CSP Optical Facilities at the National Renewable Energy Laboratory

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BACKGROUND / IMPACT

The Concentrating Solar Power (CSP) Optical Facilities at NREL comprise unique optical tools and facilities for testing and characterizing concentrating solar optical components. This allows DOE laboratories, industry, and the academic community to benefit from state-of-the-art laboratory capabilities.

OBJECTIVES

These facilities are maintained to aid researcher and industry efforts to reduce market barriers, improve the performance, reduce the cost, and improve the lifetime and reliability of CSP materials, components, subsystems, and integrated concepts, where accurate and timely characterization methods are needed.

METHODS

Maintenance and further development of:

- **Advanced Optical Materials Laboratory,**
- **"Distant Observer" for parabolic troughs,**
- **High Flux Solar Furnace,**
- **Optical Characterization Laboratory, and**
- **Indoor and outdoor accelerated weather testing tools.**

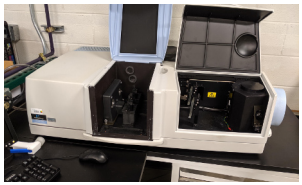
KEY OUTCOMES

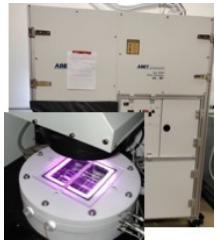
- **Track operation and maintain existing high-priority research equipment to ensure continual operation.**
- **Repair high priority CSP research equipment to keep in line with NREL mission and reduce downtime.**
- **Purchase and install key laboratory equipment.**
- **Track utilization of CSP research equipment throughout the year.**

CONCLUSION

Monitoring, maintaining and further improving our key capabilities is critical for our CSP and related renewable-energy research. NREL's CSP Optical Facilities enable rapid response to new challenges with novel solutions that align with the goals of the Solar Energy Technology Office (SETO) at the U.S. Department of Energy.

Advanced Optical Material Laboratory (AOM)





The AOM supports the development & testing of optical materials.

Ultra- Accelerated Weathering System (UAWS)

Used to accelerate material degradation by exposure to concentrated UV light.[1] R&D100 winner

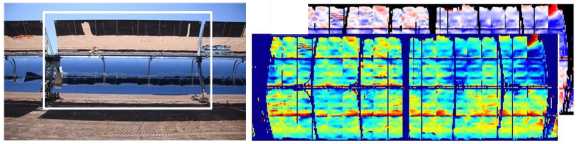
High Flux Solar Furnace (HFSF)

HFSF is a unique user facility for testing high-flux / high-temperature processes and applications.[2]

Optical Characterization Laboratory (OCL)

Validates collector accuracy to ensure quality of solar collectors in the laboratory and in-situ conditions.

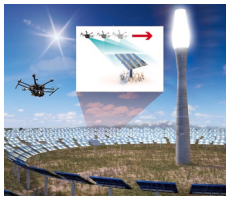
Distant Observer (DO)



DO for parabolic troughs[3]

- *DO and NIO allow for the efficient optical assessment of commercial-scale CSP solar fields.*
- *DO and NIO measure mirror surface slope error, mirror facet canting error, and heliostat tracking error*

Non-Intrusive Optical System (NIO)



NIO for power tower heliostats[4]

References

1. *G. Jorgensen, C. Bingham, J. Netter, R. Goggin, A. Lewandowski, American Chemical Society (1999), pp. 170–185.*
2. *https://www.nrel.gov/news/features/2020/high-flux-solar-furnace.html*
3. *D. Kesseli, V. Chidurala, R. Gooch, G. Zhu, J. Sol. Energy Eng. (2022), 145(2),p. 021008.*
4. *R.A. Mitchell & G. Zhu, Solar Energy, 209 (2020), pp. 431-445.*

https://www.nrel.gov/csp

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