Wind Farm Energy Yield Analysis 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

Wind Farm Energy Yield Analysis is a critical discipline for renewable energy project development, wind resource assessment, bankable energy forecasting, project finance, and performance optimization. Accurate estimation of Annual Energy Production (AEP) requires practitioners to combine high-quality wind measurements, long-term climate data, wind-flow modeling, turbine power curves, wake modeling, technical and environmental losses, and uncertainty analysis. Modern industry practice increasingly emphasizes data quality, probabilistic modeling, SCADA-informed analysis, wake-loss characterization, and P50/P75/P90 energy estimates to support robust investment and operational decisions.

Wind Farm Energy Yield Analysis Training Course develops the technical capabilities required to undertake end-to-end wind farm energy yield assessments, from measurement-data quality control and long-term correction through wind-flow modeling, turbine selection, micrositing, wake analysis, loss modeling, uncertainty quantification, and energy-yield reporting. Participants will work with realistic project scenarios and case studies covering onshore wind farms, complex terrain, large-scale projects, SCADA-based validation, curtailment, availability, electrical losses, and financial-grade energy assessment. The course reflects established approaches used in tools and methodologies such as WAsP, windPRO, GIS, IEC-aligned assessment, and advanced wake modeling.

Programme Curriculum

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Course Duration

5 days

Course Objectives

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

1. Understand wind resource assessment principles and the complete energy-yield workflow.
2. Perform wind-data quality control, validation, filtering, and gap-filling.
3. Apply Measure-Correlate-Predict (MCP) techniques for long-term wind-resource correction.
4. Analyze wind speed distributions, wind roses, turbulence, shear, and atmospheric conditions.
5. Develop wind-resource models using terrain, roughness, elevation, and flow-modeling data.
6. Calculate gross and net Annual Energy Production (AEP) using turbine power curves.
7. Evaluate wake effects, wake losses, blockage, and wind-farm efficiency.
8. Quantify technical, electrical, environmental, availability, curtailment, and other losses.
9. Apply SCADA analytics and operational data to validate and improve yield estimates.
10. Perform uncertainty quantification and develop P50, P75, and P90 energy estimates.
11. Interpret IEC-aligned wind-energy assessment and power-performance concepts.
12. Prepare professional energy-yield assessment reports suitable for technical, development, and investment decision-making.
13. Use scenario analysis, data analytics, and emerging AI/ML techniques to improve forecasting and project optimization.

Target Audience

1. Wind Energy Engineers and renewable-energy engineers
2. Wind Resource Assessment Specialists
3. Energy Yield Analysts and Consultants
4. Wind Farm Developers and Project Managers
5. Asset Managers and Operations & Maintenance Professionals
6. Technical Advisors, Lenders' Engineers, and Due-Diligence Specialists
7. GIS, Meteorological, Data Science, and Energy Analysts
8. Researchers, Academics, Graduates, and Energy Professionals

Course Modules

Module 1: Fundamentals of Wind Farm Energy Yield Analysis

- Wind-energy conversion principles and the **energy-yield assessment lifecycle**.
- Wind-resource characteristics: speed, direction, turbulence, shear, and air density.
- Gross AEP, net AEP, capacity factor, full-load hours, and energy-density concepts.
- Overview of **bankable energy assessment** and investment decision-making.
- **Case Study:** Preliminary energy-yield assessment for a proposed onshore wind farm.

Module 2: Wind Measurement, Data Quality & Long-Term Correction

- Meteorological mast, LiDAR, SoDAR, remote sensing, and measurement strategies.
- **Data validation, quality control, outlier detection, and data completeness**.
- Wind-speed and wind-direction distributions, wind roses, and time-series analysis.
- **MCP and reanalysis datasets** for long-term climate correction.
- **Case Study:** Correcting a short-term measurement campaign using long-term reference data.

Module 3: Wind Resource Modeling & Site Characterization

- Terrain, elevation, roughness, obstacles, and surface characteristics.
- **Wind-flow modeling** and spatial extrapolation of wind conditions.
- Vertical and horizontal wind-resource extrapolation.
- Complex-terrain considerations and model limitations.
- **Case Study:** Developing a wind-resource map for a complex-terrain project using site and terrain data.

Module 4: Turbine Selection, Micrositing & Power-Curve Analysis

- Turbine technology, hub height, rotor diameter, rated power, and site suitability.
- Understanding and applying **manufacturer power curves**.
- Air-density correction and power-performance considerations.
- Turbine micrositing and optimization of annual energy production.
- **Case Study:** Comparing turbine configurations to identify an optimized project layout.

Module 5: Wake Modeling & Wind Farm Optimization

- Fundamentals of **wake formation, wake recovery, and turbine-to-turbine interaction**.
- Engineering wake models and wake-superposition approaches.
- Wake losses, wind-sector effects, blockage, and array efficiency.
- Layout optimization and trade-offs between energy yield and turbine spacing.
- **Case Study:** Quantifying wake losses and redesigning a wind-farm layout to improve AEP.

Module 6: Losses, Availability, Curtailment & Net AEP

- Technical availability, electrical losses, turbine performance, and grid losses.
- Environmental losses, icing, high-wind shutdown, and temperature effects.
- **Curtailment, grid constraints, noise, shadow-flicker, and sector management**
- Building a transparent **loss tree** from gross to net energy production.
- **Case Study:** Developing a complete net-AEP model incorporating multiple project losses.

Module 7: Uncertainty, P50/P75/P90 & Bankable Energy Assessment

- Sources of uncertainty in wind-resource and energy-yield calculations.
- Measurement, long-term variability, flow modeling, power curve, wake, and loss uncertainties.
- **Probability distributions, Monte Carlo concepts, and uncertainty aggregation**.
- Development and interpretation of **P50, P75, P90, and exceedance probabilities**.

- **Case Study:** Preparing a lender-oriented energy assessment with uncertainty and exceedance statistics.

Module 8: Advanced Energy Yield Analytics, SCADA & Reporting

- SCADA data processing for **performance benchmarking and yield validation**.
- Comparing predicted versus actual production and diagnosing performance gaps.
- Advanced **data analytics, AI/ML concepts, predictive analytics, and digitalization** for wind farms.
- Building professional energy-yield dashboards, KPIs, and technical reports.
- **Case Study:** Complete energy-yield assessment of a hypothetical wind farm—from raw measurements to final P50/P90 results and investment recommendations.

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	27 Nov 2026	Online	$1,000
23 Nov 2026	27 Nov 2026	Physical	$1,500
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$3,000
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$4,500
23 Nov 2026	27 Nov 2026	Physical	$6,000
23 Nov 2026	27 Nov 2026	Physical	$6,000

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