RUGGED SOLAR LLC PROJECT
CLIMATE CHANGE AND
GREENHOUSE GAS EMISSIONS ANALYSIS

Major Use Permit 3300-12-007

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
APN	Assessor's Parcel Numbers
APS	Alternative Planning Strategy
ARB	California Air Resources Board
CAA	Clean Air Act
CAL/EPA	California Environmental Protection Agency
CAPCOA	California Air Pollution Control Officers Association
CCAA	California Clean Air Act
CCCC	California Climate Change Center
CEC	California Energy Commission
CPV	concentrating photovoltaic
CEQA	California Environmental Quality Act
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
DOT	Department of Transportation
DPLU	Department of Planning and Land Use
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
GHG	greenhouse gas
GWP	global warming potential
HFC	hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
kV	kilovolt
MMT	million metric tons
MW	megawatt
MPO	Metropolitan Planning Organization
MT	metric tons
N_2O	nitrous oxide
PFCs	perfluorocarbons
RPS	Renewable Portfolio Standard
RTP	Regional Transportation Plan
SANDAG	San Diego Association of Governments
SB	Senate Bill
SCS	Sustainable Communities Strategy
SF_6	sulfur hexafluoride
TAC	toxic air contaminants

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CHAPTER 1.0
INTRODUCTION

Rugged Solar LLC proposes the development of an 80 megawatts (MW) AC concentrating photovoltaic (CPV) renewable energy project (Project) near Boulevard, California, an unincorporated community in San Diego County. The purpose of this report is to discuss global climate change and existing greenhouse gas (GHG) emission sources; summarize applicable federal, state, and local regulations; and analyze potential GHG impacts to global climate change associated with the construction and operation of the Project.

Emissions of GHGs have the potential to adversely affect the environment because such emissions contribute, on a cumulative basis, to global climate change. Global climate change also has the potential to result in sea level rise (resulting in flooding of low-lying areas), affect rainfall and snowfall (leading to changes in water supply and runoff), affect temperatures and habitats (affecting biological and agricultural resources), and result in many other adverse effects.

Legislation, regulations, and executive orders on the subject of climate change have established federal and statewide contexts and processes for developing an enforceable cap on GHG emissions. Given the nature of environmental consequences from GHGs and global climate change, the California Environmental Quality Act (CEQA) requires that lead agencies evaluate the cumulative impacts of GHGs, even relatively small additions, on a global basis. Small contributions to this cumulative impact of global climate change (from which significant effects are occurring and are expected to worsen over time) may be potentially significant.

The Project would provide non-fossil-fuel-based electricity and would support the state's goal to obtain 33% of all electricity from renewable sources. The amount of carbon savings that would be derived from implementation of the Project, as opposed to implementation of a carbon-based power plant, is estimated at 106,990 MT CO_2e per year. After accounting for annual operational emissions and amortized construction emissions of 650 MT CO_2e per year, the Project would result in net carbon savings of 106,340 MT CO_2e per year.

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CHAPTER 2.0
AFFECTED ENVIRONMENT

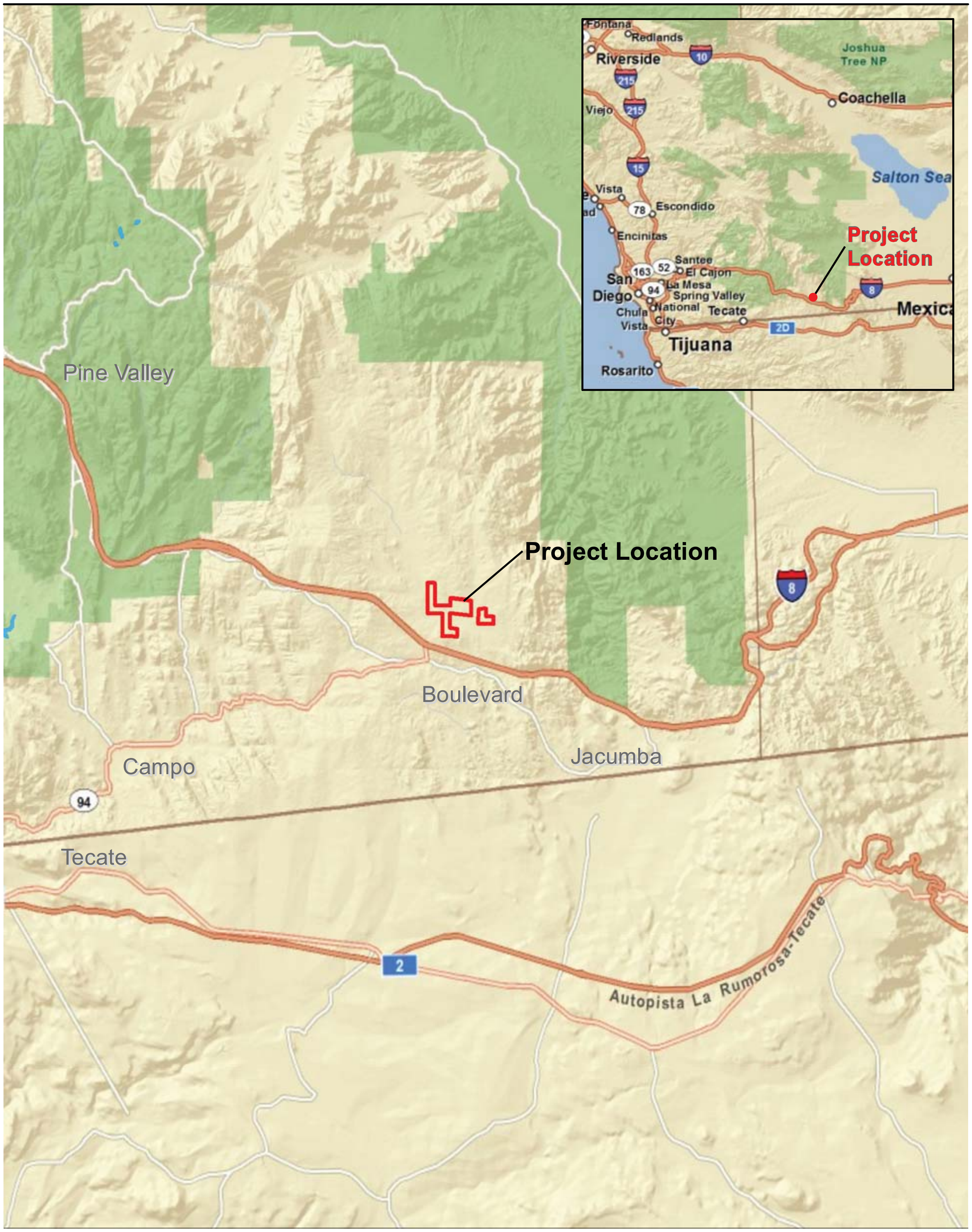
PROJECT LOCATION

Figure 1 shows the Project's relationship to San Diego County, which is located in southern California in the unincorporated community of Boulevard. Figure 2 shows the project's relationship to the surrounding unincorporated community of Boulevard and provides the context of local geography/major landforms/points of interest. The project site is located approximately 1.25 miles north of Interstate 8 (I-8) and extends roughly 2 miles between Ribbonwood Road and approximately 0.5 mile east of McCain Valley Road.

PROJECT DESCRIPTION

The Project would produce up to 80 megawatts (MW) of alternating current (AC) solar generating capacity. The Project would consist of approximately 3,588 concentrating photovoltaic electric generation systems utilizing dual axis tracking CPV trackers on 765 acres in southeastern San Diego County in the unincorporated community of Boulevard, California. In addition to the CPV trackers and inverter transformer units, the Project includes the following primary components:

- A collection system linking the CPV trackers to the on-site Project substation composed of (i) 1,000-volt (V) direct current underground conductors leading to (ii) 34.5-kilovolt (kV) underground and overhead AC conductors.
- A 7,500-square-foot (sf) (60 feet by 125 feet) operations and maintenance (O&M) building.
- A 2-acre on-site private collector substation site with a pad area of 6,000 sf (60 feet by 100 feet) with maximum height of 35 feet and includes a 450-sf (15 feet by 30 feet) control house.
- 61 Inverter/Transformer enclosures. The dimensions of each inverter unit are 10 feet by 25 or 40 feet (250 or 400 sf each) with a total structure height of up to 12 feet.



Source: Soitec 2011; AECOM 2011; ESRI 2011

5 2.5 0 5 Miles

Scale: 1 = 316,800; 1 inch = 5 mile(s)

Figure 1
Regional Map

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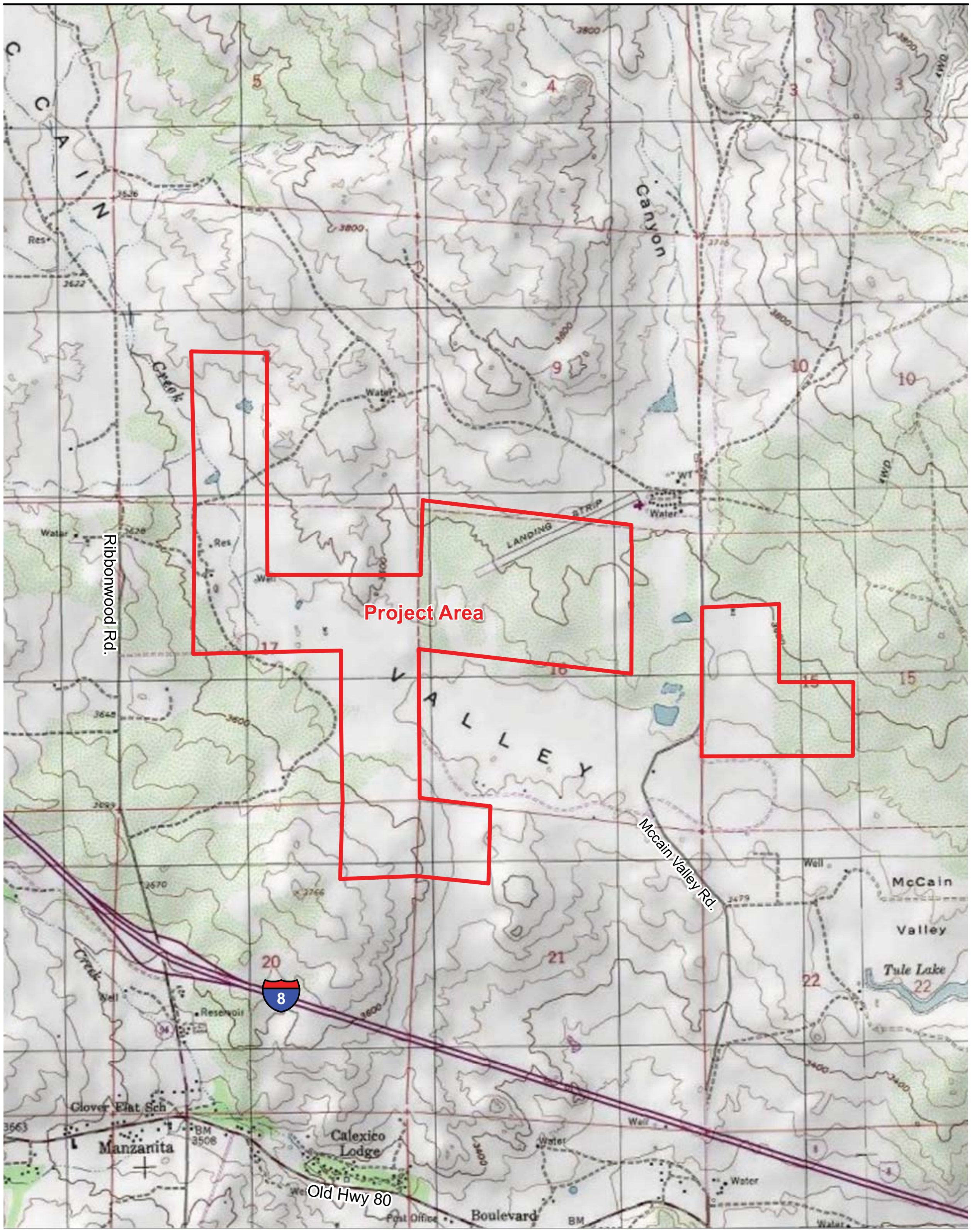

Source: USGS; Soitec 2011; AECOM 2011

Live Oak Springs USGS Quadrangle, San Diego County

0.5 0.25 0 0.5 Miles

1:31,680 1 inch = 0.5 mile(s)

Figure 2
Vicinity Map

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- A 3-mile overhead generator transmission line (gen-tie) connecting the on-site substation to SDG&E's proposed new Boulevard Substation.
- 20.5 miles of newly constructed load-bearing on-site access roads.
- 46.5 miles of graded, non-load-bearing dirt service roads.
- Temporary concrete batch plant and rock crushing facility.
- Three permanent on-site water wells for project construction, the O&M building and to facilitate washing of the CPV trackers.
- Two 20,000 gallon water storage tanks to be located at the O&M building and to be dedicated exclusively for fire suppression.
- Three additional on-site 20,000 gallon water storage tanks to support tracker washing. Each of these three 20,000 gallon water storage tanks would include 10,000 gallons of water dedicated solely for fire suppression. The outlet on the tank for tracker washing and any other non-fire uses would be located at the midpoint on the tank making it impossible to draw the water level down below 10,000 gallons in each tank for non-fire suppression use.
- A septic tank system and leach field for the O&M building.
- 6-foot perimeter fencing topped with an additional 1 foot of security barbed wire

ENVIRONMENTAL SETTING

Climate is the accumulation of daily and seasonal weather events over a long period of time, whereas weather is defined as the condition of the atmosphere at any particular time and place (Ahrens 2003). The Project is located in a climatic zone characterized as dry-summer subtropical or Mediterranean.

Scientific Basis of Climate Change

Certain gases in Earth's atmosphere, classified as GHGs, play a critical role in determining Earth's surface temperature. As solar radiation enters Earth's atmosphere from space, a portion of the radiation is absorbed by the Earth's surface and a smaller portion of this radiation is reflected back toward space. The absorbed radiation is emitted from Earth as low-frequency infrared radiation; however, the infrared radiation is absorbed by GHGs in the atmosphere. As a result, the radiation that otherwise would have escaped back into space is instead "trapped" in the atmosphere, resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on Earth. Without the greenhouse effect, Earth would not be able to support life as we know it.

Key GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Human-generated emissions of these GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of Earth's climate, known as global climate change or global warming. It is unlikely that global climate change of the past 50 years can be explained without acknowledging the contribution from human activities (IPCC 2007).

Climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants (TAC), which are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (approximately 1 day), GHGs have much longer atmospheric lifetimes of 1 year to several thousand years, which allow GHGs to be dispersed around Earth. Although the exact lifetime of any particular GHG molecule is dependent on multiple variables and cannot be pinpointed, it is understood by scientists who study atmospheric chemistry that more CO_2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO_2 emissions, approximately 54% is sequestered within 1 year through ocean uptake, northern hemisphere forest regrowth, and other terrestrial sinks. The remaining 46% of human-caused CO_2 emissions remains stored in the atmosphere (Seinfeld and Pandis 1998).

Similarly, impacts of GHGs are borne globally, as opposed to localized air quality effects of criteria air pollutants and TACs. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; suffice it to say, the quantity is enormous, and no single project alone would measurably contribute to a noticeable incremental change in the global average temperature, or to a global, local, or micro climate. From the standpoint of CEQA, GHG impacts to global climate change are inherently cumulative.

Global Climate Trends and Associated Impacts

Trends of Climate Change

Warming of the climate system is now considered to be unequivocal (IPCC 2007), with global surface temperature increasing approximately 1.33 degrees Fahrenheit (°F) over the last 100 years. The rate of increase in global average surface temperature over the last 100 years has not been consistent; the last three decades have warmed at a much faster rate—on average, 0.32°F per decade. Nine of the 10 warmest years in the instrumental record of global average surface temperature have occurred since 2000 (NOAA 2011). Continued warming is projected to increase the global average temperature by 2°F to 11°F over the next 100 years.

The causes of this warming have been identified as both natural processes and as the result of human actions. The Intergovernmental Panel on Climate Change (IPCC) concluded that variations in natural phenomena, such as solar radiation and volcanoes, produced most of the warming from pre-industrial times to 1950, and had a small cooling effect afterward. However, after 1950, increasing GHG concentrations resulting from human activity, such as fossil fuel burning and deforestation, have been responsible for most of the observed temperature increase.

Impacts of Climate Change

Over the same period that increased global warming has occurred, many other changes have occurred or are predicted to occur in other natural systems. Sea levels have risen; precipitation patterns throughout the world have shifted, with some areas becoming wetter and others drier; wildfires are predicted to increase in number and intensity; extreme weather events such as heat waves have increased; and numerous other conditions have been observed. Although it is difficult to prove a definitive cause-and-effect relationship between global warming and other observed changes to natural systems, there is a high level of confidence within the scientific community that these changes are a direct result of increased global temperatures caused by increased presence of GHGs in the atmosphere (IPCC 2007). Historical trends and predictions of future climate change effects in the above topic areas are discussed below.

Precipitation and Snowpack

An analysis of trends in total annual precipitation in the western United States by the National Weather Service's Climate Prediction Center provides evidence that annual precipitation has increased in much of California, the Colorado River Basin, and elsewhere in the west since the mid-1960s (DWR 2006). When these same precipitation data are sorted into three regions—northern, central, and southern California—trends show that precipitation in the northern portion of the state appears to have increased slightly from 1890 to 2002, and precipitation in the central and southern portions of the state show slightly decreasing trends. Although existing data indicate some level of change in precipitation trends in California, more analysis is needed to determine whether changes in California's regional annual precipitation totals have occurred as the result of climate change or other factors (DWR 2006).

As a result of climate change, global average precipitation is expected to increase during the 21st century. While precipitation is generally expected to increase on a global scale, significant regional variations in precipitation trends can be expected. Specifically in California, precipitation is projected to increase in the northern region during the winter months.

Various California climate models provide mixed results regarding forecasted changes in total annual precipitation in the state through the end of this century. Therefore, no conclusion on an increase or decrease can be provided (IPCC 2007). Although global climate change models generally predict an increase in overall precipitation on a worldwide scale, there is no such consistency among the results of regional models applied to California.

An increase in the global average temperature is expected to result in a decreased volume of precipitation falling as snow in California and an overall reduction in snowpack in the Sierra Nevada Mountains. Snowpack in the Sierra Nevada provides both water supply (runoff) and storage (within the snowpack before melting), and is a major water source for the state. According to the California Energy Commission (CEC) (2006a), the snowpack portion of the water supply could potentially decline from 30% to 90% by the end of the 21st century.

California's annual snowpack, on average, has the greatest accumulations from November through the end of March. The snowpack typically melts from April through

July. As temperatures rise, a declining proportion of total precipitation falls as snow, more winter runoff occurs, and remaining snow melts sooner and faster in spring. In some basins, spring peak runoff may increase; in others, runoff volumes may shift to earlier in the spring and winter months (DWR 2006). In some instances, runoff peak levels may increase and occur earlier. California's reservoir managers use snowmelt to help fill reservoirs once the threat of large winter and early spring storms and related flooding risks have passed.

An analysis conducted by the California Department of Water Resources (DWR) (2006) on the effect of rising temperatures on snowpack shows that a 5.4°F rise in average annual temperature would likely cause snowlines to rise approximately 1,500 feet. This would result in an annual loss of approximately 5 million acre-feet of water storage in the snowpack. This would represent a loss of approximately 23% of the total storage capacity of all key reservoirs in California (DWR 2012).

Sea Level Rise

Another major area of concern related to global climate change is sea level rise. Worldwide average sea level appears to have risen approximately 0.4 to 0.7 feet over the past century based on data collected from tide gauges around the globe, coupled with satellite measurements taken over approximately the last 15 years (IPCC 2007). Various gauge stations along the California coast show an increase similar to the global trends. Rising average sea level over the past century has been attributed primarily to warming of the world's oceans, the related thermal expansion of ocean waters, and the addition of water to the world's oceans from the melting of land-based polar ice (IPCC 2007). Melting sea-based polar ice will have a much smaller impact on sea level rise, and is not currently modeled in sea level rise estimates (Shepherd et al. 2010).

A consistent rise in sea level has been recorded worldwide over the last 100 years. According to IPCC, sea level rise is expected to continue, and increase by up to 23 inches by the year 2099 (IPCC 2007). Other climate models estimate an even greater increase in sea level rise of 55 inches by the year 2100 (DWR 2008). Although these projections are on a global scale, the rate of relative sea level rise experienced at many locations along California's coast correlates well with the worldwide average rate of rise observed over the past century. Therefore, it is reasonable to expect that changes in worldwide average sea level will also be experienced along California's coast through this century (DWR 2006); however, the amount and timing of the expected sea level rise that will be experienced along California's coast is uncertain.

Heat Waves

Historically, extreme warm temperatures in the San Diego region have mostly occurred in July and August, but as climate warming continues, the occurrences of these events will likely begin in June and could continue to take place into September. All simulations indicate that hot daytime and nighttime temperatures (heat waves) will increase in frequency, magnitude, and duration (San Diego Foundation 2008).

Wildfires

Different climate change models yield somewhat different predictions about the frequency, timing, and severity of future Santa Ana wind conditions (which are a major driver of large wildfires in San Diego County), leading to uncertainty about how fire regimes may change in the future. Analyses by the California Climate Change Center (CCCC) show that significant increases in large wildfire occurrences and burned areas are likely to occur by mid-century, with very large increases by 2085. The latter is mainly due to the effects of projected temperature increases on evapotranspiration, compounded by reduced precipitation (CCCC 2009).

Greenhouse Gas Emission Sources

Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with the transportation, industrial/manufacturing, electric utility, residential, commercial, and agricultural sectors. Emissions of CO_2 are byproducts of fossil fuel combustion, and CH_4, a highly potent GHG, is the primary component in natural gas and is associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management. For purposes of accounting for and regulating GHG emissions, sources of GHG emissions are grouped into emissions sectors. The California Air Resources Board (ARB) identifies the following main GHG emissions sectors that account for most anthropogenic GHG emissions generated within California:

- *Transportation:* On-road motor vehicles, recreational vehicles, aviation, ships, and rail

- *Electricity:* Use and production of electrical energy
- *Industry:* Mainly stationary sources (e.g., boilers and engines) associated with process emissions
- *Commercial and Residential:* Area sources, such as landscape maintenance equipment, fireplaces, and consumption of natural gas for space and water heating
- *Agriculture:* Agricultural sources that include off-road farm equipment; irrigation pumps; crop residue burning (CO_2); and emissions from flooded soils, livestock waste, crop residue decomposition, and fertilizer volatilization (CH_4 and N_2O)
- *High Global Warming Potential (GWP) Gases:* Refrigerants and electrical insulation (e.g., SF_6), among other sources
- *Recycling and Waste:* Waste management facilities and landfills; primary emissions are CO_2 from combustion and CH_4 from landfills and wastewater treatment

State Greenhouse Gas Emissions Inventory

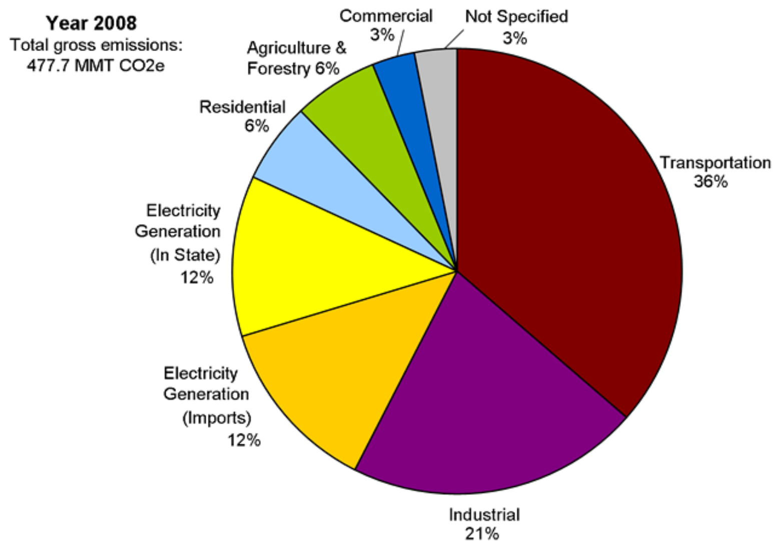
ARB performs an annual GHG inventory for emissions and sinks of the six major GHGs (CO_2, CH_4, N_2O, hydrofluorocarbons, chlorofluorocarbons, and SF_6). As shown in Figure 3, California produced 477.7 million gross metric tons (MT) of CO_2 equivalent (CO_2e) in 2008 (ARB 2010a).

CO_2e is a measurement used to account for the fact that different GHGs have different potential to retain infrared radiation in the atmosphere and contribute to the greenhouse effect. This potential, known as the global warming potential (GWP) of a GHG, is dependent on the lifetime, or persistence, of the gas molecule in the atmosphere.

Expressing emissions in CO_2e takes the contributions of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted.

The inventory is divided into the ARB-created categories or sectors of emissions: transportation, electricity generation, industrial, commercial, residential, agriculture and forestry, and not specified (i.e., recycling and waste, and high GWP gases). Combustion of fossil fuel in the transportation sector was the single largest source of California's

Figure 3
2008 California GHG Emissions by Sector (2000–2008 Emission Inventory)



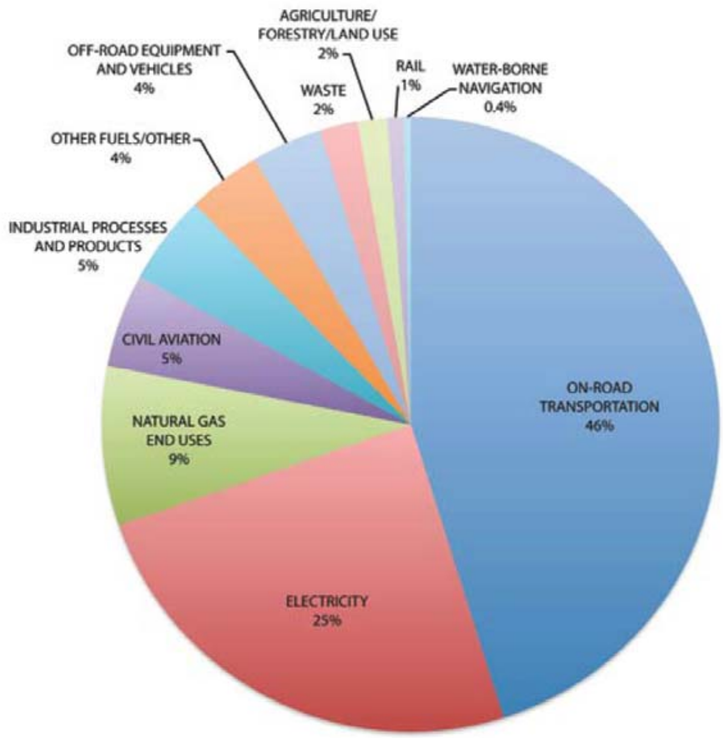
MMT=million metric tons

GHG emissions in 2008, accounting for 36% of total GHG emissions in the state. The transportation sector was followed by the electric power sector, which accounts for 24% of total GHG emissions in the state (including in- and out-of-state sources), and the industrial sector, which accounts for 21% of total GHG emissions in the state (ARB 2010a).

Regional Greenhouse Gas Emission Inventory

The University of San Diego School of Law, Energy Policy Initiative Center prepared a GHG inventory for San Diego County (Anders et al. 2008). The inventory included estimates of GHG emissions for 1990, 2006, and 2020. Based on the existing inventory and the projections for the region, the University of San Diego found that emissions of GHGs must be reduced to 33% below "business-as-usual" conditions to achieve 1990 emission levels by the year 2020. As shown in Figure 4, total GHG emissions in San Diego County in 2006 were estimated to be 34 million metric tons (MMT) of CO_2e. Transportation is the largest emissions sector, accounting for 16 MMT of CO_2e, or 46% of total emissions. Energy consumption, including electricity and natural gas use, is the next largest source of emissions, at 34% of the total.

Figure 4
San Diego County's Greenhouse Gas Emissions by Economic Sector (2006)



REGULATORY SETTING

Federal Plans, Policies, Regulations, and Laws

The U.S. Environmental Protection Agency (EPA) is the federal agency responsible for implementing the federal Clean Air Act (CAA). The U.S. Supreme Court ruled on April 2, 2007, that CO_2 is an air pollutant as defined under the CAA, and that EPA has the authority to regulate emissions of GHGs.

Proposed Endangerment and Cause or Contribute Findings for GHG under the CAA

On December 7, 2009, EPA signed two distinct findings regarding GHGs under Section 202(a) of the CAA (FR 2009):

- **Endangerment Finding**: The Administrator finds that the current and projected concentrations of the six key well-mixed greenhouse gases—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.

- **Cause or Contribute Finding**: The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle engines contribute to the greenhouse gas pollution, which threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, this action was a prerequisite to finalizing EPA's proposed GHG emissions standards for light-duty vehicles. On November 16, 2011, the Department of Transportation's (DOT) and EPA proposed stringent federal GHG and fuel economy standards for model years 2017 to 2025 passenger cars and light-duty trucks. In addition to the standards for light-duty vehicles, DOT and EPA announced standards on August 9, 2011, to reduce GHG emissions and improve the fuel efficiency of heavy-duty trucks and buses.

Mandatory Greenhouse Gas Reporting Rule

On September 22, 2009, EPA published the Final Mandatory Greenhouse Gas Reporting Rule (Reporting Rule) in the Federal Register (FR 2010b). The Reporting Rule requires reporting of GHG data and other relevant information from fossil fuel and industrial GHG suppliers, vehicle and engine manufacturers, and all facilities that would emit 25,000 MT or more of CO_2e per year. Facility owners are required to submit an annual report with detailed calculations of facility GHG emissions due on March 31 for emissions in the previous calendar year. The Reporting Rule also mandates recordkeeping and administrative requirements to enable EPA to verify the annual GHG emissions reports. Owners of existing facilities that commenced operation prior to January 1, 2011, are required to submit an annual report for calendar year 2011.

State Plans, Policies, Regulations, and Laws

ARB is the agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the California Clean Air Act (CCAA).

Assembly Bill 1493

Assembly Bill (AB) 1493 (ARB 2002), signed in 2002, required that ARB develop and adopt, by January 1, 2005, regulations that achieve "the maximum feasible reduction of greenhouse gases emitted by passenger vehicles and light-duty trucks and other vehicles determined by ARB to be vehicles whose primary use is noncommercial personal transportation in the state."

In 2004, ARB adopted standards requiring automobile manufacturers to meet fleet-average GHG emissions limits for all passenger cars, light-duty trucks within various weight criteria, and medium-duty passenger vehicle weight classes (i.e., any medium-duty vehicle with a gross vehicle weight rating less than 10,000 pounds that is designed primarily for the transportation of persons) beginning with the 2009 model year. For passenger cars and light-duty trucks, the GHG emissions limits for the 2016 model year are approximately 37% lower than the limits for the first year of the regulations, the 2009 model year. Before the regulations could go into effect, EPA had to grant California a waiver under the CAA, allowing California to regulate GHG emissions from motor vehicles within the state. EPA granted the waiver in 2009.

In April 2010, DOT and EPA established GHG gas emissions and fuel economy standards for model years 2012–2016 light-duty cars and trucks. In the fall of 2010, California accepted compliance with these federal GHG standards as meeting similar state standards as adopted in 2004, resulting in the first coordinated national program.

Executive Order S-3-05

Executive Order S-3-05 (Caltrans 2005), signed in June 2005, proclaimed that the State of California is vulnerable to the impacts of climate change. Executive Order S-3-05 declared that increased temperatures could reduce the Sierra Nevada's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total GHG emissions targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80% below the 1990 level by 2050.

Executive Order S-3-05 directed the Secretary of the California Environmental Protection Agency (CAL/EPA) to (1) coordinate a multi-agency effort to reduce GHG emissions to the target levels and (2) submit biannual reports to the governor and the

State Legislature describing progress made toward reaching the emission targets, impacts of global warming on California's resources, and mitigation and adaptation plans to combat these impacts. The Secretary of the CAL/EPA created the California Climate Action Team, made up of members from various state agencies and commissions, which is responsible for implementing global warming emissions-reduction programs. The California Climate Action Team is also responsible for reporting on the progress made toward meeting the statewide GHG targets.

Assembly Bill 32 Climate Change Proposed Scoping Plan

In December 2008, ARB adopted its Climate Change Scoping Plan (Scoping Plan), which was revised in 2011 to account for new economic activity levels. The Scoping Plan contains the main strategies California will implement to achieve reduction of approximately 80 MMT of CO_2e, or 16% from California's projected 2020 emissions level of 507 MMT of CO_2e under a "business-as-usual" scenario. The Scoping Plan also includes ARB-recommended GHG reductions for each emissions sector of California's GHG inventory. The Scoping Plan calls for the largest reductions in GHG emissions to be achieved by implementing the following measures and standards:

- Improved emissions standards for light-duty vehicles (26.1 MMT CO_2e)
- The Low-Carbon Fuel Standard (15.0 MMT CO_2e)
- Energy efficiency measures in buildings and appliances, and the widespread development of combined heat and power systems (16.7 MMT CO_2e)
- A renewable portfolio standard for electricity production (12 MMT CO_2e)

The Scoping Plan does state that land use planning and urban growth decisions will play an important role in the state's GHG reductions, since local governments have primary authority to plan, zone, approve, and permit land development to accommodate population growth and the changing needs of their jurisdictions.

The Scoping Plan expects a reduction of approximately 5.0 MMT CO_2e per year from local land use changes associated with implementation of Senate Bill (SB) 375, discussed below. The Scoping Plan does not include any direct discussion about GHG emissions generated by construction activity.

Cap and Trade

As a key part of the ARB Scoping Plan, the final adoption of regulations for the Cap and Trade program (ARB 2011) by the ARB board is an important step to the state meeting its GHG reduction goals. This program will first set an aggressive cap, or maximum limit, on emissions; sources covered by the program then receive authorizations to emit in the form of emissions allowances, with the total amount of allowance limited by the cap. Each source can design its own compliance strategy to meet the overall reduction requirement, including sale or purchase of allowances, installation of pollution controls, and implementation of efficiency measures. Individual control requirements are not specified under a cap and trade program, but each emissions source must surrender allowances equal to its actual emissions to comply. Sources must also completely and accurately measure and report all emissions in a timely manner to guarantee that the overall cap is achieved.

In the first compliance period, which will be in place from 2013 through 2014, the regulations will impose allowance obligations on the electricity distribution entities in California (both for in-state generation and out-of-state generation imported into the state) and certain large industrial facilities in specified industries whose GHG emissions exceed 25,000 MT CO_2e. In the second compliance period, starting January 1, 2015, producers and importers of natural gas and other fossil fuels will become subject to the regulations.

Executive Order S-1-07

Executive Order S-1-07 (ARB 2007), signed in 2007, establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10% by 2020. ARB identified this Low Carbon Fuel Standard as a discrete early action item under AB 32. The final ARB resolution (No. 09-31) was issued on April 23, 2009.

Senate Bill 1078, Senate Bill 107, and Senate Bill X1-2

SB 1078 (CEC 2002) requires retail sellers of electricity, including investor-owned utilities and community choice aggregators, to provide at least 20% of their supply from renewable sources by 2017. SB 107 changed the target date to 2010. Executive Order S-14-08 expands the state’s Renewable Energy Standard to 33% renewable power by 2020. This new goal was codified in 2011 with the passage of SB X1-2. In 2009, San

Diego Gas & Electric (SDG&E), which provides electricity and natural gas to the Project site, used 10% renewable energy to provide electricity to customers (SDG&E 2009). To meet the goals set out in SB X1-2, a significant effort will be needed to reduce overall energy used in the state through energy efficiency efforts and a large effort to increase the amount of renewable energy generated and purchased by SDG&E.

Senate Bill 97

Signed in August 2007, SB 97 (OPR 2007) acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA. This bill directed the California Office of Planning and Research to prepare, develop, and transmit to the California Natural Resources Agency guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions under CEQA (CNRA 2009). On February 16, 2010, the Office of Administrative Law approved the CEQA amendments and filed them with the Secretary of State for inclusion in the California Code of Regulations. The CEQA amendments became effective on March 18, 2010. The amended guidelines establish two new guidance questions in the Environmental Checklist of CEQA Guidelines Appendix G. The amendments do not establish a GHG emissions threshold, but allow a lead agency to develop, adopt, and apply its own threshold of significance or use those developed by other agencies or experts.

Senate Bill 375

Signed in September 2008, SB 375 (LC 2008) aligns regional transportation planning efforts, regional GHG-reduction targets, and land use and housing allocations. It requires Metropolitan Planning Organizations (MPOs), such as the San Diego Association of Governments (SANDAG), to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which would prescribe land use allocations in that MPO's Regional Transportation Plan (RTP). ARB has established reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets are to be updated every 8 years, but can be updated every 4 years if advancements in emissions technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets.

SANDAG became the first MPO in the state to adopt an SCS when it adopted the 2050 RTP in October 2011. This regional planning document included an SCS that will achieve the GHG emissions reduction goals set by ARB of 7% per capita GHG reductions from passenger vehicles by 2020 and 13% by 2035.

SB 375 also extends the minimum period for the Regional Housing Needs Allocation cycle from 5 years to 8 years for local governments located within an MPO that meets certain requirements. City or county land use policies (including general plans) are not required to be consistent with the RTP (and associated SCS or APS). However, new provisions of CEQA would incentivize qualified projects that are consistent with an approved SCS or APS, which would be categorized as “transit priority projects.” ARB adopted regional targets on September 23, 2010 (ARB 2010b).

Regional and Local Plans, Policies, Regulations, and Ordinances

ARB’s Scoping Plan (ARB 2008) states that local governments are “essential partners” in the effort to reduce GHG emissions. The Scoping Plan also acknowledges that local governments have “broad influence and, in some cases, exclusive jurisdiction” over activities that contribute to significant direct and indirect GHG emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations. Many of the proposed measures to reduce GHG emissions rely on local government actions. The Scoping Plan encourages local governments to reduce GHG emissions by approximately 15% from current levels, which were 469 MMT CO_2e at the time the Scoping Plan was created and are expected to rise to 507 MMT CO_2e by 2020 under a “business-as-usual” scenario (ARB 2008).

San Diego Air Pollution Control District

The San Diego Air Pollution Control District has no regulations relative to GHG emissions.

San Diego County

San Diego County has no regulations relative to GHG emissions, but it does have a Green Building Incentive Program that is a voluntary program to promote energy- and resource-efficient building design. Incentives, in the form of fast-track plan checking and fee reductions, are offered to developers who use recycled materials in construction, install irrigation systems that use greywater, build projects that exceed California’s Title 24 guidelines (i.e., the energy efficiency standards), or install photovoltaic electricity generation systems (solar power). The San Diego County General Plan Update was adopted by the County of San Diego Board of Supervisors in August 2011. The General Plan contains numerous policies in the Land Use, Mobility, Conservation and Open Space, and Housing Elements to address climate change. Adopted policies in the General Plan Update address the following major strategies:

- Reduce vehicle trips generated, gasoline/energy consumption, and GHGs.
- Reduce non-renewable electrical and natural gas energy consumption and generation (energy efficiency).
- Increase generation and use of renewable energy sources.
- Reduce water consumption.
- Reduce and maximize reuse of solid wastes.
- Promote CO_2-consuming landscapes.
- Maximize preservation of open spaces, natural areas, and agricultural lands.
- Reduce risk from wildfire, flooding, and other hazards resulting from climate change.
- Conserve and improve water supply due to shortage from climate change.
- Promote agricultural lands for local food production.
- Provide education and leadership.

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CHAPTER 3.0
ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

ANALYSIS METHODOLOGY

A single project is unlikely to have a significant impact on the environment related to climate change. However, the cumulative effect of various human activities involving emissions of GHGs has been clearly linked to quantifiable changes in the composition of the atmosphere, which in turn have been shown to be the main cause of global climate change (IPCC 2007). Although it is extremely unlikely that a single project would contribute significantly to climate change, the analysis of the environmental effects of GHG emissions from the Project is addressed as a cumulative impact analysis because cumulative emissions from many projects would affect global GHG concentrations and the climate system.

Pursuant to full disclosure and according to CEQA Guidelines that state, "A lead agency should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate, or estimate the amount of greenhouse gas emissions resulting from a project," both the total GHG emissions associated with the Project and the net change in GHG emissions from existing conditions are quantified. These are used as criteria to determine whether the associated emissions would substantially help or hinder the state's ability to attain the goals identified in AB 32 (i.e., reduction of statewide GHG emissions to 1990 levels by 2020).

The analysis of GHG emissions in this report recognizes that the impact that GHG emissions have on global climate change does not depend on whether the emissions are generated by stationary, mobile, or area sources, or whether they are generated in one region or another. Land uses need to be "GHG efficient" to attain AB 32 goals. Projects that meet specified minimum performance standards, such as those described in an existing plan or mitigation program for the reduction of emissions or specific measures adopted as part of a general plan, long-range development plan, or GHG emissions-reduction plan—can be identified as projects that are consistent with or surpass the goals of AB 32.

Construction Emissions

Construction-related GHG emissions would be associated with typical construction activities, such as site grading, CPV unit installation, embedded emissions in the water that will be used during construction, and vehicle engine exhaust from construction equipment, vendor trips, and construction employee commute trips. Generation of construction-related emissions would be temporary and would subside after completion of the Project. Construction at the project site would require up to about 12 months and is anticipated to begin in April 2014. Construction activities would generally occur for 8 hours per day and 6 days per week.

In order to provide construction materials for the proposed solar facilities, a temporary batch plant and rock crushing facility will be constructed onsite. The temporary facility will be used for preparing and mixing the concrete used for the foundations for the solar trackers, the transformers at the substation, the O&M building, and other project facilities. Source materials (e.g., sand) for the concrete batch plant would be purchased from a commercial source approximately 55 miles from the project site. Water would be provided by on-site wells, and aggregate materials would be obtained from within the development footprint.

Emissions from construction equipment and construction vehicles related to hauling materials and workers to and within the site were estimated using URBEMIS 2007 Version 9.2.4 (URBEMIS), Road Construction Emissions Model, Version 7.1.2, OFFROAD 2007 (OFFROAD), and EMFAC 2011 (EMFAC). URBEMIS is designed to estimate construction and operational emissions from land use development projects. The Road Construction Emissions Model was developed to estimate the emissions from linear projects, such as bridges, roads, or pipelines. OFFROAD and EMFAC were developed by ARB for the purposes of estimating CO_2 emissions from off-road equipment and on-road vehicle activity. Additionally, emission factors used from EMFAC account for statewide GHG reduction programs for the transportation sector such as the Low Carbon Fuel Standard and Pavely fuel efficiency regulations.

URBEMIS was used to estimate off-road construction equipment and fugitive dust emissions associated with (1) site clearing and grading, (2) trenching and construction of electrical transmission facilities, (3) solar CPV assembly and installation, and (4) construction of the substation and O&M building. The Road Construction Emissions Model was used to estimate off-road construction equipment emissions associated with construction of 20.5 miles of access roads and 46.5 miles of service roads. The Road Construction Emissions Model was also used to estimate emissions associated with construction of the gen-tie line. Haul trips associated with delivery of materials to the project site and construction worker commutes were estimated using emission factors from EMFAC. Materials were assumed to be transported from the Rancho Bernardo area of San Diego, which is the likely location for production of the solar modules. Worker commutes were conservatively estimated at 35 miles (one way) based on the travel distance from Alpine, Detailed modeling outputs and assumptions are available in Appendix A.

Operational Emissions

After construction, day-to-day activities associated with operation of the Project would generate minimal GHG emissions from a limited number of sources. GHG emissions were estimated using Project-based activity data, provided by the applicant, and the most recent and relevant emissions factors. Emissions estimates for employee vehicle trips to and from the facility were made using OFFROAD and EMFAC emission factors. EMFAC emission factors account for statewide GHG reduction programs such as the Low-Carbon Fuel Standard and Pavley fuel efficiency regulations. For emissions resulting from energy used at the facility, an emission factor was calculated that forecasts the emission factor in 2020, provided it meets the Renewable Portfolio Standard (RPS) and provides 33% of electricity from renewable sources. A forecasted emissions factor was created for 2020 as that is the year established by AB 32 as a target for achieving reduced statewide GHG emissions (ARB 2008). This forecasted emissions factor was based on the utility-specific emissions factor for SDG&E from 2009, attained from the *Power Generation/Electric Utility Reporting Protocol* report submitted to the California Climate Action Registry by SDG&E (CCAR 2009) and the 2009 annual *Power Content Label* (SDG&E 2009) reported to CEC. There is no stationary use of any other fuels.

On-site operations activity would include in-place panel washing not more frequently than every 6 to 8 weeks by mobile crews who would also be available for dispatch whenever on-site repairs or other maintenance are required (approximately 9 washes per year). A tanker truck and smaller “satellite” panel washing trucks would be used for panel washing. On-site water storage tanks, installed to provide water for fire protection will include additional capacity available for panel washing.

Operational activities associated with maintenance of the gen-tie line would include light- and heavy-duty vehicles for pole structure brushing, herbicide application, and equipment repair. Electric transmission lines may be inspected several times a year via helicopter. Helicopter emissions were estimated using emission factors from the California Climate Action Registry.

Operational emissions would also result from intermittent use of two 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.

While the water used for this project will come from local wells, at this time there is no information about the depth of the wells. This would be required to determine the energy required to pump water to the surface and the associated GHG emissions. Because of this limitation, a more conservative estimate of GHG emissions associated with the water used for the project was used that estimates emissions for the transportation, conveyance, and treatment of water that would be used on-site. To estimate these emissions, emission factors from the CEC's 2006 report, *Refining Estimates of Water-Related Energy Use in California* (CEC 2006b), were used.

A limited amount of wastewater would be conveyed to a water reclamation facility. To be conservative, the IPCC method for estimating emissions from wastewater facilities, as found in the Wastewater Treatment and Discharge chapter of the IPCC *Guidelines for National Greenhouse Gas Inventories* (IPCC 2006), was used to estimate emissions from the treatment of wastewater generated at the facility. This likely overestimates wastewater emissions because, unlike municipal wastewater, no organic material, which drives GHG emissions in wastewater treatment, would be added to the wastewater coming from the Project.

CRITERIA FOR DETERMINING SIGNIFICANCE OF EFFECTS

There are no quantitative federal or state significance criteria for global climate change impacts or GHG emissions that pertain to this Project. At the state level, climate change must be addressed in CEQA documents according to Appendix G of the CEQA Guidelines. The selection of significance criteria for this analysis is based on the environmental checklist in Appendix G of the CEQA Guidelines. According to the guidelines, the Project under consideration would result in a significant impact related to climate change if it would result in either of the following:

- generate GHG emissions, either directly or indirectly, that may have a significant cumulative impact on the environment, or
- conflict with an applicable plan, policy, or regulation of an agency adopted for the purpose of reducing the emissions of GHGs.

The County of San Diego Department of Planning and Land Use (DPLU) developed an interim approach for evaluating GHG emissions impacts. The California Air Pollution Control Officers Association (CAPCOA) published various screening thresholds for determining when a climate change analysis would be needed. DPLU recommends using the 900 MT of CO_2e per year screening criteria referenced in the CAPCOA white paper (CAPCOA 2008) for determining which projects require further analysis and mitigation. Table 1 describes the general sizes of projects that would generally require a more detailed climate change analysis.

Table 1
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 DPLU 2010

If a project meets the above size criteria or does not exceed 900 MT of CO_2e per year, then the climate change impacts would be considered less than significant. If a project exceeds 900 MT of CO_2e per year, DPLU recommends that the significance be based on whether the project would impede the implementation of AB 32. To demonstrate that a project would not impede the implementation of AB 32, the guidance recommends that a project should demonstrate how the carbon emissions generated by the project would be reduced to 33% below projected “business-as-usual” levels in 2020. The 33% reduction target is based on the San Diego County Greenhouse Gas Inventory: An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets (Anders et al. 2008).

At the time of this writing, no federal, state, regional, or local air quality regulatory agency has adopted a quantitative threshold of significance for construction-related GHG emissions. Many California air districts recommend that construction emissions associated with a project be amortized over the life of the project (typically 30 years) and added to the operational emissions. Therefore, modeled construction-related GHG emissions associated with the Project are discussed first, then operational GHG emissions are totaled and the amortized construction emissions are added to the operational emissions.

IMPACT ANALYSIS

Impact 1: Generation of Construction-Related and Operational Greenhouse Gas Emissions That Have a Cumulative Effect on the Environment

GHG emissions generated by construction of the Project would be primarily in the form of CO_2. Although emissions of other GHGs, such as CH_4 and N_2O, are important with respect to global climate change, the emissions levels of these other GHGs from on- and off-road vehicles used during construction are relatively small compared to the level of CO_2 emissions, even when factoring in the relatively larger GWP of CH_4 and N_2O.

Construction-related GHG emissions would be generated by sources such as heavy-duty off-road equipment, trucks hauling materials to the site, and worker commutes during construction of the Project.

Construction of the Project would involve localized clearing and grading, construction of primary and secondary access roads, installation of CPV foundations, trenching within each building block for the collection system and communications system, installation of small concrete footing at each pair of inverters and attendant transformer, and installation of a secondary 34.5 kV collection system, including a wood pole mounted 34.5 kV "trunk line," leading to the 34.5/69 kV project step-up substation and an on-site operations and maintenance facility.

While GHG emissions persist in the atmosphere for extended periods of time, construction-related emissions would only be generated during the construction period, which is expected to be up to about 18 months. The maximum construction emissions over the construction period for the Project would be approximately 4,476 MT CO_2e.

When this total is amortized over the 30-year life of the project, the annual construction emissions would be approximately 149 MT CO_2e per year.

Operational emissions would come from direct and indirect emissions sources generated by mobile sources, embedded in electricity and water uses, and emissions that are emitted during the treatment of wastewater generated at the Project site. Mobile source emissions would be associated with activities such as vehicle travel required for maintenance of the CPV units and the surrounding site. On-site operational activity would include in-place panel washing as often as approximately every 6 to 8 weeks, but expected to be required about four times per year. Panel washing is expected to require 6.5 gallons per tracker, but no more than 24 gallons of water would be required to wash each tracker. Each washing event would be completed by two washing trucks deployed across the site.

There would also be some usage of grid-provided electricity to power the CPV trackers and communication/monitoring system on-site. Consumption of water may result in indirect GHG emissions from electricity used to power any off-site conveyance, distribution, and treatment of water and associated wastewater. Table 2 shows the summary of operational GHG emissions estimated for the Project. The annual operational emissions levels were estimated using the best available methodologies and emission factors available at the time of writing this technical report. Additional details are available in Appendix A.

Table 2
Project GHG Emissions

Emissions Source	Unmitigated Project Emissions of CO_2e per Year
Off-Road Equipment/On-Road Vehicles	148
Energy	346
Water	7
Wastewater	<1
Total (Operational)	501
Total Amortized Construction	149
Total (Operational + Amortized Construction)	650

Note: Totals may not add correctly due to rounding.

As shown in Table 2, the Project would result in approximately 650 MT CO_2e per year. This is an increase of 650 MT CO_2e per year from existing emissions levels, because the existing site is currently used for grazing with minimal GHG emissions resulting from this activity.

As shown in Table 2, the total construction-related and operational CO_2e emissions associated with the Project would be less than the screening criteria of 900 MT CO_2e recommended by DPLU. Therefore, the Project would not require further quantification and would not be anticipated to impede the implementation of AB 32. The Project would not generate GHG emissions, either directly or indirectly, that would have a significant impact on the environment. The impact would be less than significant.

Mitigation Measure: No mitigation is required.

Impact 2: Conflict with an Applicable Plan, Policy, or Regulation Adopted to Reduce Greenhouse Gas Emissions

ARB's Scoping Plan is the most applicable state plan to evaluate the Project's actions because it provides the outline for actions to reduce California's GHG emissions and meet the goals set in AB 32. For more information regarding the Scoping Plan see "Assembly Bill 32 Climate Change Proposed Scoping Plan" on page 20. The Scoping Plan includes measures that would indirectly address GHG emissions levels associated with construction activity, including the phasing in of cleaner technology for diesel engine fleets (including construction equipment) and the development of a Low Carbon Fuel Standard. Policies formulated under the mandate of AB 32, either directly or indirectly applicable to construction-related activities, are assumed to be implemented during construction of the Project if those policies and laws are developed before construction begins. Therefore the Project construction would not conflict with the Scoping Plan.

Although construction and operation of the Project would result in an increase of GHG emissions, it is aligned with the goals of AB 32. The Project would provide non-fossil-fuel-based electricity and would support the state's goal to obtain 33% of all electricity from renewable sources and, therefore, help to achieve 1990 statewide emissions levels by 2020.

Because the electricity generated by the Project may be provided to a utility company in an effort to meet that company's RPS mandate, the Project is not able to take credit for the emissions reductions that would come from supplying clean, carbon-free electricity instead of electricity from a typical power plant. However, to demonstrate that the Project is aligned with and supporting the goals of AB 32, the Scoping Plan, and the RPS, the amount of carbon savings that would be derived from implementation of the Project, as opposed to implementation of a carbon-based power plant, was estimated for this report.

The total amount of carbon savings from implementation of the Project is estimated at 106,990 MT CO_2e per year. After accounting for annual operational emissions and amortized construction emissions of 650 MT CO_2e per year (as shown in Table 2), the Project would result in net carbon savings of 106,340 MT CO_2e per year. As these emissions reductions are accounted for by a utility that will be using them to meet its RPS goal, the reductions are not factored into the significance findings for this report; however, quantifying them does demonstrate that the Project will assist the state in meeting its RPS goal.

As discussed earlier, the Project would not exceed the screening criteria for GHG emissions recommended by San Diego County DPLU. The approach to developing a threshold of significance for GHG emissions is to identify the level of emissions for which a project would not be expected to substantially conflict with existing California legislation that has been adopted to reduce statewide GHG emissions. The Project's estimated GHG emissions of 650 MT CO_2e are below the 900 MT CO_2e threshold and would not conflict with any applicable plan, policy, or regulation for the purpose of reducing GHG emissions. This impact would be less than significant.

Mitigation Measure: No mitigation is required.

CHAPTER 4.0
EFFECTS OF GLOBAL CLIMATE CHANGE ON THE PROJECT

The level of significance of the impact of global climate change on the Project cannot be determined with certainty because of the variability in climate change models. However, an expected increase in the annual average temperature attributable to global climate change is projected to result in numerous effects in California, such as changes in precipitation patterns, snowpack, runoff, sea level rise, and water quality. Effects on precipitation and snowpack would affect runoff and surface water, but would not affect the physical conditions of the Project site. The Project is located at an elevation that would not be at or affected by a rising sea level, and increased cloud cover is not likely to cause a significant effect on operations.

The Project would achieve consistency with state plans and goals, and enhance achievement of the objectives to protect California's natural resources against the detrimental effects of climate change by generating 80 MW of renewable energy. This would help the state reach its goal, as described in SB X1-2, to obtain 33% of all electricity from renewable sources.

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CHAPTER 5.0
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APPENDIX A

Model Assumptions and Outputs

Rugged GHG Emissions Summary

Construction

	Total GHG Emissions (MT CO_2e)
2014	
Mobilization	5
Clearing/Grading	339
Road Construction	429
Concrete Batch Plant - Rock Crusher	292
Gen-Tie Line	256
Trenching - Electrical	748
Tracker Installation	491
O&M Building - Substation	154
Water	118
On-Road Vehicles	1,378
Total - 2014	4,211
2015	
Concrete Batch Plant - Rock Crusher	24
Trenching - Electrical	86
Tracker Installation	48
Clean-Up	31
On-Road Vehicles	100
Total - 2015	265
Total	4,476
Total Amortized Construction (30 Years)	149

Operations

	Total GHG Emissions (MT CO_2e)
Off-Road Equipment	25
On-Road Vehicles	106
Gen-Tie Line	17
Total Off-Road Equipment/On-Road Vehicles	148
Electricity	346
Water	7
Waste Water	0.32
Total	501
Total Amortized Construction	149
Total (Operational + Amortized Construction)	650

Rugged Solar Farm - Mobilization

Off-Road Equipment

Equipment	Equipment Category	Number	Hours Per Day	Total Days	Total Emissions (tons) CO2	CH4	NO2	Total GHG Emissions (Metric Tons)
Off-Road Equipment	Tractors/Loaders/Backhoes Compos	5	2	7	2.34	0.00		2.13

Note: Assumes off-road equipment will operate 2 hours per day during mobilization.

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Heavy-Duty Trucks	10	35	350	2,450	1.201	0.0001	0.0001	1.12

Note: Assumes 2 heavy-duty truck trips (one trip each direction) per piece of construction equipment.

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Worker Vehicles	20	35	700	4,900	1.897	0.0002	0.0002	1.79

Note: Assumes 10 workers per day to mobilize equipment.

Total					Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
					5.44	0.00	0.00	5.04

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

Project Name: Rugged - Grading - Trenching - Electrical Transmission - Tracker Installation

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2014 TOTALS (tons/year unmitigated)	1.41	11.49	5.56	0.00	8.26	0.47	8.73	1.72	0.43	2.16	1,734.69
2014 TOTALS (tons/year mitigated)	1.41	11.49	5.56	0.00	2.14	0.47	2.61	0.45	0.43	0.88	1,734.69
Percent Reduction	0.00	0.00	0.00	0.00	74.04	0.00	70.05	74.02	0.00	59.18	0.00
2015 TOTALS (tons/year unmitigated)	0.11	0.85	0.44	0.00	0.00	0.03	0.03	0.00	0.03	0.03	146.77
2015 TOTALS (tons/year mitigated)	0.11	0.85	0.44	0.00	0.00	0.03	0.03	0.00	0.03	0.03	146.77
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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2014	1.41	11.49	5.56	0.00	8.26	0.47	8.73	1.72	0.43	2.16	1,734.69
Fine Grading 04/10/2014-07/01/2014	0.33	2.74	1.39	0.00	8.26	0.12	8.37	1.72	0.11	1.83	372.82
Fine Grading Dust	0.00	0.00	0.00	0.00	8.25	0.00	8.25	1.72	0.00	1.72	0.00
Fine Grading Off Road Diesel	0.31	2.49	1.23	0.00	0.00	0.11	0.11	0.00	0.10	0.10	308.96
Fine Grading On Road Diesel	0.02	0.25	0.10	0.00	0.00	0.01	0.01	0.00	0.01	0.01	53.92
Fine Grading Worker Trips	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.93
Building 05/30/2014-01/21/2015	0.46	3.40	1.55	0.00	0.00	0.13	0.13	0.00	0.12	0.12	540.07
Building Off Road Diesel	0.46	3.40	1.55	0.00	0.00	0.13	0.13	0.00	0.12	0.12	540.07
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trenching 07/02/2014-01/21/2015	0.62	5.34	2.62	0.00	0.00	0.22	0.22	0.00	0.20	0.20	821.81
Trenching Off Road Diesel	0.62	5.34	2.45	0.00	0.00	0.22	0.22	0.00	0.20	0.20	794.97
Trenching Worker Trips	0.00	0.01	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.84
2015	0.11	0.85	0.44	0.00	0.00	0.03	0.03	0.00	0.03	0.03	146.77
Building 05/30/2014-01/21/2015	0.04	0.30	0.15	0.00	0.00	0.01	0.01	0.00	0.01	0.01	52.55
Building Off Road Diesel	0.04	0.30	0.15	0.00	0.00	0.01	0.01	0.00	0.01	0.01	52.55
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trenching 07/02/2014-01/21/2015	0.07	0.55	0.29	0.00	0.00	0.02	0.02	0.00	0.02	0.02	94.22
Trenching Off Road Diesel	0.07	0.55	0.27	0.00	0.00	0.02	0.02	0.00	0.02	0.02	91.14
Trenching Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.08

Phase Assumptions

Phase: Fine Grading 4/10/2014 - 7/1/2014 - Default Fine Site Grading/Excavation Description

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Total Acres Disturbed: 455

Maximum Daily Acreage Disturbed: 7

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 1376.93 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 358.38

Off-Road Equipment:

1 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

2 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Trenching 7/2/2014 - 1/21/2015 - Default Trenching Description

Off-Road Equipment:

1 Bore/Drill Rigs (291 hp) operating at a 0.75 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 8 hours per day

1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day

1 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (549 hp) operating at a 0.74 load factor for 8 hours per day

1 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0 hours per day

2 Trenchers (63 hp) operating at a 0.75 load factor for 8 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Building Construction 5/30/2014 - 1/21/2015 - Default Building Construction

Off-Road Equipment:

1 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 8 hours per day

2 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

3 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

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1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

2 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2014	1.41	11.49	5.56	0.00	2.14	0.47	2.61	0.45	0.43	0.88	1,734.69
Fine Grading 04/10/2014-07/01/2014	0.33	2.74	1.39	0.00	2.14	0.12	2.26	0.45	0.11	0.55	372.82
Fine Grading Dust	0.00	0.00	0.00	0.00	2.14	0.00	2.14	0.45	0.00	0.45	0.00
Fine Grading Off Road Diesel	0.31	2.49	1.23	0.00	0.00	0.11	0.11	0.00	0.10	0.10	308.96
Fine Grading On Road Diesel	0.02	0.25	0.10	0.00	0.00	0.01	0.01	0.00	0.01	0.01	53.92
Fine Grading Worker Trips	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.93
Building 05/30/2014-01/21/2015	0.46	3.40	1.55	0.00	0.00	0.13	0.13	0.00	0.12	0.12	540.07
Building Off Road Diesel	0.46	3.40	1.55	0.00	0.00	0.13	0.13	0.00	0.12	0.12	540.07
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trenching 07/02/2014-01/21/2015	0.62	5.34	2.62	0.00	0.00	0.22	0.22	0.00	0.20	0.20	821.81
Trenching Off Road Diesel	0.62	5.34	2.45	0.00	0.00	0.22	0.22	0.00	0.20	0.20	794.97
Trenching Worker Trips	0.00	0.01	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.84

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2015	0.11	0.85	0.44	0.00	0.00	0.03	0.03	0.00	0.03	0.03	146.77
Building 05/30/2014-01/21/2015	0.04	0.30	0.15	0.00	0.00	0.01	0.01	0.00	0.01	0.01	52.55
Building Off Road Diesel	0.04	0.30	0.15	0.00	0.00	0.01	0.01	0.00	0.01	0.01	52.55
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Trenching 07/02/2014-01/21/2015	0.07	0.55	0.29	0.00	0.00	0.02	0.02	0.00	0.02	0.02	94.22
Trenching Off Road Diesel	0.07	0.55	0.27	0.00	0.00	0.02	0.02	0.00	0.02	0.02	91.14
Trenching Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.08

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 4/10/2014 - 7/1/2014 - Default Fine Site Grading/Excavation Description

For Soil Stablizing Measures, the Apply soil stabilizers to inactive areas mitigation reduces emissions by:

PM10: 84% PM25: 84%

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

Project Name: Rugged - O&M Building and Substation Construction

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2014 TOTALS (tons/year unmitigated)	0.29	1.06	0.50	0.00	0.00	0.04	0.04	0.00	0.04	0.04	168.71

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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2014	0.29	1.06	0.50	0.00	0.00	0.04	0.04	0.00	0.04	0.04	168.71
Building 08/10/2014-12/04/2014	0.15	1.06	0.50	0.00	0.00	0.04	0.04	0.00	0.04	0.04	168.50
Building Off Road Diesel	0.15	1.06	0.50	0.00	0.00	0.04	0.04	0.00	0.04	0.04	168.50
Building Vendor Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Building Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating 11/03/2014-12/04/2014	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
Architectural Coating	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21

Phase Assumptions

Phase: Building Construction 8/10/2014 - 12/4/2014 - Default Building Construction

Off-Road Equipment:

1 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 8 hours per day

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

1 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

1 Off Highway Trucks (479 hp) operating at a 0.57 load factor for 8 hours per day

1 Other Equipment (190 hp) operating at a 0.62 load factor for 8 hours per day

Phase: Architectural Coating 11/3/2014 - 12/4/2014 - Type Your Description Here

Rule: Residential Interior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 100

Rule: Residential Interior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 50

Rule: Residential Exterior Coatings begins 1/1/2005 ends 6/30/2008 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 7/1/2008 ends 12/31/2040 specifies a VOC of 100

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

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Construction Mitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Mitigated

Construction Related Mitigation Measures

Rugged - Service & Access Roads

Emission Estimates for -> Rugged - Service & Access Roads				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM10 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	PM2.5 (lbs/day)	CO2 (lbs/day)
Grubbing/Land Clearing	8.6	76.4	39.6	2.7	2.7	-	1.8	1.8	-	14,517.7
Grading/Excavation	9.2	80.7	46.9	3.1	3.1	-	2.2	2.2	-	15,297.9
Drainage/Utilities/Sub-Grade	7.6	72.8	24.3	2.2	2.2	-	1.5	1.5	-	13,224.2
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (pounds/day)	9.2	80.7	46.9	3.1	3.1	-	2.2	2.2	-	15,297.9
Total (tons/construction project)	0.3	2.5	1.2	0.1	0.1	-	0.1	0.1	-	473.4

Notes: Project Start Year -> 2014
Project Length (months) -> 3
Total Project Area (acres) -> 162
Maximum Area Disturbed/Day (acres) -> 7
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in

Emission Estimates for -> Rugged - Service & Access Roads				Total	Exhaust	Fugitive Dust	Total	Exhaust	Fugitive Dust	
Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM10 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	PM2.5 (kgs/day)	CO2 (kgs/day)
Grubbing/Land Clearing	3.9	34.7	18.0	1.2	1.2	-	0.8	0.8	-	6,599.0
Grading/Excavation	4.2	36.7	21.3	1.4	1.4	-	1.0	1.0	-	6,953.6
Drainage/Utilities/Sub-Grade	3.4	33.1	11.1	1.0	1.0	-	0.7	0.7	-	6,011.0
Paving	-	-	-	-	-	-	-	-	-	-
Maximum (kilograms/day)	4.2	36.7	21.3	1.4	1.4	-	1.0	1.0	-	6,953.6
Total (megagrams/construction project)	0.3	2.3	1.1	0.1	0.1	-	0.1	0.1	-	429.4

Notes: Project Start Year -> 2014
Project Length (months) -> 3
Total Project Area (hectares) -> 162
Maximum Area Disturbed/Day (hectares) -> 7
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in

Source: Road Construction Emissions Model, Version 7.1.2

Rugged Solar Farm - On-Road Vehicles - 2014

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Heavy-Duty Trucks	50	170	8,500	1,870,000	916.387	0.0586	0.0760	856.48

Note: Assumes 4 total truck trips (2 round trips) per tracker for a total of 14,352 trips for the project, or an average of 50 trips per day.

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Worker Vehicles	186	35	6,510	1,432,200	554.612	0.0449	0.0582	521.98

Notes: Assumes a maximum of 186 trips per day during the peak construction period.

Total					Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
					1,471.00	0.10	0.13	1,378.46

Rugged Solar Farm - On-Road Vehicles - 2015

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Heavy-Duty Trucks	50	140	7,000	126,000	61.746	0.0039	0.0051	57.71

Note: Assumes 4 total truck trips (2 round trips) per tracker for a total of 14,352 trips for the project, or an average of 50 trips per day.

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Worker Vehicles	186	35	6,510	117,180	45.377	0.0037	0.0048	42.71

Notes: Assumes a maximum of 186 trips per day during the peak construction period.

Total					Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
					107.12	0.01	0.01	100.42

Rugged Solar - Concrete Batch Plant - Haul Trucks - 2014

Batch Plant Capacity	11,756	cubic yard concrete
Days of Operation per Year =	220	

	Pounds	Tons	Volume (cu yds)	Truck Capacity (cu yds)	Number of Trucks
Aggregate	21,924,940	10,962	8,120		
Sand	16,787,568	8,394	6,218	20	310.88
Cement	5,772,196	2,886	2,274	20	113.72
Cement supplement	858,188	429	338	20	16.91
Water		232,920			
Total material	45,342,892	22,671			441.50

Note: Water quantity is listed in gallons
Aggregate assumed to be produced on site. Water to be provided by on-site wells

Heavy-Duty Truck Emissions

					Total Emissions (tons)			
	Maximum Trips per Day	Distance	Average Daily Mileage	Total Mileage	CO_2	CH_4	N_2O	Total GHG Emissions (Metric
Sand	4	55	220	48,400	91.82	0.00027	0.00026	83.63
Cement	2	55	110	24,200	45.91	0.00014	0.00013	41.82
Cement supplement	2	55	110	24,200	45.91	0.00014	0.00013	41.82
Concrete Trucks	20	1	20	4,400	8.35	0.00002	0.00002	7.60
Total			440	96,800	183.63	0.00054	0.00051	167.26

Note: Materials are assumed to be delivered from San Diego to the project site.

Global Warming Potential

Gas	Atmospheric Lifetime (years)	Global Warming Potential (100 year time
Carbon Dioxide	50-200	1
Methane	12 ± 3	21
Nitrous Oxide	120	310

Materials necessary to produce 1 cubic yard concrete

	Pounds(1)	Tons
Aggregate	1,865	0.93
Sand	1,428	0.71
Cement	491	0.25
Cement supplement	73	0.04
Total Solid Material	3,857	1.93

	Liters	Gallons
Water	75	19.81

Source: EPA AP-42 Section 11.12 Concrete Batching

Volume/weight conversion
1 cubic yard

	Pounds Per Cubic Yard
Aggregate	2700
Sand	2700
Cement	2538
Cement supple	2538

Rugged Batch Plant/Rock Crushing Facility - Generator Emissions - 2014

Off-Road Equipment

					Total Emissions (tons)			
Equipment	**Equipment Category**	**Number**	**Hours Per Day**	**Total Days**	**CO2**	**CH4**	**NO2**	**Total GHG Emissions (Metric Tons)**
Generator	Batch Plant - Generator	2	8	220	137.19	0.02		125.15

Note: Assumes a total of 2 generators for the batch plant and rock crushing facility

Rugged Solar - Concrete Batch Plant - Haul Trucks - 2015

Batch Plant Capacity	962	cubic yard concrete
Days of Operation per Year =	18	

	Pounds	Tons	Volume (cu yds)	Truck Capacity (cu yds)	Number of Trucks
Aggregate	1,794,130	897	664		
Sand	1,373,736	687	509	20	25.44
Cement	472,342	236	186	20	9.31
Cement supplement	70,226	35	28	20	1.38
Water		19,060			
Total material	3,710,434	1,855			36.13

Note: Water quantity is listed in gallons
Aggregate assumed to be produced on site. Water to be provided by on-site wells

Heavy-Duty Truck Emissions

					Total Emissions (tons)			
	Maximum Trips per Day	**Distance**	**Average Daily Mileage**	**Total Mileage**	**CO_2**	**CH_4**	**N_2O**	**Total GHG Emissions (Metric**
Sand	4	55	220	3,960	7.51	0.00002	0.00002	6.84
Cement	2	55	110	1,980	3.76	0.00001	0.00001	3.42
Cement supplement	2	55	110	1,980	3.76	0.00001	0.00001	3.42
Concrete Trucks	20	1	20	360	0.68	0.00000	0.00000	0.62
Total			440	7,920	15.02	0.00004	0.00004	13.69

Note: Materials are assumed to be delivered from San Diego to the project site.

Global Warming Potential

Gas	Atmospheric Lifetime (years)	Global Warming Potential (100 year time
Carbon Dioxide	50-200	1
Methane	12 ± 3	21
Nitrous Oxide	120	310

Materials necessary to produce 1 cubic yard concrete

	Pounds(1)	Tons
Aggregate	1,865	0.93
Sand	1,428	0.71
Cement	491	0.25
Cement supplement	73	0.04
Total Solid Material	3,857	1.93

	Liters	Gallons
Water	75	19.81

Source: EPA AP-42 Section 11.12 Concrete Batching

Volume/weight conversion
1 cubic yard

	Pounds Per Cubic Yard
Aggregate	2700
Sand	2700
Cement	2538
Cement supple	2538

Rugged Batch Plant/Rock Crushing Facility - Generator Emissions - 2015

Off-Road Equipment

					Total Emissions (tons)			
Equipment	**Equipment Category**	**Number**	**Hours Per Day**	**Total Days**	**CO2**	**CH4**	**NO2**	**Total GHG Emissions (Metric Tons)**
Generator	Batch Plant - Generator	2	8	18	11.22	0.00		10.24

Note: Assumes a total of 2 generators for the batch plant and rock crushing facility

Rugged Solar Farm - Clean Up

					Total Emissions (tons)			
	Total Trips	Distance	Average Daily Mileage	Total Mileage	CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Worker Vehicles	40	35	1,400	84,000	32.529	0.0026	0.0034	30.61

Note: Assumes 20 workers per day to complete the "punch list" and clean up the project site.

Gen-Tie Line - Off-Road Construction/Worker Commutes

Emission Estimates for -> Rugged - Gen-Tie Line Project Phases (English Units)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	CO2 (lbs/day)
	-	-	-	-	-	-	-	-	-	-
Site Access Roads	6.4	36.0	72.1	26.1	3.3	22.8	7.8	3.0	4.7	6,962.6
Pole Installation	4.1	22.7	44.1	24.9	2.2	22.8	6.7	1.9	4.7	4,878.2
Conductor Installation	1.8	8.8	12.2	1.0	1.0	-	0.9	0.9	-	1,782.9
Maximum (pounds/day)	6.4	36.0	72.1	26.1	3.3	22.8	7.8	3.0	4.7	6,962.6
Total (tons/construction project)	0.1	0.7	1.4	0.6	0.1	0.6	0.2	0.1	0.1	149.9

Notes: Project Start Year -> 2014
Project Length (months) -> 3
Total Project Area (acres) -> 9
Maximum Area Disturbed/Day (acres) -> 2
Total Soil Imported/Exported (yd^3/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sum of exhaust and fugitive dust emissions shown in

Emission Estimates for -> Rugged - Gen-Tie Line Project Phases (Metric Units)	ROG (kgs/day)	CO (kgs/day)	NOx (kgs/day)	Total PM10 (kgs/day)	Exhaust PM10 (kgs/day)	Fugitive Dust PM10 (kgs/day)	Total PM2.5 (kgs/day)	Exhaust PM2.5 (kgs/day)	Fugitive Dust PM2.5 (kgs/day)	CO2 (kgs/day)
	-	-	-	-	-	-	-	-	-	-
Site Access Roads	2.9	16.4	32.8	11.9	1.5	10.3	3.5	1.4	2.2	3,164.8
Pole Installation	1.9	10.3	20.0	11.3	1.0	10.3	3.0	0.9	2.2	2,217.4
Conductor Installation	0.8	4.0	5.6	0.5	0.5	-	0.4	0.4	-	810.4
Maximum (kilograms/day)	2.9	16.4	32.8	11.9	1.5	10.3	3.5	1.4	2.2	3,164.8
Total (megagrams/construction project)	0.1	0.7	1.3	0.6	0.1	0.5	0.2	0.1	0.1	135.9

Notes: Project Start Year -> 2014
Project Length (months) -> 3
Total Project Area (hectares) -> 9
Maximum Area Disturbed/Day (hectares) -> 2
Total Soil Imported/Exported ($meters^3$/day)-> 0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns H and I. Total PM2.5 emissions shown in Column J are the sume of exhaust and fugitive dust emissions shown in

Source: Road Construction Emissions Model, Version 7.1.2

Gen-Tie Line
On-Road Construction Emissions

	Total Daily Round Trips	Distance	Average Daily	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Pole Installation	8	134	1,072	64,320	122	0.00036	0.00034	111
Concrete Trucks	16	5	80	4,800	9	0.00003	0.00003	8
Total			**1,152**	**69,120**	**131.12**	**0.00**	**0.00**	**119.43**

Notes:
Material delivery for pole installation assumes 67 miles per trip from San Diego to the project site
Concrete trucks are assumed to travel approximately 35 miles from Alpine to the project site
Emission factors from EMFAC 2011 for San Diego County

Total Estimated Water for Temporary Project Construction					
Activity	Time Frame (workdays)[1]	Water Use (gallons)	Acres	Total Estimated Water Demand (gallons)	Total Estimated Water Demand (acre-feet)
Site preparation (clearing, grading)[2]	40	52,400	455	23,842,000	73.17
Application of Water/Soil Binding Agent[3]	260	3,300	455	1,501,500	4.61
Total Construction Water				**25,343,500**	**77.78**

1. Assumes 20 workdays per month
2. Assumes 0.160 acre-feet of water per acre (ac-ft/ac) would be used for site preparation (Project Description)
3. Assumes 0.01 acre-feet (3,300 gallons) of water application per acre (Project Description)

Rugged GHG Emission From Construction Water Usage		
Energy Factor for Outdoor water use for Southern CA (kWh/MG) [1]	**MWh**	**Emission Factor CO_2 [2] (lb/MWh)**
11,110	281.57	919.64
CH_4 [2]	**N_2O[2] (lb/MWh)**	**Total CO_2e**
0.029	0.01	117.92

1- CEC. 2006 (December).Refining Estimates of Water-Related Energy Use in California prepared by Navigant Consulting, Inc.

2 -Emission factor: LGOP 2010 V1.1 Table G.7 California Grid Average Electricity Emission

Rugged Solar Farm - Operational Emissions

Off-Road Equipment

Equipment	Equipment Category	Number	Hours Per Day	Total Days	Total Emissions (tons) CO2	CH4	NO2	Total GHG Emissions (Metric Tons)
Generators	Generator Sets Composite	2	1	50	27.19	0.00		24.77

Panel Washing

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Water Truck	2	5	10	360	0.68	0.00000	0.00000	0.62

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Satellite Washing Trucks	10	5	50	1,800	0.882	0.0001	0.0001	0.82

Operations

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Worker Vehicles	30	35	1,050	277,200	107.344	0.0087	0.0113	101.03

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Personnel Transport Vehicles	4	5	20	5,280	2.587	0.0002	0.0002	2.42

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
Service Trucks	2	5	10	2,640	1.294	0.0001	0.0001	1.21

Total					Total Emissions (tons) CO_2	CH_4	N_2O	Total GHG Emissions (Metric Tons)
					139.98	0.01	0.01	130.87

Gen-Tie Line - Operational Emissions
Heavy-Duty Vehicles

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO$_2$	CH$_4$	N$_2$O	Total GHG Emissions (Metric
Equipment Repair Vehicles	3	38	228	1,140	2.16	0.00001	0.00001	2

Notes:
Assumes 3 HHDT for equipment repair
Mileage is based on distance from Alpine to the project site (approximately 35 miles) and length of the Gen-Tie line (3 miles)

Light-Duty Vehicles

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO$_2$	CH$_4$	N$_2$O	Total GHG Emissions (Metric
Pole Structure Brushing	3	38	228	5,472	2.119	0.0002	0.0002	1.99

Notes:
Assumes 3 worker vehicles, 3 LDA vehicles for pole structure brushing, 3 employee vehicles for herbicide application, and 3 LDA vehicles for equipment repair
Mileage is based on distance from Alpine to the project site (approximately 35 miles) and length of the Gen-Tie line (3 miles)

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO$_2$	CH$_4$	N$_2$O	Total GHG Emissions (Metric
Herbicide Application	3	38	228	5,472	2.119	0.0002	0.0002	1.99

Notes:
Assumes 3 worker vehicles, 3 LDA vehicles for pole structure brushing, 3 employee vehicles for herbicide application, and 3 LDA vehicles for equipment repair
Mileage is based on distance from Alpine to the project site (approximately 35 miles) and length of the Gen-Tie line (3 miles)

	Total Trips	Distance	Average Daily Mileage	Total Mileage	Total Emissions (tons) CO$_2$	CH$_4$	N$_2$O	Total GHG Emissions (Metric
Equipment Repair	3	38	228	1,140	0.441	0.0000	0.0000	0.42

Notes:
Assumes 3 worker vehicles, 3 LDA vehicles for pole structure brushing, 3 employee vehicles for herbicide application, and 3 LDA vehicles for equipment repair
Mileage is based on distance from Alpine to the project site (approximately 35 miles) and length of the Gen-Tie line (3 miles)

Helicopter

	Fuel Consumption Per Hour (gal)	Hours per Day	Days Per Year	Total Hours	Total Emissions (tons) CO$_2$	CH$_4$	N$_2$O	Total GHG Emissions (Metric
	15	8	2	16	2.003	0.002	0.000	1.86

Notes:
Helicopter assumed to be a Robinson 44 model with a fuel consumption of 15 gal/hr. U.S. Department of Interior, National Business Center, Aviation Management Directiv
Emission factors for fuel consumption from California Climate Action Registry

Total	Total Trips		Average Daily Mileage	Total Mileage	Total Emissions (tons) CO$_2$	CH$_4$	N$_2$O	Total GHG Emissions (Metric
	12		912	13,224	8.85	0.00	0.00	8.24

Rugged - Electricity-Related GHG Emissions

Equipment Electricity Assumptions			
Equipment	**Electricity Draw (watts)[1]**	**Assumptions**	**Annual Energy Usage (kWh)**
Per Tracker:			
Tracker Control Unit:	50	The control unit only uses energy during daylight hours	219
Tracker Motor (only one used at a time):	250	Each tracker motor runs for one minute every hour	18
Air Drying Unit:	192	per day and for 10 hours every 3 weeks	103
Total Per Tracker			**341**
Per Building Block:			
Field communications:	300	Operates during daylight hours	1314
Inverters:	100	The Inverter operates at night	438
PV Box Ventilation:	173	Operates during daylight hours	758
Total Per Building Block			**2510**
1 - Equipment energy usage information and assumptions come from Rugged Solar LLC			

Rugged GHG Emission from Electricity Usage				
# of Building Block	**# of CPV units[3]**	**Building Block Annual Energy usage**	**Tracker annual kWh usage**	**Total Annual kWh**
61	3,588	153,094	1,222,109	1,375,203
CO2 Emission Coefficient[1] (lbs/kWh)	**CH4 Emission Coefficient[2] (lbs/kWh)**	**N20 Emission Coefficient[2] (lbs/kWh)**	**Annual Emissions (MT CO2e/yr)**	
0.55014	0.000029	0.000014	346.26	
1 - Estimated 2020 SDG&E emission factor with 33% renewable energy				
2 - LGOP Table G.7 California Grid Average Electricity Emission Factors (1990-2007)				
3 - From most recent Project Description				

Rugged Operational Water Use

Dust Suppression	
Number of gallons/acre[1]	1650
Acres[2]	455
Water use/year (gallons)	750,750
Water use/year (acre-feet)	2.30
Panel Washing	
Washes/year	9
Number of Trackers	3,588
Gallons/tracker/wash	24
water use/year (gallons)	775,008
water use/year (acre-feet)	2.38
Total water use (gallons/year)	**1,525,758**
Total water use (acre-feet/year)	**4.68**

1. Based on suppression activities of 3,300 gallons every 2 years
2. Based on constructed acres within the project site. Open space areas are not included in estimates for dust suppression
3. 1 acre-foot = 325,851 gallons

Rugged GHG Emission From Operational Water Usage

Energy Factor for Outdoor water use for Southern CA (kWh/MG)[1]	MWh	Emission Factor CO_2 [2] (lb/MWh)
11,110	16.95	919.64
CH_4 [2]	**N_2O[2] (lb/MWh)**	**(MT CO_2e/yr)**
0.029	0.01	7.10

1- CEC. 2006 (December).Refining Estimates of Water-Related Energy Use in California prepared by

1 -Emission factor: LGOP 2010 V1.1 Table G.7 California Grid Average Electricity Emission Factors

Rugged GHG Emissions from Wastewater

Facility/Jurisdiction	Influent Emissions					
	Influent (MGD)	Influent (gal/yr)	Influent BOD* (mg/L)	Influent BOD (kg/yr)	Adjusted BOD Emission Factor (kg CH4/kg BOD)	Influent Emissions (MT CO_2e)
Joint Water Pollution Control Plant/LA County Sanitation District	0.0001954	71,328	439	119	0.12	**0.30**
Effluent Emissions						**Total Emissions (MT CO2e)**
Effluent (MGD)	**Effluent (gal/yr)**	**Effluent Nitrogen Content (mg/L)**	**Effluent Nitrogen Content (kg/yr)**	**N2O Emissions (kg/yr)**	**Effluent Emissions (MT CO_2e)**	
0.0001954	71,328	40	10.80	0	**0.0263**	**0.3250**

* Likely an overestimate as treatment facility takes in industrial waste.

Source: Intergovernmental Panel on Climate Change 2006. IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 6:

EMISSION FACTORS

Methane Emissions

EmisFact (kg CH4/kg BOD) (EF = Max CH4 * MCF)	Max CH4 Producing Capacity (kg CH4/kg BOD)	Methane Correction Factor	GWP
0.12	0.6	0.2	21

Equation 6.2 IPCC Chapter 6

Nitrogen Emissions

$EF_{Effluent}$ (kg N2O-N/kg N)		GWP
0.005	1.57142857	310

L/gal 3.785

Rugged GHG Emissions Offset

Maximum Installed Capacity (MW_{DC})	kWh_{AC} per Installed kW_{DC}	Annual Output Output (kWh)	CO_2 Emission Factor (lb/kWh)	CH_4 Emission Factor (lb/kWh)	N_2O Emission Factor (lb/kWh)	Annual GHG Offset
105.235	2,083	219,204,505	1.071	0.000029	0.000014	106,990

Notes:

CO_2 emission factor based on 739.05 lb/MWh in 2008 and

Source:

http://www.sdge.com/sites/default/files/FINAL092610_PowerLabel.pdf