

# Multi-tube Receivers for Solar Energy Collection

## Rong Xu and Theodore Wiesner, PhD PE

“Making Solar Energy Economical” is one of the Grand Challenges posed by the National Academy of Engineering. We are addressing two major problems impeding the adoption of solar energy for the production of chemical fuels and electric power. 1) The *intermittency* problem. Solar energy is only available during daytime, and fluctuates due to weather and season. 2) The solar collector field has a very high capital cost.

### Approach

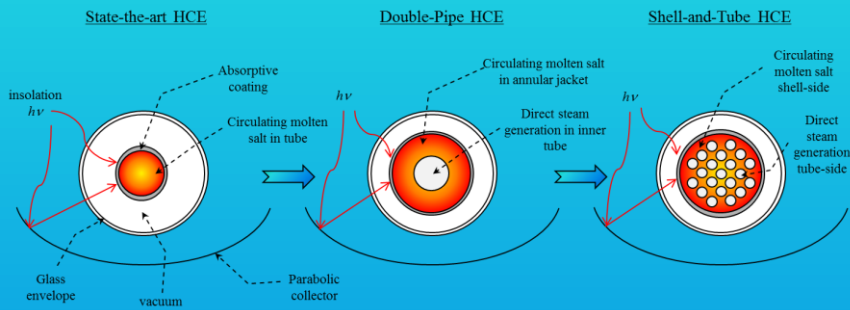
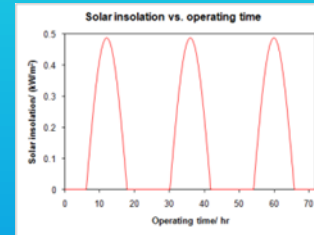


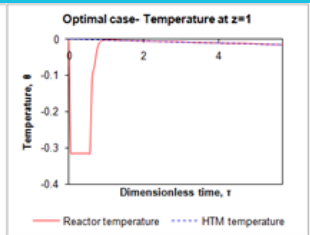
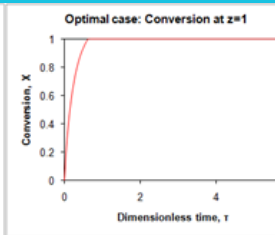
Figure 1. Proposed Advancement in Solar Receiver Technology

### Result-Solar Hydrogen Production

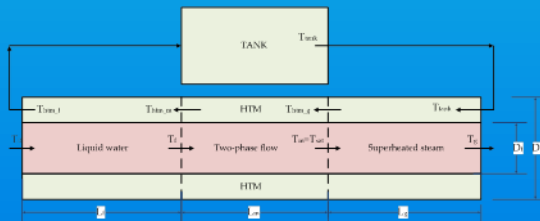
#### Variable Solar Input



#### With intermediate energy storage



### In Progress-Direct Steam Generation



Uniform circumferential heat flux of 1 MW/m².

Liquid water at 45 °C  
Shell-side: 1 pass  
30000 tubes

Superheated steam at 450 °C  
and 13 MPa

HTM at 250 °C  
(shell-side)

