



# Renewable Energy

## City of Carlsbad Photovoltaic System Feasibility Study

### Background

The City of Carlsbad, CA, a scenic coastal community of more than 100,000 residents located 35 miles north of the city of San Diego, contracted Alternative Energy Systems Consulting, Inc. (AESC) to conduct photovoltaic (PV) feasibility studies for the Alga Norte Community Park and the Safety Training Center. The purpose of the studies was to determine the size, cost, performance and internal rate of return for the PV systems at each site.

The Alga Norte Community Park is located north of Poinsettia Lane approximately one-half mile east of El Camino Real. It was under construction during the PV feasibility study and was scheduled to open at the end of 2013.

The Safety Training Center is located on Orion Street just north of Faraday Avenue. It is a multi-faceted, state-of-the-art training facility that spans a four-acre campus and is designed to provide quality training opportunities for Carlsbad police, fire and public works departments.

### Study Description

AESC began the study by collecting drawings, load data, historical electrical bills and other available information for the project sites. An AESC engineer then performed site inspections and collected information on available space, mounting surface pitch and orientation, shade impacts, planned electrical loads, and site layout.

Once data collection was completed, AESC developed multiple conceptual PV designs. AESC then estimated the performance of each

conceptual design using the California Solar Initiative (CSI) Incentive Calculator. The CSI Incentive Calculator provides estimated PV system energy output and CSI incentive, based on specific qualified PV modules and inverter equipment. The CSI Incentive Calculator utilizes the National Renewable Energy Laboratory's PV Watts performance model algorithm. AESC was the developer of the calculator for the CSI program.

The prototype PV systems analyzed included monocrystalline and multicrystalline panels, central and micro-inverters, and various tilts and azimuths.

In addition to the performance estimate, AESC developed an estimate of total installed costs and created a detailed economic analysis. AESC analyzed the annual costs and benefits (grid electric savings, net energy metering and avoided GHG emissions) over the expected useful life of the system. Estimated PV system degradation and maintenance costs were included in the analysis.

### Project Results<sup>1</sup>

The study revealed that the best PV locations for these sites were –

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<sup>1</sup> Study results estimate future performance and costs of the PV systems. Note that actual performance and cost will vary due to a number of factors.

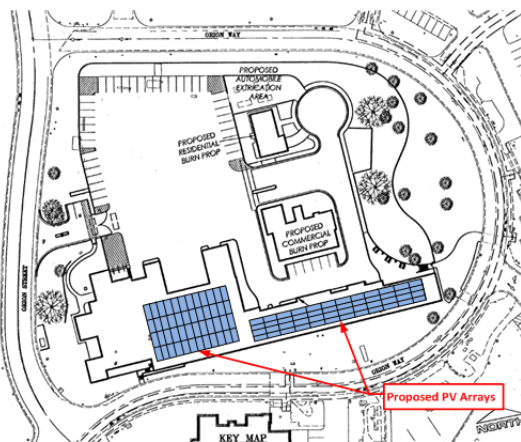
The Alga Norte Community Park parking covers.



[Image Courtesy of the City of Carlsbad]

Alga Norte Community Park	
System Size	629 kW
Annual Production	1,100,510 kWh/yr
Green House Gas Reduction	6,980 Metric Tons
Capital Cost	\$3,076,000
Net Savings	\$1,803,000
Adj. IRR	3.1%

The Safety Training Center indoor shooting range building rooftop.



[Image Courtesy of the City of Carlsbad]

Safety Training Center	
System Size	60 kW
Annual Production	98,279 kWh/yr
Green House Gas Reduction	844 Metric Tons
Capital Cost	\$318,000
Net Savings	\$117,000
Adj. IRR	2.6%

The best PV system configuration was determined to be multicrystalline panels, central inverter, with fixed optimal tilt and azimuth.

Estimated costs and benefits were calculated.

Site specific system size, performance, costs and economics were estimate for both locations.

## AESC Services and Specialties

- Renewable Energy Feasibility Analysis
- Energy & Environmental Impact Evaluation
- Evaluation of Advanced Generation, Energy Storage & Energy Efficiency Technologies
- Stochastic Energy Forecast Modeling
- Post Installation Inspection & Verification
- Equipment Specification Development
- Project Management
- Life Cycle Economic & Financing Analysis
- Customer & Utility Energy Program Development & Support