

FINAL SCIENTIFIC/TECHNICAL REPORT

SOLAR ENERGY PARKING CANOPY DEMONSTRATION PROJECT

A. PROJECT OBJECTIVES

The goal of this pilot/demonstration program is to measure the viability of using solar photovoltaic (PV) technology at three locations in a mountain community environment given the harsh weather conditions. An additional goal is to reduce long-term operational costs, minimize green house gas emissions, lower the dependency on energy produced from fossil fuels, and improve the working environment and health of city employees and residents.

B. PROJECT SCOPE

As part of this project, solar photovoltaic (PV) systems will be installed at three locations: on the roof and adjacent canopy of a warm storage building at a public works maintenance yard, on a parking canopy at the Visitors Center, and on a shade canopy at a recycling facility.

The roof of the warm storage building and the adjacent canopy will support an approximately 85 kilowatt (kW) solar photovoltaic system. The photovoltaic system will be installed over a 7,500 square foot building that will provide for warm storage to approximately 12 vehicles and other emergency equipment. The power that is generated is expected to be sufficient to operate the facility. The parking canopy at the Visitors Center will support an approximately 100 kilowatt (kW) solar photovoltaic system and the approximately 8,100 square foot structure will provide covered parking for approximately 25 vehicles. The power generated will be utilized to offset the energy consumption for operation of the Civic Center. Finally, the existing roof of the DWP offices located at 41972 Garstin Drive will support about a 50 kilowatt (kW) solar photovoltaic system on 4,300 square feet of the south facing roof. The power generated will be utilized to off-set the energy consumption for operations of the DWP offices.

The project will also include a public education component. Residents and schools will be invited to tour the solar projects and learn how each of the solar energy systems work and the benefits to the community and the environment. Elementary-aged students will be given solar energy demonstration kits to complement science course work. Other age-appropriate solar energy items will be distributed to encourage the use of solar energy as an alternative to conventionally-generated forms of energy produced from fossil fuels. Additionally, displays in both the operation building at the maintenance yard and at the Civic Center will be erected to demonstrate the amount of solar power being generated at each location and the overall reduction in environmental impacts.

C. TASKS TO BE PERFORMED

Task 1.0: Maintenance Yard

This project will construct a 7,500 ft² warm storage building and adjacent canopy designed to provide the appropriate roof surface area and structural support for a solar energy collection system, as well as provide warm storage for approximately 12 vehicles and emergency

equipment. Additionally, an approximately 85 kilowatt (kW) solar photovoltaic system will be installed on the roof of the warm storage building and adjacent canopy. The roof area will be designed to accommodate operational maintenance of the solar panels, as well as addition loads from snow and wind.

Subtask 1.1: Develop Project Specifications

Within the development of this project there are four main specifications that will be addressed. They include cash flow estimates, project design, permitting, and installation drawings and specifications.

Subtask 1.1.1: Cash Flow Estimates

For cost control on this project, the construction plan and the associated cash flow estimates will be used to provide the baseline reference. The budget for this project is based on best available information. Labor and raw materials estimates will be extrapolated from other local projects. Equipment costs will be estimated from various vendors. Once plans and specifications are developed, a detailed engineer's estimate will be produced. Subsequently, the plans and specifications will be advertised for public bid. The instruction to the bidders will require a project schedule and timeline which will be used to measure performance progress. The bidders will be prequalified on ability and past performance.

Subtask 1.1.2: Project Design

Once the budget is approved, the design professionals will be utilized for project design. They will include electrical engineers, mechanical engineers, structural engineers, soils engineers, architects, and other disciplines as needed to complete the project design. Project design shall include all plans and specifications necessary to construct and operate the project. They will decide the materials and systems to incorporate into the project which will result in safe, healthy, useful, and effective design. An effective and efficient design will result in lower operational costs, minimize green house gases, lower the dependency on energy produced by fossil fuels, and improve health and working environment for employees. Developing plans with design professionals will insure that all structural, mechanical, and electrical materials and systems are safe and operationally effective. .

Subtask 1.1.3: Permitting

After completing the project design, the plans will be submitted for permitting. The permitting process also includes a planning review and a public hearing with the Planning Commission which allows citizens to be involved in the permit review process. Required permits include but are not limited to:

Environmental Clearance- This project will be reviewed for compliance with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA).

Air Quality Management District (AQMD) permits- Permits for the power generation system are required to ensure compliance with current regulations.

National Pollutants Discharge Elimination System (NPDES) permits- Construction activities (which include soil disturbing activities such as clearing, grading, excavating, stockpiling, etc.) that disturb one or more acres, or smaller sites that are part of a larger common plan of

development or sale, are regulated under the NPDES storm water program.

Building Permits-This project will be required to obtain building permits for the grading, installation of the utilities, electrical, mechanical and solar systems.

Subtask 1.1.4: Installation Drawings and Specification

Develop detailed drawing and specification. Design professionals will be utilized during project design. They will include electrical engineers, mechanical engineers, structural engineers, soils engineers, architects, and other disciplines as needed to complete the project design. Project design shall include all plans and specifications necessary to construct and operate the project. At a minimum the plans and specifications will address the following:

Grading- This project requires grading of the site to prepare the area for the installation of the vehicle storage building and canopy which will support the solar energy system elements of the project.

Utilities- The vehicle storage building and canopy will require underground utilities including water, sewer, storm drain, gas, and electrical. Special inverters and meters will be required to integrate the solar energy system with commercial power and emergency back-up power systems.

Landscape- To mitigate the environmental impact of the project, landscaping will be installed on the project perimeter. Federal and state NPDES require new construction to implement a Water Quality Management Plan. Local development ordinances require new construction to implement buffer zones for snow storage and project aesthetics. The Federal, state, and local requirements can be achieved with landscaping specifically designed to meet those requirements.

Building- A 7,500 (SF) vehicle storage building and adjacent canopy will be installed to provide the appropriate roof surface area for solar energy collection system. The roof area will be designed to accommodate operational maintenance of the solar panels as well as addition loads from snow and wind.

Electrical- The electrical distribution system will integrate the solar energy collection system. Special inverters and meters will be required to integrate the solar energy system with commercial power and emergency back-up power systems be installed to transmit power to the equipment.

Mechanical- Heating and ventilation and other systems will be installed to provide necessary life support and suitable working conditions for the employees at the project.

Solar- The solar collection system has been designed to make the entire facility power neutral by generating enough solar power so that the annual net purchase of energy from fossil fuel plants is zero. Design also anticipates the possibility of expanding the solar collection system as the facility grows. Special inverters and meters will be required to integrate the solar energy system with the commercial and emergency back-up power systems. This project will construct a photovoltaic system over

warm storage building and adjacent canopy with associated support system that will sustain an 85 kilowatt (kW) solar photovoltaic system. The photovoltaic system will be installed over a 7500 square foot warm storage building and adjacent canopy. The power that is generated will be utilized for the operation of the facility.

Subtask 1.2: Bid Documents, Advertise, and Award

Bidders shall be advised that this Contract is a public work for purposes of the California Labor Code, which requires payment of prevailing wages.

Subtask 1.2.1: Advertise

This project will be publicly advertised in accordance with local and federal bidding procedures.

Subtask 1.2.2: Award

The City staff will make a recommendation to the City Council to Award a construction contract to the lowest responsive bidder (Contractor).

Subtask 1.3: Installation

Once the installation contractor has been selected and the construction contract documents have been executed by the Contractor and the City, a pre-construction meeting will be held. At pre-construction meeting the City and Contractor will review key personnel, schedule, procedures, protocols, and the City will issue the Notice to Proceed.

Subtask 1.4: Outreach

An outreach program will be established and conducted annually which will include public education for schools and residents on the benefits solar energy. Schools and residents can schedule tour of the solar energy collection system. They will receive a guided tour and age-appropriate literature to explain how the solar energy system works and its benefits to the community and the environment. Elementary aged students will be given solar energy demonstration kits to complement science course work. Other age-appropriate solar energy items will be distributed to encourage the use of solar energy as an alternative to conventionally-generated forms of energy produced from fossil fuels. On special occasions, such as Earth Day, the City will open the facility to school-age children and visitors/residents to demonstrate the effectiveness of the solar system. A City representative will conduct tours of the facility showing the mechanical workings of the solar system. A display monitor will be placed in the lobby of the existing administration building that will show the power consumption and energy savings. The City's web site will display similar information. A special program will be setup with school districts to target 4th and 5th grade students to educate them on the benefits of solar energy systems and having them come to the facility for a tour with some hands-on learning sessions.

Task 2.0: Visitors Center

This project will construct an approximately 8,100 ft² parking canopy designed to provide the appropriate roof surface area and structural support for a solar energy collection system, as well as provide covered parking for about 25 vehicles. Additionally, an approximately 110 kilowatt

(kW) solar photovoltaic system will be installed on the canopy. The roof area will be designed to accommodate operational maintenance of the solar panels as well as addition loads from snow and wind.

Subtask 2.1: Develop Project Specifications

Within the development of this project there are four main specifications that will be addressed. They include cash flow estimates, project design, permitting, and installation drawings and specifications.

Task 2.1.1: Cash Flow Estimates

For cost control on this project, the construction plan and the associated cash flow estimates will be used to establish a baseline reference. The budget for this project is based on the construction contractor's Design Build Proposal. Labor and raw materials estimates will be extrapolated from other local projects.

Equipment costs will be estimated from various vendors.

Subtask 2.1.2: Project Design

Design professionals, including electrical engineers, mechanical engineers, structural engineers, soils engineers, architects, and other disciplines, will be utilized as needed to complete the project design. Project design shall include all plans and specifications necessary to construct and operate the project. They will decide the materials and systems to incorporate into the project which will result in safe, healthy, useful, and effective design. An effective and efficient design will result in lower operational costs, minimize green house gases, lower the dependency on energy produced by fossil fuels, and improve health and working environment for employees. Developing plans with design professionals will insure that all structural, mechanical, and electrical materials and systems are safe and operationally effective.

Subtask 2.1.3: Permitting

After completing the project design, the plans will be submitted for permitting. The permitting process also includes a planning review and a public hearing with the Planning Commission which allows citizens to be involved in the permit review process. Required permits include but are not limited to:

Environmental Clearance- This project will be reviewed for compliance with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA).

Air Quality Management District (AQMD) permits- Permits for the power generation system are required to ensure compliance with current regulations.

National Pollutants Discharge Elimination System (NPDES) permits- Construction activities (which include soil disturbing activities such as clearing, grading, excavating, stockpiling, etc.) that disturb one or more acres, or smaller sites that are part of a larger common plan of development or sale, are regulated under the NPDES storm water program.

Building Permits-This project will be required to obtain building permits for the grading, installation of the utilities, electrical, mechanical and solar systems.

Subtask 2.1.4: Installation Drawings and Specification

Develop detailed drawing and specification. Design professionals will be utilized during project design. They will include electrical engineers, mechanical engineers, structural engineers, soils engineers, architects, and other disciplines as needed to complete the project design. Project design shall include all plans and specifications necessary to construct and operate the project. At a minimum the plans and specifications will address the following:

Grading- This project requires minimal grading of the existing parking lot site to prepare the area for the installation of the covered parking canopy which will support the solar energy system elements of the project.

Utilities- The covered parking canopy will require underground utilities including storm drain and electrical. Special inverters and meters will be required to integrate the solar energy system with commercial power and emergency back-up power systems.

Landscape- To mitigate the environmental impact of the project, landscaping will be installed on the project perimeter. Federal and state NPDES require new construction to implement a Water Quality Management Plan. Local development ordinances require new construction to implement buffer zones for snow storage and project aesthetics. The Federal, state, and local requirements can be achieved with landscaping specifically designed to meet those requirements.

Building- A covered parking canopy will be installed to provide the appropriate roof surface area for solar energy collection system. The roof area will be designed to accommodate operational maintenance of the solar panels as well as addition loads from snow and wind.

Electrical- The electrical distribution system will integrate the solar energy collection system. Special inverters and meters will be required to integrate the solar energy system with commercial power and emergency back-up power systems be installed to transmit power to the equipment.

Solar- The solar collection system has been designed to reduce dependency of fossil fuel generated power by 50%. Design also anticipates the possibility of expanding the solar collection system as the facility grows. Special inverters and meters will be required to integrate the solar energy system with the commercial and emergency back-up power systems. This project will construct a photovoltaic system over a covered parking canopy with associated support system that will sustain a 110 kilowatt (kW) solar photovoltaic system. The photovoltaic system will be installed over an 8,100 square foot covered parking canopy. The power that is generated will be utilized for the operation of the Civic Center.

Subtask 2.2: Issue Change Order

A change order will be issued to the low bid contractor from Task 1 (previously advertised and awarded to the low bidder) for the Design Build Proposal. Applicable California Prevailing Wage Rates shall be paid as long as they are equal to or exceed the applicable Federal Rates, otherwise the higher Davis Bacon wage rates shall be paid.

Subtask 2.3: Construction and Installation

Following execution of the construction contract documents, a pre-construction meeting will be held. At the pre-construction meeting the City and Contractor will review key personnel, schedule, procedures, protocols, and the City will issue the Notice to Proceed. Construction will include demo of portions of the existing parking lot, relocate underground utilities, excavation of foundations, placing concrete piles and concrete grade beams for canopy foundations, excavating trenches for underground conduits for electrical system, placing concrete pads for new transformer and inverter, installing the structural steel for the canopy, installing the solar panels on the canopy, install canopy drainage improvements, repair the existing parking lot including curbs and gutters and masonry, backfill and repair of trenches, restripe the existing parking lot, commission and integrate the solar energy system into the Civic Center electrical distribution system.

Subtask 2.4: Outreach

An outreach program will be established and conducted annually which will include public education for schools and residents on the benefits solar energy. Schools and residents can schedule a tour of the solar energy collection system. They will receive a guided tour and age-appropriate literature to explain how the solar energy system works and its benefits to the community and the environment. Elementary aged students will be given solar energy demonstration kits to complement their science course work. Other age-appropriate solar energy items will be distributed to encourage the use of solar energy as an alternative to conventionally-generated forms of energy produced from fossil fuels.

Task 3.0: DWP Offices

This project will install a solar energy collection system on the existing roof of the DWP offices located at 41972 Garstin Drive. The office roof will support 50 kilowatt (kW) solar photovoltaic system on 4,300 square feet of the south facing roof. The power generated will be utilized to off-set the energy consumption for operations of the DWP offices.

Subtask 3.1: Develop Project Specifications

Within the development of this project there are four main specifications that will be addressed. They include cash flow estimates, project design, permitting, and installation drawings and specifications.

Subtask 3.1.1: Cash Flow Estimates

For cost control on this project, the construction plan and the associated cash flow estimates will be used to establish a baseline reference. The budget for this project is based on the construction contractor's Design Build Proposal. Labor and raw materials estimates will be extrapolated from other local projects. Equipment costs will be estimated from various vendors.

Subtask 3.1.2: Project Design

Design professionals, including electrical engineers, mechanical engineers, structural engineers, soils engineers, architects, and other disciplines, will be utilized as needed to complete the project design. Project design shall include all plans and specifications necessary to construct and operate the project. They will decide the materials and systems to incorporate into the project which will result

in safe, healthy, useful, and effective design. An effective and efficient design will result in lower operational costs, minimize green house gases, lower the dependency on energy produced by fossil fuels, and improve health and working environment for employees. Developing plans with design professionals will insure that all structural, mechanical, and electrical materials and systems are safe and operationally effective.

Subtask 3.1.3: Permitting

After completing the project design, the plans will be submitted for permitting. The permitting process also includes a planning review and a public hearing with the Planning Commission which allows citizens to be involved in the permit review process. Required permits include but are not limited to:

Environmental Clearance- This project will be reviewed for compliance with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA).

Air Quality Management District (AQMD) permits- Permits for the power generation system are required to ensure compliance with current regulations.

National Pollutants Discharge Elimination System (NPDES) permits- Construction activities (which include soil disturbing activities such as clearing, grading, excavating, stockpiling, etc.) that disturb one or more acres, or smaller sites that are part of a larger common plan of development or sale, are regulated under the NPDES storm water program.

Building Permits-This project will be required to obtain building permits for the grading, installation of the utilities, electrical, mechanical and solar systems.

Subtask 3.1.4: Installation Drawings and Specification

Develop detailed drawing and specification. Design professionals will be utilized during project design. They will include electrical engineers, mechanical engineers, structural engineers, soils engineers, architects, and other disciplines as needed to complete the project design. Project design shall include all plans and specifications necessary to construct and operate the project. At a minimum the plans and specifications will address the following:

Grading- This project requires no grading. The photovoltaic system will be installed on an existing office roof.

Utilities- All utilities are existing onsite. Special inverters and meters will be required to integrate the solar energy system with commercial power and emergency back-up power systems.

Landscape- The property is already landscaped. Since this is a solar project on an existing roof top (no grading), Federal and state NPDES do not apply and the Water Quality Management Plan is not needed. Local development ordinances require new construction to implement buffer zones for snow storage and project aesthetics which have already been accomplished when the existing roof was constructed. Therefore, the Federal, state, and local requirements have been satisfied because of the

existing landscaping and existing roof and no grading on this specific roof top solar project.

Building- No new building construction is required. The existing south facing roof area will accommodate the solar panels as well as addition loads from snow and wind.

Electrical- The electrical distribution system will integrate the solar energy collection system. Special inverters and meters will be required to integrate the solar energy system with commercial power and emergency back-up power systems be installed to transmit power to the equipment.

Solar- The solar collection system has been designed to reduce dependency of fossil fuel generated power by 64%. Special inverters and meters will be required to integrate the solar energy system with the commercial and emergency back-up power systems. This project will construct a photovoltaic system on approximately 4,300 square foot of existing south facing roof that will sustain a 50 kilowatt (kW) solar photovoltaic system. The power that is generated will be utilized for the operation of the DWP offices located at 41972 Garstin Drive.

Subtask 3.2: Bid Documents, Advertise, and Award

A change order will be issued to the low bid contractor from Task 1 (previously advertised and awarded to the low bidder) for the Design Build Proposal. Applicable California Prevailing Wage Rates shall be paid as long as they are equal to or exceed the applicable Federal Rates, otherwise the higher Davis Bacon wage rates shall be paid.

Subtask 3.3: Construction and Installation

Following execution of the construction contract documents, a pre-construction meeting will be held. At the pre-construction meeting the City and Contractor will review key personnel, schedule, procedures, protocols, and the City will issue the Notice to Proceed. Construction will include installation of the photovoltaic system on the existing south facing roof of the DWP office. The 50 kW photovoltaic solar energy system installation includes commissioning, and integration with the existing office electrical distribution system.

Subtask 3.4: Outreach

An outreach program will be established and conducted annually which will include public education for schools and residents on the benefits solar energy. Schools and residents can schedule a tour of the solar energy collection system. They will receive a guided tour and age-appropriate literature to explain how the solar energy system works and its benefits to the community and the environment. Elementary aged students will be given solar energy demonstration kits to complement their science course work. Other age-appropriate solar energy items will be distributed to encourage the use of solar energy as an alternative to conventionally-generated forms of energy produced from fossil fuels.

Task 4.0: Project Management and Reporting

Reports and other deliverables will be provided in accordance with the Federal Assistance Reporting Checklist following the instructions included therein.

Background: The City received a Department of Energy (DOE) grant in the amount of \$2,169,006 for three solar demonstration projects. These grant projects are 50% funded by grant proceeds. One of these proposed projects, "Solar Energy Parking Canopy Demonstration Project", was approved on August 23, 2010 by the City Council. After completion of detailed design, the project was publicly bid. On April 3, 2012, the City Clerk received four (4) bids and publicly opened bids for the project. All four (4) bids received were significantly higher than the approved budget. The low bid was 14.28% over the proposed budget of \$2,193,310. Furthermore, staff found uncharacteristically high mark-ups on some line items by the bidders. As a result, staff recommended that City Council reject all four (4) bids and direct staff to re-advertise with a modified scope of work. The project was rebid with a modified scope of work. On May 15, 2012, the City Clerk received four (4) bids and publicly opened bids for the project. The four (4) bids received were on average \$150,600 lower than the April 3, 2012 bid opening due to modifications in scope of work. The lowest responsive base bid was \$2,445,000.00. The bid is 11.5% higher than the Engineer's Estimate of \$2,193,310, which was prepared 2 years ago and was based on conceptual drawings. The higher price may be, in part, due to more precise installation/construction drawings and steel and fuel costs, which have increased steadily since the project design phase was completed.

Staff intends to recommend that City Council award an installation construction contract to the lowest responsive bidder at an upcoming City Council meeting. Due to budget workshops in June and vacations in July, the next available opportunity to award the installation/construction contract will be the City Council meeting scheduled for August 27, 2012.

On August 1, 2012 the four (4) construction bids and bid analysis were sent to the DOE.

On August 27, 2012 the City Council awarded a construction contract to Facility Builders & Erectors, Inc for the Public Works Maintenance Yard Solar Energy Project.

On August 28, 2012 the PMC123.1 - Budget Justification for SF 424A Budget was sent to the DOE.

On September 4, 2012 the contractor's budget breakdown was sent to the DOE.

On September 17, 2012 the individual subcontractors' quotes were sent to the DOE.

On September 21, 2012 a discrepancy was discovered and corrected on the contractor's budget breakdown.

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On September 27, 2012 forwarded additional info regarding the SunQuest Energy quote was provided to the DOE.

October-Forwarded additional information for NEPA clearance

October and November- Ongoing discussions with DOE related to the SOPO and admin bldg remodel.

On November 5, 2012 supplied DOE with justification and copies of estimates and correspondence with previous DOE staff members.

On December 4, 2012 DOE sent its determination on the admin bldg remodel.

On December 27, 2012 received more queries from the DOE related to the ongoing NEPA review and a request for project plans. The requested information was sent to the DOE later on the same day.

On January 2, 2013 received email advising "that NEPA has completed their approval and we have everything we need to finish processing the modification. Since that was the biggest hurdle, the formal modification should breeze through review from the procurement team in the next couple weeks."

On January 3, 2013 forwarded bid documents requested by the DOE.

Throughout January and February 2013 the DOE requested more detail on the budget and requested changes to the PMC123.1 to satisfy the procurement team.

On March 6, 2013 the DOE reduced the allocable contract cost from \$2,445,000 to \$2,186,238 and requested a another revised PCM123.1

On March 11, 2013 supplied a revised PMC123.1 to the DOE as instructed by Joe Lucas removing the un-allocable admin building remodel costs of \$258,762.

On March 18, 2013 sent the DOE an email regarding the narrow window of opportunity for construction and fast approaching deadline for approved project period.

On March 21, 2013 received notice from the DOE procurement team that the "award modification has been released to your organization via FedConnect".

On March 28, 2013 confirmed with the DOE that the FedConnect 002 award modification authorizes the construction of Task 1.0.

On March 28, 2013 initiated the project stormwater NOI and WDID.

On April 22, 2013 construction contract executed between City and Facility Builders & Erectors, Inc (FBE).

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On May 1, 2013 FBE notified that Notice to Commence Work (Notice to Proceed) on May 6, 2013.

On May 13, 2013 held a project construction meeting with utilities, FBE, design team, and City

On June 2, 2013 the SWPPP was approved.

On June 24, 2013 the NOI was ACTIVE.

On June 28, 2013 FBE delivered the temp construction trailer to the jobsite.

During July, August, and September significant project progress was accomplished. Accomplishments included over excavating the jobsite and re-compacting to achieve grades, installing underground stormwater facilities, and completing the concrete foundation of the Warm Storage Bldg. Equipment and product submittals were reviewed. Long lead items were ordered. Started underground facilities.

During October, November and December 2013 significant project progress was continued. Accomplishments included the erection of the Warm Storage Bldg (columns, beams, girts, siding, roofing, insulation, and trim), installed roll-up doors, and concrete placement for the apron. The solar panels were installed on the Warm Storage Bldg roof. The tenant improvements, electrical, plumbing, and HVAC inside the Warm Storage Bldg were started. Additional equipment and product submittals were reviewed. Long lead items were ordered. Continued progress was made with underground facilities including the installation of catch basins, stormwater interceptor, and oily-water separator.

During January, February, and March 2014 significant project progress was continued. Accomplishments included construction of the generator pad, installation of the generator, continued underground utilities and stormwater facilities, started wiring the solar equipment, installed yard lighting, and constructed the electrical equipment enclosure. Completed tenant improvements, electrical, plumbing, and HVAC inside the Warm Storage Bldg and started paving the parking lot. Completed procurement and delivery of long lead items.

During April, May, and June 2014 accomplishments included completion of wiring the solar equipment, completed the generator installation, completed yard lighting, completed installation of the equipment within the electrical enclosure including inverters, completed paving of the parking lot, completed underground utilities, and completed the underground stormwater facilities. Also, received approval from DOE for Task 2 on June 12, 2014 and began detail design. Began preliminary design for Task 3.

During July, August and September 2014 accomplishments included the conditional acceptance, effective July 28, 2014, from the contractor signifying the construction completion of Task 1 for the Solar Energy Parking Canopy Demonstration Project

(Public Works Maintenance Yard Solar Project). Other accomplishments included completion of detailed design for Task 2 (Visitor Center/Civic Center Solar Project) and start of construction for Task 2 on September 15, 2014, received approval from DOE for Task 3 (DWP Solar Project) on August 20, 2014 and began detailed design. On September 18, 2014 submitted to the DOE a "Justification for Extension of Award DEEE0003186".

During October, November and December 2014 accomplishments included completion of construction for Task 2 (Visitors Center/Civic Center Solar Project) and completed detailed design of Task 3 (DWP Solar Project) then started and completed construction of Task 3 (DWP Solar Project). On October 27, 2014 received DOE Extension of Award DEEE0003186 to June 30, 2015.

During January, February, and March 2015 accomplishments included preparation for Outreach Program and purchase of solar demonstration kits for students. The inverters at DWP (Task 3) had a period of down-time last quarter due to internal inverter faults. Each inverter has a set of internal fuses on the grid side connection to protect the inverter's circuitry. There was a malfunction with these fuses that caused them to activate unnecessarily. The fuses were replaced after the first trip and a minor investigation was conducted by the contractor's technician. It was determined the most likely cause was a one-time anomaly and the fuses reacted properly. A second inverter showed the same issue shortly after the first repair. The contractor contacted the inverter vendor technical support for assistance. Two replacement inverters were delivered and the contractor's technicians tested all aspects of the external AC and DC side circuits to confirm that everything was connected and installed as expected. The new inverters were installed and the system was put back in to operation. The symptom has occurred twice again since the last repair. Both times, DWP personnel replaced the internal inverter fuses to put the system back into operation and the inverter vendor is currently setting up an investigation to determine the cause of the problem and take whatever action is necessary to solve this issue.

During April, May, and June 2015 accomplishments included completion of Outreach Program and distribution of solar demonstration kits for students. Over 600 students and their teachers from local private and public schools attended our Outreach presentation. At the end of the Outreach presentation, the students were given a solar kit model to further educate themselves with solar technology and its benefits. Service calls were made at all 3 solar projects this quarter. The manufacturer's technician upgraded a communication circuit board inside the inverters and conducted routine service and testing of the units. The final investigation of the issues at DWP revealed a manufacturing defect in the internal fused circuit board of the inverters. This board was re-designed by the manufacturer and the updated pieces were installed by their technician at all 3 solar projects. The inverters have been operating problem free since this last repair.

Operational Summary: The three (3) solar projects have been operating as expected. There were a few kinks that were worked out during the early operations as described

previously. Since then, there have been no outages and the projects have been maintenance free.

The Maintenance Yard Solar Project has generated 202 MWh of power since it began operating on May 30, 2014 to September 23, 2015. Here are the project details:

Visit webpage <http://www.solrenview.com/SolrenView/mainFr.php?siteId=2673>

System Size 86.4 kWdc
Location 42040 Garstin Dr.
Big Bear Lake, CA 92315 US
Inverter 1 PVI 100kW
Modules 360 x Canadian Solar CS6 240

The Visitors Center/Civic Center Solar Project has generated 202 MWh of power since it began operating on November 20, 2014 to September 23, 2015. Here are the project details:

Visit webpage <http://www.solrenview.com/SolrenView/mainFr.php?siteId=3177>

System Size 110.72 kWdc
Location 39707 Big Bear Blvd.
Big Bear Lake, CA 92315 US
Inverter 1 PVI 100kW
Modules 363 x Can. Sol. CS6X-305 305

The DWP Solar Project has generated 69.9 kWh of power since it began operating on November 20, 2014 to September 23, 2015. Here are the project details:

Visit webpage <http://www.solrenview.com/SolrenView/mainFr.php?siteId=3178>

System Size 51.85 kWdc
Location 41972 Garstin Dr.
Big Bear Lake, CA 92315 US
Inverters 3 PVI 14TL
Modules 170 x Can. Sol. CS6X-305 305

Recommendations: There are energy efficiency differences between the three (3) projects due to panel orientation and inclination. Future installations of solar panel in mountain communities with harsh winter environments should increase the panel inclination. The Maintenance Yard Solar Project has a panel inclination of 0.23 inches per foot. The Visitors Center/Civic Center Solar Project has a panel inclination of 0.167 inches per foot.

The DWP Solar Project has a panel inclination of 6 inches per foot.

	Roof Inclination	Snow Shedding Ability
Visitors Ceenter/Civic Center Solar Project	0.167 inches per foot	Very Poor
Maintenance Yard Solar Project	0.23 inches per foot	Poor
DWP Solar Project	6.0 inches per foot	Best

As a result, after a snow storm the steepest roof sheds its snow faster and continues generating solar power sooner than the other roofs. Future installations of solar panels in harsh winter conditions should maximize the inclination of the solar panels to maximize snow shedding and solar energy production.