DOE Solar Energy Technologies Program Peer Review

Technical Track: CSP

Project Name: Industry Support

Principal Investigator: Chuck Kutscher

Denver, Colorado

March 9-10, 2009

Objectives

- Support the development of CSP technology for central station power generation by assisting industry in the development, deployment and maintenance of CSP technology

FY08:	$312K
FY09:	$652, $843K enhanced

Contributing Staff

- Frank Burkholder –Ph.D. graduate student, heat transfer and optics (2 student research awards--ASES, ASME)
- Dr. Keith Gawlik – heat transfer and CFD expert (2006 NREL Staff Award)
- Dr. Greg Glatzmaier – chemical engineer
- Allison Gray – mechanical engineer, heat transfer, CPV, 2-axis trackers, UNLV Center for Energy Research
- Gary Jorgensen – optical and materials expert
- Cheryl Kennedy – completing Ph.D., materials expert
- Dr. Chuck Kutscher – heat transfer, solar collectors (ASES 2006 Abbot Award, 2007 NREL Chairman's Award, 2008 Governor's Renewable Energy Individual Award)
- Kathleen Stynes – Ph.D. graduate student, heat transfer, data acquisition
- Tim Wendelin – optical and collector expert (2008 NREL Staff Award)

Activities

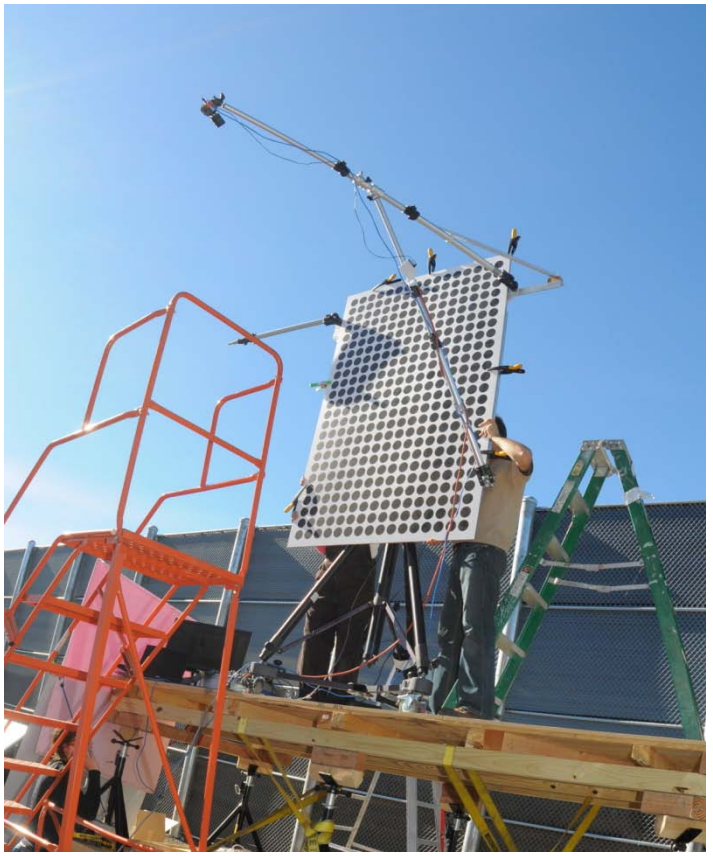
- Support Federal Opportunity Announcement (FOA) Awardees
  - Alcoa, Inc.
  - Abengoa Solar, Inc.
  - SkyFuel, Inc.
  - Solar Millennium

Activities (cont.)

- Direct Industry Support
  - VSHOT Optical Test Support
  - VSHOT Technology Transfer
  - Receiver Thermal Loss Testing
  - Solar Trough Performance Evaluation
  - Abrasion Resistant Coating for Solar Films

Direct Industry Support

- VSHOT Optical Test Support
  - Abengoa Solar
  - SkyFuel, Inc.
  - Guardian
  - Glasstech
  - Stirling Energy Systems

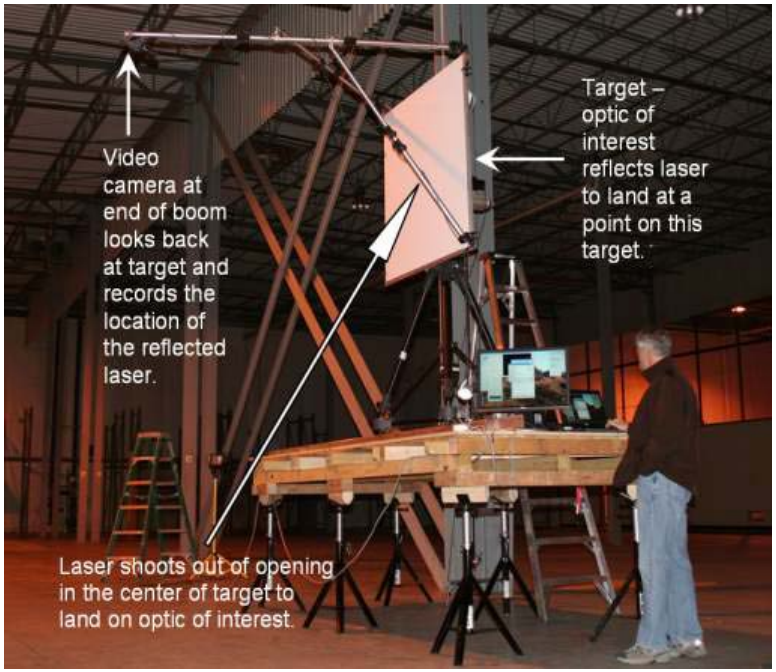


VSHOT Test Support

- Abengoa Solar
  - Background/Objectives
    - Assist in developing near-term cost-effective trough module through VSHOT testing
    - Assist in developing longer-term large scale power design based on IST approach
    - Transfer VSHOT technology to Abengoa
  - FY08 Results
    - VSHOT tested first prototype from initial assembly jig in Spain
    - VSHOT tests of Abengoa advanced design prototypes
    - Transfer VSHOT capability to Abengoa
  - Future Work
    - Validate VSHOT system through side-by-side testing
    - Provide SolTrace support for modeling VSHOT data

VSHOT Test Support

- SkyFuel, Inc.
  - Background/Objectives
    - Assist in developing near-term cost-effective trough module through VSHOT testing
  - FY08 Results
    - Number of prototypes tested with VSHOT
    - Last iteration yielded excellent optical performance
  - Future work
    - Continue VSHOT testing support



VSHOT Test Support

- Guardian Glass
  - Background/Objectives
    - Assist in development of mirror technology for trough industry
  - FY08 Results
    - Number of prototypes tested with VSHOT
    - Continued improvement of mirror quality noted
  - Future Work
    - Continue VSHOT testing support as requested

VSHOT Test Support

- Glasstech
  - Background/Objectives
    - Assist in effort to make mirror production molding equipment
  - FY08 Results
    - Number of glass prototypes tested with VSHOT
  - Future work
    - Provide VSHOT testing as requested

VSHOT Test Support

- Stirling Energy Systems
  - Background/Objectives
    - Assist in deployment of dish technology
  - FY08 Results
    - Number of mirror concepts tested with VSHOT
    - Excellent mirror quality noted
  - Future Work
    - Continue VSHOT testing support as requested

VSHOT Technology Transfer

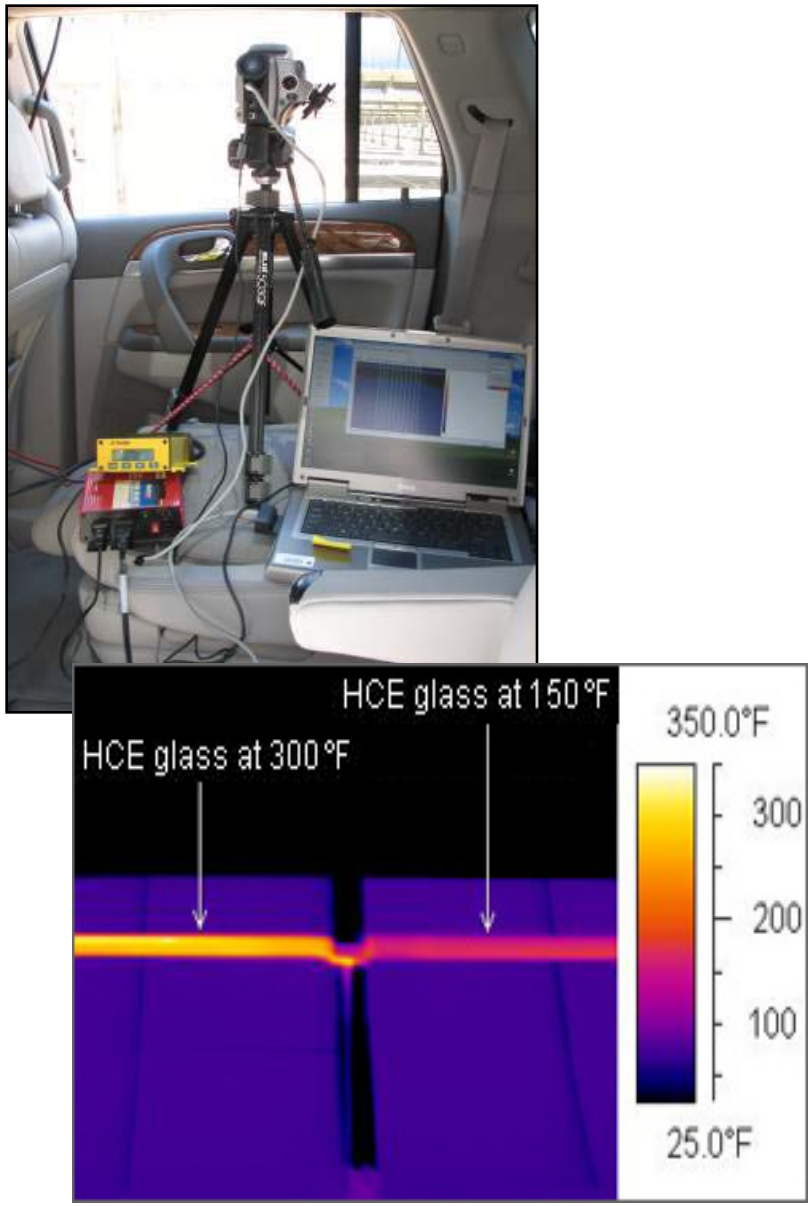
- Solar Systems CRADA
  - Designed and implemented a VSHOT system for heliostat mirror QC testing
- Abengoa
  - Initiated the process in FY08
  - Future work
    - Complete design and implementation of VSHOT for Abengoa
    - Side-by-side validation tests with NREL system

Receiver Thermal Loss Testing

- Background/Objectives
  - Isolate and measure receiver thermal losses at temperature in lab
- FY08 Results
  - Solel UVAC3 tested and report published
- Reports, Papers, Presentations
  - Report NREL/TP-550-42394, “Heat Loss Testing of Solel’s UVAC3 Parabolic Trough Receiver,” is available online at http://www.nrel.gov/docs/fy08osti/42394.pdf
- Future Work
  - Schott PTR70 and Schott/SkyFuel design to be tested

Solar Trough Performance Evaluation

- Background/Objectives
  - Evaluate trough plant performance improvements under various HCE replacement scenarios
- FY08 Results
  - HCE Temperature data collected at SEGS VIII and IX
  - Potential production increases estimated due to HCE replacement
  - Information useful to industry in understanding HCE performance over time and replacement cost/performance tradeoffs
- Future Work
  - SEGS III-VI to be evaluated in 2009



Abrasion-Resistant Coating for Solar Films

- Background/Objectives
  - SkyFuel pursuing abrasion resistant coating for solar films
  - NREL providing materials and testing expertise under CRADA
- FY08 Results
  - Number of commercial coating products evaluated with promising results
- Reports, Papers, Presentations
  - Milestone Report #1: “Summarize Literature Review, Identify Promising ARC Products and Processes, and Obtain Relevant Samples”
  - Milestone Report #2: “Prepare, in Collaboration with SkyFuel, a Test Plan for ARC Evaluation”
  - Presentation, “Status of ReflecTech Hardcoat Testing”, June 26, 2008
- Future Work
  - Complete testing of candidate samples; final report

Quality, Productivity, Accomplishments: Summary

- Strong team of solar, optical, and materials experts working with strong industry
- Milestones all met on time and within budget
- Results are of immediate benefit to industry: improved mirror design, overall optical design, total field, and receivers

Scientific/Technical Approach: Summary

- Very close collaboration with industry
- Optical testing, materials development, and analysis provided significant near-term improvement in parabolic trough collectors

Relevance/Impact of Research

- Optical mirror measurements of immediate benefit to SkyFuel, Abengoa, Guardian, etc.
- Transfer of VSHOT to industry
- Measuring and documenting receiver performance important to trough industry
- Field IR measurements of receivers and plant analysis led to significant increase in revenue for FPL Energy
- Partnered with industry to develop advanced optical materials to improve performance and lower cost of current designs