matrix rating.
5. Percentage distribution of weighted rating by project; this weighting will be used to distribute capital cost responsibilities by project.
6. The allocation of capital cost responsibility to project is based on distributing the allocated fire facility cost share based on the weighted rating percentages.
7. Cost allocations rounded to the nearest thousands.
8. Estimated total new and upgraded fire facility capital costs.
9. Estimated fire facility capital cost share of proposed solar farm projects based on allocation factor as provided by San Bernardino County Fire Department.
10. Allocation factor based on call volumes associated with commercial development, as reported by the San Bernardino Fire Department and shown in Table 9.
11. Projects were also rated for demand for County fire services due to absolute size using project megawattage output to group the projects into four impact categories.

Source: Stanley R. Hoffman Associates, Inc.

Table 2
Distribution of Annual Operations and Maintenance Costs

Serial Number	Project Name	Technology	Emergency Response Matrix Rating[1] (A)	Megawatts by Project[2]	Size Impact Rating[3] (B)	Weighted Composite Response and Size Rating[4] (A X B)	Percentage Distribution of Weighted Rating[5]	Allocation of Capital Costs by Project[6]	Rounded Allocation of Capital Costs by Project[7]
1	Soltech Solar, Inc	PVA	1.0	1.3	1.0	1.0	1.86%	$62,190	$62,000
2	Solutions For Utilities	PVA	1.0	3.0	1.0	1.0	1.86%	$62,190	$62,000
3	Strawberry Peak	PVA	1.0	15.0	1.0	1.0	1.86%	$62,190	$62,000
4	Boulevard Assoc-Next Era, Kramer Junction	PVA	1.0	20.0	1.0	1.0	1.86%	$62,190	$62,000
5	Lightsource Renewables	PVA	1.0	40.0	1.0	1.0	1.86%	$62,190	$62,000
6	Boulevard Assoc-Next Era, Lucerne Valley	PVA	1.0	60.0	2.0	2.0	3.71%	$124,381	$124,000
7	Rabbit Springs Solar, Llc	PVA	1.0	104.0	3.0	3.0	5.57%	$186,571	$187,000
8	Redco Power	PVA	1.0	5.0	1.0	1.0	1.86%	$62,190	$62,000
9	Axio Power Holdings, Joshua Tree	PVA	1.0	20.0	1.0	1.0	1.86%	$62,190	$62,000
10	Axio Power Holdings, El Mirage	PVA	1.0	90.0	2.0	2.0	3.71%	$124,381	$124,000
11	Lucerne Valley Solar	PVA	1.8	45.0	1.0	1.8	3.25%	$108,833	$109,000
12	Abengoa Mojave Solar	Solar Thermal Therminol	4.3	250.0	3.0	12.8	23.65%	$792,926	$793,000
13	Ivanpah SEGS, Bright Source	Solar Thermal Steam	2.6	400.0	3.0	7.8	14.47%	$485,084	$485,000
14	Solar One, Calico Solar	Solar Thermal Hydrogen	4.4	850.0	4.0	17.6	32.65%	$1,094,549	$1,095,000
			23.0	1,903.3		53.9	100.00%	$3,352,058	$3,351,000

OPERATIONS AND MAINTENANCE COST[8]	$11,558,820
COST SHARE OF SOLAR PROJECTS[9]	$3,352,058
ALLOCATION FACTOR[10]	29.00%

MEGAWATTAGE IMPACT CATEGORIES[11]

Megawatts	Rating
<50	1
50 to <100	2
100 to 500	3
Above 500	4

1. The emergency response weightings have been developed by the San Bernardino County Fire Department based on factors shown in Table 4.
2. This is the estimated total megawattage by project as provided by the project proponents applications.
3. See note 11.
4. Estimated weighted megawattage when multiplied by the emergency response matrix rating.
5. Percentage distribution of weighted megawattage by project; this weighting will be used to distribute operations and maintenance cost responsibilities by project.
6. The allocation of operations and maintenance cost responsibility to project is based on distributing the allocated fire facility cost share based on the weighted megawattage percentages.
7. Cost allocations rounded to the nearest thousands.
8. Estimated operations and maintenance costs from proposed upgrades and new stations.
9. Estimated operations and maintenance cost share of proposed solar farm projects based on allocation factor as provided by San Bernardino County Fire Department.
10. Allocation factor based on call volumes associated with commercial development, as reported by the San Bernardino Fire Department and shown in Table 9.
11. Projects were also rated for demand for County fire services due to absolute size using project megawattage output to group the projects into four impact categories.

Source: Stanley R. Hoffman Associates, Inc.

Table 3
Physical Characteristics of Proposed Solar Farm Projects

No.	PROJECT NAME/ NUMBER	PROJECT NUMBER	TECHNOLOGY	JURISDICTION	EMPLOYMENT[1]	MEGAWATTS	ACREAGE	MEGAWATTS PER 1,000 ACRES
1	GRANITE WIND	P200700743	Wind	Under County Jurisdiction, Joint Review & Permitting with BLM	n/a	64.4	2,640	24.4
2	DAGGETT RIDGE WIND FARM, LLC	P200800589	Wind	Under County Jurisdiction, Joint Review & Permitting with BLM	n/a	82.5	1,957	42.2
3	SOLTECH SOLAR, INC	P20100018	PVA	County	n/a	1.3	12	112.3
4	SOLUTIONS FOR UTILITIES	P200900339/CUP/CF	PVA	County	n/a	3.0	22	136.4
5	STRAWBERRY PEAK	P200900655/CF	PVA	County	n/a	15.0	160	93.8
6	BOULEVARD ASSOC - NEXT ERA/ KRAMER JUNCTION		PVA	County	n/a	20.0	191	104.7
7	LIGHTSOURCE RENEWABLES	P200900470	PVA	County	n/a	40.0	350	114.3
8	BOULEVARD ASSOC - NEXT ERA/ LUCERNE VALLEY	P200900663/CF	PVA	County	n/a	60.0	440	136.4
9	RABBIT SPRINGS SOLAR, LLC	P200900580/CF	PVA	County	n/a	104.0	922	112.8
10	REDCO POWER	P200900558	PVA	Pre-application	n/a	5.0	40	125.0
11	AXIO POWER HOLDINGS - JOSHUA TREE	P200900666/PAC	PVA	Pre-application	n/a	20.0	157	127.4
12	AXIO POWER HOLDINGS - EL MIRAGE	P200900665/PAC	PVA	Pre-application	n/a	90.0	634	142.0
13	LUCERNE VALLEY SOLAR		PVA	BLM	n/a	45.0	516	87.2
14	ABENGOA MOJAVE SOLAR		Solar Thermal with Therminol Fluid	CEC	80	250.0	1,765	141.6
15	IVANPAH SEGS (BRIGHT SOURCE)		Solar Thermal with Steam	CEC & BLM	90	400.0	3,640	109.9
16	SOLAR ONE (CALICO SOLAR)		Hydrogen Stirling Engines	CEC & BLM	164	850.0	8,230	103.3
				TOTAL	**334**	**2,050.2**	**21,676**	**94.6**
				TOTAL (SOLAR ONLY)	**334**	**1,903.3**	**17,079**	**111.4**
				TOTAL (WIND ONLY)[1]	**n/a**	**146.9**	**4,597**	**32.0**

1. There is no significant full-time employment estimated for the photovoltaic and wind systems.

Source: Stanley R. Hoffman Associates, Inc.
San Bernardino County Land Use Services Department
San Bernardino County Fire Services Department

Table 4
Emergency Response Matrix Ratings by Solar Farm Project

Emergency Response Matrix																			
A. Response Criteria		points	weighting factor	Kramer	Harper	Lucerne	Abengoa	Ivanpah	Solar 1	SolarTech	Solun	Strawbry	Boule KJ	LightSrc	Boule LV	RBT Spgs	Red Co	Axio JT	Axio EM
1. Inspections			0.10																
a.	minimal need	1								1	1	1	1	1	1	1	1	1	1
b.	average need	3		3	3	3													
c.	significant need	5					5	5	5										
			Net -->	0.3	0.3	0.3	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
2. Fire																			
A. Quantity stored on-site			0.20																
a.	<1,000 gal	1				1		1		1	1	1	1	1	1	1	1	1	1
b.	>1000 and <100,000 gal	2																	
c.	>100,000 gal Therminol or High Volume High Pressure Hydrogen	5		5	5		5		5										
			Net -->	1.00	1.00	0.20	1.00	0.20	1.00	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
B. Fire/Explosion off-site consequences	On site and off site consequence		0.30																
a.	Limited to site	1				1		1		1	1	1	1	1	1	1	1	1	1
b.	Potential for smoke and/or fire and/or	2																	
	blast effects	3			3				3										
c.	Potential for major fire/blast structure damage	4																	
	and/or injuries/fatalities off-site and/or major hwy disruption/closure	5		5			5												
			Net -->	1.50	0.90	0.30	1.50	0.30	0.90	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
3. HazMat																			
A. Proximity to or potential for effect on all human receptors			0.05																
a.	no sig quant of hazmats or no potential for off-site impacts within 1/2 mile	1				1		1		1	1	1	1	1	1	1	1	1	1
b.	<10 receptors within 1/2 mile	2																	
c.	>10 receptors within 1/2 mile	3			3														
d.	>50 within 1/2 mile	4					4												
e.	>100	5		5					5										
			Net -->	0.25	0.15	0.05	0.20	0.05	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
B. Hazmat response time			0.05																
a.	<30 minutes	1						1		1	1	1	1	1	1	1	1	1	1
b.	30 - 60 minutes	3		3	3	3	3												
c.	>60 minutes	5							5										
			Net -->	0.15	0.15	0.15	0.15	0.05	0.25	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
4. Rescue First Alarm			0.15																
a.	< 30 minutes	1		1						1	1	1	1	1	1	1	1	1	1
b.	30 - 60 minutes	3			3	3	3												
c.	>60 minutes	5						5	5										
			Net -->	0.15	0.45	0.45	0.45	0.75	0.75	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
5. EMS Response of Certified Medic																			
EMS response time			0.15																
a.	No Staff on site	1								1	1	1	1	1	1	1	1	1	1
b.	<15 minute resposne time	2				2													
c.	>15 <30 minute response time	3			3		3												
d.	>30 and < 60 minute response time	4		4															
e.	>60 minute response time	5						5	5										
			Net -->	0.60	0.45	0.30	0.45	0.75	0.75	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
	Sum weighting factors		1.00																
TOTAL SCORE			======>	3.95	3.4	1.75	4.25	2.60	4.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LOW Priority: additional resources and mitigation may be needed.		< or =1																	
MEDIUM Priority: additional resources and mitigation needed.		1.0 - 2.5																	
HIGH Priority: very significant need for additional resources and mitigation.		2.5 - 3.0																	
VERY HIGH Priority: urgent need for additional resources and mitigation.		>3.0																	

SOURCE. San Bernardino County Fire Department
California Energy Commission Staff.

Table 5
Summary of Solar Farm Project Characteristics by Sub-Area

	Morongo Basin	Outlying Desert	Victor Valley-Barstow	TOTAL
Proposed Energy Projects				
A. Number				
Photovoltaic	2	1	8	11
Solar Thermal - Steam	0	1	0	1
Solar Thermal - Hydrogen	0	1	0	1
Solar Thermal - Therminol	0	0	1	1
Total	2	3	9	14
B. Megawatts				
Photovoltaic	65	5	333	403
Solar Thermal - Steam	0	400	0	400
Solar Thermal - Hydrogen	0	850	0	850
Solar Thermal - Therminol	0	0	250	250
Total	65	1,255	583	1,903
C. Disturbed Acreage				
Photovoltaic	673	40	2,731	3,444
Solar Thermal - Steam	0	3,640	0	3,640
Solar Thermal - Hydrogen	0	8,230	0	8,230
Solar Thermal - Therminol	0	0	1,765	1,765
Total	673	11,910	4,496	17,079
B. Megawatts per 1000 Acres				
Photovoltaic	97	125	122	117
Solar Thermal - Steam	n/a	110	n/a	110
Solar Thermal - Hydrogen	n/a	103	n/a	103
Solar Thermal - Therminol	n/a	n/a	142	142
All Average	97	105	130	111

Source: Stanley R. Hoffman Associates, Inc.
San Bernardino County Fire Department
San Bernardino County Land Use Services Department.

Table 6
Estimated Capital Costs and Annual Operations and Maintenance Costs by Facility

STATION_NO	ECNSUBAREA	TYPE OF IMPROVEMENT	CAPITAL COSTS	ANNUAL OPERATIONS AND MAINTENANCE COSTS
PROPOSED STATIONS				
125 - HINKLEY STATION	VICTOR - BARSTOW	Proposed Upgrades	$0	$1,875,094
46 - HARVARD STATION	VICTOR - BARSTOW	Proposed Upgrades	$0	$1,875,094
53 - BAKER CSD STATION	OUTLYING DESERT AREA	Proposed Upgrades	$0	$1,875,094
MTN PASS	OUTLYING DESERT AREA	Proposed Facility	$4,688,636	$1,977,846
AMBOY	OUTLYING DESERT AREA	Proposed Facility	$3,162,183	$1,977,846
KRAMER	VICTOR - BARSTOW	Proposed Facility	$4,688,636	$1,977,846
			$12,539,455	$11,558,820
FUTURE STATIONS				
4 - SILVER LAKES / HELENDALE STATION	VICTOR - BARSTOW	Future Upgrades	0	$1,875,094
17 - BIG RIVER STATION	OUTLYING DESERT AREA	Future Upgrades	0	$1,875,094
31 - NEEDLES CITY STATION	OUTLYING DESERT AREA	Future Upgrades	0	$1,875,094
119 - WEST WONDER VALLEY STATION	MORONGO BASIN	Future Upgrades	0	$1,875,094
127 - NORTH TRONA STATION	OUTLYING DESERT AREA	Future Upgrades	0	$1,875,094
118 - HAVASU LANDING STATION	OUTLYING DESERT AREA	Future Upgrades	0	$1,875,094
111 - LUCERNE	VICTOR - BARSTOW	Future Upgrades	0	$1,875,094
19 - LANDERS	MORONGO BASIN	Future Upgrades	0	$1,875,094
GOFFS	OUTLYING DESERT AREA	Future Facility	$4,688,636	$1,977,846
VIDAL	OUTLYING DESERT AREA	Future Facility	$4,688,636	$1,977,846
KELSO	OUTLYING DESERT AREA	Future Facility	$4,688,636	$1,977,846
			$14,065,908	$20,934,290
		TOTAL	$26,605,363	$32,493,110

Source: Stanley R. Hoffman Associates, Inc.
San Bernardino County Fire Department

Table 7
County Fire Services Level of Service [1]: 2010
San Bernardino County Fire Department

	Mountain Division	North Desert Division	Victorville Division	South Desert Division	Valley Division	County Total	North and South Desert Divisions
Stations	8	20	8	17	15	68	37
Population Served	70,000	150,000	117,000	49,648	210,800	597,448	199,648
Square Miles	616	10,884	74	7,968	585	20,127	18,852
Population per Station	8,750	7,500	14,625	2,920	14,053	8,786	5,396
Sq Miles Served per Station	77	544	9	469	39	296	510

1. All information obtained from the San Bernardino County Fire Department.

Source: Stanley R. Hoffman Associates, Inc.
San Bernardino County Fire Department.

Table 8
Estimated Impact of Population Growth on Demand for Fire Services

	Outlying Desert	Victor-Valley Barstow	Morongo Basin	Desert Total
ESTIMATED 2008 to 2020 GROWTH [1]				
Population	202	7,760	1,495	9,457
Households	47	1,798	346	2,191
Employment	141	5,429	1,046	6,616
COST ALLOCATION TO POPULATION GROWTH				
Estimated Population Served per Station [2]	5,396	5,396	5,396	5,396
Projected Demand for Stations from Growth	0.04	1.44	0.28	1.75
Proposed New Stations [3]	2.00	1.00	0.00	3.00
Share of New Growth on Proposed Facilities				58.4%
Proposed New Station Facility Costs [3]	$7,850,819	$4,688,636	$0	$12,539,455
Cost Allocation to Population Growth				$7,325,673
Balance Costs to Proposed Projects				$5,213,782

1. Based on information provided by the San Bernardino County Land Use Services Department (LUSD) on projected General Plan growth by the three County General Plan Planning Areas -- Valley, Mountain and Desert. The growth projected for the Desert Planning Area was then allocated to the three Desert sub-regions -- Outlying Desert, Victor Valley/Barstow, and the Morongo Basin, based on historic housing permit trends.

2. The population served per station factor was developed from data on current level of services obtained from the County Fire Department for the North and South Desert Divisions.

3. Proposed new stations and their associated capital costs are shown in Table 4.

Source: Stanley R. Hoffman Associates, Inc.
San Bernardino County Fire Department
San Bernardino County Land Use Services Department

Table 9
Type of Service Calls by Geography: 2009
San Bernardino County

	Urban	Rural	Remote	Total	Rural and Remote	
Fire						
Residential	184	79	23	286	102	
Traffic	86	28	53	167	81	
Commercial	149	73	33	255	106	
Subtotal	419	180	109	708	289	
Medical/Other						
Residential	10,258	4,611	373	15,242	4,984	
Traffic	1,326	548	345	2,219	893	
Commercial	4,866	1,862	489	7,217	2,351	
Subtotal	16,450	7,021	1,207	24,678	8,228	
Total Calls	**16,869**	**7,201**	**1,316**	**25,386**	**8,517**	
Total Calls						
Residential	10,442	4,690	396	15,528	5,086	
Traffic	1,412	576	398	2,386	974	
Commercial	5,015	1,935	522	7,472	2,457	
	16,869	**7,201**	**1,316**	**25,386**	**8,517**	
Percent Distribution						Rounded
Residential	61.9%	65.1%	30.1%	61.2%	59.7%	60.0%
Traffic	8.4%	8.0%	30.2%	9.4%	11.4%	11.0%
Commercial	29.7%	26.9%	39.7%	29.4%	28.8%	29.0%
	100.0%	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Stanley R. Hoffman Associates, Inc.
San Bernardino County Fire Department

APPENDIX A
OVERVIEW OF SOLAR ENERGY TECHNOLOGIES[1]

Photovoltaic (PV) Systems

Photovoltaic systems produce clean, reliable energy through the conversion of sunlight directly into electricity via a process called the photovoltaic effect. PV systems are comprised of individual PV cells (also known as solar cells) made from semiconductor materials which are connected to form PV modules. PV modules generate direct current (DC) electricity, which is then passed through an inverter and converted into alternating current (AC) electricity. This energy can be used in a wide variety of residential and commercial applications, including utility power, lighting, communications, refrigeration, water purification, and crop irrigation.

Advantages of PV Systems

- PV systems require considerably less fire protection than thermal systems. As shown in Table 1, the 11 proposed PV projects in San Bernardino County were judged as a low to medium priority for emergency fire response, while the three thermal projects were judged as a very high priority for emergency fire response.
- Once built, PV systems have a much lower demand for on-site staff to perform operations and maintenance. This means fewer people at PV facilities, which lowers the demand for public services such as fire protection and emergency medical response.
- Unlike thermal systems, PV systems do not require water. This is particularly advantageous in the desert regions where many solar farms are proposed to be located.

Disadvantages of PV Systems

- PV systems are expensive to build. As a result, PV projects tend to be smaller and generate less electricity than thermal projects. For example, in San Bernardino County the most productive proposed PV project has an installed capacity of 104 megawatts (Rabbit Springs Solar), while the three proposed thermal projects have capacities ranging from 250 to 850 megawatts (see Table 1).

1 Sources:
U.S. Energy Information Administration <http://www.eia.doe.gov>
Solar Energy International <http://www.solarenergy.org>
Solar Developments <http://www.solardev.com>
SolarPACES <http://www.solarpaces.org>
The Energy Blog < http://thefraserdomain.typepad.com/energy/2005/09/about_parabolic.html >
Jones, J. (2000). "Solar Trough Power Plants." National Renewable Energy Laboratory.
The Center For Land Use Interpretation <http://www.clui.org/>

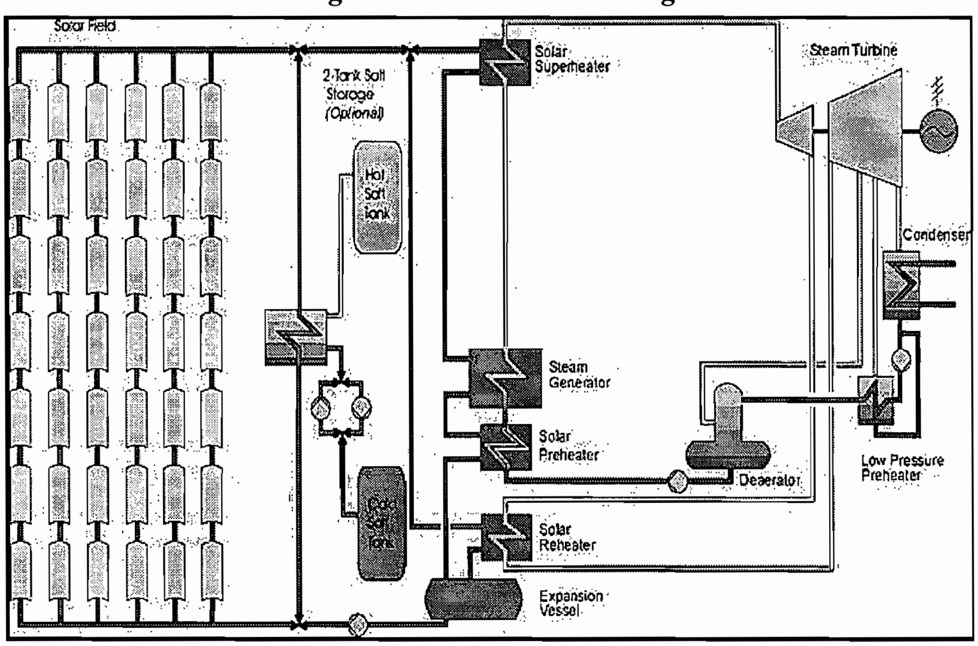
Thermal Systems

Thermal systems harness the sun's energy to heat transfer mediums, such as Therminol, to drive steam-turbine generating plants and produce energy. In the solar thermal hydrogen systems, the sun's energy causes the expansion and contraction of hydrogen to drive the turbine. The three main types of solar thermal systems are parabolic troughs, solar power towers, and dish systems. Each of these systems is represented in San Bernardino County. The Abengoa project uses parabolic trough technology; the Ivanpah project uses solar power tower technology; and the Solar One project uses dish systems technology.

Parabolic Trough

Illustrated in Figure A-1 is a parabolic trough solar thermal energy collector. A solar trough has a long, parabolic mirror that reflects sunlight onto a receiver tube located at the focus of the parabola. Heat transfer fluids such as Therminol run through the tube, absorb the concentrated sunlight, and then heat water to create steam. This steam is piped to an onsite turbine-generator to produce electricity, which is then transmitted over power lines. The solar trough can be rotated to track the sun as it moves throughout the day. On cloudy days, the plant has a supplementary natural gas boiler that can be used to heat the water, creating steam to generate electricity.

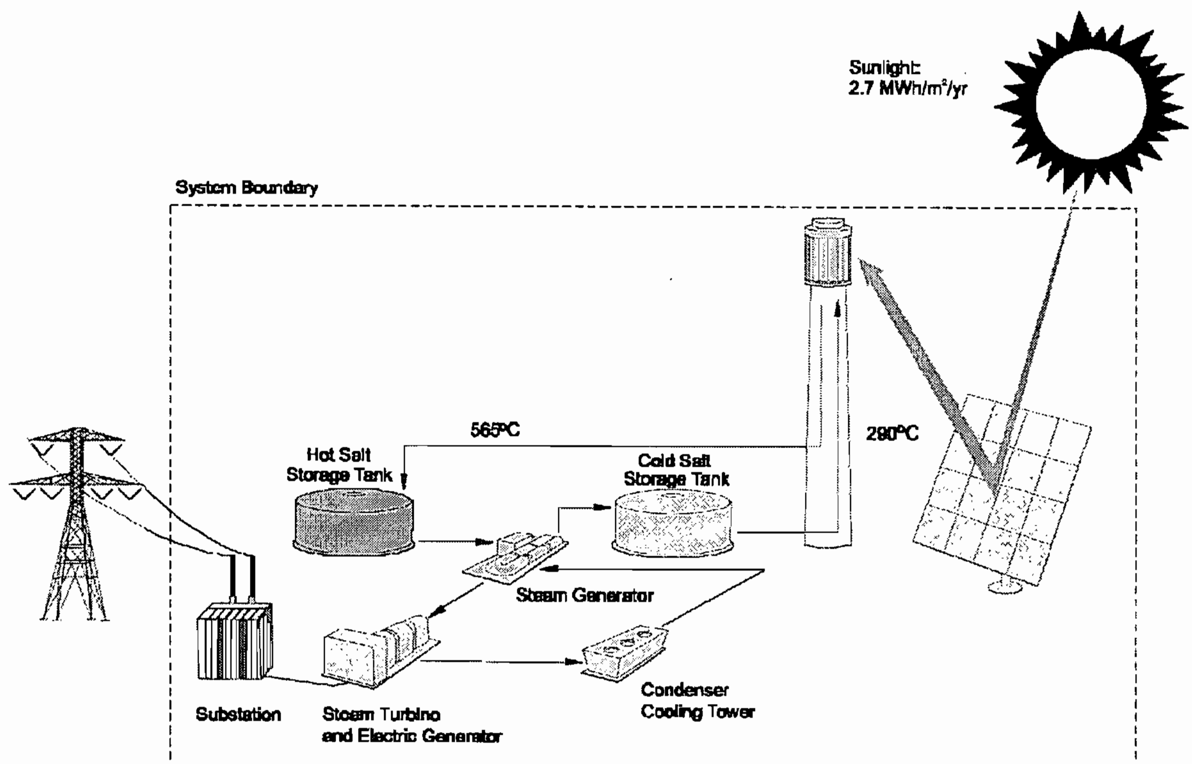
Figure A-1
Diagram of a Parabolic Trough



Solar Power Tower

As shown in Figure A-2, solar power towers are comprised of hundreds of large mirror assemblies, or heliostats, which track the sun and reflect solar energy onto a black tower-mounted boiler that absorbs the heat and converts water into high pressure steam. The high pressure steam is then carried to the ground where the steam is used to spin a series of turbines, much like a traditional power plant. Power towers must be large to be economical. This is a promising technology for large-scale, grid-connected power plants; however, it is in its early stages of development compared to parabolic trough technology.

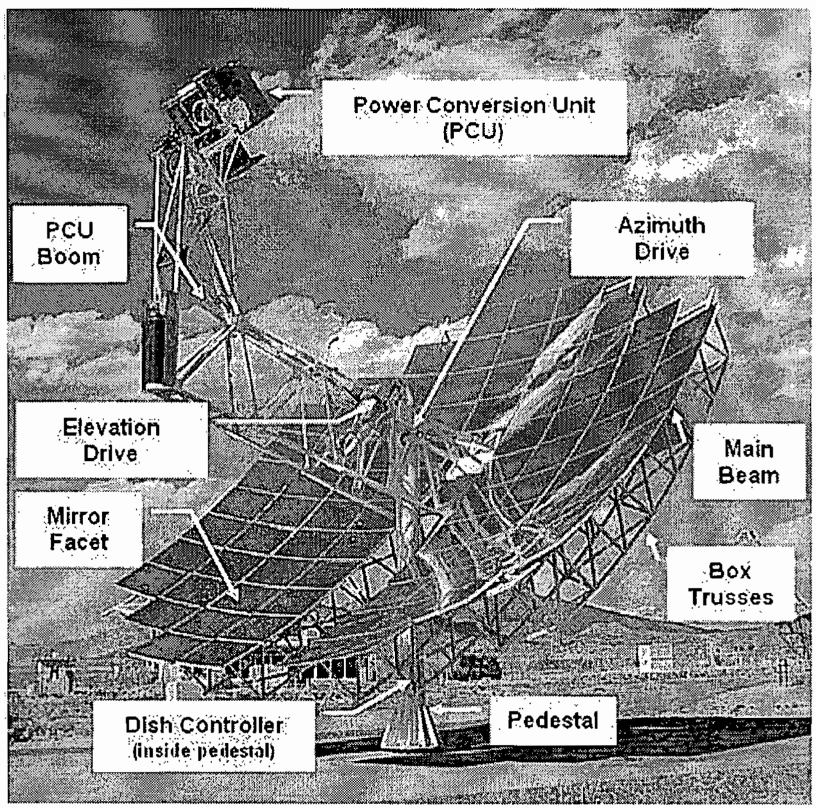
Figure A-2
Solar Power Tower System Schematic



Dish Systems

As shown in Figure A-3, a dish system consists of a large, parabolic dish (similar in shape to a satellite television dish) that reflects sunlight onto a receiver mounted at its center. The expansion and contraction of hydrogen is then used to power an engine. Typically, the receiver is mounted with a Stirling engine, although other types of engines are occasionally used. The engine is coupled with an electric generator that converts mechanical power into electricity. Dish systems can achieve high concentrations of light which result in higher temperatures and a more efficient conversion of solar energy to electricity.

Figure A-3: Dish System



Advantages of Thermal Systems

- Thermal systems produce more energy than PV systems. As shown previously in Table 1, in San Bernardino County the three thermal systems range from 250 to 850 megawatts, while the PV systems range from 1.3 to 104 megawatts.
- Solar thermal systems can work in the shade for brief amounts of time, since the heated fluids they depend on can stay hot enough to generate electricity for some time without the sun.

Disadvantages of Thermal Systems

- Thermal systems present a much higher fire risk than PV systems. As shown previously in Table 1, the San Bernardino County Fire Department and California Energy Commission jointly ranked the three thermal projects as very high priorities for emergency fire response, while the 11 PV projects were ranked as only low to moderate priorities.
- Unlike PV systems, thermal systems require on-site staff to perform operations and maintenance. Because individuals are required to work on-site, these systems require additional public services such as fire protection and emergency medical response.
- Thermal systems are larger and require more land than PV systems. As shown previously in Table 1, the three proposed thermal systems in San Bernardino County have disturbed acreages ranging from 1,765 acres to 8,230 acres, while the 11 proposed PV systems have disturbed acreages ranging from 12 acres to 922 acres.