PNM Sponsors Feasibility Study of Solar Central Power

PNM's Algodones Photovoltaic Arrays

Public Service Company of New Mexico (PNM) – A 2009 EPRI Technology Transfer Award Recipient

"The technology assessment gave PNM a strong working knowledge of the different types of solar technologies as well as the tools to evaluate vendor statements, even for offerings that might not exist commercially yet."

Travis Coleman
PNM Advanced Generation Development

Public Service Company of New Mexico (PNM) has long taken a leadership role in developing renewable energy projects, mitigating climate change, meeting the need for more generation capacity, and developing a diversified generation portfolio even before the advent of state Renewable Portfolio Standards.

Located in an area with a world-class solar resource, PNM sought to explore the potential for development of a solar project. All solar technologies were of interest, including solar thermal technologies, such as central receiver and parabolic trough, as well as photovoltaic technologies such as crystaline and thin-firm. Solar thermal is of particular interest due to the emerging ability to integrate thermal storage into the plant design, thus improving operating flexibility and enabling the plant to operate during more hours of the day.

Preliminary research indicated that although solar technologies have high capital costs relative to other renewable technologies, there were substantial economies of scale to be realized in large projects. As a result, PNM took the lead in formation of an energy company collaboration to study the potential for a large-scale solar power project, which became known as Central Station Solar Power or CSSP.

Feasibility Study for CSSP Plant in New Mexico

The first step in the kind of large-scale energy project envisioned by PNM is a feasibility study that develops detailed information on potential sites, technology options, economic factors, regulatory considerations, and environmental impacts. In this case, EPRI was engaged with PNM as the lead sponsor to conduct a study that would evaluate the potential for a 50-500 MW CSSP plant to be built in New Mexico.

Site, Technology, Economic, and Environmental Assessments

The study scope included performing site and technology assessments, analyzing technology-specific design and performance, evaluating plant economics and financial incentives, and assessing environmental and regulatory issues.

For the siting portion of the study, the team developed a scoring system to evaluate and rank the candidate sites. The criteria included direct normal irradiance/capacity factor, access to the transmission grid, natural gas availability, potential for water availability, constructability considerations, area available for expansion, and other factors. A key requirement was that the plant be installed and operational by mid-2011. As a result, only sites with access to firm transmission were considered for further study.

The study's technology assessment utilized a request-for-information process to collect information on the current status of the solar industry. In addition to cost and operational characteristics, technologies were evaluated based on demonstrated commercial readiness. The following solar thermal technologies were evaluated: central receiver, compact linear Fresnel reflector,

dish/engine, and parabolic trough. Four photo- voltaic (PV) technologies were also evaluated.

Based on three criteria—commercial status, current levels of deployment, and ability to ramp up manufacturing for a 2011 project—three technologies were selected for further evaluation: central receiver, parabolic trough, and PV. The cost and performance of these technologies were then quantitatively compared using the levelized cost of electricity (LCOE), which provided a common set of assumptions and aided in determining which technologies and plant designs would be most economical for a CSSP plant in New Mexico during the time frame being considered.

To determine the major environmental and regulatory issues associated with project development, the project team assessed various sites. A 15-month regulatory plan was developed to guide the permit application process.

Results Offer Insights for Planning CSSP Projects

The site assessment led to selection of two sites for in-depth consideration—one located in central New Mexico inside the Albuquerque-Santa Fe load center, and the other located in southwestern New Mexico where the solar resource is best.

Parabolic trough was identified as the best solar technology, based on the combination of large-scale, commercial operating experience, low cost of energy relative to other solar technology options, and operating flexibility through thermal storage or hybridization. Parabolic trough was recommended for this specific project based on the technical and economic feasibility of developing a 50–500 MW plant in the mid-2011 timeframe.

In terms of environmental impacts, the assessment found that, overall, most project impacts will be acceptably minor or approved with mitigation measures. The study also showed that securing financial incentives will be essential for any solar plant; in this case, incentives were identified that resulted in LCOE reductions of 30% or more.

The results of the study led to PNM's issuance of a request for proposal for renewable energy from a parabolic trough solar thermal plant providing 211,000 to 375,000 MWh/year. Response to the RFP provided valuable guidance on real costs associated with the option.

The results of this project will be beneficial to PNM and any other energy company or project developer considering a CSSP project and will serve as an example for the industry. The cost data for a range of technology options and design configurations can be used in planning and siting solar plants in other locations. The plant design specified in this study would avoid over 350,000 tons of CO2 annually compared to a coal plant with similar annual output.

The detailed design cases yielded some interesting, and not necessarily intuitive results for solar thermal plants. In particular, a trough facility with dry cooling in Albuquerque doesn't perform poorly relative to a dry cooled trough in southwestern NM where the best solar resource exists. The higher ambient temperature, associated heat rejection challenges and cost of wheeling power back to PNM's load center offset the superior solar insolation. Finally, the economic and incentive analysis really helped PNM as an organization understand the effects of existing and envisioned incentives on the cost of producing solar energy for our ratepayers.

Related EPRI Work

New Mexico Central Station Solar Power: Feasibility Study. EPRI, Palo Alto, CA: 2008. 1016344.

New Mexico Central Station Solar Power: Summary Report. EPRI, Palo Alto, CA: 2008. 1016342.

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

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