



The

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California Solar Electrical Power Generation - Going Green

The California Energy Commission (CEC) recently approved the design and construction of a number of solar energy generating stations. These are the first of several large scale commercial solar projects planned within the State. Other, smaller pilot projects have been developed recently; but these projects were on a much smaller scale than these new commercial electrical power generating stations.



Ivanpah Heliostat Mirrors

The first of these projects, the Ivanpah Solar Electric Generating Station, broke ground in late 2010, near Primm, Nevada. Upon completion, this station will supply more than 300 megawatts (MW) of electrical power to the grid. The project site covers over 3,500 acres of the southeastern California desert. This project is somewhat unique in the way in which it will convert sunlight into electrical power. It will use literally thousands of heliostat mirrors that track the sun during the day as it crosses the horizon. The mirrors will reflect the sunlight to three centrally located solar boilers, which are situated on top of 450 foot tall towers. Each heliostat solar collector will be approximately seven feet wide and ten feet tall; the mirrors will be mounted on driven steel piles. The reflected solar energy will directly heat water in the boilers to produce steam, which will be used to drive steam turbine generators. During start-up and during cloudy conditions, a natural gas powered boiler will supplement the solar boiler.



Ivanpah Solar Electric generating stations

The Ivanpah project, like many others, has dealt with some challenging environmental issues. These issues range from rare and endangered plants to protecting endangered wildlife. The most notable of the endangered wildlife species is the desert tortoise. The project team surveyed and cleared the entire project site of the desert tortoise before any heavy equipment began disturbing the ground surface. Once found, the tortoises were relocated to protective pens where they spend their hibernation free from the threat of predators. Special pens with overhead netting protect the juveniles from aerial predators. Many of the tortoises will eventually be relocated to lands set aside by the project proponent for a tortoise habitat. Some tortoises will be placed outside the boundaries of the project fencing, which is designed to prevent the tortoises from re-entering the project site.

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Los Medanos Station - Motor Control Center Replacement Project

Chevron Pipe Line Company (CPL) owns and operates the Los Medanos crude oil pumping station, located in Pittsburg, California. This station has been in continuous operation for nearly a century. The station currently has four operational main line centrifugal pumps that pump crude oil westward, to several of the San Francisco Bay Area refineries (e.g., Valero Benicia Refinery, Tesoro Avon Refinery, and the Shell Martinez Refinery). The station is also home for CPL's Northern California operations and maintenance team and includes an office, warehouse, maintenance shop, and material storage areas. The station contains the typical pump station medium and low voltage electrical equipment, including:

- Main line shipping pumps,
- motor actuated valves,
- electro-hydraulic flow control valves,
- sump pumps,
- area lighting, and
- other electrically powered devices.

Electrical power to the facility was supplied by two separate Pacific Gas and Electric electrical feeders. One feeder (21kv stepped down to 2.4KV) supplied electrical power to the station's main line pumps and other three phase devices. The second feeder (240V/120V) supplied power for the office, operations and maintenance buildings, area lighting, and other low voltage sources. Both feeders were routed through a Motor Control Center (MCC) and power distribution building. The MCC building's wood frame and stucco structure had been relocated to this site from another Chevron Corporation facility in 1967. But due to the age of the power distribution equipment, it had reached the end of its useful life; replacement parts had become very difficult to secure.

In early 2008, CPL contracted with EDM Services, Inc. to assist with the preliminary project scoping and design of a replacement for the aging MCC Building and electrical equipment. After initial project scoping was completed and cost estimates were developed, CPL management decided that the best plan forward was to replace the building structure and power distribution equipment, including the installation of new, modern soft-start motor control equipment and low voltage power distribution equipment. This also included the installation of a new electrical feed, the replacement of the existing station supervisory control and data acquisition (SCADA) system programmable logic controller (PLC), and most of the electrical wiring.

In late 2008, with preliminary project scoping complete, EDM Services, Inc. began development of the detailed civil, structural and electrical engineering. To reduce operational downtime of the pumping station, all electrical power distribution, control, instrumentation, and communications wiring was designed to be constructed in parallel with the existing circuits. In addition to these new wiring circuits, more efficient facility transformers were included in the project scope. A new 3,000 kva - 12kv / 2.4kv medium voltage transformer and a new 500 kva - 2.4kv / 480v low voltage transformer were integrated into the project. EDM Services, Inc. subcontracted with SPEC Services, Inc. to provide medium and low voltage electrical engineering design assistance.



Prefabricated MCC being lowered into position

In addition to the MCC replacement itself, EDM Services, Inc. provided other engineering services to support the project. EDM Services, Inc. assisted with the replacement of the station's aging valve motor actuators. The new actuators included integral reversing motor starters that eliminated the need for similar devices within the new MCC. EDM Services, Inc. provided engineering to re-route the station's 12-inch crude oil suction piping in order to provide clear routing of the pumping unit's medium voltage and instrumentation duct banks to the station, as well as building permit acquisition assistance.

The design and fabrication of the MCC pre-fabricated building was the longest lead time project component.

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Going Green

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So how does a regional engineering firm know so much about these high tech green projects?

Working through Aspen Environmental Group, EDM Services, Inc. began assisting the CEC with their Delegate Chief Building Official (DCBO) oversight program nearly ten years ago. Initially, the firm helped establish consistent plan check and inspection practices among the various third party DCBO's. During the development of the natural gas fired turbine power generation projects, most of the DCBO's had limited experience with industrial process piping. Our extensive knowledge of the California Building Code (CBC), as well as the industrial codes (e.g., ASME Boiler and Pressure Vessel Code, ASME B31.3, ASME B31.8, etc.) helped the CEC provide continuity among the many projects being developed at the time. It also enabled the firm to act as the developer's advocate in resolving conflicts. The firm provided conflict resolution and code interpretations that kept the development of these projects moving forward while complying with the CBC and the CEC conditions of approval. This same experience has proved beneficial in the development of the solar energy generating stations.

In addition to the Ivanpah project, several other solar energy generating projects are in various stages of development. These projects include: Blythe, Rice, Calico, Genesis, and others. Details regarding these and other power generating projects can be found on the California Energy Commission's renewable energy website:

<http://www.energy.ca.gov/renewables/index.html>

Most of the proposed projects utilize a solar trough design. In this process, a heat transfer fluid is heated. This fluid then passes through a boiler to generate steam. A couple of these projects will utilize a Sterling Engine mounted at the focal point of the individual solar collectors. The solar radiation will power the Sterling Engines that will in turn drive numerous individual generators. These individual power sources will be connected to a main step-up transformer(s) before the electrical power is connected to nearby transmission power lines. These plants will range in generating capacity from 150 MW to 1,000 MW.

Los Medanos Station

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Completed MCC building

Concurrent with the facility civil, structural and electrical engineering, Powell Electrical Group was contracted to design and fabricate the replacement MCC building pre-fabricated assembly. The functionality of the building was defined by an electrical one-line diagram, which was developed by EDM Services, Inc. during the preliminary scoping phase of the project. The MCC building structure was designed and fabricated by Powell to meet the requirements of the 2007 California Building Code, which included seismic resistant design. The building was delivered to the site in late 2009 with the station PLC installed. The PLC industrial control enclosure was designed and fabricated by NS Controls of Houston.

In the Spring of 2010, on-site construction began for the building foundations, electrical duct banks, vaults, transformer foundations and firewall. The construction and circuit testing proceeded over the next six months. The project was completed in October 2010 after all facility power, communications, and control circuits were transferred to the new MCC Building.

Scott Piglia, Vandad Khani and Erin Baker served as CPL's Project Managers, with assistance from a number of subject matter experts, including: Bill Stewart (Electrical Engineering), Hank Clark (Electrical Engineering), Kathryn Roussel (Electrical Engineering), Rabih Radwan (Controls), Jeff Hulsey (Construction), Rand Reynolds (Permitting), Joe Marshall (I&E Specialist), Carey Wages (Operations and Maintenance), and Jerami Myers (Operations and Maintenance). Butch Walls, P.E., served as the EDM Services, Inc. Project Manager.

In The Spotlight



Kyle Wendel-Smith spent the summer of 2010 traveling the United States with the Pacific Crest Drum and Bugle Corps. They spent nine months perfecting an eleven minute field show, which was performed in competition. They were on the road for four weeks, competed in twenty-five competitions, in thirteen different states, and traveled over 12,000 miles.

It all started in December 2009 with a two day audition camp. Hundreds of people auditioned for about 150 spots in the Corps, Kyle secured a spot in the Euphonium section of the horn line. After the auditions, the group rehearsed one weekend a month until May, when they started rehearsing every weekend. In June, they began rehearsing for ten hours each day until they started their tour of the United States on July 17th.

The tour schedule was fast paced. The Corp traveled at night, arriving at their housing very early in the morning. Once there, they would try to get as much sleep as possible before being woken up at eight a.m. to begin their day. One hour was scheduled for breakfast and rehearsal preparation. After a four to six hour rehearsal, the group would pack their things, load up the buses, perform at the competition that night, and then travel to the next destination. The tour ended in Indianapolis, Indiana where the group performed at the Drum Corp International (DCI) World Championships at Lucas Oil Stadium, home of the Indianapolis Colts.

Kyle began working at EDM Services, Inc. in November 2007. Kyle is currently attending Moorpark Community College and is looking forward to transferring to California State University, Northridge, where he will continue his study of Civil Engineering.



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