

U.S. Department of Energy

HelioCon

Heliostat Consortium for
Concentrating Solar-Thermal Power

Heliostat Consortium: Gaps Analysis on Resources, Training, and Education for Developing the Heliostat Industry Workforce

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Co-lead: Jeremy Sment, SNL

September 27, 2022

conceptual design



components



integration



mass production



heliostat field

Heliostat Consortium (HelioCon)



US Energy Department has funded 5-year heliostat consortium:

- To advance U.S. heliostat technologies, capabilities and national workforce
- \$25M + cost share: 30% of funds allocated to RFPs for engagement of US industries and other stake holders



conceptual design



components

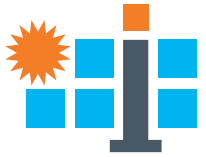
integration

mass production



heliostat field

Scope of Resource, Training, and Education



University Involvement



Training Resources

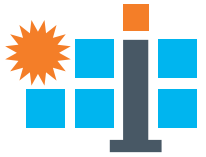


Diversity, Equity, and Inclusion



Online Database

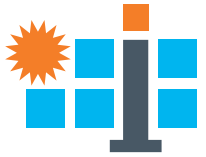




HelioCon RTE Objectives

- Develop heliostat training programs
 - Identify training and education needs of labs, industry, and universities
 - Design and test training materials for new workers
- Engage education institutes to develop workforce pipeline
 - Support heliostat Master's/PhD thesis development, technical training programs
 - Create heliostat grant opportunities
 - Provide internships opportunities
- Promote Diversity, Equity, and Inclusion (DEI)
 - Create programs that benefit minority/underserved communities
- Create centralized resource database
 - Compile all RTE materials and information into centralized web-based resource

RTE Identified Gaps and Feedback from Workshop



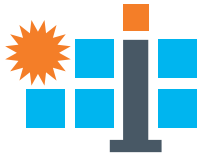
- Required skills and training needs
 - Heliostat or broadly CSP workforce? Different for R&D versus plant operations
 - Many skills: optics, industrial engineering, electronics, software, firmware, power use communication
 - Driven by career opportunities presented by industry
 - Recognize value/need for social science skills to engage underserved communities
- Establishing workforce pipeline from universities
 - Lots of interest for renewable energy among students, needs to be targeted towards CSP
 - Industry drives career interest, facilitate industry-academic communication
 - Funding opportunities: fellowships, internships, training grant proposals, smaller grant opportunities for seed projects, SBIR/STTR
- Promoting DEI and engaging underserved communities
 - Targeted funding opportunities for underrepresented groups: NSF programs, Louise-Stoke Alliance Minority Program
 - Community college engagement for industry workers
 - Engage social science/DEI experts at early project stages to drive solutions
- Education and database resources
 - Resources to market CSP to student community
 - Database of existing resources to be shared among the workforce community
 - Cross-over works that have appropriate skills in other industries

University Outreach

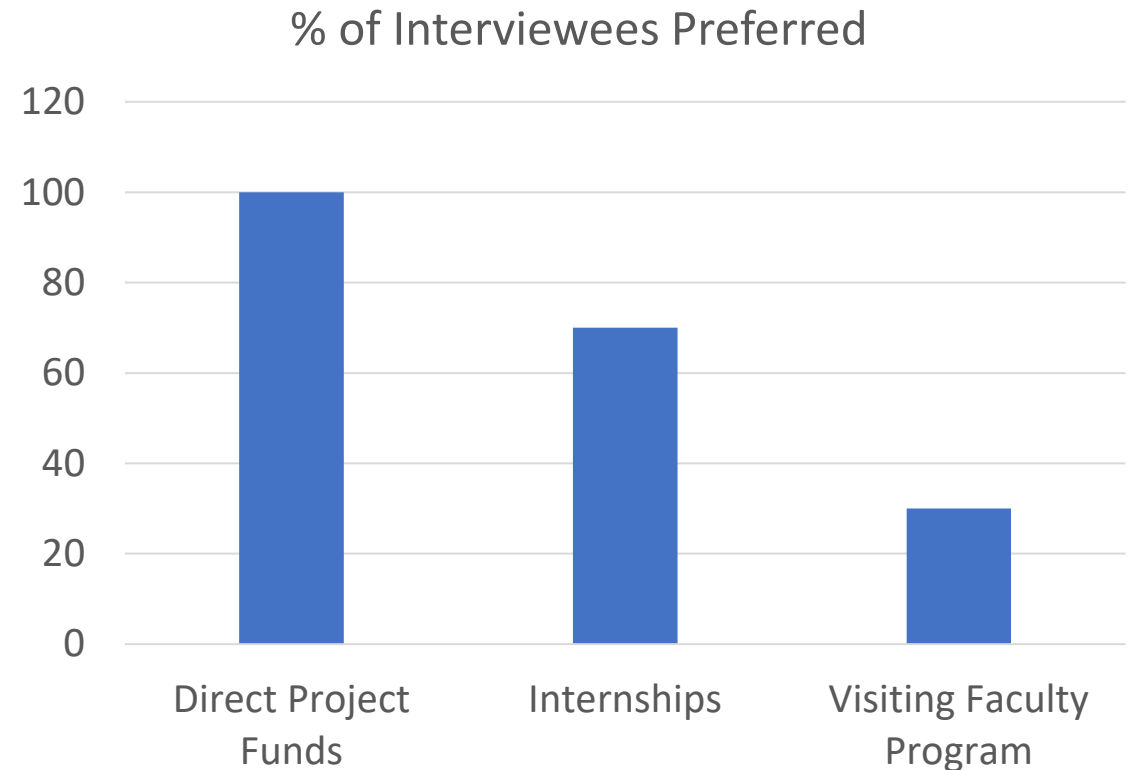
- Conducted 11 interviews with university faculty in mechanical engineering programs who do research in solar thermal applications.
 - Yucheng Liu, South Dakota State University
 - Hohyun Lee, Santa Clara University
 - Kimani Toussaint, Brown University
 - Greg Jackson, Colorado School of Mines
 - Peiwin Li, University of Arizona
 - Sarah Kurtz and YangQuan Chen, University of California Merced
 - Renkun Chen, University of California San Diego
 - Peter Vorobieff, University of New Mexico
 - Mike Wagner and Greg Nellis, University of Wisconsin
 - Ranga Pitchumani, Virginia Technical Institute
 - Nathan Siegel, Bucknell University

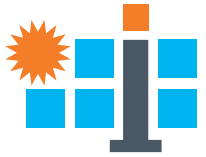


University Outreach: Preferred Collaboration Mechanisms



- Strong preference for project funds supplemented with internships
 - Professors at advocates for students
 - Internships allow exposure to large-scale problems
- Visiting Faculty Program logistically difficult, target junior faculty





University Outreach: Main Takeaways

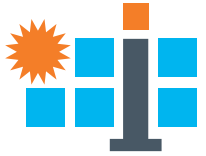
- Multidisciplinary approach
 - Renewable/sustainable energy programs are already popular
 - Insert Heliostat educational materials into existing ME and RE coursework to reach students with diverse set of skill sets
 - Supporting students' STEM development more generally sets them up for more career options
- Exposure to CSP Industry
 - Support access of academic programs to industry plant data and networking opportunities
 - Provide more general CSP problems to form basis of research/education
- Project funds combined with lab/industry engagement



Diversity, Equity, and Inclusion

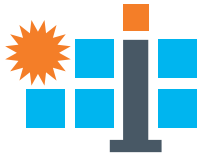
- Collaborated with NREL, DOE, and Sandia DEI and workforce development experts to develop HelioCon DEI plan
- DEI should be incorporated at every level of project planning
- DEI Building blocks:
 - DEI within project team
 - Partnering with minority serving institutions
 - Projects that benefit underserved communities
 - Metrics to measure success

RTE Top Ranked Gaps



Tier 1 Gaps (Most Important)	
R1	<p>Heliostat technology resources are not accessible in a centralized web-based format</p> <ul style="list-style-type: none">• Need for a heliostat reference library that is accessible to newcomers• Lack of documentation and accessibility of current institutional knowledge, including knowledge on industry standards, materials, procedures, and case studies of lessons learned• Need for a centralized database to find information on available software/hardware tools and methods• Need for a centralized database of training/education materials
R2	<p>Lack of heliostat research projects in universities</p> <ul style="list-style-type: none">• Small number of university students/faculties performing heliostat-related research• Very few students masters/PhD thesis projects related to heliostats/CSP• Need for CSP/heliostat research funding accessible to minority/underrepresented students
R3	<p>Little public awareness of CSP/heliostat technologies</p> <ul style="list-style-type: none">• Awareness of CSP/heliostat technologies is not widespread across students or the public• Lack of informational videos and documents introducing heliostat/solar thermal technologies to a general audience• Lack of CSP/heliostats social media content
R4	<p>Lack of resources and guidance for promoting DEI in CSP workforce</p> <ul style="list-style-type: none">• Lack of DEI training resources and guidance for heliostat workforce• Need resources for project leaders to prioritize DEI in project planning• Need for more partnerships with minority-serving institutions

Recommended Pathways



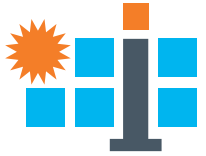
Gaps	Recommended Pathways
R1: Heliostat technology resources are not accessible in a centralized-web based format	<ul style="list-style-type: none"> • Compile institutional knowledge, such as manufacturing and plant O&M best practices and lessons learned through interviews and surveys • Compile available resource materials including industry data/knowledge, references, training and educational resources, and available tools • Organize resource materials and data into web database
R2: Lack of heliostat research projects in universities	<ul style="list-style-type: none"> • Establish connections between students/faculty and researchers/industry leaders through internship opportunities • Identify and support PhD/masters students to pursue heliostat-focused thesis projects • Pose industry problems to universities to innovate solutions
R3: Little public awareness of CSP/heliostat technologies	<ul style="list-style-type: none"> • Create short introductory/informational videos targeted at a general audience • Create social media accounts for CSP/heliostat technologies and enlist researchers and students to generate content • Create public events, such as seminar series or workshops to educate a broad audience of heliostat fundamentals • Partner with universities to create annual fundamental CSP trainings open to the public
R4: Lack of resources and guidance for promoting DEI in CSP workforce	<ul style="list-style-type: none"> • Consult with DEI staff/experts establish resource and training materials, create diverse project teams • Partner with minority-serving institutions on CSP projects • Identify organizations and contacts to partner with that work with underserved communities



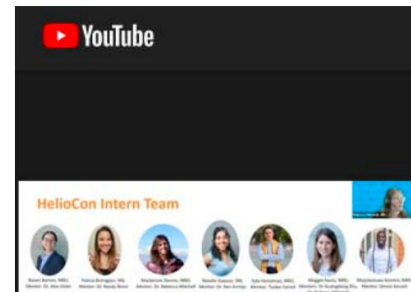
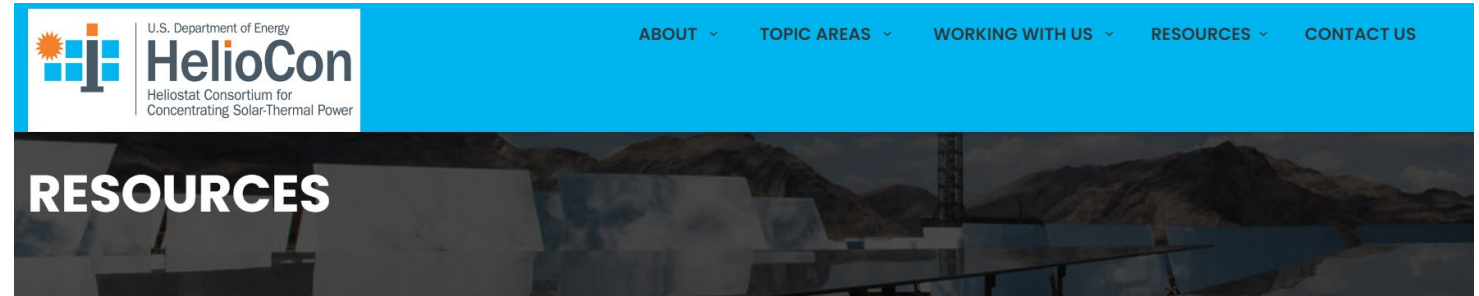
HelioCon RTE Efforts

- Resource Database
- Internship Opportunities
- Educational Materials

Resource Database - <https://heliocan.org/>



- Code libraries
- Metrology/software tools list
- Standards/guidelines
- Current projects
- Heliostat component suppliers/developers and contact information
- Specialized database libraries
 - Site characterization
 - Components
 - Integrated heliostats
 - Manufacturing
 - Solar field O&M
 - Safety protocols
- Best practices/lessons learned
- Education/training resources
- Existing power plants
- External resource databases

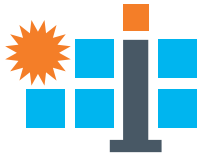


Resources

The resources in this section include background on concentrating solar power (CSP), available scientific publications, videos, and additional information on heliostats.

- [Background on Concentrating Solar Power](#)
- [Heliocan Seminar and Educational Videos](#)
- [Zotero References](#)
- [Heliocan Publications](#)

HelioCon 1st Year Intern Team



Raven Barnes, NREL
Mentor: Dr. Alex Zolan



Felicia Brimigion, SNL
Mentor: Dr. Randy Brost



Mackenzie Dennis, NREL
Mentor: Dr. Rebecca Mitchell



Natalie Gayoso, SNL
Mentor: Dr. Ken Armijo



Kyle Heinzman, NREL
Mentor: Tucker Farrell



Maggie Kautz, NREL
Mentors: Dr. Guangdong Zhu,
Dr. Rebecca Mitchell



Mojolaoluwa Keshiro, NREL
Mentor: Devon Kesseli



Dimitri Madden, SNL
Mentor: Dr. Ken Armijo



Dylan Mayes, NREL
Mentor: Tucker Farrell



Nicole Piatko, DOE
Mentor: Andru Prescod



Katelyn Spadavecchia, NREL
Mentors: Mackenzie Dennis
and Devon Kesseli



Gabriel Shuster, NREL
Mentor: Dr. Rebecca Mitchell



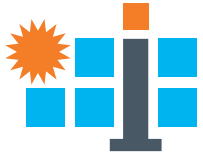
Daniel Tsvankin, NREL
Mentor: Dr. Matt Muller



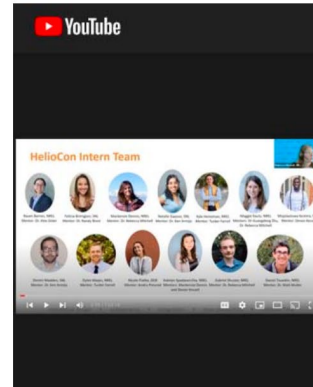
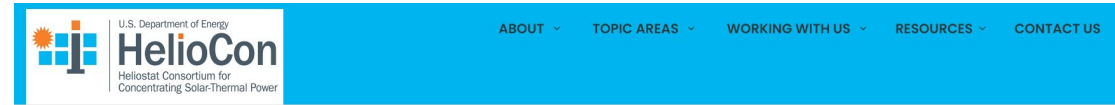
Future Opportunities with HelioCon for Students

- Science Undergraduate Laboratory Internships (SULI) at NREL and SNL
 - How to apply: <https://science.osti.gov/wdts/suli/How-to-Apply>
 - Applications for Spring due **Oct 5**, applications for summer due **Jan 10**
- Internships at NREL
 - <https://www.nrel.gov/careers/internships.html>
 - Current HelioCon postings: https://heliocan.org/hiring_opportunity.html
- Fellowships at SNL
 - <https://www.sandia.gov/careers/career-possibilities/students-and-postdocs/fellowships/>
 - <https://www.sandia.gov/working-with-sandia/academic-partnerships/postdoctoral-research-and-fellowship-programs/>
- Internships at DOE
 - SETO: <https://www.energy.gov/eere/solar/fellowships-and-research-opportunities>
 - EERE: <https://www.energy.gov/eere/education/internships-fellowships-graduate-and-postdoctoral-opportunities>

Educational Materials

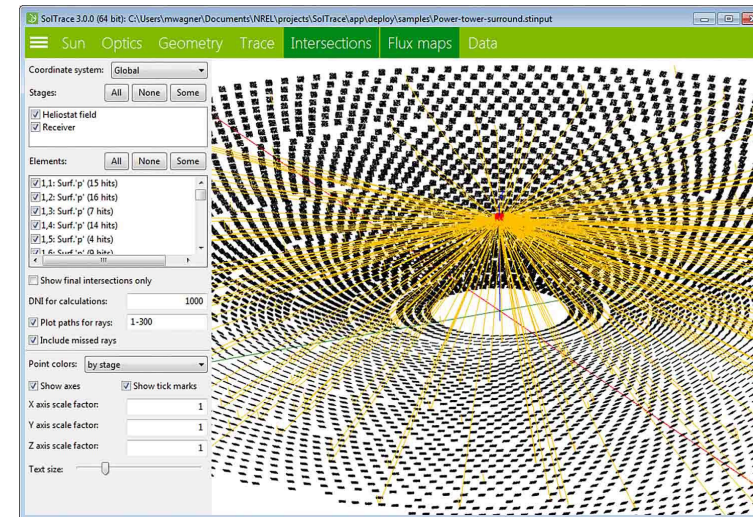


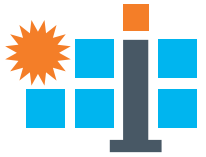
- HeliCon Seminar Series
 - https://heliocan.org/resources/heliocan_esev.html
- SolTrace Training workshop
 - Session I: A Beginner's Overview - <https://nrel.zoomgov.com/rec/play/9scgFWQZY4dzOcYEGp06Ygwkbge-oOjTbgnTIPIW8Tg03HkYYSMBWZd4pCBlqdu8HeZ6TREVnlM0av8.tbBC1Gd5G1k4RRz?continueMode=true>
 - Session II: Implementing Advanced Geometries - https://nrel.zoomgov.com/rec/play/LPjLwHPUIfeEMV_B6ELGXmtK7KX2SfC-VuIOv8RQa4tY1JT2cYpTiT6Ww5QU2gNfUKG7tgt7OC0l8xi.rtlXR45lqerC-R_o?continueMode=true



HeliCon Seminar & Educational Videos

Date	Title	Speakers	Video Link	Seminar Documents
August 11, 2022	Advanced Manufacturing for Heliostats – What We Can Learn from Automotive Joining Technologies, Materials, and Automation	Wagon Wills, Gonzalez Group Dr. Randy Brost, Sandia	video	Slides, Flyer
August 1, 2022	13 HeliCon Interns, NREL/SNL/DOE	13 HeliCon Interns, NREL/SNL/DOE	video	Slides, Flyer
July 13, 2022	Heliostat Aerodynamics and Wind Load: Characterization and Prediction in Atmospheric Boundary Layer	Matthew Emes, University of Adelaide	video	Slides, Flyer
June 29, 2022	Soiling Losses for Concentrating Solar Power – Prediction, Assessment, and Mitigation	Dr. Michael Cholette, Queensland University of Technology	video	Slides, Flyer





Get in Touch!

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