renac
renewables academy

Online Training Programme

Applying Green Energy Finance

Renewable Energy and Energy Efficiency






CONTENT

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Version: May 2023

PROGRAMME SUMMARY

The Applying Green Energy Finance programme provides a thorough introduction to green energy finance topics. It covers the fundamentals of renewable energy (RE) and energy efficiency (EE) technologies and financing RE and EE projects. This comprehensive programme also includes international perspectives on climate finance.

To complete this programme, participants need to take all the mandatory courses and select one elective from each section. Optional courses are available if you would like to review the basics of energy, solar resource, and electricity.

TARGET GROUPS

This programme is suitable for you if you:

- seek an introduction to green energy finance
- are involved in project finance
- want to specialise in green energy project finance
- would like to learn more about renewable energy and energy efficiency

Certified by

Staatliche Zentralstelle zugelassen zfu Nr. 7422622 für Fernunterricht

To benefit from this programme, participants should have a basic understanding of financial management and business administration. Additionally, experience using Excel and an interest in renewable energy and energy efficiency technology are also beneficial.

LEARNING OUTCOMES

After completing this programme, participants should be able to:

- assess risks in RE or EE project lifecycles,
- understand bankability criteria and apply them to RE and EE projects,
- identify project finance structures and procedures for RE and EE projects and
- explain the principles and context of climate finance mechanisms.

PROGRAMME STRUCTURE

MANDATORY COURSES
120 hours

- Introduction to renewable energy projects
- Financing energy efficiency projects and ESCOs
- Renewable energy feasibility assessment and investment valuation
- Renewable energy project finance
- Project contracts
- Policy frameworks of RE power generation
- Climate finance

ELECTIVE COURSES
50 hours

Additionally, you will need to choose one course from each RE and EE technologies.

Renewable energy electives (pick one):

- PV application
- Wind power application
- Biogas application

Renewable energy electives (pick one):

- Energy efficiency in industry - application
- Energy efficient buildings - application

EXAM AND CERTIFICATE
1 hours 45 minutes

- Exam and retake covering mandatory courses
- Evaluation considering final exam and assignments
- Applying Green Energy Finance certificate
- Certificate of attendance

OPTIONAL COURSES

- Introduction to energy
- Introduction to electricity
- Introduction to the solar resource

To supplement the learning experience, participants will have access to optional introductory courses on energy, solar resource, and electricity. These courses are not mandatory, do not contain assignments, and will not be covered in the exam. Participants new to these topics would benefit from reviewing the content in these courses.

Spring semester / Fall semester

April / October			May / November		June / December	
Introduction to RE Projects	Financing energy efficiency projects and ESCOs	RE feasibility assessment / investment valuation	RE project finance	Project contracts	Policy frameworks for RE power generation	Climate finance

Online Orientation Session

LIVE VIRTUAL CLASSROOM SESSION 1

INTRODUCTION TO RENAC ONLINE

first week of the semester (1 hour)

The programme begins with a live online orientation session where participants meet some RENAC staff members who explain how the Moodle platform works and its functions, and introduce the forum. The live virtual session also covers programme details such as activities and assignments, the exam, deadlines and scheduling. Attending the session is not mandatory but participation is strongly recommended.

Live virtual sessions

Three live virtual sessions are part of the online training programme. These live events are not mandatory, but participation is strongly recommended.

LIVE VIRTUAL CLASSROOM SESSION 2

RE POLICY FRAMEWORKS

1st month of semester

(1 hour)

LIVE VIRTUAL CLASSROOM SESSION 3

ENERGY EFFICIENCY FINANCE

2nd month of semester

(1 hour)

LIVE VIRTUAL CLASSROOM SESSION 4

RENEWABLE ENERGY PROJECTS CASH FLOW

3rd month of semester

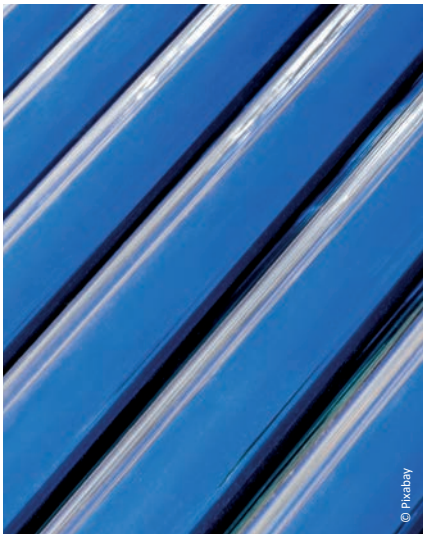
(1 hour)

Exam and certificates

RENAC Online Academy programme final grades comprise the grades obtained on the programme's final exam (weighted 90% of total) and those from programme assignments (weighted 10% of total). The passing grade is 70%. For the exam to be computed in the overall grade, it must also have been passed (i.e. the exam grade must also be over 70%). The exam has 70 multiple choice questions and participants are given 105 minutes to complete it. To prepare, participants should work through the self-test questions in each mandatory course. Participants who score below 70% may request a certificate of attendance if they have attempted all the self-tests contained in the compulsory courses. Certificates are sent as PDF files via e-mail. Participants who do not pass the exam the first time will have the opportunity to take it again at a later date. Exam and retake dates will be announced during the orientation session.

Assignments and evaluation

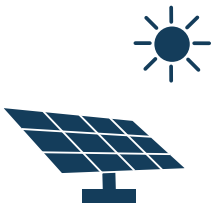
The courses are designed for a continuous participation from the beginning of the semester until the exam. There is an assignment for each course, which counts towards the final grade. Participants are asked to write a short statement regarding an important topic of each course. Assignments need to be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



INTRODUCTION TO RENEWABLE ENERGY PROJECTS

After completing this course, participants should 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, and
- assess project attractiveness with standard methods.



Content

Renewable energy projects

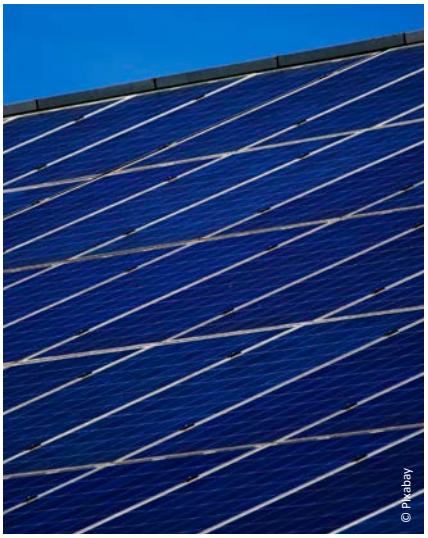
- General characteristics of RE projects
- The project realisation cycle
- The average lifetime of a RE project
- End of life considerations
- Typical players in RE projects

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
- Monetising external effects



FINANCING OF ENERGY EFFICIENCY PROJECTS AND ENERGY SERVICE COMPANIES (ESCOS)

Upon completion of this course, you should be able to:

- distinguish energy efficiency investments from conventional investments,
- explain the different financing options for energy efficiency projects,
- analyse business model innovation in the energy sector, including feedback from energy efficiency experts, energy performance contracts, how ESCOs work, and collaborative de-risking mechanisms,
- identify important stakeholders in energy efficiency finance (including those outside financial institutions),
- develop an energy efficiency finance portfolio and combine it with existing customer offers, and
- evaluate an energy efficiency project assessment from the perspective of a bank.

Content

Types of energy efficiency finance (EEF)

- The attractiveness of EE investment for financial institutions (FIs)
- Main sectors for EE projects and their financial characteristics
- Financing EE project challenges

Energy efficiency financing mechanisms and framework conditions

- Important framework conditions for EEF
- Energy efficiency financial instruments
- Energy efficiency finance innovations for FIs
- Identification of EE financing opportunities

De-risking technology in EE projects through collaboration with EE experts

- The need for technical expertise to de-risk technology
- Energy efficiency experts and energy service companies
- Technology and energy service providers
- Appraisal of technical experts

Project lifecycle and project development I—technical focus

- Introduction to EE project lifecycle
- Project development stages
- Technical project development—energy savings
- Selecting the most suitable technology

Project development II—financial model

- Introduction and screening
- Financial model analysis
- Investment (CAPEX) and OPEX estimations
- Sources of finance
- Balance sheets
- Co-benefits of EE projects
- Financial model—cash flow analysis
- Sensitivity analysis

Underwriting process I—contractual structure, measurement and verification (M&V), and creditworthiness

- Contract stakeholders and types of contract
- Technical de-risking contracts
- Background checks on clients' creditworthiness and energy awareness
- M&V system

Underwriting process II—risk assessment, environmental and social impact assessment (ESIA), investment decisions, and implementation

- Risk assessment of EE projects I—performance, equipment, and O&M risks
- Risk assessment II—assessing behavioural and operational risks, construction risks, weather-related risks, risks related to fluctuations in energy prices, and regulatory risks
- Mitigating regulatory risks—through ESIAs
- Investment decisions
- Commissioning (technical)/ drawdown (financial) and operations (technical)/servicing (financial)

Global EEF support

- Introduction to EEF support organisations
- Public finance support initiatives
- Industry initiatives and networks

RENEWABLE ENERGY FEASIBILITY ASSESSMENT AND INVESTMENT VALUATION

After completing this course, participants should be able to:

- illustrate basic financial principles including the time value of money and the determination of cost of capital,
- increase understanding of capital budgeting tools to assess renewable energy investment attractiveness,
- perform calculations of important economic parameters to assess the viability of a renewable energy project, and
- demonstrate concepts of risk and uncertainty as well as risk assessment instruments.

Content

Basic financial principles and concepts

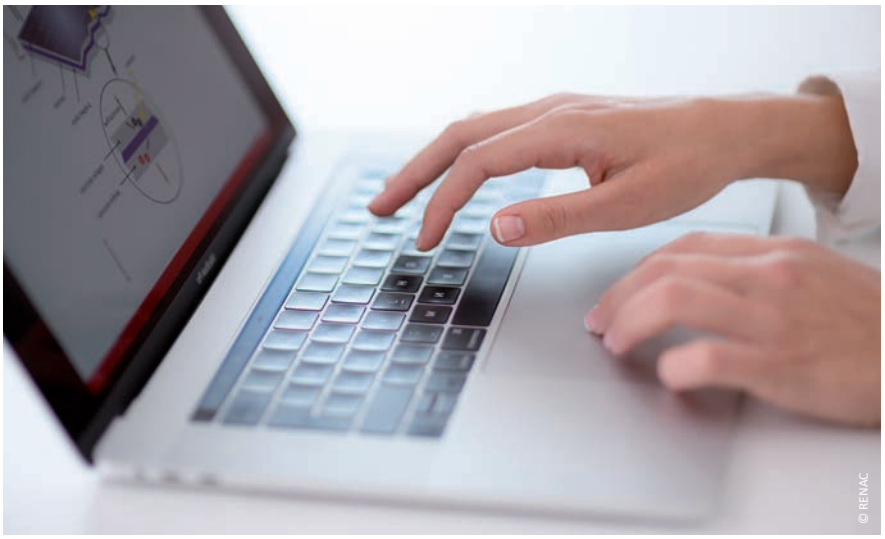
- Feasibility Study
- Time value of money: interest and future value, present value and discounting and interest rate components
- Discount rate and required rate of return concept
- Weighted average cost of capital (WACC)

Financial performance indicators

- The basic cash flow valuation model
- Net Present Value (NPV)
- Rates of return
- Payback periods
- Profitability index (PI)

RE project risks and uncertainties

- An overview of risks for RE projects
- General risk assessment instruments in investment appraisal
- Risk reduction in practice



RENEWABLE ENERGY PROJECT FINANCE

After completing this course, participants should be able to:

- demonstrate 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,
- interpret a bank's view of the risks related to PV, wind, and biogas plants, and
- collect the data required for a bankability assessment of a renewable energy project.

Content

Available financing options

- Financing options - overview
- Balance sheet financing and project finance
- Export Credit Agency cover
- Capital market financing

SPV-contract negotiation

- Introduction to the financing process
- Project investment, operating and financing agreements

Business planning

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

Bankability assessment

- Why conduct bankability assessments?
- Information asymmetries as a reason for bankability assessments
- Moral hazard risk for lending banks
- Setting credit limits to prevent moral hazard
- Differentiating between risk and uncertainty
- The financial value of risk and ABC-analysis
- RE project risks and project due diligence advisors
- Scopes of work for the advisors
- Design of a "project data room"

Financial engineering

- Key financial ratios
- Calculation of LLCR, PLCR and the maximum borrowing capacity

PROJECT CONTRACTS

Upon completion of this course, you should be able to:

- distinguish different types of project contracts and their corresponding contract partners,
- draft and prepare different types of contracts required in RE project finance,
- use these project contracts to achieve a bankable project finance structure and to minimise the project risks, and
- analyse the project contract requirements of international financial institutions.

Content

Introduction to project contracts

- Contractual relations in RE project finance
- Key functions and relevant components of project contracts
- Contract negotiation
- How to create and execute “Fit for Purpose” contract

Contracts in international projects

- Dispute settlement in international projects
- International private law
- The UN Convention on Contracts for the International Sale of Goods (CISG)
- Advantages and disadvantages of CISG
- Arbitration as an alternative dispute resolution (ADR) method

Contracts in renewable energy projects

- Overview of contracts
- Engineering, procurement, and construction (EPC) and purchase contracts
- Grid connection agreements
- Supply and offtake agreements, land leases, and other operating contracts
- Power purchase agreements (PPAs)
- Supply contracts in biogas projects
- Land lease agreements
- Management and operating (M&O) contracts
- Operations and maintenance (O&M) contracts

Potential risks for investors

- Overview of risks
- Legal risks associated with the land required for a project
- Political risks
- Legal due diligence and lender protection

Requirements of financial institutions

- Requirements of the main financial institutions: the World Bank, the Asian Development Bank (ADB), and the Inter-American Development Bank (IDB)

POLICY FRAMEWORKS OF RE POWER GENERATION

After completing this course, participants should be able to:

- analyse and design the most widely used support mechanisms for renewable energy (feed-in tariff, net-metering, auctions and other schemes),
- determine conditions to design successful support mechanisms or regulatory policies, and
- discuss suitability of policy regulations for different phases of the energy transition.

Content

Introduction to renewable energy policy and target setting

- Objectives of renewable energy policies
- Cost-competitiveness of RE technologies
- RE target setting: international trends and various types of RE targets
- RE targets and quota-based mechanisms
- Categorisation of support mechanisms for renewable energies (classic support mechanisms, additional incentives and frameworks)
- Combining support mechanisms: FiTs and auctions

Net-metering for distributed generation (prosumers/self-consumption)

- Cost developments for distributed generation (roof-top PV)
- Grid parity and self-consumption
- Introduction to net-metering
- Net-metering design: Programme and project size caps and roll-over provisions in net metering schemes, and pricing methodology
- Increased risks for prosumers to finance projects based on self-consumption
- Outlook: Rate design options for electricity pricing

Feed-in tariffs for distributed generation and large-scale projects

- Introduction to feed-in tariff (FiT) design
- FiT design: Long payment duration under FiT regimes
- FiT design: Tariff calculation methodologies for FiTs (value-based and cost based)
- Challenges of FiT calculation
- Input data for cost-based FiT tariff calculation: CAPEX and OPEX parameters and financing costs
- FiT design: Tariff degression in FiT and capacity caps in FiT schemes, and Feed-in premiums
- Location specific support: Location-specific FiTs

Competitive procurement/auctions for large-scale projects

- Introduction to auction mechanisms
- Recent auction results for wind and PV around the world
- Auction design: Frequency of procurement, technology neutral versus technology specific, price-finding mechanism, penalties for non-compliance, pre-qualifications and selection criteria)
- Location specific support: Location-specific auctions (pre-selected sites and development zones)

Additional incentives

- Overview of additional incentives
- Fiscal incentives: Tax credits and accelerated depreciation
- Financial incentives: Rebates and investment incentives
- Low-interest loans
- Corporate PPAs: contractual arrangements and design features and recent trends and regulatory frameworks
- General framework conditions for low-cost renewables: contractual and market factors and regulatory factors

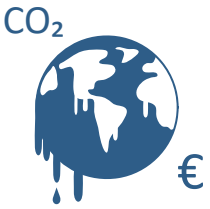
Grid connection, grid bottlenecks and related regulatory frameworks

- Priority grid access
- Cost sharing for grid connection
- Priority dispatch
- Approaches to RE curtailment and system integration: Japan and Germany

CLIMATE FINANCE

Upon completion of this course, you should be able to:

- compare the roles and contributions of the main stakeholder groups in the climate finance landscape,
- distinguish between the different sources and mechanisms of climate finance,
- assess the suitability of various sources and mechanisms for specific projects, and
- analyse practical examples of countries using climate finance sources and mechanisms.



Content

Principles of climate finance

- Climate finance after the Paris Agreement
- Climate finance definitions
- Climate finance commitments by developed countries
- Climate finance needs, flows, sources, and instruments
- Climate finance uses: mitigation and adaptation

Sources and mechanisms of climate finance

- Financial mechanisms of the United Nations Framework Convention on Climate Change (UNFCCC)
- Access modalities: intermediaries and direct access
- Multilateral development banks
- Bilateral finance: relevance and landscape
- Domestic climate financial sources
- Private financing in climate finance
- Carbon pricing and green bonds

Frameworks to deliver finance for climate action

- Nationally Determined Contributions (NDCs)
- Low-carbon emission development strategies
- Nationally Appropriate Mitigation Action (NAMA)
- Project-based climate financing

Measurement, reporting, and verification (MRV)

- Measurement, reporting, and verification: concept and purpose
- Elements of Monitoring and Evaluation
- Compare monitoring and evaluation (M&E) with MRV

PV APPLICATION

After completing this course, participants should be able to:

- describe a range of grid-connected and off-grid PV applications and how they are useful,
- visualise how onsite PV electricity generation can meet daily electricity demand,
- describe solar irradiation around the globe,
- calculate the required spacing between PV module rows to avoid self-shading,
- calculate the basic energy yield from a PV system using peak sun hours and performance ratios,
- explain which factors influence the capital and operating expenditures of PV systems and provide examples of system costs around the world, and
- perform basic calculations of payback times and unit cost of electricity for grid-connected and off-grid PV systems.

Content

Grid-connected PV applications

- Residential PV systems
- Commercial and industrial (C&I) PV systems
- Utility-scale PV power plants

Off-grid PV applications

- Solar home systems
- Telecom towers
- Street lightning
- Refrigeration
- Mobile phone charging
- Water pumping

Energy flow and metering options

- Energy generation profiles
- Metering options
- Energy flow in grid-connected systems with and without storage
- Providing backup power or going off-grid
- Connecting storage systems and the importance of energy efficiency

Solar irradiation and space requirements

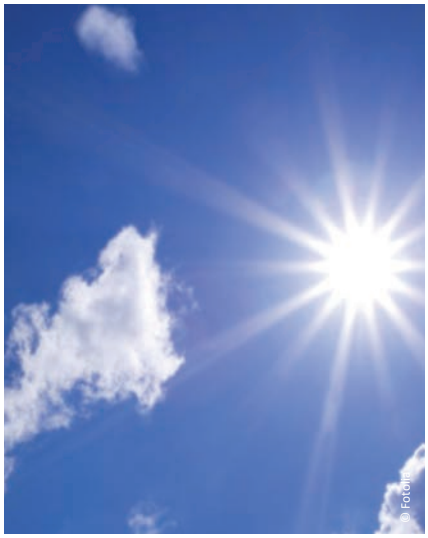
- Solar irradiation around the globe and on inclined surfaces
- Space required for the PV array

PV system energy yield

- Peak sun hours (PSH) and performance ratio (PR)
- Energy yield calculations for grid-connected systems
- Available energy for end-users of PV systems with storage

Economics of PV systems

- Capital expenditure, operating expenditure, payback and unit cost of electricity
- Economics of grid-connected PV systems
- Economics and financing of off-grid PV systems



WIND POWER APPLICATION

After completing this course, participants should be able to:

- list the different applications of wind turbines and name the turbine components, and
- understand the economic and environmental aspects of wind power.

Content

Wind power applications

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

Introduction to wind turbine components

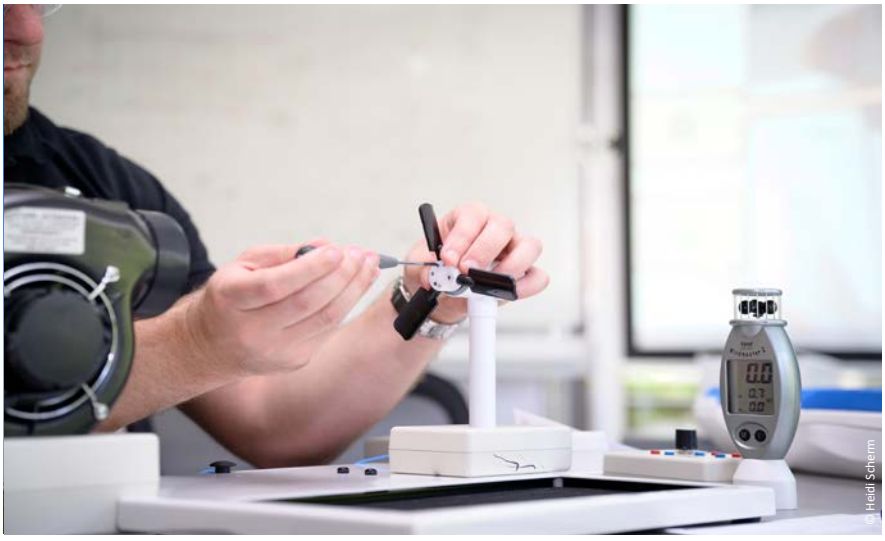
- Principles of wind turbine design
- Towers, nacelle, rotor blades and generators
- Wind turbine power curves

Economic aspects

- Investment costs (CAPEX)
- Operating costs (OPEX)
- Levelised cost of energy (LCOE)

Environmental aspects

- Noise
- Shadow
- Landscape and nature



BIOGAS APPLICATION

After completing this course, participants should be able to:

- describe the range of applications for biogas systems,
- explain the relevance of biogas in the energy mix,
- classify the most common types of biogas systems and their components, purpose, and output,
- explain a biogas plant's role in transforming organic waste into organic fertiliser,
- describe all the logistics required to provide the needed substrates for a biogas system,
- analyse the impact of different input parameters on the power output of biogas systems, and
- evaluate biogas systems based on economic and environmental aspects.

Content

Biogas applications

- What is biogas?
- Benefits of biogas
- The role of bioenergy in the energy mix

Biogas production

- Biogas production through anaerobic digestion
- Substrates
- Methane yield of substrates: shares of dry matter and organic dry matter
- Biogas yield
- Substrate quality
- Anaerobic digestion process parameters: temperature, pH and inhibiting substances

Biogas plant output

- Biogas: conditioning, direct combustion, combined heat and power generation, and biogas upgrading (CO_2 separation)
- Digestate

Biogas system classification

- Household digesters: fixed-dome digesters, floating-drum digesters, and tubular digesters
- Covered lagoon systems: non-agitated covered and agitated covered lagoons
- Industrial plants: agricultural plants, municipal solid waste plants, and wastewater treatment plants

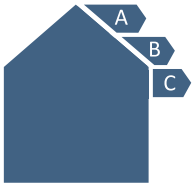
Economic and environmental aspects

- Investment and capital expenditure
- Operating expenditures: substrate costs, general operating costs, digestate costs
- Environmental aspects and health and safety

ENERGY EFFICIENT BUILDINGS - APPLICATION

Upon completion of this course, you should be able to:

- explain the relevance of buildings in the context of climate mitigation,
- compare different energy efficiency standards for buildings,
- explain how climate factors affect structural measures and building energy consumption,
- illustrate the benefits of energy-efficient buildings, and
- compare the economics of green buildings with conventional buildings.



Content

Energy consumption in buildings

- Energy flows and energy balance of buildings (e.g. heating, cooling)
- Final energy consumption of residential buildings and buildings in the service sector
- Energy efficiency trends and appliances in residential buildings
- Energy efficiency trends and appliances in service sector buildings

Buildings in different climate zones

- Climatic factors influencing and building design
- Environmental and geographical factors influencing building design
- Structural design features in different climate zones
- Traditional climate-friendly construction methods

Energy efficiency policies and building standards

- Building codes
- Building certificates
- Labelling and minimum energy performance standards (MEPS) for energy performance in buildings
- Financial incentives for energy efficiency in buildings
- More than energy efficiency: certificates of sustainability

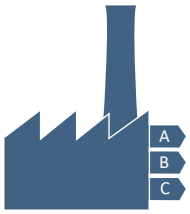
Benefits of green buildings

- Definition of green buildings
- Health and well-being
- Climate mitigation and adaptation
- Changes in the real estate markets
- Economic aspects of green buildings
- Case studies

ENERGY EFFICIENCY IN INDUSTRY - APPLICATION

Upon completion of this course, you should be able to:

- demonstrate the basic functions of cross-sectoral technologies in industry,
- determine areas of application for cross-sectoral technologies in industry,
- prepare technical measures to enhance the energy efficiency of cross-sectoral technology, and
- explain the technical energy-saving potential of technical measures to enhance energy efficiency.



Content

Heating and cooling

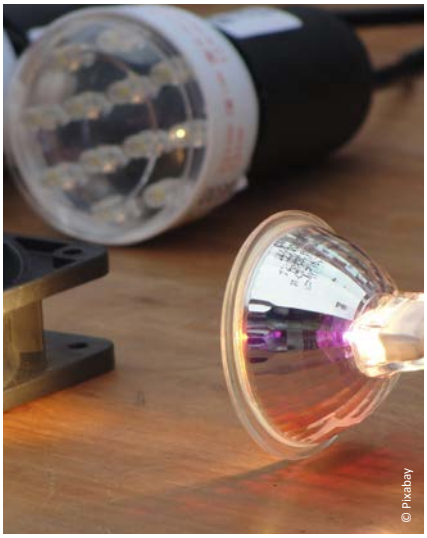
- Heating: industrial areas of application
- Energy efficiency in heating processes
- Cooling: industrial areas of application
- Energy efficiency measures and potential for cooling equipment

Electricity-based cross-sectoral technology

- Electric drives: areas of application in industrial sectors
- Lifecycle costs of electric drives and saving potential
- Pump systems
- Energy efficiency in pump systems
- Compressed air systems
- Energy efficiency in compressed air systems
- Ventilation: industrial areas of application
- Energy efficiency in ventilation systems
- Lighting
- Luminaires and their industrial areas of application
- Energy demand reduction strategies for lighting

Sectoral approaches

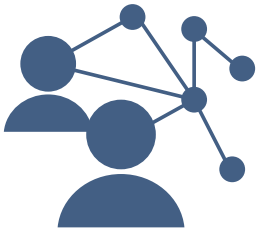
- Cement industry
- Textile industry
- Food industry



RENAC´S ONLINE ACADEMY

The Renewables Academy (RENAC) AG is a leading international provider of training, educational, and capacity building services on renewable energy technologies and energy efficiency. Since 2008, more than 30,000 participants from over 160 countries have taken part in RENAC training courses and programmes. We are convinced that knowledge and skills are the key to the sustainable development of clean and secure energy supplies and it is our mission to provide this knowledge and skills to as many people as possible.

As part of this mission, our Online Academy was founded in 2014. Today, RENAC´s Online Academy offers over 30 courses and programmes, with participants learning with us from the comfort of their own homes around the globe.



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 staff are:

- Experienced professionals
- In direct contact with industry

Demo course

- We invite you to visit our online platform demonstration course:
- http://renewables-online.de/blocks/demologin/logindemo.php?course=Demo

"Applying Green Energy Finance is a comprehensive and well-structured interactive programme that helped me upgrade my knowledge and skills in renewable energy project analysis. I would not hesitate to recommend this programme. Thank you RENAC!" *Viktoriya Sergeyeva, Applying Green Energy Finance: Renewable Energy and Energy Efficiency, 2023*

LEARNING WITH RENAC ONLINE

Learning with RENAC Online is done asynchronously in two steps. First, participants work through each course's content, and then get the opportunity to apply the newly acquired knowledge and skills, consolidating them in their minds. In practice, both steps are accomplished in several ways. Programmes also contain written assignments with feedback from RENAC that not only further reinforce learning outcomes but may also complement their exam grades.

Text and images

Courses are organised into short, instructional chapters with illustrations. Learners are guided through the material step by step.

Videos

Recorded lectures cover some of the most important topics in a visual and engaging way.

Live virtual classroom

It is recommended that participants attend live virtual lectures, which are given by RE and finance experts. During and after lectures, participants are invited to chat about topics and issues in the live online forum.

Online Forum

A discussion forum helps to support students and foster communication between them and with RENAC. This forum is monitored by RENAC staff and experts who can provide technical assistance and discussion about course topics.

Self-tests

Self-tests within each course help participants assess their knowledge.

Assignments

Programmes contain written assignments with individual feedback from RENAC.

PLEASE NOTE

RENAC uses plagiarism detection software to detect its presence in submitted assignments. Plagiarism, using someone else's work or ideas as if they were your own, is unacceptable. When completing assignments, participants must acknowledge any work by others that has been included in their answers by referencing its authors.

INTAKES, TECHNICAL INFORMATION, AND FEES

START DATES

1 April / 1 October

Spring semester and fall semester each year.

RECOMMENDED STUDY TIME

5 – 10 hours per week

DURATION

3–5 weeks per course

3–6 months to complete the entire programme

TECHNICAL INFORMATION

You need to provide an email address in order to register and create your account, where you will receive course updates and feedback. You need access to a device with a reliable internet connection (at least 2 Mbit/s). This may be a mobile device, but we recommend using a computer. Live virtual lectures and orientation take place on Zoom, so you also need a headset or speakers to listen to the presentations.

REGISTRATION

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

REGISTRATION DEADLINE

1 April / 1 October

FEE

EUR 1,309.00 including 19 % of German VAT

DISCOUNTS

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

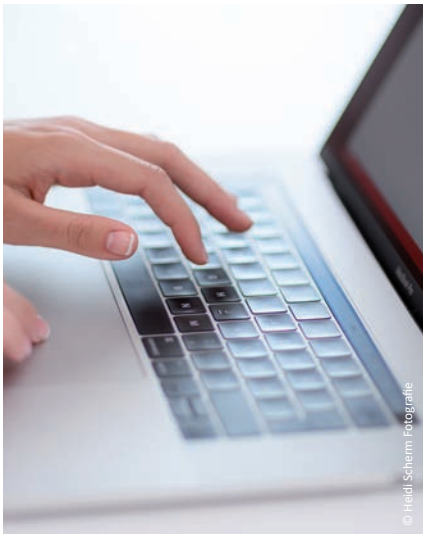
EARLY BIRD DISCOUNT DEADLINE

20 February / 20 August

PAYMENT METHODS

VISA, MasterCard, PayPal, or bank transfer

Q1 Start of semester: 1 April and 1 October



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