U.S. DEPARTMENT OF ENERGY | Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

SOLAR ENERGY TECHNOLOGIES OFFICE

Unlocking Solar Thermochemical Potential:

Leveraging CSP Experience for Solar Thermochemistry

R&D Virtual Workshop Series

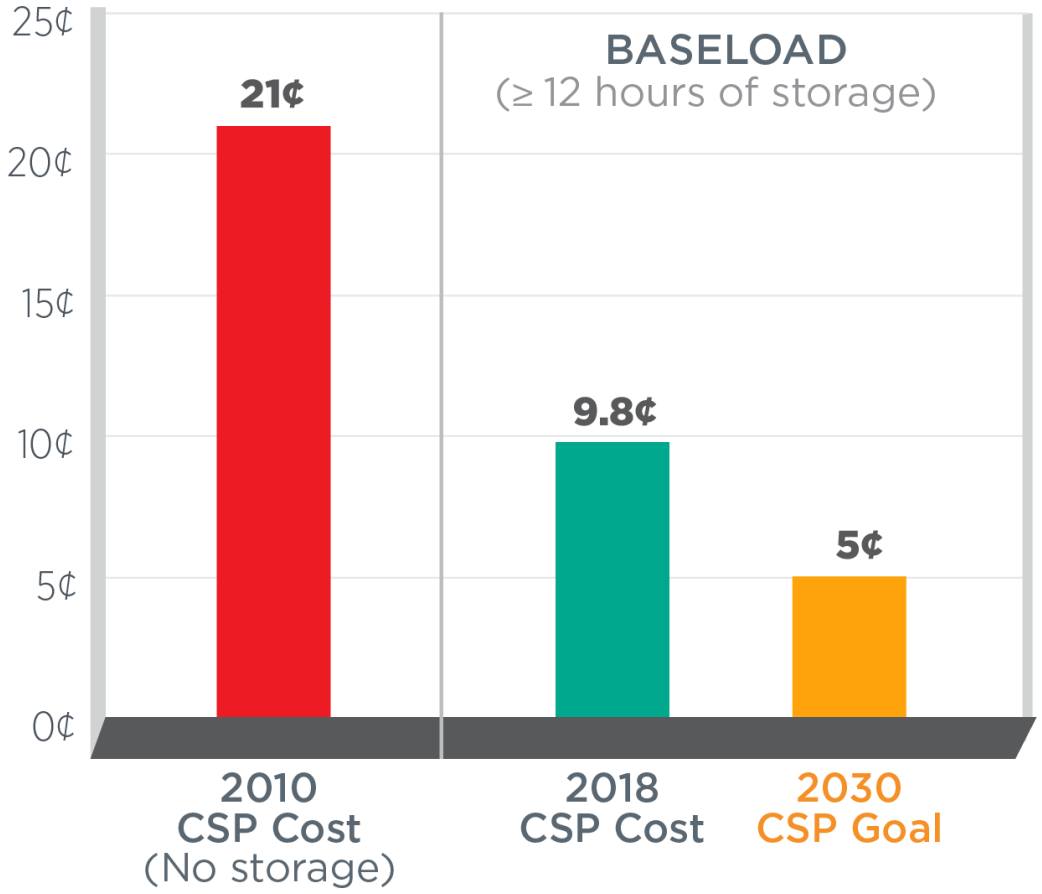
Concentrating Solar Power Program

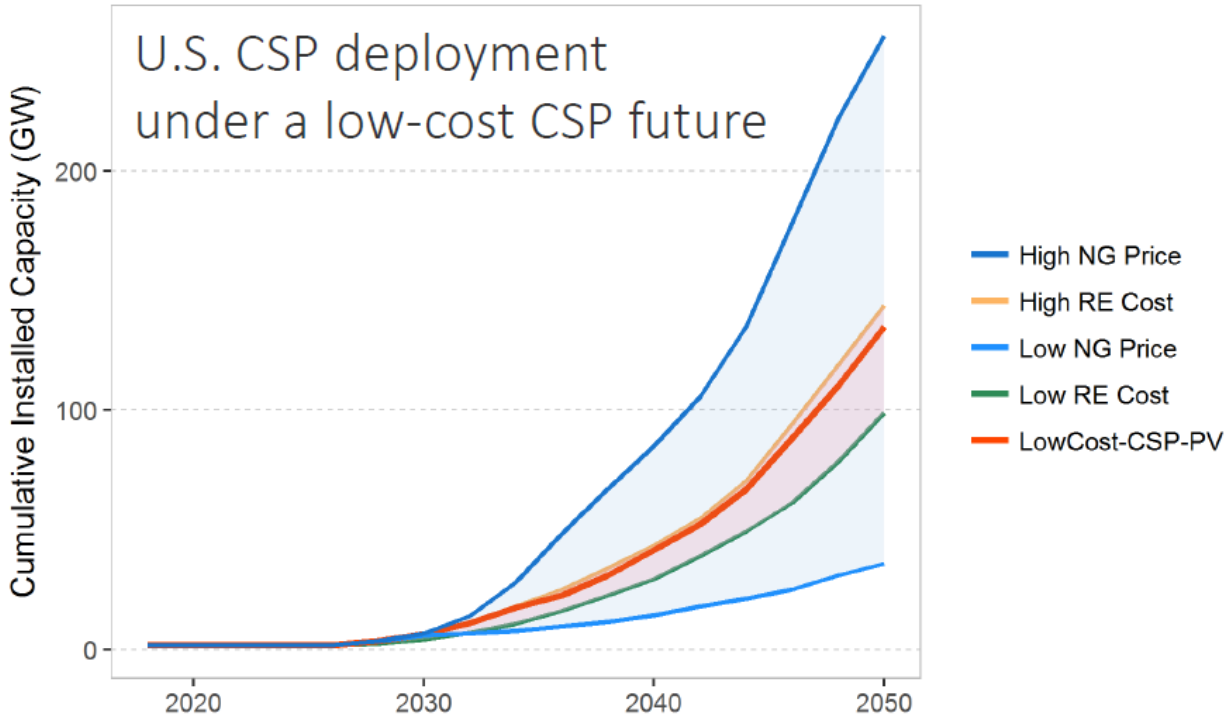
Avi Shultz, CSP Program Manager, US DOE

Levi Irwin, CSP Technology Manager, Contractor to US DOE

Levi.Irwin@ee.doe.gov

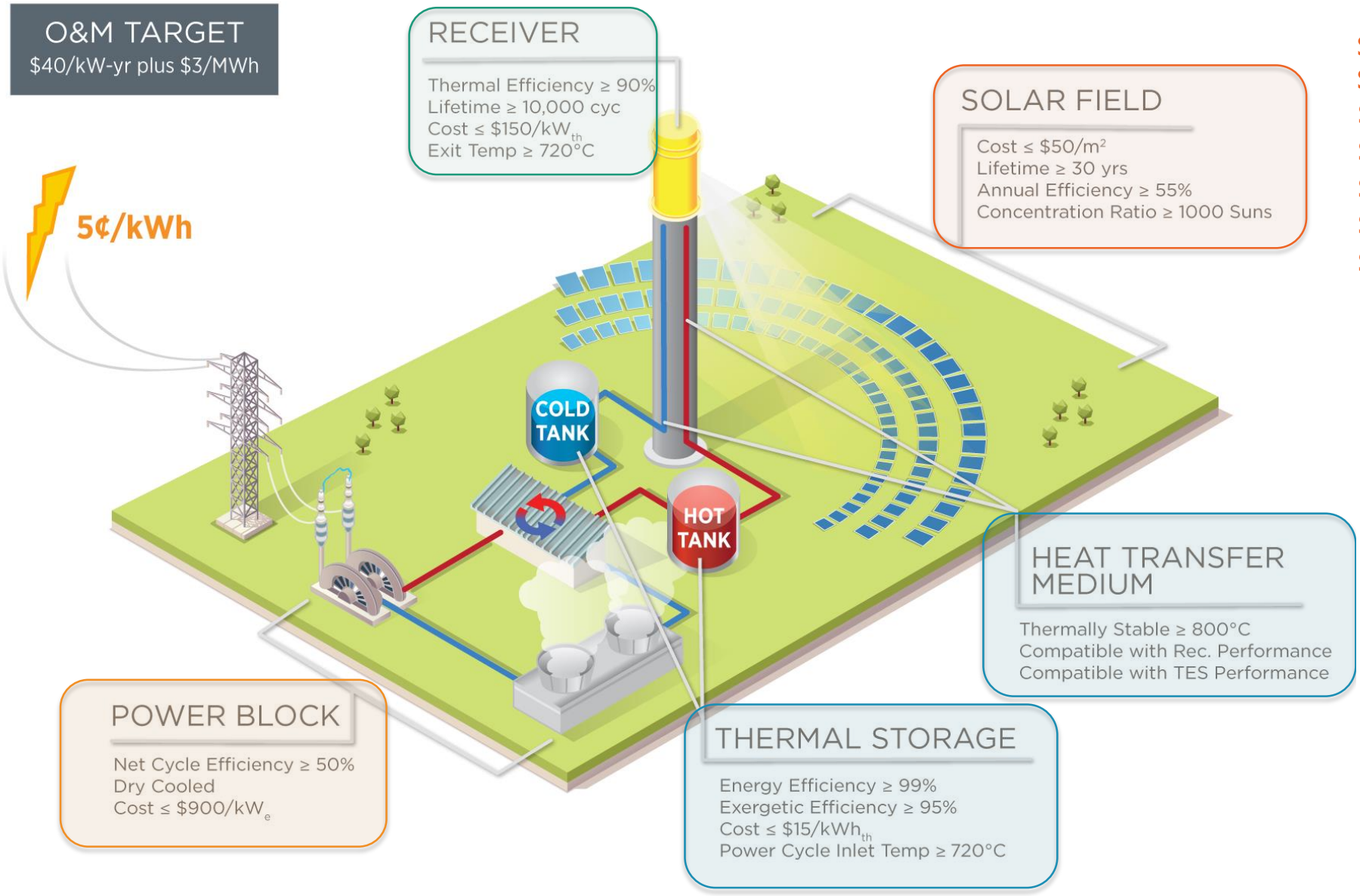
Progress and Goals: 2030 LCOE Goals





Murphy, et al. **2019**, NREL/TP-6A20-71912

CSP Technical Targets



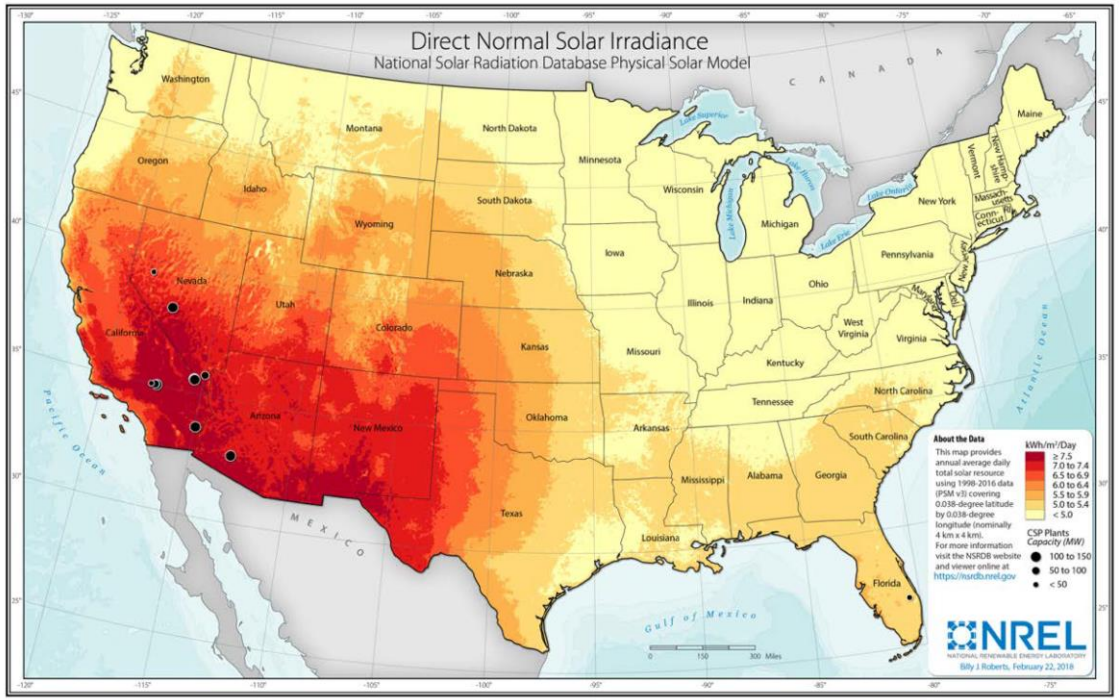
Competitive Programs

$43M	FY 2020 SETO FOA (2020)
$30M	FY 2019 SETO FOA (2019)
$22M	FY 2018 SETO FOA (2019)
$21M	Solar Desalination (2018)
$22M	FY19-21 National Lab Call (2018)
$70M	Gen3 CSP Systems (2018)
$15M	Gen3 CSP Lab Support (2018)
$9M	COLLECTS (2016)
$32M	CSP: APOLLO (2015)
$29M	CSP SuNLaMP (2015)
$1.4M	SolarMat II (2014)
$10M	CSP: ELEMENTS (2014)
$1.1M	SunShot Incubator (Recurring)
$4M	PREDICTS (2013)
$2M	SolarMat (2013)
$10M	CSP-HIBRED (2013)
$27M	National Lab R&D (2012)
$10M	SunShot MURI (2012)
$56M	CSP SunShot R&D (2012)
$0.5M	BRIDGE (2012)
$62M	CSP Baseload (2010)

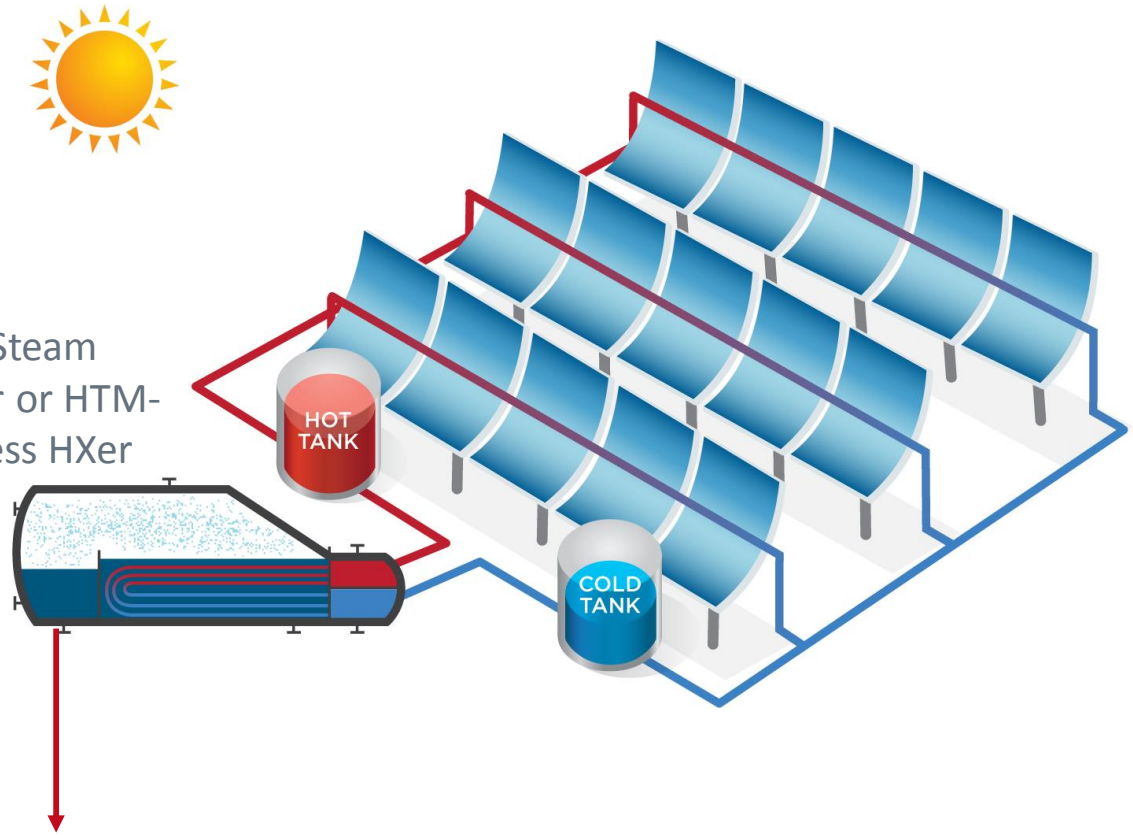
Solar Thermal Industrial Process Heat

Thermally-Driven Industrial Processes:

- Desalination
- Enhanced Oil Recovery
- Agriculture and Food Processing
- Fuel and Chemicals Production
- Mining and Metals Processing



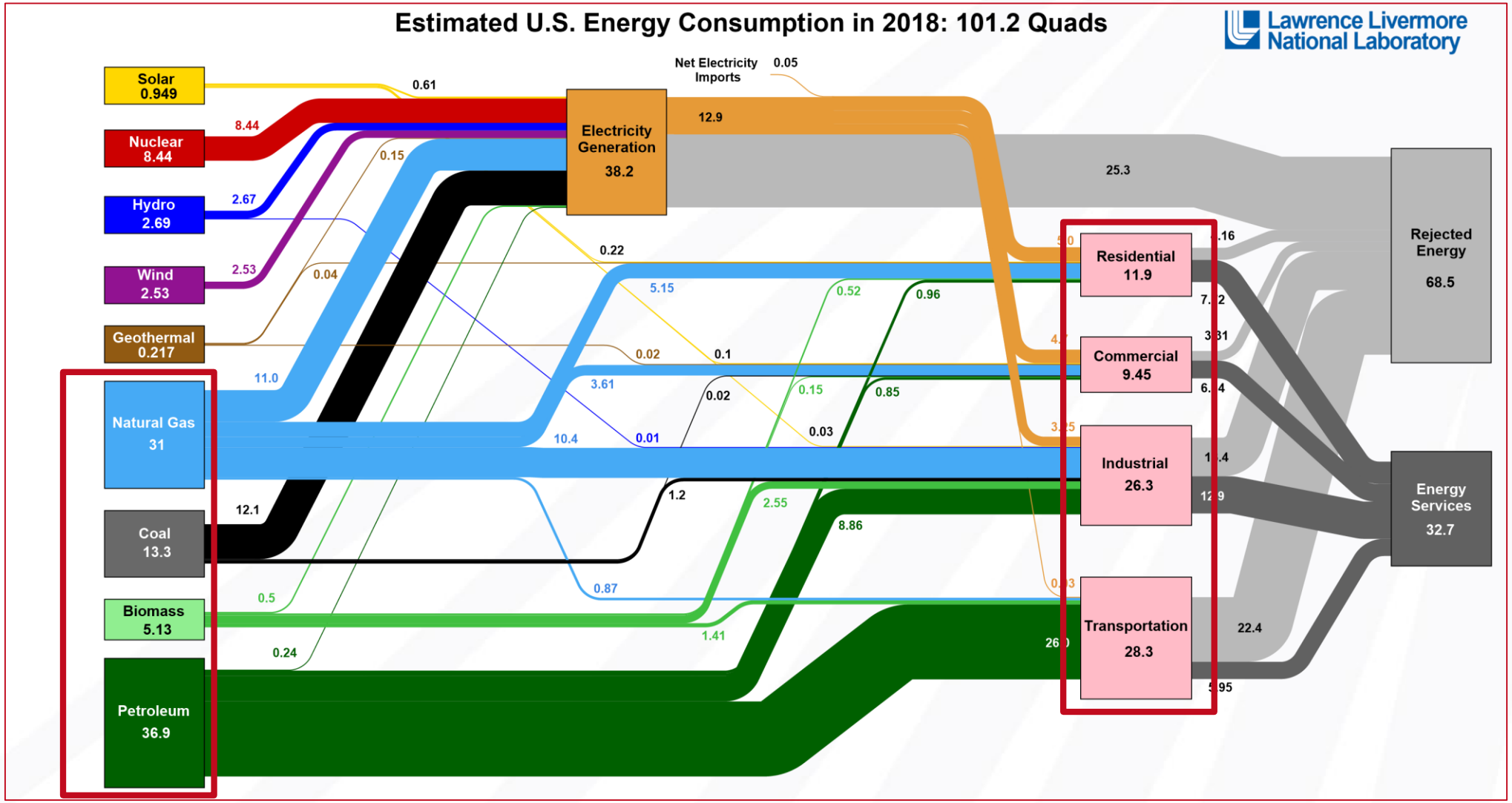
SOLAR PROCESS HEAT



Solar Steam Generator or HTM-to-Process HXer

Process Heat

Solar Thermal can Integrate with the Existing Energy System



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CSP R&D Virtual Workshop Series

UPCOMING WEBINARS:

- Unlocking Solar Thermochemical Potential: Receivers, Reactors, and Heat Exchangers
  December 3 | 11:00 a.m. to 2:00 p.m. ET
- CSP Performance and Reliability Innovations
  December 10 | 11:00 a.m. to 2:00 p.m. ET

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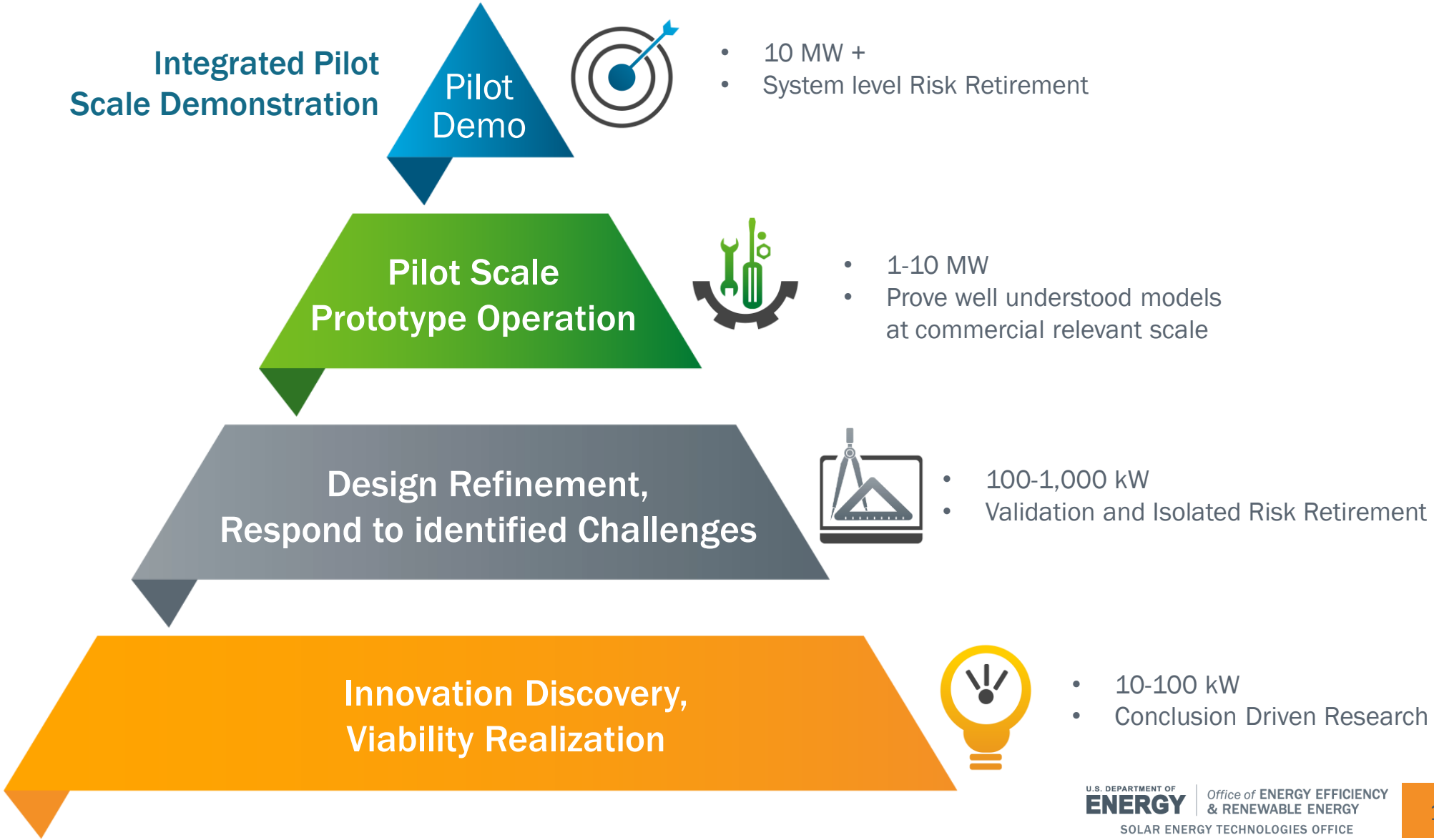
Agenda

Time	Session
11:00AM– 11:30AM	**Introduction and Workshop Overview** Avi Shultz, *DOE Program Manager, Concentrating Solar Power* **Levi Irwin**, *Technology Manager, Concentrating Solar Power*
11:30AM– 12:30PM	**Panel – Leveraging CSP Experience for Solar Thermochemistry** Christian Sattler, *DLR German Aerospace Center* James Klausner, *Michigan State University* Tim Held, *Echogen* Andrea Ambrosini, *Sandia National Laboratory*
12:30PM– 1:30PM	**Panel Discussion, Question and Answer**
1:30 PM	**Closing Remarks** Avi Shultz, *Department of Energy*

Solar Thermochemical Systems – What Are They?

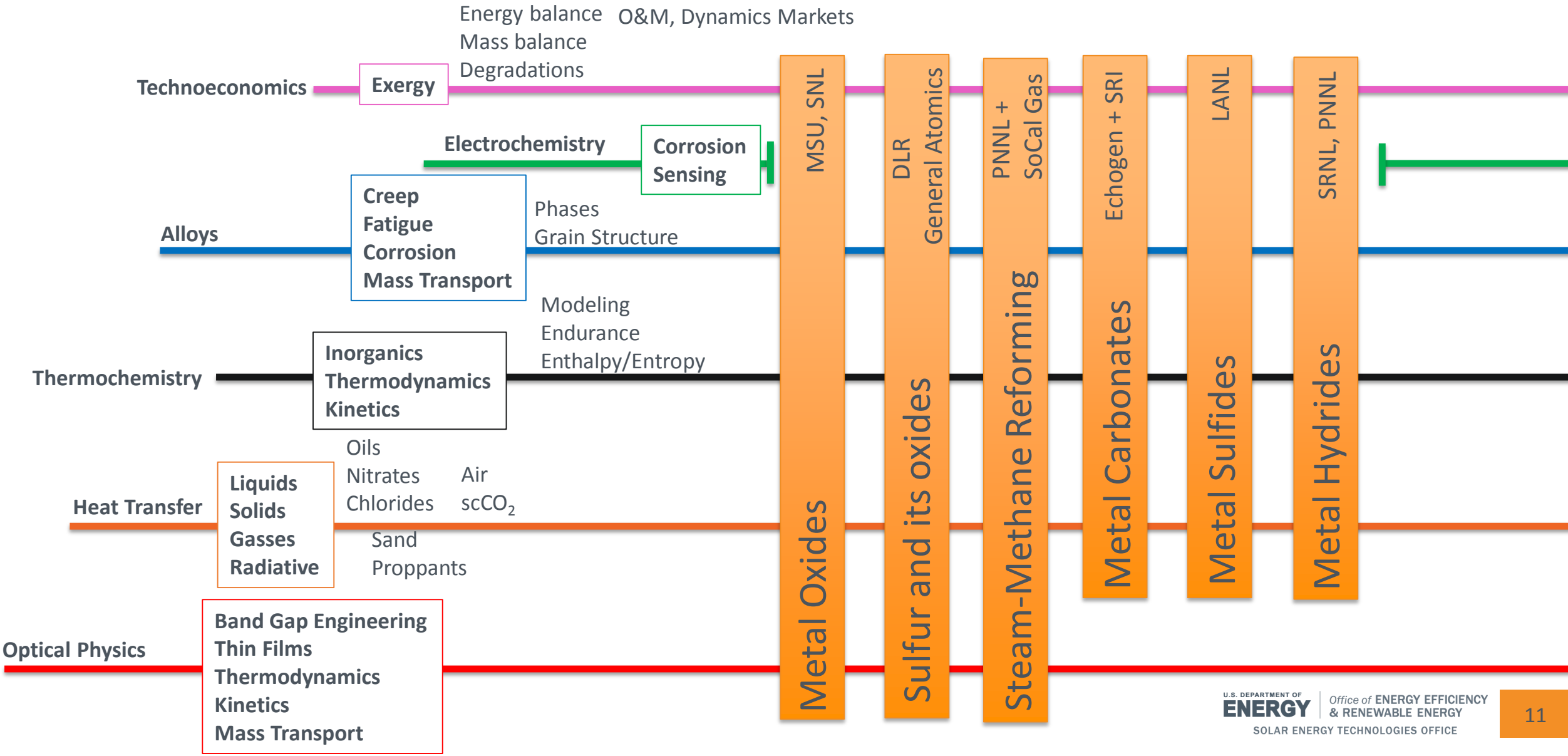
- Being a Concentrating Solar Thermal Facility and a Chemical Processing Facility
  - May or may not also produce power (electricity)
- The chemical may be stored and re-used on site or shipped off-site as a finished product
  - Includes the preparation of fuels, commodity chemicals
- Green field or brown field?
  - New infrastructure; new process
  - Append to existing infrastructure; (slight) mod to process

Thinking through Risk within Tiers of Technology Maturity



A Little Bit History

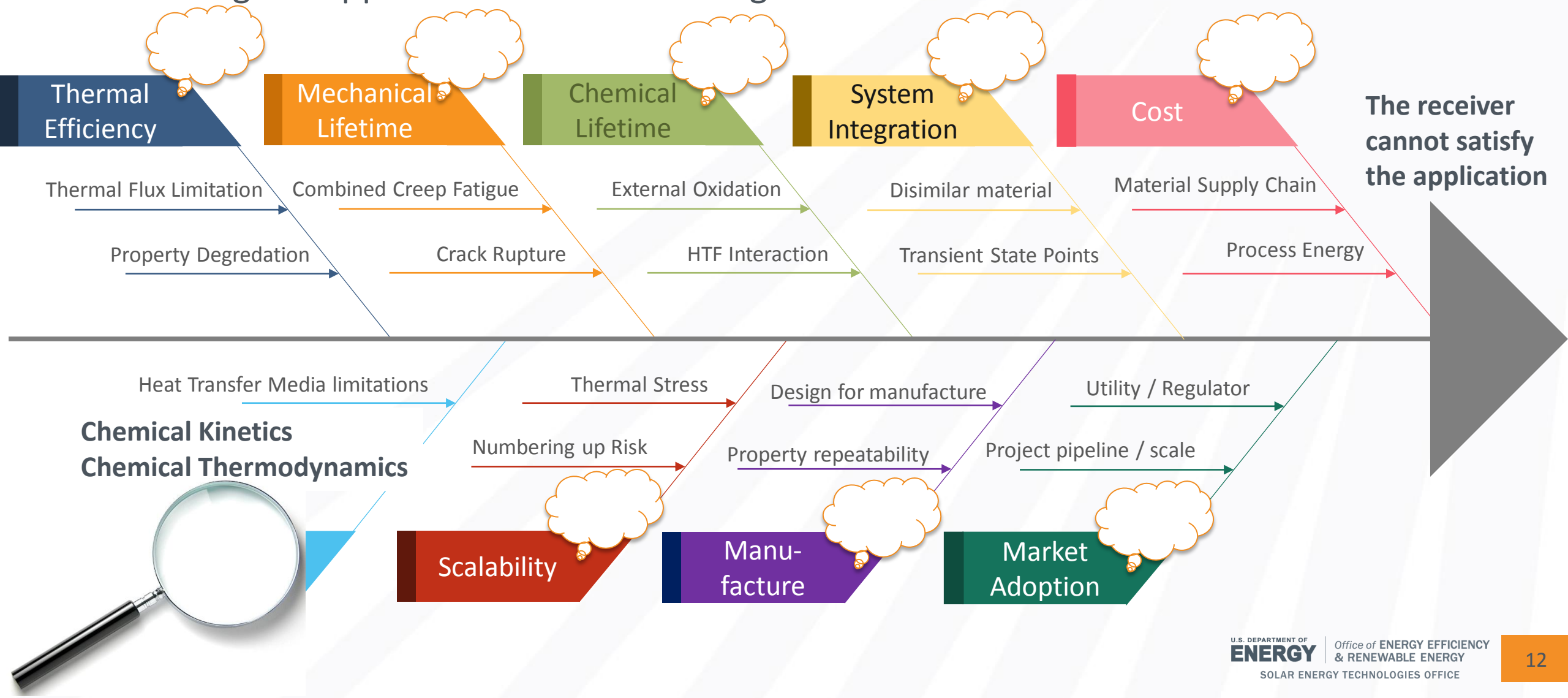
Innovation Discovery,
Viability Realization



Thermochemical Concerns Compound with Innovative Receivers

Ishikawa diagram approach

Be thinking about how thermochemical nests into all these…



Workshop Goals

For the Panel and Audience:

How comes a solar receiver to be part of a chemically reactive system?

- Instead of systems level analysis think what systems must be in place to achieve thermochemical process
- Lift innovation up from lab-scale research to on-sun demonstration
- Balance constraints between solar component and the remainder of the system
- What are the key risks that are often overlooked early in the development process
  How should testing campaigns be designed to manage those risks?
- What are overlooked technical metrics/objectives that should be considered at both early and late stages?

How should research outcomes be packaged so as to draw attention from industry and other private sponsors?

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Leveraging CSP Experience for Solar Thermochemistry

~Our Panelists~

Christian Sattler

DLR German Aerospace Center

James Klausner

Michigan State University

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