TECHNICAL EDUCATION ACADEMY

School of Business and Management

COURSE PROGRAMME

000589

FIAC014 - The Economics of Renewable Energy Systems

This training offers a comprehensive introduction to renewable energy, including biomass, hydropower, wind, solar, geothermal, and marine energy.



Learn from the Best in the Business!

Course overview

Advanced level

Why take this course

This training offers a comprehensive introduction to renewable energy, including biomass, hydropower, wind, solar, geothermal, and marine energy. It highlights the influence of geographical and climatic factors on the accessibility and efficiency of these resources, and delves into the economic reasons driving the global shift from fossil fuels. This includes rising fossil fuel costs, decreasing expenses of renewable technologies due to advancements, and policies aimed at internalizing environmental costs.

Key technologies such as wind turbines and solar photovoltaic systems are explored, focusing on their design improvements, operational efficiencies, and the technological progress from raw materials to operational plants. The course also covers hydropower and geothermal energy, discussing parameters affecting power generation, and financial and technical challenges.

Participants will learn about the uncertainties in energy output and resource assessment, including the use of data for precise resource assessment and the economic implications of resource variability.

Economic analysis forms a core part of the program, addressing cost factors like capital and operational expenditures, and the levelized cost of electricity. It also includes an overview of renewable energy finance, risk management, and the structuring of power purchase agreements, providing insights into financial strategies and risk mitigation in renewable energy projects.

The training concludes with case studies and analytical tools that offer practical insights, ensuring participants are well-prepared for roles in the dynamic field of renewable energy economics

Who it is for and how it helps

This course is ideal for:

• Energy sector professionals looking to deepen their knowledge of renewable energy economics.
• Financial analysts and investors focusing on the renewable energy market.
• Policy makers and government officials involved in energy regulation and sustainable development.
• Project managers and engineers working in the renewable energy industry.
• Environmental consultants and sustainability officers aiming to integrate renewable energy solutions into their practices.

What you will learn

- Understand the diverse types of renewable energy sources and the environmental and geographical factors influencing their efficiency and deployment
- Analyze the economic and market trends driving the transition from fossil fuels to renewable energy, including the financial implications of policy and technological advancements
- Evaluate the technical aspects and economic viability of specific renewable technologies like wind turbines and solar photovoltaic systems

Course overview — continued

- Assess the uncertainties and variabilities in renewable energy resources using data-driven approaches
- Conduct comprehensive economic and financial analyses of renewable energy projects, including cost assessments and risk management
- Develop strategies for structuring and financing renewable energy projects, understanding stakeholder roles and project bankability

Curriculum

Modules 01–04

01 Introduction to Renewable Energy Sources

- Overview of Renewable Energy: Biomass, Hydropower, Wind Power, Solar Energy, Geothermal Energy, Marine Energy
- Availability and Accessibility: How geographical and climatic factors influence the availability and efficiency of different renewable resources

02 Transitioning to Renewable Energy

- Rising Costs of Fossil Fuels: Market trends and implications.
- Decreasing Costs of Renewables: Technological advances and scaling up
- Accounting for Externalities of Fossil Fuels: Policies to internalize environmental and health costs
- Enabling Policies for Renewable Energy: Incentives, subsidies, and regulatory support
- Global Case Studies: Successful transitions, challenges faced, and lessons learned from around the world

03 Wind Turbines

- Importance of Rotor Blades in Power Output
- Impact of Drive Train Reliability on Energy Costs
- Effects of Increased Rotor Diameters and Tower Heights
- Assessment of Offshore Technology Challenges and Justifications
- Influence of Wind Duration, Speed, and Measurement Variables on Turbine Efficiency

04 Solar Photovoltaic Technology

- From Silicon to Solar PV Power Plants: Growth Constraints
- Future Prospects Across Various Photovoltaic Technologies
- Critical Balance of System Components: Inverters, Transformers, and More
- Analysis of Solar Irradiation Types and Their Implications
- Understanding Measurements: Watt-Peak, Cell Efficiency, and Performance Ratios
- Benefits and Challenges of Tracking Systems in Energy Output

Curriculum

Modules 05–08

05 Hydro Power

- Essential Hydrological Parameters: Catchment Area and Flow Rates
- Hydraulic Structures and Project Types: Dams versus Run-of-River
- Innovations and Performance of Turbine Technologies
- Water Quality and Environmental Factors Affecting Hydro Power
- Integration of Hydro Power with Environmental and Recreational Activities

06 Geothermal Power

- Overview of Geothermal Plant Types and Their Applications
- Financial and Technical Challenges in Geothermal Exploration
- Scalability Potential of Geothermal Power Facilities
- Transition of Enhanced Geothermal Systems to Operational Status
- Utilization of Geothermal Heat and Revenue Generation Opportunities
- Key Geothermal Metrics: Drilling Depth and Induced Water Cycle Effects

07 Energy Uncertainty & Resource Assessment in Renewable Technologies

- Utilization of Satellite and Terrestrial Data for Renewable Resource Assessment
- Significance of Measurement Campaigns for Reliable Energy Production Estimates
- Understanding Power Curve Uncertainties: Expectations vs. Reality
- Decoding Resource Assessment Reports: Standard Deviation, Variance, and Probability Metrics (P50/P90)
- Historical Predictability and Variability in Renewable Resource Assessments
- Impact of Data Duration and Additional Measurements on Bankability
- How Minimizing Uncertainties in Annual Energy Output Enhances Financial Outcomes
- Exploring Sources of Uncertainty and Variability: Expert vs. Layman Perspectives

08 Economics and Cost Analysis of Renewable Energy Technologies

- Analysis of Capacity Factors and Availability Variations
- Capital Expenditure (CAPEX) and Operational Expenditure (OPEX): Trends and Differences
- Understanding the Levelized Cost of Electricity and Its Dependency on Location

Curriculum

Modules 09–12

09 Renewable Energy Finance and Structural Considerations

- Importance of Integrating Financial Concepts in Project Development
- Comparative Analysis of Corporate Finance and Project Finance
- Evolution of Project Finance in Infrastructure and Renewable Sectors
- Overview of Project Financing Structures and Associated Legal Complexities
- Criteria for a Bankable Project: Understanding and Meeting Lender's Requirements
- Stakeholders in Project Financing: Roles and Relationships
- Constructing a Strong Project Foundation Using Equity and Debt Sources

10 Risk Management in Renewable Energy Projects

- Risk Identification Stages: Development, Construction, Start-up, Operations & Maintenance
- Key Milestones: Concession Signing, Financial Close, Commercial Operation, Loan Maturity
- Importance of EPC Turn-key Contracts for Timely, Budgeted, and Specified Delivery
- Risk Control: Delay & Performance Liquidated Damages, Liability Limits
- Force Majeure and Dispute Resolution
- Essential Factors for O&M Providers and Contract Bankability
- Mitigating Financial Risks with Warranties, Insurances, Guarantees
- Role of Multilateral Banks and Export Credit Agencies in Developing Markets

11 Renewable Energy Project Screening Checklists

- Project Description and Characteristics Overview
- Land Lease Agreements
- Resource Assessment
- Required Permits and Concessions
- Grid Connection Requirements
- Key Contracts: EPC, PPA, Sponsors, Lenders, O&M, Insurance, Guarantees
- Bankability, Due Diligence, and External Advisors Financial Analysis and Debt Capacity Assessment
- Financial Analysis and Debt Capacity Assessment

12 Loan Term Sheet Elements for Renewable Energy Financing

- Capital Injection Timing and Basis

Curriculum

Modules 12–15 · Module 12 — continued

- Lender Security: Grace Periods, Debt Service, O&M Reserves
- Financial Controls: Cash Sweeps, Cash Traps, Dividend Blockers
- Cash Flow Waterfall Placement
- Covenants, Securities, Sources and Uses Overview
- Financial Terms Review: Rates, Fees, Margins, Commissions
- Preconditions for Financial Close and Agreements

13 Financial Analysis & Structuring in Renewable Energy Projects

- Cash Flow Analysis for Debt Service (CFADS)
- Debt Capacity Influenced by Cash Flow Predictions, DSCR, and Loan Tenure
- Equity Return Enhancement via Equity-to-Debt Gearing
- Project and Equity NPV and IRR Analysis
- Loan Tenure Constraints
- DSCR Comparisons Throughout Loan Life
- Loan and Project Life Cover Ratio Assessment
- Loan Repayment Structures: Linear, Annuity, Debt Sculpting
- Sensitivity & Scenario Analysis on CAPEX, OPEX, Revenue Variations

14 Power Purchase Agreements (PPAs)

- Importance of Off-take Agreements for revenue stability across power, heat, and certificates
- Characteristics of a bankable PPA
- Timing and payment conditions in PPAs
- Comparison of tariff structures for dispatchable vs. non-dispatchable technologies
- Details on capacity and energy charges, metering, and delivery points
- Cure periods and step-in rights to set a deemed commercial operation date
- Curtailment clauses: deemed capacity and generation
- Risks of non-payment by off-takers, FX volatility, and currency convertibility

15 Case Studies and Analytical Tools in Renewable Energy

- Case studies showcasing best practices, failures, and varied applications in renewable technologies
- Analysis of resource audits and annual energy production for different technologies and locations
- Examples of PPA, EPC, and O&M contract clauses across various jurisdictions and technologies

Curriculum

Module 15 — continued

- Sample loan term sheets for renewable energy project financing
- Financial models to analyze the levelized cost of electricity (LCOE) and financial ratios

Joining the programme

Contact the Academy and quote course code 000589 to confirm dates, delivery format, prices and enrolment terms.

Training for your team

Tell us your business goals, the roles and number of participants, and your preferred dates and location. This will help us discuss the right training option.

Preparing for the programme

The published programme does not specify any prerequisites. Contact us before enrolling to confirm how to prepare.

Discuss your training needs

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