Greenhouse Gas Technical Report
Rugged Solar Farm Project
Major Use Permit 3300-12-007
Environmental Review Project Number 3910-120005
Boulevard, San Diego County, California

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GLOSSARY OF TERMS AND ACRONYMS

AB	Assembly Bill
CAFE	Corporate Average Fuel Economy
CAP	Climate Action Plan
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CCAR	California Climate Action Registry
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CO_2	carbon dioxide
CO_2E	carbon dioxide equivalent
CPUC	California Public Utilities Commission
CPV	concentrating photovoltaic
CH_4	methane
CEQA	California Environmental Quality Act
EPA	Environmental Protection Agency
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
kW	kilowatt
mpg	miles per gallon
MUP	Major Use Permit
MSCP	Multiple Species Conservation Program
MW	megawatts
NF_3	nitrogen trifluoride
NHTSA	National Highway Traffic Safety Administration
N_2O	nitrous oxide
O_3	ozone
O&M	operations and maintenance
OPR	Governor's Office of Planning and Research
PFC	perfluorocarbon
RFS	Renewable Fuel Standard
SDG&E	San Diego Gas & Electric
SDAPCD	San Diego County Air Pollution Control District
SDCGHGI	San Diego County Greenhouse Gas Inventory
SF_6	sulfur hexafluoride

U.S.	United States
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V	volt
VMT	vehicle miles traveled

EXECUTIVE SUMMARY

The proposed Rugged Solar Farm Project (project) would produce up to 80 megawatts (MW) of solar energy and would consist of approximately 3,588 concentrating photovoltaic (CPV) trackers on 765 acres in southeastern San Diego County near the unincorporated community of Boulevard, California.

The greenhouse gas (GHG) analysis evaluates the potential for significant adverse impacts related to GHG emissions and climate change as a result of the proposed project's construction and operational emissions.

GHG emissions generated by the proposed project associated with construction equipment and vehicles, operations and maintenance vehicular traffic, electrical generation, and water supply were estimated. The annualized construction emissions are included in the overall GHG emission estimates. The estimated GHG emissions would be 722 metric tons carbon dioxide equivalent (CO_2E) per year. As such, project emissions would not exceed the 900-metric-ton threshold as indicated in the County of San Diego's DPLU *Interim Guidance for Greenhouse Gas Analysis – Industrial Use/East Otay Mesa Specific Plan* (County of San Diego 2010a), which was used as guidance for determining significance of GHG emissions from project implementation. In addition to the County of San Diego Interim Guidance, the proposed project was analyzed under the updated County of San Diego *Guidelines for Determining Significance – Climate Change* which includes a 2,500 metric ton per year "bright line" screening threshold for operational emissions (County of San Diego 2012b). The proposed project's operational emissions of 584 metric tons CO_2E per year would not exceed this threshold. The updated *Guidelines for Determining Significance – Climate Change* guidelines have not been formally adopted; therefore, analysis relating to these guidelines is provided for informational purposes.

Based on estimates by the project proponent, the project would generate 2,083 kilowatt-hours alternating current annually per installed kilowatt (based on the direct current capacity of the CPV trackers). This factor reflects the available daylight hours, conversion of direct current to alternating current, and various system losses. Using the installed CPV capacity of 105 MW (105,000 kilowatts) direct current, the project is anticipated to generate 219,204,505 kWh per year. The proposed project would provide a potential reduction of 106,990 metric tons CO_2E per year if the electricity generated by the proposed project were to be used instead of electricity generated by fossil-fuel sources. After accounting for the annualized construction and annual operational emissions of 722 metric tons CO_2E per year, the net reduction in GHG emissions would be 106,268 metric tons CO_2E per year. This reduction is not considered in the significance determination of the proposed project's GHG emissions but is provided for disclosure purposes.

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1.0 INTRODUCTION

1.1 Purpose of the Report

The purpose of this report is to estimate and evaluate the greenhouse gas (GHG) emission impacts associated with construction and operation of the proposed project and their potential contribution to climate change. Impacts relative to climate change are evaluated based on guidance provided in the County of San Diego's (County's) *DPLU Interim Guidance for Greenhouse Gas Analysis – Industrial Use/East Otay Mesa Specific Plan* (County of San Diego 2010a).

1.2 Project Location and Description

Solar Farm

The Rugged solar farm would produce up to 80 megawatts (MW) of alternating current (AC) generating capacity and would consist of approximately 3,588 trackers installed in groups or building blocks, with any of the following inverter combinations: two 630 kilowatt (kW) inverters, and either two 680 kW inverters or three 680 kW inverters, and either a 1.5 megavolt amperes (MVA) or 2.0 MVA transformer. Approximately 59 building blocks would be constructed. The project would utilize dual-axis trackers on 765 acres in the unincorporated community of Boulevard, California (see Figures 1 and 2). In addition to the CPV trackers and inverter transformer units, Rugged includes the following primary components, as shown in Figure 3, Rugged Site Plan:

- A collection system linking the trackers to the on-site project substation consisting of (1) 1,000-volt (V) direct current (DC) underground conductors leading to (2) 34.5 kV underground and overhead AC conductors.
- A 60-foot by 125-foot (7,500-square-foot) operations and maintenance (O&M) building. The O&M building would be used for storage, employee operations, and maintenance of equipment.
- A 2-acre on-site private collector substation site with a fenced pad area of approximately 6,000 square feet and maximum height of 35 feet. The on-site substation would include a 450-square-foot control house.

Upon completion, Rugged would be monitored on site at the O&M annex and off site through a supervisory control and data acquisition (SCADA) system.

Primary access to the Rugged site would be from Ribbonwood Road and McCain Valley Road. One roadway would be constructed off site from McCain Valley Road leading to the central subarea if Rough Acres Ranch Rd is not constructed per Rough Acres Ranch Major Use Permit (MUP) 3300-09-019. Access to the northwest subarea would be provided via Ribbonwood Road. The central subarea would also include an access road leading south crossing Tule Creek to

provide access to the southern subarea. The eastern subarea would be accessible via an access road leading from McCain Valley Road crossing beneath the Sunrise Powerlink.

Power from the on-site private substation would be delivered to the 69 kV bus at SDG&E's proposed Rebuilt Boulevard Substation via the Tule Wind Energy project (MUP) 3300-09-019) gen-tie alignment (Tule gen-tie) as adopted by the Board of Supervisors on August 8, 2012. The 138 kV gen-tie for the Tule Wind Energy project includes a 69 kV undersling line, which will be used to service the Rugged solar farm. The Tule gen-tie will run south along the east side of McCain Valley Road and SDG&E's Sunrise Powerlink and across I-8, after which it will cross McCain Valley Road and run parallel to Old Highway 80 along the north side until it crosses Old Highway 80 at the proposed new SDG&E Boulevard East Substation. Both the Rebuilt Boulevard Substation and Tule gen-tie were subject to prior environmental analysis; construction of these facilities would be completed prior to completion of construction of the Rugged solar farm (Iberdrola Renewables 2013). Rugged Solar LLC and Tule Wind LLC have a joint-use agreement in place for use of the gen-tie line, associated transmission towers, and access road.

Individual tracker dimensions are approximately 48 feet across by 25 feet tall. Each tracker unit would be mounted on a 28-inch steel mast (steel pole), which would be supported by either (i) extending it into the ground up to 20 feet and encasing it in concrete, (ii) vibrating the mast into the ground up to 20 feet deep, or (iii) attaching it to a concrete foundation sized to be suitable to adequately support the tracker based on wind loading and soil conditions at the site. The preferred method would be to set the mast by vibratory pile driving methods depending upon soil conditions.

In its most vertical position and depending on foundation design, the top of each tracker would not exceed 30 feet above grade, and the lower edge would not be less than 1 foot above ground level. In its horizontal "stow" mode (for high winds), each tracker would have a minimum ground clearance of 13 feet 6 inches.

Power within each building block would be delivered through a 1,000 V DC underground collection system from the trackers to the inverter stations. Each set of inverters would be equipped with a step-up transformer to convert the power from 350 V AC on the "low side" to 34,500 V (34.5 kV) on the "high side." An alternative inverter and transformer configuration may be used, with negligible difference in appearance. It is uncertain if a two 680 kV inverter configuration or a three 680 kV inverter configuration would be utilized. Therefore, the project has been sized to accommodate the larger of the two configurations, which is 10 feet by 40 feet (400 square feet), with an approximate height of 12 feet (including inverter enclosure). The smaller option is 10 feet by 25 feet (250 square feet). The project would require approximately 59 inverter skids for a total of 24,400 square feet, assuming use of the larger 10-foot by 40-foot (400-square-foot) inverter and transformer configuration.

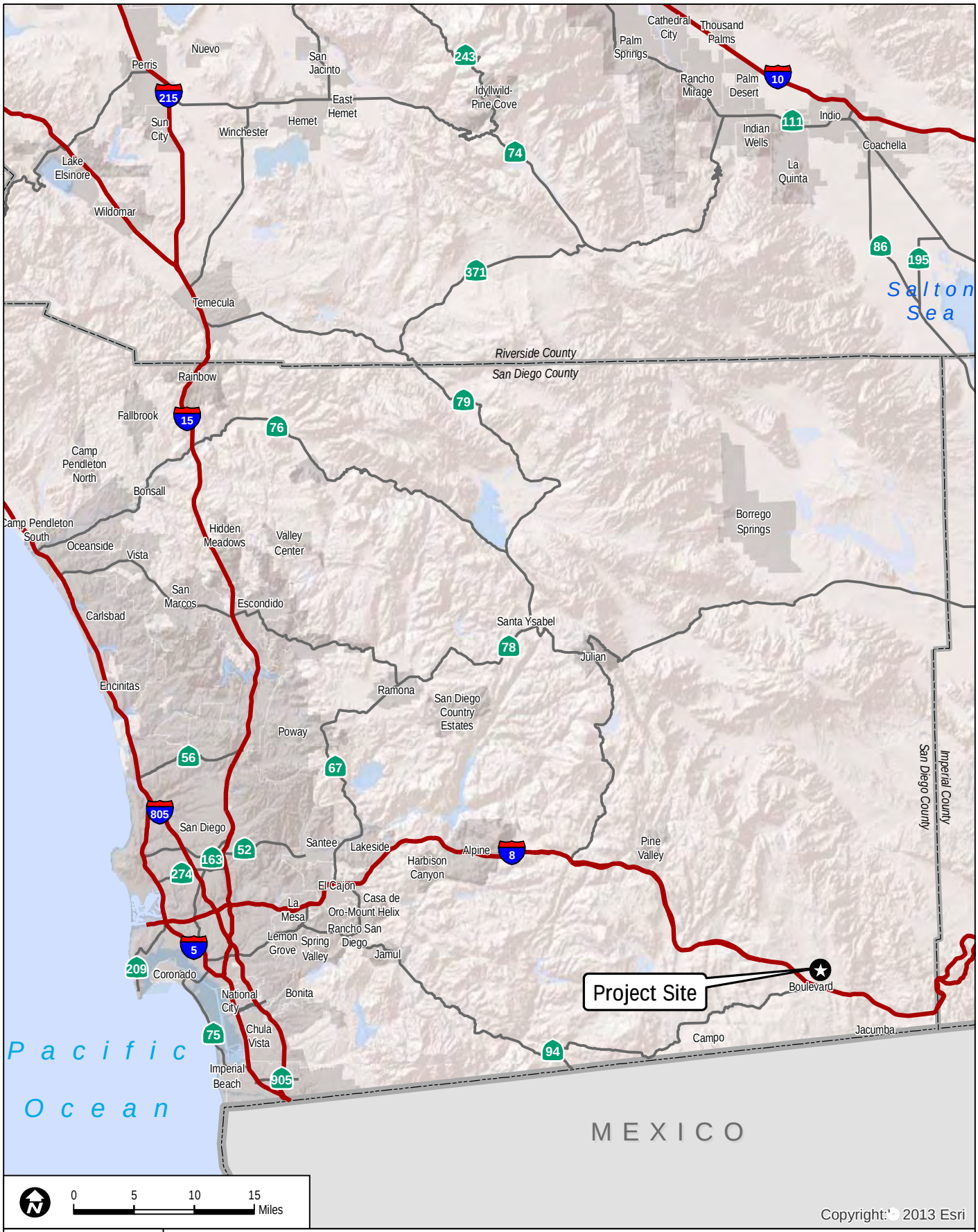

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FIGURE 1

Regional Map

RUGGED GREENHOUSE GAS ANALYSIS

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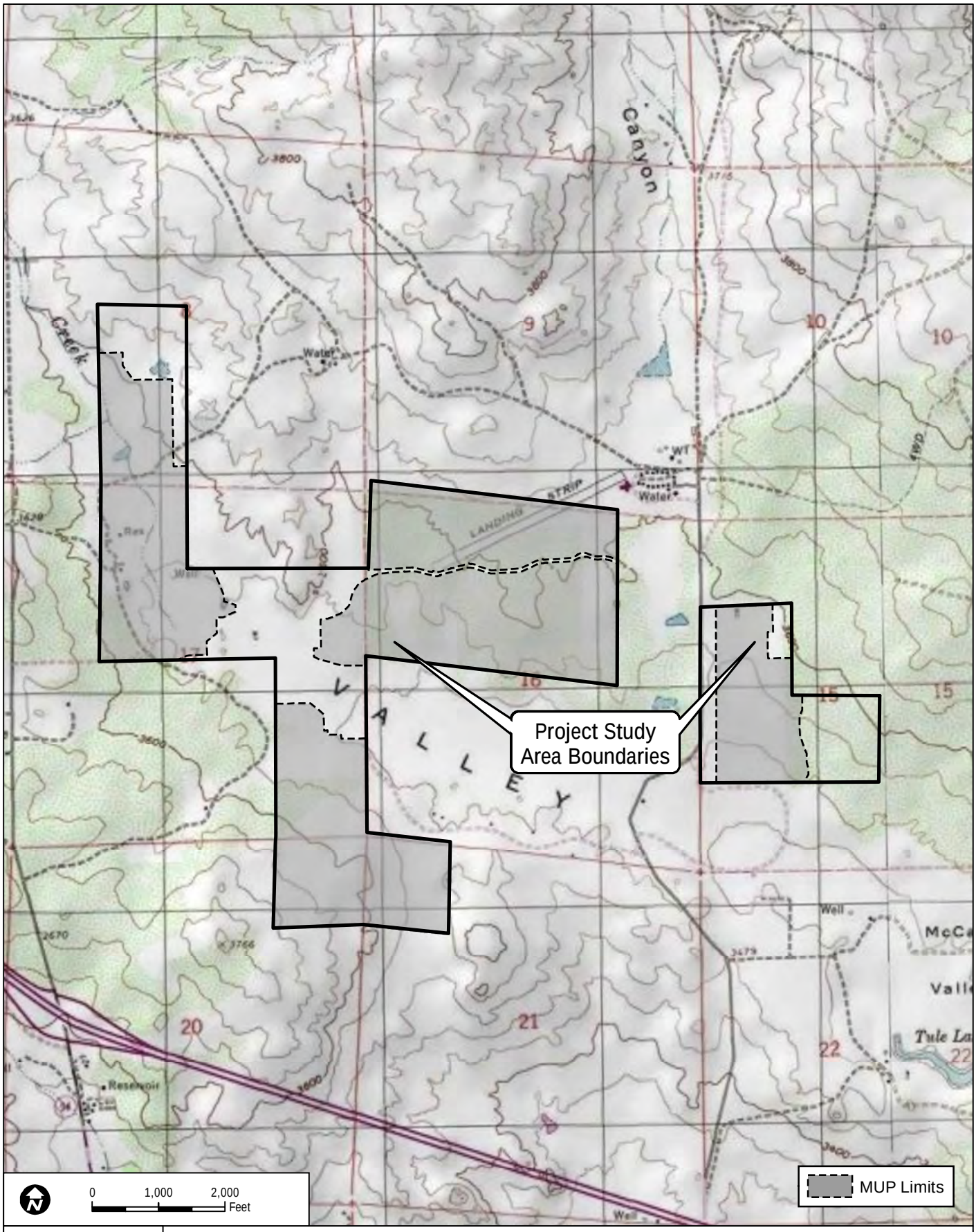

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SOURCE: USGS 7.5-Minute Series Live Oak Springs Quadrangle.

FIGURE 2
Vicinity Map

RUGGED GREENHOUSE GAS ANALYSIS

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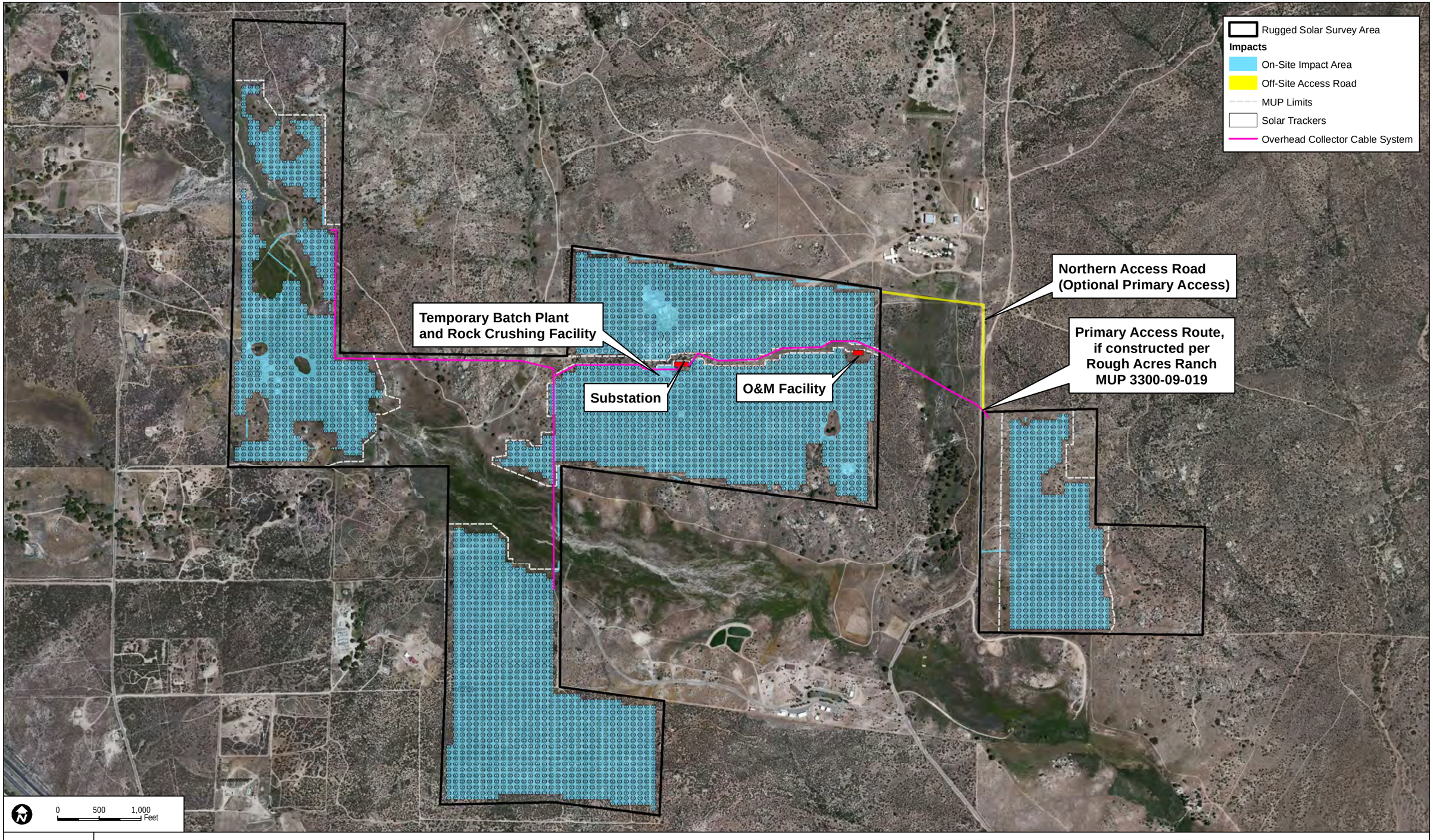

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SOURCE: AECOM 2012; Soitec 2012; SanGIS 2012; Bing Maps

FIGURE 3

Rugged Solar - Site Plan

RUGGED GREENHOUSE GAS ANALYSIS

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The Rugged solar farm would include the construction of a 60-foot by 100-foot (6,000-square-foot) private on-site collector substation area that would be located within the central portion of the Rugged site. The substation site would be located approximately 0.5 mile west of the O&M building on the site. The purpose of the substation is to collect the energy received from the overhead and underground collector system and increase the voltage from 34.5 kV to 69 kV. Once the voltage is stepped up to 69 kV, the power would be conveyed through a 35-foot-high dead-end structure (a fully self-supporting steel tower) that connects the on-site collector substation with the Tule gen-tie.

A backup power and storm positioning system would bring the trackers into the horizontal "stow" mode position (Storm Position) in case the electrical power is cut or if there is an approaching storm that could be damaging to the trackers. The backup power and storm positioning system must fulfill two function:

- To adequately detect a damaging storm and to be able to communicate a Storm Position command to each tracker
- To have enough electrical capacity to power each tracker into the Storm Position in case of the loss of the primary power supply.

The backup power and storm positioning system would consist of one of the following options: (1) a 1.5 MW diesel-powered emergency generator or equivalent located at the substation, (2) an Uninterrupted Power Supply (UPS) battery storage system at each inverter station, or (3) a 20 kW propane generator at each inverter skid (Trojan 2013a, Trojan 2013b). The backup power systems would be appropriately sized to allow the trackers to be moved into the "stow" mode, as described. The UPS system would include approximately 20 8D-GEL batteries enclosed in a 7-foot by 6-foot metal enclosure. In the event of an electrical outage, the emergency generators would be expected to operate no more than 20 minutes to bring all the trackers into the stow mode position. An O&M area is located at the north-central portion of the Rugged site approximately 0.5 mile east of the on-site private substation. The O&M building would be used for storage, employee operations, and maintenance of equipment. The O&M facility would consist of a 7,500-square-foot building. The building would include administrative and operational offices and meeting facilities, along with material storage and equipment warehouse and lavatory facilities served by a private on-site septic system and groundwater well. The building would be surrounded by a disintegrated granite improved parking area and parking spaces. The building and parking areas would include security lighting designed to minimize light pollution and preserve dark skies, while enhancing safety, security, and functionality.

Construction

Construction of the Rugged solar farm is anticipated to commence in July 2014 and would require approximately 12 months for completion. Table 1, Rugged Construction Schedule, provides the proposed schedule for Rugged. While the schedule may be modified due to the date of County project approval as well other project approvals/permits, this table illustrates the approximate duration of major project activities. Construction activities would occur between the hours of 7 a.m. and 7 p.m., Monday through Saturday.

Table 1
Rugged Construction Schedule

Project Activity	Working Days[1]	Start	End
80 MW			
Mobilization	7	7/1/2014	7/8/2014
Clear and Grub	60	7/10/2014	9/18/2014
Grading/Road Construction	9	9/20/2014	9/29/14
Underground Electric	100	10/2/2014	1/26/2015
Substation	35	7/17/2014	8/26/2014
O&M Building	60	11/28/2014	2/5/2015
Tracker Installation	200	8/27/2014	4/16/2015
Phase 1 (24 MW)	60	8/27/2014	11/4/2014
Phase 2 (16 MW)	40	11/5/2014	12/20/2014
Phase 3 (24 MW)	60	12/22/2014	2/28/2015
Phase 4 (16 MW)	40	3/2/2015	4/16/2015
Punch List and Cleanup	60	4/22/2015	6/30/2015
Total Months (80 MW)	**12**		

[1] Working days during construction period = 6 days per week

Construction Personnel, Traffic, and Equipment

Construction would employ up to 146 workers per day during the peak construction period. Depending on the specific stage of construction, an average daily workforce of 60 to 70 workers would be present at the construction site. During the peak of construction, a typical day would include the transportation of trackers, movement of heavy equipment, and transportation of materials. Assuming there would be a percentage of workers that carpool to the site given its remote location; a reduction factor of 30% would reduce vehicle worker trips to approximately 130 trips per day. Trip generation for workers and delivery trucks would vary depending on the phase of construction. It is estimated that approximately 49,773 total trips would be made during the 12-month construction period. Thus, on average approximately 160 trips per day would be generated during project construction, and during the clearing and grubbing phase, construction trips would peak at approximately 392 trips per day for two months.

2.0 EXISTING CONDITIONS

2.1 Existing Setting

Project Site

The approximately 765-acre Rugged site is located north of I-8 to the east of Ribbonwood Road and primarily west of McCain Valley Road. More specifically, Rugged is located east of Ribbonwood Road and includes a property located adjacent to and east of McCain Valley Road. The land use category for the Rugged site is Rural Lands with a permitted density of 1 dwelling unit per 80 acres (RL-80). The area is zoned General Rural (S92).

The Rugged site is located in a desert transition zone dominated by chaparral communities, subshrub communities, alkali meadows and seeps, oak woodlands, and wildflower fields. The site is characterized by gently sloping hillsides and shallow valleys, with rock outcrops and a few small hills scattered throughout. Much of the site is part of an active ranching operation, with a series of ranch houses, stables, out buildings, roads, fencing, corrals, stock ponds, and other features typical of a horse and cattle ranch.

A portion of the Rugged site was just recently used as a staging area for construction of SDG&E's Sunrise Powerlink Project. The site is located at an elevation of approximately 3,500 to 3,670 feet above mean sea level. The site is located within San Diego County's draft East County Multiple Species Conservation Program (MSCP) Plan Area. The majority of the site is disturbed by extensive grazing activities, but also includes some vegetation of moderate to high value for wildlife species. Although the open area of the site is heavily grazed, a small field of herbaceous wildflower species was identified during the spring blooming period.

2.2 The Greenhouse Effect and Greenhouse Gases

Climate change refers to any significant change in measures of climate, such as temperature, precipitation, or wind, lasting for an extended period (decades or longer).

Gases that trap heat in the atmosphere are often called "greenhouse gases" (GHGs). The greenhouse effect traps heat in the troposphere through a threefold process as follows: Short-wave radiation emitted by the Sun is absorbed by the Earth; the Earth emits a portion of this energy in the form of long-wave radiation; and GHGs in the upper atmosphere absorb this long-wave radiation and emit it into space and toward the Earth. This "trapping" of the long-wave (thermal) radiation emitted back toward the Earth is the underlying process of the greenhouse effect. Principal GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), ozone (O_3), and water vapor (H_2O). Some GHGs, such as CO_2, CH_4, and N_2O, occur naturally and are emitted

to the atmosphere through natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Emissions of CO_2 are largely byproducts of fossil fuel combustion, whereas CH_4 results mostly from off-gassing associated with agricultural practices and landfills. Man-made GHGs, which have a much greater heat-absorption potential than CO_2, include fluorinated gases, such as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3), which are associated with certain industrial products and processes (CAT 2006).

The greenhouse effect is a natural process that contributes to regulating the earth's temperature. Without it, the temperature of the Earth would be about 0°F (-18°C) instead of its present 57°F (14°C). Global climate change concerns are focused on whether human activities are leading to an enhancement of the greenhouse effect (National Climatic Data Center 2009).

The effect each GHG has on climate change is measured as a combination of the mass of its emissions and the potential of a gas or aerosol to trap heat in the atmosphere, known as its "global warming potential" (GWP). GWP varies between GHGs; for example, the GWP of CH_4 is 21, and the GWP of N_2O is 310. Total GHG emissions are expressed as a function of how much warming would be caused by the same mass of CO_2. Thus, GHG gas emissions are typically measured in terms of pounds or tons of "CO_2 equivalent" (CO_2E).[1]

2.3 Contributions to Greenhouse Gas Emissions

In 2010, the United States produced 6,822 million metric tons of CO_2E (MMT CO_2E) (EPA 2012). The primary GHG emitted by human activities in the United States was CO_2, representing approximately 84% of total GHG emissions. The largest source of CO_2, and of overall GHG emissions, was fossil-fuel combustion, which accounted for approximately 94% of the CO_2 emissions and 78% of overall GHG emissions.

According to the 2009 GHG inventory data compiled by the California Air Resources Board (CARB) for the California Greenhouse Gas Inventory for 2000–2009, California emitted 457 MMT CO_2E of GHGs, including emissions resulting from out-of-state electrical generation (CARB 2011). The primary contributors to GHG emissions in California are transportation, electric power production from both in-state and out-of-state sources, industry, agriculture and forestry, and other sources, which include commercial and residential activities. These primary contributors to California's GHG emissions and their relative contributions in 2009 are presented in Table 2, GHG Sources in California.

[1] The CO_2 equivalent for a gas is derived by multiplying the mass of the gas by the associated GWP, such that $MTCO_2E$ = (metric tons of a GHG) x (GWP of the GHG). For example, the GWP for CH_4 is 21. This means that emissions of 1 metric ton of methane are equivalent to emissions of 21 metric tons of CO_2.

Table 2
GHG Sources in California

Source Category	Annual GHG Emissions (MMT CO_2E)	% of Total
Agriculture	32.13	7.03%
Commercial and residential	42.95	9.40%
Electricity generation	103.58a	22.68%
Forestry (excluding sinks)	0.19	0.04%
Industrial uses	81.36	17.81%
Recycling and waste	7.32	1.60%
Transportation	172.92	37.86%
High-GWP substances	16.32	3.57%
Totals	**456.77**	**100.00%**

Source: CARB 2011.
Notes: a Includes emissions associated with imported electricity, which account for 48.05 MMTCO2E annually.

2.4 Potential Effects of Human Activity on Climate Change

According to CARB, some of the potential impacts in California of global warming may include loss in snow pack, sea level rise, more extreme heat days per year, more high O_3 days, more large forest fires, and more drought years (CARB 2006). Several recent studies have attempted to explore the possible negative consequences that climate change, left unchecked, could have in California. These reports acknowledge that climate scientists' understanding of the complex global climate system, and the interplay of the various internal and external factors that affect climate change, remains too limited to yield scientifically valid conclusions on such a localized scale. Substantial work has been done at the international and national level to evaluate climatic impacts, but far less information is available on regional and local impacts.

The primary effect of global climate change has been a rise in average global tropospheric temperature of 0.2°C per decade, determined from meteorological measurements worldwide between 1990 and 2005. Climate change modeling using 2000 emission rates shows that further warming would occur, which would induce further changes in the global climate system during the current century. Changes to the global climate system and ecosystems and to California would include, but would not be limited to:

- The loss of sea ice and mountain snowpack resulting in higher sea levels and higher sea surface evaporation rates with a corresponding increase in tropospheric water vapor due to the atmosphere's ability to hold more water vapor at higher temperatures (IPCC 2007)
- A rise in global average sea level primarily due to thermal expansion and melting of glaciers and ice caps and the Greenland and Antarctic ice sheets (IPCC 2007)

- Changes in weather that includes widespread changes in precipitation, ocean salinity, and wind patterns, and more energetic aspects of extreme weather including droughts, heavy precipitation, heat waves, extreme cold, and the intensity of tropical cyclones (IPCC 2007)
- A decline of Sierra snowpack, which accounts for approximately half of the surface water storage in California, by 70% to as much as 90% over the next 100 years (CAT 2006)
- An increase in the number of days conducive to O_3 formation by 25% to 85% (depending on the future temperature scenario) in high O_3 areas of Los Angeles and the San Joaquin Valley by the end of the 21st century (CAT 2006)
- High potential for erosion of California's coastlines and sea water intrusion into the Delta and levee systems due to the rise in sea level (CAT 2006).

2.5 Regulatory Setting

2.5.1 Federal Activities

Massachusetts vs. EPA. On April 2, 2007, in *Massachusetts v. EPA*, the Supreme Court directed the U.S. Environmental Protection Agency (EPA) Administrator to determine whether GHG emissions from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision. In making these decisions, the EPA Administrator is required to follow the language of Section 202(a) of the federal Clean Air Act. On December 7, 2009, the Administrator signed a final rule with two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act:

- The Administrator found that elevated concentrations of GHGs—CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6—in the atmosphere threaten the public health and welfare of current and future generations. This is referred to as the "endangerment finding."
- The Administrator further found the combined emissions of GHGs—CO_2, CH_4, N_2O, and HFCs—from new motor vehicles and new motor vehicle engines contribute to the GHG air pollution that endangers public health and welfare. This is referred to as the "cause or contribute finding."

These two findings were necessary to establish the foundation for regulation of GHGs from new motor vehicles as air pollutants under the Clean Air Act.

Energy Independence and Security Act. On December 19, 2007, President Bush signed the Energy Independence and Security Act of 2007. Among other key measures, the Act would do the following, which would aid in the reduction of national GHG emissions:

1. Increase the supply of alternative fuel sources by setting a mandatory Renewable Fuel Standard (RFS) requiring fuel producers to use at least 36 billion gallons of biofuel in 2022
2. Set a target of 35 miles per gallon (mpg) for the combined fleet of cars and light trucks by model year 2020 and directs National Highway Traffic Safety Administration (NHTSA) to establish a fuel economy program for medium- and heavy-duty trucks and create a separate fuel economy standard for work trucks
3. Prescribe or revise standards affecting regional efficiency for heating and cooling products and procedures for new or amended standards, energy conservation, energy efficiency labeling for consumer electronic products, residential boiler efficiency, electric motor efficiency, and home appliances.

EPA and NHTSA Joint Final Rule for Vehicle Standards. On April 1, 2010, the EPA and NHTSA announced a joint final rule to establish a national program consisting of new standards for light-duty vehicles model years 2012 through 2016. The joint rule is intended to reduce GHG emissions and improve fuel economy. The EPA is finalizing the first-ever national GHG emissions standards under the Clean Air Act, and NHTSA is finalizing Corporate Average Fuel Economy (CAFE) standards under the Energy Policy and Conservation Act (EPA 2010). This final rule follows the EPA and Department of Transportation's joint proposal on September 15, 2009, and is the result of the President Obama's May 2009 announcement of a national program to reduce greenhouse gases and improve fuel economy (EPA 2011). The final rule became effective on July 6, 2010 (EPA and NHTSA 2010).

The EPA GHG standards require new passenger cars, light-duty trucks, and medium-duty passenger vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile in model year 2016, equivalent to 35.5 mpg if the automotive industry were to meet this CO_2 level through fuel economy improvements alone. The CAFE standards for passenger cars and light trucks will be phased in between 2012 and 2016, with the final standards equivalent to 37.8 mpg for passenger cars and 28.8 mpg for light trucks, resulting in an estimated combined average of 34.1 mpg. Together, these standards will cut GHG emissions by an estimated 960 million metric tons and 1.8 billion barrels of oil over the lifetime of the vehicles sold under the program. The rules will simultaneously reduce GHG emissions, improve energy security, increase fuel savings, and provide clarity and predictability for manufacturers (EPA 2011).

In 2011, the EPA and NHTSA approved the first-ever program to reduce GHG emissions and increase fuel efficiency for medium- and heavy-duty vehicles (EPA and NHTSA 2011). Effective November 14, 2011, the CO_2 emissions and fuel efficiency standards of this regulation apply to model year 2014 to 2018 combination tractors (i.e., semi-trucks), heavy-duty pickup trucks and vans, and vocational vehicles including transit and school buses. This regulation covers vehicles with a gross vehicle weight rating of 8,500 pounds or greater; medium-duty passenger vehicles are covered by the previous regulation for passenger cars and light-duty trucks. In addition, the EPA has adopted standards to control HFC leakage from air conditioning systems in combination tractors and heavy-duty pickup trucks and vans as well as CH_4 and N_2O standards for heavy-duty engines, pickup trucks, and vans. Phased in through model year 2017, the CO_2 and fuel consumption standards for combination trailers depend on the weight class, cab type, and roof length. The CO_2 standards are expressed in grams CO_2 per ton-mile, while the fuel consumption standards are expressed in gallons per 1,000 ton-miles, each accounting for the carrying capacity of the tractor and trailer. These standards represent an overall fuel consumption and CO_2 emissions reduction of up to 23% when compared to a baseline 2010 model year. The CO_2 and fuel consumption standards for heavy-duty pickup trucks and vans are applied as corporate average values and are phased in with increasing stringency from model year 2014 to 2018. The final EPA standards for heavy-duty pickup trucks and vans for 2018 (including a separate standard to control air conditioning system leakage) represent a GHG reduction of 17% for diesel vehicles and 12% for gasoline vehicles compared to a 2010 baseline. Due to the variety of vocational vehicles, many of which involve a body installed on a chassis, the CO_2 and fuel consumption standards are applied to the chassis manufacturers. Like the CO_2 and fuel consumption standards for combination tractors, the standards for vocation vehicles are expressed in grams CO_2 per ton-mile and gallons per 1,000 ton-miles, respectively. Upon final implementation, the EPA standards for vocational vehicles, which apply initially to model year 2014 to 2016 and then to model year 2017 vehicles, are expected to reduce GHG emissions by 6 to 9% compared to a 2010 baseline.

In August 2012, the EPA and NHTSA approved a second round of GHG and CAFE standards for model years 2017 and beyond (EPA and NHTSA 2012). These standards will reduce motor vehicle GHG emissions to 163 grams of CO_2 per mile, which is equivalent to 54.5 mpg if this level were achieved solely through improvements in fuel efficiency, for cars and light-duty trucks by model year 2025. A portion of these improvements, however, will likely be made through improvements in air conditioning leakage and through use of alternative refrigerants, which would not contribute to fuel economy. The first phase of the CAFE standards, for model year 2017 to 2021, are projected to require, on an average industry fleet-wide basis, a range from 40.3 to 41.0 mpg in model year 2021. The second phase of the CAFE program, for model

years 2022 to 2025, are projected to require, on an average industry fleet-wide basis, a range from 48.7 to 49.7 mpg in model year 2025. The second phase of standards have not been finalized due to the statutory requirement that NHTSA set average fuel economy standards not more than five model years at a time. The regulations also include targeted incentives to encourage early adoption and introduction into the marketplace of advanced technologies to dramatically improve vehicle performance, including:

- Incentives for electric vehicles, plug-in hybrid electric vehicles, and fuel cells vehicles
- Incentives for hybrid technologies for large pickups and for other technologies that achieve high fuel economy levels on large pickups
- Incentives for natural gas vehicles
- Credits for technologies with potential to achieve real-world greenhouse gas reductions and fuel economy improvements that are not captured by the standards test procedures.

2.5.2 State of California

Assembly Bill (AB) 1493. In a response to the transportation sector accounting for more than half of California's CO_2 emissions, AB 1493 (Pavley) was enacted on July 22, 2002. AB 1493 required CARB to set GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined by the state board to be vehicles whose primary use is noncommercial personal transportation in the state. The bill required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004. When fully phased in, the near-term (2009–2012) standards will result in a reduction of about 22% in GHG emissions compared to the emissions from the 2002 fleet, while the mid-term (2013–2016) standards will result in a reduction of about 30%.

Before these regulations could go into effect, the EPA had to grant California a waiver under the federal Clean Air Act, which ordinarily preempts state regulation of motor vehicle emission standards. The waiver was granted by Lisa Jackson, the EPA Administrator, on June 30, 2009. On March 29, 2010, the CARB Executive Officer approved revisions to the motor vehicle GHG standards to harmonize the state program with the national program for 2012–2016 model years (see "EPA and NHTSA Joint Final Rule for Vehicle Standards" above). The revised regulations became effective on April 1, 2010.

Executive Order S-3-05. In June 2005, Governor Schwarzenegger established California's GHG emissions reduction targets in Executive Order S-3-05. The Executive Order established the following goals: GHG emissions should be reduced to 2000 levels by 2010;

GHG emissions should be reduced to 1990 levels by 2020; and GHG emissions should be reduced to 80% below 1990 levels by 2050. CalEPA Secretary is required to coordinate efforts of various agencies to collectively and efficiently reduce GHGs. The Climate Action Team is responsible for implementing global warming emissions reduction programs. Representatives from several state agencies comprise the Climate Action Team. The Climate Action Team fulfilled its report requirements through the March 2006 Climate Action Team Report to the governor and the legislature (CAT 2006). A second draft biennial report was released in April 2009.

The 2009 Draft Climate Action Team Report (CAT 2009) expands on the policy outlined in the 2006 assessment. The 2009 report provides new information and scientific findings regarding the development of new climate and sea-level projections using new information and tools that have recently become available and evaluates climate change within the context of broader soil changes, such as land use changes and demographics. The 2009 report also identifies the need for additional research in several different aspects that affect climate change in order to support effective climate change strategies. The aspects of climate change determined to require future research include vehicle and fuel technologies, land use and smart growth, electricity and natural gas, energy efficiency, renewable energy and reduced carbon energy sources, low GHG technologies for other sectors, carbon sequestration, terrestrial sequestration, geologic sequestration, economic impacts and considerations, social science, and environmental justice.

AB 32. In furtherance of the goals established in Executive Order S-3-05, the legislature enacted AB 32 (Núñez and Pavley), the California Global Warming Solutions Act of 2006, which Governor Schwarzenegger signed on September 27, 2006. The GHG emissions limit is equivalent to the 1990 levels, which are to be achieved by 2020.

CARB has been assigned to carry out and develop the programs and requirements necessary to achieve the goals of AB 32. Under AB 32, CARB must adopt regulations requiring the reporting and verification of statewide GHG emissions. This program will be used to monitor and enforce compliance with the established standards. CARB is also required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. AB 32 allows CARB to adopt market-based compliance mechanisms to meet the specified requirements. Finally, CARB is ultimately responsible for monitoring compliance and enforcing any rule, regulation, order, emission limitation, emission reduction measure, or market-based compliance mechanism adopted.

The first action under AB 32 resulted in the adoption of a report listing early action GHG emission reduction measures on June 21, 2007. The early actions include three specific GHG

control rules. On October 25, 2007, CARB approved an additional six early action GHG reduction measures under AB 32. The three original early-action regulations meeting the narrow legal definition of "discrete early action GHG reduction measures" include:

1. A low-carbon fuel standard to reduce the "carbon intensity" of California fuels
2. Reduction of refrigerant losses from motor vehicle air conditioning system maintenance to restrict the sale of "do-it-yourself" automotive refrigerants
3. Increased methane capture from landfills to require broader use of state-of-the-art methane capture technologies.

The additional six early-action regulations, which were also considered "discrete early action GHG reduction measures," consist of:

1. Reduction of aerodynamic drag, and thereby fuel consumption, from existing trucks and trailers through retrofit technology
2. Reduction of auxiliary engine emissions of docked ships by requiring port electrification
3. Reduction of PFCs from the semiconductor industry
4. Reduction of propellants in consumer products (e.g., aerosols, tire inflators, and dust removal products)
5. Requirements that all tune-up, smog check and oil change mechanics ensure proper tire inflation as part of overall service in order to maintain fuel efficiency
6. Restriction on the use of SF_6 from non-electricity sectors if viable alternatives are available.

As required under AB 32, on December 6, 2007, CARB approved the 1990 GHG emissions inventory, thereby establishing the emissions limit for 2020. The 2020 emissions limit was set at 427 million metric tons CO_2E. In addition to the 1990 emissions inventory, CARB also adopted regulations requiring mandatory reporting of GHGs for large facilities that account for 94% of GHG emissions from industrial and commercial stationary sources in California. About 800 separate sources fall under the new reporting rules and include electricity generating facilities, electricity retail providers and power marketers, oil refineries, hydrogen plants, cement plants, cogeneration facilities, and other industrial sources that emit CO_2 in excess of specified thresholds.

On December 11, 2008, CARB approved the Climate Change Proposed Scoping Plan: A Framework for Change (Scoping Plan; CARB 2008) to achieve the goals of AB 32. The Scoping Plan establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions. The Scoping Plan evaluates opportunities for sector-

specific reductions, integrates all CARB and Climate Action Team early actions and additional GHG reduction measures by both entities, identifies additional measures to be pursued as regulations, and outlines the role of a cap-and-trade program.

The key elements of the Scoping Plan include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards
- Achieving a statewide renewables energy mix of 33%
- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system and caps sources contributing 85% of California's GHG emissions
- Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets
- Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State of California's long term commitment to AB 32 implementation.

SB 1368. In September 2006, Governor Schwarzenegger signed SB 1368, which requires the California Energy Commission (CEC) to develop and adopt regulations for GHG emissions performance standards for the long-term procurement of electricity by local publicly owned utilities. These standards must be consistent with the standards adopted by the California Public Utilities Commission (CPUC). This effort will help protect energy customers from financial risks associated with investments in carbon-intensive generation by allowing new capital investments in power plants whose GHG emissions are as low or lower than new combined-cycle natural gas plants, by requiring imported electricity to meet GHG performance standards in California, and by requiring that the standards be developed and adopted in a public process.

SB 97. In August 2007, the legislature enacted SB 97 (Dutton), which directs the Governor's Office of Planning and Research (OPR) to develop guidelines under the California Environmental Quality Act (CEQA) for the mitigation of GHG emissions. OPR was to develop proposed guidelines by July 1, 2009, and the Natural Resources Agency was directed to adopt the guidelines by January 1, 2010.

On June 19, 2008, OPR issued a technical advisory as interim guidance regarding the analysis of GHG emissions in CEQA documents (OPR 2008). The advisory indicated that a project's GHG emissions, including those associated with vehicular traffic, energy consumption, water usage, and construction activities, should be identified and estimated. The advisory further recommended that the lead agency determine significance of the impacts and impose all mitigation measures that are necessary to reduce GHG emissions to a level that is less than significant.

The Natural Resources Agency adopted the CEQA Guidelines Amendments on December 30, 2009. The amendments became effective on March 18, 2010. The amended guidelines establish several new CEQA requirements concerning the analysis of GHGs, including the following:

- Requiring a lead agency to "make a good faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of GHG emissions resulting from a project" (Section 15064(a))
- Providing a lead agency with the discretion to determine whether to use quantitative or qualitative analysis or performance standards to determine the significance of GHG emissions resulting from a particular project (Section 15064.4(a))
- Requiring a lead agency to consider the following factors when assessing the significant impacts from greenhouse gas emissions on the environment:
    - The extent to which the project may increase or reduce greenhouse gas emissions as compared to the existing environmental setting.
    - Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project.
    - The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions. (Section 15064.4(b))
- Allowing lead agencies to consider feasible means of mitigating the significant effects of GHG emissions, including reductions in emissions through the implementation of project features or off-site measures, including offsets that are not otherwise required (Section 15126.4(c)).

The amended guidelines also establish two new guidance questions regarding GHG emissions in the Environmental Checklist set forth in CEQA Guidelines Appendix G:

- Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?
- Would the project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

The adopted amendments do not establish a GHG emission threshold, and instead allow a lead agency to develop, adopt, and apply its own thresholds of significance or those developed by other agencies or experts.[2] The Natural Resources Agency also acknowledges that a lead agency may consider compliance with regulations or requirements implementing AB 32 in determining the significance of a project's GHG emissions.[3]

Executive Order S-14-08. On November 17, 2008, Governor Schwarzenegger issued Executive Order S-14-08. This Executive Order focuses on the contribution of renewable energy sources to meet the electrical needs of California while reducing the GHG emissions from the electrical sector. The governor's order requires that all retail suppliers of electricity in California serve 33% of their load with renewable energy by 2020. Furthermore, the order directs state agencies to take appropriate actions to facilitate reaching this target. The Resources Agency, through collaboration with the CEC and California Department of Fish and Wildlife (CDFW), is directed to lead this effort. Pursuant to a Memorandum of Understanding between the CEC and CDFW creating the Renewable Energy Action Team, these agencies will create a "one-stop" process for permitting renewable energy power plants.

SB X1 2. On April 12, 2011, Governor Jerry Brown signed SB X1 2 in the First Extraordinary Session, which would expand the RPS by establishing a goal of 20% of the total electricity sold to retail customers in California per year, by December 31, 2013, and 33% by December 31, 2020, and in subsequent years. Under the bill, a renewable electrical generation facility is one that uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation of 30 megawatts or less, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current and that meets other specified requirements with respect to its location. In addition to the retail sellers covered by SB 107, SB X1 2 adds local publicly owned electric utilities to the RPS. By January 1, 2012, the CPUC is required to establish the quantity of electricity products from eligible renewable energy resources to be procured by retail sellers in order to achieve targets of 20% by December 31, 2013; 25% by December 31, 2016; and 33% by December 31, 2020. The statute also requires that the governing boards for local

[2] "The CEQA Guidelines do not establish thresholds of significance for other potential environmental impacts, and SB 97 did not authorize the development of a statement threshold as part of this CEQA Guidelines update. Rather, the proposed amendments recognize a lead agency's existing authority to develop, adopt and apply their own thresholds of significance or those developed by other agencies or experts" (California Natural Resources Agency 2009, p. 84).

[3] "A project's compliance with regulations or requirements implementing AB 32 or other laws and policies is not irrelevant. Section 15064.4(b)(3) would allow a lead agency to consider compliance with requirements and regulations in the determination of significance of a project's greenhouse gas emissions" (California Natural Resources Agency 2009, p. 100).

publicly owned electric utilities establish the same targets, and the governing boards would be responsible for ensuring compliance with these targets. The CPUC will be responsible for enforcement of the RPS for retail sellers, while the CEC and CARB will enforce the requirements for local publicly owned electric utilities.

2.5.3 County of San Diego

County of San Diego Climate Action Plan

The County of San Diego Climate Action Plan (CAP), adopted June 2012, documents the County's long-term strategy for addressing the adverse effects of climate change (County of San Diego 2012a). The CAP outlines various mechanisms and measures for reducing GHG emissions at the County level, including those specific to water conservation, waste reduction, land use, and adaptation strategies to fulfill the obligations delineated in AB 32. The CAP includes County goals previously established under the County General Plan and County Strategic Energy Plan, and establishes reduction targets at 15% below 2005 levels by 2020 and 49% below 2005 levels by 2035. The CAP builds on long-standing efforts, including state initiatives, County staff recommendations, and regional planning strategies to enhance environmental sustainability and carbon neutrality, particularly unincorporated segments of the County. As shown in Table 3, GHG Sources in San Diego County, unincorporated San Diego County emitted approximately 4.51 MMT CO_2E of GHGs in 2005. Similar to the statewide emissions inventory, the transportation sector was the largest contributor to GHG emissions in 2005 accounting for approximately 59% of total GHG emissions (more than 2.6 MMT CO_2E). Emission sources and emission estimates by sector are shown in Table 3.

Table 3
GHG Sources in San Diego County

Source Category	Annual GHG Emissions (MMT CO_2E)	% of Total
Transportation	2.64	59%
Agriculture	0.19	4%
Solid Waste	0.14	3%
Wastewater	0.05	1%
Potable Water	0.24	5%
Other	0.13	3%
Energy	1.12	25%
Totals	**4.51**	**100.00%**

Source: County of San Diego 2012a.

San Diego County Greenhouse Gas Inventory

The University of San Diego School of Law's Energy Policy Initiative Center (University of San Diego 2008) prepared a regional GHG inventory. This San Diego County Greenhouse Gas Inventory (SDCGHGI) consisted of a detailed inventory that took into account the unique characteristics of the region in calculating emissions. The study found that emissions of GHGs must be reduced by 33% below business as usual in order for San Diego County to achieve 1990 emission levels by 2020.

3.0 SIGNIFICANCE CRITERIA AND ANALYSIS METHODOLOGIES

3.1 State of California

The State of California has developed guidelines to address the significance of climate change impacts based on Appendix G of the CEQA Guidelines, which provides guidance that a project would have a significant environmental impact if it would:

1. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment
2. Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

Neither the State of California nor the San Diego County Air Pollution Control District (SDAPCD) has adopted emission-based thresholds for GHG emissions under CEQA. OPR's Technical Advisory titled *CEQA and Climate Change: Addressing Climate Change through California Environmental Quality Act (CEQA) Review* states that "public agencies are encouraged but not required to adopt thresholds of significance for environmental impacts. Even in the absence of clearly defined thresholds for GHG emissions, the law requires that such emissions from CEQA projects must be disclosed and mitigated to the extent feasible whenever the lead agency determines that the project contributes to a significant, cumulative climate change impact" (OPR 2008, p. 4). Furthermore, the advisory document indicates in the third bullet item on page 6 that "in the absence of regulatory standards for GHG emissions or other scientific data to clearly define what constitutes a 'significant impact,' individual lead agencies may undertake a project-by-project analysis, consistent with available guidance and current CEQA practice."

3.2 County Climate Change Analysis Screening Criteria

As indicated in the County's *DPLU Interim Guidance for Greenhouse Gas Analysis – Industrial Use/East Otay Mesa Specific Plan* (County of San Diego 2010a), any commercial or light industrial use that exceeds a screening criteria threshold of 900 metric tons of carbon dioxide equivalent (CO_2E)[4] per year would be required to prepare a Climate Change analysis. The 900-metric-ton threshold for determining when a more detailed climate change analysis is required was chosen based on available guidance from the California Air Pollution Control Officers

[4] The CO_2 equivalent for a gas is derived by multiplying the mass of the gas by the associated GWP, such that metric tons CO_2E = (metric tons of a GHG) x (GWP of the GHG). For example, the GWP for CH_4 is 21. This means that emissions of 1 metric ton of methane are equivalent to emissions of 21 metric tons of CO_2.

Association (CAPCOA) white paper on addressing GHG emissions under CEQA (CAPCOA 2008). The CAPCOA white paper references a 900-metric-ton guideline as a conservative threshold for requiring further analysis and mitigation. Table 4, Project Size Thresholds, shows the general sizes of projects that would generally require a more detailed climate change analysis based on the 900-metric-ton threshold.

Table 4
Project Size Thresholds

Project Type	Size
Single-Family Residential	50 units
Apartments / Condominiums	70 units
General Commercial Office Space	35,000 square feet
Retail Space	11,000 square feet
Supermarket / Grocery Space	6,300 square feet

Source: County of San Diego 2010a

If a project meets the above size criteria or does not exceed 900 metric tons CO_2e per year, then the climate change impacts would be considered less than significant.

For project's whose emissions exceed the screening threshold, the project needs to demonstrate that it would reduce overall GHG emissions to 33% below business as usual. The 33% reductions should be an overall reduction for operational emissions, construction-related emissions, and vehicular-related GHG emissions (County of San Diego 2010a). Construction emissions are to be annualized over a project life of 30 years and added to the operational emissions. Business as usual is defined as the emissions that would be generated prior to AB 32 related emission restrictions.

This approach ensures that new development with the potential to make cumulatively considerable contributions to climate change will incorporate appropriate mitigation measures and not result in a conflict with the goals of AB 32.

In addition to the County of San Diego Interim Guidance, the proposed project was analyzed under the updated County of San Diego *Guidelines for Determining Significance – Climate Change* which includes a 2,500 metric ton CO_2E per year "bright line" screening threshold. The County developed screening criteria for a range of project types and sizes to identify smaller projects that would have less-than-cumulatively considerable GHG emissions effects (Table 5). If a proposed project is the same type and equal to, or smaller than the project size listed, it is presumed that the operational GHG emissions for that project would not exceed 2,500 MT CO_2E per year, and there would be a less-than-cumulatively considerable impact

(County of San Diego 2012b). Use of the 2,500 metric ton "bright line" threshold only applies to a project's operational emissions and does not require construction emissions be annualized and added to the operational emissions.

Table 5
Screening Criteria

Project/Plan Type	Screening Threshold
Single-Family Housing	86 dwelling units
Low-Rise Apartment Housing	121 dwelling units
Mid-Rise Apartment Housing	136 dwelling units
High-Rise Apartment Housing	144 dwelling units
Condominium or Townhouse Housing	120 dwelling units
Congregate Care (Assisted Living) Facility	239 dwelling units
Elementary or Middle School	91,000 square feet
High School	103,000 square feet
University/College (four years)	336 students
Library	81,000 square feet
Restaurant	12,000 square feet
Hotel	106 rooms
Free-Standing Retail Store	31,000 square feet
Shopping Center	33,000 square feet
Convenience Market (24-hour)	2,000 square feet
Office Building	61,000 square feet
Office Park	56,000 square feet
Hospital	47,000 square feet
Warehouse	141,000 square feet
Light Industrial Facility	74,000 square feet

Source: County of San Diego 2012b

Notes: Land use types outlined in the table above are intended to correlate with those presented in the Institute of Transportation Engineers' Trip Generation Manual (8th Edition). Proposed project land use types will be compared with the land use types included in the screening table above to determine applicability. Low-rise apartments have one or two stories, such as garden apartments. Mid-rise apartments have between 3 and 10 stories. High-rise apartments are normally rental units in buildings with more than 10 stories. A shopping center includes a group of commercial establishments that is developed as a unit. A free-standing retail store (also known as "free-standing discount store") is a free-standing store with off-street parking that offers a wide range of customer services and would typically be open 7 days per week with relatively long hours. Office parks are normally in a suburban context and contain office buildings and support services arranged in a campus-type setting, whereas an office building would accommodate multiple tenants in a single structure. Light industrial facilities would typically involve assembly of processed or partially processed materials into products and would have an energy demand that is not substantially higher than office buildings of the same size and scale. Light industrial facilities would not typically generate dust, other air pollutants, light, or noise that it perceptible beyond the boundary of the subject property.

It should be noted that the updated *Guidelines for Determining Significance – Climate Change* guidelines have not been formally approved; therefore, analysis relating to these guidelines is provided for informational purposes.

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4.0 PROJECT IMPACT ANALYSIS

The significance criteria described in Section 3.0 were used to evaluate impacts associated with the construction and operation of the proposed project.

4.1 Significance of Impacts Prior to Mitigation

The project proponent has stated that the project is scheduled to commence construction in July 2014 and would be completed within approximately 12 months. Construction phases and associated durations were provided by the project proponent and include the following subphases:

- Mobilization (1 week)
- Site clearing, grubbing, and grinding (10 weeks)
- Grading and road construction (9 days)
- Underground electric/communications cable installation (17 weeks)
- Tracker installation (33 weeks)
- Substation construction (6 weeks)
- Operations and maintenance building construction (10 weeks)

Project completion is anticipated in late June 2015. Details of the construction schedule including heavy construction equipment hours of operation and duration, worker trips, and equipment mix are included in Appendix A.

The equipment mix anticipated for construction activity was based on information provided by the applicant and best engineering judgment. The equipment mix is meant to represent a reasonably conservative estimate of construction activity.

Operation of the project would involve in-place tracker washing that would occur every 6 to 8 weeks by mobile crews who will also be available for dispatch whenever on-site repairs or other maintenance are required. Tracker washing will be undertaken using a tanker truck and smaller "satellite" tracker washing trucks. On-site water storage tanks may be installed to facilitate washing. A 4-acre O&M annex site would be located adjacent to the substation site and would house operations and maintenance supplies, telecommunications equipment and rest facilities all within a single-story building.

4.2 Construction GHG Emissions

GHG emissions would be associated with the construction phase of the proposed project (solar farm) through use of construction equipment and vehicle trips. Emissions of CO_2 from off-road equipment used the construction phase of the project were estimated using emission rates derived using CARB's offroad equipment model, OFFROAD2007, available online (http://www.arb.ca.gov/msei/offroad/offroad.htm). Emissions of all pollutants from on-road trucks and passenger vehicles were estimated using emission factors derived using CARB's motor vehicle emission inventory program, EMFAC2011, available online (http://www.arb.ca.gov/msei/modeling.htm).

Vehicle miles traveled (VMT) for paved road travel by workers are based on a 35-mile commute distance from Alpine, El Centro, and surrounding areas[5], and equipment delivery truck VMT are based on 85-mile one-way routes from Rancho Bernardo where equipment deliveries would originate.[6] Based on off-site water demand, approximately 15 water trucks per day would be required for water importation during the peak water demand period of construction.

To provide the concrete for the substation, O&M building, and tracker foundations for both the Rugged and Tierra del Sol solar projects, a temporary concrete batch plant would be sited on the project site. The CO_2 emissions associated with material hauling trucks used to bring concrete ingredients (e.g., sand, cement, and cement supplement) to the project site were estimated using emission factors derived from EMFAC2011 as described above. Process rates for concrete and the ingredients, truck travel distances, and related information are found in Appendix A. Aggregate would be provided from locations on the Rugged project site. The batch plant would be powered by two diesel-powered generators, each nominally rated at 85 horsepower. The CO_2 emissions from the two generators were calculated using emission and load factors obtained from the *CalEEMod User's Guide* (Environ 2011) assuming the use of typical off-road engines that would operate in 2014.

The results were adjusted to estimate CH_4 and N_2O emissions in addition to CO_2. The CO_2 emissions from off-road equipment and vehicles and delivery trucks, which are assumed to be diesel fueled, were adjusted by a factor derived from the relative CO_2, CH_4, and N_2O for diesel fuel as reported in the California Climate Action Registry's (CCAR) General Reporting Protocol for transportation fuels and the global warming potential for each GHG

[5] The average of the distances from Alpine and El Centro is 46 miles. This distance was reduced by 25% to reflect employee commute trips from local housing (temporary or permanent) for an average employee commute distance of 35 miles.

[6] VMT = one-way miles × 2 × number of trips

(CCAR 2009). The CO_2 emissions associated with construction worker trips were multiplied by a factor based on the assumption that CO_2 represents 95% of the CO_2E emissions associated with passenger vehicles (EPA 2005). The results were then converted from annual tons per year to metric tons per year. Table 6, Estimated Construction GHG Emissions, shows the estimated annual GHG construction emissions associated with the proposed project, as well as the 30-year annualized construction emissions.

Table 6
Estimated Construction GHG Emissions (metric tons/year)

Construction Year	CO_2E Emissions
2014	2,418.40
2015	1,654.04
30-year annualized emissions	135.75

Source: OFFROAD2007, EMFAC 2011. See Appendix A for complete results.

4.3 Operational GHG Emissions

The following section discusses the calculations of GHG emissions resulting from the primary sources of GHGs associated with the operation of the proposed project. Operation of the project would produce GHG emissions associated with employee vehicles, personnel transport vehicles, washing vehicles (heavy-duty diesel water trucks), satellite washing vehicles (light-duty diesel trucks), service trucks, emergency generators, electricity consumption, and water supply during operation and maintenance for the solar project. GHG emissions from natural gas use and creation of solid waste are not associated with the proposed project.

4.3.1 Motor Vehicles

The proposed project would impact air quality through the vehicular traffic generated by operations and maintenance vehicles including employee vehicles, on-site personnel transport vehicles, washing vehicles and a service truck. Employee trip distances for operation and maintenance of the solar farm were conservatively estimated for the model inputs as originating in Alpine, El Centro, and surrounding areas (approximately 35 miles one-way as discussed in Section 4.2). All other operation and maintenance vehicles were assumed to be staged on-site. For the purposes of modeling, it was assumed operation and maintenance vehicles would conduct approximately 10 miles per day of maintenance activities per vehicle.

Annual CO_2 emissions from motor vehicle trips associated with the proposed project were quantified using EMFAC2011. The CO_2 emissions from diesel-fueled washing vehicles were

adjusted by a factor derived from the relative CO_2, CH_4, and N_2O for diesel fuel as reported in the CCAR's General Reporting Protocol for transportation fuels and the global warming potential for each GHG (CCAR 2009). CH_4 and N_2O emissions from all other motor vehicles during operation of the project were accounted for by multiplying the estimated CO_2 emissions by a factor based on the assumption that CO_2 represents 95% of the CO_2E emissions associated with passenger vehicles (EPA 2005). As summarized in Table 7, Estimated Operational GHG Emissions, total annual operational GHG emissions from motor vehicles would be 162.92 metric tons CO_2E per year. Additional detail regarding these calculations can be found in Appendix A.

4.3.2 Diesel Generators

Operational emissions would result from intermittent use of two 680 kW diesel-powered emergency generators for maintenance and testing purposes. Each generator would be run for testing and maintenance approximately one hour each week for a total of 50 hours per year. Generator engines would meet the EPA standards for Tier 2 engines as required by the CARB Airborne Toxic Control Measure for new and in-use stationary diesel engines. The CO_2 emission factor was obtained from Section 3.4 (Large Stationary Diesel and All Stationary Dual-fuel Engines) of the EPA's *Compilation of Air Pollutant Emission Factors* (EPA 1996). The CO_2 emissions from diesel combustion were adjusted by a factor derived from the relative CO_2, CH_4, and N_2O for diesel fuel as reported in the CCAR's *General Reporting Protocol* (CCAR 2009) for stationary combustion fuels and their GWPs. The estimated emissions from the emergency generator engines are shown in Table 7. Refer to Appendix A for additional information.

4.3.3 Gas-Insulated Switchgear

At the present time, specific substation devices, such as transformers and circuit breakers, have not been identified; however, the substation may include gas-insulated switchgear (e.g., circuit breakers) that use SF_6, which is a GHG often associated with high-voltage switching devices. If the substation circuit breakers contain SF_6, they would potentially leak small amounts of SF_6 to the atmosphere. New circuit breakers are reported to have a potential upper-bound leakage rate of 0.5% (Blackman n.d.). For the 138-kV substation, the estimated total capacity of the circuit breakers could be up to 75 pounds (Mehl, pers. comm. 2013). SF_6 has a global warming potential of 23,900 using CO_2 at a reference value of 1 (UNFCCC 2012). Thus, the annual SF_6 emissions, expressed in units of CO_2E), would be calculated as follows:

$$75 \text{ pounds} \times 0.5\% = 0.375 \text{ pounds } SF_6/\text{year}$$

$$0.375 \text{ pounds } SF_6/\text{year} \times 23{,}900 \text{ (GWP)} \div 2204.623 \text{ pounds/metric ton} = 4.07 \text{ metric tons } CO_2E/\text{year}$$

4.3.4 Electrical Generation

Annual electricity use for the proposed O&M annex was based upon estimated generation rates for land uses in the SDG&E service area (see Appendix A). In addition, the trackers (e.g., control units, motors) and other devices (e.g., inverters, field communications) common to each building block of trackers would use electricity to be provided by SDG&E (see Appendix A). The project proponent provided the estimated ratings of the devices and their operating schedule. Annual usage was determined depending on the period that devices would operate (e.g., daylight hours only). The generation of electricity through combustion of fossil fuels typically results in emissions of CO_2 and to a smaller extent CH_4 and N_2O. Annual electricity emissions were estimated using the reported CO_2 emissions per megawatt-hour for SDG&E in 2008 (SDG&E 2010), which would provide electricity for the project, adjusted to reflect 33% renewable energy in 2020 as calculated in the following equations:

$$\text{2008 } CO_2 \text{ Factor (lb/MWh)} \div (1 - \text{2009 \% Renewables}^{7}) \times (1 - \text{2020 \% Renewables}) = \text{2020 } CO_2 \text{ Factor (lb/MWh)}$$

$$739.05 \text{ lb/MWh} \div (1 - 0.10) \times (1 - 0.33) = 550.18 \text{ lb/MWh}$$

The contributions of CH_4 and N_2O for powerplants in California were obtained from the CCAR's General Reporting Protocol (CCAR 2009), which were adjusted for their GWPs. The proposed project would consume an estimated 1,448,103 kilowatt-hours per year, generating approximately 363.45 metric tons CO_2E annually as shown in Table 7 (see Appendix A for complete results).

4.3.5 Water Supply and Wastewater

Water supplied to the proposed project would be obtained from an on-site well, which would require the use of electricity. Annual water use for the proposed project for the O&M annex and washing the CPV trackers was based upon information provided by the project proponent and would result in a water consumption rate of approximately 8.70 acre-feet per year. The estimated electrical usage associated with water supply was obtained from a CEC report on electricity associated with water supply in California (CEC 2006). An electricity usage factor representing supply and conveyance of locally supplied water in Northern California was assumed to be applicable (the factor for Southern California water assumes that water would be provided from the State Water Project, which is not the case for this project). GHG emissions from electrical generation were calculated as described in Section

[7] A Power Content Label showing the mix of power sources in 2008 for SDG&E was not available. Thus, the Power Content Label for 2009 was used (SDG&E n.d.). The 2009 Power Content Label indicated that 10% of SDG&E's electricity sales were generated by renewable energy sources, such as biomass, wind, and solar.

4.3.3. As shown in Table 7, annual water use would result in approximately 4.62 metric tons CO_2E per year (see Appendix A).

GHG emissions associated with wastewater treatment using a septic tank were estimated based on data provided in the *County of San Diego Design Manual for Onsite Wastewater Treatment Systems* (County of San Diego 2010b) and a CH_4 emission factor derived from the *CalEEMod User's Guide* (Environ 2011). Estimated annual wastewater treatment would result in approximately 0.38 metric tons CO_2E per year (see Appendix A).

4.3.6 Summary of GHG Emissions

As shown in Table 7, total annual GHG emissions from construction and operation of the proposed project would be approximately 722 metric tons CO_2E per year.

Table 7
Estimated Operational GHG Emissions (metric tons/year)

Source	CO_2E Emissions
Motor Vehicles	162.92
Emergency Generators	50.97
Gas-Insulated Switchgear	4.07
Electrical Generation	363.45
Water Supply	4.62
Wastewater	0.38
30-year annualized construction emissions	135.75
Total	**722.16**

Source: EMFAC2011; CCAR 2009; EPA 2005; CEC 2006. See Appendix A for complete results.

Because the total project GHG emissions would not exceed the County's screening threshold of 900 metric tons CO_2E, the impact would be less than significant. Additionally, the project's operational emissions would not exceed the updated County screening threshold of 2,500 metric tons CO_2E per year as delineated in the County's *Guidelines for Determining Significant – Climate Change* (County of San Diego 2012b).

4.4 Project Design Features and Mitigation Measures

No mitigation measures would be required.

4.5 GHG Emission Benefits

In keeping with the renewable energy target under the Scoping Plan and as required by SB X1 2, the proposed project would provide a source of renewable energy to achieve the Renewable Portfolio Standard of 33% by 2020. Renewable energy, in turn, potentially offsets GHG emissions generated by fossil-fuel power plants. Based on estimates by the project proponent, the project would generate 2,083 kilowatt-hours alternating current annually per installed kilowatt (based on the direct current capacity of the CPV trackers). This factor reflects the available daylight hours, conversion of direct current to alternating current, and various system losses. Using the installed CPV capacity of 105 MW (105,000 kW) direct current, the project is anticipated to generate 219,204,505 kWh per year. A GHG factor for fossil-fuel-generated electricity was developed based on reported CO_2 emissions per kilowatt-hour for SDG&E in 2008 (SDG&E 2010) and an adjustment to reflect electricity from renewable energy, large hydroelectric, and nuclear sources in 2009 (SDG&E n.d.), which do not generate GHG emissions. The CO_2 factor for fossil-fuel-generated electricity would be 1.071 pounds CO_2 per kilowatt-hour as calculated in the following equations:

$$\text{2008 } CO_2 \text{ Factor (lb/kWh)} \div (1 - \text{2009 \% Renewables, Large Hydroelectric, Nuclear}[8]) = \text{Fossil Fuel } CO_2 \text{ Factor (lb/kWh)}$$

$$0.739 \text{ lb/kWh} \div (1 - (0.10 + 0.03 + 0.18)) = 1.071 \text{ lb/kWh}$$

The contributions of CH_4 and N_2O for powerplants in California were obtained from the CCAR's *General Reporting Protocol* (CCAR 2009), which were adjusted for their GWPs. Thus, the proposed project would provide a potential reduction of 106,990 metric tons CO_2E per year if the electricity generated by the proposed project were to be used instead of electricity generated by fossil-fuel sources. Additional detail regarding these calculations can be found in Appendix A. After accounting for the annualized construction and annual operational emissions of 722 metric tons CO_2E per year, the net reduction in GHG emissions would be 106,268 metric tons CO_2E per year. This reduction is not considered in the significance determination of the proposed project's GHG emissions but is provided for disclosure purposes.

[8] A Power Content Label showing the mix of power sources in 2008 for SDG&E was not available. Thus, the Power Content Label for 2009 was used (SDG&E n.d.). The 2009 Power Content Label indicated that 10%, 3%, and 18% of SDG&E's electricity sales were generated by renewable, large hydroelectric, and nuclear energy sources, respectively.

4.6 Conclusion

The proposed project's potential effect on global climate change was evaluated, and GHG emissions were estimated. The project is estimated to result in construction and operational GHG emissions of approximately 722 metric tons CO_2E. As such, the proposed project would not exceed the 900-metric-ton threshold as described in the *DPLU Interim Guidance for Greenhouse Gas Analysis – Industrial Use/East Otay Mesa Specific Plan*, and it is therefore not likely to impede the implementation of AB 32. In fact, the proposed project would provide more renewable energy in keeping with Measure No. E-3 of the Climate Change Scoping Plan, which calls for a 33% renewables mix by 2020. Additionally, the project's operational emissions of 584 metric tons CO_2E would not exceed the updated County screening threshold of 2,500 metric tons CO_2E per year as delineated in the County's *Guidelines for Determining Significant – Climate Change* (County of San Diego 2012b). The project would therefore have a less-than-significant impact on climate change.

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APPENDIX A

Greenhouse Gas Emission Calculations

CONSTRUCTION

Rugged Solar Farm Project
Emissions Summary

CONSTRUCTION

CO2

Activity	2014 Emissions (tons/yr)		2015 Emissions (tons/yr)
Offroad Emissions			
Mobilization and Clean Up	2.35		—
Site Clearing/Grubbing/Grinding	112.02		—
Grading/Road Construction	34.41		—
Underground Electric/Communications Cable Installation	200.12		56.44
Tracker Installation	613.99		512.59
Substation Construction	35.70		—
O&M Building Construction	20.79		22.23
OFFROAD ANNUAL TOTAL	**1,019.37**		**591.26**
Onroad Emissions	**1,544.18**		**1,097.20**
Concrete Batch Plant	**69.37**		**104.34**
ANNUAL EMISSIONS	**2,632.91**		**1,792.80**

Rugged Solar Farm Project
Off Road Equipment Emissions

2014 EMISSIONS

Equipment	# of Units	Hrs/Day	Duration (Days)	Category	2014 Emissions (lb/day)							2014 Emissions (tons/year)						
					ROG	CO	NOx	SOx	PM10	PM2.5	CO2	ROG	CO	NOx	SOx	PM10	PM2.5	CO2
Mobilization and Clean-Up																		
Tractor/Loader/Backhoes	5	2	7	Off-Road	0.35	3.75	4.22	0.01	0.29	0.26	671.29	0.00	0.01	0.01	0.00	0.00	0.00	2.35
				PHASE SUBTOTAL	**0.35**	**3.75**	**4.22**	**0.01**	**0.29**	**0.26**	**671.29**	**0.00**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**	**2.35**
Site Clearing/Grubbing/Grinding																		
Crawler Tractors	2	8	60	Off-Road	1.35	9.21	19.46	0.02	0.94	0.86	1822.00	0.04	0.28	0.58	0.00	0.03	0.03	54.66
Excavators	2	8	60	Off-Road	0.59	8.46	8.72	0.02	0.38	0.35	1912.02	0.02	0.25	0.26	0.00	0.01	0.01	57.36
				PHASE SUBTOTAL	**1.94**	**17.67**	**28.18**	**0.04**	**1.32**	**1.21**	**3734.02**	**0.06**	**0.53**	**0.85**	**0.00**	**0.04**	**0.04**	**112.02**
Grading/Road Construction																		
Tractor/Loader/Backhoes	3	8	9	Off-Road	0.85	9.00	10.14	0.02	0.69	0.63	1611.10	0.00	0.04	0.05	0.00	0.00	0.00	7.25
Crawler Tractors	2	8	9	Off-Road	1.35	9.21	19.46	0.02	0.94	0.86	1822.00	0.01	0.04	0.09	0.00	0.00	0.00	8.20
Scrapers	2	8	9	Off-Road	2.51	15.85	38.87	0.04	1.61	1.48	4212.75	0.01	0.07	0.17	0.00	0.01	0.01	18.96
				PHASE SUBTOTAL	**4.70**	**34.06**	**68.47**	**0.08**	**3.24**	**2.98**	**7645.85**	**0.02**	**0.15**	**0.31**	**0.00**	**0.01**	**0.01**	**34.41**
Underground Electric/Communications Cable Installation																		
Bore/Drill Rigs	1	8	78	Off-Road	0.36	3.98	6.57	0.01	0.25	0.23	1293.28	0.01	0.16	0.26	0.00	0.01	0.01	50.44
Cranes	1	8	78	Off-Road	0.60	3.54	8.42	0.01	0.40	0.37	999.10	0.02	0.14	0.33	0.00	0.02	0.01	38.96
Excavators	1	8	78	Off-Road	0.30	4.23	4.36	0.01	0.19	0.17	956.01	0.01	0.16	0.17	0.00	0.01	0.01	37.28
Forklifts	1	8	78	Off-Road	0.21	1.77	2.13	0.00	0.16	0.15	434.78	0.01	0.07	0.08	0.00	0.01	0.01	16.96
Crawler Tractors	1	8	78	Off-Road	0.67	4.61	9.73	0.01	0.47	0.43	911.00	0.03	0.18	0.38	0.00	0.02	0.02	35.53
Tractor/Loader/Backhoes	1	8	78	Off-Road	0.28	3.00	3.38	0.01	0.23	0.21	537.03	0.01	0.12	0.13	0.00	0.01	0.01	20.94
				PHASE SUBTOTAL	**2.42**	**21.12**	**34.59**	**0.06**	**1.70**	**1.56**	**5131.20**	**0.09**	**0.82**	**1.35**	**0.00**	**0.07**	**0.06**	**200.12**
Tracker Installation																		
Skid Steer Loader	1	6	109	Off-Road	0.09	1.36	1.30	0.00	0.08	0.07	181.50	0.01	0.07	0.07	0.00	0.00	0.00	9.89
Bore/Drill Rigs	4	8	109	Off-Road	1.45	15.92	26.28	0.05	0.99	0.91	5173.12	0.08	0.87	1.43	0.00	0.05	0.05	281.94
Cranes	2	8	109	Off-Road	1.20	7.08	16.84	0.02	0.80	0.74	1998.19	0.07	0.39	0.92	0.00	0.04	0.04	108.90
Module Suction Lifters	6	8	109	Off-Road	1.26	10.61	12.79	0.03	0.98	0.90	2608.65	0.07	0.58	0.70	0.00	0.05	0.05	142.17
Forklifts	3	8	109	Off-Road	0.63	5.31	6.40	0.01	0.49	0.45	1304.33	0.03	0.29	0.35	0.00	0.03	0.02	71.09
				PHASE SUBTOTAL	**4.64**	**40.27**	**63.60**	**0.12**	**3.34**	**3.07**	**11265.79**	**0.25**	**2.19**	**3.47**	**0.01**	**0.18**	**0.17**	**613.99**
Substation Construction																		
Cranes	1	6	35	Off-Road	0.45	2.66	6.31	0.01	0.30	0.28	749.32	0.01	0.05	0.11	0.00	0.01	0.00	13.11
Aerial Lifts	1	4	35	Off-Road	0.03	0.74	0.62	0.00	0.03	0.03	138.76	0.00	0.01	0.01	0.00	0.00	0.00	2.43
Excavators	1	6	35	Off-Road	0.22	3.17	3.27	0.01	0.14	0.13	717.01	0.00	0.06	0.06	0.00	0.00	0.00	12.55
Forklifts	1	8	35	Off-Road	0.21	1.77	2.13	0.00	0.16	0.15	434.78	0.00	0.03	0.04	0.00	0.00	0.00	7.61
				PHASE SUBTOTAL	**0.91**	**8.34**	**12.33**	**0.02**	**0.63**	**0.58**	**2,039.87**	**0.02**	**0.15**	**0.22**	**0.00**	**0.01**	**0.01**	**35.70**
O&M Building Construction																		
Cranes	1	8	29	Off-Road	0.60	3.54	8.42	0.01	0.40	0.37	999.10	0.01	0.05	0.12	0.00	0.01	0.01	14.49
Forklifts	1	8	29	Off-Road	0.21	1.77	2.13	0.00	0.16	0.15	434.78	0.00	0.03	0.03	0.00	0.00	0.00	6.30
				PHASE SUBTOTAL	**0.81**	**5.31**	**10.55**	**0.02**	**0.56**	**0.52**	**1433.87**	**0.01**	**0.08**	**0.15**	**0.00**	**0.01**	**0.01**	**20.79**
											2014 TOTALS	**0.46**	**3.94**	**6.35**	**0.01**	**0.32**	**0.30**	**1019.37**

Rugged Solar Farm Project
Off Road Equipment Emissions

2015 EMISSIONS

Equipment	# of Units	Hrs/Day	Duration (Days)	Category	2015 Emissions (lb/day)							2015 Emissions (tons/year)						
					ROG	CO	NOx	SOx	PM10	PM2.5	CO2	ROG	CO	NOx	SOx	PM10	PM2.5	CO2
Underground Electric/Communications Cable Installation																		
Bore/Drill Rigs	1	8	22	Off-Road	0.36	3.97	6.35	0.01	0.24	0.22	1293.25	0.00	0.04	0.07	0.00	0.00	0.00	14.23
Cranes	1	8	22	Off-Road	0.59	3.42	8.24	0.01	0.39	0.36	999.10	0.01	0.04	0.09	0.00	0.00	0.00	10.99
Excavators	1	8	22	Off-Road	0.29	4.19	4.20	0.01	0.18	0.17	956.01	0.00	0.05	0.05	0.00	0.00	0.00	10.52
Forklifts	1	8	22	Off-Road	0.20	1.76	2.05	0.00	0.16	0.14	434.78	0.00	0.02	0.02	0.00	0.00	0.00	4.78
Crawler Tractors	1	8	22	Off-Road	0.67	4.51	9.61	0.01	0.47	0.43	911.00	0.01	0.05	0.11	0.00	0.01	0.00	10.02
Tractor/Loader/Backhoes	1	8	22	Off-Road	0.28	2.98	3.29	0.01	0.22	0.20	537.03	0.00	0.03	0.04	0.00	0.00	0.00	5.91
				PHASE SUBTOTAL	**2.40**	**20.84**	**33.74**	**0.06**	**1.66**	**1.53**	**5131.16**	**0.03**	**0.23**	**0.37**	**0.00**	**0.02**	**0.02**	**56.44**
Tracker Installation																		
Skid Steer Loader	1	6	91	Off-Road	0.09	1.33	1.24	0.00	0.07	0.07	181.50	0.00	0.06	0.06	0.00	0.00	0.00	8.26
Bore/Drill Rigs	4	8	91	Off-Road	1.45	15.89	25.41	0.05	0.96	0.88	5173.00	0.07	0.72	1.16	0.00	0.04	0.04	235.37
Cranes	2	8	91	Off-Road	1.17	6.85	16.47	0.02	0.79	0.72	1998.19	0.05	0.31	0.75	0.00	0.04	0.03	90.92
Module Suction Lifters	6	8	91	Off-Road	1.25	10.56	12.29	0.03	0.96	0.88	2608.66	0.06	0.48	0.56	0.00	0.04	0.04	118.69
Forklifts	3	8	91	Off-Road	0.61	5.27	6.15	0.01	0.47	0.43	1304.33	0.03	0.24	0.28	0.00	0.02	0.02	59.35
				PHASE SUBTOTAL	**4.58**	**39.90**	**61.57**	**0.12**	**3.25**	**2.99**	**11265.67**	**0.21**	**1.82**	**2.80**	**0.01**	**0.15**	**0.14**	**512.59**
O&M Building Construction																		
Cranes	1	8	31	Off-Road	0.59	3.42	8.24	0.01	0.39	0.36	999.10	0.01	0.05	0.13	0.00	0.01	0.01	15.49
Forklifts	1	8	31	Off-Road	0.20	1.76	2.05	0.00	0.16	0.14	434.78	0.00	0.03	0.03	0.00	0.00	0.00	6.74
				PHASE SUBTOTAL	**0.79**	**5.18**	**10.29**	**0.02**	**0.55**	**0.51**	**1433.87**	**0.01**	**0.08**	**0.16**	**0.00**	**0.01**	**0.01**	**22.23**
											2015 TOTALS	**0.25**	**2.12**	**3.33**	**0.01**	**0.17**	**0.16**	**591.26**

Source (Equipment Specs): Soitec. 2013 Tierra del Sol Solar Farm - Construction Schedule and Equipment. January 2013.

1. Assumed module suction lifter and tracker lift beam would generate comparable emissions to forklift

2. Assumed bore/drill rig would generate comparable emissions to truck-mounted auger used during pole installation

Rugged Solar Farm Project
Off-Road Equipment Emission Rates

Equipment	Category	2014 Emission Rates (lb/hr)	2015 Emission Rates (lb/hr)
		CO2	CO2
Mobilization/Site Clearing/Grubbing/Grinding/Grading			
Tractor/Loader/Backhoes	Off-Road	67.129	67.129
Crawler Tractors	Off-Road	113.875	113.875
Excavators	Off-Road	119.501	119.501
Scrapers	Off-Road	263.297	263.297
Underground Electric/Communications Cable Installation			
Bore/Drill Rigs	Off-Road	161.660	161.656
Cranes	Off-Road	124.887	124.887
Excavators	Off-Road	119.501	119.501
Forklifts	Off-Road	54.347	54.347
Crawler Tractors	Off-Road	113.875	113.875
Tractor/Loader/Backhoes	Off-Road	67.129	67.129
Tracker Installation			
Skid Steer Loaders	Off-Road	30.249	30.250
Bore/Drill Rigs	Off-Road	161.660	161.656
Cranes	Off-Road	124.887	124.887
Module Suction Lifters[1]	Off-Road	54.347	54.347
Forklifts	Off-Road	54.347	54.347
Substation Construction			
Cranes	Off-Road	124.887	124.887
Aerial Lifts	Off-Road	34.691	34.691
Excavators	Off-Road	119.501	119.501
Forklifts	Off-Road	54.347	54.347
O&M Building Construction			
Cranes	Off-Road	124.887	124.887
Forklifts	Off-Road	54.347	54.347

Source (Emission Factors): OFFROAD2011 - ROG, NOx, PM10; OFFROAD2007 - CO, SOx, CO2.
PM2.5 fraction = 92% of PM10 (http://www.arb.ca.gov/ei/speciate/pmsize_07242008.xls for "diesel vehicle exhaust")
1. Forklift emission factors were utilized as representative factors for module suction lifters

Rugged Solar Farm Project
On-Road Motor Vehicle Emissions

2014 EMISSIONS

Vehicle Type	Trips/Day	No. of Units	Distance (mi)	Duration (days)	Category	2014 Emissions (lb/day)							2014 Emissions (lbs/month)						
						ROG	CO	NOx	SOx	PM10	PM2.5	CO2	ROG	CO	NOx	SOx	PM10	PM2.5	CO2
July																			
Worker Vehicles[1]	43		35	18	On-Road	0.79	7.58	0.76	0.01	0.46	0.14	1,357.64	14.24	136.48	13.65	0.25	8.36	2.57	24,437.44
Delivery Trucks[2]	30		85	18	On-Road	2.20	10.25	50.07	0.10	1.95	1.15	10,257.58	39.53	184.47	901.23	1.76	35.07	20.66	184,636.40
Water Trucks (on-site)[3]		2	120	18	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	3.72	17.36	84.82	0.17	2.43	1.73	17,377.54
Water Trucks (off-site)[4]	30		58	18	On-Road	1.50	6.99	34.16	0.07	0.98	0.70	6,999.29	26.97	125.88	614.96	1.20	17.64	12.55	125,987.19
Dump Trucks[5]		4	60	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
August																			
Worker Vehicles[1]	130	4	35	26	On-Road	2.37	22.75	2.28	0.04	1.39	0.43	4,072.91	61.71	591.43	59.15	1.07	36.21	11.14	105,895.59
Delivery Trucks[2]	30		85	26	On-Road	2.20	10.25	50.07	0.10	1.95	1.15	10,257.58	57.10	266.46	1301.78	2.54	50.66	29.84	266,697.02
Water Trucks (on-site)[3]		2	120	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
Water Trucks (off-site)[4]	30		58	26	On-Road	1.50	6.99	34.16	0.07	0.98	0.70	6,999.29	38.96	181.82	888.27	1.74	25.48	18.13	181,981.50
Concrete Material Trucks[6]	8		55	26	On-Road	0.38	1.77	8.64	0.02	0.34	0.20	1,769.93	9.85	45.98	224.62	0.44	8.74	5.15	46,018.31
Concrete Trucks[7]	8		5	26	On-Road	0.03	0.16	0.79	0.00	0.03	0.02	160.90	0.90	4.18	20.42	0.04	0.79	0.47	4,183.48
Dump Trucks[5]		4	60	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
September																			
Worker Vehicles[1]	130	4	35	26	On-Road	2.37	22.75	2.28	0.04	1.39	0.43	4,072.91	61.71	591.43	59.15	1.07	36.21	11.14	105,895.59
Delivery Trucks[2]	30		85	26	On-Road	2.20	10.25	50.07	0.10	1.95	1.15	10,257.58	57.10	266.46	1301.78	2.54	50.66	29.84	266,697.02
Commissioning Trips[8]	6		35	26	On-Road	0.11	1.05	0.10	0.00	0.06	0.02	187.69	2.84	27.25	2.73	0.05	1.67	0.51	4,879.98
Water Trucks (on-site)[3]		2	120	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
Water Trucks (off-site)[4]	30		58	26	On-Road	1.50	6.99	34.16	0.07	0.98	0.70	6,999.29	38.96	181.82	888.27	1.74	25.48	18.13	181,981.50
Concrete Material Trucks[6]	8		55	26	On-Road	0.38	1.77	8.64	0.02	0.34	0.20	1,769.93	9.85	45.98	224.62	0.44	8.74	5.15	46,018.31
Concrete Trucks[7]	8		5	26	On-Road	0.03	0.16	0.79	0.00	0.03	0.02	160.90	0.90	4.18	20.42	0.04	0.79	0.47	4,183.48
Dump Trucks[5]		4	60	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
October																			
Worker Vehicles[1]	130	4	35	26	On-Road	2.37	22.75	2.28	0.04	1.39	0.43	4,072.91	61.71	591.43	59.15	1.07	36.21	11.14	105,895.59
Delivery Trucks[2]	30		85	26	On-Road	2.20	10.25	50.07	0.10	1.95	1.15	10,257.58	57.10	266.46	1301.78	2.54	50.66	29.84	266,697.02
Commissioning Trips[8]	6		35	26	On-Road	0.11	1.05	0.10	0.00	0.06	0.02	187.69	2.84	27.25	2.73	0.05	1.67	0.51	4,879.98
Water Trucks (on-site)[3]		2	60	26	On-Road	0.10	0.48	2.36	0.00	0.07	0.05	482.71	2.69	12.54	61.26	0.12	1.76	1.25	12,550.45
Concrete Material Trucks[6]	8		55	26	On-Road	0.38	1.77	8.64	0.02	0.34	0.20	1,769.93	9.85	45.98	224.62	0.44	8.74	5.15	46,018.31
Concrete Trucks[7]	8		5	26	On-Road	0.03	0.16	0.79	0.00	0.03	0.02	160.90	0.90	4.18	20.42	0.04	0.79	0.47	4,183.48
Dump Trucks[5]		4	60	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
November																			
Worker Vehicles[1]	130	4	35	26	On-Road	2.37	22.75	2.28	0.04	1.39	0.43	4,072.91	61.71	591.43	59.15	1.07	36.21	11.14	105,895.59
Delivery Trucks[2]	30		85	26	On-Road	2.20	10.25	50.07	0.10	1.95	1.15	10,257.58	57.10	266.46	1301.78	2.54	50.66	29.84	266,697.02
Commissioning Trips[8]	6		35	26	On-Road	0.11	1.05	0.10	0.00	0.06	0.02	187.69	2.84	27.25	2.73	0.05	1.67	0.51	4,879.98
Water Trucks (on-site)[3]		2	60	26	On-Road	0.10	0.48	2.36	0.00	0.07	0.05	482.71	2.69	12.54	61.26	0.12	1.76	1.25	12,550.45
Concrete Material Trucks[6]	8		55	26	On-Road	0.38	1.77	8.64	0.02	0.34	0.20	1,769.93	9.85	45.98	224.62	0.44	8.74	5.15	46,018.31
Concrete Trucks[7]	8		5	26	On-Road	0.03	0.16	0.79	0.00	0.03	0.02	160.90	0.90	4.18	20.42	0.04	0.79	0.47	4,183.48
Dump Trucks[5]		4	60	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
December																			
Worker Vehicles[1]	130	4	35	26	On-Road	2.37	22.75	2.28	0.04	1.39	0.43	4,072.91	61.71	591.43	59.15	1.07	36.21	11.14	105,895.59
Delivery Trucks[2]	30		85	26	On-Road	2.20	10.25	50.07	0.10	1.95	1.15	10,257.58	57.10	266.46	1301.78	2.54	50.66	29.84	266,697.02
Commissioning Trips[8]	6		35	26	On-Road	0.11	1.05	0.10	0.00	0.06	0.02	187.69	2.84	27.25	2.73	0.05	1.67	0.51	4,879.98
Water Trucks (on-site)[3]		2	60	26	On-Road	0.10	0.48	2.36	0.00	0.07	0.05	482.71	2.69	12.54	61.26	0.12	1.76	1.25	12,550.45
Concrete Material Trucks[6]	8		55	26	On-Road	0.38	1.77	8.64	0.02	0.34	0.20	1,769.93	9.85	45.98	224.62	0.44	8.74	5.15	46,018.31
Concrete Trucks[7]	8		5	26	On-Road	0.03	0.16	0.79	0.00	0.03	0.02	160.90	0.90	4.18	20.42	0.04	0.79	0.47	4,183.48
Dump Trucks[5]		4	60	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	5.37	25.08	122.52	0.24	3.51	2.50	25,100.90
												TOTAL 2014	**872.58**	**5715.33**	**12595.94**	**29.77**	**636.55**	**332.57**	**3,088,352.02**

Rugged Solar Farm Project
On-Road Motor Vehicle Emissions

2015 EMISSIONS

Vehicle Type	Trips/Day	No. of Units	Distance (mi)	Duration (days)	Category	2015 Emissions (lb/day)							2015 Emissions (lbs/month)						
						ROG	CO	NOx	SOx	PM10	PM2.5	CO2	ROG	CO	NOx	SOx	PM10	PM2.5	CO2
January																			
Worker Vehicles[1]	130		35.0	26	On-Road	2.14	20.37	2.04	0.04	1.39	0.43	4,066.21	55.75	529.65	53.09	1.06	36.10	11.08	105,721.51
Delivery Trucks[2]	30		85.0	26	On-Road	1.98	9.27	43.06	0.10	1.71	0.93	10,249.24	51.44	241.02	1119.44	2.54	44.49	24.17	266,480.31
Commissioning Trips[8]	6		35.0	26	On-Road	0.10	0.94	0.09	0.00	0.06	0.02	187.67	2.57	24.45	2.45	0.05	1.67	0.51	4,879.45
Water Trucks (on-site)[3]		2	60.0	26	On-Road	0.09	0.44	2.03	0.00	0.06	0.04	482.32	2.42	11.34	52.68	0.12	1.47	0.98	12,540.25
Concrete Material Trucks[6]	8		55.0	26	On-Road	0.34	1.60	7.43	0.02	0.30	0.16	1,768.50	8.88	41.59	193.16	0.44	7.68	4.17	45,980.92
Concrete Trucks[7]	8		5.0	26	On-Road	0.03	0.15	0.68	0.00	0.03	0.01	160.77	0.81	3.78	17.56	0.04	0.70	0.38	4,180.08
Dump Trucks[5]		4	60.0	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	4.84	22.68	105.36	0.24	2.93	1.97	25,080.50
February																			
Worker Vehicles[1]	130		35.0	26	On-Road	2.14	20.37	2.04	0.04	1.39	0.43	4,066.21	55.75	529.65	53.09	1.06	36.10	11.08	105,721.51
Delivery Trucks[2]	30		85.0	26	On-Road	1.98	9.27	43.06	0.10	1.71	0.93	10,249.24	51.44	241.02	1119.44	2.54	44.49	24.17	266,480.31
Commissioning Trips[8]	6		35.0	26	On-Road	0.10	0.94	0.09	0.00	0.06	0.02	187.67	2.57	24.45	2.45	0.05	1.67	0.51	4,879.45
Water Trucks (on-site)[3]		2	60.0	26	On-Road	0.09	0.44	2.03	0.00	0.06	0.04	482.32	2.42	11.34	52.68	0.12	1.47	0.98	12,540.25
Concrete Material Trucks[6]	8		55.0	26	On-Road	0.34	1.60	7.43	0.02	0.30	0.16	1,768.50	8.88	41.59	193.16	0.44	7.68	4.17	45,980.92
Concrete Trucks[7]	8		5.0	26	On-Road	0.03	0.15	0.68	0.00	0.03	0.01	160.77	0.81	3.78	17.56	0.04	0.70	0.38	4,180.08
Dump Trucks[5]		4	60.0	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	4.84	22.68	105.36	0.24	2.93	1.97	25,080.50
March																			
Worker Vehicles[1]	130		35.0	26	On-Road	2.14	20.37	2.04	0.04	1.39	0.43	4,066.21	55.75	529.65	53.09	1.06	36.10	11.08	105,721.51
Delivery Trucks[2]	30		85.0	26	On-Road	1.98	9.27	43.06	0.10	1.71	0.93	10,249.24	51.44	241.02	1119.44	2.54	44.49	24.17	266,480.31
Commissioning Trips[8]	6		35.0	26	On-Road	0.10	0.94	0.09	0.00	0.06	0.02	187.67	2.57	24.45	2.45	0.05	1.67	0.51	4,879.45
Water Trucks (on-site)[3]		2	60.0	26	On-Road	0.09	0.44	2.03	0.00	0.06	0.04	482.32	2.42	11.34	52.68	0.12	1.47	0.98	12,540.25
Concrete Material Trucks[6]	8		55.0	26	On-Road	0.34	1.60	7.43	0.02	0.30	0.16	1,768.50	8.88	41.59	193.16	0.44	7.68	4.17	45,980.92
Concrete Trucks[7]	8		5.0	26	On-Road	0.03	0.15	0.68	0.00	0.03	0.01	160.77	0.81	3.78	17.56	0.04	0.70	0.38	4,180.08
Dump Trucks[5]		4	60.0	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	4.84	22.68	105.36	0.24	2.93	1.97	25,080.50
April																			
Worker Vehicles[1]	158		35.0	26	On-Road	2.61	24.79	2.49	0.05	1.69	0.52	4,948.27	67.85	644.54	64.61	1.30	43.93	13.48	128,654.94
Delivery Trucks[2]	30		85.0	26	On-Road	1.98	9.27	43.06	0.10	1.71	0.93	10,249.24	51.44	241.02	1119.44	2.54	44.49	24.17	266,480.31
Commissioning Trips[8]	6		35.0	26	On-Road	0.10	0.94	0.09	0.00	0.06	0.02	187.67	2.57	24.45	2.45	0.05	1.67	0.51	4,879.45
Water Trucks (on-site)[3]		2	60.0	26	On-Road	0.09	0.44	2.03	0.00	0.06	0.04	482.32	2.42	11.34	52.68	0.12	1.47	0.98	12,540.25
Concrete Material Trucks[6]	8		55.0	26	On-Road	0.34	1.60	7.43	0.02	0.30	0.16	1,768.50	8.88	41.59	193.16	0.44	7.68	4.17	45,980.92
Concrete Trucks[7]	8		5.0	26	On-Road	0.03	0.15	0.68	0.00	0.03	0.01	160.77	0.81	3.78	17.56	0.04	0.70	0.38	4,180.08
Dump Trucks[5]		4	60.0	26	On-Road	0.21	0.96	4.71	0.01	0.14	0.10	965.42	4.84	22.68	105.36	0.24	2.93	1.97	25,080.50
May																			
Worker Vehicles[1]	28		35.0	26	On-Road	0.46	4.39	0.44	0.01	0.30	0.09	875.80	12.01	114.08	11.44	0.23	7.78	2.39	22,770.79
Delivery Trucks[2]	30		85.0	26	On-Road	1.98	9.27	43.06	0.10	1.71	0.93	10,249.24	51.44	241.02	1119.44	2.54	44.49	24.17	266,480.31
June																			
Worker Vehicles[1]	28		35.0	26	On-Road	0.46	4.39	0.44	0.01	0.30	0.09	875.80	12.01	114.08	11.44	0.23	7.78	2.39	22,770.79
												TOTAL 2015	**594.38**	**4,082.08**	**7,328.81**	**21.20**	**448.01**	**204.38**	**2,194,407.39**

1. Trips per day - assumes 30% decrease in worker trips due to carpooling
   Employee commute distance of 35 miles is assumed based on local workforce from Alpine and Boulevard
2. Materials delivery coming from Rancho Bernardo, San Diego
3. Assumes on-site water trucks will be operating at 15 mph for 8 hours per day during site preparation (120 mi/day), and 4 hours per day following site preparation activities (60 mi/day)
9. Assumes 85,416 gallons/day of water is imported from Jacumba Community Services District (approx. 11 miles) during October, November, and December for site preparation (clear and grub)
5. Assumes dump trucks will be operating at 15 mph for 4 hours per day = 60 mi/day
6. Assumes concrete material (sand, cement, etc) trucks will be travelling 55 miles
7. Assumes concrete trucks will be travelling 5 miles
8. Employee commute/commissioning distance of 35 miles is assumed based on local workforce from Alpine and Boulevard

Rugged Solar Farm Project
EMFAC2011 Modeling Results and Emission Factor Calculations

LDA

CALYR	VMT/1000	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS
2014						
2014	43614	GAS	ROG	Total	10.173	Day
2014	190	DSL	ROG	Total	0.009	Day
2014	43614	GAS	NOx	Total Ex	8.915	Day
2014	190	DSL	NOx	Total Ex	0.133	Day
2014	43614	GAS	CO	Total Ex	97.134	Day
2014	190	DSL	CO	Total Ex	0.051	Day
2014	43614	GAS	SOx	Total Ex	0.178	Day
2014	190	DSL	SOx	Total Ex	0.001	Day
2014	43614	GAS	PM10	Total	2.271	Day
2014	190	DSL	PM10	Total	0.016	Day
2014	43614	GAS	PM2.5	Total	0.962	Day
2014	190	DSL	PM2.5	Total	0.010	Day
2014	43614	GAS	CO2	Total Ex	17646.734	Day
2014	190	DSL	CO2	Total Ex	78.503	Day
2015						
2015	44100	GAS	ROG	Total	9.172	Day
2015	194	DSL	ROG	Total	0.008	Day
2015	44100	GAS	NOx	Total Ex	8.145	Day
2015	194	DSL	NOx	Total Ex	0.123	Day
2015	44100	GAS	CO	Total Ex	87.928	Day
2015	194	DSL	CO	Total Ex	0.046	Day
2015	44100	GAS	SOx	Total Ex	0.180	Day
2015	194	DSL	SOx	Total Ex	0.001	Day
2015	44100	GAS	PM10	Total	2.287	Day
2015	194	DSL	PM10	Total	0.015	Day
2015	44100	GAS	PM2.5	Total	0.966	Day
2015	194	DSL	PM2.5	Total	0.009	Day
2015	44100	GAS	CO2	Total Ex	17836.977	Day
2015	194	DSL	CO2	Total Ex	80.267	Day

LDT1

CALYR	VMT/1000	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS
2014						
2014	6327	GAS	ROG	Total	3.052	Day
2014	7	DSL	ROG	Total	0.001	Day
2014	6327	GAS	NOx	Total Ex	2.478	Day
2014	7	DSL	NOx	Total Ex	0.006	Day
2014	6327	GAS	CO	Total Ex	26.716	Day
2014	7	DSL	CO	Total Ex	0.003	Day
2014	6327	GAS	SOx	Total Ex	0.030	Day
2014	7	DSL	SOx	Total Ex	0.000	Day
2014	6327	GAS	PM10	Total	0.346	Day
2014	7	DSL	PM10	Total	0.001	Day
2014	6327	GAS	PM2.5	Total	0.155	Day
2014	7	DSL	PM2.5	Total	0.001	Day
2014	6327	GAS	CO2	Total Ex	2951.180	Day
2014	7	DSL	CO2	Total Ex	2.890	Day
2015						
2015	6386	GAS	ROG	Total	2.849	Day
2015	7	DSL	ROG	Total	0.001	Day
2015	6386	GAS	NOx	Total Ex	2.276	Day
2015	7	DSL	NOx	Total Ex	0.005	Day
2015	6386	GAS	CO	Total Ex	24.337	Day
2015	7	DSL	CO	Total Ex	0.002	Day
2015	6386	GAS	SOx	Total Ex	0.030	Day
2015	7	DSL	SOx	Total Ex	0.000	Day
2015	6386	GAS	PM10	Total	0.347	Day
2015	7	DSL	PM10	Total	0.001	Day
2015	6386	GAS	PM2.5	Total	0.154	Day
2015	7	DSL	PM2.5	Total	0.001	Day
2015	6386	GAS	CO2	Total Ex	2981.868	Day
2015	7	DSL	CO2	Total Ex	3.010	Day

LDT2

CALYR	VMT/1000	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS
2014						
2014	16522	GAS	ROG	Total	4.125	Day
2014	7	DSL	ROG	Total	0.000	Day
2014	16522	GAS	NOx	Total Ex	5.104	Day
2014	7	DSL	NOx	Total Ex	0.006	Day
2014	16522	GAS	CO	Total Ex	42.486	Day
2014	7	DSL	CO	Total Ex	0.002	Day
2014	16522	GAS	SOx	Total Ex	0.092	Day
2014	7	DSL	SOx	Total Ex	0.000	Day
2014	16522	GAS	PM10	Total	0.858	Day
2014	7	DSL	PM10	Total	0.001	Day
2014	16522	GAS	PM2.5	Total	0.363	Day
2014	7	DSL	PM2.5	Total	0.000	Day
2014	16522	GAS	CO2	Total Ex	9110.407	Day
2014	7	DSL	CO2	Total Ex	2.967	Day
2015						
2015	16700	GAS	ROG	Total	3.851	Day
2015	7	DSL	ROG	Total	0.000	Day
2015	16700	GAS	NOx	Total Ex	4.568	Day
2015	7	DSL	NOx	Total Ex	0.005	Day
2015	16700	GAS	CO	Total Ex	38.554	Day
2015	7	DSL	CO	Total Ex	0.002	Day
2015	16700	GAS	SOx	Total Ex	0.093	Day
2015	7	DSL	SOx	Total Ex	0.000	Day
2015	16700	GAS	PM10	Total	0.865	Day
2015	7	DSL	PM10	Total	0.001	Day
2015	16700	GAS	PM2.5	Total	0.365	Day
2015	7	DSL	PM2.5	Total	0.000	Day
2015	16700	GAS	CO2	Total Ex	9209.495	Day
2015	7	DSL	CO2	Total Ex	2.978	Day

HHDT

CALYR	VMT/1000	VEH TECH	POLLUTANT	PROCESS	EMISSIONS	BASIS
2014						
2014	1718	DSL	ROG	Total	0.740	Day
2014	1718	DSL	NOx	Total Ex	16.866	Day
2014	1718	DSL	CO	Total Ex	3.452	Day
2014	1718	DSL	SOx	Total Ex	0.033	Day
2014	1718	DSL	PM10	Total	0.484	Day
2014	1718	DSL	PM2.5	Total	0.344	Day
2014	1718	DSL	CO2	Total Ex	3455.453	Day
2015						
2015	1796	DSL	ROG	Total	0.697	Day
2015	1796	DSL	NOx	Total Ex	15.163	Day
2015	1796	DSL	CO	Total Ex	3.265	Day
2015	1796	DSL	SOx	Total Ex	0.034	Day
2015	1796	DSL	PM10	Total	0.422	Day
2015	1796	DSL	PM2.5	Total	0.283	Day
2015	1796	DSL	CO2	Total Ex	3609.401	Day

2014 Emission Factors

Reactive Organic Gases		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
ROG	tons/day	10.18	3.05	4.13	17.36	0.74
	g/mi	0.21	0.44	0.23	0.24	0.39

Oxides of Nitrogen		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
NOx	tons/day	9.05	2.48	5.11	16.64	16.87
	g/mi	0.19	0.36	0.28	0.23	8.91

Carbon Monoxide		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
CO	tons/day	97.19	26.72	42.49	166.39	3.45
	g/mi	2.01	3.83	2.33	2.26	1.82

Sulfur Oxides		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
SOx	tons/day	0.18	0.03	0.09	0.30	0.03
	g/mi	0.00	0.00	0.01	0.00	0.02

Particulate Matter (PM10)		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
PM10	tons/day	2.29	0.35	0.86	3.49	0.48
	g/mi	0.05	0.05	0.05	0.05	0.26

Particulate Matter (PM2.5)		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
PM2.5	tons/day	0.97	0.16	0.36	1.49	0.34
	g/mi	0.02	0.02	0.02	0.02	0.18

Carbon Dioxide		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	43,804	6,334	16,529	66,667	1,718
CO2	tons/day	17,725.24	2,954.07	9,113.37	29,792.68	3,455.45
	g/mi	367.10	423.10	500.18	405.41	1,824.64

2015 Emission Factors

Reactive Organic Gases		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
ROG	tons/day	9.18	2.85	3.85	15.88	0.70
	g/mi	0.19	0.40	0.21	0.21	0.35

Oxides of Nitrogen		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
NOx	tons/day	8.27	2.28	4.57	15.12	15.16
	g/mi	0.17	0.32	0.25	0.20	7.66

Carbon Monoxide		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
CO	tons/day	87.97	24.34	38.56	150.87	3.26
	g/mi	1.80	3.45	2.09	2.03	1.65

Sulfur Oxides		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
SOx	tons/day	0.18	0.03	0.09	0.30	0.03
	g/mi	0.00	0.00	0.01	0.00	0.02

Particulate Matter (PM10)		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
PM10	tons/day	2.30	0.35	0.87	3.52	0.42
	g/mi	0.05	0.05	0.05	0.05	0.21

Particulate Matter (PM2.5)		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
PM2.5	tons/day	0.97	0.16	0.37	1.50	0.28
	g/mi	0.02	0.02	0.02	0.02	0.14

Carbon Dioxide		LDA	LDT1	LDT2	LDA+LDT1+LDT2 Total (Worker Trucks)	HHDT (Delivery Trucks)
VMT	1000 mi/day	44,294	6,393	16,707	67,394	1796
CO2	tons/day	17,917.24	2,984.88	9,212.47	30,114.59	3,609.40
	g/mi	366.96	423.56	500.23	405.37	1,823.16

Source: EMFAC2011 online results for San Diego County
1. "Total Exhaust" emissions used for all pollutants, except ROG, PM10, and PM2.5. ROG is calculated using the "Total" emissions.
PM10 and PM2.5 emissions are calculated using "Total" emissions, which include exhaust, brake wear (BW) and tire wear (TW).

Rugged Solar Farm Project
Diesel Engine-Generator Emissions

No. of Units	2	
Engine Rating	680	kW
	960	HP
Operating Schedule (per unit)*	1.0	hr/day
	50	hr/year

	CO_2
gm/BHP-hr	526.18
Data Source	5
Pounds/hour	2,227
Pounds/day	2,227
Pounds/year	111,360
Metric tons/year	50.5

Notes:
*Assumed 50 hours per year for testing and maintenance.
Sources:
1. Current ARB and USEPA engine standards for Tier 2 equipment, except SOx and CO2.
2. Fraction of NOx and ROG based on Table B-26 in California Air Resources Board. 2008. The Carl Moyer Program Guidelines, Part IV of IV (Appendices). April. http://www.arb.ca.gov/msprog/moyer/guidelines/cmp_guidelines_part4.pdf
3. Based on 15 ppm (0.0015%) sulfur by weight.
4. PM2.5 fraction = 97.6% of PM10 (http://www.arb.ca.gov/ei/speciate/pmsize_07242008.xls for "stationary IC engine - diesel")
5. AP-42, Section 3.4, Table 3.4-1.

OPERATION

Rugged Solar Farm Project
Operational Emissions[1]

	Trips/day	Days/Year	# of Units	Distance (mi)	Vehicle Type		2015 Emissions (lbs/day) CO2	tons/year[4] CO2
Solar Farm								
Employee Vehicles[2]	40	264		35	LDA/LDT		1,251.14	165.15
Personnel Transport Vehicles[3]		264	2	10	LDT2		22.06	2.91
Washing Vehicles[3]		36	1	10	HHDT		40.19	0.72
Satellite Washing Vehicles[3]		36	2	10	LDT2		22.06	0.40
Service Trucks[3]		264	1	10	LDT2		11.03	1.46
Emergency Generators		N/A	2		N/A		2,227.20	55.68
							Total	**226.32**

1. Operational Emissions would result primarily from mobile sources including all operation and maintenance vehicles. It was assumed operation of the O&M building and Substation would not result in area source emissions generated from natural gas or landscaping.
2. Employees for O&M would be coming from Alpine, El Centro, and surrounding areas
3. For the purposes of modeling, it was assumed O&M vehicles would travel 10 miles per day
4. Assumed 22 work days per month for 12 months = 264 days/year for worker vehicles

Assumed washing would occur every 6-8 weeks or 9 washings per year, 4 days/wash = 36 days/year for washing vehicles

Rugged Solar Farm Project
GHG Emissions Summary

	CO_2 (tons/yr)	CO_2E (Mtons/yr)
CONSTRUCTION		
2014		
Off-Road Diesel	1,019.37	933.22
Diesel Trucks	1,257.46	1,142.01
Passenger Vehicles	286.72	273.80
Concrete Batch Plant		69.37
Total for 2014	2,563.54	**2,418.40**
2015		
Off-Road Diesel	591.26	541.29
Diesel Trucks	841.76	764.48
Passenger Vehicles	255.44	243.93
Concrete Batch Plant		104.34
Total for 2015	1,688.46	**1,654.04**
Annualized Construction Emissions		*135.75*
OPERATION		
Light-Duty Vehicles	169.91	162.26
Heavy-Duty Diesel Trucks	0.72	0.66
Emergency Generators	55.68	50.97
Gas-Insulated Switchgear	4.48	4.07
Electrical Generation		363.45
Water Supply		4.62
Wastewater		0.38
Total Operational	226.32	**586.41**

Rugged Solar Farm Project
CO_2-to-CO_2 Equivalent Factors

	Source	Units	CO_2	CH_4	N_2O	CO_2E/CO_2
Global Warming Potential			1	21	310	
Diesel Equipment	1	kg/gal	10.15	0.00058	0.00026	1.009
Diesel Trucks	2	g/mi	1,450.00	0.0051	0.0048	1.001
Passenger Vehicles	3					1.053
Helicopters	4	g/gal	8,320.00	7.04	0.11	1.022
Electrical Generation	5	lb/MWh	550.18	0.0302	0.0081	1.006

Serving Utility: SDG&E

1. California Climate Action Registry. 2009. *General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions* , Version 3.1, Tables C.6 and C.7.
2. California Climate Action Registry. 2009. *General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions* , Version 3.1, Tables C.3 and C.4.
3. US EPA, Office of Transportation and Air Quality. 2005. *Greenhouse Gas Emissions from a Typical Passenger Vehicle* (EPA420-F-05-004), p. 4.
4. California Climate Action Registry. 2009. *General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions* , Version 3.1, Tables C.3 and C.6.
5. San Diego Gas & Electric. 2010. Annual Entity Emissions: Electric Power Generation/Electric Utility Sector. http://www.climateregistry.org/CarrotDocs/35/2009/2008_SDGE_PUP(March 26).xls adjusted to reflect an increase in renewables from 10% in 2009 to 33% in 2020 and California Climate Action Registry. 2009. *General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions* , Version 3.1, Table C.2.

Rugged Solar Farm Project
Greenhouse Gas Emissions from Project Electrical Demand

Land Use	Units	Electrical Demand Factor[1] (kW-hr/unit/yr)	Electric Demand (kW-hr/yr)	CO_2E Emission Factor[2] (lbs CO_2E/kW-hr)	Annual CO_2E Emissions (Mtons CO_2E/yr)
Miscellaneous (O&M Bldg.)	7.50 ksf	9,720	72,900	0.553	18.30
Trackers/Inverters/Other			1,375,203	0.553	345.16
Total			1,448,103		363.45

Utility Region: SDG&E

Sources:

1. Itron, Inc. 2006. *California Commercial End-Use Survey*. Prepared for California Energy Commission, CEC-400-2006-005. March
2. San Diego Gas & Electric. 2010. Annual Entity Emissions: Electric Power Generation/Electric Utility Sector. http://www.climateregistry.org/CarrotDocs/35/2009/2008_SDGE_PUP(March 26).xls adjusted to reflect an increase in renewables from 10% in 2009 to 33% in 2020 and California Climate Action Registry. 2009. *General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions,* Version 3.1, Table C.2.

Notes:

CO_2E	Carbon dioxide equivalent
kW-hr	kilowatt-hour
MT	metric tons (= 2,204.623 lbs)

Rugged Solar Farm Project
Other Operational Electricity Usage

Equipment (per tracker)	Electrical Draw (watts)	Notes	Daily Operating Hours	Annual Electricity Usage (kWh)
Tracker Control Unit	50	Control unit uses energy during sunlight hours only.	12	219
Tracker Motor	250	Tracker motor runs for 1 minute every hour	12	18
Air Drying Unit	192	Air drying unit runs 1 hour per day and 10 hours every 3 weeks		103
Total per Tracker				341
Number of Trackers	3,588			
Total Annual Electricity Usage				**1,222,109**

Equipment (per Building Block)	Electrical Draw (watts)	Notes	Daily Operating Hours	Annual Energy Usage (kWh)
Field Communications	300	Operates during sunlight hours	12	1,314
Inverters	100	Operates at night	12	438
PV Box Ventilation	173	Operates during sunlight hours	12	758
Total per Building Block				2,510
Number of Building Blocks	61			
Total Annual Electricity Usage				**153,094**
Grand Total Annual Elecricity				**1,375,203**

Rugged Solar Farm Project
Gas-Insulated Switchgear

SF_6 Capacity [1]	lbs	75
Leakage Rate [2]	%/year	0.5%
Annual Leakage	lbs SF_6/year	0.375
GWP SF_6		23,900
Annual Emissions	tons CO_2E/year	4.48
	MT CO_2E/year	4.07

1. Per estimate by CARB staff (pers. communication 3/6/13).
2. Typical upper-bound leakage rate for new devices.
   NEMA Guideline - 0.1%/year
   IEC Specification - 0.5%/year

Notes:

CO_2E	Carbon dioxide equivalent
MT	metric tons (= 2,204.623 lbs)

Rugged Solar Farm Project
Greenhouse Gas Emissions from Project Water Supply

Land Use	Units	Acre-Feet per Year[1]	Electrical Demand Factor[2] (kW-hr/AF)	Electric Demand (kW-hr/yr)	CO_2E Emission Factor[3] (lbs CO_2E/kW-hr)	Annual CO_2E Emissions (Mtons CO_2E/yr)
N/A	N/A	8.70	2,117	18,418	0.553	4.62

Sources:

1. Chapter 2.9, Hydrology and Water Quality, Soitec Solar Development Program EIR.
2. California Energy Commission. 2006. *Refining Estimates of Water Related Energy Use in California.* (Northern California factor for water supply and conveyance for local (non-SWP) water) http://www.energy.ca.gov/2006publications/CEC-500-2006-118/CEC-500-2006-118.PDF
3. San Diego Gas & Electric. 2010. Annual Entity Emissions: Electric Power Generation/Electric Utility Sector. http://www.climateregistry.org/CarrotDocs/35/2009/2008_SDGE_PUP(March 26).xls and California Climate Action Registry. 2009. *General Reporting Protocol: Reporting Entity-Wide Greenhouse Gas Emissions* Version 3.1, Table C.2.

Notes:

CO_2E	Carbon dioxide equivalent
kW-hr	kilowatt-hour
Mtons	metric tons (= 2,204.62 lbs)

Residential	540	gpd/DU
High School	3,000	gpd/ac
Commercial	2,000	gpd/ac
Mixed Use	2,000	gpd/ac

Northern California

Water Supply and Conveyance	2,117	kW-hr/AF
Water Treatment	111	kW-hr/AF
Water Distribution	1,272	kW-hr/AF
Total	3,500	kW-hr/AF

Southern California

Water Supply and Conveyance	9,727	kW-hr/AF
Water Treatment	111	kW-hr/AF
Water Distribution	1,272	kW-hr/AF
Total	11,110	kW-hr/AF

Rugged Solar Farm Project
Greenhouse Gas Emissions from Project Wastewater Treatment

Gallons/Day	Liters/Day	Liter/Year	CH_4 Emission Factor[2] (MT/liter)	Annual CH_4 Emissions (Mton CH_4/yr)	Annual CO_2E Emissions (Mtons CO_2E/yr)
300	1,136	299,772	6.00E-08	0.018	0.38

Sources:

1. Daily wastewater generation from County of San Diego. 2010. Design Manual for Onsite Wastewater Treatment Systems, p. 38. (15 gal/person for day workers at offices per shift, 20 employees)
2. CH_4 emission factor from Environ. 2011. CalEEMod User's Guide, p. 33.

Notes:

CH_4	methane
CO_2E	Carbon dioxide equivalent
Mtons	metric tons (= 2,204.62 lbs)

Rugged GHG Emissions Offset

Maximum Installed Capacity (MW_{DC})	kWh_{AC} per Installed kW_{DC}	Annual Output (kWh)
105.235	2,083	219,204,505

CO_2 Emission Factor (lb/kWh)	CH_4 Emission Factor (lb/kWh)	N_2O Emission Factor (lb/kWh)	Annual GHG Offset (MT CO_2E)
1.071	0.000029	0.000014	106,990

Notes:
CO_2 emission factor based on 739.05 lb/MWh in 2008 and
adjustment for 10% renewables/3% large hydro/18% nuclear in 2009
(no Power Content Label available for 2008)
http://www.sdge.com/sites/default/files/FINAL092610_PowerLabel.pdf