Case Study

Harmonic Filter Solution Applied to Massive Solar Energy Project

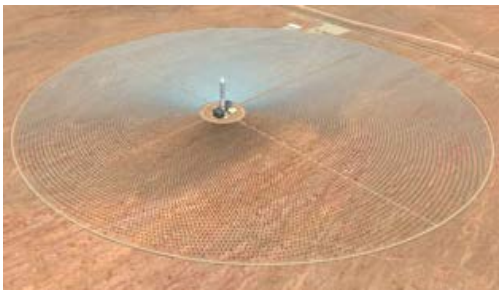
Written By:
Patrick Lee
Terese Neureuther

Introduction

When the Crescent Dunes Solar Energy Project was having power quality problems, their team called on TCI to find a solution. The engineers at TCI determined that both active harmonic filters and line reactors were needed. The solution improved the power factor and reduced costs while meeting IEEE-519 requirements.

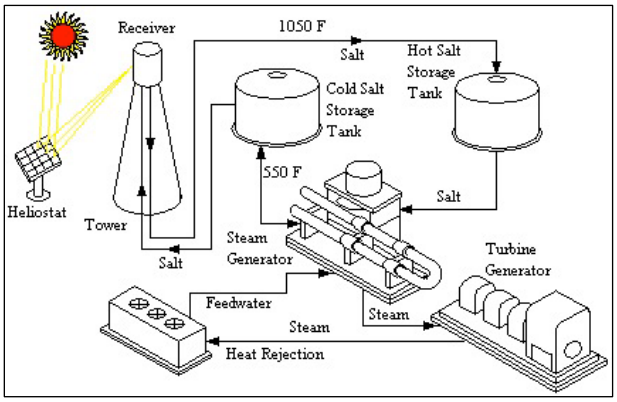
The Solution

Crescent Dunes Solar Energy Project is a 110MW Solar Thermal project 190 miles northwest of Las Vegas in the Nevada Desert. When completed, this power plant, designed and built by SolarReserve of Santa Monica California, will use the sun's thermal energy to generate enough electrical energy to power 75,000 homes.



The project site

17,500 independently controlled mirrors, or heliostats, are positioned to reflect the sun's energy to a central collector at the top of a 640 foot tower. As the sun tracks across the sky during the day, the heliostats are repositioned to track its movement and to ensure that a maximum amount of energy is harvested. In this tower, the energy of the sun is used to heat molten salt from 550°F to 1050°F. The superheated salt is then directed to either a heat exchanger used to create steam to drive a turbine, or to a storage tank for use later. This ability to store energy is what sets Crescent Dunes apart from other forms of solar energy generation methods. By making the heated salt available when the sun is not out, Crescent Dunes can generate clean, solar based energy well into the night.



The process of turning molten salt into electricity

Each 34 foot by 37 foot heliostat weighs 3 tons and is positioned by two motors and two variable frequency drives to direct the sunlight to the target atop the tower. The large number of VFDs in this installation was a cause of concern. SolarReserve engineers contacted TCI for assistance in solving their significant power quality problem. TCI engineers, working together with engineers from SolarReserve, recommended a solution combining the use of TCI's KDR Line Reactors and H5 Active Harmonic Filters.

The solution, optimized for this application, uses 347 line reactors and six 300 Amp active harmonic filters to bring this installation into compliance with IEEE-519. The line reactors help reduce the high load on the system, while the active harmonic filters mitigate harmonics and improve power factor. The high

harmonic content and large number of drives made many traditional solutions economically prohibitive. The H5 Active Harmonic Filter with its ability to be paralleled and applied directly to the bus coupled with our KDR Optimized Line Reactors allowed TCI and SolarReserve to configure the most cost effective solution to their problem. With our products helping to regulate the electrical system, this unique power plant will produce electricity for thousands of people without harming or impacting the environment for many years to come. Contact TCI to see how we can help with your power quality problem.

The nearly completed tower

For more information, pictures and videos on this project visit www.solarreserve.com.

Sources:

EcoSeed Staff. "Crescent Dune Solar Thermal Project Completes Solar Receiver Panel Assembly." *EcoSeed*. Global Content & Research Ltd., 3 Apr. 2013. Web. 10 Apr. 2013.

Tibbitts, Mike. Telephone interview. 7 Mar. 2013.

Project site picture: http://static.sandiego.com/articlefiles/595f1b11-dcbb-4a0d-9446-8406a509444f/solar-325.jpg

Process Diagram: http://www.fastcompany.com/1754512/molten-salt-and-rocket-science-make-solar-work-night

Tower picture: http://www.solarreserve.com/wp-content/gallery/crescent-dunes-project/SR-CD9-largeDec2012.jpg

TCI, LLC
W132 N10611 Grant Drive
Germantown, WI 53022
(414) 357-4480
FAX (414) 357-4484
PQ Helpline (800) TCI-8282
www.transcoil.com