

U.S. Department of Energy

HelioCon

Heliostat Consortium for
Concentrating Solar-Thermal Power

Heliostat Consortium: Update on Resource, Training, and Education Development and Women+ in Concentrating Solar

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July 10-12, 2023

ASME

Washington, D.C.

conceptual design



components



integration

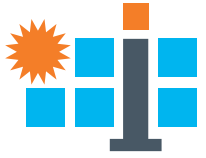


mass production



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

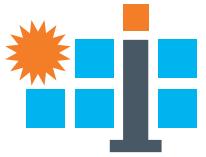
integration

mass production



heliostat field

Scope of Resource, Training, and Education



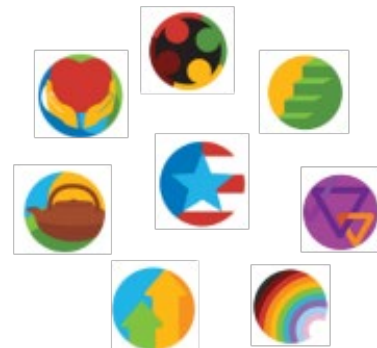
University Involvement



Training Resources

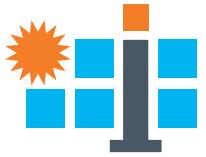


Diversity, Equity, and Inclusion



Online Database

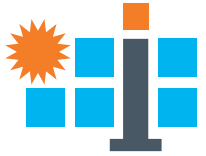




HelioCon RTE Objectives

- 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 Top Ranked Gaps

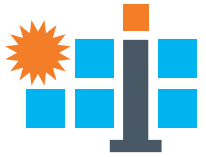


Tier 1 Gaps (Most Important)

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

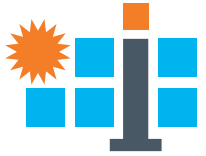
Recommended Pathways

HelioCon scope focuses on the resource database

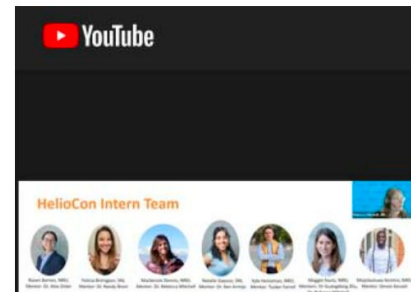
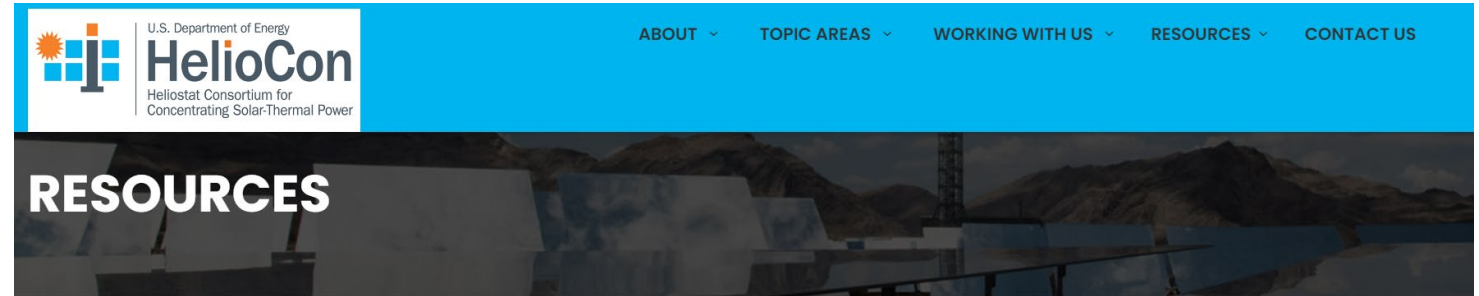


Gaps	Recommended Pathways
R1: Heliostat technology resources are not accessible in a centralized-web based format	<ul style="list-style-type: none"> • Compile institutional knowledge, such as manufacturing and plant O&M best practices and lessons learned through interviews and surveys • Compile available 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

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



- Reference library
- Education and training resources
- Lists of heliostat component suppliers and developers, metrology tools, and software tools
- Existing power tower plant database
- List of standards/guidelines
- Summary of best practices and lessons learned
- References to external resources



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](#)

Reference Library



https://www.zotero.org/groups/4045055/solar_thermal_application/library

- Create in Zotero
- Scientific publications pertaining to heliostats and power tower solar fields
- Over 300 publicly available sites and articles

The screenshot shows the Zotero web interface for the 'Solar_Thermal_Application' group. The interface includes a search bar at the top right with the text 'Title, Creator, Year'. Below the search bar, there are navigation links for 'Groups', 'Documentation', 'Forums', 'Get Involved', and 'Log In'. The main content area displays a list of documents with columns for 'Title', 'Creator', and 'Date'. The list includes items such as '10 Largest Glass Manufacturers in the ...', '11,600,000,000 ZAR to USD - South Af...', '180822_SolarPACES-Heliostat-Guidelin...', '2002_05_Neumann_representative_terr...', '2012_Volume1_AR_8.pdf', '2014_10_DroneDrivenPhotogrammetr...', '2014_10_DroneDrivenPhotogrammetr...', '2021 Annual Technology Baseline - Co...', '2021 IEEE 48th IEEE Photovoltaic Speci...', and '2022 Annual Technology Baseline'. A sidebar on the left shows a tree view of the library structure, including folders like 'Advanced Heliostat Manufacturing', 'Heliostat Components and Controls', 'Heliostat Field Deployment', 'Heliostat Metrology and Standards', 'Heliostat Resources, Training and E...', 'Heliostat Techno-economic Analysis', 'Miscellaneous', 'S0038092X22003644', and 'SeasonalStorage'. The number '1331 i' is visible in the bottom right corner of the document list area.

Title	Creator	Date
10 Largest Glass Manufacturers in the ...	Industry Select	2020-12-10
11,600,000,000 ZAR to USD - South Af...	XE	2022-03-29
180822_SolarPACES-Heliostat-Guidelin...		
2002_05_Neumann_representative_terr...		
2012_Volume1_AR_8.pdf		
2014_10_DroneDrivenPhotogrammetr...		
2014_10_DroneDrivenPhotogrammetr...		
2021 Annual Technology Baseline - Co...	NREL	2021
2021 IEEE 48th IEEE Photovoltaic Speci...	IEEE Photovoltaic Specialists ...	2021
2022 Annual Technology Baseline	NRFI	2022

Education and Training Resources



https://heliocan.org/resources/heliocan_esev.html

[https://heliocan.org/resource_download/An Overview of Heliostats and Concentrating Solar Power Tower Plants.pdf](https://heliocan.org/resource_download/An_Overview_of_Heliostats_and_Concentrating_Solar_Power_Tower_Plants.pdf)

- Video recordings and slides from the HelioCon seminar series featuring industry and R&D experts
- Two-part video tutorial on SolTrace
- Introductory document on CSP power tower plants and heliostats through the design cycle

zotero

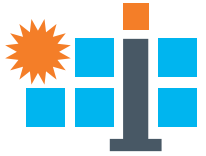
Groups Documentation Forums Get Involved Log In

Q Title, Creator, Year

Other Group Libraries		Title	Creator	Date	
▼ Solar_Thermal_Application					
▶ Advanced Heliostat Manufacturing		10 Largest Glass Manufacturers in the ...	Industry Select	2020-12-10	
▶ Heliostat Components and Controls		11,600,000,000 ZAR to USD - South Af...	XE	2022-03-29	
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▶ Heliostat Resources, Training and E...		2012_Volume1_AR_8.pdf			
▶ Heliostat Techno-economic Analysis		2014_10_DroneDrivenPhotogrammetr...			
▶ Miscellaneous		2014_10_DroneDrivenPhotogrammetr...			
▶ S0038092X22003644		2021 Annual Technology Baseline - Co...	NREL	2021	
▶ SeasonalStorage		2021 IEEE 48th IEEE Photovoltaic Speci...	IEEE Photovoltaic Specialists ...	2021	
		2022 Annual Technology Baseline	NRFI	2022	

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Components, Metrology, and Software



https://heliocn.org/resources/Background_on_Concentrating_Solar_Power.html

- Components list includes solar field equipment suppliers, thermal energy system providers, and power block equipment suppliers
- Metrology list includes tools to measure specular reflectance, opto-mechanical errors, and heliostat shape
- Software list includes tools for modeling, simulation, and optimization of CSP power systems

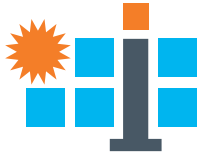
An Overview of Heliostats and Concentrating Solar Power Tower Plants

This downloadable report, '*An Overview of Heliostats and Concentrating Solar Power Tower Plants*,' includes a summary of design types and concerns, components, field implementation and performance assessment of heliostats, along with the standard solar power tower plant design as a reference to those interested in heliostats and CSP tower technology.

Downloads:

- [An Overview of Heliostats and Concentrating Solar Power Tower Plants \(PDF\)](#)
- [Metrology Tools List \(.xlsx\)](#)
- [Software \(.xlsx\)](#)
- [Component supplier \(.xlsx\)](#)

Power Tower Plant Database



- Field layout, tower, and heliostat design data
- Timeline of plant construction, commissioning, and operation
- Plant power generation data
- Major plant events and lessons learned
- Plant image gallery

Ivanpah Solar Electric Generating System



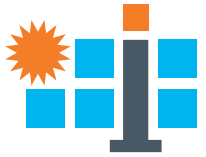
General Plant Data

Location: Primm, NV California US

Owner: NRG, [Brightsource](#), Google

Capacity: 377MW

- Tower 1: 120MW
- Tower 2: 133MW
- Tower 3: 133MW



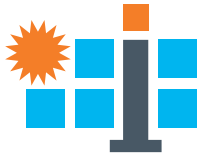
Women+ in Concentrating Solar

- Formed at SolarPACES 2022 to promote education, professional development, and advancement of underrepresented genders in the Concentrated Solar Power community
- Use our expert database to recruit speakers from diverse backgrounds: <https://women.solarpaces.org/members/>
- Mentorship program coming soon!



Become a member today, all gender identities welcome!

<https://women.solarpaces.org/register/>



Get in Touch!

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- <https://heliocan.org/>