Advanced Wind Farm Design Training Course

Professional Development Training Course Outline

Category	Renewable Energy	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

Advanced Wind Farm Design Training Course is designed to develop advanced expertise in next-generation wind energy systems, offshore and onshore wind farm engineering, digital wind resource assessment, turbine optimization, and sustainable renewable energy project development. With the global transition toward clean energy, net-zero targets, carbon neutrality, and renewable power expansion, wind energy professionals require advanced skills in aerodynamic modeling, wind farm layout optimization, advanced simulation tools, energy yield forecasting, and smart grid integration. This course equips engineers, project developers, consultants, and energy professionals with practical knowledge to design efficient, reliable, and economically viable wind farms using modern industry standards and emerging technologies.

The program integrates advanced wind farm planning, computational fluid dynamics (CFD), wake effect analysis, AI-driven optimization, offshore wind technologies, hybrid renewable systems, digital twins, and predictive analytics. Through real-world case studies, industry examples, and practical design exercises, participants gain the capability to manage complete wind farm development cycles from site selection and feasibility analysis to turbine selection, construction planning, performance monitoring, and lifecycle optimization. The course prepares professionals to contribute effectively to the rapidly growing global wind power market and sustainable energy transformation.

Programme Curriculum

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Course Objectives

1. Develop advanced expertise in wind farm design engineering and renewable energy project development.
2. Master wind resource assessment, forecasting, and advanced meteorological analysis techniques.
3. Apply AI-powered optimization and digital technologies for wind farm performance improvement.
4. Understand onshore and offshore wind farm design principles and engineering challenges.
5. Perform advanced wind turbine selection, micrositing, and layout optimization.
6. Analyze wake losses, turbulence impacts, and aerodynamic efficiency improvements.
7. Utilize industry-standard wind energy simulation and modeling software tools.
8. Design cost-effective wind projects using energy yield analysis and financial modeling strategies.
9. Implement smart wind farm monitoring, automation, and predictive maintenance solutions.
10. Develop knowledge of grid integration, energy storage, and hybrid renewable systems.
11. Apply sustainable practices aligned with net-zero energy and ESG goals.
12. Evaluate offshore wind challenges including marine engineering, foundations, and floating wind systems.
13. Build professional capability for future-ready renewable energy leadership and innovation.

Target Audience

1. Wind Energy Engineers
2. Renewable Energy Project Managers
3. Mechanical and Electrical Engineers
4. Wind Farm Developers
5. Energy Consultants
6. Sustainability and ESG Professionals
7. Power System Engineers
8. Government Energy Officials

Course Modules

Module 1: Fundamentals of Advanced Wind Farm Engineering

- Evolution of modern wind energy technologies and global market trends.
- Wind farm development lifecycle and engineering requirements.
- Key principles of advanced wind turbine technology.
- Renewable energy transition and decarbonization strategies.
- **Case Study:** Development approach of a large-scale European onshore wind farm.

Module 2: Advanced Wind Resource Assessment

- Meteorological data collection and validation techniques.
- Wind measurement systems and remote sensing technologies.
- Long-term wind resource prediction methodologies.
- Advanced uncertainty analysis and forecasting models.
- **Case Study:** Wind resource optimization for a utility-scale wind project.

Module 3: Wind Farm Site Selection and Feasibility Analysis

- Geographic information system (GIS)-based site evaluation.
- Environmental and regulatory assessment processes.
- Terrain analysis and infrastructure planning.
- Land suitability and project risk evaluation.
- **Case Study:** Site selection strategy for a renewable energy development zone.

Module 4: Wind Turbine Technology and Selection

- Advanced turbine designs and performance characteristics.
- Turbine rating, rotor diameter, and hub height optimization.
- Direct-drive and variable-speed turbine technologies.
- Offshore and next-generation turbine innovations.
- **Case Study:** Turbine selection optimization for high-wind regions.

Module 5: Wind Farm Layout Optimization

- Principles of optimal turbine positioning.
- Micrositing techniques and layout constraints.
- Terrain effects and atmospheric conditions.
- Optimization algorithms for maximum energy production.
- **Case Study:** Layout redesign improving annual energy output.

Module 6: Wake Effect Modeling and Reduction

- Understanding turbine wake interactions.
- Wake modeling methods and simulation approaches.
- Turbulence intensity analysis.
- Strategies for minimizing wake losses.
- **Case Study:** Wake optimization in a multi-turbine wind farm.

Module 7: Computational Fluid Dynamics (CFD) Applications

- CFD fundamentals for wind engineering.
- Atmospheric flow simulation techniques.
- Complex terrain modeling.
- Advanced aerodynamic analysis.

- **Case Study:** CFD-based optimization of mountainous wind sites.

Module 8: Wind Farm Simulation and Digital Modeling

- Advanced wind simulation platforms and workflows.
- Digital twin concepts for wind assets.
- Performance prediction modeling.
- Data-driven wind farm optimization.
- **Case Study:** Digital twin implementation for predictive performance improvement.

Module 9: Offshore Wind Farm Design

- Offshore wind development fundamentals.
- Marine environment assessment.
- Floating and fixed-bottom wind technologies.
- Offshore electrical infrastructure planning.
- **Case Study:** Offshore wind farm development in deep-water environments.

Module 10: Electrical System Design and Grid Integration

- Wind farm electrical architecture.
- Collection systems and substations.
- Grid stability and power quality challenges.
- Energy storage and hybrid renewable integration.
- **Case Study:** Grid-connected wind project integration strategy.

Module 11: Energy Yield Analysis and Performance Optimization

- Annual energy production calculations.
- Loss assessment methodologies.
- Availability and efficiency improvement.
- Production forecasting techniques.
- **Case Study:** Increasing wind farm profitability through optimization.

Module 12: Wind Farm Construction and Project Management

- Engineering procurement and construction processes.
- Logistics and installation planning.
- Risk management strategies.
- Quality control and commissioning.
- **Case Study:** Construction management of a large wind farm project.

Module 13: Operations, Maintenance, and Asset Management

- Smart monitoring systems.
- Predictive maintenance technologies.
- AI-based fault detection.
- Lifecycle management strategies.
- **Case Study:** Reducing downtime through digital maintenance solutions.

Module 14: Advanced Analytics, AI, and Smart Wind Farms

- Artificial intelligence applications in wind energy.

- Machine learning for forecasting and optimization.
- Big data analytics for operational improvement.
- Automation and autonomous wind operations.
- **Case Study:** AI-driven wind farm performance enhancement.

Module 15: Future Trends in Wind Energy Innovation

- Floating offshore wind expansion.
- Hydrogen production from wind energy.
- Hybrid renewable energy systems.
- Next-generation turbine technologies.
- **Case Study:** Future renewable energy hub development.

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
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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