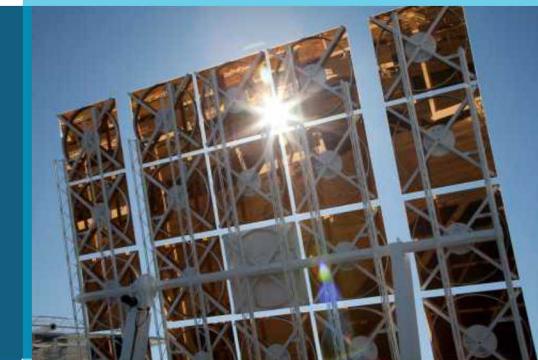
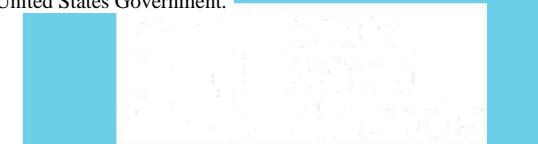


Sensible Thermal Energy Storage – High-Temperature Particles



PRESENTED BY

Clifford K. Ho

Sandia National Laboratories, Albuquerque, NM



Sandia National Laboratories is a multimission laboratory managed and operated by National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

SAND2020-1206 PE

“Sensible” Thermal Energy Storage



- Sensible (single-phase) storage
 - Use temperature difference to store heat
 - Molten salts (nitrates <600 °C; carbonates, chlorides 700 – 900 °C)
- Solids storage (sand, rocks, ceramic particles, concrete)
 - Wider temperature range (below freezing to >1000 °C)
 - Low cost (~\$0.01 - \$1 / kg)

Sensible Molten Salt Storage

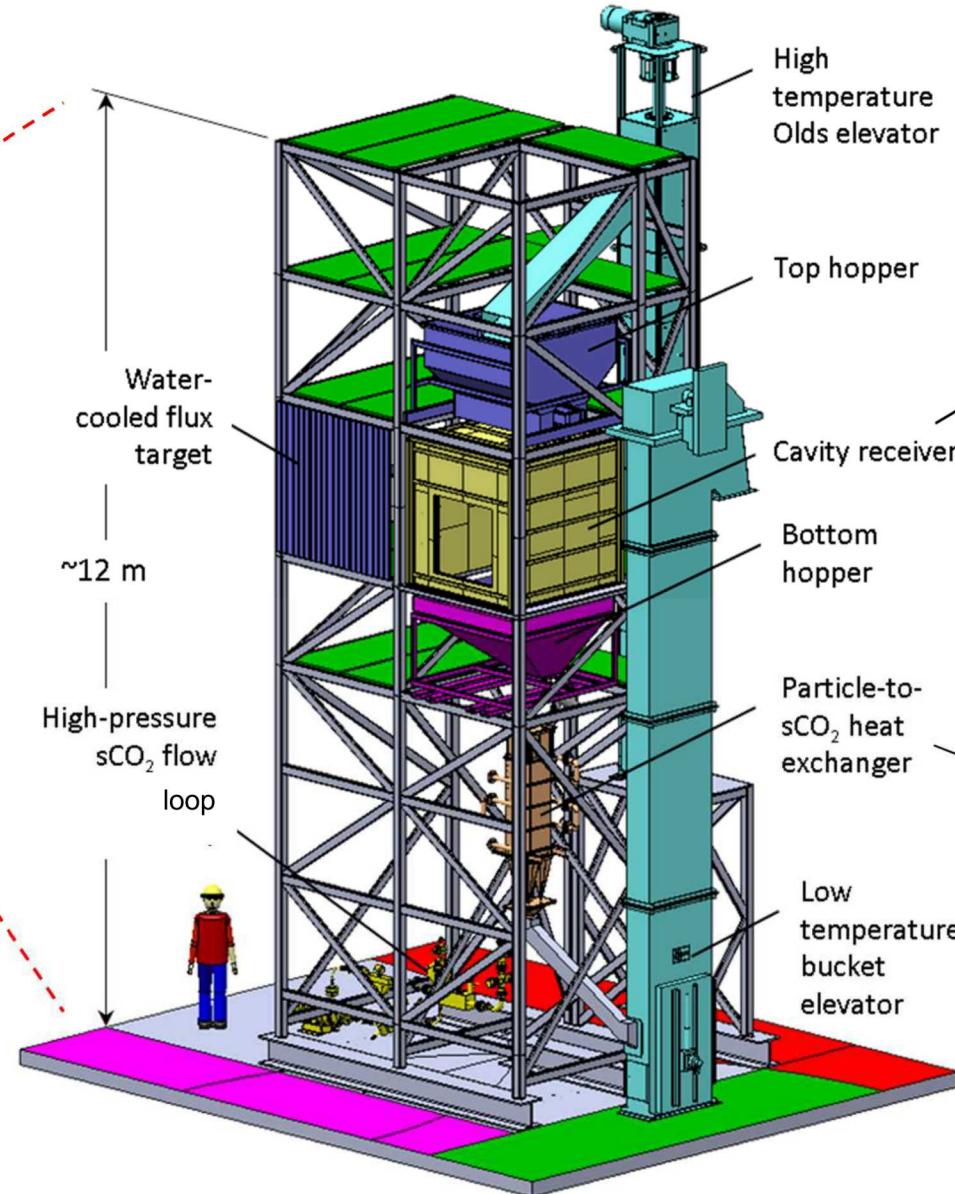
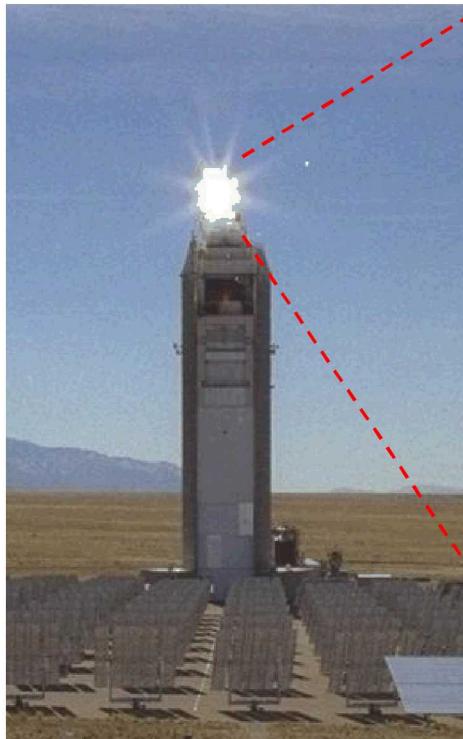


photo credit: Mary Grikas, Wiki commons, 10/9/15
Crescent Dunes CSP, Nevada
100 MW/1 GWh

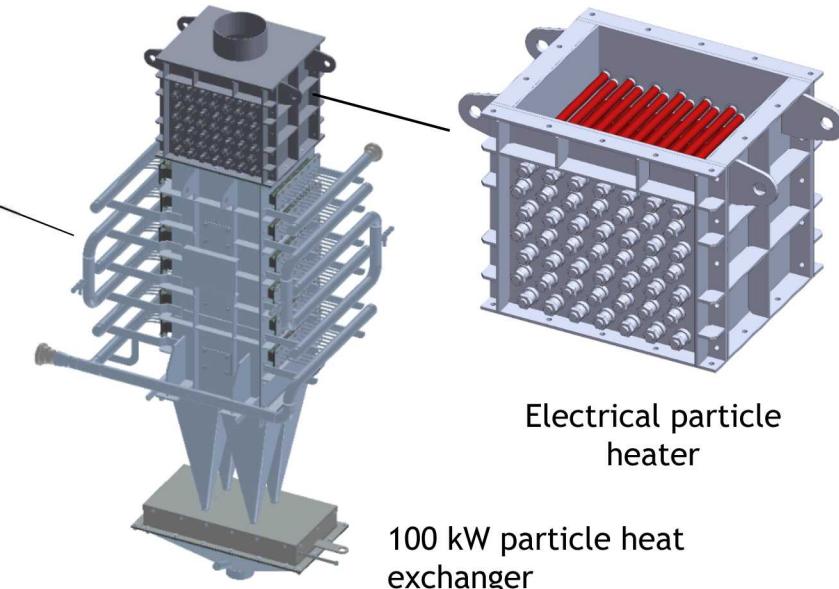


https://en.wikipedia.org/wiki/Solana_Generating_Station
Solana CSP, Arizona
280 MW/1.7 GWh

Prototype Solid Particle Thermal Storage System



Falling particles through slot aperture



Electrical particle heater

100 kW particle heat exchanger

Summary and Needs

Thermal Storage	Method/Materials	Advantages	Challenges/Needs
Sensible 	Temperature difference (e.g., molten salts, rock, sand)	<ul style="list-style-type: none"> • Mature technology • Demonstrated large capacity with concentrating solar power (~GWh) • Low cost 	<ul style="list-style-type: none"> • Achieving higher temperatures* • Heat loss • Large volumes required • Heat exchange to and from storage material

*To achieve higher thermal-to-electric conversion efficiencies

Questions?



Cliff Ho, (505) 844-2384, ckho@sandia.gov