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. 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

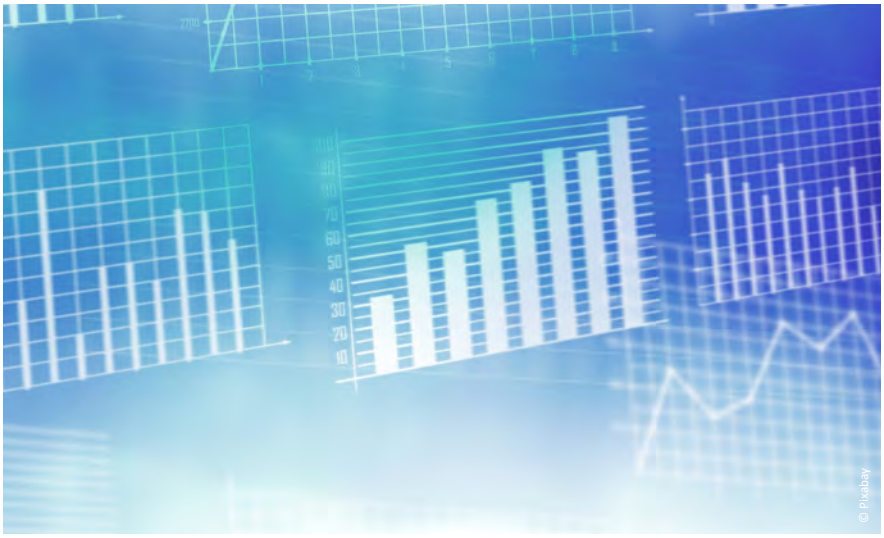
Staatliche Zentralstelle zugelassen zfu Nr. 7422622 für Fernunterricht

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,
- analyse the political and legal market frameworks that apply to specific Renewable Energy and Energy Efficiency projects
- identify project finance structures and procedures for RE and EE projects.



PROGRAMME STRUCTURE

MANDATORY COURSES
120 hours

- Introduction to renewable energy (RE) projects
- Introduction to energy efficiency (EE) projects
- Market overview of global RE and EE financing
- Policy frameworks of RE power generation
- Support mechanisms for energy efficiency projects
- Renewable energy feasibility assessment and investment valuation
- Debt financing process and credit risk management
- RE project 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

ASSIGNMENTS AND EXAM
15 hours

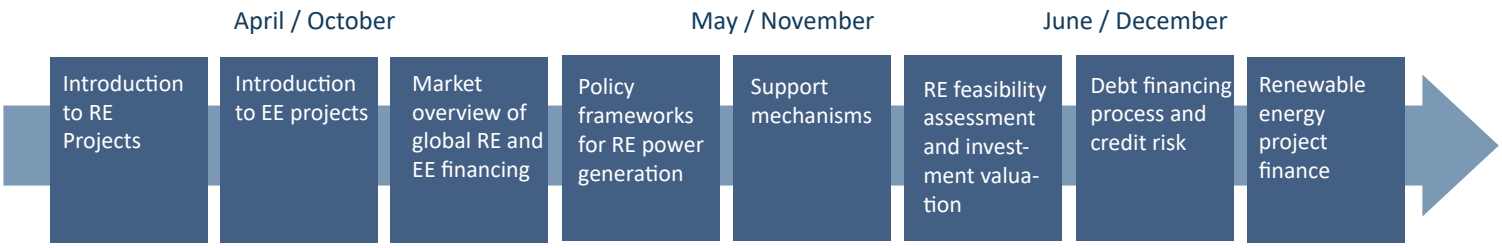
- Forum assignments and RE Term Sheet development
- Exam and retake covering
- mandatory courses
- Applying Green Energy Finance certificate
- Certificate of attendance

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



Live virtual sessions

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. This session also covers programme details such as activities and assignments, the exam, deadlines and scheduling. The other three live virtual sessions are part of the online training programme.

These four virtual live events are not mandatory, but participation is strongly recommended.

SESSION 2

RE POLICY FRAMEWORKS

1st month of semester

(1 hour)

SESSION 3

ENERGY EFFICIENCY FINANCE

2nd month of semester

(1 hour)

SESSION 4

RE PROJECTS CASH FLOW

3rd month of semester

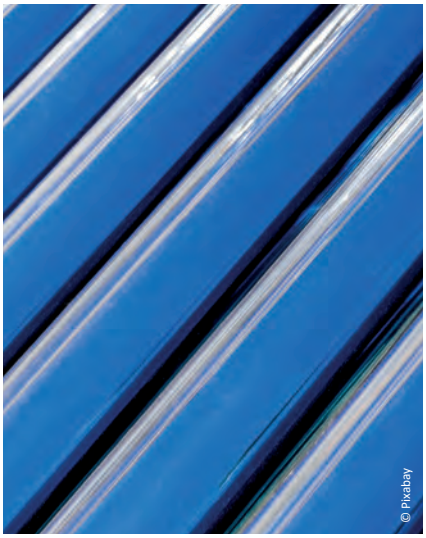
(1 hour)

Exam and certificates

RENAC Online Academy programme final grades comprise the grades obtained on the programme's final exam (weighted 75% of total) and those from programme assignments (weighted 25% 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

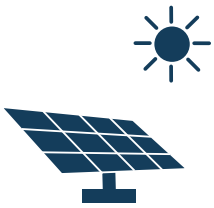
The courses are designed for a continuous participation from the beginning of the semester until the exam. There are three assignments during the course, which count towards the final grade. Participants are asked to write two short forum posts elaborating on relevant topics from the courses. Additionally, participants are asked to prepare a RE Term Sheet based on a case study. Assignments need to be handed in by the deadlines. Assignments need to be handed in by the deadlines.



INTRODUCTION TO RENEWABLE ENERGY PROJECTS

After completing this course, participants should be able to:

- define the character of energy efficiency project,
- analyse drivers and barriers for energy efficiency projects,
- assess the relevance of energy efficiency in different economic sectors in the context of climate change, and
- demonstrate principles of energy efficiency finance options and the role of providers of finance.



Content

Introduction to energy efficiency

- Current status of energy efficiency worldwide
- Energy efficiency and the Paris Agreement

Setting the scene for energy efficiency

- The importance of energy efficiency
- Energy efficiency to reduce energy demand
- Energy efficiency strategies cost
- Benefits of energy efficiency
- Energy consumption by sectors
- Stakeholders in energy efficiency
- Drivers of implementation of energy efficiency measures
- Barriers in implementation of energy efficiency
- Strategic Principles for Implementing EE Policies

Definitions, standards and technical terms

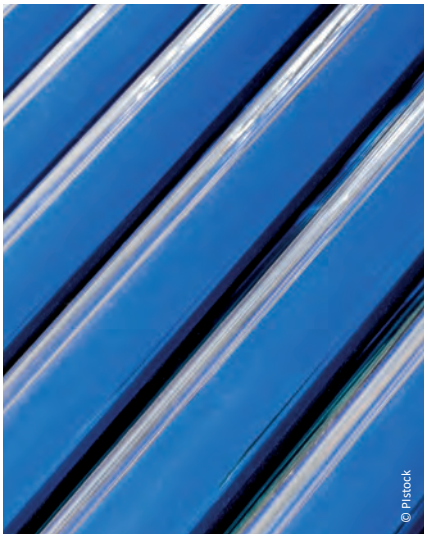
- Greenhouse Gases (GHG)
- Definition of Baseline and Business as usual
- Definition of energy consumption and energy baseline
- Definition of energy efficiency
- Definition of Energy Intensity on the country level
- Definition of energy conservation

Energy efficiency projects

- Differences between programmes and projects
- Concept and types of energy efficiency projects
- Energy efficiency projects by investment category

Financing of energy efficiency projects

- Sustainable finance taxonomy and energy efficiency
- The economics behind energy efficiency projects
- Project cost and revenues
- The role of providers of finance in a green economy
- Climate finance investment evolution
- Internal processes for providers of finance
- Special features of energy efficiency finance
- Barriers to energy efficiency finance
- Financing options



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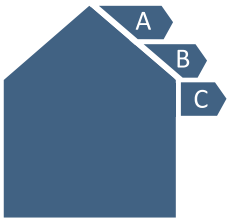

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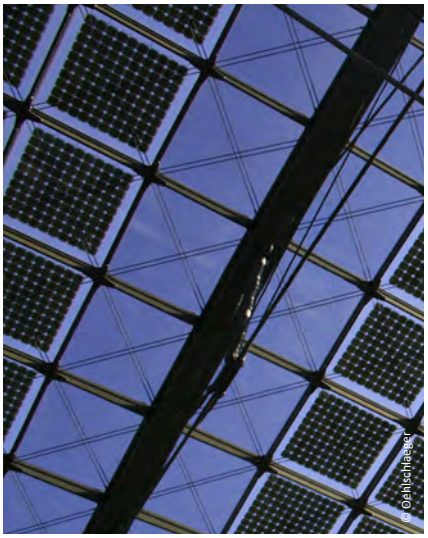


MARKET OVERVIEW OF GLOBAL RE AND EE FINANCING

After completing this course, participants should be able to:

- Demonstrate the global investment situation and major trends in renewable energy and energy efficiency finance,
- Classify and define renewable energy and energy efficiency finance as well as asset classes, and
- Distinguish different types of investors.

Assignment

- Short forum post to assess renewable energy and energy efficiency in a specific country, including market trends, top technologies, and key sectors for improvement.

Content

Introduction to energy efficiency

- Current status of energy effiRenewable energy finance market overview
- Global RE financing market volume
- Global RE financing market by region and technology
- Classification of RE financing
- Major market trends and regional comparison
- Renewable energy country attractiveness index (RECAI)
- Global RE financing market – major asset classes
- Global RE financing market – major investors
- Global RE financing market - league tables
- Regional installed RE capacity

Energy efficiency finance market overview

- Energy efficiency – a global market
- Global EE financing market by region and technology
- Market trends in energy efficiency investments
- Classification of EE financing
- EE financing market - major issuers of green bonds

POLICY FRAMEWORKS FOR 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

SUPPORT MECHANISMS FOR ENERGY EFFICIENCY PROJECTS

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

- name different barriers to energy efficiency deployment,
- identify the roles and competencies of political stakeholders in energy efficiency,
- explain the bundling of different support mechanisms to achieve governmental goals, and
- discuss the benefits and drawbacks of the most common support mechanisms.

Assignment

- Short forum post which focuses on discussing policy measures for renewable energy and energy efficiency to enhance investment opportunities, and hypothesizing a new frameworks to support energy efficiency investments.

Content

Why we need energy efficiency policies

- Economic barriers
- Knowledge and cultural barriers
- Principal-agent barrier

Benefits of support mechanisms

- Benefits of support mechanisms for investors of energy efficiency projects
- Responsible entities for energy efficiency policymaking

Types of energy efficiency policy measures

- Regulation policy
- Information policy
- Economic incentives
- Voluntary agreements

Combining and assessment of different measures

- Bundling of different types of measures
- Assessment and comparison of policy measures

RE FEASIBILITY ASSESSMENT AND INVESTMENT VALUATION

Upon completion of this course, you 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

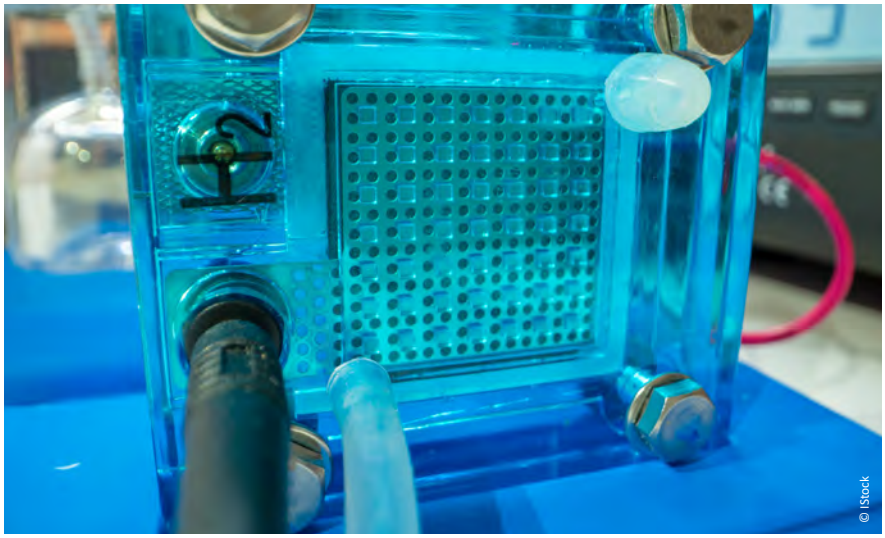
- Feasibility Study
- Time value of money: interest and future value, present value and discounting and interest rate components
- Discount rate and required rate of return concept
- Weighted average cost of capital (WACC)

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



DEBT FINANCING PROCESS AND CREDIT RISK

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

- compareexplain the process of credit risk management related to RE project financing transactions,
- apply the principles of risk allocation in projects,
- 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, anddiscuss the project loan documentation and important clauses included in its main agreements, and
- recall the principles of restructuring project financing.

Content

Foundations of risk management in project financing

- Risk and risk management
- Main risk management goal in project financing: securing stable cash flows
- Risk analysis
- Risk quantification and evaluation
- Risk allocation

Project documentation, structuring, credit analysis, rating and credit approval

- Bank-internal credit decision process
- Information memorandum
- Letter of Intent – Flower Letter
- The term sheet
- Rating of RE project loans
- Fulfilment of covenants – achieving first loan disbursement

Project loan documentation

- The concept of ‘collateral’ in project financing transactions
- Aims of collateral agreements
- Typical collateral agreements in RE project financing
- Syndication
- Credit monitoring and re-rating

Due Diligence - documenting a project for credit assessment

- Introduction to Due Diligence
- Due Diligence: process and roles
- Due Diligence: scope and completion
- Loan conditions and covenants
- Project financing in a crisis
- Legal and economic restructuring options

Analysis of contracting options in the RE project setting

- Basic aspects of game theory
- Selection of contractors in one-time transactions
- Selection of contractors in repeated transactions
- Conclusive analysis of rational choice in the contracting game
- Remuneration strategies in repeated transactions

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.

Assignment

- Creation of a preliminary term sheet for a renewable energy project, where participants act as a bank's renewable energy project specialist, proposing a financing plan based on a provided case study and template, with a focus on structuring.

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

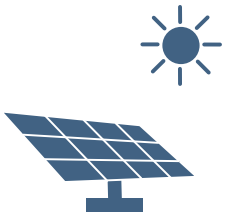
Bankability assessment

- 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

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

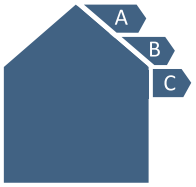
Economic and environmental aspects

- 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

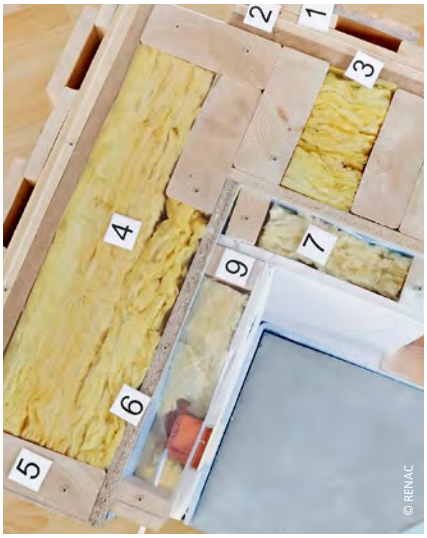
- Climatic factors influencing and building design
- Environmental and geographical factors influencing building design
- Structural design features in different climate zones
- Traditional climate-friendly construction methods

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

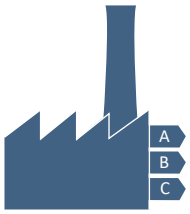
- Definition of green buildings
- Health and well-being
- Climate mitigation and adaptation
- Changes in the real estate markets
- Economic aspects of green buildings
- Case studies



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

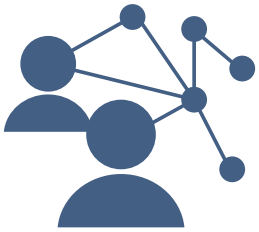
Sectoral approaches

- 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

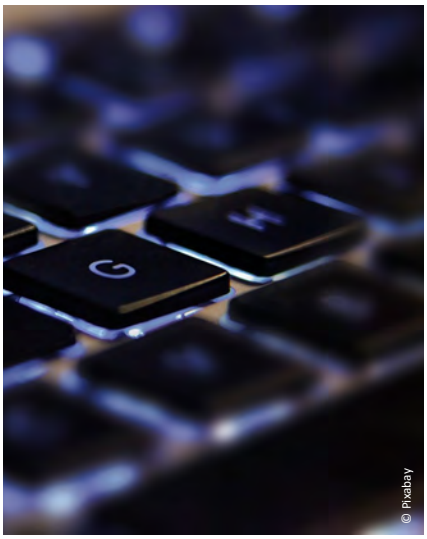
Self-tests within each course help participants assess their knowledge.

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

RECOMMENDED STUDY TIME

5 – 10 hours per week

DURATION

3–5 weeks per course

3–6 months to complete the entire programme

REGISTRATION

You can register online at:

www.renac.de/online-academy

REGISTRATION DEADLINE

1 April / 1 October

EARLY BIRD DISCOUNT DEADLINE

20 February / 20 August

PAYMENT METHODS

VISA, MasterCard, PayPal, bank transfer

DISCOUNTS

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

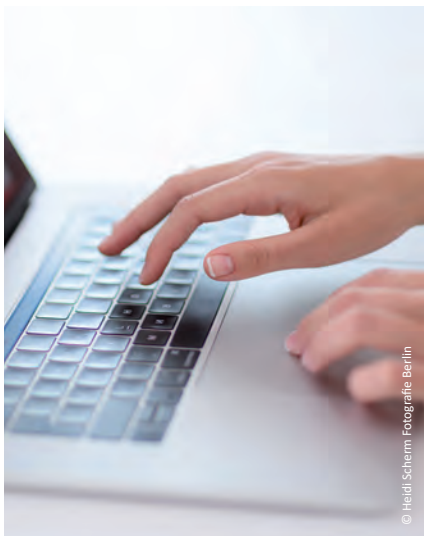
Start of semester:

1 April and

1 October

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.



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www.renac.de/online-academy