

# Solar Thermal Hybrid Demonstration Project at Natural Gas Combined-Cycle Plant



*Solar thermal energy, in conjunction with traditional generation sources, is one of the most promising options for large-scale “green” generation.*

Solar thermal hybrid applications could be the lowest-cost option for adding solar power to the generation fleet, and costs are expected to decrease as the technologies mature and deployment increases. Several plant owners are considering installing first-of-a-kind utility-scale solar thermal hybrid technology at existing natural gas combined-cycle plant sites in order to meet renewable energy regulatory targets, reduce plant emissions, and avoid fuel costs.

NV Energy plans to implement a solar thermal hybrid project at the 1102-MW Chuck Lenzie Generating Station located in North Las Vegas, Nevada. Together with plant owners and operators and other participants, EPRI will create a collaborative project to provide relevant and timely knowledge and data from this utility-scale solar thermal hybrid project for the industry and public. EPRI will support the project host in selecting the integration design and conduct independent plant performance monitoring and evaluation and economic assessments. Collaborative funders will be integrally involved in the project journey via site visits and regular updates.

## **Value**

Reliable and cost-effective renewable energy is a critical element for the widespread deployment of variable resources and their integration into the existing grid infrastructure. Solar

- Receive timely understanding of solar thermal hybrid technology potential
- Be exposed to project/technology successes and shortfalls
- Receive ongoing access to results and assessments as projects unfold
- Have a voice and front-line role in research intended to accelerate technologies that avoid fuel costs and reduce plant emissions
- Build in-house skills through interaction with world-class experts

thermal energy, in conjunction with traditional generation sources, may be one of the most promising options for large-scale “green” generation.

Integration of solar thermal energy in a fossil-fueled plant allows the plant to serve (from an operator’s point of view) as a dispatchable resource with firm capacity in the expanded solar operating window, reducing the need for regulating and backup reserves. Solar-derived steam is introduced into the steam cycle when it is available, and the fossil plant provides stable power output to the grid, balancing the variability of the solar thermal input as needed. Less fuel is consumed and fewer emissions are generated on an annual basis.

## **Drivers and Trends**

There is significant worldwide pressure to reduce carbon emissions and develop viable renewable generation alternatives. Reducing the carbon emissions of existing assets by adding a renewable component is one option for addressing these regulatory pressures. Federal, state, and municipal governments have established goals and financial incentives to encourage solar industry growth. This support has prompted the announced development of over 10,000 MW of solar thermal electric projects worldwide in the past few years; however, only a few projects involve retrofitting existing fossil-fueled assets,

and only one small (~3 MW) solar thermal hybrid project has been built. Many existing fossil-fueled plants are suitable candidates for solar thermal retrofit applications, and there is a need to demonstrate solar thermal integration at utility scale to validate the technical and economic performance.

## Project Summary

In 2009, EPRI completed a study to determine the feasibility of integrating solar thermal steam into existing natural gas combined-cycle plants, including a detailed case study for the Chuck Lenzie Generating Station. EPRI assessed the near-term commercial capability of three solar thermal technologies—parabolic trough, central receiver, and compact linear Fresnel reflector—to supply heat input to a steam cycle. The study included a broad modeling effort to evaluate all feasible integration options and four detailed case studies.

This project will support the first commercial-scale demonstration of solar thermal technology at an operating natural gas combined-cycle plant. The project will include three distinct phases:

**Phase 1** will begin in conjunction with the commercial-scale plant development, in parallel with the design, siting, and permitting. The focus will be on solar thermal technology selection and development of an efficient integration design. EPRI will support NV Energy in selecting a design that can achieve the desired cost and performance targets while maintaining the availability and reliability of the existing plant. This task is expected to take approximately one year.

During site construction, in **Phase 2**, EPRI will develop the plan for the hybrid plant performance evaluation and testing. This will include developing test procedures and designing a monitoring system that will capture key performance metrics for both the solar field and the integrated hybrid plant. Testing plans for commissioning the hybrid plant also will be developed. This phase is expected to take two to three years.

**Phase 3** takes place during commissioning and operations when EPRI will carry out performance monitoring and evaluation, component testing, economic assessment, and reporting of operating parameters. A key objective is to establish procedures that can be used to develop guidelines for solar thermal hybrid plant design, performance evaluation and testing, and monitoring that can be applied at other sites.

The testing and monitoring activities will be conducted for one to two years to ensure the full range of operating modes and plant loads are experienced. EPRI will help identify potential means of improving the cost-effectiveness of the integrated hybrid process, including modifications or operating strategies that could improve plant economics.

## Deliverables

EPRI intends to provide annual reports covering each phase of project development: design selection, construction and commissioning, and operations and testing. EPRI also intends to provide collaborative funders timely updates in the form of quarterly web casts, progress reports, and site visits, which would include non-proprietary information on O&M requirements, cost and performance validation, and impacts on plant reliability and controls. In addition to these tangible deliverables, EPRI intends to provide collaborative funders with access to the knowledgeable team of experts involved in the project.

## Price of Project

Please contact your EPRI Account Executive for your collaborative price to participate in this project. There is a separate pulverized coal project, which is independently offered.

## Project Status and Schedule

Work on this project is expected to begin in early 2010, and should be completed in five years.

## Who Should Participate

Companies generating electricity that are interested in the performance, integration, and costs of solar thermal systems in natural gas combined-cycle plants. Entities interested in accelerating the development of solar thermal hybrid plants also should participate.

## Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 ([askepri@epri.com](mailto:askepri@epri.com)).

## Technical Contact

Cara Libby at 650.855.2382 ([clibby@epri.com](mailto:clibby@epri.com)).

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### Electric Power Research Institute

3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA  
800.313.3774 • 650.855.2121 • [askepri@epri.com](mailto:askepri@epri.com) • [www.epri.com](http://www.epri.com)