U.S. Department of Energy
HelioCon
Heliostat Consortium for Concentrating Solar-Thermal Power

Heliostat Consortium Seminar Series

Brought to you by the Resource, Training, and Education (RTE) topic area

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Research Associate,
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Host: Dr. Rebecca Mitchell

Title: Heliostat Aerodynamics and Wind Load: Measurements, Characterization, and Prediction in Atmospheric Boundary Layer

When: July 13th
4-5 PM MDT

Zoom:
https://nrel.zoomgov.com/j/1600359585?pwd=VENUTG9BK0J1T2xhazh0Y1JDRXl6QT09

Abstract:

Detailed understanding of the static and dynamic wind loads on heliostats due to the low-altitude wind conditions at CSP field sites is needed to reduce material cost and structural failures due to high-wind events. Wind load predictions for heliostats commonly adopt building design codes that cannot sufficiently account for the dynamic response of unique geometry structural components and site-dependent wind velocity and turbulence characteristics in the lowest 10 meters of the atmospheric boundary layer (ABL).

This seminar will provide an overview of the measurement and characterization of ABL turbulence parameters and their impact on heliostat aerodynamics and design wind load coefficients. Wind tunnel investigations at the University of Adelaide highlight the importance of measuring and resolving the temporal and spatial variations of high-frequency ABL turbulence that impact the maximum operational and stow loads on heliostats. These have been incorporated into heliostat-specific analytical models and tools, such as the Australian Solar Thermal Research Institute (ASTRI) wind load spreadsheet. Wind load prediction models are being further developed with full-scale measurements at the atmospheric boundary layer research facility (ABLRF) in Adelaide, wake interactions and load distributions on heliostat arrays in field models, and heliostat shape effects with dynamic performance impacts. The talk will conclude with some identified research gaps and suggested research directions for HelioCon.

Bio:

Dr Matthew Emes is a Postdoctoral Research Associate in the School of Mechanical Engineering at the University of Adelaide in Adelaide, Australia. He received his PhD in Mechanical Engineering from the University of Adelaide in 2018 and has a background in experimental fluid mechanics, bluff body aerodynamics, atmospheric boundary layer turbulence, and turbulence effects on the wind loads on heliostats in CSP plants. Since 2019, Dr Emes has co-led the Australian Solar Thermal Research Institute (ASTRI) heliostat wind load and aerodynamics project team and the establishment of the Atmospheric Boundary Layer Research Facility (ABLRF) at the University of Adelaide. He and his team develop physical modelling techniques of ABL wind tunnel simulation and wind load design characterization on single heliostats, heliostat arrays and strategies for wind load reduction.