Concentrated Solar Power Technologies Training Course

Professional Development Training Course Outline

Category	Renewable Energy	**Duration**	5 Days
Base Fee	$1,500 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Concentrated Solar Power (CSP) is an advanced renewable energy technology that uses mirrors, lenses, or heliostat fields to concentrate direct solar radiation and convert it into high-temperature thermal energy for electricity generation and industrial applications. The technology is increasingly relevant to grid flexibility, renewable energy integration, long-duration energy storage, energy security, and low-carbon power generation. Current research is particularly focused on high-temperature Gen3 CSP, advanced molten-chloride salts, improved heat exchangers, and sCO? Brayton cycles.

Concentrated Solar Power Technologies Training Course develops practical and technical competence in the complete CSP value chain from solar resource assessment, optical concentration and collector design to thermal receivers, heat-transfer fluids, thermal energy storage, power blocks, plant control, performance optimization, techno-economic analysis, and project development. Participants will examine real-world CSP applications and case studies while exploring emerging opportunities in dispatchable solar power, hybrid renewable energy systems, industrial decarbonization, solar process heat, green hydrogen, solar thermal desalination, and high-temperature thermal storage. The course connects engineering theory with practical plant operation, project decision-making, and the latest technology pathways for achieving reliable, flexible, and low-carbon energy systems.

Programme Curriculum

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Course Duration

5 days

Course Objectives

By the end of the training, participants will be able to:

1. Explain CSP fundamentals and distinguish CSP from photovoltaic and other renewable-energy technologies.
2. Assess solar resource availability, including Direct Normal Irradiance (DNI), solar geometry, and site suitability.
3. Analyze parabolic trough, linear Fresnel, solar tower, and dish-Stirling CSP technologies.
4. Understand heliostat-field design, optical efficiency, tracking systems, and solar concentration.
5. Evaluate thermal receivers, heat-transfer fluids (HTFs), heat exchangers, and high-temperature materials.
6. Design and assess Thermal Energy Storage (TES) configurations, including two-tank molten-salt systems and emerging storage concepts.
7. Analyze molten-salt technology, high-temperature chloride salts, corrosion management, and next-generation storage.
8. Understand steam Rankine and supercritical CO? Brayton power cycles for CSP applications.
9. Apply energy, exergy, efficiency, and heat-balance analysis to CSP systems.
10. Evaluate CSP plant performance, reliability, dispatchability, capacity factor, and grid flexibility.
11. Conduct preliminary techno-economic, LCOE, CAPEX/OPEX, and lifecycle assessments of CSP projects.
12. Develop strategies for CSP integration with PV, batteries, green hydrogen, industrial heat, and renewable-energy hubs.
13. Evaluate emerging Gen3 CSP, advanced TES, digital optimization, AI-enabled controls, and decarbonization opportunities.

Target Audience

1. Renewable Energy Engineers and Solar Engineers
2. Electrical, Mechanical, Chemical, and Energy Engineers
3. CSP Plant Operators and Maintenance Professionals
4. Energy Managers and Sustainability Professionals
5. Power-System Planners and Grid Integration Specialists

6. Project Developers, Investors, and Energy Consultants
7. Government, Utility, and Energy-Regulatory Professionals
8. Researchers, Academics, Lecturers, and Technical Students

Course Modules

Module 1: CSP Fundamentals and Solar Resource Assessment

- CSP principles and energy-conversion pathways
- Direct Normal Irradiance (DNI), solar geometry, and solar resource mapping
- Solar concentration ratios and optical fundamentals
- Site selection, land requirements, water availability, and environmental considerations
- Case Study: Solar-resource assessment and preliminary site selection for a utility-scale CSP project

Module 2: CSP Collector and Concentrator Technologies

- Parabolic trough collector design and operation
- Linear Fresnel reflector technology and applications
- Solar power tower/central receiver systems
- Dish concentrators and advanced concentrating solar thermal systems
- Optical efficiency, tracking, shading, blocking, and concentrator performance
- Case Study: Comparison of a parabolic trough plant and solar tower plant under the same solar-resource conditions.

Module 3: Solar Receivers, Heat-Transfer Fluids and High-Temperature Systems

- Solar receiver configurations and heat-transfer mechanisms
- Synthetic oil, molten salt, water/steam, and advanced HTF technologies
- High-temperature receiver materials and thermal losses
- Heat exchangers and thermal-fluid management
- **Corrosion, degradation, safety, and reliability challenges**
- **Case Study:** Selection of an appropriate HTF and receiver configuration for a next-generation CSP plant.

Module 4: Thermal Energy Storage and Molten-Salt Technologies

- **Thermal Energy Storage (TES)** fundamentals and sizing
- Two-tank molten-salt storage systems
- Sensible, latent, thermochemical, packed-bed, and advanced TES concepts
- High-temperature molten-chloride salts and corrosion control
- TES charging, discharging, round-trip performance, and dispatch optimization
- **Case Study:** Designing a multi-hour molten-salt storage system to extend CSP generation beyond sunset.

Module 5: CSP Power Cycles and Power-Block Integration

- **Steam Rankine cycle** for conventional CSP plants
- Supercritical CO? (**sCO?**) Brayton cycle fundamentals
- Turbines, compressors, generators, condensers, and heat exchangers
- Thermal-to-electric efficiency and exergy performance
- Integration of high-temperature receivers, TES, and advanced power blocks

- **Case Study:** Comparison of a conventional steam Rankine cycle with an advanced sCO? cycle for a solar-tower application.

Module 6: CSP Plant Design, Control, Operation and Performance Optimization

- CSP plant configuration and major balance-of-plant systems
- **Energy and exergy analysis**
- Plant controls, forecasting, tracking, and automated operation
- Performance indicators: efficiency, availability, capacity factor, and LCOE
- Digitalization, predictive maintenance, AI-assisted optimization, and smart plant operation
- **Case Study:** Optimizing CSP dispatch using solar forecasts, TES state-of-charge, electricity demand, and grid requirements.

Module 7: CSP Project Development, Economics and Renewable Integration

- CSP feasibility studies and project-development lifecycle
- CAPEX, OPEX, LCOE, financial modeling, and risk assessment
- Grid integration and dispatchable renewable energy
- CSP-PV, CSP-battery, and hybrid renewable-energy systems
- Industrial process heat, desalination, green hydrogen, and decarbonization applications
- **Case Study:** Development of a hybrid PV-CSP project designed to provide daytime solar electricity and evening dispatchable power.

Module 8: Advanced CSP, Emerging Technologies and Future Trends

- Gen3 CSP and ultra-high-temperature solar thermal systems
- Advanced molten salts and high-temperature TES
- sCO? power conversion and advanced heat exchangers
- CSP for industrial decarbonization, green hydrogen, desalination, and thermal applications
- Future CSP markets, innovation pathways, digital twins, AI optimization, and commercialization
- Case Study: Conceptual design of a next-generation CSP plant combining a high-temperature receiver, advanced molten-salt TES, and an sCO? Brayton power cycle.

Training Methodology

- Interactive lectures and presentations.
- Group discussions and brainstorming sessions.
- Hands-on exercises using real-world datasets.
- Role-playing and scenario-based simulations.
- Analysis of case studies to bridge theory and practice.
- Peer-to-peer learning and networking.
- Expert-led Q&A sessions.
- Continuous feedback and personalized guidance.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
21 Sep 2026	25 Sep 2026	Online	$1,000
21 Sep 2026	25 Sep 2026	Physical	$1,500
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0
21 Sep 2026	25 Sep 2026	Physical	$0

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