

PROJECT OBJECTIVES

Goal: To investigate the engineering and economic feasibility of supplying baseload power using a concentrating solar power (CSP) plant integrated with sulfur based thermochemical heat storage

- *This is a novel concept to store solar energy in chemical bonds. The energy storage density is two orders or magnitude higher than conventional means*

Innovation: Solar heat is converted into elemental sulfur through a thermochemical cycle

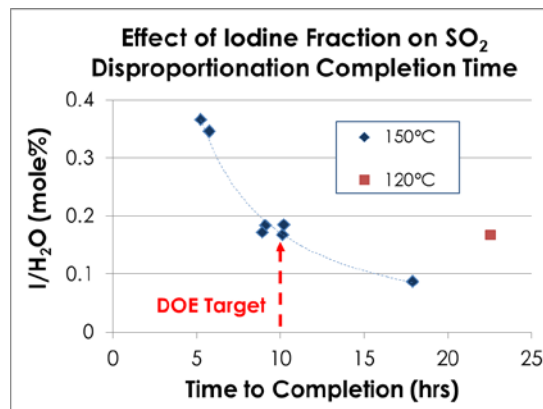
- *Energy storage is very cheap as the cost of sulfur is low*
- *The recovered heat can drive a Brayton or combined cycle*
- *Long term energy storage is possible since sulfur is stable under ambient condition*

Milestones: Complete constant SO₂ pressure test set up

APPROACH

- Conduct laboratory studies on reaction thermodynamics and kinetics of the sulfur generating disproportionation reaction. Effect of various potential catalysts and means to separate the reaction products will be investigated. A kinetic equation for process design will be defined.
- Improve the solar reactor design and catalyst performance to increase SO₃ to SO₂ conversion fraction
- Preliminary process component design and experimental validation for the three process steps. Carry out process integration design between the CSP plant, the sulfur processing and storage plant and the electricity generation unit.
- Design and flowsheet studies to assess the system economics, its environmental impact and pathways to ascertain safe operations of such an integrated plant.

KEY RESULTS AND OUTCOMES



- >10%/hr SO₂ disproportionation rate achieved
- Reaction reached >90% of equilibrium (57wt% vs. 62wt%)
- Constant pressure test set up completed
- Sulfuric acid decomp. test set up online

NEXT MILESTONES

- Complete the constant SO₂ pressure test set up and begin experiments (1/31/2013) - COMPLETED
- Define the process condition and reactor design that provides a 10%/hr disproportionation rate (4/30/2013)
- Define a kinetic equation for disproportionation process design (5/30/2013)
- Complete test set up modifications for long term catalyst testing and begin testing (1/31/2013) - COMPLETED