

NREL

National Renewable Energy Laboratory

Innovation for Our Energy Future

CSP Research Infrastructure in the U.S.

Mark S. Mehos
CSP Program Manager
National Renewable Energy Laboratory
Golden, CO



Discussion

- Background
- NREL/Sandia Infrastructure Support Facilities
- Mechanisms for Working with the DOE Laboratories

Background

FY02 – FY06:

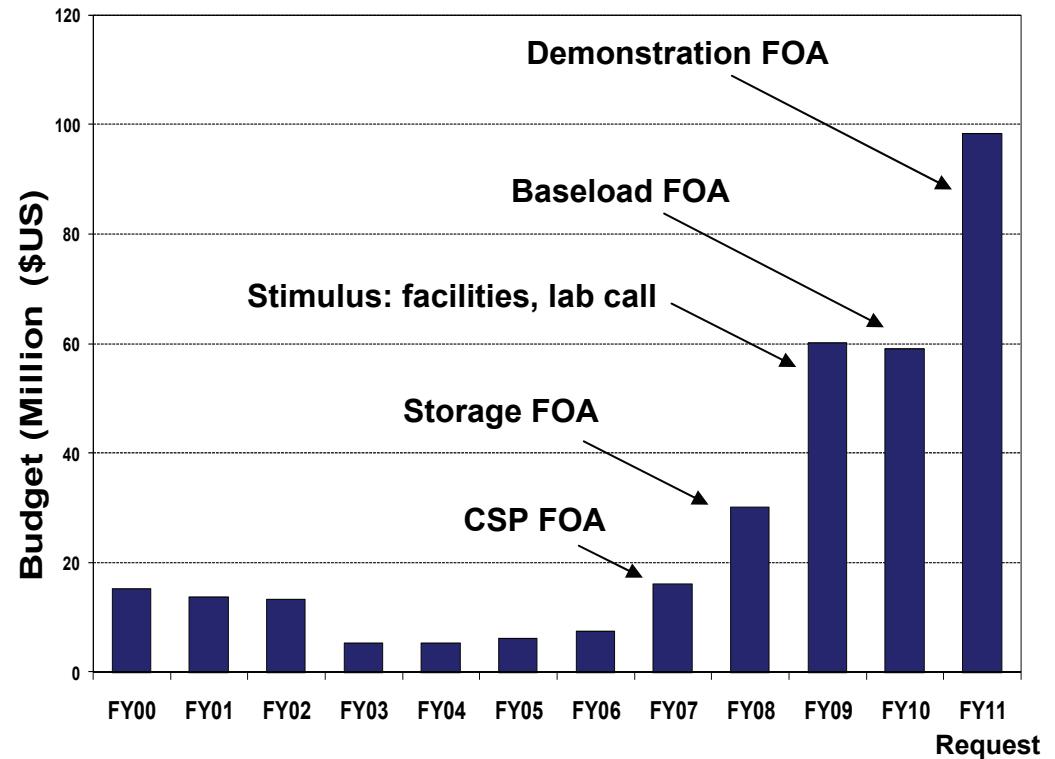
- DOE requested CSP closeout
- Limited ability to maintain existing infrastructure

FY07-Present:

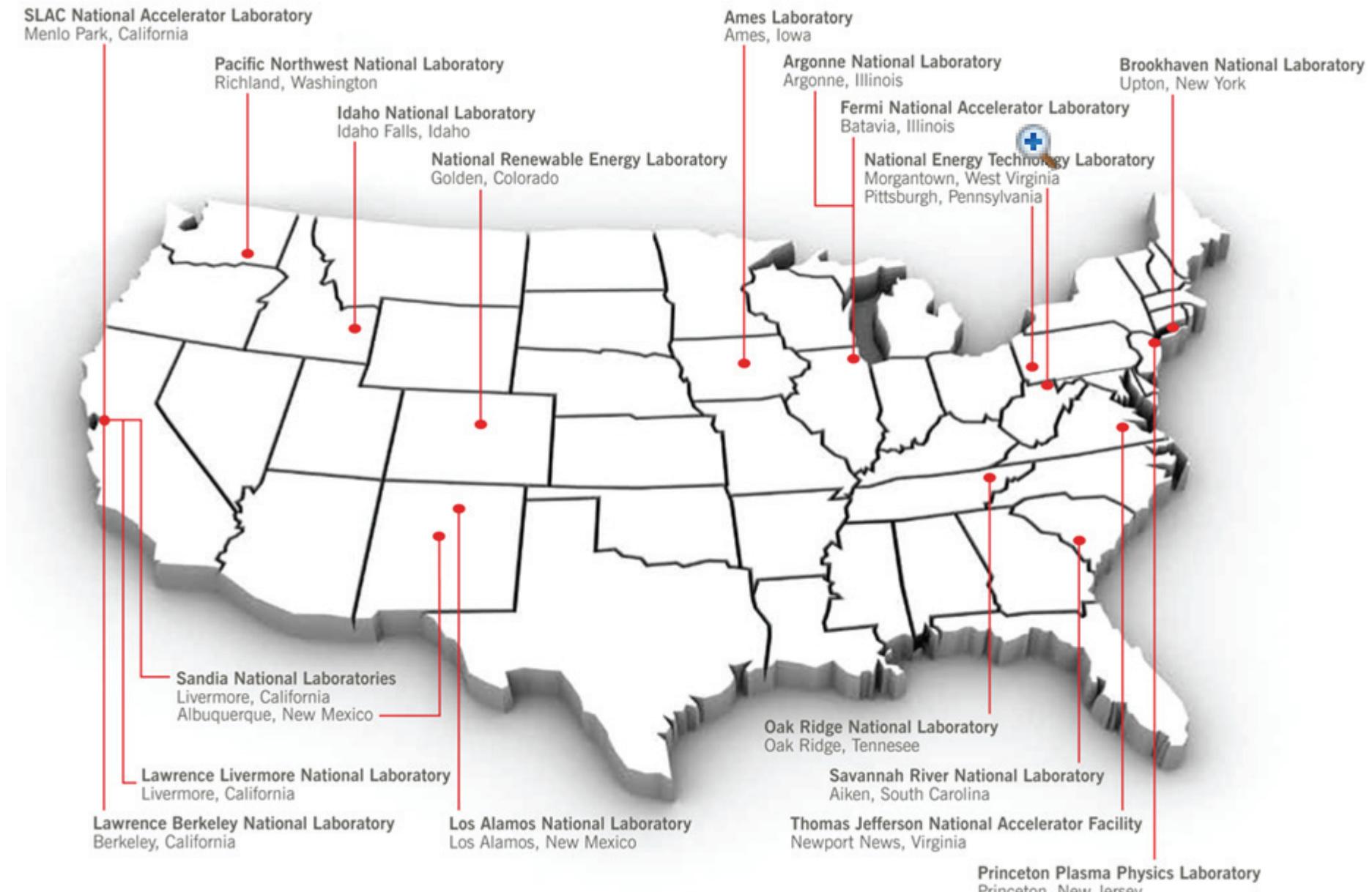
- Significant increase in DOE funding for CSP
- Industry/university FOA grants
- Increased NREL/SNL R&D and infrastructure funding

DOE Goals

- Intermediate power market by 2017
- Carbon constrained baseload market by 2022
- Storage compatible to achieve cost/performance targets for both markets



DOE Laboratory System



DOE Laboratory Roles (NREL and Sandia)

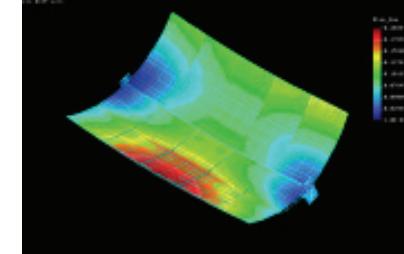
The National Renewable Energy Laboratory and Sandia National Labs work together on CSP R&D

- NREL's Role
 - R&D for line focus systems (parabolic troughs and linear Fresnel)
 - Analysis lead (systems analysis, market/transmission/environmental analysis, solar resource assessment)
- Sandia Role
 - R&D for point focus systems (dish/Stirling and power tower)
- Both labs share R&D responsibility for advanced thermal storage concepts as they relate to line and point focus systems
- There is crossover and sharing of activities in many areas

NREL/SNL Technology/Market Support Activities

Concentrator/receiver R&D

- create advanced evaluation capabilities
- test and evaluate receiver and concentrator designs
- support development of next-generation collector designs



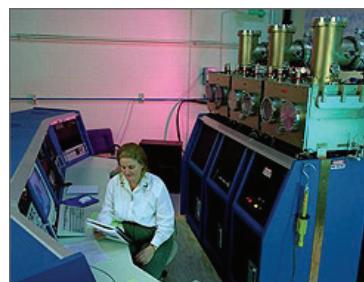
Advanced Thermal Storage

- develop advanced heat transfer fluids and TES materials for more efficient operation at high temperatures
- analyze and test innovative designs for low-cost storage options



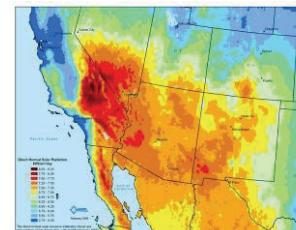
Advanced CSP Concepts and Components

- develop, characterize, and test advanced reflector and absorber materials
- analyze and assess advanced system concepts



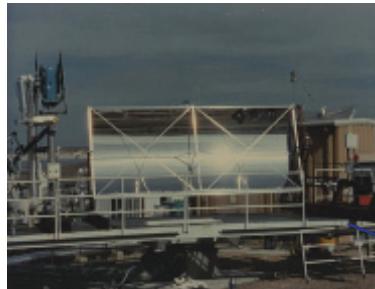
CSP Systems Analysis

- conduct grid integration and market penetration analyses
- support resource measurement and forecasting
- conduct and support CSP benefits analyses



Current CSP Facilities at the Sandia Albuquerque, New Mexico

Rotating Platform



Dish Engine Testing



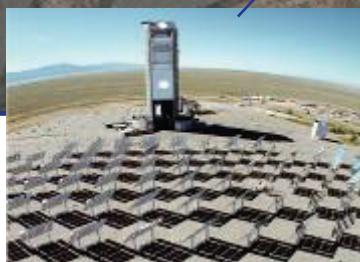
Engine Test Facility



NSTTF

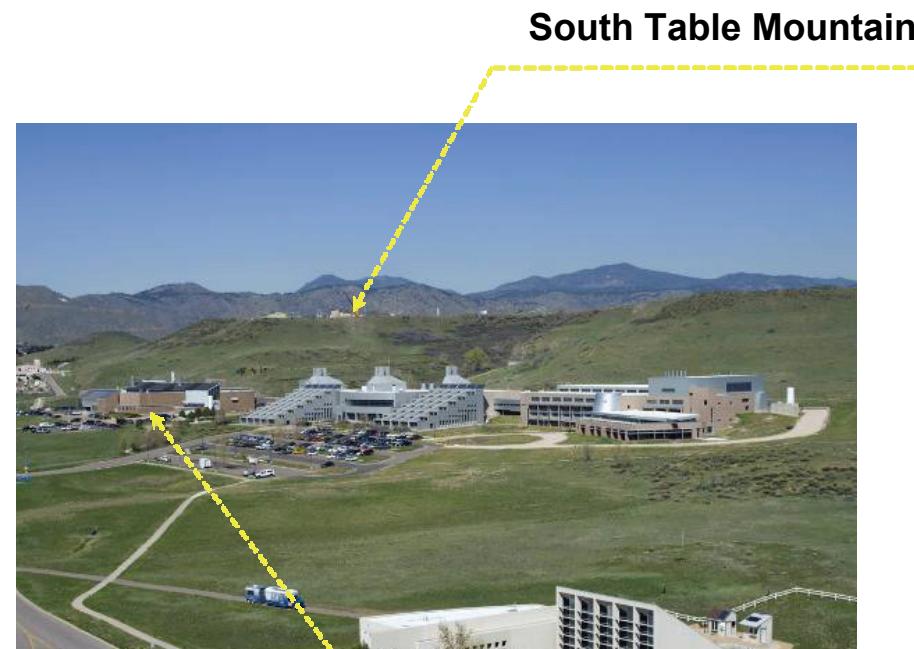


Tower Testing



Solar Furnace

Current CSP Facilities at NREL Golden, Colorado



High Flux Solar Furnace



Solar Radiation
Research Laboratory



Large Payload dual-
axis Tracker



Field Test Laboratory



Receiver Characterization
Laboratory



Weatherization and
Characterization
Laboratories

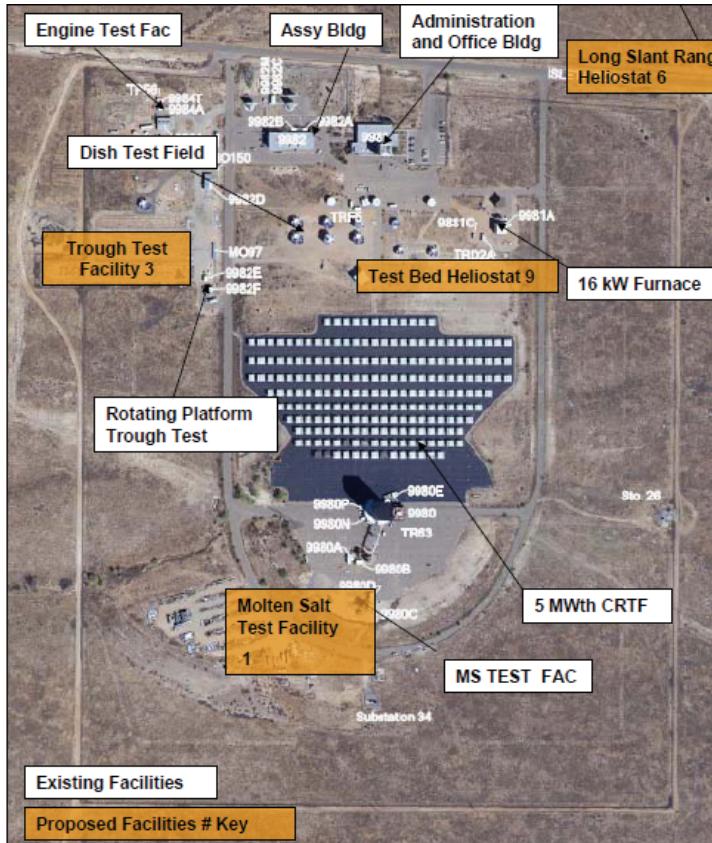


Deposition Laboratory



Advanced Fluids
Laboratories

NSTTF ARRA Stimulus Upgrades



- Molten Salt Test Facility Upgrade
- NSTTF Site Facilities Upgrade
- Trough Alternate Working Fluids Test Facility
- Optical Methods Test Laboratory
- Mobile CSP Test Laboratory
- Long Range Heliostat Test Site
- Small Tower Receiver Panel Test Facility
- Re-Lamp NSTTF Heliostats
- Test Bed Heliostat

NREL CSP Facilities under Development/Construction

Congressional Appropriation and ARRA Stimulus



Energy Systems Integration Facility



- Thermal Energy Storage Process and Components Integration Laboratory (Appropriation/ARRA Stimulus)
- Thermal Energy Storage/HTF Materials Characterization Laboratory (Appropriation)
- Optical Components Integration Laboratory (Appropriation/ARRA Stimulus)

Solar Technology Acceleration Center (SolarTAC)

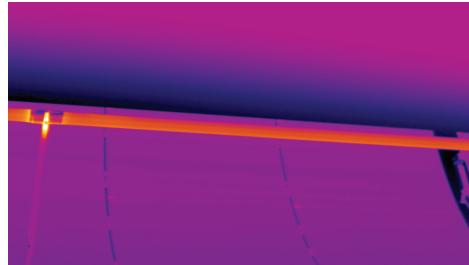


- Private/Public Partnership
 - Abengoa (founder)
 - Sun Edison (founder)
 - Xcel Energy (founder)
 - NREL (sponsor)
 - EPRI (sponsor)
 - Others TBD
- 2.5MWt Thermal Energy Storage Test Facility (ARRA Stimulus)

Field Characterization Capabilities



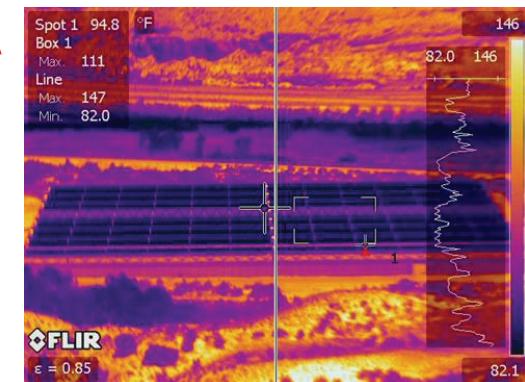
VSHOT
FPL Martin ISCCS



HCE IR survey
Acciona Nevada Solar One



Distant Observer
Abengoa Cameo



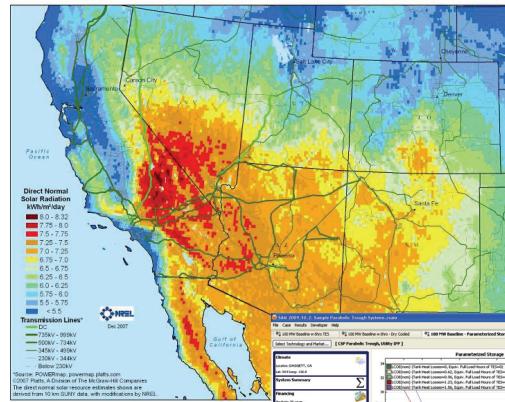
Distant Observer HCE IR survey
Abengoa Cameo



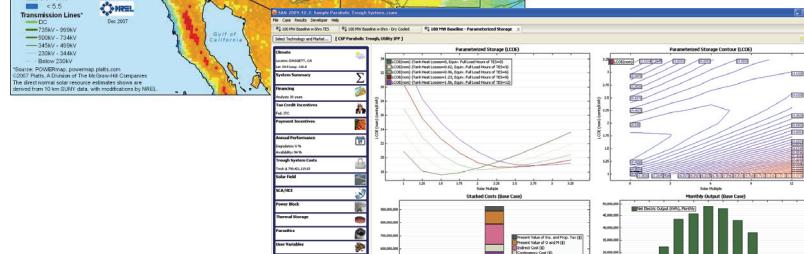
TOP (Theoretical Overlay Photographic)
Alignment

Addition Capabilities - Systems Integration and Market Transformation

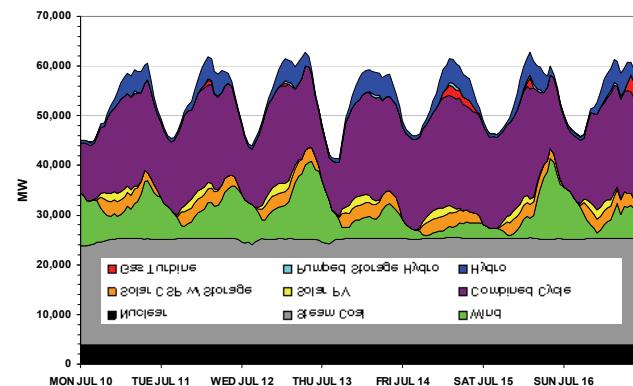
- CSP Resource Assessment



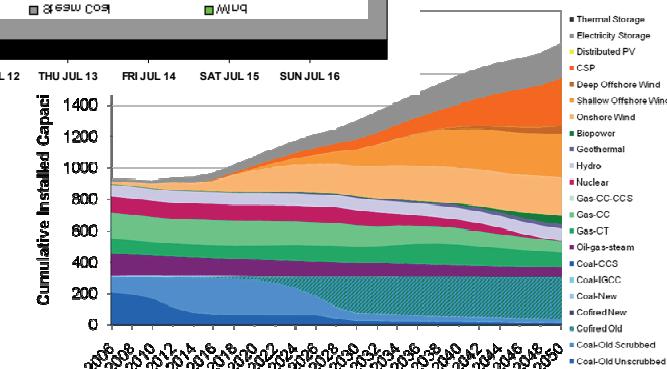
- CSP Systems Modeling



- CSP Grid Integration



- CSP Market Analysis



Working with DOE Laboratories

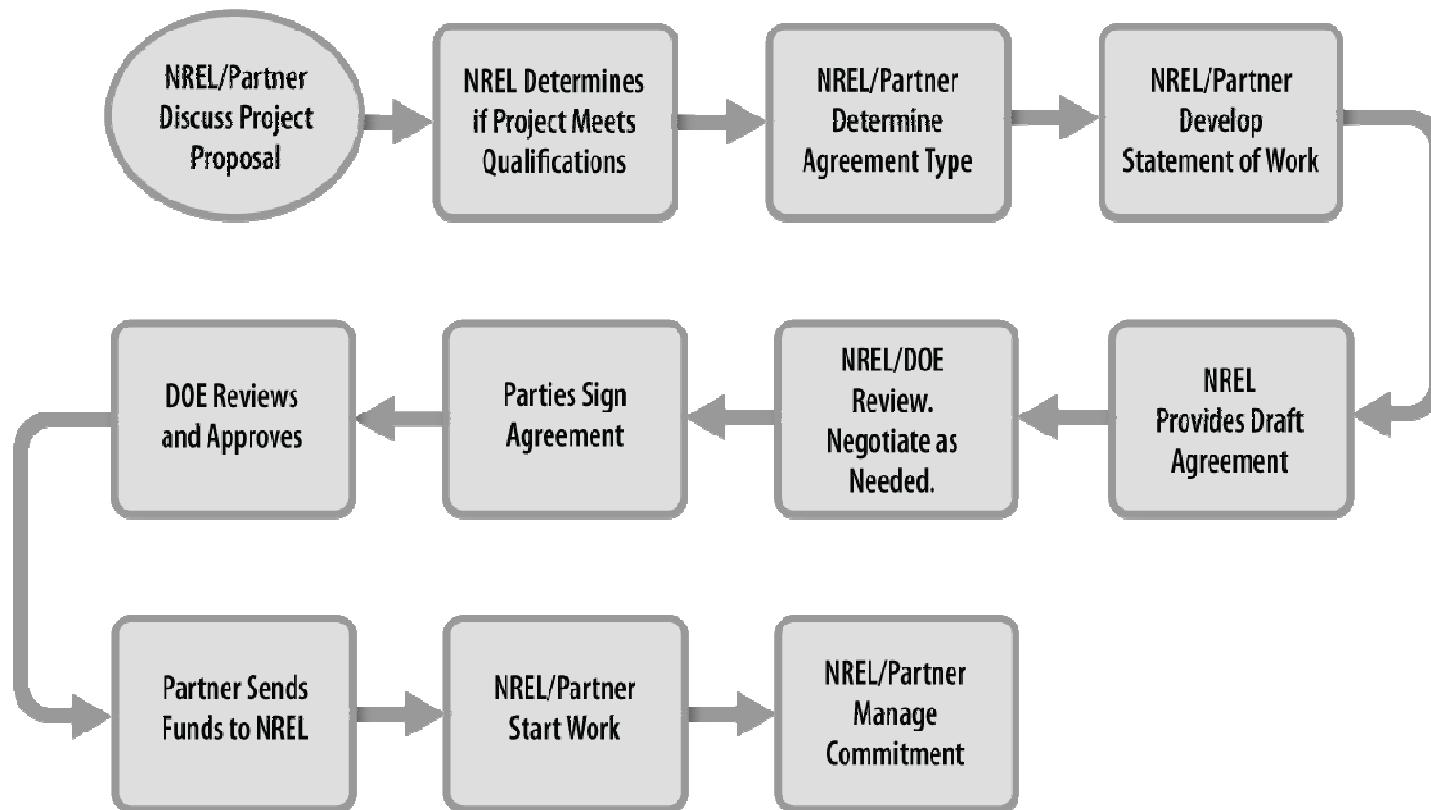
DOE-Funded Support

- Supports existing industry/university FOA awardees
- Can support limited non-FOA interactions

Technology Partnership Agreements (Two Types)

- Cooperative Research and Development Agreements (CRADAs)
 - Shared resources
 - Funds-In
- Work for Others (Three Types)
 - Funds-In Agreement
 - Technical Services Agreement
 - Analytical Services Agreement

NREL Technology Partnership Agreement Process



For more information about the technology partnership agreement process, see the NREL Technology Transfer Web site at www.nrel.gov/technologytransfer/.

More Information about Facilities at NREL and Sandia

NREL:

<http://www.nrel.gov/csp/capabilities.html>

Sandia:

http://www.sandia.gov/Renewable_Energy/solar_thermal/nsttf.html

Thank you!

Mark Mehos
National Renewable Energy Laboratory

mark.mehos@nrel.gov
(303) 384-7458
www.nrel.gov/csp