On-Line Short Course: How to Design, Finance and Integrate Renewables in the Power Grid

George Washington University



Environmental & Energy Management Institute
SCHOOL OF ENGINEERING & APPLIED SCIENCE

How to Design, Finance and Integrate Renewables in the Power Grid

Course opens on **September 7th**

Complete by December 31 to qualify for the GWU certificate

Ten hours of recordings and three webinars with the instructor

Cost $350

Register Here

Receive a GWU School of Engineering and Applied Science Professional Education Certificate

Instructor: **Stratos Tavoulareas** has 40 years of experience in the power sector worldwide. He combines broad sector experience (in policy, regulation, sectoral reforms, planning and strategy) with a deep understanding of power technologies (thermal, renewables and hydro) and project finance. He has been involved in cutting-edge technologies and entrepreneurial ventures. Stratos has held leading positions with the International Finance Corp, private engineering/advisory firms, and power plant suppliers. Stratos has extensive work experience in Africa, Central Asia, China, Eastern Europe, Japan, Middle East, South and East Asia, and North America. More about the instructor.

Overview

Renewables, especially solar and wind, are expanding rapidly overtaking conventional power generation technologies globally. This short course provides a practical introduction to all aspects of planning and deploying grid-connected renewable projects.

Stratos Explains Renewable Impacts on the Grid in an 8 Minute Video

The power grid is an interconnected system designed and operated to satisfy the demand for electricity at all times, no matter how demand is changing (up or down; slowly or very quickly). Each power generation project, which is interconnected into the power grid, affects the grid, and is affected by the grid. The relationship between the project and the power grid is essential for all stakeholders to understand (project planners, engineers, regulators, financiers, etc.).

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The power grid is complicated in itself and is becoming more complex as it is evolving rapidly with the addition of disruptive technologies such as renewables (an intermittent energy resource), energy storage (batteries), hydrogen, smart grid capabilities, distributed generation, and demand-response, among others.

Moreover, power system regulations (for renewables, but also for all other power sources) and the design of power markets have substantial impact on the viability and the design of renewable projects.

Course participants will learn:

- Key rules and requirements of power system operation
- How different power sources are dispatched
- The importance of firm capacity and ancillary services to the stability of the grid
- Key aspects of power system planning
- The impacts of intermittent renewables and how they can be managed to ensure smooth grid operation
- The status of renewables globally and the outlook
- Step-by-step project development guidance from concept development to site identification, plant design, permitting, financing, engineering, construction, and operation
- The characteristics of regulatory frameworks used around the world (feed-in tariffs; renewable portfolio obligations; green certificates; auctions/tenders)
- Understanding probabilities and risks, and linking them to financial parameters
- Understanding the basics of non-recourse financing and the perspective of stakeholders
- Key elements of the Power Purchase Agreement (PPA)
- How to manage project risks
- How the risk-reward relationship influences the design of the financial package
- The project term sheet

Who will benefit?

The course is designed for professionals seeking to broaden their knowledge of renewable energy technology and the benefits and challenges of integration into the power grid. Experts in one or more aspects of the power system will enhance their understanding of the entire system and become better developers, investors, advisors, policy and decision makers, and educators.

- **Energy Project Developers** will be exposed to all aspects of project planning and deployment, approvals, design, business development, contractual arrangements, and financing.
- **Engineers and Consultants** will learn important non-technical aspect of energy projects such as renewable regulations, financing options, how to put a financial package together, and lessons learned in the global marketplace, among others.

- **Financiers** will be able to identify the project risks and improve their ability to manage them as they develop a better understanding of how the power sector operates and is evolving.
- **Government officials** (including regulators and policymakers) will improve their understanding of the issues and options associated with the integration of renewables in the power grid. As a result, they will be better able to develop climate and energy policy, and to design incentives and regulations that accelerate renewable technology deployment and innovation.
- **Academics** will appreciate the multidisciplinary nature of renewable project development, as well as the challenges facing the evolving power grid. As a result, they may establish more multidisciplinary educational programs the focus on addressing technical and regulatory energy system challenges.
- **Graduate Students** from engineering, business, law, environmental and other professional disciplines will get a broad overview of renewable project development improving expanding the application of their concentrations to the power industry.

Module 1 -

Integrating Renewables in the Power System (~3 hrs.)

- **Power System Operation**
  1. Key rules and requirements
  2. Energy-Firm Capacity- Ancillary Services
- **Power System Planning**
  1. Traditional planning
  2. Key inputs and outputs
  3. The role of planning in modern power systems
- **Unique features of renewables and integration in the power system**
  1. Intermittency
  2. Need for firm capacity, flexibility, and ancillary services
  3. Grid integration costs
  4. Energy storage

Module 2

Key Aspects for Renewable Project Development (~3 hrs.)

- **Global Market Overview**
  1. Global energy resources and trends
  2. Renewable installations and outlook
  3. Key factors supporting the continuing expansion of renewables

- **Project development process for renewables**
    1. Site evaluation and selection
    2. Energy resource; power plant design; energy yield
    3. Permits/licensing/environmental and social assessment
    4. Contracts, acceptance testing and commercial operation
    5. Project due diligence
- **Regulatory support frameworks for renewables**
    1. Feed-in tariffs
    2. Renewable obligations
    3. Auctions/Tenders
    4. Green Certificates
    5. Future Outlook

Module 3

Project Finance (~4 ½ hr.)

- **Understanding the "P"**
    1. Fundamentals of probability
    2. How probabilities are applied to project assessment and financing

- **The Basics of Non-Recourse Financing**
    1. Key structure of non-resource financing
    2. Equity/Debt/Guarantees
    3. Examples
- **Power Purchase Agreement (PPA)**
    1. Key elements of PPAs
    2. Examples
- **Putting the financial package together**
    1. Risk assessment and management
    2. The risk allocation matrix
    3. Terms of the loan ("term sheet")
    4. Examples
    5. New financial instruments
    6. Summary/Conclusion