4.1 ALTERNATIVES

This alternatives analysis for the Project was prepared to meet the requirements of California Environmental Quality Act (CEQA) and the National Environmental Policy Act of 1969 (NEPA) as described within the 2007 Memorandum of Understanding (MOU).

The Applicant proposes to construct and operate the Project approximately 37 miles east of Barstow, California, north of Interstate 40 (I-40). This region of San Bernardino County is primarily undeveloped desert land that lies to the south of the Cady Mountain Wilderness Study Area (WSA) and east of the Pisgah Area of Critical Environmental Concern (ACEC).

CEQA and NEPA both require an applicant to address the implications of taking "No Action" or the "No Project Alternative." The analysis provided in this section reflects existing environmental conditions at the Project Site and in the region, and serves as a basis for comparing the Project proposed by the Applicant with other design, technological, and site alternatives.

Title 20 of the California Code of Regulations (CCR) requires an applicant to consider:

> *"the range of reasonable alternatives to the project, including the No Action Alternative, that would feasibly achieve most of the basic objectives of the project, but would avoid or substantially lessen any of the significant impacts of the project, and an evaluation of the comparative merits of the alternatives."*

CEQA also requires consideration of:

> *"a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant impacts of the project, and evaluate the comparative merits of the alternatives." (14 CCR 15126.6[a])*

Thus, the focus of an alternatives analysis should be on those alternatives that:

> *"could feasibly accomplish most of the basic objectives of the project and could avoid or substantially lessen one or more of the significant effects." (14 CCR 15126.6[c])*

The CEQA Guidelines (14 CCR 15126.6[c]) further provide that, "among the factors that may be used to eliminate alternatives from detailed consideration in an Environmental Impact Report" are:

- failure to meet most of the basic project objectives,
- infeasibility, and
- inability to avoid significant environmental impacts.

NEPA also requires the identification and analysis of a reasonable range of alternatives. Council on Environmental Quality NEPA Regulations (Title 40 of the Code of Federal Regulations 1502.14) state that:

> *"reasonable alternatives include those that are practical or feasible from the technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant." (Title 46 of the Code of Federal Regulation at 18.029, CEQ Forty Most Asked Questions, Question 2a)*

An Environmental Impact Statement (EIS) is required under NEPA if a significant impact is determined through the NEPA process. In that case, the EIS is required to rigorously explore and objectively evaluate all reasonable alternatives that meet the purpose of and need for the proposed action, including those alternatives that are not within the jurisdiction of the lead agency. NEPA also requires a brief explanation of the reasons for eliminating an alternative from detailed study.

The Bureau of Land Management (BLM) will be the lead federal agency for NEPA compliance for the Project. The Federal Land Policy and Management Act (FLPMA) specify the responsibilities of the BLM in preparing NEPA documents. As identified in Section 1765 of the FLPMA, the BLM's responsibility in granting a right-of-way (ROW) permit is to:

> *"minimize damage to scenic and aesthetic values and fish and wildlife habitat and otherwise protect the environment…require compliance with State standards for public health and safety, environmental protection, and siting, construction, operation, and maintenance of [ROWs] … [and] … require location of the [ROW] along a route that will cause least damage to the environment, taking into consideration feasibility and other relevant factors."*

4.2 DETAILED CONSIDERATION OF ALTERNATIVES

This section describes the Project Site and the alternatives analyzed for the site. The criteria used by the Applicant in selecting the Project Site as well as siting considerations identified by the California Energy Commission (CEC), BLM, Southern California Edison (SCE), and California Independent Service Operator (CAISO) are discussed in Section 4.2.1. The No Action Alternative, or status quo alternative, described in Section 4.2.2, No Action Alternative, reflects existing conditions and serves as a basis for comparing and evaluating the other alternatives. A discussion of the alternative site locations that were considered but rejected is provided in Section 4.3, Alternative Sites Considered.

4.2.1 Project and Site Evaluation Criteria

Several layers of screening were used in the evaluation of the proposed Project Site and alternative sites. The Project was proposed in response to a competitive solicitation from SCE in 2005 to assist the company in meeting its legislatively mandated 20 percent goal for the California Renewable Portfolio Standard (RPS) Program. SCE evaluated all projects on the following criteria:

- Project must meet RPS Program criteria.
- Power must be produced in California or at the nearest Western Electrical Coordinating Council interconnect outside California going into California.

In selecting the winning proposals, SCE used a "best-fit and least-cost" criteria. In selecting Solar One, SCE stipulated in the amended Power Purchase Agreement that the project be located in the vicinity of the Pisgah Substation.

In proposing the project to SCE, the Applicant developed the criteria listed below to evaluate the suitability of sites for solar power development.

- **Solarity:** The site needed to be located in an area with long hours of sunlight (low cloudiness). Ideally, insolation, the rate of delivery of direct solar radiation per unit of horizontal surface**,** levels would be at least 7 kilowatt-hours per square meter per day. Solar intensity was the most important screening criteria from a perspective of selecting general regions in California for development of the Project.
- **Topography:** The site needed to be relatively flat; site grade may be up to 5 percent. Topography, combined with wind speed, represents the second most critical site selection criteria for a project of this nature.
- **Wind Speed:** The wind speed needed to be less than 35 miles per hour 98 percent of the time.
- **Land Area:** There should be sufficient land area to accommodate a minimum number of acres of solar generation.
- **Site Control:** The land needed to be available for sale or use (e.g., lease or use of an ROW). If private land, the landowner must be willing to negotiate a long-term option agreement so that site control does not require a large capital investment until the license is obtained.
- **Proximity to Infrastructure:** The site needed to be located in close proximity to high-voltage CAISO transmission lines with adequate capacity. Ideally, the site should be located within 10 miles of existing transmission lines and should have an adequate water supply.
- **Accessibility:** The site should have ease of access; close proximity to access roads and railroads is preferred.
- **Environmental Sensitivity:** The site had to be located outside of environmentally excluded areas (such as State and National Parks, areas of critical environmental concern) should have few or no environmentally sensitive resources (particularly biological and cultural resources) and should allow development with minimal environmental impacts.
- **Jurisdictional Issues:** The proposed use should be consistent with existing laws, ordinances, regulations, and standards (LORS).
- **Land Cost:** The site should be located on property currently available at a reasonable cost.

These screening criteria were used to evaluate the potential alternative sites and select the site for the Project.

4.2.2 No Action Alternative

4.2.2.1 No Action Alternative Description

The Project will produce renewable electricity for SCE in particular, and the state of California, in general. As stated in Section 2.0, Project Objectives/Purpose and Need, the objective of the Project is to provide clean, renewable, solar-powered electricity and to assist both SCE and the state of California in meeting its legislatively mandated obligations under the RPS Program. A secondary objective is to assist both SCE and the state of California in reducing their greenhouse gas emissions. The Project will have environmental benefits relative to traditional fossil-fuel power plants. This characteristic supports both NEPA's requirement that agencies take a "hard

look" at the environmental impacts of their decisions as well as the FLPMA requirement that the BLM consider multiple use policies that include siting renewable energy projects on public lands.

In the event that the Project is not constructed, SCE and the state of California would have greater difficulty in achieving their objective of obtaining power from renewable resources and in meeting their greenhouse gas emission reduction goals.

4.2.2.2 Environmental Impacts of the No Action Alternative

4.2.2.2.1 Air Quality

The No Action Alternative would not involve construction or operation of the Project. Therefore, the minor increases in emissions that would occur during construction and operation of the Project would not occur. It is possible that impacts from the No Action Alternative could result in greater fuel consumption and air pollution because new power plants would need to be brought into operation or electricity would need to be generated from older, less-efficient plants that have higher air emissions. Because solar energy is produced during periods of peak demand, much of the replacement power would be generated by plants that generate significantly greater criteria air emissions and greenhouse gas emissions.

4.2.2.2.2 Geologic Hazards and Resources

Under the No Action Alternative, no potential would exist for the Project infrastructure to be affected by the geological hazard of seismic shaking because the Project would not be constructed. Also, the minor potential impacts to geologic or mineral resources from construction-related activities (such as grading and excavating) would not occur.

4.2.2.2.3 Soils

The No Action Alternative would not involve construction or operation of the Project. However, the minor erosion and runoff that currently occurs would continue.

4.2.2.2.4 Water Resources

Under the No Action Alternative, no potential would exist for discharges from the Project to degrade water quality and the small quantity of water used by the Project for mirror washing would not be extracted from groundwater supplies.

4.2.2.2.5 Biological Resources

Because the No Action Alternative would not involve construction or operation of the Project, land disturbance that could have the potential to result in some loss or degradation of habitat would not occur.

4.2.2.2.6 Cultural Resources

Under the No Action Alternative, land disturbance that could have the potential to result in some loss or degradation of cultural resources would not occur.

4.2.2.2.7 Paleontological Resources

Under the No Action Alternative, no potential would exist for land disturbance associated with construction or operation of the Project to cause loss or degradation of paleontological or karst resources.

4.2.2.2.8 Land Use

Under the No Action Alternative, existing land uses on the Project Site would continue according to local, state, and federal land use plans for the area (refer to Section 5.9, Land Use, for a description of existing land use at the Project Site). Impacts associated with restricting use of the site for Project construction and operation would not occur. Existing land use plans would not require modification or amendment.

4.2.2.2.9 Socioeconomics

Under the No Action Alternative, the Project would not be built and therefore would not provide the anticipated increase in jobs or the potential increase in revenues to the local economy.

4.2.2.2.10 Traffic and Transportation

Under the No Action Alternative, no workers would travel to the Project Site for construction or operation of the Project.

4.2.2.2.11 Noise

Under the No Action Alternative, no new noise would be generated from the Project because the Project would not be constructed or operated.

4.2.2.2.12 Visual Resources

Under the No Action Alternative, the Project would not be constructed or operated and the land would be maintained in its present state. Therefore, no change would occur on sensitive viewers or on scenic quality.

4.2.2.2.13 Waste Management

Under the No Action Alternative, waste associated with construction or operation of the Project would not be generated.

4.2.2.2.14 Hazardous Materials Handling

Under the No Action Alternative, the Project would not be constructed and operated. Therefore, no hazardous materials handling would occur.

4.2.2.2.15 Public Health and Safety

Under the No Action Alternative, the potential impacts to public health and safety associated with construction and operation of the Project would not occur.

4.2.2.2.16 Worker Safety

Under the No Action Alternative, the Project would not be constructed and operated. Therefore, no workers would be employed by the Applicant and there would be no risk of injury to the workers.

4.3 ALTERNATIVE SITES CONSIDERED

The Applicant evaluated several alternatives sites in selecting the location for Solar One (see Figure 4-1, Proposed and Alternative Siting Areas). Using the screening criteria discussed in Section 4.2.1, five of these sites were excluded from further consideration for development of solar power using the SunCatcher technology.

4.3.1 Alternative Sites

Five alternative site locations were considered but not carried forward for further analysis. The sites were:

- Alternative Site #1 (Site AS1): Camp Rock Road,
- Alternative Site #2 (Site AS2): Upper Johnson Valley,
- Alternative Site #3 (Site AS3): West of Twenty-Nine Palms Military Base,
- Alternative Site #4 (Site AS4): Interstate 40 (I-40) South, and
- Alternative Site #5 (Site AS5): Broadwell Lake.

These alternative sites are further discussed below.

4.3.1.1 Screening for Site AS1 – Camp Rock Road

This site was considered because it would be in close proximity to the Mohave-Lugo-El Dorado Transmission Line corridor (Site 1 on Figure 4-1). The site is located east on nine sections of land southwest of T6NR2E north of Camp Rock Road and bisected by an existing transmission line corridor. It has existing access on a county-maintained road (approximately 10 miles to the site). Slopes range typically from 3 to 6 percent and are moderately rocky. There is no railroad within 10 miles. It is classified as Category I for Desert Tortoise habitat. Land use has been classified by the Mojave Resource Management Plan (BLM) as limited and moderate. Because the site is fairly remote and scenic quality is low, impacts on visual resources were not anticipated to be significant.

This site was not moved forward for detailed evaluation for the following reasons:

- lack of railroad access,
- lack of major highway access, and
- designated critical habitat for the Desert Tortoise.

4.3.1.2 Screening for Site AS2 – Upper Johnson Valley

This site was considered because it contained three sections of land owned by SCE and would be in close proximity to the SCE Lugo-El Dorado Transmission Line corridor (Site 2 on Figure 4-1). The site is located east of Lucerne Valley (north of SR 247) on nine sections of land southeast of T6NR3E; northeast of 6N3E (north of Bessemer Mine Road). It has existing access on a county-maintained road (approximately 10 miles to the site). Slopes range typically from 3 to 5 percent. There is no railroad within 10 miles. It is classified as Category III for Desert Tortoise habitat. Some land use considerations included:

- the Upper Johnson Valley Off Highway Vehicle (OHV) Area (intensive use),
- Marine Corps Air Ground Combat Center (i.e., Twentynine Palms) 8 miles east, and
- Bessemer Mine Road (public access).

Because the site is fairly remote and scenic quality is low, impacts on visual resources were not anticipated to be significant.

This site was not moved forward for detailed evaluation for the following reasons:

- lack of railroad access,
- lack of major highway access, and
- on a BLM-designated OHV use area (the largest in the U.S.).

4.3.1.3 Screening for Site AS3 – West of Twentynine Palms Military Base

This site was considered because it was located in a remote area. The site is located on 10 sections of land west T6NR5E and north 5N5E and is adjacent to Twentynine Palms and is within 3 miles of the SCE Lugo-Pisgah No. 2 Transmission Line (Site 3 on Figure 4-1). It has existing access on a gravel road 15 miles south of I-40. Slopes range typically from 3 to 5 percent. There is no railroad within 10 miles. No critical habitat has been indentified for the Desert Tortoise. Some land use considerations included:

- the Upper Johnson Valley OHV Area (intensive use) and
- Twentynine Palms military base (adjacent to the east).

Because the site is remote and scenic quality is low, impacts on visual resources were not anticipated to be significant.

This site was not moved forward for detailed evaluation for the following reasons:

- lack of railroad access,
- lack of major highway access,
- distance from existing transmission line corridors,
- potential impacts on the Upper Johnson Valley OHV Area, and
- potential conflicts with Twentynine Palms military base.

4.3.1.4 Screening for Site AS4 – I-40 South

This site was considered because it was located in a remote area. The site is located on 10 to 12 sections of checkerboard federal and private land ownership and is traversed by the SCE Lugo-Pisgah No. 2 Transmission Line (Site 4 on Figure 4-1). It has existing access on a gravel road 6 miles southwest of I-40. Slopes range typically from 3 to 5 percent on rocky and vulcanized (lava) soils. The BNSF railroad is located several miles to the north. No critical habitat has been identified for the Desert Tortoise. Some land use considerations included:

- existing mining claims and
- Twentynine Palms military base (adjacent to the southeast).

The site would be slightly visible from I-40 and would be sited within an area of low scenic quality.

This site was not moved forward for detailed evaluation for the following reasons:

- potential impacts on the existing mining claims,
- constraining slopes and soils, and
- potential conflicts with Twentynine Palms military base.

4.3.1.5 Screening for Site AS5 – Broadwell Lake

This site was considered because it was located near the existing SCE Lugo-Pisgah No. 2 Transmission Line corridor. The site is located on 12 sections of BLM land south T9NR7E and north in T8NR7E. It has existing access on a gravel road 9 miles north of I-40 (Site 5 on Figure 4-1). Slopes range typically from 3 to 5 percent. The BNSF railroad is located approximately 6 miles to the south. Suitable habitat has been indentified for the Desert Tortoise to the west side of the site at the base of the Cady Mountains WSA. This site would be contained wholly within an area previously proposed as the Sleeping Beauty WSA and is sited north of the BLM-designated Pisgah ACEC.

The site would be slightly visible from I-40/U.S. Route 66 and would be sited within an area of low to moderate scenic quality.

This site was not moved forward for detailed evaluation for the following reasons:

- potential impacts on the previously proposed Sleeping Beauty WSA, and
- restricted access.

4.4 COMPARISON OF ALTERNATIVE TECHNOLOGIES

Renewable energy effectively uses natural resources (such as sunlight, wind, rain, tides, waves, and geothermal heat) which are naturally occurring. Renewable energy technologies include wave and tidal power, solar power, wind power, hydroelectricity/micro-hydroelectricity, biomass, and biofuels (for transportation).

In 2007, about 20 percent of global final energy consumption came from renewables, with 15 percent coming from traditional biomass uses, such as wood-burning. Hydropower was the

next largest renewable source, providing 3 percent, followed by hot water/heating, which contributed 1.3 percent. Modern technologies, such as geothermal, wind, solar, and ocean energy, together provided about 0.8 percent of final energy consumption. The technical potential for the use of renewable energy is very large, exceeding all other readily available sources.

Several other alternative renewable technologies would meet the Project objectives (as described in Section 2.0, Project Objectives/Purpose and Need). However, since the Applicant has a solar thermal technology that is proven, reliable, and effective, these other technologies were considered but rejected. For informational purposes only, these other technologies are briefly described below.

4.4.1 Other Solar Thermal Technologies

Several other solar thermal technologies are currently being developed and/or refined. As background**,** solar thermal projects are defined as "the process of concentrating sunlight on a relatively small area to create the high temperature necessary to vaporize water or other liquids to drive a turbine (or other engine) for generation of electric power" (CEC Glossary 2003). These projects include technologies such as solar trough, solar power tower, and compact linear Fresnel reflectors; all of which require higher annual water use than the technology used by Solar One.

4.4.2 Solar Photovoltaic Technology

In general, photovoltaic technologies are a more familiar solar technology than solar thermal technologies. Photovoltaic technology differs from solar thermal in that photovoltaic technology converts light directly into electricity (CEC Glossary 2003). Although photovoltaic technology is more widely known (e.g., most rooftop solar panels are photovoltaic), this technology is still relatively expensive and not commonly associated with large utility-scale electric generation.

4.4.3 Integrated Gasification Combined Cycle

Integrated gasification combined cycle (IGCC) technology gasifies applications that burn coal or petroleum coke in a gas turbine cycle. The coal gasification equipment is located at the same site as the power generating equipment (a combustion turbine, a heat recovery steam generator, and a steam turbine). IGCC does not have adequate commercial operating experience, and its cost-effectiveness consistently varies. IGCC would also require either the importation of coal by truck and/or rail to the Project area from outside California or the importation of coke from petroleum refineries. Additional issues include increased traffic levels and on-site coal/coke storage. Also, the control of coal dust from coal that is in storage is a large capital cost. Although IGCC can result in lower emissions than a conventional coal-fired power plant, an IGCC plant would still have substantially more pollutant emissions (both criteria and greenhouse gas emissions) than a gas-fired combined-cycle plant. Also, IGCC would not provide renewable energy.

4.4.3.1 Coal or Other Solid Fuel Conventional Furnace/Boiler – Steam Turbine

With this technology, coal, petroleum coke, or other solid fuels are burned in a boiler, creating steam that is used in a steam turbine generator. The steam is condensed and returned to the

boiler. Efficiencies would be in the range of 35 to 40 percent, which is comparable to that of a gas-fired boiler/steam turbine unit. This technology would require either the importation of coal by rail and/or truck from outside the state or the importation of coke from in-state petroleum refineries. This technology would result in increased traffic and would also require on-site coal/coke storage. In addition, this technology would produce more emissions (both criteria and greenhouse gas emissions) than a natural gas-fueled facility of equivalent size, require a larger site, and be more costly to build and operate. Finally, this technology would not provide renewable energy.

These technologies are commercially available and could be implemented. However, because of their relatively low efficiency, these technologies, when implemented, result in the emission of a greater quantity of air pollutants per kilowatt-hour generated than solar power. Use of these fuel sources do not meet the Project objectives as a renewable power source.

4.4.3.2 Fluidized-Bed Combustion

Fluidized-bed combustion burns coal or other solid fuels in a hot bed of limestone-containing inert material that is kept suspended or fluidized by a hot air stream. Water coils in the furnace create steam, which drives a steam turbine generator. Fluidized-bed technologies (atmospheric and pressurized) have efficiencies in the range of 35 to 45 percent. Pressurized fluidized-bed technology is not commercially available on the scale of the Project. As with other solid-fuel technologies, fluidized-bed technology would require either the importation of coal from outside the state or the importation of coke from in-state petroleum refineries; this technology would also require a larger site and produce higher air emission levels of both criteria and non-criteria pollutants, such as carbon monoxide. In addition, this technology would not produce renewable energy.

4.4.3.3 Nuclear

California law prohibits the construction of new nuclear plants until the scientific and engineering feasibility of disposing of high-level radioactive waste has been demonstrated. To date, the CEC has been unable to make a finding of disposal feasibility, as required by law for this alternative to be viable in California.

4.4.3.4 Geothermal

Geothermal was eliminated from further consideration because the Applicant's technology is not geothermal and because the cost-effective application of geothermal technology requires more expensive means and longer lead times for permitting and equipment design than required for solar technology.

4.4.3.5 Biomass

Biomass fuels, such as wood wastes, were eliminated from further consideration because they are not available in the immediate Project area in sufficient quantities to make them a practical alternative fuel. Also, potential issues include problems with logistics, tipping fees, and control of quality and quantity of municipal solid waste created. In addition, biomass facilities can produce considerable air emissions.

4.4.3.6 Wind

Wind energy involves the use of wind power to drive a rotor or propeller, which in turn drives a generator. Only a limited number of sites have sufficient wind available for energy generation purposes. The Project area is not identified as an important wind energy resource area in the Renewable Energy Atlas of the West (Nielsen, et al. 2006).

4.4.3.7 Hydroelectric

Hydroelectric was eliminated from further consideration because the resources for water movement within San Bernardino County are limited.

4.5 ALTERNATIVE LINEAR ROUTES

This section generally discusses four possible options to access the site and one sub option that could be applied to all options considered.

Option 1: Hector Road Access with Overhead Grade Separation (bridge) Utilize I-40/Hector Road interchange and travel north on Hector Road, crossing the BNSF railroad with the construction of a private overhead grade separation (bridge).

Option 2: Temporary Construction Road from I-40 Construction of a temporary off-ramp and on-ramp from I-40 freeway (westbound) with a two-way paved temporary construction access road east of the SCE Lugo-Pisgah No. 2 Transmission Line from I-40, traversing a BLM-designated ACEC.

Option 3: Crucero Road Access Utilize I-40/Crucero Road Interchange, then utilize National Trail Highway (U.S. Route 66) up to Lavic Road, then construct a two-lane road westerly to reach the site.

Option 4: Fort Cady Road Access This alternative yields the longest path to the site, with approximately 8 miles of paved and unpaved public roads and approximately 9.8 miles of unimproved roadways, for a total length of approximately 17.8 miles, utilizing the I-40/Fort Cady Road interchange for westbound traffic and the I-40 interchange for eastbound traffic.

Railroad Siding Sub-Option (applicable to Options 1 to 4 above) Construction of a railroad siding adjacent to the BNSF ROW (north side) for the purposes of delivering Project equipment during Project construction, operation, and long-term maintenance.

Option 1

Hector Road Access with Overhead Grade Separation (Bridge)

With this alternative vehicles will utilize the I-40/Hector Road interchange and travel north on Hector Road, crossing the BNSF railroad into the northern side of the Project Site. A portion of Hector Road is paved (approximately 1 mile) and the remainder will be constructed as a private roadway as part of the Project. In addition, a new overhead grade separation bridge will be constructed. The bridge approach is anticipated to be placed where the BNSF ROW is reduced from 200 feet to 100 feet in width (approximately ¼ mile east of the existing Hector Road alignment).

The pavement section of the private access roadway to be constructed will be approximately 30 feet wide to allow for two lanes and shoulders, with 1 (12-foot) lane in each direction and 2 (3-foot) shoulders. The length of roadway improvement up to the site is estimated to be approximately 1 mile long.

For this alternative, it is assumed that a new bridge will consist of a 220-foot-long, 125-foot clear span, and a 36-foot-wide PC/PS girder bridge carrying 2 (12-foot) lanes of traffic and a 6-foot pedestrian/bicycle pathway per BNSF Clearances for Highway and Pedestrian Overpass. The bridge may consist of PC/PS concrete or steel girders alternative with cast-in-place concrete deck.

Option 2

Temporary Construction Road from I-40

This alternative would include the construction of a deceleration and acceleration interchange (westbound) and a two-way road from I-40 to the Project Site along an existing unimproved road located north of the BNSF Railroad ROW, across a BLM-designated ACEC approximately 3 miles in length. The proposed temporary construction access road will be 30 feet wide to allow for two lanes and shoulders, 1 (12-foot) lane in each direction and 2 (3-foot) shoulders. Several conceptual designs are being evaluated related to this project feature. This road would become the primary construction road for the Project and would be a lifeline road for emergency service vehicles. Permanent site access would be provided upon construction of the Hector Road access with bridge over the BNSF railroad as described in Option 1.

Option 3

Crucero Road Access

With this alternative vehicles will utilize I-40/Crucero Road Interchange then travel west on National Trail Highway (U.S. Route 66) up to Lavic Road. A new road will be constructed from Lavic Road westerly to reach the southeasterly corner of the Project Site.

The pavement section to be constructed will be 40 feet wide to allow for two lanes and shoulders, 1 (12-foot) lane in each direction, and 2 (8-foot) shoulders. The length of roadway improvement from Lavic Road up to the site is estimated to be approximately 6.5 miles.

Approximately one mile west of Lavic Road, there are hills adjacent to westbound I-40. Significant grading and retaining walls may be required as part of the proposed roadway improvements.

Option 4

Fort Cady Road Access

This alternative yields the longest path to the site and has been added due to environmental concerns associated with Option 3. The total length of approximately 17.8 miles utilizes the I-40/Fort Cady Road Interchange for westbound traffic and the I-40/National Trail Highway (U.S. Route 66) Interchange for eastbound traffic, National Trail Highway (U.S. Route 66) north to Newberry Road, cross BNSF railroad utilizing an existing signalized public at-grade crossing, travel eastbound on Fairview Road (partially paved), southbound on Troy Road (unpaved),

eastbound on Bon View Avenue (unpaved), where a two-lane road would be constructed over Troy Lake easterly to reach the southwesterly corner of the Project Site.

Sub Option

Railroad Siding

Delivery of equipment during construction, operation, long-term maintenance, and abandonment may be completed through the use of the existing BNSF rail network that bisects the Project Area. It should be noted that this sub option could be employed with selection of any of the four options described above. BNSF currently has an existing siding adjacent to the Project Site, located west of Hector Road. Three primary considerations are being evaluated related to this sub option as follows:

1. current and future costs of transportation fuel,
2. potential congestion on I-40 with the delivery of equipment solely through the use of trucks, and
3. reduction of environmental impacts (e.g., air emission reductions).

Preliminary engineering has identified data gaps that would be required to develop this sub option to a point where design concepts could be developed as follows:

- Standard Transportation Commodity Code (STCC),
- size requirement of box cars (e.g., 50 and 60 feet, top clearance),
- origin/destination pairs (city and state),
- volume of shipping/receiving,
- target ship/receive date,
- dimensions of loads, and
- loading diagram.

4.6 WATER SUPPLY

The expected average well water consumption for Project construction is approximately 50 acre-feet per year. Under normal operation with dish mirror cleaning, dust control, and potable water usage, the amount will be approximately 36.2 acre-feet per year. The design of the Project minimizes water use and maximizes the recovery of process potable water. If possible, wastewater discharge will be routed to the on-site raw water storage tank for reuse.

Alternative water supplies considered but rejected are discussed in detail in Section 5.5, Water Resources. The following water supply alternatives are considered viable water supply alternatives to be considered for the Project. A brief discussion of each is included below. See also Section 5.5 for more information.

Viable water supply alternatives are as follows:

- **Groundwater:** This option is considered a long-term, permanent water supply option for the provision of adequate water during construction phases and normal operation of the Project.

The Project Site is located outside of the jurisdictional boundaries of the Mojave Water Agency; however, it is within the scope of the San Bernardino County Ordinance 3872. Pursuant to the provisions of the above-referenced County Code, prior to the construction and operation of any new groundwater, a water permit must be obtained from the County.

The groundwater supply source currently considered for the Project is a groundwater well on BLM land within the boundaries of the Project Site.

- **Imported Water:** This option is considered a short-term supply option if the main supply source is interrupted or at times inadequate, especially during the construction phases of the Project. This option includes importing water by truck from nearby communities. See Section 4.5, Alternative Linear Routes, for more information on this option.

4.6.1 Trucking Water to the Project Site from Surrounding Areas

Trucking water to the Project Site from the surrounding area is both a short-term water supply alternative and an emergency backup option for supplying water to the Project. Under this short-term alternative, the water would be driven 37 miles to the Project Site (from Barstow, California). During normal Project operations under this alternative, three to five 12,000-gallon tanker trucks per day would be sufficient to sustain daily average and daily maximum requirements for operations. However, it is not anticipated that this alternative would be viable for long-term Project operation. To continuously haul water to the Project Site for the life of the Project would be costly and increase the potential for environmental impacts (e.g., increase the traffic and air quality emissions related to the truck trips).

4.7 DEMINERALIZER WATER TREATMENT FACILITY

Although counter-current regenerated ion exchange demineralizer plants have been widely available since the 1960s, the past decade has seen the introduction of a new generation of demineralizer designs in North America and Europe. A variety of systems are available with minor differences in design, but all of these systems tend to share a number of common features. These include:

- counter-flow (i.e., counter-current) regeneration,
- packed resin beds (i.e., no freeboard),
- fine/uniform particle resins,
- short resin beds, and
- shorter operating cycles.

The major advantages claimed for this technology are lower regenerate chemical consumption, higher demineralized water purity, and smaller equipment. The varieties of products within the industry have sparked renewed interest in ion exchange demineralization. The improved performance has reversed or slowed the industry-wide trend toward the use of reverse osmosis in lieu of ion exchange. As knowledge of health issues increases and detection methods improve, we learn that our drinking water has "new" impurities. Ion exchange is a well understood process that can remove contaminants and is reliable, selective, and economical.

The Project will have an ion exchange facility installed at the Main Services Complex. This system will produce all of the potable water required for on-site usage. Enough water for two full days of demineralized water usage will be stored on-site at all times.

The entire Project will be served by a septic wastewater management system and other individual drain disposal systems. No wastewater treatment plants are located in the area of the Project, so Project wastewater cannot be sent for treatment. Thus, the proposed sanitary system will consist of a buried 1,000-gallon septic tank and dual leach field for all sanitary wastes, including toilets, sinks, and showers. Storm water will be collected on-site and directed to swales and detention areas for percolation into the ground. No other alternative wastewater treatment methods would be practical for the Project Site, and other treatment methods would have an increased potential for environmental impacts.

4.8 HYDROGEN GAS MANAGEMENT ALTERNATIVES

The Stirling Engine is a closed-loop hydrogen gas managed system. During normal operations, the dish will direct the focus of the sun into the engine aperture, which will create the heat mass balance required for normal operations. During normal operations, an on-sun condition means that the dish system is focused on the sun and the hydrogen gas is in circulation.

In addition to the single k-bottle hydrogen gas management option described for the Project (see Section 3.0, Project Description and Location), two other hydrogen gas management system methods could be used. These two methods are described below.

4.8.1 Hydrogen Gas Management System Alternative 1

Hydrogen gas management system Alternative 1 would be segmented into a single, low-pressure stainless steel line for supplying high-pressure hydrogen compressor for the engine. This compressor automatically would feed hydrogen to the continuously small and decreasing volume of hydrogen within the Stirling cycle process. The hydrogen feed system would consist of a grouping of approximately 360 dishes that would have a hydrogen feed system centrally located within the dish group. The tubing would be a centralized main hydrogen feed header with buried tubing lateral that connects to each dish. There would be 94 centralized hydrogen tube bundle storage tanks that would have an adequate amount of hydrogen feed for 90 to 120 days.

4.8.2 Hydrogen Gas Management System Alternative 2

Hydrogen gas management system Alternative 2 would segment the hydrogen stainless tubing into a high-pressure and a low-pressure feed and discharge to the engine. By allowing high- and low-pressure hydrogen tubing feed and discharge to the engine, numerous and very expensive hydrogen engine cycle components could be removed from the hydrogen gas management system. The high- and low-pressure system is still being developed and is one of the best means of controlling hydrogen usage and inventory control.

4.9 REFERENCES

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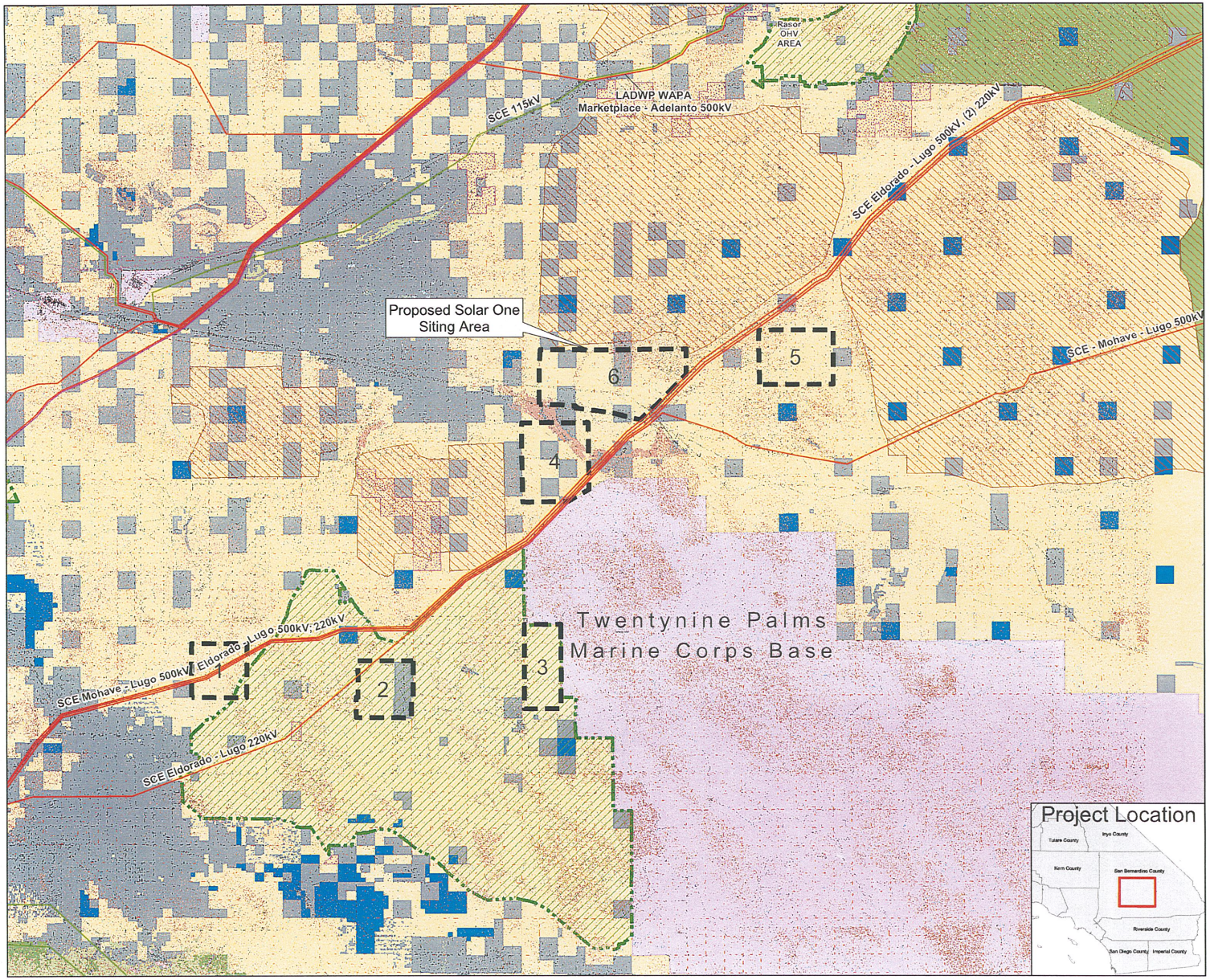
CEC (California Energy Commission) Glossary. 2003. http://www.energy.ca.gov/glossary/glossary-p.html.

Nielsen, Innis, Pollock, Rhoads-Weaver, Shutak and Northwest Sustainable Energy for Economic Development. 2006. Renewable Energy Atlas of the West.

UROPACK Data Brochure. 2001. Available at: http://www.purolite.com/Upload/HTMLEditor/PuropackCaseHistory.pdf.



SOLAR ONE

Proposed and Alternative Siting Areas

Figure **4-1**

Legend

Alternative Siting Area

Surface Land Management Status

- Bureau of Land Management
- Department of Defense
- Bureau of Indian Affairs
- US Fish and Wildlife Service
- US Forest Service
- National Park Service
- Bureau of Reclamation
- State Land
- City / County Land
- Park Land (City, County, Private)
- Private / Unclassified
- Wilderness Area/Wilderness Study Area
- Area of Critical Environmental Concern
- 'Open' OHV Area

Existing Transmission Lines

- 69kV - 161kV
- 220kV - 500kV
- +/- 500kV DC

Sources

U.S. Bureau of Land Management (2004)
U.S. Geological Survey (1999)
National Atlas of the U.S. (2004)

Note: Site data and transmission line information are from secondary sources.

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August 2006

SES Stirling Energy Systems

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Adequacy Issue:	Adequate		Inadequate		**DATA ADEQUACY WORKSHEET**		Revision No.	0	Date	
Technical Area:	**Alternatives**				Project:	SES Solar One		Technical Staff:		
Project Manager:					Docket:			Technical Senior:		

SITING REGULATIONS	**INFORMATION**	**AFC SECTION NUMBER**	**ADEQUATE YES OR NO**	**INFORMATION REQUIRED TO MAKE AFC CONFORM WITH REGULATIONS**
Appendix B (b) (1) (D)	A description of how the site and related facilities were selected and the consideration given to engineering constraints, site geology, environmental impacts, water, waste and fuel constraints, electric transmission constraints, and any other factors considered by the applicant.	Sections 4.1 through 4.6		
Appendix B (f) (1)	A discussion of the range of reasonable alternatives to the Project, or to the location of the Project, including the No Project Alternative, which would feasibly attain most of the basic objectives of the Project but would avoid or substantially lessen any of the significant effects of the Project, and an evaluation of the comparative merits of the alternatives. In accordance with Public Resources Code section 25540.6(b), a discussion of the applicant's site selection criteria, any alternative sites considered for the Project, and the reasons why the applicant chose the proposed site.	Section 4.1 Section 4.2 Section 4.3 Section 4.5 Figure 4-1		
Appendix B (f) (2)	An evaluation of the comparative engineering, economic, and environmental merits of the alternatives discussed in subsection (f)(1).	Section 4.2.3.2 Section 4.3 Section 4.4 Section 4.5 Section 4.8		