renac
renewables academy

Renewables Academy Online

Certified Renewable Energy Project Developer

Online Training on Methodology, Support mechanisms and Financing of Renewable Energy Projects

Focus on Photovoltaic, PV-diesel hybrid systems, Bioenergy, or Solar thermal for water heating







Impressum

Content and Layout:

Renewables Academy (RENAC)

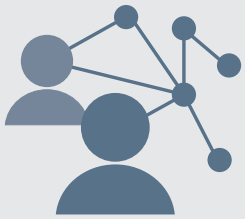
Pictures:

RENAC, Fotolia: page 1

RENAC Online

RENAC Online helps you:

- Boost your professional career
- Study with flexibility following your own schedule
- Learn at any time and from any location



RENAC Online offers extensive support & interactive learning:

- Videos
- Graphics
- Exercises for self-evaluation
- Discussion forum
- Virtual classrooms

RENAC Online staff are:

- Certified e-learning trainers
- Experienced professionals
- In direct contact with the industry

CERTIFIED EUROPEAN E-LEARNING MANAGER

What is the „Certified RE Project Developer“ Online Training?

This online training explains the most important economic aspects of renewable energy project planning. It describes the methodologies of different support mechanisms and conveys knowledge of legal and regulatory frameworks. Participants will learn which parameters are used to assess the bankability of RE projects, and understand a banker’s view on risks related to PV, wind and biogas projects. The elective course allows insights in the planning process. The elective course allows insights into the planning process for a plant of the chosen.

This training suits you if you:

- are charged with setting the scene for a renewable energy project
- need to deal with various stakeholders in a project appraisal process
- will supervise the implementation of a power plant of the chosen technology

After the online training, participants will be able to:

- calculate relevant economic parameters of a renewable energy project
- decide which of the most widely used support mechanisms are applicable
- collect/prepare the data required for a bankability assessment
- define the necessary steps from planning to O&M for the elective technology

Courses

Introductory courses

Each participant will have access to short introductory courses explaining energy and electricity topics and the basics of renewable energy projects. Also, before the elective course, there will be time to study the fundamentals of the elective technology. All introductory and fundamentals courses have no assignments and will not be covered in the exam.

Certified RE Developer Courses

Three regular courses:

- Methodology of project valuation
- Support mechanisms for renewable energy projects
- Renewable energy project finance

One eligible project planning course:

- Photovoltaic
- PV-diesel hybrid systems
- Biogas
- Solar thermal for hot water production

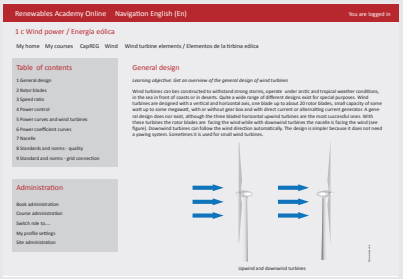
Certified Renewable Energy Project Developer

Why choose RENAC Online?

Self-study material

1 Text and Images

Courses are structured in small, illustrated units of instruction; learners are guided through the material step-by-step.

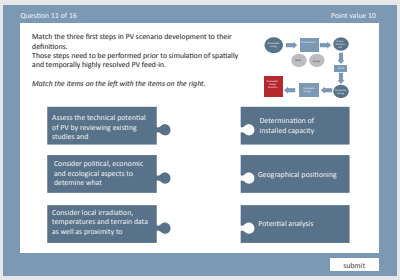


2 Videos

Video lectures explain some of the most important topics in a visual and entertaining way.

3 Tests

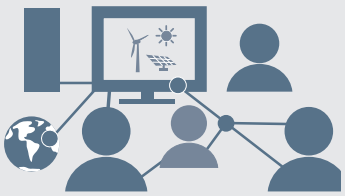
Many self-assessment tests within each course help participants to test their knowledge.



Extensive support

1 Forum

Support and communication take place in a discussion forum. RENAC monitors the forum constantly. RENAC experts are ready to give assistance and discuss the course topics.



2 Assignment

After studying each course, participants are asked to answer an assignment question. RENAC gives individual feedback for these assignments.

3 Virtual classroom

Participants should attend the live virtual classroom sessions (webinars). These are conducted by renewable energy experts. During and after the presentation participants are invited to discuss in the live chat.

Certificate

All participants who score above 70% in the final online exam will receive a printed RENAC certificate. All others will receive a certificate of attendance per e-mail.

For Spanish-speaking participants (upon request):

- Course texts and self-tests in Spanish
- Videos with Spanish subtitles
- Support by a Spanish-speaking tutor

Live virtual classrooms (webinars) for the whole class and exams are held in English language only.

Schedule

The courses will be online:

Spring and fall semester each year
Start date: 1 April / 1 October

Recommended study time:

5 – 10 hours per week
approx. 130 hours in total

Duration:

4 to 6 months for the entire training depending on previous knowledge and study habits.

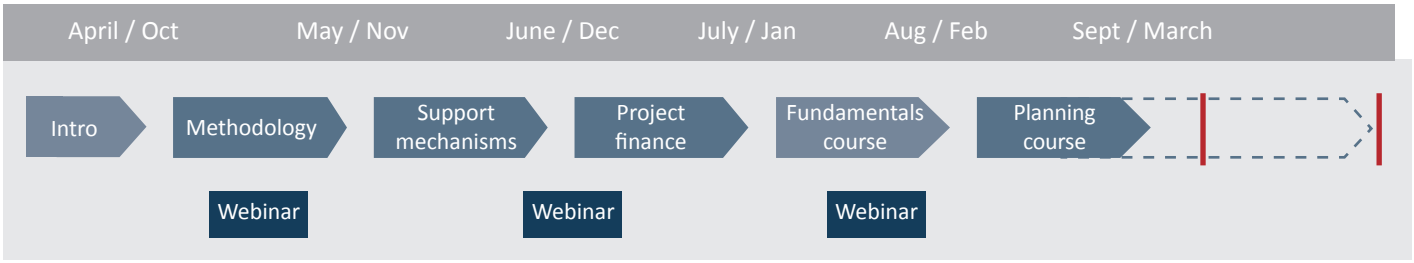
Assignments:

The courses are designed for a continuous participation from the beginning of the semester until the exam. There is an assignment for each course, which counts towards the final grade. Participants are asked to write a short statement regarding an important topic of each course. Assignments need to be handed in by the deadlines.

Scheduled exam dates:

Participants can take the exam after 4, 5 or 6 months

Spring semester / fall semester



Live virtual classrooms (webinars)

Three live virtual classrooms are part of the Certified Renewable Energy Project Developer online training. These live events are not mandatory, but participation is strongly recommended.

Webinar 1
Introduction to RENAC Online
First week of the semester
(1 hour)

Webinar 2
Energy yield of renewables
Mid of semester
(1 hour)

Webinar 3
Financial aspects of RE projects
End of semester (1 hour)

Registration and discounts

Registration:

You can register for the Applying Renewable Energy online training via the registration form at:

www.renac.de/trainings-services/trainings/renac-online/

Deadlines:

Early bird deadline: 20 August / 20 February

Registration deadline: 22 March / 22 September

Participants who are not able to finish the online training in one semester can book an extension of 6 months (following semester) at a 80% reduced course fee

Fee:

1190 Euro

Discount:

Early bird 10%; group (2 or more) 5%; combination of both 15%

Payment:

VISA, MasterCard, American Express, invoice

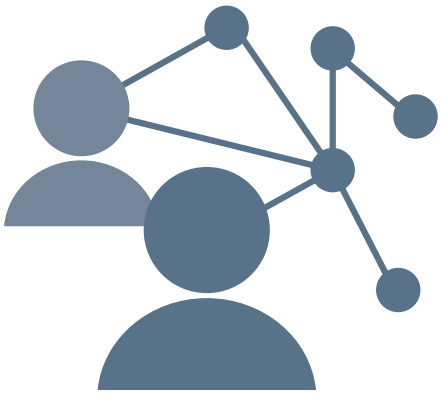
Technical information

You need to provide an e-mail address, which you check regularly. Furthermore you need a computer with a stable internet connection (at least 2 Mbit/s). For webinars, the AdobeConnect add-in or app should be installed, and a headset or speakers are required to listen to the presentation.

Demo course

For a first impression of our online platform, have a look at:

http://renewables-online.de/blocks/demologin/logindemo.php?course=Demo



Learning objectives and content of the courses

Introduction to renewable energy projects

Learning objectives

- Illustrate the steps and tasks of a project life-cycle of RE projects
- Compare different public and private perspectives onto RE projects
- Assess project attractiveness with standard methods

Content

Renewable energy projects

- General characteristics of a project
- Project realization cycle and average lifetime of RE projects
- End of life considerations
- Typical players in RE projects

Financial aspects of RE projects

- 'Investment' and 'Investment appraisal'
- Investment decision
- Assessing an investment's attractiveness
- Financial management tasks, cost structure of RE projects

Non-financial aspects of RE projects

- Public and private investment appraisal, public support mechanisms
- Externalities of RE projects
- Translating external, non-monetary effectsls

Methodology of project valuation

Learning objectives

- Describe the principal setting of a renewable energy project, incl. relevant stakeholders, development processes and project appraisal structure
- Explain the most important economic parameters used in renewable energy project planning
- Perform some example calculations of the basic economic parameters, e.g. the internal rate of return (IRR)

Content

Introduction to REP financing options

- REP financing options, equity and debt capital
- Corporate (balance sheet) and project financing, corporate financing versus project financing
- Special financing considerations for REPs, example REP financing structures

REP risks and uncertainties

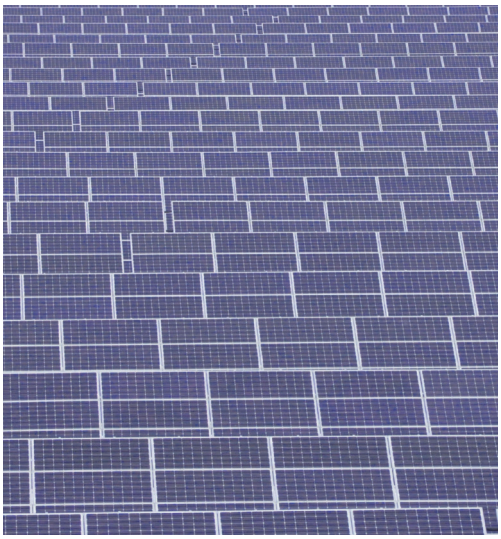
- Introduction to REP risks and uncertainties; concepts of risk and uncertainty in investment appraisal
- Typical sources of risk and uncertainty in REPs, general risk assessment instruments
- Mark-ups / Sensitivity analysis / Simulation / Scenario analysis
- Risk reduction in practice – 'operational treatment of risk's

Basic financial principles

- Introduction to basic financial attractiveness
- 'Profit' as indicator of project attractiveness? 'Cash flow' as proper indicator of project attractiveness
- Time value of money: interest, components, the concept of discounting
- Interest and cost of capital, weighted Average Cost of Capital (WACC)

Financial performance indicator

- Introduction to financial performance indicators
- Net Present Value (NPV), internal Rate of Return (IRR)
- IRR as investment decision criterion; simple Payback (SPB) and discounted Payback (DPB)
- Benefit-to-Cost Ratio (B/C) and levelized Cost of Energy (LCOE) (4 pp.)
- How is LCOE calculated? / Typical values of LCOE / When is LCOE useful? / What are the limitations of the LCOE method?
- Debt Service Cover Ratio (DSCR)



Support mechanisms for Renewable Energy

Learning objectives

- Contrast the concepts of grid parity and fuel parity
- Analyse the most widely used support mechanisms for renewable energy
- Recommend specific support mechanisms for certain RE projects
- Demonstrate the basic principles of electricity markets

Content

Introduction

- Unit structure and learning objectives, objectives and categorisation of support mechanisms for renewable energies
- Renewable energy support and cost-competitivenes
- Cost comparison of renewable with conventional power plants

Net metering design and feed-in tariff (Fit) design

- Grid parity and incentives for self-consumption via net metering
- Retail electricity tariff structure and self-consumption incentives
- Program and project size caps in net metering schemes, roll-over provisions in net metering schemes
- Payment for excess electricity production in net metering schemes, cost-benefit analysis for net metering
- Long payment duration under FiT regimes
- Tariff calculation methodologies for FiTs, Tariff calculation objectives and spreadsheets
- Input data for cost-based FiT tariff calculation in Germany
- Tariff degression in FiT schemes, flexible tariff degression in FiT schemes
- Capacity caps in FiT schemes, feed-in premiums, advantages and disadvantages of FiTs

Auction mechanisms

- Sealed bid and descending clock auctions, pre-qualifications for bidders in auctions
- Penalties for failure to fulfil contracts won in auctions

Net metering design

- Grid parity and incentives for self-consumption via net metering
- Retail electricity tariff structure and self-consumption incentives
- Program and project size caps in net metering schemes
- Roll-over provisions in net metering schemes, payment for excess electricity production in net metering schemes
- Cost-benefit analysis for net metering

Quota-based mechanisms and renewable portfolio standards

- Revenue sources for the project developers under certificate trading mechanisms
- Volatility of certificate prices, technology-specific support and quota-based mechanisms

Financing renewable energy support mechanisms and frameworks, electricity markets and revenue streams

- Allocation mechanism
- Public financing for renewable energys
- The ’merit order principle’, the ’merit order effect’s

Support mechanisms and risk perception for project financing

- Evaluation criteria for different RE support mechanisms
- Risk perception and evaluation, project finance risk in developing countries

Renewable energy project finance

Learning objectives

- Know the different financing options of renewable energy projects in principle and the project finance option in more detail
- Perform a risk assessment for renewable energy projects
- Understand a bank's view of the risks related to PV, wind, and biogas plants
- Collect the data required for a bankability assessment of a renewable energy project.

Content

Part I: Process perspective on RE project financing and bankability assessments

Three different financing options

- Financing options - overview
- Balance-sheet financing and project finance, capital market financings

The financing process in four steps

Step 1: SPV-contract negotiation

- Project investment agreements
- Operating and financing agreements

Step 2: Business planning

- Estimation of a project's cash out-flows and in-flows (cont'd)
- Cash flow "waterfall" concept
- Calculation of project revenues
- Operational cost calculation and taxes payable
- From CADS to ECF
- Decommissioning costs and terminal values

Step 3: Bankability assessment

- Bankability assessments, information asymmetries as a reason for bankability assessments
- Setting credit limits to prevent moral hazard
- Differentiating between risk and uncertainty, financial value of risk and ABC-analysis
- RE project risks during construction
- Technology and operational risks and mitigation measures
- Market, resource and regulatory risks and mitigation measures
- RE project due diligence advisors
- Scopes of work for the advisors, design of a "project data room"s

Step 4: Bankability assessment

- Key financial ratios
- Calculation of the maximum borrowing capacity

Part 2: Process perspective on RE project financing and bankability assessments

Examples: PV projects in Germany, France and Romania

- Assessment of annual energy generation
- Revenues from support systems / the energy market
- Risk analysis (identification, assessment and mitigation) and due diligence
- Cash flow analysiss

Photovoltaics

After completion of this course, participants will be able to:

- Name the different applications for PV systems and corresponding categories,
- Decide which system types and components are to be used for which purpose,
- Explain the basic parameters impacting power output of a PV system and
- Paraphrase the economic aspects of PV systems incl. energy yield, metering options and costs.

Content

Application

- PV system categories/application
- Grid-connected and off-grid configuration

Components of a PV system

- Overview of PV cell types, PV modules
- Introduction to inverters and mounting structures

Physical aspects

- PV cell energy output
- Electrical characteristics and the I-V curve
- Factors affecting power output

Energy yield and Performance Ratio

- Definition, calculation and Example
- Economics of PV systems

Solar Thermal

After completion of this course, participants will be able to:

- Present the relevance of solar thermal in the energy mix and its basic economics,
- Explain how solar thermal systems and their system components work,
- Differentiate types of solar thermal systems and solar thermal collectors and
- Describe basics of system sizing, installation, commissioning, operation and maintenances.

Content

How solar thermal works

- Introduction to solar thermal, solar thermal applications
- Solar thermal collectors (Absorber, flat plate collector, evacuated tube collectors, efficiency of solar collectors)

System types

- HThermosiphon (or gravity flow) systems and forced circulation systems
- Direct and indirect systemsts

Solar thermal system components

- Storage tanks, pumps and controllers, other system componentsn

Practical considerations and economics

- Basic system design, installation, commissioning, operation and maintenance, economics

Planning of large-scale PV grid-connected systems

After completion of this course, participants will be able to:

- Define and explain the required components of the PV power plant,
- Describe the contracts, studies and permissions required for PV project development,
- Present all necessary steps from planning to operation and maintenance and
- Assess and supervise the implementation of a large-scale PV power plant.

Project mission

- Commercial viability of large PV systems
- Supply options

Main system components

- PV module (PV module standards/certification, limits of module testing, mismatching PV modules in PV array strings)
- Inverter concepts, transformers (types, cost comparison)
- Switchgear, monitoring and control, irradiation measurement

Project development

- Life cycle of a large PV plant
- Feasibility study (site assessment, yield estimation, cost estimates), contracts

Project planninhg

- Yield assessment (solar radiation data sources, landscape topology, 'technical availability' of PV systems, yield assessment and project bankability
- Legal and regulatory issues (permits and licenses, access to the grid, access to the electricity market, environment-related issues associated with site selection
- Infrastructure

Construction and installation

- Construction and installation planning, construction and installation issues
- System commissioning procedures and documentation
- PV plant decommissioning and dismantling

Plant operation

- Monitoring, power output control
- Operation modes , standards and codes

Planning of large-scale solar thermal systems

After completion of this course, participants will be able to:

- Explain how large-scale solar thermal systems work and describe different system components and their respective performance standards,
- Distinguish between different large-scale system configurations and describe their areas of application,
- Perform preliminary large-scale system design and sizing calculations,
- Describe common system installation, commissioning, and maintenance tasks and list and explain typical causes of system faults and how to rectify these.

Content

Introduction

- Large-scale solar thermal
- Large scale systems – the sleeping giant

Components

- Losses in a solar collector
- Selective absorber coatings
- Flat plate collectors structural shape
- Evacuated tube collectors, evacuated tube collectors „Sydney“ type
- Efficiency of solar collectors
- Standards and Collector test procedures, storage cylinders requirements and materials and applications
- Heat exchanger and pumps; armatures in large scale installations
- Sensors and controllers

Systems

- Thermosiphon (or gravity flow) systems and forced circulation
- Open - closed systems; direct – indirect systems
- DHW systems with buffer store
- Systems with multiple consumers; backup systems
- Heat transfer in systems with buffer tanks
- Recirculation and mixing valves
- Large scale system configurations

Sizing

- Efficiency and solar fraction; calculation of heat quantity
- Stagnation and pressures in closed pressurized systems

Example

- Sizing example and solar irradiation at the site
- Calculation of the energy demand, collector area and storage capacity
- Choice of system configuration and collectors
- Collector array arrangement and flow rate
- Determination of pipe diameter and pressure loss
- Calculation of pressure losses in the system
- Pump selection, heat exchanger sizing
- Pressures in the system; expansion vessel calculation I and II
- Practical aspects
- Commissioning and frequent faults; economic aspects

Planning of PV-diesel hybrid systems

After completion of this course, participants will be able to:

- Distinguish different system designs and their preferable application,
- Lead a feasibility study to integrate PV into an existing diesel power system,
- Explain functioning of system components, operational strategies and optimising potential and
- Assess and supervise the planning and implementation of a PV-diesel power plant.

Content

Introduction

- Diesel power plants – applications and characteristics
- Global distribution of diesel plants
- Off-grid sectors and target groups for hybridisation projects
- PV-diesel hybrid systems – conditions for economical attractiveness
- Project examples from around the world

Introduction to feasibility case study

- Feasibility study overview and importance of accuracy in data collection and processing
- Step 1 (Typical load profiles, monitoring and assessment of load profiles, case study load profile, load profile projections)
- Step 2 (Diesel engines and generators, electric generator, operational limits of diesel gensets (I), operational limits of diesel gensets (II),
- System stability in diesel based mini-grid

Feasibility study – PV integration and conclusions

- The engineer has to realize the PV-hybridization
- PV-diesel hybrid system control; mini-grid internal communication infrastructure
- Sensors and actuators, active and passive control systems
- Comparison of active and passive control systems
- Load-driven control in mini-grids, spinning reserve (definitions, factors, example)
- N+1 criteria, PV-diesel hybrid system limitations
- Electrical protection in mini-grids, operational strategies
- Effects of PV-hybridisation on diesel generator operation and effect of hybridisation on diesel generator working lives
- PV-diesel hybrid system dynamics, fluctuating PV power output
- Frequency deviations, voltage fluctuations and irush currents on mini-grids

Additional options to optimize system

- The chief planning engineer wants to dig deeper
- Impact of diesel generator setup on mini-grid performance
- Overview on storage technologies for mini-grids
- Lead-acid and lithium-ion batteries
- Battery integration, management and control, system stability and energy storage

Installation, commissioning, operation and maintenance

- The chief planning engineer carries out the financial planning
- Overview of cash-flow structure, LCOE for diesel-only and PV-diesel hybrid systems
- Influence of financing costs on cash-flowss, battery integration, management, control, system stability and energy storage

Final conclusions

- Inauguration ceremony, references and glossary

Planning of medium-sized biogas plants

After completion of this course, participants will be able to:

- Distinguish different system designs and their preferable application,
- Describe the anaerobic digestion process and relevant process parameters,
- Discuss special substrates and technologies for biogas production in connection with sustainability issues,
- Explain all necessary steps from planning to operation and maintenance and
- Present the functioning of system components and their respective applications.

Content

The anaerobic digestion process – Types of process and process parameters

- Stage of the process, continuous and batch systems
- Dry fermentation and plug flow systems, process control(digestion parameters)
- Special additives for substrated

Special Substrates and Sustainability

- Industrial Substrates: Wastewaters and wastes, pre-treatment of Waste
- Sustainability aspects: CO2, food vs. Fuel

Special technologies for biogas production

- Low-tech household size biogas plants, industrial biogas plants, UASB

Main components

- Pre-treatment of feedstock, feeding/conveying of solid biomass
- Substrate pumps, reactors, piping on biogas plants; biogas conditioning (drying/cleaning) and stirring devices

Biogas application

- CCHP (Combined cooling, heat and power)
- Biogas upgrading and district heating, satellite CHP-Unit

Treatment of digestate

- Digestate Treatment – Separation and Drying

Example Biogas plant

- Biogas Plant Concept and Design (Substrate Characteristics, main design parameters, biogas plant components – CHP unit, stirring devices, pumps and feeding units, layout of the example plant)

Feasibility studies

- Feasibility studies, technical and legal feasibility
- Economic feasibility: investment costs and country differences, O&M costs and revenues

Realisation

- Planning, permitting and planning, construction, quality assurance, testing the execution and the workmanship
- Commissioning of the plant

Safety aspects

- Process safety, fire and explosion safety
- Handling toxic and explosive gases and safety training

Cash flow analysis

- Costs, investment costs, O&M costs, revenue
- Analysis: cash flow and sensitivity

Operation and maintenance

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