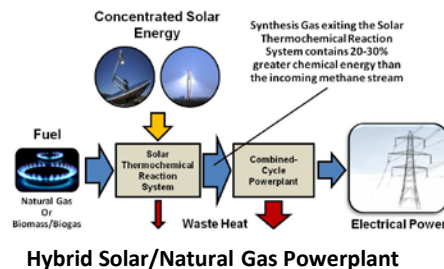


## PROJECT OBJECTIVES

**Goal:** Advance solar thermochemical reaction systems from Technology Readiness Level (TRL) 3 to TRL 6 in support of CSP electricity production at a levelized cost of electricity (LCOE) no greater than 6¢/kWh.

**Innovation:** The incorporation of highly efficiently, micro- and meso-channel process technology within the reaction system, enabling solar-to-chemical energy conversion efficiencies exceeding 60%<sup>1</sup>, perhaps as high as 74%–75%.

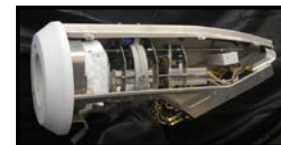
**Milestones:** This quarterly report provides information on work that was accomplished between project start (Feb 19) and the end of the quarter (March 30). No milestones were scheduled to be accomplished during this six-week period.



## APPROACH

### Approach for this three-year project:

- Improve the performance of the Solar Thermochemical Reaction System:
  - Increase solar-to-chemical energy conversion efficiency from ~63% to 74–75%
  - Increase solar thermochemical augment from about 20% to as much as 28%
- Reduce the manufactured costs for critical components (e.g., micro- and meso-channel process technology) so that the combination of performance and cost meet the overall LCOE goal of no more than 6¢/kWh



<sup>1</sup>Wegeng et.al, 2011. "Development and Demonstration of a Prototype Solar Methane Reforming System for Thermochemical Energy Storage – Including Preliminary Shakedown Testing Results," 2011 International Energy Conversion Engineering Conference, July 2011.

## KEY RESULTS AND OUTCOMES

### Progress:

Progress was made on multiple project activities, including

- Updated LCOE calculations based on preliminary estimates of system performance and manufacturing costs:
- Initial work to set up parabolic dish concentrator (from Infinia) at PNNL
- Design of replacement for high-temperature recuperative microchannel heat exchanger
- Initiation of manufacturing cost studies

### Significance of Work Performed:

- LCOE cost estimates confirm substantial "margin" (nearly ½ ¢/kWh) for Hybrid Solar/NG Power plant to achieve DOE LCOE goal of 6¢/kWh
- Setup of the Solar Concentrator Test Stand at PNNL will enable incremental advances in the performance of the solar thermochemical reaction system

**Number of Journal Articles, Patents and Major Awards:** Four conference papers on this work have been accepted and are in preparation

## NEXT MILESTONES

### Scheduled Milestone for Next Quarter:

- Solar Concentrator Test Stand Commissioning – June 14, 2013

### Additional Work during Next Quarter Includes:

- Preparation of TRL 4 Reaction System for Testing, including fabrication of high-temperature recuperative heat exchanger
- Initiation of Catalyst Durability Testing
- Develop initial baseline bottoms-up equipment cost
- Down-select manufacturing processes to include in equipment cost modeling tools

### Replacement Heat Exchanger

