
Project Title  (required)

Limit: 15 words | Word count: 6

Creative Solutions for Large Scale Renewables

 Which category best fits your proposal? (required)

Sustainability Innovations

 Project Location(s) (required)

Cal Poly Sheep Unit Pasture

 Completion date or implementation period (required)

Contract executed Feb 2017, Construction complete Nov 2017

 Narrative of project goals and strategies  (required)

Limit: 300 words | Word count: 291

This project will construct a renewable energy system that will make significant progress toward Cal Poly's goal of Climate Neutrality via a unique Power Purchase Agreement and utility tariff.  The [RES-BCT](http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_RES-BCT.pdf) (Renewable Energy Self-Generation Bill Credit Transfer) program allows local government agencies to build renewable energy systems up to 5 MW in capacity, connected to campus or utility owned infrastructure, and producing power under a "generating account".  The dollar value of energy generated by the system is transferred as a bill credit to another customer owned meter or "benefitting account", in this case the main campus substation.

For this project, the PG&E A6 "Small General Time-of-Use Service" rate schedule was used as the generating account, which can serve a maximum load of 75kW but has no limit on generation.  Time of use modeling against the A6 tariff determined the average value of generation (adjusted to include PCIA charges) is estimated to be $0.129/kWh in the first year.  By comparison, Cal Poly's substation is served on PG&E's E20T tariff, which had a blended average cost of $0.112/kWh over FY 15/16, meaning this project will produce energy with a generation value greater than purchased grid power.

An RFP was developed based on previous CSU solar solicitations, fine tuned for Cal Poly's needs and the RES-BCT program, with award based on Net Present Value of savings over the 20 year agreement.  The winning bidder, REC Solar, proposed a unique PPA structure with a price of $0.1156/kWh in years 1-6, dropping to $0.012/kWh in years 7-20.  The system will generate approximately 25% of the university's electricity needs, and save $26.8M dollars (NPV of $17.2M) over 20 years.

Cal Poly is in the process of site selection for a second RES-BCT project, which would generate a bill credit against the second substation meter.

 Relevancy to the Best Practice Program  (required)

Limit: 200 words | Word count: 194

Many campuses need to develop cost effective renewable energy generation systems.  Many will have to deal with the limitations of available space, campus electrical infrastructure, and non-export restrictions.  The RES-BCT program allows campuses to bypass these limitations by opening the doors to potential development off-site (but within local government jurisdiction) and allowing direct connection to utility infrastructure.  For Cal Poly, this meant we were able to avoid a potentially difficult and unclear path to NEM, which would have necessitated a $1.5M upgrade to the campus substation to install a ground grid - a requirement for energy export.

The maximum RES-BCT system size of 5 MW (per project) is far greater than what many campuses could fit on building rooftops or parking structures.  Ground mounted arrays of this size benefit from inherently lower cost of generation as compared to rooftop or covered parking shade, and from economy of scale.  The RES-BCT program is available to any bundled utility service customer on a time of use rate in PG&E, SCE, or SDG&E territory.  It provides the opportunity to produce renewable energy with a generation value greater than that of purchased grid power, resulting in significantly greater cost savings.

 Collaborative design and implementation  (required)

Limit: 200 words | Word count: 194

When Cal Poly learned of the RES-BCT program, it contacted the neighboring California Mens Colony to share the opportunity.  CMC is now developing a large solar system.

Eleven sites (9 on-campus and 2 private) were evaluated for size, orientation, slope, constructability, Coastal Commission authority, and proximity to utility infrastructure.  Interconnection to 12kV distribution was preferred, as stepup to transmission voltage would increase interconnection costs.  PG&E's PVRAM ([Renewable Energy Auction Mechanism](https://www.pge.com/en_US/for-our-business-partners/energy-supply/solar-photovoltaic-and-renewable-auction-mechanism-program-map/solar-photovoltaic-and-renewable-auction-mechanism-program-map.page)) Map was used to understand utility distribution infrastructure capacity to accept generation at each site.

Using Google Earth, site evaluation was presented to campus leadership for approval, resulting in selection of the 20 acre Sheep Unit pasture adjacent to PG&E's Goldtree substation.  Single-axis tracking was specified to maximize production from the site and hedge against future TOU changes, along with provisions to add battery storage.  CEQA and Interconnection were initiatated by the University in parallel with the RFP to save time.

Academic applications of the system were an integral part of the RFP.  Faculty stakeholders in Animal Science and Electrical Engineering were solicited for input on the RFP.  Interest in academic collaboration was part of vendor qualification criteria, facilitating opportunities for collaboration on curriculum and applied research.

 Education and Outreach

Limit: 200 words | Word count: 197

In addition to providing guest lectures to classes and tours of the system, Cal Poly required the following features be included in the design:

* 5 minute interval metering of module temperature, ambient temperature, relative humidity, solar irradiance, wind speed/direction, tracker position, and voltage/current/kW/kWh/PF/power quality/harmonics for the entire system and each inverter.
* A hemispherical sky camera to quantify cloud cover.
* Creation of a public facing dashboard and database of all interval data to support Energy Management functions in Facilities, as well as academic applications for class assignments, senior projects, Master's Theses, and applied research.
* Design and construction of an ADA accessible 15,000 square foot solar engineering laboratory - comprised of five different 6kW grid tied arrays of different designs (fixed arrays of varying tilt/orientation, tracking arrays with different ground cover ratios, and a variety of different manufacturers' equipment - each fully instrumented for remote monitoring and data collection) to support student and faculty hands-on Learn by Doing.

The cost to design and construct the laboratory was rolled into the PPA, and REC will contribute cash payments of $30K/year for five years to support faculty release time for curriculum development, a Clean Tech Competition prize, and research through Cal Poly's Renewable Energy Institute.

 Total project cost (required)

$8,000,000

 Total Incentives Received (If applicable)

30% Federal ITC

** Quantitative Savings and Benefits**

Strong proposals will have quantitative savings in at least one of the following areas, but it is unlikely that any proposal will have savings in all of the below areas.

 Number of people reached by your program

In the first year after the project is completed, REC will collaborate with faculty to develop a solar PV science and engineering fundamentals teaching module that could be integrated into a wide variety of curriculum and K-12 outreach, as well as an in depth upper division Electrical Engineering Solar PV design class.  These have the potential to impact hundreds of students at Cal Poly in multiple programs, and hundreds of local K-12 students in the surrounding communities.  Additional curriculum will be developed in future years.

The Animal Science program will utilize the solar farm to perform research on sustainable range management practices in general, and more specifically, vegetation management and erosion control practices for utility scale solar farms.

The public facing dashboard and database have the potential to provide useful and meaningful data not only to Cal Poly faculty and students, but to students at other universities, as well as members of the public that are interested in learning more about how solar energy systems work and perform.  The agreement with REC will allow us to connect future campus solar systems to this database and dashboard for consistency and ease of access.

 Measured annual energy savings in kWh (If measured savings are unavailable, estimated savings will be accepted provided an explanation is included as to how savings were calculated.)

System will generate 11,330,000 kWh/year - 25% of the university's total needs

 Measured annual energy savings in therms (If measured savings are unavailable, estimated savings will be accepted provided an explanation is included as to how savings were calculated.)

no answer

 Estimated greenhouse gas emission reductions in metric tons CO2e

 System will offset 2,200 MTCO2e per year, based on published 2015 PG&E GHG emission factor.

 Measured annual water savings in gallons (If measured savings are unavailable, estimated savings will be accepted provided an explanation is included as to how savings were calculated.)

no answer

 Estimated annual waste reduction in pounds

no answer

 Actual or estimated annual cost savings

The system will save $157K in utility expenses in year one, increasing to $360K/year in year six, then jump to $1.54M in year seven, increasing to $2.09M in year 20 (assuming 0.5% annual panel degradation, 2.25% CPI, 2.5% annual PG&E rate escalation, and 3.5% discount rate).  Total utilty savings over the 20 year agreement is $26.8M, with a Net Present Value of $17.2M.  See attached REC Price Proposal for specific structure of PPA, and financial evaluation of projected savings.

 For the Energy Efficiency in HVAC Design/Retrofit and Commissioning and Lighting Design/Retrofit as well as Overall Sustainable Design categories, provide estimated annual energy savings as compared to Title 24 Energy Code in percent better than baseline.

no answer

 Percentage of total food and beverage purchases that is local (under 250 miles) in origin and/or meets one or more third party-certified sustainability criteria (e.g. USDA certified organic). List the third party-certified sustainability criteria included

no answer

 List any green business or green restaurant certifications that this project achieved

no answer

 Additional environmental, social, and/or economic sustainability benefits

Limit: 300 words | Word count: 148

The RFP specified Tier 1 equipment, which ensures high quality and reliability, and REC has selected Trina Solar TSM-340DD14A modules for this project.  Trina is ranked in the top 3 manufacturers by Silicon Valley Toxics Coalition's 2015 [Solar Scorecard](http://www.solarscorecard.com/2015/2015-scorecard.php), which takes into account factors including cradle to cradle recycling, manufacturing emissions transparency, embedded energy and GHG, material toxicity, worker rights, health and safety, supply chain accountability, and prohibition of conflict minerals.

The RFP specified minimal disturbance of the site to reduce potential erosion, and to prevent growth of invasive plant species.  Site vegetation management using the Cal Poly sheep herd reduces panel shading and fire risk, with zero emissions from conventional fossil fuel powered equipment typically used for this purpose.

The academic collaboration between Cal Poly and REC will ensure broader exposure of Cal Poly and local K-12 students to the benefits of solar energy, and related technical and financial challenges.