renac
renewables academy

Renewables Academy Online

Applying Renewable Energy

Online training on Photovoltaics, Wind power, Biogas, Solar thermal, Small hydro power, Concentrated Solar Power, PV-diesel hybrid systems







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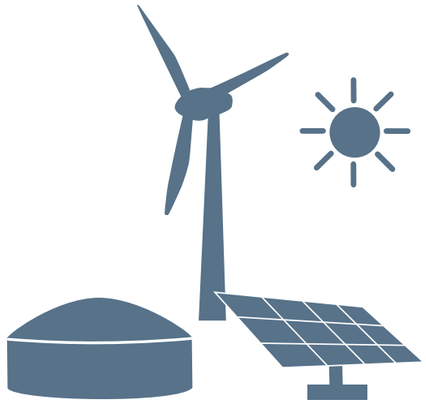

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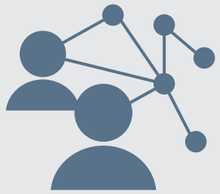
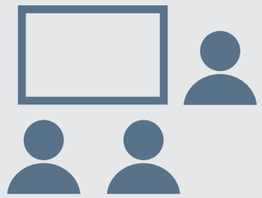
RENAC Online



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
- Live lectures (webinars)

RENAC Online staff are:

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

CERTIFIED EUROPEAN E-LEARNING MANAGER

What is “Applying Renewable Energy”?

Applying Renewable Energy provides fundamental knowledge on the most widely used renewable energy technologies. No previous knowledge of electricity or renewable energy is required.

Introductory courses

Each participant will have access to short introductory courses on energy and electricity topics to learn or revise the basics. These courses are not mandatory, and will not be covered in the exam.

Courses

Each “Applying Renewable Energy” online training comprises a combination of 3, 4 or 7 courses on the most widely used renewable energy technologies.

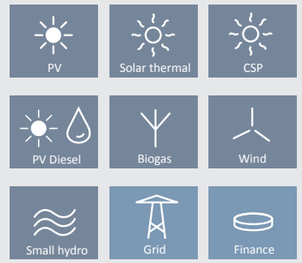
Optional courses on grid integration and financial aspects of renewable energy are available to all participants (not part of the exam/certificate).

This training suits you if you:

- Need an overview of RE technologies for private or professional purposes
- Would like to refresh technical knowledge before further training
- Want to make the first step towards implementing RE projects

After the online training, participants will be able to:

- assess resources and suitability of sites for each technology
- decide which components are to be used for which purpose (e.g. off-grid)
- roughly calculate system size and energy yield and determine crucial parameters
- explain the principle functioning and physics of each technology



Renewable energy technologies covered by Applying Renewable Energy

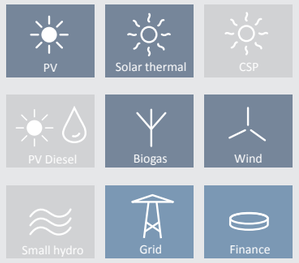
Optional courses on grid integration and financial aspects of renewable energy

Course combinations

Participants can choose between five different online trainings, which each present a selection of renewable energy technologies:

Market Leaders (3 courses)

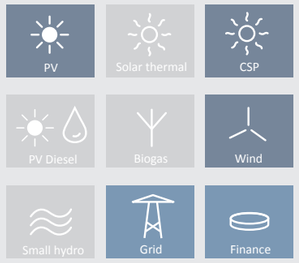
This training introduces the technologies with the biggest shares in the renewable energy world markets:



Technologies: PV, Biogas, Wind
Fee: 460 Euro
Duration: approx. 2 – 3 months
Study time: approx. 60 hours

Large-Scale Systems (3 courses)

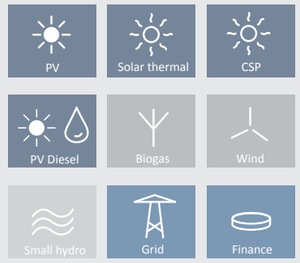
This training focuses on large-scale grid connected renewable energy systems for electricity production:



Technologies: PV, CSP, Wind
Fee: 460 Euro
Duration: approx. 2 – 3 months
Study time: approx. 60 hours

Solar Technologies (4 courses)

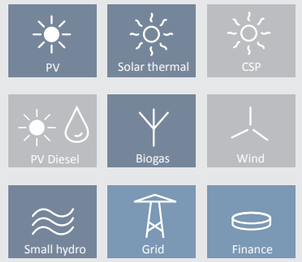
This training presents different solar technologies used for hot water provision or electricity production.



Technologies: PV, ST, CSP, PV-diesel
Fee: 570 Euro
Duration: approx. 3 – 4 months
Study time: approx. 80 hours

Small-Scale Systems (4 courses)

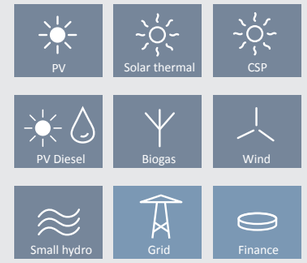
You will study small-scale systems used for the provision of hot water or electricity in households:



Technologies: PV, ST, Biogas, Hydro
Fee: 560 Euro
Duration: approx. 3 – 4 months
Study time: approx. 80 hours

Complete Overview (7 courses)

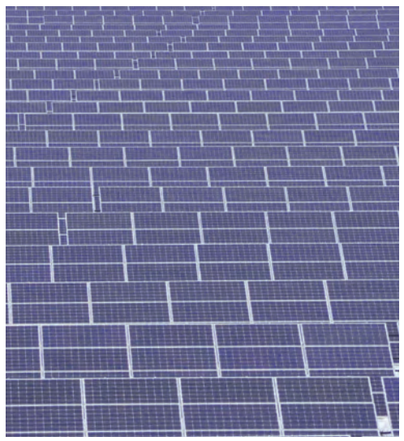
This training covers all seven technologies and helps to understand the big picture of renewable energy:



Technologies: PV, ST, CSP, PV-diesel, Biogas, Wind, Small hydro,
Fee: 760 Euro
Duration: approx. 5 – 6 months
Study time: approx. 100 hours

Two course intakes per year:
1st April and 1st October!

- Technologies covered in the online training
- Optional courses on grid integration and financial aspects of renewable energy
- Course is not offered in this training



Why choose RENAC Online?

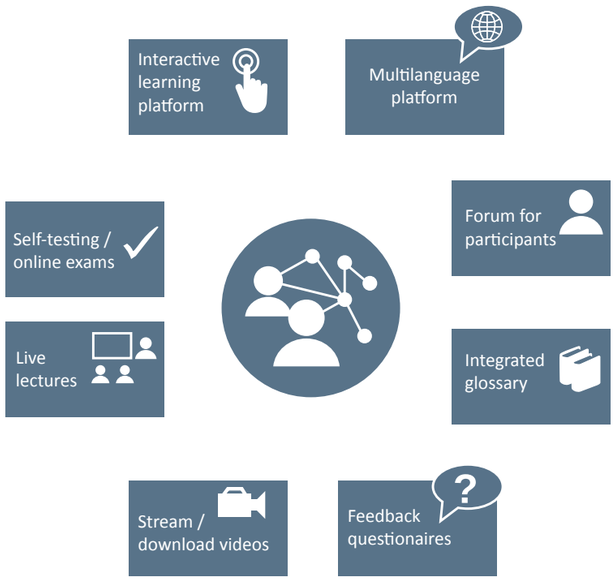
Self-study material

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.

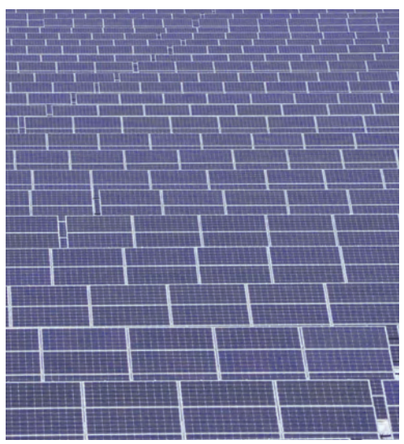
Features



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

Webinar in Spanish (upon request):

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

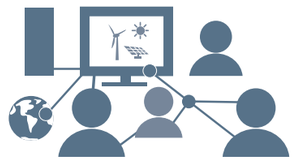


Extensive support

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 Live lectures
Participants should attend the live lectures (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.

Applying Renewable Energy

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. 20 hours per course

Resulting duration:

3 to 5 weeks per course, 3 to 6 months for the entire training depending on the number of courses.

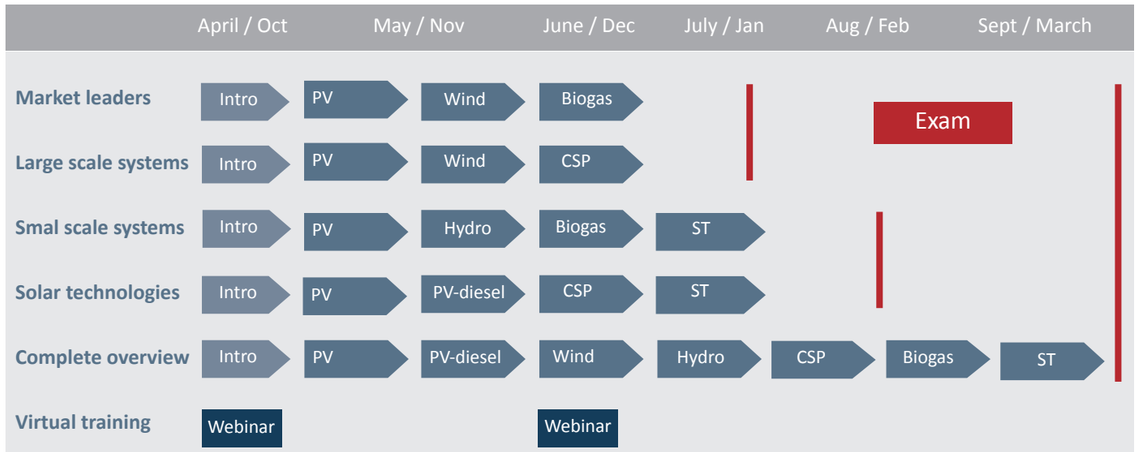
Assignments:

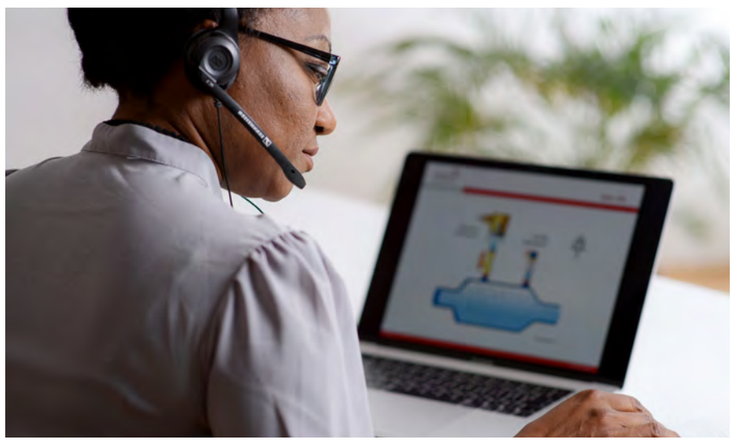
The courses are designed for a continuous participation from the beginning of the semester until the exam. There is an assignment for each course, which counts towards the final grade. Participants are asked to write a short statement regarding an important topic of each course. Assignments need to be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

Scheduled exam dates:

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

Spring semester / fall semester





Registration and discounts

Registration:

You can register online at:
www.renac.de/trainings-services/trainings/renac-online/

Deadlines:

Early bird deadline: 20 August / 20 February
Registration deadline: 31 March / 30 September

Discount:

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

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.

Live lectures (webinara)

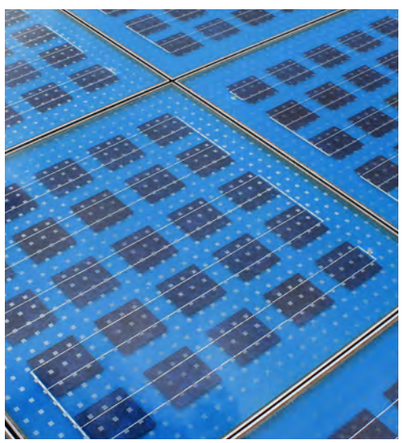
Two live lectures (webinars) are part of the online training. These live events are not mandatory, but participation is strongly recommended.

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

Webinar 2
Energy yield of renewables
Middle of the semester
(1 hour)

Demo course and introduction

For a first impression of our online platform, have a look at our demo course:
www.renewables-online.de/blocks/demologin/logindemo.php?course=Demo
An introduction to the RENAC online platform:
https://www.youtube.com/watch?v=n_bjaFfxFog



Learning objectives and content of the courses

Introduction to energy

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

- Describe the global situation of energy supply and demand
- Differentiate forms of energy as well as energy and power
- Name fundamental parameters, units and conversion factors related to energy topics

Content

Development of the energy market

- Energy supply and demand, fossil fuels
- Renewable energy resources
- Outlook of energy supply

Physical basics

- Energy supply chain
- Forms of energy, energy and power
- Performance indicators for energy conversion
- Capacity factor and full load hours

Units and conversions

- Introduction
- International System of Units
- Energy content of different fuels

Introduction to electricity

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

- Describe the basic technological terms and principles governing the operation of electrical power systems
- Give reasons for keeping grid frequency stable
- Explain why power systems are typically built as three-phase AC systems
- Distinguish between electric energy and electric power

Content

Basics of electricity

- Current, voltage, resistance, frequency
- Balance and imbalance in the grid, reasons for keeping grid frequency stability
- Peak voltage and phase angle, different phase angles
- Three phase systems
- Active, reactive and apparent power
- Relationship between voltage, current and power, power factors

Introduction to solar resource

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

- Describe the variability of the solar resource around the world and influencing factors
- Explain the difference between irradiation and irradiance and explain components of solar radiation
- Define important solar terms and the position of the sun in the sky
- Discover the importance of orientation and tilt of a solar array for optimising energy yield

Content

Introduction

- What is solar energy used for?

Physical basics of solar energy

- What is the difference between solar irradiation and irradiance?
- What is solar irradiance physically: waves or particles?
- How is solar irradiance composed?

Sun positioning

- How does the sun position affect solar irradiance?

Introduction to electric grids

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

- Explain the basic technological terms and principles governing the operation of electrical power systems
- Explain the importance of frequency and voltage stability for electric grid operation
- Describe the parameters that affect frequency and voltage stability in electric power grids
- Distinguish impacts that conventional power plants and RE power plants have on the operation of a power grid

Content

Structure of electricity grids

- Basic elements of the grid
- AC vs. DC transmission system
- Voltage in the grid
- Conventional power plants
- A new paradigm

Secure operation of electricity grids

- Quality of energy supply, security of energy supply
- Frequency range
- Operating states of the power system, frequency deviation and frequency control
- Voltage stability, voltage profiles on lines

Example

- DSO in Germany

PV – application

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
- Paraphrase the economic aspects of PV systems incl. energy yield, metering options and costs

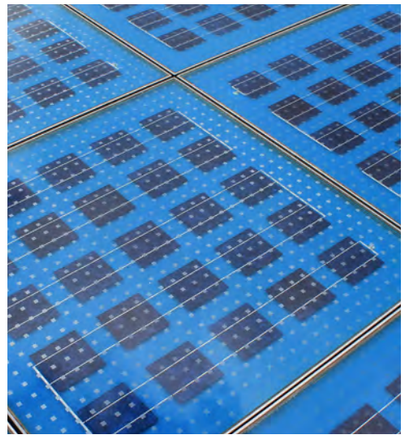
Content

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 examples
- Economics of PV systems



PV-diesel hybrid systems

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

- Estimate the potential and suitable locations for PV-diesel hybrid systems
- Decide which components are to be used for which purpose
- Explain the basic parameters for system sizing and dynamic system behaviour
- Evaluate PV-diesel hybrid systems from an economic perspective

Content

Introduction
- Access to electricity, micro and hybrid power systems, grid extension costs
- Categories of PV-diesel hybrid systems

System components
- Structure of small hybrid power systems
- Diesel generators, balance of system, SMA Fuel Save Controller Components

System sizing
- Load profile, peak load, penetration rate, energy share
- Generator minimum loading

Dynamic system behavior
- Behaviour on a sample day, different set-ups
- Adding storage, energy efficiency and demand side management

Economic evaluation
- Lifetime of components, cost structure of hybrid systems
- Levelized cost of electricity (LCOE) from pure diesel generator systems and hybrid systems
- Mini-grid vs. single household system

Wind power – application

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

- Assess the potential and requirements for wind energy (e.g. resources, site selection)
- Decide which of the most widely used system types and components are to be used for which purpose
- Employ the basic parameters for system sizing and roughly calculate the energy yield
- Sketch the planning and implementation steps for a wind power plant

Content

Wind power applications

- Large-scale wind turbines
- Small-scale wind turbines
- Offshore wind turbines

Introduction of wind turbine components

- Range of designs
- Towers
- Nacelle
- Rotor blades
- Generators
- Wind turbine power curves

Economical aspects

- Investment costs (CAPEX)
- Operational costs (OPEX)
- Levelized cost of energy (LCOE)

Environmental aspects of wind power

- Noise
- Shadow
- Landscape and nature

Small hydro power

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

- Distinguish different types of hydropower plants and their main components
- Calculate the power from a flow of water and describe different methods of measuring flow rate and head
- Explain the civil and electro-mechanical engineering system design
- Present specific costs as well as a cost breakdown of a sample scheme

Content

Introduction

- Large-scale hydroelectric power plants, pumped storage hydro, mode of operation, fields of application and cost
- Run-of-river hydro, power from water – flow and head

Resource assessment

- Head measurement and flow duration curve, energy yield assessment

Civil engineering components

- Intake (arrangement, screens), power canal and forebay tank (power canal, forebay tank)
- Penstock pipe, powerhouse, tailraces

Electro-mechanical equipment

- Hydro turbines (impulse turbines, reaction turbines, turbine selection)
- Generators (synchronous, asynchronous, permanent magnet generator

Costs

- Capital and operating costs

Concentrated solar power

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

- Explain the functioning and global potential of concentrated solar power (CSP) plants
- Distinguish the different CSP technologies including their functionality, current state of the technology
- Describe various components of CSP plants
- Present CSP costs and cost trends

Content

Market

- CSP plant site selection and country situation

CSP Technologies

- Introduction to the different CSP technologies
- Parabolic trough collectors, solar tower, Linear Fresnel, dish

Other components of CSP plants

- Heat transfer fluids, thermal storage
- Power block; cooling of CSP plants

Comparison of CSP technologies

- Annual energy yield and system efficiency
- Capacity factor, water requirements
- Cost of CSP

Biogas – application

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

- Assess the potential of bioenergy and define basic terms of bioenergy
- Classify the most frequent biogas system types, their components and purpose
- Illustrate the basic functioning and biological processes of a biogas plant
- Explain the different outputs of a biogas plant and their use

Content

Applications

- What is biogas?
- Benefits of biogas; role of bio energy in the energy mix
- Classification of biogas systems
- Household digesters
- Covered lagoon systems, industrial plants

Principles of biogas production

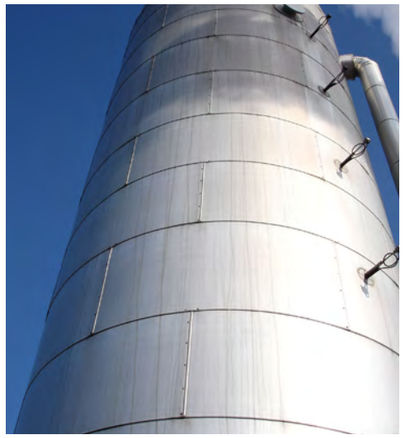
- Production of biogas through anaerobic digestion
- Substrates
- Methane yield of the substrate
- Quality of the substrate
- Parameters for the anaerobic digestion process

Output of biogas plants

- Direct combustion of biogas
- Combined heat and power (CHP) generation
- Digestate
- Storage and conditioning of biogas

Economic and environmental aspects

- Investment and CAPEX
- Operational expenditures
- Environmental evaluation



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
- Describe basics of system sizing, installation, commissioning, operation and maintenances

Content

Fundamentals of solar thermal energy

- Relevance of solar thermal
- What types of energy do we need?
- Solar energy is everywhere
- Types of renewable energy derived from the sun

How solar thermal works

- How solar radiation is absorbed by the solar thermal collector
- Solar thermal applications

Solar thermal collectors

- Absorber; flat plate collector, evacuated tube collectors
- Efficiency of solar collectors

Solar thermal types

- Thermosiphon (or gravity flow) systems and forced circulation systems
- Open and closed systems
- Direct and in direct systems

Solar thermal system components

- Storage tanks; pumps and controllers
- Other system components

Practical considerations and economics

- Basic system design
- Installation, commissioning , operation and maintenance

Introduction to renewable energy projects

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

- 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
- The project realization cycle
- The 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 effects

Contact

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Impressum

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