Hydropower Rehabilitation and Modernization 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

Hydropower Rehabilitation and Modernization Training Course is designed to equip participants with the technical, managerial, and digital capabilities required to extend the service life, improve reliability, increase efficiency, and modernize aging hydropower assets. The course covers the complete modernization lifecycle from condition assessment, rehabilitation planning, hydraulic and electromechanical upgrades, asset management, predictive maintenance, digitalization, cybersecurity, grid flexibility, and sustainability through to investment appraisal and implementation. IEEE 1147-2021 specifically provides guidance for the technical and economic evaluation of existing hydroelectric installations for rehabilitation, while current industry initiatives increasingly emphasize digitalization, advanced sensing, predictive maintenance, and cybersecurity.

Participants will explore how Digital Twins, Artificial Intelligence (AI), Internet of Things (IoT), SCADA analytics, predictive maintenance, condition-based maintenance, advanced monitoring, data-driven asset management, and climate resilience can transform existing hydropower facilities. Recent research positions Digital Twin-enabled predictive maintenance as an emerging pathway from monitoring and diagnosis toward prognostics and prescriptive maintenance, while European hydropower initiatives are demonstrating integrated approaches to condition monitoring, forecasting, environmental management, and intelligent asset management. Through technical case studies, workshops, simulations, group exercises, and project-based learning, participants will develop practical strategies for life extension, performance optimization, outage reduction, risk management, operational resilience, and sustainable modernization.

Programme Curriculum

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5 days

Course Objectives

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

1. Assess hydropower asset condition using modern inspection, diagnostics, and performance-assessment techniques.
2. Develop risk-based rehabilitation and modernization strategies for aging hydropower facilities.
3. Evaluate turbine, generator, transformer, control, protection, and auxiliary-system upgrades.
4. Apply predictive maintenance, condition-based maintenance, and reliability-centered maintenance principles.
5. Integrate SCADA, IoT sensors, data analytics, and intelligent monitoring into modernization programs.
6. Understand the application of Digital Twins and AI-driven diagnostics for hydropower asset management.
7. Improve plant efficiency, availability, reliability, and operational flexibility through targeted modernization.
8. Develop life-cycle cost, investment appraisal, and capital-planning approaches for rehabilitation projects.
9. Strengthen dam, civil works, hydraulic infrastructure, and electromechanical rehabilitation decision-making.
10. Incorporate cybersecurity, critical-infrastructure protection, and digital resilience into modernization programs.
11. Apply climate resilience, environmental sustainability, and water-resource optimization principles.
12. Plan modernization projects using project risk management, procurement, contract management, and performance KPIs.
13. Develop an integrated Hydropower Modernization Roadmap aligned with operational, financial, environmental, and grid requirements.

Target Audience

1. Hydropower plant managers and operations managers

2. Mechanical, electrical, civil, and hydraulic engineers
3. Asset management and maintenance professionals
4. Utility and independent power producer (IPP) executives
5. Renewable-energy and power-system specialists
6. Project managers, consultants, and engineering contractors
7. Regulators, policymakers, financiers, and infrastructure planners
8. Researchers, technical specialists, and energy-sector professionals

Course Modules

Module 1: Hydropower Rehabilitation and Modernization Fundamentals

- **Aging hydropower fleet assessment** and modernization drivers
- Rehabilitation versus **replacement, refurbishment, uprating, and redevelopment**
- Hydropower asset lifecycle and **life-extension strategies**
- Modernization priorities: efficiency, availability, flexibility, resilience, and safety
- **Case Study:** Developing a modernization strategy for an aging conventional hydropower plant

Module 2: Condition Assessment, Diagnostics and Rehabilitation Planning

- **Condition assessment** of turbines, generators, transformers, gates, valves, and auxiliaries
- Inspection, testing, vibration monitoring, and **non-destructive testing**
- Failure-mode identification and **risk-based prioritization**
- Remaining useful life and **asset health assessment**
- **Case Study:** Prioritizing rehabilitation investments using condition, criticality, risk, and lifecycle cost

Module 3: Turbine, Generator and Electromechanical Modernization

- Turbine rehabilitation, hydraulic optimization, and **efficiency improvement**
- Generator rewinding, insulation systems, cooling, and performance upgrades
- Governor, excitation, protection, and **control-system modernization**
- Transformer, switchgear, auxiliary-system, and balance-of-plant upgrades
- **Case Study:** Uprating an existing generating unit to improve efficiency and operational availability

Module 4: Civil, Hydraulic and Dam Infrastructure Rehabilitation

- Assessment of **waterways, penstocks, tunnels, spillways, gates, and intake structures**
- Structural deterioration, corrosion, erosion, leakage, and material degradation
- Modern repair technologies and **high-performance rehabilitation materials**
- Hydraulic performance, sediment management, and infrastructure resilience
- **Case Study:** Rehabilitation planning for deteriorating hydraulic infrastructure while maintaining generation continuity

Module 5: Digitalization, SCADA, IoT and Digital Twins

- Modern **SCADA architecture**, instrumentation, sensors, and data acquisition
- IoT-enabled condition monitoring and **real-time asset intelligence**
- Digital Twin concepts for plant modeling, monitoring, simulation, and decision support
- AI, machine learning, analytics, and **predictive maintenance**
- **Case Study:** Designing a Digital Twin-enabled monitoring and predictive-maintenance framework for an existing hydropower plant

Module 6: Asset Management, Reliability and Predictive Maintenance

- **Strategic asset management** and lifecycle planning
- Preventive, predictive, condition-based, and reliability-centered maintenance
- Asset criticality, failure probability, and **risk-based maintenance**
- Reliability, availability, maintainability, and **O&M performance KPIs**
- **Case Study:** Building a predictive-maintenance program to reduce forced outages and extend equipment life

Module 7: Grid Flexibility, Sustainability and Climate Resilience

- Hydropower modernization for **grid flexibility and ancillary services**
- Renewable-energy integration and changing generation requirements
- Climate-risk assessment, water variability, drought, floods, and **resilient operations**
- Environmental performance, ecological monitoring, and sustainable water management
- **Case Study:** Modernizing a hydropower plant to improve flexibility while responding to changing hydrology and grid requirements

Module 8: Modernization Project Delivery, Economics and Implementation

- **Feasibility studies, business cases, and investment appraisal**
- Lifecycle cost analysis, CAPEX/OPEX optimization, and financing considerations
- Procurement, contracting, outage planning, and **project risk management**
- Cybersecurity, change management, commissioning, and performance verification
- **Case Study:** Preparing an integrated rehabilitation and modernization roadmap under budget, outage, and performance constraints

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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