SOLAR ENERGY
TECHNOLOGIES OFFICE
U.S. Department Of Energy

PORTFOLIO REVIEW
2018

SOLAR ENERGY TECHNOLOGIES OFFICE
U.S. Department Of Energy

2018 SETO Portfolio Review

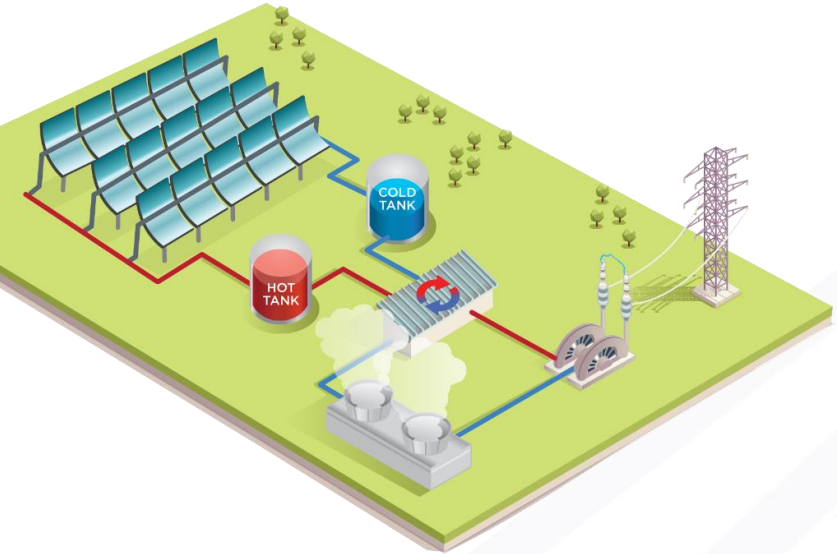
Concentrating Solar Thermal Power Subprogram

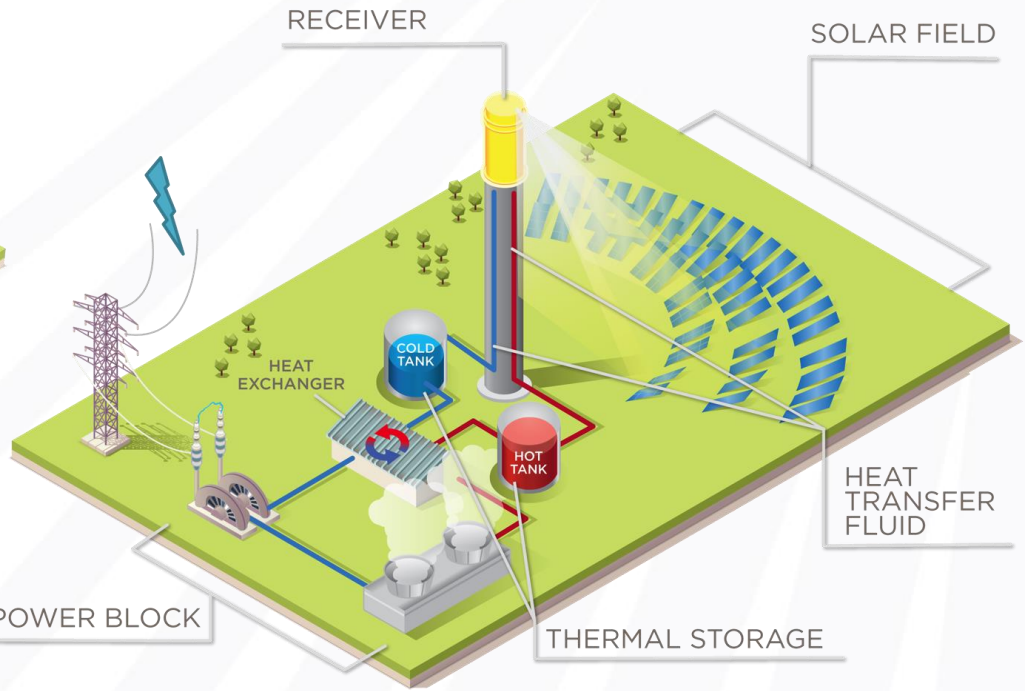
SETO Portfolio Review

February, 2018

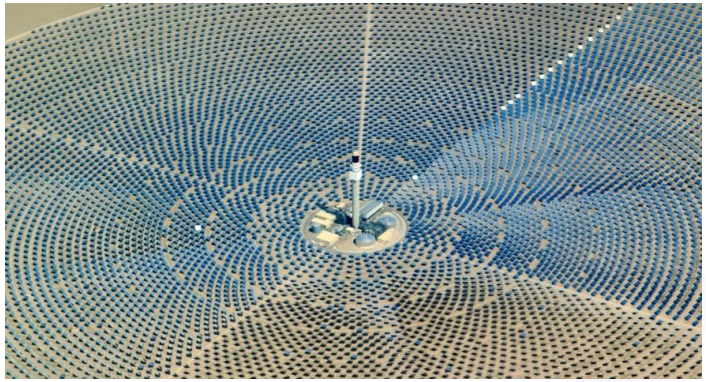
Dr. Avi Shultz, Program Manager (Acting)

CSP with Storage is Solar Energy On-Demand





CSP is Deployed Worldwide



4.8 GW CSP deployed globally

1.8 GW CSP deployed in the U.S.

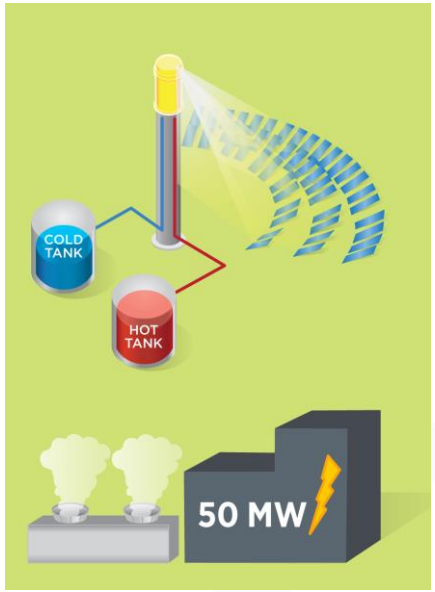
0.4 GW CSP deployed in the U.S. *with storage*

Since 2016 CSP's share of electricity generation:

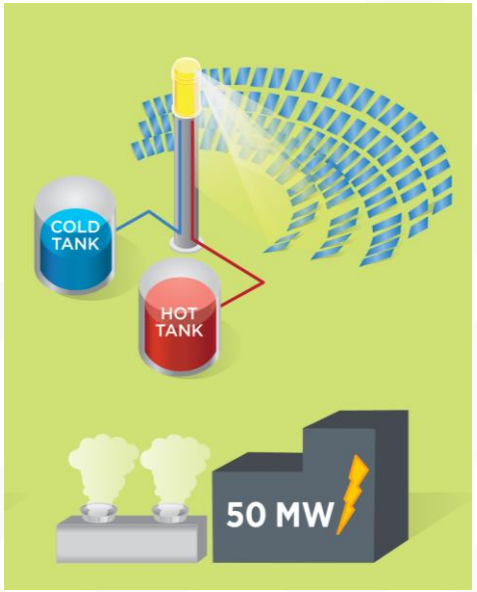
- 1% of California
- 2% of Spain

CSP: Flexible Designs for an Evolving Grid

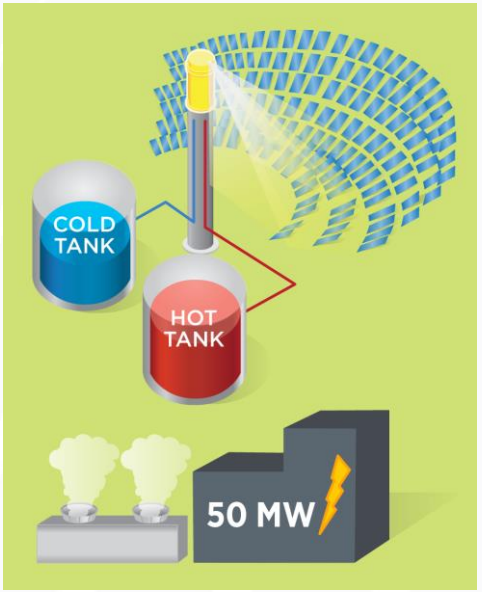
'Peaker'
(≤6 hours of storage)



'Intermediate'
(9 hours of storage)

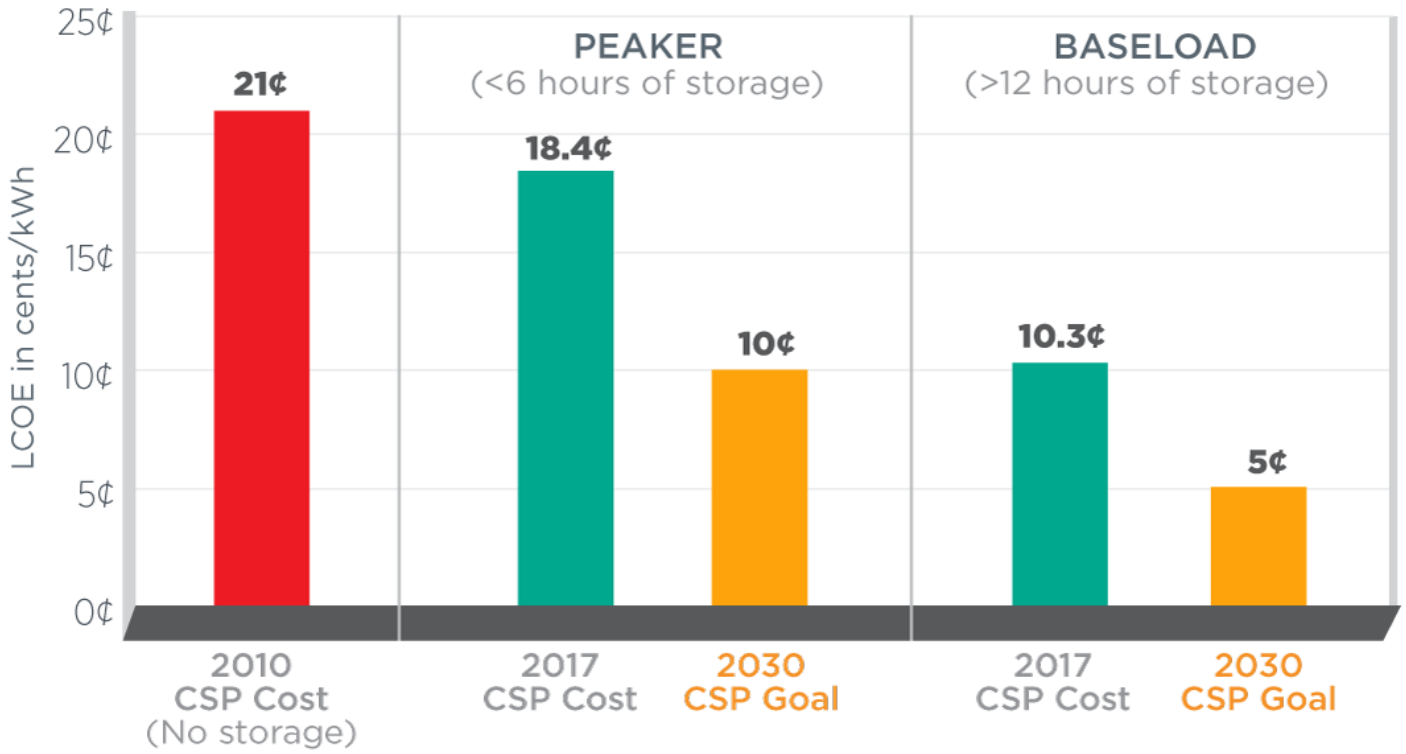


'Baseload'
(≥12 hours of storage)

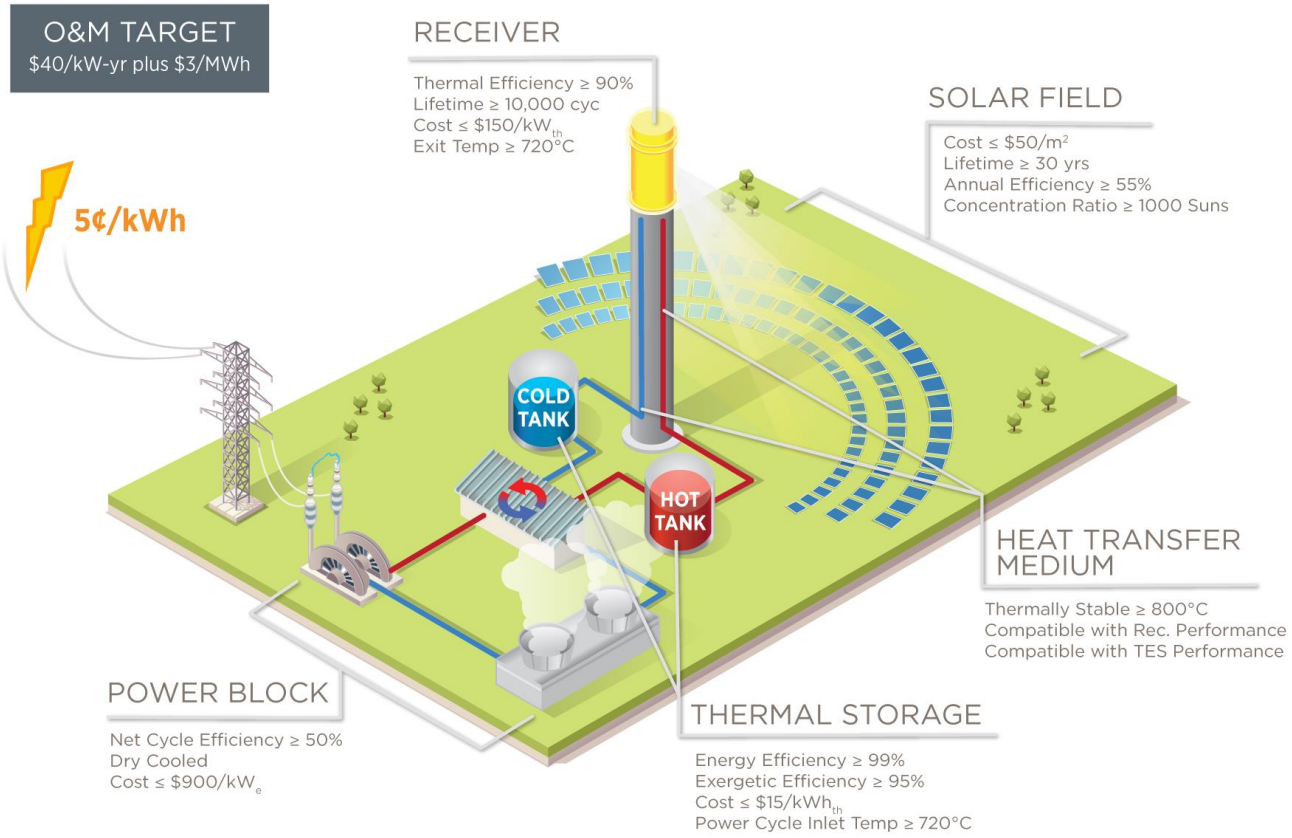


By choosing the size of the solar field and thermal energy storage, the same CSP technology can be configured to meet evolving demands of the future grid

2030 Levelized Cost of Electricity Targets



CSP Program Technical Targets



Collector Field
- Optical Physics
- Structural design and dynamics
- Manufacturing and automation
- Sensors and control

Receivers
- Optical properties
- Coatings
- High temperature materials
- Chemistry
- Heat Transfer, Fluid Mechanics

TES and HTF
- Chemistry
- High temperature materials
- Materials Science
- Heat Transfer, Fluid Mechanics

Power Block
- High temperature materials
- Turbomachinery
- Manufacturing and automation
- Sensors and control

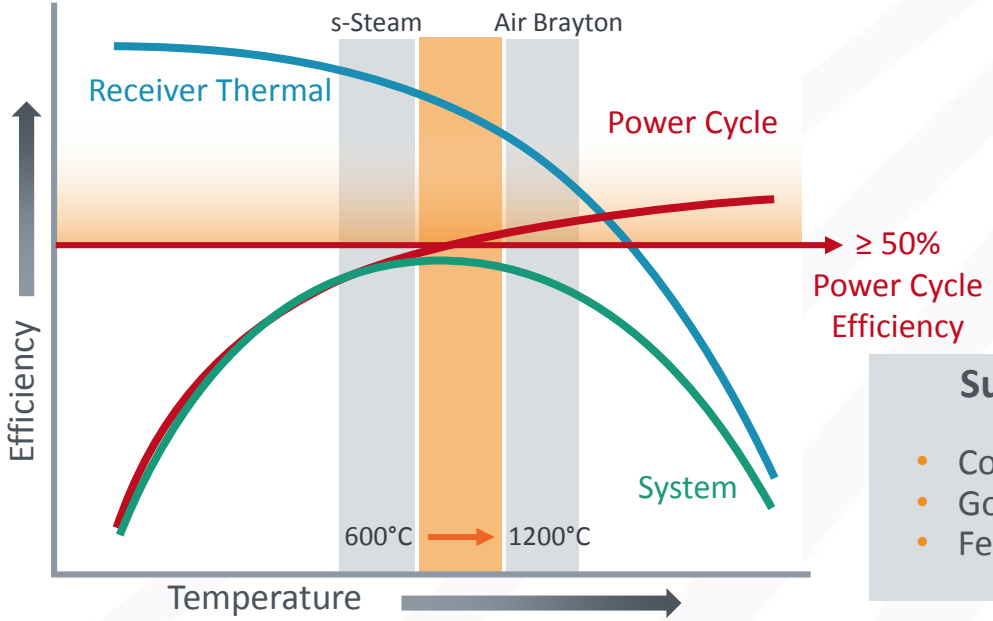
Gen3 CSP: Raising the Temperature of Solar Thermal Systems

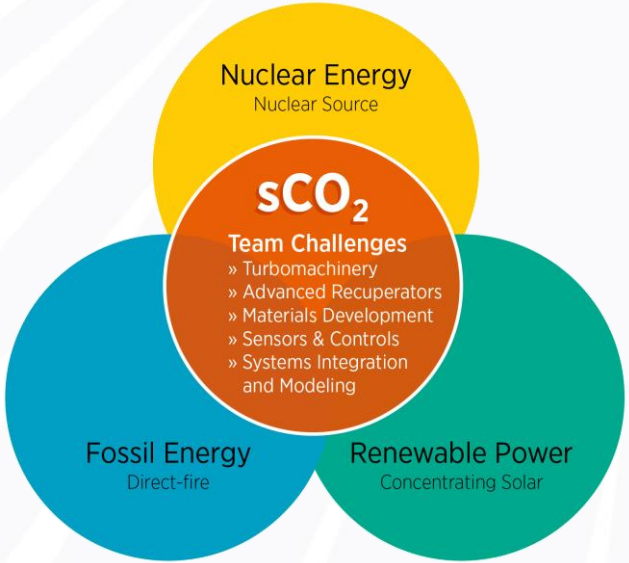
$$\eta = 1 - \frac{T_C}{T_H}$$

Thermal Pathway	Primary Challenges
Liquids	Reliable corrosion management with advanced molten salts
Solids	High-efficiency transfer of heat in and out of particles
Gas	Integrating low-density gases with cost-effective thermal energy storage

Next Generation CSP will Leverage Next Generation Power Cycles

$$\eta_{Cycle} = 1 - \frac{T_C}{T_H} \quad vs. \quad Q_{Radiative} \, \alpha \, T^4$$

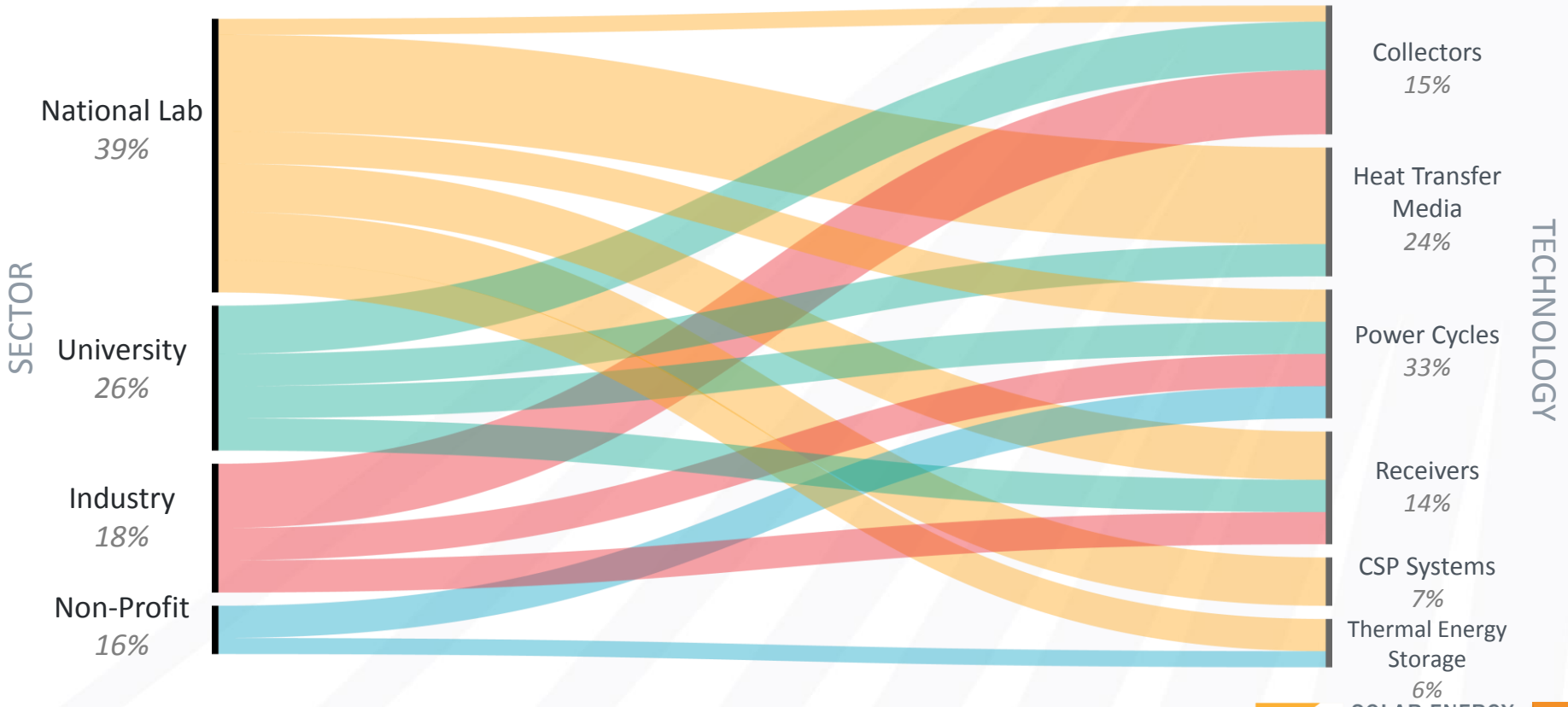




Supercritical CO_2 is a dense, compressible fluid:

- Compact turbomachinery
- Good compatibility with dry cooling
- Fewer loss mechanisms and parasitics

CSP Awardee Breakdown by Funding



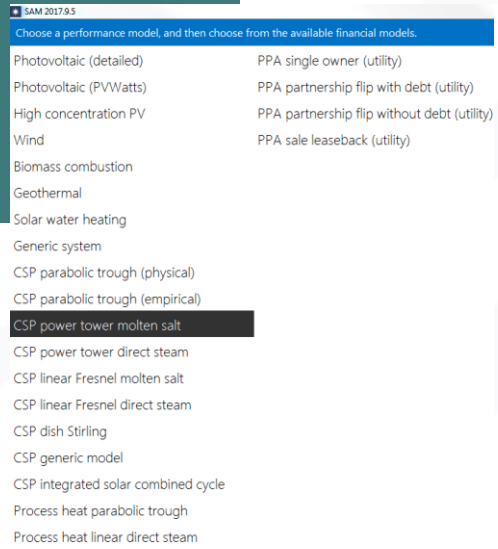
Lab Core Capabilities

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

System Advisor Model

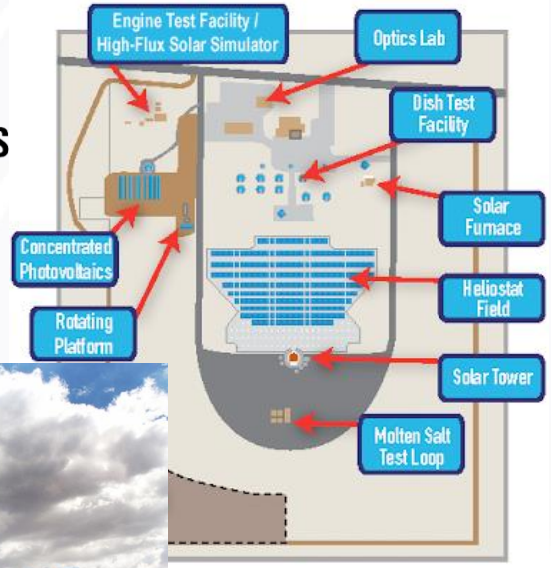
Version 2017.9.5

Starting up...please wait



National Solar Thermal Test Facility (NSTTF)

Sandia National Laboratories



energy.gov/solar-office

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SETO CSP Team

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Patty Clark, MBA, PMP
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Operations

Meisha Baylor
On contract from Red Horse

CSP Review Overview

- Monday, February 12
  - 11am – 12pm: CSP Subprogram Strategy and Vision
  - 1pm – 2pm: Tech-to-Market CSP Overview
  - 2pm – 3pm: Research Guided by Technoeconomic Analysis
- Tuesday, February 13
  - 9:30am: CSP Awardee Plenary – Hank Price, Solar Dynamics
  - 11am – 12pm: From Concept to Prototype
  - 1pm – 2pm: Designing for System and Component Interfaces
  - 2pm – 3pm: Materials Challenges and Opportunities