Supported by:

Federal Ministry
for the Environment, Climate Action,
Nature Conservation and Nuclear Safety

based on a decision of
the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

green banking
an initiative by RENAC

renac
renewables academy

Green Hydrogen Specialist: Project Development and Economics

Online programme overview

The Alliance For green Commercial Banks

An Initiative of IFC International Finance Corporation WORLD BANK GROUP

GBAC Green Banking Academy

AN INNOVATION OF IFC International Finance Corporation WORLD BANK GROUP

PFAN
Accelerating Investment for Climate and Clean Energy

TRAINING AND PROJECT OVERVIEW

INTRODUCTION

Funded by the Green Banking – Capacity Building on Green Energy and Climate Finance project, the Green Hydrogen Economics and Project Development online training addresses the rapidly growing global demand for green hydrogen and its derivatives. The programme equips participants with a solid understanding of the economic, technological, and project development aspects of green hydrogen as a key pillar of the low-carbon transition.

Participants gain essential knowledge of hydrogen electrolysis, ammonia production, fuel cells, transport options, and global green hydrogen markets. The training provides a strong foundation for initiating green hydrogen projects worldwide and supports early-stage project development and market ramp-up.

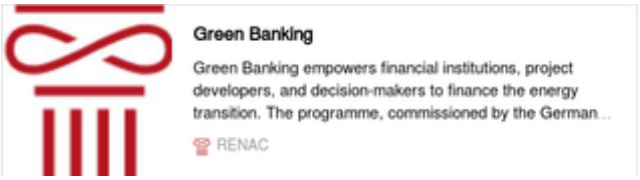
The programme also prepares participants to engage in economic and policy discussions on green hydrogen market development, formulate the right questions around market expansion, and assess project-specific parameters such as permitting, regulatory frameworks, and risk factors. Proven technological developments are covered to support the design of competitive and financially viable projects.

WHAT IS THE GREEN BANKING PROGRAMME?

The Green Banking – Capacity Building on Green Energy and Climate Finance is a scholarship programme under the German International Climate Initiative (IKI). The programme is implemented by Renewables Academy AG (RENAC) on behalf of the German Federal Ministry for Economic Affairs and Climate Action (BMWK).

The Green Banking project supports professionals across the entire banking value chain in developing and implementing green energy and climate finance solutions. Through holistic training formats, it builds capacity among banking professionals, project developers, and policymakers to finance renewable energy and energy efficiency projects in partner countries.

More information:
https://shop.renac.de/projects/green-banking-climate-finance/



COURSE OVERVIEW & ENROLLMENT INFORMATION

THIS PROGRAM IS SUITABLE FOR THOSE WHO:

- An employee of a company that develops projects involving cutting-edge technologies, such as production of hydrogen using electrolysers.
- An employee of a bank, insurance company, or financial institution seeking to evaluate the financial aspects of Green Hydrogen, green ammonia, and fuel cell power stations.
- An employee of a company that makes informed decisions regarding opportunities for:
  - production of Green Hydrogen using electrolysers
  - production of ammonia from Green Hydrogen
  - transport of hydrogen and ammonia
  - production of energy from Green Hydrogen via fuel cells

Whether you are part of a company looking to venture into these exciting areas of project development or a financial institution seeking to assess the viability of financing such projects, this programme is designed to provide you with fundamental knowledge. You will be prepared to make informed decisions regarding project development and financing opportunities.

LEARNING OBJECTIVES

After completing these courses, participants should be able to:

- apply the basic principles of project development in the production of Green Hydrogen via electrolysis, green ammonia production, and for small fuel cell power plants,
- evaluate and implement sustainability aspects into project planning and operation,
- assess project economic viability and identify associated project risks,
- explain the various markets and transport options available for Green Hydrogen and ammonia,
- explain the fundamentals of hydrogen as an energy carrier and its potential in various applications and
- assess investment opportunities in the evolving Green Hydrogen economy.

PROGRAM BACKGROUND AND PARTICIPATION

APPLICATION PROCESS

As part of the Green Banking project, RENAC will be able to offer 20 scholarships to participants from each partner country: Brazil, Colombia, Kenya, Indonesia, South Africa and Vietnam. Individuals who wish to participate in the training programme must submit a completed application form, available on the RENAC website.

The programme takes into account a balanced gender selection of participants and promotion of career opportunities.

RENAC will inform candidates via email as soon as possible if they have been selected for a scholarship for the online training. The applicant must confirm their acceptance of the scholarship offer by replying to the invitation from RENAC via email.

NOTE: Scholarship recipients must log into the learning platform no later than 2 weeks after the start of the training programming.

LANGUAGE

The programme language is English, Spanish and Portuguese. All programme material (including course content, videos, pre-recorded lectures, assignments, and exams) will be available in the language of the target country.

SELECTION CRITERIA

Criteria for the selection of participants are:

1. Citizen of an eligible country: Brazil, Colombia, Kenya, Indonesia, South Africa or Vietnam.
2. Good command of spoken and written English.
3. Not currently enrolled students.
4. A robust application and the provision of a CV within the application window.

ONLINE TRAINING PROGRAMME FEATURES

The Green Hydrogen Project Development and Economics programme combines asynchronous and synchronous learning methods. Participants will have access to texts, assignments, and instructional videos, and they will have the opportunity to participate in virtual classrooms. Learning with RENAC 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. The online training also contains written assignments that not only further reinforce learning outcomes but may also complement their exam marks.

FINAL EXAMINATION AND CERTIFICATE

In order to finalise the training successfully, participants will need to complete and pass an online examination with a grade of at least 70%. Successful participants will receive a digital certificate from RENAC.

WORKLOAD FOR PARTICIPANTS

Depending on prior knowledge, participants should expect to spend about 150 hours to successfully complete the course. This includes: Reading and understanding the material, watching videos, answering self-test questions, participating in virtual classrooms, and joining the Q&A forum. It also includes submitting short assignments, completing administrative work (familiarising with the Moodle platform and creating profiles, etc.), and successfully preparing for and taking an online exam.

PROGRAM BACKGROUND AND PARTICIPATION

ASSIGNMENTS

During the training, participants are required to complete three assignments. The first two involve researching a specific topic and submitting a written response of approximately 800 words. The third assignment additionally requires the use of a Levelised Cost of Hydrogen (LCOH) calculation tool provided by RENAC.

The average grade across the three assignments will contribute 30% to the final course grade; the remaining 70% will be based on the online exam.

Each assignment submission must be accompanied by:

- A declaration regarding the use of AI tools, and
- A list of references used

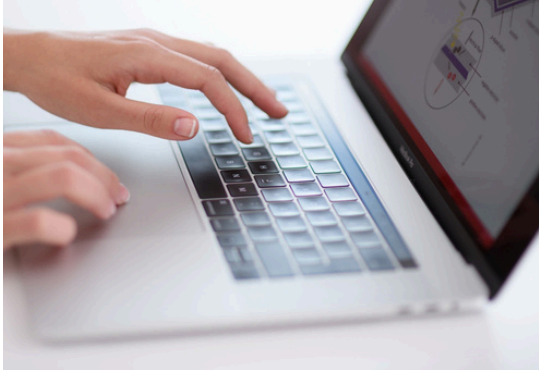
CONTENT

The Green Hydrogen Project Development and Economics online programme provides project developers and representatives from finance institutions with the necessary knowledge and skills to navigate the emerging field of Green Hydrogen economics and project development. Through a combination of 10 courses, participants will gain a deep understanding of Green Hydrogen energy systems and hydrogen transport, hydrogen electrolyser technologies, ammonia production and transport, fuel cell power stations, Power-to-X applications, and fuel cell power station projects. This programme aims to equip participants with the expertise needed to capitalise on the growing opportunities in the Green Hydrogen market.

PROGRAMME SCHEDULE

The Green Banking Scholarship for the Green Hydrogen Economics programme lasts 20 weeks.

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 1: INTRODUCTION TO GREEN HYDROGEN

MANDATORY COURSES

Introduction to hydrogen

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

- Explain the basic components of a hydrogen-based energy system and infrastructure
- Describe the current uses of hydrogen, its production methods, and value chains
- Describe the opportunities and limitations of hydrogen as a future energy carrier and in developing a sustainable energy future
- Understand the current status of hydrogen policies in the international arena

Content

- The element hydrogen (H)
- Energy related properties of hydrogen
- Types of hydrogen applications
- Hydrogen generation and fuel cells
- Hydrogen infrastructure
- System integration/sector coupling (Power-to-X) ptX
- The cost of hydrogen
- International hydrogen strategies and roadmaps

Power-to-X applications and cost developments

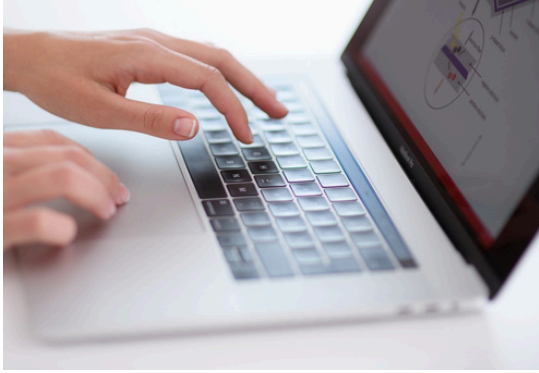
After completion of this course, participants will be able to:

- Explain the purpose of the concept of sector coupling as well as opportunities and challenges associated with the concept
- Compare the status quo of available technologies for sector coupling in the heating/cooling sector and in the transport sector, as well as generally expected future developments regarding technology options and costs

Content

- Introduction to sector coupling
- Direct electrification in the heating and cooling sector
- Direct electrification in the transport sector
- Indirect use of electricity
- Renewable hydrogen in steel production
- Renewable methanol
- Regulatory framework
- Power-to-X supply chain examples

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 1: INTRODUCTION TO GREEN HYDROGEN

OPTIONAL COURSES

Introduction to energy

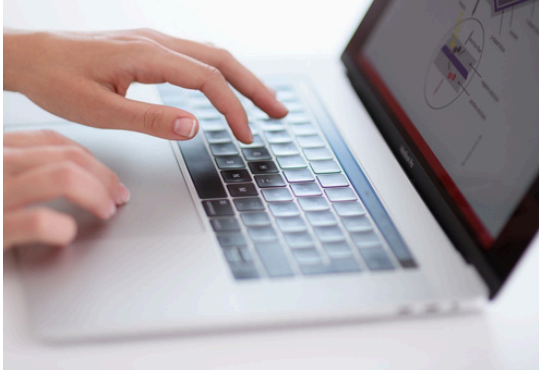
After completion of this course, participants will be able to:

- 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 markets
- Physical basics
- Units and conversions

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 2: GREEN HYDROGEN ELECTROLYSIS

MANDATORY COURSES

Green Hydrogen Production by Electrolysis: Project Development and Financial Evaluation

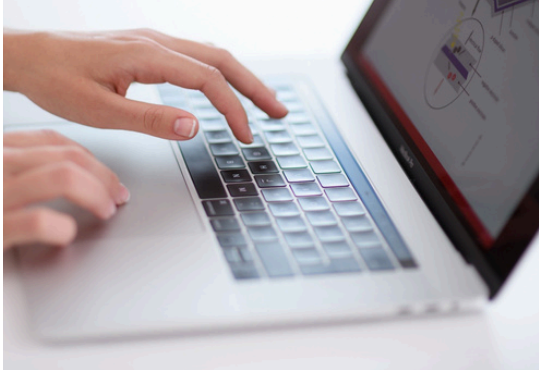
After completion of this course, participants will be able to:

- Describe the main technologies used in green hydrogen electrolysis
- Successfully apply the basics of project planning and system sizing
- Apply important sustainability aspects in the planning, design and operation of hydrogen projects
- Assess the economic viability of green hydrogen plants

Content

- Sizing fundamentals of key onshore electrolyser plant components
- Impact of variable wind and photovoltaics on plant design and component sizing
- Simple design and sizing tool for important plant components (Excel tool for basic engineering)
- Main plant components
- Filling stations for hydrogen transport
- International standards
- Sustainability
- Operation and safety
- Requirements for bankable business cases for green hydrogen with electricity from onshore wind and/or photovoltaics
- Hydrogen business case inputs for electrolyser plants using electricity from onshore wind and/or photovoltaics
- Financial evaluation of business cases for hydrogen generation using electricity from onshore wind and/ or photovoltaics
- Preparing the financial evaluation
- Checklists
- Offshore wind to hydrogen electrolysis

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 2: GREEN HYDROGEN ELECTROLYSIS

OPTIONAL COURSE

Introduction to ammonia

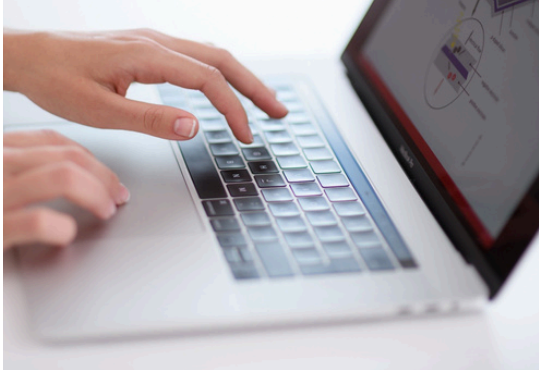
After completion of this course, participants will be able to:

- Describe the physical-chemical characteristics of ammonia
- Explore the novel applications of ammonia, its production methods, and value chains
- Understand different ammonia production technologies
- Differentiate the colours of ammonia and the environmental impact associated

Content

- Physical-chemical characteristics of ammonia
- Energy related properties of ammonia
- The global uses and demand for ammonia
- Developing fields of use for ammonia
- Ammonia production technology overview
- Nitrogen production technology overview
- Colours of ammonia

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 3: GREEN AMMONIA AND FUEL CELLS

MANDATORY COURSES

Green Ammonia Production – Project Development and Financial Evaluation

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

- Describe the main technologies used in green ammonia production
- Understand basic project planning and sizing.
- Apply safety and sustainability considerations in the planning and operation of green ammonia projects
- Understand important factors that impact the economic viability of plants for green ammonia

Content

- Fundamentals of sizing important plant components
- Impact of variable wind and photovoltaics on plant design and component sizing
- Simple design and sizing tool for important plant components (Excel tool for basic engineering)
- Main plant components
- Filling stations for transport
- Sustainability
- Operation and safety
- Economic viability
- Calculation tool for financial evaluation
- Financial evaluation of business cases
- Checklists

Fuel cell electric power generation

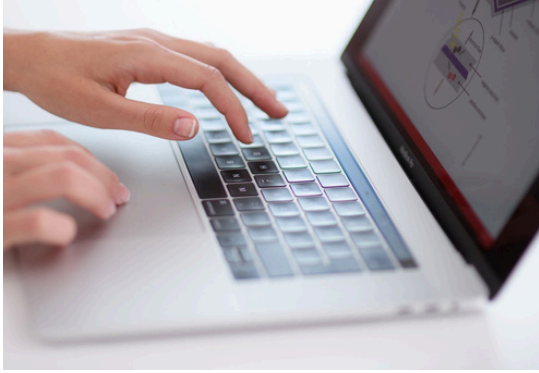
After completion of this course, participants will be able to:

- Describe the main technologies in fuel cell power generation
- Understand the basics of planning and sizing a fuel cell power plant
- Consider important aspects of sustainability in the planning and operation of fuel cell projects
- Assess the conditions for economic viability of electricity from fuel cells

Content

- Fundamentals of important plant components
- Main plant components
- Operation & Safety
- Sustainability
- Evaluation of business cases
- Economic viability

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 3: GREEN AMMONIA AND FUEL CELLS

OPTIONAL COURSE

Energy storage - application and technology

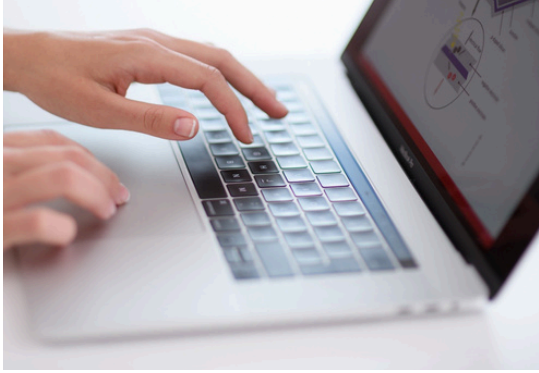
After completion of this course, participants will be able to:

- describe the purpose and future role of energy storage systems (ESS)
- classify storage technologies
- calculate specific costs and compare different economic aspects of ESS
- explain how different energy storage technologies complement each other.

Content

- Storage systems: components, technologies, and integration strategies
- Terminology and definitions
- Energy storage system classification
- Storage applications in different sectors
- Mechanical energy storage systems
- Electrochemical and chemical energy storage systems
- Thermal energy storage (TES)
- Economics of energy storage systems
- Competition among technologies

LEARNING OBJECTIVES & CONTENT OF THE COURSES



MODULE 4: MARKETS AND TRANSPORT

MANDATORY COURSE

Green Hydrogen and Ammonia Transport – Overview

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

- Describe transport options (road, train, ship, pipeline) for hydrogen and ammonia
- Recognise the capacity and scale of transport infrastructure needed to achieve climate goals
- Understand advantages and limitations of various transport alternatives
- Describe the challenges of using ammonia as a hydrogen carrier
- Discuss matters of energy efficiency and economic viability as they are impacted by hydrogen transport

Content

- Transport options (road, train, ship, pipeline)
- Typical capacities of transport options
- From hydrogen blending in natural gas networks to a 100% hydrogen pipeline infrastructure
- Recovering hydrogen from ammonia
- Sustainability, risks, and risk mitigation
- Economic viability

Markets for Hydrogen and Its Derivatives

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

- Describe various use cases for hydrogen and products derived using hydrogen
- Address the challenges in advancing from the current situation, taking into account the high ambitions reflected in announced projects and sector projections
- Evaluate broader financing and market openings that hold the potential for a more impactful hydrogen sector

Content

- Current market and outlook for centralised and decentralised applications – Industry
- Current market and outlook for centralised and decentralised applications – Transport
- Current market and outlook for centralised and decentralised applications - Power and heat
- Prioritising market actions
- Guarantees of origin and certification of green hydrogen and its derivatives
- Economics and cost development

LEARNING METHODS & ONLINE PLATFORM FEATURES

IMPORTANT FEATURES

- Interactive learning platform
- Multilanguage platform
- Forum for participants
- Integrated Glossary
- Feedback questionnaires
- Stream/Download videos
- Live lectures
- Self-quizzes/Online exams
- Certificates

EARN YOUR CERTIFICATE

- Digital Certificate of Completion (final grade 70% or above)
- Digital Certificate of Attendance (final grade below 70%, issued upon request and after completion of all mandatory course self-tests)

TECHNICAL REQUIREMENTS

- An e-mail address, which is regularly checked
- A stable internet connection (at least 2 Mbit/s)
- We use Zoom for webinars
- Headset or speakers are required to participate on webinars

FOR MORE INFOMRATION PLEASE SCAN THE QR CODE

Contact

Volker Jaensch
Head of Division
Green Energy and Climate Finance
Schoenhauser Allee 10-11, 10119 Berlin, Germany
Tel: +49 30 587 08 70 03
E-Mail: greenbanking@renac.de

Editors
Renewables Academy (RENAC) AG
Graphic Design
Renewables Academy (RENAC) AG
Cover Picture Credit
Envato/ Canva Stock