Theoretical Overlay Photographic Collector Alignment Technique (TOPCAT) Development

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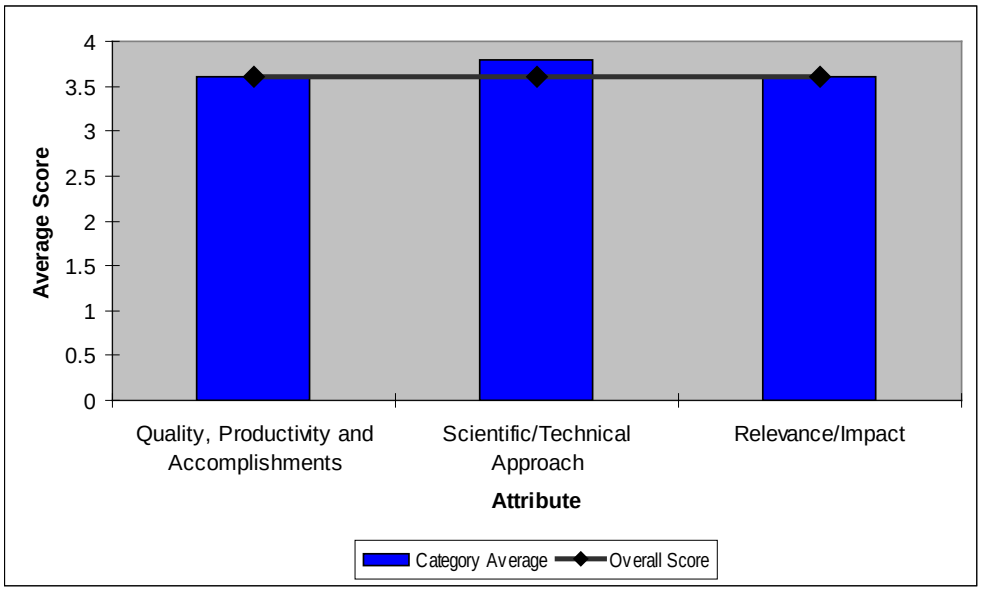

Overview of SNL's work with TOPCAT, an optical evaluation tool for parabolic trough solar collectors. TOPCAT aims to reduce the cost of parabolic trough solar power by increasing optical intercept, concentration ratios, collection efficiencies, and aperture. There is a potential for near-term licensing of the technology to trough developers and/or plant operators.

Quality, Productivity and Accomplishments (Average Rating 3.6)

Rating	Comments
4.0	The team developing this tool to assess parabolic trough overall optical quality and to calculate needed adjustment has the required expertise and technical know-how. It is doing an outstanding job.
3.8	a) The facilities engaged for development and testing of the TOPCAT technology include Sandia Lab, Saguaro, and SEGS plants, which are very appropriate and strong. Insufficient information to assess the composition and quality of the resources (people) engaged. b) Productivity seems to be high. Considerable progress has been made starting from validation of the concept at Sandia, then developing the trailer mounted prototype and testing it at the Saguaro plant, and finally initiating the second generation truck mounted system are strong and significant accomplishments. This technology not only finds the problem, but tells you how to fix it. Can do a whole loop in 1hr Payback period under 3 yrs. Reduces the LCOE by half a cent per kWh. TOPCAT value: 1/2 cent/kWh
3.0	An appropriate number of people, with well recognized technical credentials, have been engaged in this project. The members of the team and collaborators clearly demonstrate their ability to contribute to the project. The facilities deployed on the project appear to be adequate, but limited, for the task at hand. The work under way is producing an appropriate level of

	accomplishment relative to the costs incurred. The project team appears to be on schedule, but the project is clearly still in progress and not yet complete.
None	-TopCat – optical evaluation tool for parabolic trough solar collectors -Near term project, Aligns mirrors to receivers The overall objective of the Theoretical Overlay Photographic Collector Alignment Technique (TOPCAT) project is to develop an optical evaluation approach that can rapidly and effectively evaluate the alignment of mirrors in parabolic trough power plants and prescribe corrective actions as needed.

Scientific/Technical Approach (Average Rating 3.6)

Rating	Comments
4.0	The project's scientific approach is sound, practical, and effective. It is delivering outstanding and timely results.
3.5	The TOPCAT technology appears to be time consuming, requiring considerable human intervention in setting it up, data collection and processing the data. Based on a measurement time of 30 seconds per module, it will take over 41 hours to collect the data for a 30 MW plant, which is quite long. It is difficult to estimate the total time due to inadequate information on how long it takes to set up the system and process the video images after collection. Very short payback period is claimed, however, no data or cost-benefit analysis is presented to support this claim. Based on the stated objectives, the project appears to have made good accomplishments. However, if one could use more advanced technologies (e.g. laser or ultrasound, etc.) instead of video imaging and more direct method as opposed to the post processing of data and video images, the prospect of reducing time and cost would have been better.
3.0	The project team applied an appropriate technical approach in pursuit of project objectives. The design and execution of the approach are good.
3.9	-Proof of concept test -Developed two generation of field characterization -It can reduce cost by at least ½ cent -Close loop tracking -Enabling technology – working with Acciona and other companies -Improved performance to make it cheap

Relevance/Impact (Average Rating 3.8)

Rating	Comments
4.0	The development of optical characterization tools such as the one which is the main goal of this project are essential for the correct deployment of parabolic trough CSP plants.
4.0	The research is highly relevant to the needs of the CSP industry. It will significantly contribute to broader program goals and industry needs. The research addresses important technical and market barriers and the tasks being performed are likely to contribute to increasing the output and lowering the cost of CSP electricity.
3.0	* Possible 5% improvements in an existing LS plant * Payback periods on the order of three years or better – for payback on labor cost and realignment costs * Hardware and software is essentially ready for commercial application * This is an enabling technology to do 2x supertrough – gossamer space frame * Expect to be able to cut the cost of electricity by a couple of pennies

Truck mounted system.
3- to 35 seconds per module data acquisition time
Takes about 1 hour to transform to from road position to survey position, layover to get beneath 6 ft headers
Probably characterize a 30 mw plant in a week or two

How do you feed these field adjustments back into the fundamental design of the troughs for the next generation?

4.0 Future:
Quantify improvements with calorimetric techniques
Cost effective – payback 3 year or less
Enabling technology for higher concentration ratio trough
Need training , develop processes, QA
Number of errors in the plant
Each module in about 20 seconds
30 MW alignment is about $200,000

Overall (Average Rating 3.6)

Rating	Comments
4.0	This is a project with a very clear and practical objective, which is being developed timely and effectively, and that has the potential to substantially contribute to the appropriate deployment of CPS parabolic trough plants.
3.3	Lessons learned: Dealing with the plant site specific issues (e.g. rules, procedures, trades, processes, etc.)' handling the "site errors".
3.0	Needs to be better integrated with other optical tools and technologies, as part of a comprehensive suite. Concerns about labor intensive nature shared among the technologies. TOPCAT – optical evaluation tool for parabolic troughs This tools tells you how to fix it vs characterize the performance; think we can double the concentration ratio of parabolic trough design. Multi-camera on a vertical pole. NIKON d70 camera TOPHAT – heliostats TOPDAT - Dishes
3.9	The optical evaluation tool for parabolic trough solar collectors – TOPCAT – has helped in reducing the cost of parabolic trough solar power by increasing optical intercept of existing trough plants, increasing aperture with same receiver size of new plants, and increasing concentration ratios/collection efficiencies & economies of scale. TOPCAT helps to find and correct problems - however, it still needs appreciable amount of labor, and should have more built in automation.