DESALINATION TASK FORCE MEMORANDUM

TO: DESALINATION TASK FORCE

FROM: PROGRAM MANAGERS

SUBJECT: ENERGY STUDY STATUS REPORT, CEQA UPDATE AND PROJECT ASSESSMENT PRESENTATION

DATE: SEPTEMBER 21, 2011

RECOMMENDATION: That the **scwd²** Desalination Task Force receive the fifth Energy Study status report and schedule, which include updates on goal identification, receive presentation on the sixteen draft Project Assessments (dPAs), and receive hard copies of the sixteen dPAs for subsequent review and comment.

BACKGROUND: This memorandum serves as the fifth status report and will update the Task Force on work progress with regard to the Energy Minimization and Greenhouse Gas Reduction Study (Energy Study). With guidance from members of the Energy Study Technical Working Group (ETWG) and additional local energy experts, the Energy Study work to date has focused on establishing the potential energy use of the facility, CEQA and other regulatory framework used to understand and evaluate that energy use, and projects that could be implemented to reduce the associated indirect greenhouse gas (GHG) emissions of the project. Current work examines the capital, operation and maintenance, lifecycle, and social costs associated with the implementation of a GHG reduction plan that is regulatory compliant, economical, and representative of our community values.

DISCUSSION: At its July meeting, Task Force members recommended that staff study and evaluate sixteen GHG reduction projects, requested that staff add sustainability as a project evaluation criterion, and tentatively approved the evaluation criteria sensitivity analysis. Task Force members also requested that staff continue to engage the ETWG to provide specific feedback on the dPAs and sensitivity analysis.

<u>Energy Study Schedule and Work Flow</u>

As mentioned in previous status reports, the Energy Study is being developed in stages and includes the following tasks:

1. Define the potential energy use and associated indirect GHGs of the desalination facility.
2. Identify a range of potential GHG reduction goals for future consideration.
3. Identify and assess potential GHG reduction projects.
4. Score and rank the projects according to the evaluation criteria and sensitivity analysis.
5. Recommend a portfolio of projects to meet a range of potential goals for each agency.

With regard to Task 2, work on establishing the CEQA threshold of significance for GHG emissions is underway as part of the development of the Draft EIR. The Energy Study will identify feasible GHG reduction measures to mitigate indirect GHG emissions that exceed the threshold of significance identified in the EIR. Staff is currently working closely with the project's EIR consultant to identify a substantiated CEQA threshold of significance for the project, which will be the basis for the EIR analysis of GHG emissions.

The Energy Study will identify a portfolio of projects sufficient in scope to meet the yet to be determined CEQA threshold of significance. Rather than selecting a particular GHG reduction goal at this time, staff recommends that the Energy Study identify and evaluate the technical merits, effectiveness and feasibility of the GHG reduction projects and assemble project portfolios capable of meeting the full range of possible GHG reduction goals. This information can then be used by the lead agencies in future project decision making and incorporated into the permitting process.

In addition to the CEQA analysis, Energy Study work remains on schedule and includes the upcoming milestones:

Item	Corresponding Task No.	Participants	Approximate Date
Identify CEQA threshold of significance	2	EIR consultant, Staff, K/J	Late September
TF and ETWG review of 16 dPAs	3	TF, ETWG[1]	Sept. 21st – Oct. 19th
ETWG meet to review dPAs and evaluate and rank the GHG reduction projects	4	Staff, Kennedy/Jenks (K/J), ETWG[1]	October
Present ETWG meeting results, review TF comments on dPAs, discuss CEQA and goal identification	4	TF, Staff, K/J, ETWG[1]	October TF meeting
Review scoring and ranking of the GHG reduction projects	4	TF, Staff, K/J, ETWG[1]	November TF meeting
Prepare the draft GHG reduction plan	5	Staff, K/J	Mid Nov. – Mid Dec.
Energy Community Informational Meeting	N/A	TF, Staff, K/J, ETWG[1], community	December
Review GHG reduction strategy including goal identification and GHG reduction project selection	5	Staff, Kennedy/Jenks (K/J), ETWG[1]	December TF meeting
ETWG review the GHG reduction plan	5	Staff, K/J, ETWG[1]	January
Present the Draft Energy Study to the **scwd^2** Task Force	5	TF, Staff, K/J, ETWG[1]	February TF meeting

1: ETWG engagement and work plan is discussed in greater detail below

Project Assessments

Staff and K/J have spent the previous several weeks researching and analyzing the sixteen GHG reduction projects. The dPAs provide qualitative and quantitative values for each of the evaluation criteria and present the analysis using the follow narrative:

- What is the project? (Description)
- How long has it been in use? (History and Technical Maturity)
- Is it reliable? Is it complex? (Reliability and Operational Complexity)
- How long is it reliable? (Sustainability)
- What are the local considerations associated with the project? (Local Considerations)
- What is the project's GHG reduction potential? (Energy Production and GHG Reductions)
- What is the cost of the project? (Cost)
- What are the project's advantages and disadvantages? (Summary of Advantages and Disadvantages)

All components of the dPA narrative incorporate the Task Force approved evaluation criteria with exception of sustainability, which was added after the July Task Force meeting. Because sustainability can be defined broadly, staff consulted ETWG member, Dr. Brent Haddad, to define sustainability as it relates to GHG reduction projects. Dr. Haddad recommended the following definition of sustainability: "A sustainable GHG reduction project would provide reliable benefit over the life of the water supply project and beyond. In addition, a sustainable project would offer additional educational, social and/or economic local benefit."

To familiarize Task Force members with the content, structure, and analysis methodology of the dPAs, attached is the draft Project Assessment No. 10, Local Solar Projects and Project Assessment Format. Task Force members will receive the remaining dPAs at the September 21st meeting, where staff and K/J will discuss their content and how to evaluate them.

ETWG members will also be receiving the 16 dPAs. In October, the ETWG will meet to discuss and rank each project according to the evaluation criteria. At the October Task Force meeting, staff will present the results of this process. The ETWG will continually engage in the development of the Energy Study. Their final task will be to review and comment on the draft GHG reduction plan, and prepare recommendations to the TF for plan approval.

FISCAL IMPACT: There is no fiscal impact associated with this item.

ATTACHMENTS:

1. draft Project Assessment No. 10, Local Solar Projects
2. Project Assessment Format

Attachment 1:

Project Assessment No. 10 – Local Solar Projects

Description

A local solar program would entail installing solar photovoltaic (PV) panels on SCWD and SqCWD properties to provide an emissions-free renewable energy source that reduces the use of grid electricity and the associated indirect GHG emissions. This assessment included a preliminary review of SCWD and SqCWD properties to identify examples of potential solar PV project sites and understand the size requirements of potential projects. The example sites identified include the proposed **scwd^2** desalination facility (SCWD and SqCWD), the Bay Street Reservoir site (SCWD), numerous SCWD properties, SqCWD's headquarters buildings, and SqCWD's Fairway Drive property. Other sites could present additional project opportunities but would need to be evaluated further.

Amount of GHG Reduction

For the purpose of this assessment, the following projects were analyzed:

- Solar PV panels could be installed on the roofs of several buildings at the proposed **scwd^2** desalination facility. The estimated space available would hold approximately 300kW, which could offset approximately 94 MT CO_2e per year over 30 years. This project could be shared by SCWD and SqCWD based on their respective desalination plant operation.
- SCWD could offset approximately 388 MT CO_2e per year over 30 years by installing 780 kW of solar PV panels on two tanks at the Bay Street Reservoir site and a total of 455 kW on several other sites (listed in Table 2).
- SqCWD could offset approximately 268 MT CO_2e per year over 30 years by installing 104 kW of solar PV panels on its administration building and 750 kW on its Fairway Drive property.

Project Life and Sustainability

Local solar projects would continue to provide GHG reduction (and energy) for the life of the project and beyond. The project would be sustained by normal maintenance to repair any infrastructure deterioration.

Project Cost

Table ES-1 summarizes the estimated costs of the example projects discussed above.

Table ES-1: Local Solar Program Summary

Example Projects	Size	Life	Average Annual GHG Reduction (MT CO_2e/yr)	Capital Cost ($ mil)	Average Annual Net Cost ($/yr)[1]	Lifecycle Energy Cost ($/kWh)	Lifecycle GHG Reduction Cost ($/MT CO_2e)	Space Required (1 kW/ 100 SF)
scwd^2 desalination facility	300 kW	30	94	$1.8	$98,000	$0.18/kWh	$800	< 1 acre
Bay Street (SCWD)	780 kW	30	245	$4.7	$256,000	$0.18/kWh	$800	< 2 acres
Small properties (SCWD)	455 kW	30	143	$2.7	$149,000	$0.18/kWh	$800	~ 1 acre
Admin Bldg (SqCWD)	104 kW	30	33	$0.6	$34,000	$0.18/kWh	$800	< 1 acre
Fairway (SqCWD)	750 kW	30	235	$4.5	$246,000	$0.18/kWh	$800	< 2 acres

[1]Includes energy savings.

Description

This assessment estimates the energy generation and GHG reduction potential from the development of local solar photovoltaic (PV) projects. SCWD and SqCWD investment or participation in non-local solar and other renewable energy projects is discussed in Project Assessment No. 9. Rebate programs for residential and commercial solar projects are discussed in Project Assessment No. 3.

Background

Solar energy refers to a number of technologies that derive their energy from the sun. This assessment focuses on PV solar electric systems, in which sunlight is converted directly into electricity using solar panels. A PV system includes PV panels, support structures to direct panels toward the sun, and components that covert the direct-current (DC) electricity produced by modules to alternate-current (AC) electricity.

A local solar program would entail installing solar photovoltaic (PV) panels on SCWD (or potentially the City of Santa Cruz) and SqCWD properties to provide an emissions-free renewable energy source that reduces the use of grid electricity and the associated indirect GHG emissions. Solar PV systems could be mounted on top of SCWD or SqCWD structures (such as buildings and water tanks, as shown in Figure 1), on other municipal-owned structures (such as parking garages), or mounted on the ground on property owned by SCWD or SqCWD. The solar PV systems could produce energy to directly provide power to SCWD or SqCWD facilities, or could connect to the overall electrical grid to indirectly provide power to SCWD or SqCWD facilities. When the solar PV system is not producing energy, electrical power would be obtained from the overall electrical grid through Pacific Gas and Electric (PG&E).

Figure 1: Existing Solar PV Installation on SCWD's Graham Hill WTP

With regard to coordinating with PG&E and connecting to the overall electrical grid, there are four categories of solar PV projects: 1) Behind the Meter; 2) Virtually Behind the Meter; 3) Virtual Meter Aggregation; and 4) In-front of the Meter. These categories are described below.

Behind the Meter

A Behind the Meter project describes a solar PV facility that is sited at a facility where the electricity is consumed, all or in part by the account holder. The solar PV system connects to the facility behind the PG&E meter and replaces some or all of the power from PG&E. When the solar PV system is not producing energy, electrical power would be obtained from the overall electrical grid from PG&E.

Net energy metering (NEM) applies to Behind the Meter solar PV projects less than 1 MW in size. NEM is a method of metering the energy produced and consumed by a customer that has a renewable resource generation project, and it credits the customer with the value of the generated electricity. Effectively, the meter runs backwards, causing a credit on the customer's bill. The benefit of NEM is the deferred cost of the electricity at the retail rate that SCWD/SqCWD would not have to purchase – an avoided cost. Net excess generation (NEG) beyond one month's actual usage is carried over as a credit for a 12-month cycle, but is zeroed out after one year, so SCWD/SqCWD would not be paid for any remaining excess generation. A NEM Behind the Meter project should be sized so that the project does not create any NEG over the course of a year.

Virtually Behind the Meter

A Virtually Behind the Meter project describes a solar facility that is sited at a location other than where some or most of the electricity is consumed. The electricity is transmitted over the overall electrical grid to the user. This approach is relatively new and was included in California Senate Bill (SB) SB1 and updated by California Assembly Bill (AB) AB510. Municipalities in California can install solar PV systems at facilities on different properties and can use the electricity generated to credit electricity bills at other properties (with some restrictions). Generally, if a facility produces more solar electricity than it uses, that excess energy can be used to credit the generation portion of another benefiting account. However, the same entity needs to be the account holder at both the point of generation and the benefiting account.

Therefore, electricity produced from a PV solar array at one SCWD or SqCWD facility location (within the SCWD or SqCWD geographic boundaries) can be used to offset the SCWD or SqCWD energy generation charges at other locations (per AB 2466, codified as Section 2830 of the California Public Utilities Code). This credits the generation portion of the utility bill, while the benefiting account still pays the transmission costs and other utility fees.

Virtual Meter Aggregation

Another potential option is for SCWD and/or SqCWD, and other government entities (such as the City of Santa Cruz or school districts) to pool land resources and identify properties that have space and favorable characteristics for a PV system within SCWD/SqCWD geographical boundaries. This aggregation has some restrictions, but if there are municipal facilities with open roof tops and low electricity demands, a solar PV project could get credit via virtual net metering at other properties/accounts.

In Front of the Meter

An In-front of the Meter project describes a project in which the PV system is located at a site where there is no electricity use by the project owner, and the electricity produced by the solar facility is sold to a utility at wholesale rates through the Feed-in Tariff (FiT). These projects are generally larger (approximately 2 to 20 megawatts) to maximize efficiency. Since generated electricity is sold to PG&E, **scwd²** would not get credit for KWh generated or for the associated GHG reductions. Since there are favorable Behind the Meter and Virtual Behind the Meter projects available, this assessment does not address potential In-front of the Meter projects.

History and Technical Maturity

Solar PV cells were developed in the 1950s in the aerospace industry and have been used in utility-scale applications for nearly 30 years. Improved technology has allowed for the expansion of solar PV applications over time, and today there are many utility-scale and small-scale uses. Federal and state incentives have greatly increased the use of solar PVs as a renewable energy resource for electricity. In California, there are over 95,000 solar PV installations totaling almost 950 MW (http://gosolarcalifornia.org/). In the Santa Cruz area, over 2 MW of solar PV have been installed on local residences and businesses in the past 5 years under the California Solar Incentive (CSI) program (http://www.californiasolarstatistics.ca.gov/current_data_files/).

SCWD currently has two solar installations – a 74 kW system on the administrative office and 128 kW system on the operations building at the Graham Hill Water Treatment Plant (GHWTP).

Reliability and Operational Complexity

Although research continues to improve the efficiency of solar arrays, this is considered a reliable and mature technology. The operational complexity of a solar PV system would be low. O&M activities would include periodically cleaning the PV panels and performing modest routine maintenance and testing.

Sustainability

A local solar PV system would produce renewable energy for at least the life of the project, which is assumed to be 30 years. The project would be sustainable and could continue beyond the life of the project through routine maintenance and parts replacement as required.

Local Considerations

Economy

Local solar PV systems could benefit the local economy through job creation, and training of PV system installers and service providers. The local PV systems could provide reliable energy at a low impact to the environment. Local projects would reduce local energy use and could provide opportunities to help to educate the community on renewable energy.

Table 1 provides a partial list of companies that have been involved in the sale and installation of solar PV equipment in the Santa Cruz area. The average size of the local projects is approximately 5 kW.

Table 1: Local Solar Vendors

Contractor	Location	Average System Size	# of Projects
Real Goods Energy Tech Inc.	Santa Cruz	4.9 kW	258
Solar Technologies	Santa Cruz	4.8 kW	229
REC Solar, Inc.	San Francisco	4.2 kW	36
Solcon Solar Construction	Santa Cruz	3.8 kW	25
Akeena Solar, Inc.	Campbell	3.7 kW	25
SolarCity	San Mateo	11.4 kW	24
Anderson Solar Controls	Scotts Valley	4.6 kW	17
Santa Cruz Solar	Santa Cruz	3.6 kW	11
Suns Up Solar (Putt Construction)	Santa Cruz	4.6 kW	7
Full Circle Energy Cooperative, Inc.	Fresno	5.2 kW	7
Petersen-Dean, Inc.	Los Gatos	5.1 kW	7
Borrego Solar Systems, Inc.	Oakland	4.5 kW	6
Renewable Power Solutions Inc.	San Jose	5.8 kW	5
Poco Solar Energy, Inc.	Santa Clara	4.6 kW	5
Gregory Heitzler Design	Santa Cruz	6.0 kW	5

Source: California Public Utility Commission and California Energy Commission "Go Solar California" website: http://www.californiasolarstatistics.ca.gov/search/contractor/

Environment

Air: Solar PV systems do not produce air pollution or GHG emissions, and they prevent pollution by displacing conventional power generation sources.

Land: Larger solar PV projects require large, unobstructed, and unshaded areas, typically 100 square feet per kW. A 100 kW system would require approximately 10,000 square feet, or approximately one quarter acre of land. Land impacts would be mitigated if the installation space is on land that is already disturbed or improved (ie – on rooftops or parking lot shade structures).

Water: Solar PV systems use only a modest amount of water during periodic cleaning.

Noise: Solar PV systems produce little noise pollution. Larger inverters can make a "humming" sound similar to transformers. The sound can be mitigated by locating inverters in an enclosure or within existing maintenance or electrical yards, and locating them away from residences or offices.

Aesthetic/Visual: Visual impacts from solar PV installations coincide with space constraints, and solar PV systems impact a viewshed in proportion to the size of the project. Placement of the system is the main factor that affects visual impact. For example, roof-top systems integrating solar PVs into existing structures would minimize visual impacts, whereas utility-scale installations would likely occupy large open spaces that would be visible from a considerable distance.

Waste By-products: Installed solar PV systems generate no waste by-products from their operation.

Energy Production and GHG Reductions

The PVWatts calculator, developed by the National Renewable Energy Laboratory, estimates electricity production in terms of kilowatt-hour (kWh) per year per kilowatt (kW) installed at a selected location and can be found at: http://www.nrel.gov/rredc/pvwatts/. Using meteorological weather data for a selected location, PVWatts determines the solar radiation, which is then converted into energy. According to the PVWatts calculator, a 1 kW PV installation in the Santa Cruz area would generate approximately 1,200 kWh per year for a fixed-tilt system on a roof top and facing due south. The actual output of existing SCWD projects was approximately 110,000 kWh at the administration offices and 146,000 kWh at GHWTP, which are close to the estimates by PVWatts.

Potential Solar PV Projects

This assessment included a preliminary review of SCWD and SqCWD properties to identify examples of potential solar PV project sites and understand the size requirements of potential projects. The example sites identified include the proposed **scwd^2** desalination facility (SCWD and SqCWD), the Bay Street Reservoir site (SCWD), numerous SCWD properties, SqCWD's headquarters buildings, and SqCWD's Fairway Drive property. Other sites could present additional project opportunities but would need to be evaluated further.

scwd^2

SCWD and SqCWD could choose to offset some or all of energy related to the **scwd^2** desalination plant. The proposed desalination plant running at half capacity would use approximately 6,800 MWh per year. At 1,200 kWh per kW installed, approximately 5,700 kW of solar PV would be needed to offset this energy usage. This translates into approximately 13 acres.

Based on the preliminary layout of the proposed **scwd^2** desalination facility, there appears to be approximately 30,000 square feet of roof space on the MF/UF, SWRO, and Control buildings. At 12 kWh per year per SF, the PV panels could provide approximately 323,000 kWh per year or about 5%.

SCWD

Bay Street Reservoir (Virtual Behind the Meter): Based on information from SCWD, the Bay Street tank site (at 200 Cardiff Place) will have two, 223-foot diameter concrete tanks that will provide a total roof area of approximately 78,115 square feet. There would not be a significant space available for ground-mounted panels. At 12 kWh per year per SF, the Bay Street tank roofs could provide approximately 841,000 kWh per year.

Various Identified SCWD Properties (Behind the Meter or Virtual Behind the Meter): In 2006-2007, an assessment of the solar potential for SCWD-owned facilities was conducted. Table 2 lists the sites identified with the best potential for installing solar PV systems. In addition to those shown in Table 2, SCWD identified and ruled out other sites based on size, access, shading, and other issues. The estimated combined square footage available at the potential future sites totals approximately 45,500 SF, or over 1 acre. At 12 kWh per year per SF, these sites could provide approximately 546,000 kWh per year combined.

Table 2: Assessment of Solar Potential for SCWD Properties

Location	Estimated Area Available (SF)	Actual/Estimated Energy Generation (kWh/yr)
Existing Locations		
Graham Hill WTP	12,300	146,000
Administration Bldg	7,400	110,000
Total Existing	**19,700**	**256,000**
Potential Future Locations		
Graham Hill WTP – Lab	2,000	24,500
Parking Lot 1 – Soquel/Front	8,400	101,000
Parking Lot 2 – Locust Garage	8,400	101,000
Golf Lodge Delaveaga	7,200	86,400
Municipal Wharf	6,200	74,400
Recycling Center at Landfill	5,200	62,000
Corp yard	4,800	57,000
Sanitation Shop Corp Yard	3,300	39,300
Total Potential	**45,500**	**546,000**

Source: Santa Cruz Water Department Memorandum, February 2007.

In addition to the sites identified in the 2006-2007 assessment and shown in Table 2, the SCWD has several other smaller properties (including reservoirs, wells, and pump stations) with small electricity needs that could be assessed in the future.

Additional Potential Areas of Exploration (Virtual Behind the Meter): SCWD properties were evaluated with the goal of identifying several properties that are large enough to develop a substantial solar array ranging in size from 500 kW (1 acre) to 5,700 kW (13 acres). The sites also need to be a reasonable distance from a transmission line and have little shading.

SCWD owns over 100 properties, ranging in size from less than 100 SF to over 1,000 acres. The largest properties lie outside the agency's geographic boundaries in the upper watershed areas of Newell, Laguna, and Zayante creeks, but are located within Santa Cruz County's Timber Preserve Zones. A solar array potentially could be developed on these properties, but several elements must be considered:

- Proximity to transmission lines.
- If the properties are outside the service territory, the energy generated cannot be wheeled to agencies' electricity meters.
- The properties may need to be rezoned.

- A timber harvest plan may be required. (The public may respond unfavorably to harvesting trees in order to build a solar PV project.)

SqCWD

Table 3 lists some of the sites identified by SqCWD staff as potential locations for solar PV projects.

Table 3: Operations Department Initial Assessment

Potential SqCWD Locations for Solar	Notes
Main Headquarters Administration and Maintenance Buildings	
Garnet Well and Opal Treatment Plant	
Country Club Well	Large parcel
Altivo Well	
Mar Vista Tanks and Boosters (Tank 2)	Substantial electrical usage
Madeline Well	
Seascape Tank and Boosters	
Bonita Well	Large parcel
Ledyard Well	
Fairway Tank	
San Andreas Well	
Cornwell Tank and Boosters	
Aptos Booster Station	
Aqua View Tanks and Boosters	Substantial electrical usage
Aptos Creek Well	Substantial electrical usage
Tannery Well and Treatment Plant	
Seascape Well	
Austrian Tank and Boosters	
Main Street Well and Treatment Plant	limited space
T. Hopkins Well and Treatment Plant	limited space
Papermill	Vacant lot not planned for future development
Suncatcher Court	Vacant lot not planned for future development
Rincon	Vacant lot not planned for future development
Hillcrest	Vacant lot not planned for future development

SqCWD Headquarters (Virtual Behind the Meter): SqCWD is interested in installing solar PV panels on the roofs of the administration and maintenance buildings at its main headquarters. The areas of the roofs are approximately 5,800 SF and 4,600 SF, respectively. At 12 kWh per year per SF, this could provide approximately 112,000 kWh per year.

Fairway Drive (Virtual Behind the Meter): Similar to SCWD, SqCWD owns many properties within their upper watershed areas with similar site considerations. SqCWD has a property on Fairway Drive (APN 040-431-06) that is approximately 2.8 acres in size (Figure 2). This property houses a storage tank, but the remainder of the property appears to be mostly open space with good sun exposure. A ground-mounted solar array of 500 kW to 1 MW potentially could be constructed at this site. Assuming 1,200 kWh per year produced per kW installed, a 750 kW project at this site could generate approximately 809,000 kWh per year.

Figure 2: Potential SqCWD Site for Ground Mounted Solar Array

<u>Potential Additional Areas of Exploration (Behind the Meter):</u> This assessment included a cursory review of SqCWD's land holdings. Fairway had the ideal characteristics for siting a solar facility, but additional properties may meet these criteria. As a next step, SqCWD would undertake a more detailed review and rank each of their properties by its ability to successfully house a solar array.

Since solar PV systems do not produce GHG emissions, the projects would offset the indirect GHG emissions associated with the purchase of electricity from PG&E. Table 4 summarizes the potential energy production and GHG reductions for analyzed solar PV projects.

Table 4: Estimated Energy Production and GHG Reduction for Solar PV Projects

Project	Size	Average Annual Energy Production (kWh/yr)[1]	Average Annual GHG Reduction (MT CO_2e/yr)[1,2]
scwd[2] desalination facility	300 kW	323,000	94
Bay Street (SCWD)	780 kW	841,000	245
Small properties (SCWD)	455 kW	491,000	143
Admin Bldg (SqCWD)	104 kW	112,000	33
Fairway (SqCWD)	750 kW	809,000	235

[1]Includes decline of energy production due to degradation of equipment over 30 years.
[2]Based on 2009 PG&E emission factor of 641.35 lbs CO_2e/ MWh.

Cost

According to data available on the Go Solar California website, 2,400 PV projects (including residential, commercial, and governmental) were completed under the CSI program in the first 6 months of 2011. The average installation cost of these projects was $5.40 per watt.

Capital Cost: Average PV module prices are currently approximately $3.00 per watt, and installation costs can range from $2.00 to $4.50 per watt. The variation in this price range is dependent upon the size of the system (economies of scale), physical location, new versus existing structure, and siting challenges (i.e. equipment, penetrations, slope). This assessment assumes a conservative $6.00 per watt installed cost for the Santa Cruz area.

The cost estimate for a potential project includes photovoltaic panels, fixed-tilt solar arrays, inverters, wiring, engineering, installation, utility grid interconnect, warranty, 5 years of maintenance, and 5 years of performance monitoring and reporting service (an eligibility requirement by some of the financial incentive programs).

O&M Cost: Maintenance requirements depend upon the system size. Regular maintenance is minimal over the life of the system and includes periodically cleaning the panels, as well as testing and cycling the inverters. The lifetime of most PV arrays is between 20 and 30 years, and failures that require replacements are rare. PV arrays degrade at a rate of approximately less than one percent of total system capacity per year, since energetic particles from the sun produce physical damage to silicon-based solar cells. Manufacturer warranties and PPA's usually take this degradation into account. However, the inverter needs to be replaced every 10 years for approximately $0.70 per watt installed, and this cost is usually included in the vendor maintenance agreement. (http://www.solarbuzz.com/Inverterprices.htm)

Incentives and Rate Structures: A part of the Go Solar California campaign, the California Solar Initiative (CSI) offers rebates to customers in California's investor-owned utility territories. CSI rebates vary according to system size, customer class, and performance and installation factors. The subsidies decline in "steps" based on the volume of solar megawatts confirmed within each utility service territory. In 2011, the CSI rebate applicable to a 100 kW array is the Performance Based Incentive (PBI), which pays out an incentive based on actual kWh production over a period of five years. Currently, the CSI program is oversubscribed, and new CSI projects are not guaranteed an incentive at this time (http://www.csi-trigger.com/).

Lifecycle Cost: The average energy cost for the resource, assuming a project life of 30 years, with a 6 percent bond, and NEM rate structure (retail rate of $0.15/KWh escalating at 2%), would be approximately $0.18/kWh. This is greater than the levelized cost of utility power from PG&E of $0.14/kWh.

Table 5: Estimated Solar PV Project Costs

Project	Life (yrs)	Capital Cost ($ mil)	Average Annual Net Cost ($/yr)[1]	Lifecycle Energy Cost ($/kWh)	Lifecycle GHG Reduction Cost ($/MT CO_2e)
scwd^2 desalination facility	30	$1.8	$98,000	$0.18/kWh	$800
Bay Street (SCWD)	30	$4.7	$256,000	$0.18/kWh	$800
Small properties (SCWD)	30	$2.7	$149,000	$0.18/kWh	$800
Admin (SqCWD)	30	$0.6	$34,000	$0.18/kWh	$800
Fairway (SqCWD)	30	$4.5	$246,000	$0.18/kWh	$800

[1] Includes energy savings, but not CSI incentives. The CSI incentive program is currently oversubscribed and all un-confirmed projects are not guaranteed an incentive.

Summary of Advantages and Disadvantages

Advantages

- Creates local jobs.
- Mature technology with low risk.
- Environmental considerations are low.
- Low O&M requirements and costs.
- No fuel costs.

Disadvantages

- Relatively large space or land requirements.
- Limited sites available for SCWD/SqCWD.
- Financial incentives (CSI) may not be available for new solar PV projects.
- High purchase/installation costs per kW relative to other forms of electricity.
- Non-local solar projects could take advantage of better solar insolation resources. For example, a 1 kW PV installation near Barstow, California is estimated to produce almost 1,500 kWh per year versus 1,200 kWh per year in the Santa Cruz area.

References

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Attachment No. 2

Project Assessment Format

The **scwd²** GHG reduction dPAs have been developed using a common format to facilitate comparing and contrasting the various efficiency, renewable energy and GHG reduction project options. The dPAs include the following nine sections which are based on the project evaluation criteria.

1. **Executive Summary –** The first page of each dPA presents an executive summary that describes the project, the expected amount of GHG reduction, the project lifetime and sustainability of the GHG reduction, and the conceptual cost of the project.

2. **Project Description –** This section provides a description of the project, background information on the program or technology, and vendors that could provide equipment or services related to the project.

3. **History and Technical Maturity –** This section provides a discussion of the history of the technology or program, the stage of research and/or development of the technology, and existing systems or programs that SCWD or SqCWD have experience with.

4. **Reliability and Operational Complexity –** This section discusses the proven performance, stage of research and/or development, and reliability of the proposed project. Reliability of the project is the ability of the project to produce the expected GHG reductions. This section also discusses the operational complexity of the project.

5. **Sustainability –** This section describes the project life and the sustainability of the project to provide GHG reductions (and/or water and energy savings) over a long period of time, assuming proper maintenance to the system. For example, a solar project will provide GHG reductions for the 20 to 30 year life of the solar equipment. The solar equipment can be replaced and the renewable energy and GHG reductions can be sustained into the future. An efficiency project only provides a GHG reduction for the accelerated period of the equipment replacement. Efficiency projects do not provide sustained GHG reductions into the future due to the requirement for GHG reductions to be "additional" to what would happen in the absence of proposed project.

6. **Local Considerations –** This section describes the local economic and social benefits of the proposed project to the community and considers the environmental and community factors related to the proposed projects. Local considerations include:

    a. Helping to improve the local economy through local construction, job creation, and training

    b. Helping to educate and inform the community on water, energy and sustainability issues

    c. Reduction of local energy consumption and/or reduction of local GHG emissions

    d. Reduction/reuse of local waste generation.

    e. Impacts on the air, land, water, noise, aesthetic/visual, and if it creates waste by-products

7. **Energy Production, Energy Savings, and GHG Reduction –** This section describes the expected amount of energy saved, renewable energy produced, or GHG mitigated by a proposed project. In many of the dPAs, the GHG reductions are calculated separately for SCWD and for SqCWD to account for different proposed operating scenarios for the desalination facility and different project specific factors for each agency.

8. **Cost / Cost Effectiveness –** This section provides a summary of the conceptual level costs for the project, and develops a GHG reduction cost effectiveness factor in dollars per metric ton of carbon dioxide reduced (\$/MT CO_2e). A cost summary table is provided for each project that summarizes the cost categories described below:

    a. Conceptual Capital Costs: The conceptual level capital costs generally include equipment, engineering and construction or installation. For efficiency rebate programs, the money for the rebates was assumed to be set aside as a capital cost. For some projects, applicable PG&E rebates or incentives that could reduce the project capital costs are included.

    b. Conceptual O&M Costs: The conceptual level operations and maintenance (O&M) costs include labor, materials, and applicable fuel, chemical, or other operating costs. For efficiency rebate programs, the money for marketing was assumed to be an operating cost. For efficiency and renewable energy projects that reduce the cost of energy purchased from the grid, the savings are included to reduce O&M costs.

    c. Average Annual Net Costs: This represents the average of the calculated annual net costs for a project, and is intended to show the magnitude of the annual cost of implementing the project. The net cost is calculated by subtracting the project benefits from the project costs for each year of operation. Project costs include debt service on the capital cost of the project (if any), O&M costs, and any fuel costs. Benefits include any cash payments paid by PG&E as an incentive and the avoided cost of electricity that results from saving or generating electricity.

    d. Lifecycle Energy Cost: Lifecycle cost is a tool to gauge the cost effectiveness of the project. The net present value (NPV) of the Annual Net Cost is used for this calculation. This eliminates the effects of inflation, the different cost characteristics of projects, and the different lives of projects. A NPV calculation converts the Annual Net Costs to present day dollars, and creates a levelized cost in \$/KWh.

    e. Lifecycle CO_2 Reduction Cost: This metric is similar to the Lifecycle Energy Cost but reflects the cost of the reduced metric tons of GHG rather than the energy saved or generated. The calculation is the same except for the denominator changes from energy (KWh) to metric tons reduced (MT). This metric is expressed in \$/MT.

9. **Summary of Advantages and Disadvantages –** This section provides an overview of general advantages and disadvantages of the project.