



U.S. Department of Energy  
**Energy Efficiency  
and Renewable Energy**

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# DOE Solar Energy Technologies Program Peer Review

**Technical Track: CSP**

**Project Name: Facility Plans - NREL**

**Principal Investigator: Mark Mehos**

**Denver, Colorado**

**March 9-10, 2009**

**This presentation does not contain any proprietary or confidential information.**



- Refurbish existing NREL facilities that have significantly deteriorated over time
- Expand NREL facilities to support growing DOE/industry needs for
  - Near-term testing of CSP components
  - Long-term development of advanced storage and optical materials



- Mark Mehos – Program Manager (CSP/NREL)
- Dr. Chuck Kutscher – Parabolic trough R&D team lead
- Dr. Greg Glatzmaier – Advanced thermal storage team lead
- Cheryl Kennedy – Advanced optical materials team lead
- Carl Bingham – High flux solar furnace
- Dr. Michael Pacheco - SolarTAC



- High Flux Solar Furnace
- Collector/Receiver Characterization Laboratories
- Advanced Optical Materials Laboratories
- Advanced Thermal Storage Materials Laboratory
- SolarTAC (Solar Technology Acceleration Center)



# Current NREL Laboratory Facilities and Capabilities



● **South Table Mountain**

● **Field Test Laboratory Building (FTLB)**

**Denver West Office Complex Bldg. 16**



● **Joyce Street**



**Energy Systems Integration Facility (ESIF)**

Visitor's Center

## Energy Systems Integration Facility

## Solar Technology Acceleration Center\*



**Solar Technology Acceleration Center**  
 Aurora Campus for Renewable Energy, Colorado



**SolarTAC**  
 Technology Acceleration Center



- HFSF (Upgrade)
  - Data acquisition and controls equipment
  - Instrumentation (flux, power, cameras, etc...)
  - Primary concentrator
  - Small 2-axis trackers
- HFSF (Expansion)
  - Add 500 ft<sup>2</sup> of additional laboratory space
  - Supply running water



Long-focal-length, off-axis design facilitates use of secondary concentrators

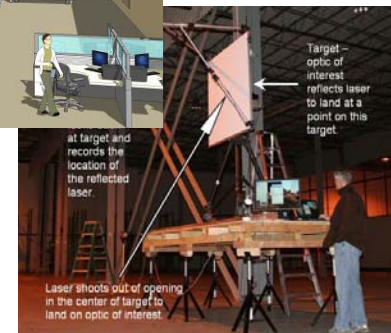


Applications include high-temperature thermochemical reactions and small Stirling engine and CPV performance testing



# Collector/Receiver Characterization Facilities

- Large Payload 2-axis Tracker & Optical Efficiency Test Loop (Upgrade)
  - Support testing thermal performance of advanced high-temperature receivers (operation  $>500^{\circ}\text{C}$ )
  - Support development of test standards for optical characterization of CSP components for trough, tower, and dish systems
  
- Optical Characterization Laboratory (Relocate and Upgrade)
  - Move from Joyce Street facility (10 miles from NREL campus) to new ESIF building
  - Add additional capabilities (large freeze/thaw chamber, large area specular characterization)
  - Optical characterization under loads



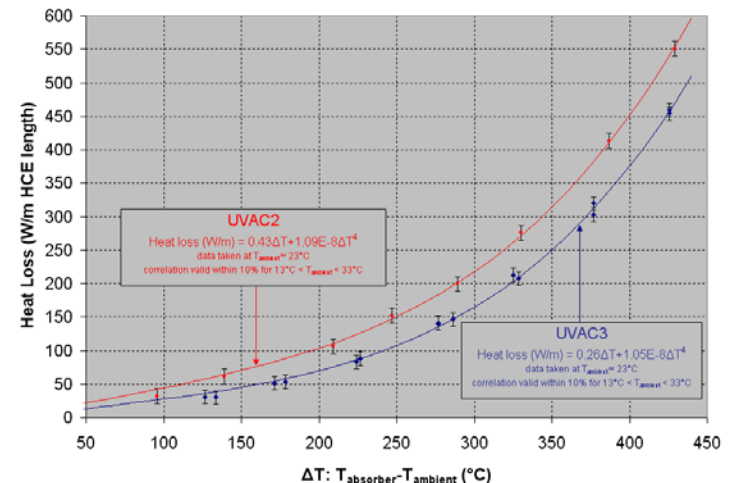


# Receiver Characterization Facilities and Capabilities

- Receiver Characterization Laboratory (Upgrade)
  - Test greater number and greater variety of advanced heat collection elements under development
  - Support development of future test standards for receiver performance

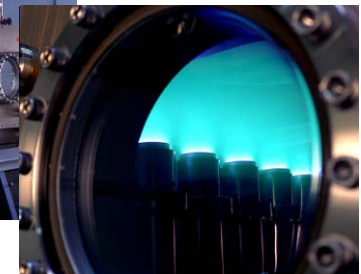


Comparison of UVAC3 and UVAC2 Heat Loss  
NREL Thermal Test Bed - March and October 2007  
Information regarding testing available at:  
[http://www.nrel.gov/csp/troughnet/testing\\_standards\\_reports.html#receivers](http://www.nrel.gov/csp/troughnet/testing_standards_reports.html#receivers)





- **Advanced Optical Materials Facilities**
  - Optical characterization laboratory
  - Accelerated and outdoor exposure testing laboratory
  - Thin-film-deposition research laboratory
- **Planned Upgrades**
  - Utilities for new equipment
  - Deposition system upgrades
  - Data network lines
  - Safety equipment





- Thermal Storage Materials Laboratory (Relocate and Upgrade)
  - Laboratory is temporarily located in Building 16 of Denver West Office Park
  - Will establish enhanced thermal storage materials lab at ESIF facility
- Advanced thermal storage components and process laboratory
  - Investigate and characterize process issues relating to sensible, phase change, and thermochemical storage materials
  - Support laboratory and industry storage concepts
  - Permanent location will be at ESIF facility



# SolarTAC

## Technology Acceleration Center

A world-class facility where solar technology moves from research lab to test site.



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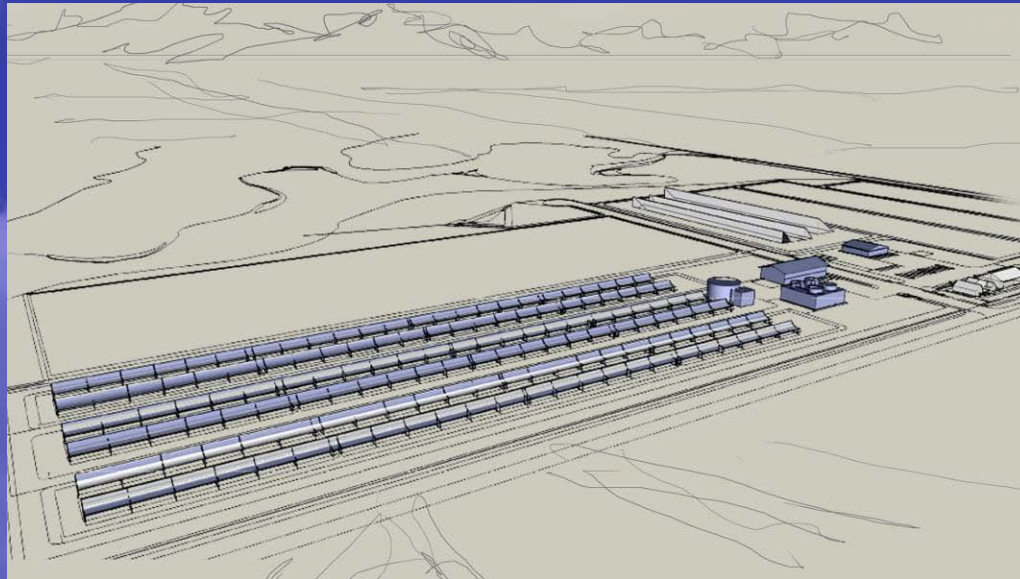
**Solar Technology Acceleration Center**  
Aurora Campus for Renewable Energy, Colorado



**SolarTAC**  
Technology Acceleration Center

A **partnership** among the **private sector, research community, and government**

- To accelerate market adoption



## A **venue** for **research,** **demonstration, testing,** and **validation**



### Photovoltaic and Concentrating Solar Power

- Generation technologies
- System components
- Thermal storage
- Electric-grid integration

Draws upon the **solar expertise**  
and leverages the **financial**  
participation of its **members**.

**The Original Founding Member**  
Xcel Energy

**Original Founding Members**  
SunEdison  
Abengoa Solar

## Accesses R&D expertise from the Colorado Renewable Energy Collaboratory

- National Renewable Energy Laboratory
- Colorado State University
- University of Colorado, Boulder
- Colorado School of Mines

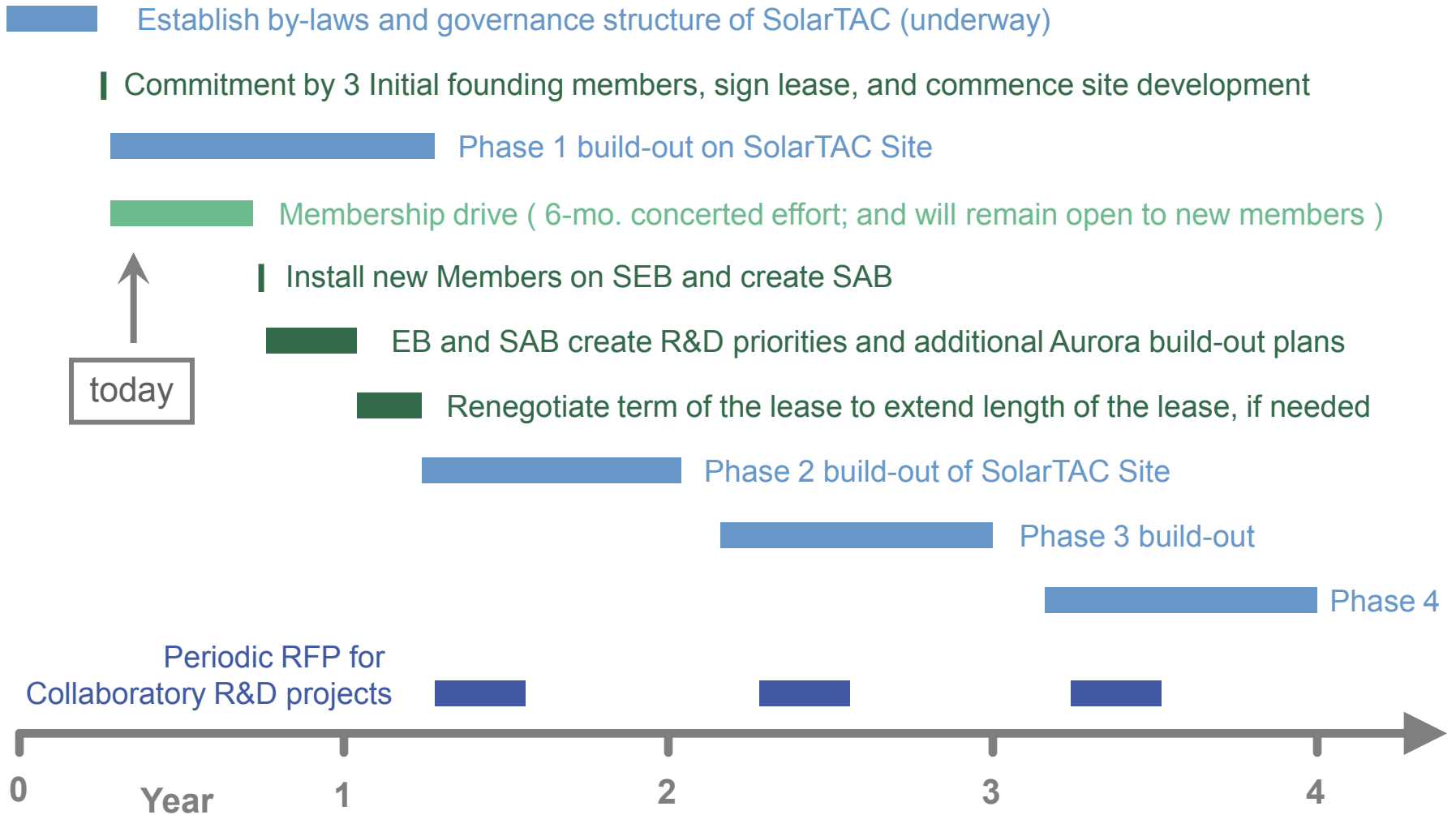


## Location: **Aurora, Colorado**

- Near Denver International Airport
- Flat, graded topography
- Excellent insolation – more than 300 days of sunshine/year
- 74-acre initial development site
- 1,900-acre total site holdings
- Good accessibility and visibility



## Timeline for Years 1-4





- Opportunities for upgrading existing and constructing new facilities at NREL have been identified
- Budget outlook is very positive for most or all of the facilities identified
- SETP support for CSP facilities are highly leveraged by additional funding sources (e.g. ESIF, SolarTAC)
- We will continue to work closely with DOE and CSP industry to update or modify plans as appropriate.