

A REBUTTAL OF THE NATIONAL RESEARCH COUNCIL'S REVIEW OF THE U.S. DOE CONCENTRATING SOLAR POWER PROGRAM

Executive Summary¹ June 2000

from the

U.S. Concentrating Solar Power Industry Review Panel

INTRODUCTION

In April 2000, the National Research Council (NRC) issued a report "Renewable Power Pathways", which presented the results of their programmatic review of the U.S. Department of Energy's Office of Power Technologies (OPT) and its R&D programs. It has become apparent that this report has become a serious threat not only to the DOE CSP Program but also to the very viability of the concentrating solar technologies. Therefore, the Concentrating Solar Power (CSP) Industry Panel ("Panel") was formed to provide a fair balance to this damaging review. The Panel considers this matter to be of the utmost importance, in that the NRC report attacks the very substance of our industrial endeavors with few substantive facts and conclusions. The CSP Industry Panel is comprised of representatives of major U.S. industrial firms in power, solar engineering and marketing technologies, such as Duke, Bechtel, SAIC and Boeing, as well as key experts from solar plant operating companies, national lab staff, and technology developers.

The CSP industry takes strong exception to elements of that report regarding the status and commercial viability of CSP technology. We assert that the NRC Review Committee conclusions are based on inconsistent analysis and misconstrued data, as well as oversight of critical input and current market circumstances. The experienced and knowledgeable view of the Panel is significantly different than that of the NRC report.

We further assert that:

- **There is a strong U.S. industry interest in CSP technologies.**
- **There is a U.S. market today for trough technology**
- **There is an overseas market today for trough and tower technologies.**
- **CSP is by far the cheapest current source of solar electricity**
- **Further improvements in performance and reductions in cost will come from additional CSP power plants and supporting R&D.**

It is very important to our industrial and environmental goals and to the interests of the U.S. taxpayer that the DOE CSP Program support the U.S. CSP industry's interests. Lack of program support will send a damaging message to our potential customers, and undermines the considerable

¹ Full rebuttal report available on request. Contact Mr. John Myles, Duke Solar, (919) 776-2000.

investment and advances of this important technology **at a most critical time of its development.** A reduction or elimination of the CSP Program at DOE will undermine the U.S. industry's efforts to raise private capital for the U.S. and overseas markets. The CSP industry is moving forward, and there is no logic in the loss of meaningful DOE support to recognize CSP as a vital part of the renewable energy portfolio. It is clearly worthy of the same incentives and support as other renewable electric technologies. Lack of recognition and support at this critical time is viewed by the Panel as a strategic mistake, and counter to both our goals and those of DOE program. With such support, **the CSP industry itself will develop its market and continue to drive the technology and system costs down.** For several reasons, **now** is the most opportune and critical time in the last 10 years to advance the commercial deployment of the CSP technology.

INDUSTRY CONCERNS

**A FLAWED ANALYSIS SHOULD NOT BE A BASIS FOR EITHER JUDGEMENTS
ON TECHNOLOGY WORTHINESS OR BUDGET REDUCTIONS.**

The CSP Industry Review Panel noted serious inconsistencies in the treatment of CSP relative to the other renewable energy power-generation technologies. We found that many of the favorable findings and recommendations made for other renewable energy technologies are just as applicable to CSP technologies. In addition, a careful review of the entire report raised questions about the process used by the NRC review committee to arrive at a consensus. It is our considered opinion that the NRC treatment of CSP is inconsistent, inaccurate and reaches unjustified conclusions.

More specifically, it is apparent that the NRC did not contact key members of the CSP industry and other well-qualified CSP experts, did not take into account credible relevant studies done by organizations in the U.S. and abroad, and did not arrive at a true consensus.

The CSP Industry Review Panel is well qualified to rebut the NRC evaluation and comment on this technology. Collectively the Panel represents major U.S. energy companies with markets around the world. Members have operated CSP power plants successfully for over a decade, have conducted R&D and field testing for decades, and have considerable private investment at stake. Collectively Panel members have decades of research and development experience in solar troughs, power towers and dish technologies. From our industry perspective we see things quite differently than the NRC Review Committee.

THE MERITS

We believe that the CSP technologies are a vital component of the U.S. renewable energy technology portfolio. Critical merits include:

- **CSP capabilities are well proven with 354 MW in operation for 10 years, with excellent performance and availability, and documented cost reductions by a factor of 3. In addition all of these plants continue to operate today, a feat that no other renewable technology has achieved.**
- **At present, trough and tower technologies are the only viable solar technologies for large-scale projects.**
- **Dispatchable power via thermal storage or hybrid operation can meet peaking and intermediate loads. Therefore, unlike most renewables, CSP can provide power**

whenever it is needed – not only at the moment that the sun or wind resource is available.

- **This ability of CSP plants to meet peak demand – the most valuable electricity in the U.S. market – makes them attractive to power marketers**

MARKET OPPORTUNITIES

United States: The NRC report clearly misrepresents the domestic power market. Given the power sector restructuring that has been occurring over the last 10 years, very few power plants of any kind (fossil or renewable) have been built. To fault CSP for a lack of market penetration during this period is unreasonable. While well aware of the potential impacts of the restructuring of the power-generation industry, the report seems to ignore the importance of recent changes in the energy market that affect CSP technologies.

Now that the market is stabilizing we are beginning to see a resurgent customer-driven interest in renewables. Wind, a technology that currently has larger cost subsidies available than solar, is just now beginning to make significant penetration in the market. The CSP circumstance would be greatly improved with similar subsidies in view of current opportunities.

The rapidly changing Renewable Portfolio Standards situation at the state level will open new opportunities for CSP, especially if a portion is designated for solar - as they are in Arizona, California and soon Nevada. CSP technologies will target half of this 100 MW market over the next 5 years. A similar portfolio standard for wind has resulted in thousands of Megawatts for installation in Texas and Minnesota.

Duke Solar is a major player in a consortium of major energy companies working to build one or more large CSP plants in the Southwest, blended with wind, biomass, and/or geothermal. Such a hybrid system has very large market potential because a relatively small addition of a solar CSP component to a natural gas power plant yields large benefits in premium time of day supply for a small overall increase in generation cost.

Integration of CSP solar technologies with power cycle technologies developed for geothermal resources will allow smaller modular CSP thermal plants (approximately 1-10 MW capacity) to be deployed cost effectively for distributed and remote power applications. Many of the industrial players in the geothermal industry are moving forward on the development of modular CSP systems (ORMAT, Exergy, Bib & Associates, and Barber Nichols). The CSP dish program also continues to move forward aggressively developing even smaller kW-scale engine systems for distributed applications.

Continued movement towards market-based electricity prices and continued reduction in cost of CSP power creates an attractive market outlook for U.S. CSP industry. Polls of U.S. electricity customers have indicated a strong preference for renewable power. In the dozens of studies conducted for more than a decade, solar is always the preferred form of renewable power, and the public indicates a willingness to pay more for solar power than any other conventional or renewable power source. **CSP technology provides the lowest cost solar power generation option. This in and of itself qualifies CSP for maximum support, not the minimum accorded by the NRC report.**

International: The overseas market for CSP is absolutely essential, desirable and a dynamic catalyst for the U.S. CSP industry. The NRC position, downplaying this critical market, is totally inconsistent with current global market activity. We cite two examples to emphasize the crucial significance of this market:

First, the Global Environmental Facility (GEF) and the World Bank have committed \$200 million to four CSP plants in Egypt, Mexico, Morocco and India and is currently considering subsidizing additional CSP plants, e.g., in Brazil, South Africa and China. **This commitment is a dramatic endorsement of the CSP technology. From the GEF perspective, CSP is the leading renewable technology to achieve significant carbon emissions abatement on a global scale.**

U.S. companies have been involved in all four of these projects to date. In a May 2000 pre-qualification of bidders for the upcoming Egyptian RFP five major U.S. companies have applied and are confident of approval.

FURTHERMORE, IN DIRECT CONFLICT WITH THE NRC REPORT, A KNOWLEDGEABLE INDEPENDENT EVALUATOR AND WB/GEF PANEL ASSESSED IN 1999 THE POTENTIAL FOR CSP TO REACH ITS COST GOALS IN A FUTURE COMMERCIAL MARKET, AND CONCLUDED THAT THE \$200M GEF COMMITMENT TO CSP TECHNOLOGY WAS WELL FOUNDED².

Second, Spain's recent Royal Decree may open significant CSP markets in that country. The official objective for the year 2005 is for a minimum of five CSP plants for a total installed power of 200 MW. Investment subsidies of up to \$300M are projected for CSP in the same period.

Considering both the U.S. and foreign activity, the CSP Industry Review Panel concludes that today's market prospects for CSP technologies are exciting, worthy of substantial private investments, and critically important to the industry and the investment to date by the U.S. taxpayer

PRIVATE SECTOR INTEREST IN CSP DEPLOYMENT AND DEVELOPMENT

In contrast to the NRC conclusion that the industry support for CSP is weak, the contributors to this rebuttal – major energy companies such as Duke Solar, Bechtel, Boeing, Siemens, Sargent & Lundy, ABB, El Paso Electric, ASE and SAIC – are fully committed to this technology. These companies have the ability to deliver major energy projects. They are able to guarantee performance, back warranties, build on fixed price contracts, and bring equity financing and arrange for debt at reasonable risk.

The CSP Industry Review Panel expects that the next 300-400 MW of solar fields, trough or tower, will markedly reduce the technology cost, bringing electricity costs from CSP plants closer to the competitive range. Contrary to a NRC conclusion, we argue that incremental, evolutionary improvements - significant in scope - are the paths to success for CSP. There is absolutely no evidence that R&D investments will not be commensurate with the potential payoff, and in fact the opposite can be shown by myriad examples. We consider the need for R&D to support our efforts to reach competitive costs to be a valid and justified goal.

Furthermore, government incentives and government purchase of electricity from CSP plants are as

² Carpenter, Stephen, Entermodal Engineering Ltd., Cost Reduction Study for Solar Thermal Power Plants, prepared for the World Bank/Global Environment Facility, June 1999.

important for CSP technology as they are for the other renewable energy technologies. Thus, the GEF commitment to the technology in these early commercialization stages is very important. For example, most of the wind power that is currently being installed in the U.S. is a result of legislated minimum requirements rather than economic competitiveness.

The Industry has worked with the DOE CSP program to develop a joint technology roadmap for the development of trough technology. We believe this roadmap shows significant near-term and future opportunity for trough and other CSP technologies. The roadmap clearly identifies the need for both market deployment of the technologies in early niche markets (such as the GEF projects, Spain, Arizona, etc.) as well as continued R&D to enable future cost reductions necessary to enable introduction of the technology into more competitive markets. The DOE CSP R&D program is based on the trough roadmap and has helped make significant contributions to the advancement of trough technology in the last year. The roadmap has clear sequential metrics that are being met or exceeded through current programmatic activities. For example, in the last year the DOE CSP program has made significant advances in the development of thermal storage for troughs and optimization of the integration of trough technology into combined cycle plants.

It is not clear to the CSP industry how DOE is assessing the relative merits of different renewable technologies. We have seen no clear technology roadmaps for other renewable technologies that set out performance metrics to evaluate the progress of the technologies. From our perspective, as well as that of the GEF, **large scale CSP technologies clearly provide the greatest environmental benefit at the lowest cost today and are likely to remain that way for a long time into the future.** PV, for example, requires \$5000 per kW_{peak} subsidies with net metering (another form of subsidy) and still provides only half the environmental benefits of large-scale CSP plants per consumer dollar invested. This PV investment subsidy alone is 2 to 4 times higher than the full capital cost of a CSP plant. From this standpoint how does DOE justify continued investment in PV while cutting back on an already superior technology? PV deserves support, but our Panel believes that commitments to both CSP and PV are justified in their own right.

We who endorse this document have worked in the CSP field or the energy industry for the past 20 years. Our companies are leaders in the power field and our companies have collectively built hundreds of power plants, and are willing to invest significant equity in the upcoming CSP plants, an investment that dwarfs the DOE budgets we are concerned about protecting.

The CSP Industry Review Panel offers the following alternate recommendation:

The Office of Power Technologies should continue its research and development on CSP because further refinements are at hand and guaranteed to achieve significant cost reductions leading to increased deployment, which will strengthen the ability of industry to capture segments of both current and future renewable markets in large blocks. The U.S. taxpayer, the DOE and industry will all benefit from this support.