Wind Energy Forecasting and Analytics 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 Energy Forecasting and Analytics Training Course provides a practical, data-driven pathway for professionals seeking advanced capabilities in wind power forecasting, renewable energy analytics, SCADA data analysis, machine learning, artificial intelligence (AI), time-series modeling, and grid integration. As wind generation becomes increasingly important to modern power systems, accurate forecasting is essential for energy scheduling, grid stability, balancing, asset optimization, and improved renewable-energy utilization. Current industry and research developments increasingly emphasize deep learning, Transformer architectures, physics-informed machine learning, probabilistic forecasting, digital twins, explainable AI, and real-time analytics.

The course combines technical concepts, practical datasets, analytical exercises, forecasting model development, visualization, and industry case studies to help participants translate operational data into actionable energy insights. Learners explore the complete analytics lifecycle from SCADA and meteorological data acquisition through preprocessing, feature engineering, model development, validation, uncertainty analysis, and deployment. Case-based learning reflects emerging applications such as digital twins for wind farms, predictive maintenance, intelligent operations, wake-effect analysis, and AI-enabled energy management, giving participants a strong foundation for applying advanced analytics to real-world wind-energy challenges.

Programme Curriculum

Wind Energy Forecasting and Analytics Training Course

Introduction

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Course Duration

5 days

Course Objectives

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

1. Understand wind energy forecasting principles, variability, uncertainty, and operational requirements.
2. Analyze SCADA, meteorological, IoT, and historical wind-power datasets.
3. Apply data preprocessing, cleaning, feature engineering, and quality-control techniques.
4. Build short-term, medium-term, and long-term wind-power forecasting workflows.
5. Apply machine learning and deep learning algorithms to wind-energy prediction.
6. Explore LSTM, RNN, Transformer, ensemble, and hybrid forecasting models.
7. Perform time-series analysis, cross-validation, and forecast-error evaluation.
8. Develop probabilistic forecasting and uncertainty quantification approaches.
9. Use explainable AI (XAI) techniques to interpret forecasting and analytics results.
10. Apply predictive analytics and anomaly detection for wind-turbine performance monitoring.
11. Explore digital twin and physics-informed machine learning applications in wind-energy operations.
12. Develop analytics that support grid integration, dispatch, energy scheduling, and renewable-energy optimization.
13. Translate analytical outputs into data-driven operational and investment decisions.

Target Audience

1. Wind Energy Engineers and renewable-energy engineers
2. Electrical and Power Systems Engineers
3. Energy Data Analysts and data scientists
4. SCADA, IoT, and Monitoring Specialists
5. Wind Farm Operations and Maintenance Professionals
6. Utility, Grid Operations, and Energy Planning Professionals
7. Renewable-Energy Consultants and Project Managers
8. Researchers, Academics, and Technical Professionals working with AI and energy analytics

Course Modules

Module 1: Fundamentals of Wind Energy Forecasting

- Wind-resource characteristics and **power-generation variability**
- Forecasting horizons
- Wind-turbine power curves and forecasting workflows
- Forecasting requirements for **grid operations and energy markets**
- **Case Study:** Developing a baseline forecasting workflow for a utility-scale wind farm

Module 2: Wind Energy Data Acquisition and SCADA Analytics

- **SCADA data architecture**, sensors, tags, and operational parameters
- Integration of **wind speed, direction, temperature, nacelle orientation, rotor speed, and power output**
- Meteorological, reanalysis, remote-sensing, and IoT data sources
- Data-quality assessment, missing values, outliers, and sensor anomalies
- **Case Study:** Cleaning and analyzing real-world wind-turbine SCADA time-series data

Module 3: Data Analytics, Feature Engineering and Time-Series Modeling

- Exploratory data analysis and **data visualization**
- Time-series decomposition, trends, seasonality, and autocorrelation
- Feature engineering for wind-speed and power forecasting
- Lag variables, rolling statistics, weather features, and turbine operating states
- **Case Study:** Creating predictive features from multi-parameter wind-farm datasets

Module 4: Machine Learning for Wind Power Forecasting

- **Regression, Random Forest, Gradient Boosting, XGBoost, and ensemble learning**
- Model training, testing, cross-validation, and hyperparameter optimization
- Forecasting performance metrics including **MAE, RMSE, MAPE, and R^2**
- Model comparison, overfitting prevention, and generalization
- **Case Study:** Comparing traditional machine learning models for wind-power prediction

Module 5: Deep Learning, Transformers and Advanced Forecasting

- **LSTM, RNN, BiLSTM, attention mechanisms, and sequence modeling**
- Introduction to **Transformer-based time-series forecasting**
- Multi-step and spatio-temporal wind-power forecasting
- Hybrid and ensemble deep-learning architectures
- **Case Study:** Applying a Transformer-based framework to multi-step wind-power forecasting

Module 6: Probabilistic Forecasting, Uncertainty and Explainable AI

- Deterministic versus **probabilistic forecasting**
- Prediction intervals and **uncertainty quantification**
- Forecast-error analysis and calibration
- **Explainable AI, feature importance, and SHAP-based interpretation**
- **Case Study:** Using interpretable AI to understand drivers of wind-power forecast uncertainty

Module 7: Predictive Analytics, Digital Twins and Wind-Farm Optimization

- **Anomaly detection and predictive maintenance**

- Wind-turbine performance analytics and early-warning indicators
- **Digital twin** concepts for monitoring, simulation, and optimization
- Wake effects, turbine interactions, curtailment, and operational scenarios
- **Case Study:** Using a digital-twin approach to analyze wind-farm performance and operational scenarios

Module 8: Grid Integration, Deployment and Capstone Analytics

- Forecast-informed **energy scheduling, dispatch, and grid balancing**
- Real-time analytics and forecasting-system deployment
- Dashboard development and communication of forecast insights
- Model monitoring, retraining, governance, and operational integration
- **Case Study:** Designing an end-to-end wind forecasting solution for renewable-energy grid integration

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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