

# Advanced Master's Degree Renewable Energies and Sustainability in Building Construction





## Advanced Master's Degree Renewable Energies and Sustainability in Building Construction

- » Modality: online
- » Duration: 2 years
- » Certificate: TECH Global University
- » Credits: 120 ECTS
- » Schedule: at your own pace
- » Exams: online

Website: [www.techtute.com/us/engineering/advanced-master-degree/advanced-master-degree-renewable-energies-suistainability-building-construction](http://www.techtute.com/us/engineering/advanced-master-degree/advanced-master-degree-renewable-energies-suistainability-building-construction)

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# 01

# Introduction

Renewable Energies are in full expansion at the international level and their use extends to practically all sectors. Increased environmental awareness has resulted in us all embracing a greener lifestyle and, therefore, Clean Energy has also reached the field of Building and Construction, requiring more and more engineers who have the ability to manage them and use the most appropriate ones for each project. Therefore, with this TECH program we offer superior education in this field, thanks to this extensive specialization that includes the most important aspects of Renewable Energies and Sustainability in Building Construction.



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*In this Advanced Master's Degree, we give you the keys to the use of Renewable Energies in Building, in an intensive and complete specialization. Undoubtedly a unique study opportunity that musn't be missed”*

This program has been created as additional learning for engineers, as it includes the main innovations in two fields that, although they may seem very different, are increasingly linked: Renewable Energies and Building Construction. Consequently, considering the installation of clean energy sources when creating new facilities will make a more reasonable use of resources, favoring energy saving and sustainability.

It is necessary to take into account that Renewable Energies are in constant growth, so the market demands more and more engineering professionals who are able to apply them to the building construction sector, achieving long-term benefits not only for the environment, but also for family finances. In order to offer a superior and high-quality specialization to these professionals, this program will provide an insight into the main Renewable Energies so students can understand the current situation in the world energy market and its regulatory framework at the international level. In addition, students will learn about the different parties involved in the financing, management and operation of renewable energy and energy saving projects in building construction.

Throughout this specialization, the student will learn all of the current approaches to the different challenges posed by their profession. A highly-skilled program that will result in an improvement, not only on a professional level, but also on a personal level. Additionally, at TECH we have a social commitment: to help highly qualified professionals to specialize and develop their personal, social and professional skills throughout the course of their studies.

In this way, students will go through all the current approaches in the different challenges that their profession involves. A high-level step that will become a process of improvement, not only professional, but also personal. For this, students will not only have the best theoretical knowledge, but will also face another way of studying and learning, more organic, simpler and efficient, developing critical thinking.

This qualification is designed to give you access to the specific knowledge in the discipline in an intensive and practical way which will be of great value for any professional. Furthermore, as it is a 100% online specialization, the student decides

when and where to study. Without the restrictions of fixed timetables or having to move between classrooms, this course can be balance with your work and family life.

In addition, the program includes access to 10 exclusive and complementary Masterclasses, delivered by an internationally renowned professor, specialized in Innovation and Renewable Energies, with an impressive and successful background. Under his guidance, students will gain the knowledge and skills necessary to excel in this highly relevant and sought-after field

This **Advanced Master's Degree in Renewable Energies and Sustainability in Building Construction** contains the most complete and up-to-date program on the market. The most important features include:

- ◆ The latest technology in e-learning software
- ◆ Intensely visual teaching system, supported by graphic and schematic contents that are easy to assimilate and understand
- ◆ The development of practical case studies presented by practising experts
- ◆ State-of-the-art interactive video systems
- ◆ Teaching supported by telepractice
- ◆ Continuous updating and recycling systems
- ◆ Self-regulated learning: full compatibility with other occupations
- ◆ Practical exercises for self-assessment and learning verification
- ◆ Support groups and educational synergies: questions to the expert, debate and knowledge forums
- ◆ Communication with the teacher and individual reflection work
- ◆ Content that is accessible from any fixed or portable device with an Internet connection
- ◆ Complementary resource banks that are permanently available



*Don't miss this exclusive opportunity that only TECH offers you! You will have access to 10 Masterclasses developed by an outstanding and recognized international expert in Innovation and Renewable Energies"*

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*A program created for professionals who aspire to excellence that will allow you to acquire new skills and strategies in a smooth and effective way”*

Our teaching staff is made up of working professionals. That way we can be sure to offer you the up-to-date information we aim to provide. A multidisciplinary team of professionals with training and experience in different environments, who will develop the theoretical knowledge in an efficient way, but above all, they will bring their practical knowledge from their own experience to the course.

This command of the subject is complemented by the effectiveness of the methodological design of this Advanced Master's Degree. Developed by a multidisciplinary team of e-learning experts, it integrates the latest advances in educational technology. In this way, professionals will be able to study with a range of comfortable and versatile multimedia tools that will give them the operability they need in their training.

The design of this program is based on Problem-Based Learning, an approach that conceives learning as a highly practical process. To achieve this remotely, TECH will use telepractice. With the help of an innovative, interactive video system and learning from an expert, you will be able to acquire the knowledge as if you were dealing with the case you are studying in real time. A concept that will allow students to integrate and fix learning in a more realistic and permanent way.

*A deep and comprehensive look at the most up-to-date strategies and approaches in Renewable Energies and Sustainability in Building Construction.*

*The implementation of renewable energies in buildings is essential to help improve the environment and achieve greater energy and economic savings.*



# 02

# Objectives

Our objective is to train highly qualified professionals for the working world. An objective that is also complemented, in a global manner, by promoting human development that lays the foundations for a better society. This objective is made a reality by helping professionals reach a much higher level of expertise and control. A goal that students will be able to achieve thanks to a highly intensive and detailed course.







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*If your goal is to improve in your profession, to acquire a qualification that will enable you to compete among the best, then look no further: Welcome to TECH”*



## General objectives

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- ◆ Conduct an exhaustive analysis of current legislation and the energy system, from electricity generation to the consumption phase, as well as the fundamental production factor in the economic system and the functioning of the different energy markets
- ◆ Identify the different phases required for the feasibility and implementation of a Renewable Energy project and its commissioning
- ◆ Analyze the different technologies and manufacturers available to create Renewable Energy exploitation systems in depth, and distinguish and critically select those qualities according to costs and their actual implementation
- ◆ Identify the operation and maintenance tasks required for the correct operation of Renewable Energy facilities
- ◆ Size facilities for the application of all energy sources of lesser implementation such as mini-hydro, geothermal, tidal and clean vectors
- ◆ Manage and analyze relevant bibliography on a topic related to one or some of the areas of renewable energies, published at the international level
- ◆ Adequately interpret society's expectations on the environment and climate change, and engage in technical discussions and critical opinions on energy aspects of sustainable development, as skills that Renewable Energy professionals should have
- ◆ Integrate knowledge and face the complexity of formulating reasoned judgments in the field applicable to a company in the Renewable Energy sector
- ◆ Master the different existing solutions or methodologies for the same problem or phenomenon related to Renewable Energies and develop a critical spirit knowing the practical limitations
- ◆ Understand the impact of energy consumption in cities and of the main structures that make it function, the buildings
- ◆ Gain deeper knowledge of energy consumption and demand, as these are the key conditioning factors for a building to be energetically comfortable
- ◆ Provide students with general knowledge of the different norms, standards, regulations and existing legislation, which will allow them to deepen in the specific ones that concern the procedures for energy saving actions in buildings
- ◆ Offer fundamental knowledge for support in the rest of the modules and related information search tools
- ◆ Apply the key aspects of the circular economy in buildings using life cycle and carbon footprint analysis tools to establish plans for the reduction of environmental impact, as well as to meet the criteria of green public procurement
- ◆ Train students to carry out energy audits in accordance with EN 16247-2, provide energy services and energy certification in order to establish improvement measures to increase energy savings and sustainability in buildings
- ◆ Delve deeper into the importance of the architectural tools that will make possible the maximum use of the climatic environment of a building
- ◆ Carry out exhaustive analysis on renewable energy techniques. This will allow students to have the skills and vision to design the best options for choosing an energy source in terms of available resources
- ◆ Internalize and delve deeper into self-consumption, as well as the advantages of its installation in buildings
- ◆ Choose the most efficient equipment and detect deficiencies in electrical installations to reduce consumption, optimize functioning and establish a culture of energy efficiency in the organization
- ◆ Design electric vehicle charging point infrastructures for their implementation in buildings



- ◆ Delve deeper into the different cold and heat generation systems, more often used today
- ◆ Perform a complete analysis of the main maintenance operations of air conditioning equipment, cleaning and replacement of parts
- ◆ Thoroughly break down the properties of light involved in building energy saving
- ◆ Master and apply the techniques and requirements for the design and calculation of lighting systems, complying with health, visual and energy criteria
- ◆ Thoroughly analyze the different control systems installed in buildings, the differences between them, the applicability criteria in each case and the energy savings provided

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*We are the largest online university in the world and we want to help you improve your future"*



## Specific objectives

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### Module 1. Renewable Energies and their Current Environment

- ◆ Delve into the world's energy and environmental situation, as well as that of other countries
- ◆ Gain detailed knowledge of the current energy and electricity context from different perspectives: structure of the electricity system, operation of the electricity market, regulatory environment, analysis and evolution of the electricity generation system in the short and medium and long term
- ◆ Master the technical-economic criteria of generation systems based on the use of conventional energy: nuclear energy, large hydro, conventional thermal, combined cycle and the current regulatory environment of both conventional and renewable generation systems and their dynamics of evolution
- ◆ Apply the knowledge acquired to the understanding, conceptualization and modeling of systems and processes in the field of energy technology, particularly in the field of renewable energy sources
- ◆ Effectively pose and solve practical problems, identifying and defining the significant elements that constitute them
- ◆ Critically analyze data and reach conclusions in the field of energy technology
- ◆ Use the acquired knowledge to conceptualize models, systems and processes in the field of energy technology
- ◆ Analyze the potential of Renewable Energies and energy efficiency from multiple perspectives: technical, regulatory, economic and market
- ◆ Gain the ability to search for information on public websites related to the electricity system and to elaborate this information

### Module 2. Hydraulic Energy Systems

- ◆ Make an in-depth analysis of hydrology and the management of water resources related to hydropower
- ◆ Implement environmental management mechanisms in the field of hydroelectric energy
- ◆ Identify and select the necessary equipment for different types of hydroelectric developments
- ◆ Design, dimension and operate of hydroelectric power plants
- ◆ Master the elements that make up hydroelectric works and facilities, both in technical and environmental aspects, as well as those connected to operation and maintenance

### Module 3. Biomass and Biofuel Energy Systems

- ◆ Gain detailed knowledge of the current situation and future forecasts of the biomass and/or biofuels sectors in the European context
- ◆ Quantify the advantages and disadvantages of this type of Renewable Energy
- ◆ Delve into biomass energy utilization systems, i.e., the ways in which energy can be obtained from biomass
- ◆ Assess the biomass resources available in a given area, called the study area
- ◆ Differentiate the types of energy crops that exist today, their advantages and disadvantages
- ◆ Typify the biofuels used today. Understand the processes for obtaining both biodiesel and bioethanol and/or biomethanol
- ◆ Conduct comprehensive analyses of legislation and regulations related to biomass and biofuels
- ◆ Carry out an economic analysis and gain in-depth knowledge of the legislative and economic frameworks in the biofuels sector

**Módulo 4. Solar Thermal Energy Systems**

- ◆ Select the necessary equipment for different solar thermal applications
- ◆ Be able to make a basic design and dimensioning of low and medium temperature solar thermal installations
- ◆ Estimate solar radiation at a given geographical location
- ◆ Recognize the conditions and restrictions for the application of solar thermal energy

**Module 5. Wind Energy Systems**

- ◆ Assess the advantages and disadvantages of replacing fossil fuels with Renewable Energies in different situations
- ◆ Gain in-depth knowledge to implement wind energy systems and the most appropriate types of technology to be used according to location and economic requirements
- ◆ Obtain a scientific-technical vocabulary of Renewable Energies
- ◆ Correctly develop hypotheses to address problems in the field of Renewable Energies, and the criterion to evaluate results in an objective and coherent manner
- ◆ Understand and master the fundamental concepts of wind types and the implementation of wind measurement systems
- ◆ Understand and master the fundamental concepts of the general laws governing the capture of wind energy and wind turbine technologies
- ◆ Develop wind power plant projects

**Module 6. Grid-Connected and Off-Grid Photovoltaic Solar Energy Systems**

- ◆ Master the specific subject matter required to meet the needs of specialized companies and to become highly qualified professionals in the design, construction, assembly, operation and maintenance of photovoltaic solar energy equipment and facilities
- ◆ Apply the knowledge acquired to the understanding, conceptualization and modeling of solar photovoltaic installations

- ◆ Synthesize knowledge and research appropriate methodologies for integration into innovation and project development departments in any company in the solar photovoltaic field
- ◆ Effectively pose and solve practical problems, identifying and defining the significant elements that constitute them
- ◆ Apply innovative methods in solving problems related to photovoltaic solar energy
- ◆ Identify, find and obtain data on the Internet related to the context of solar photovoltaic energy
- ◆ Design and conduct research based on analysis, modeling and experimentation in the field of solar photovoltaic energy
- ◆ Gain in-depth knowledge and handle the specific regulations for photovoltaic solar installations
- ◆ Gain in-depth knowledge and select the necessary equipment for different solar photovoltaic applications
- ◆ Design, dimension, implement, operate and maintain solar photovoltaic installations

**Module 7. Other Emerging Renewable Energies and Hydrogen as an Energy Carrier**

- ◆ Master the different technologies to use sea energies
- ◆ Gain in-depth knowledge and apply geothermal energy
- ◆ Associate the physicochemical properties of hydrogen with its potential use as an energy carrier
- ◆ Learn about the use of hydrogen as a renewable energy source
- ◆ Identify the most commonly used fuel cells and accumulators to date, highlighting the technological improvements throughout history
- ◆ Characterize the different types of fuel cells
- ◆ Delve into recent advances in the use of new materials for the manufacture of fuel cells and their most innovative applications
- ◆ Classify ATEX zones with hydrogen as fuel

### Module 8. Hybrid Systems and Storage

- ♦ Analyze the importance of electrical energy storage systems in the current energy sector landscape, showing the impact it has on the planning of generation, distribution and consumption models
- ♦ Identify the main technologies available in the market, explaining their characteristics and applications
- ♦ Have a transversal vision with other sectors in which the deployment of electric storage systems will have an impact on the configuration of new energy models, with special emphasis on the automotive and electric mobility sectors
- ♦ Have an overview of the usual steps followed in the development of projects with storage systems, especially focused on batteries
- ♦ Identify the main concepts for the integration of storage systems in power generation systems, especially with photovoltaic and wind systems

### Module 9. Development, Financing and Feasibility of Renewable Energy Projects

- ♦ Gain in-depth knowledge and analyze the technical documentation of Renewable
- ♦ Energy projects required for their feasibility, financing and processing
- ♦ Manage technical documentation up to the “Ready to Built” step
- ♦ Establish types of financing
- ♦ Understand and carry out an economic and financial study of a renewable energy project
- ♦ Use all the tools for project management and planning
- ♦ Master the part of insurance involved in the financing and viability of Renewable
- ♦ Energy projects, both in their construction and operation phases
- ♦ Delve into the processes of valuation and appraisal of claims in Renewable
- ♦ Energy assets

### Module 10. Digital Transformation and Industry 4.0 Applied to Renewable Energy Systems

- ♦ Optimize processes, both in production and in Operations and Maintenance
- ♦ Learn in detail about the capabilities of digital industrialization and automation in
- ♦ Renewable Energy installations

- ♦ Gain in-depth knowledge and analyze the different alternatives and technologies offered by digital transformation
- ♦ Implement and test IoT systems
- ♦ Use tools such as Big Data to improve processes and/or energy facilities
- ♦ Gain in-depth knowledge of the scope of drones and autonomous vehicles in preventive maintenance
- ♦ Learn new forms of energy commercialization: Blockchain and Smart Contracts

### Module 11. Energy in Building Construction

- ♦ Gain insight into energy in cities
- ♦ Identify the importance of a building's energy performance
- ♦ Delve into the differences between energy consumption and energy demand
- ♦ Analyze in detail the importance of energy comfort and livability

### Module 12. Standards and Regulations

- ♦ Identify the responsible bodies and agencies
- ♦ Achieve a global vision of current regulations
- ♦ Justify the differences between the different documents, whether they are norms, regulations, standards, legislation and their scope of application
- ♦ Analyze in detail the main regulations for procedures on energy saving and sustainability in buildings
- ♦ Provide tools to search for related information

### Module 13. Circular Economy

- ♦ Have a comprehensive approach to the circular economy in buildings in order to maintain a strategic vision of implementation and best practices
- ♦ Quantify, through life cycle analysis and carbon footprint calculation, the impact of real estate management on sustainability in order to develop improvement plans that allow energy savings and environmental impact reduction in buildings
- ♦ Master the criteria of green public procurement in the real estate sector in order to be able to face and manage them with criteria

**Module 14. Energy Audits and Certification**

- ◆ Recognize the type of work to be developed depending on the objectives set by the client to recognize the need to perform an energy audit
- ◆ Perform an energy audit according to EN 16247-2 to establish an action protocol to determine the initial situation and to propose energy saving options
- ◆ Analyze the provision of energy services to know each of their characteristics in defining energy service contracts
- ◆ Perform energy certification on buildings to determine the initial energy rating and define improvement options according to standards

**Module 15. Bioclimatic Architecture**

- ◆ Gain exhaustive knowledge of the structural elements and their effect on building energy efficiency
- ◆ Study structural components that allow the use of sunlight and other natural resources and their architectural adaptation
- ◆ Detect the connection between buildings and human health

**Module 16. Renewable Energies**

- ◆ Deal in detail with the evolution of renewable energies up to their current applications
- ◆ Carry out exhaustive studies of applying these energies in today's construction
- ◆ Internalize and delve deeper into self-consumption, as well as the advantages of its installation in building construction

**Module 17. Electrical Installations**

- ◆ Choose the most efficient equipment to ensure the lowest possible energy consumption in building construction activity
- ◆ Detect and correct defects derived from the existence of harmonics to reduce energy losses in the electrical grid by optimizing its energy transmission capacity
- ◆ Design electric vehicle charging infrastructures in the building in compliance with current regulations or specific customer requirements

- ◆ Optimize electricity bills to obtain the greatest economic savings according to the building's demand profile
- ◆ Implement a culture of energy efficiency to increase energy and economic savings in managing facility activity within property management

**Module 18. Thermal Installations**

- ◆ Master the different thermal air conditioning systems and their operation
- ◆ Break down their components in detail for machine maintenance
- ◆ Analyze the role of energy efficiency in the evolution of different systems

**Module 19. Lighting Installations**

- ◆ Apply the principles of lighting technology, its properties, differentiating the aspects that contribute to energy savings
- ◆ Analyze the criteria, characteristics and requirements of the different solutions that can arise in buildings
- ◆ Design and calculate lighting projects, improving energy efficiency
- ◆ Integrate lighting techniques to improve health as a reference in energy savings

**Module 20. Control Installations**

- ◆ Analyze the different installations, technologies and control systems applied to energy saving in buildings
- ◆ Differentiate between the different systems to be implemented, distinguishing the characteristics in each specific case
- ◆ Delve into how control installations bring energy savings to buildings by optimizing energy resources
- ◆ Master the principles of control systems configuration in buildings

# 03 Skills

Once all the contents have been studied and the objectives of the Advanced Master's Degree in Renewable Energies and Sustainability in Building Construction have been achieved, professionals will have gained superior expertise and performance in this area. A very complete approach, in an Advanced Master's Degree, which makes the difference.







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*Achieving excellence in any profession requires effort and perseverance. But, above all, the support of professionals, who will give you the boost you need, with the necessary means and assistance. At TECH, we offer you everything you need”*



## General skills

- ◆ Master the global environment of Renewable Energies, from the international energy context, markets, electricity system structure, to project development, operation and maintenance plans; and sectors such as insurance and asset management
- ◆ Apply acquired knowledge and problem-solving skills in current or unfamiliar environments within broader contexts related to renewable energies
- ◆ Integrate knowledge and get a thorough understanding of the different sources of renewable energies, as well as the importance of their use in today's world
- ◆ Learn to communicate concepts of design, development and management of the different renewable energy systems
- ◆ Gain a detailed understanding of the importance of hydrogen as an energy carrier of the future, and large-scale storage within the integration of renewable energy systems
- ◆ Understand and internalize the scope of digital and industrial transformation applied to renewable energy systems for their efficiency and competitiveness in the future energy market
- ◆ Critically analyze, evaluate and synthesize new and complex ideas related to the field of renewable energies
- ◆ Be able to promote, in professional contexts, technological, social or cultural progress within a knowledge-based society
- ◆ Understand building energy consumption and carry out actions to reduce it
- ◆ Apply specific regulations related to energy saving in buildings
- ◆ Perform energy audits in buildings
- ◆ Detect and solve problems in electrical installations to save energy consumption





## Specific skills

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- ◆ Gain in-depth knowledge of the potential of renewable energies from multiple perspectives: technical, regulatory, economic and market
- ◆ Project, calculate and design products, processes, installations and plants with the most common renewable energies in our environment: wind energy, solar thermal energy, solar photovoltaic, biomass and hydropower
- ◆ Conduct research, development and innovation in products, processes and methods related to renewable energy systems
- ◆ Follow the technological evolution of renewable energies and have prospective knowledge of this evolution
- ◆ Understand the operating principles of the following power generation technologies: solar thermal, mini-hydro, biomass, cogeneration, geothermal, and wave power
- ◆ Master the current state of technical and economic development of these technologies
- ◆ Understand the role of the main elements of each technology, their relative importance and the constraints imposed by each of them
- ◆ Identify the existing alternatives for each technology, as well as the advantages and disadvantages of each of them
- ◆ Be able to assess the resource potential and perform basic sizing for solar thermal, mini-hydro and biomass power plants
- ◆ Have a transversal vision with other sectors in which the deployment of electric storage systems will have an impact on the configuration of new energy models
- ◆ Gain in-depth knowledge of the digital transformation applied to renewable energy systems, as well as the implementation and use of the most important tools
- ◆ Discover the impact of a city's energy consumption
- ◆ Know the legislation and regulations related to energy saving and sustainability in building construction and apply them at work
- ◆ Develop improvement plans to reduce the environmental impact of buildings
- ◆ Apply the EN 16247-2 standard for carrying out audits
- ◆ Use natural resources following a bioclimatic architectural adaptation
- ◆ Apply renewable energies in building construction
- ◆ Apply all the techniques necessary to achieve energy savings in buildings
- ◆ Develop and apply efficient air-conditioning systems
- ◆ Develop and apply efficient lighting systems
- ◆ Use control systems for energy savings



*Our objective is very simple: to offer you quality training with the best teaching methods currently available, so you can reach new heights of excellence in your profession"*

04

# Course Management

For our Advanced Master's Degree to be of the highest quality, we are proud to work with a teaching staff of the highest level, chosen for their proven track record in the field of education. Professionals from different areas and fields of expertise that make up a complete, multidisciplinary team. A unique opportunity to learn from the best.



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*Our professors bring their vast experience and their teaching skills to offer you a stimulating and creative specialized program”*

## International Guest Director

Varun Sivaram, Ph.D. is a physicist, bestselling author and leading clean energy technology expert with a career spanning the corporate, public and academic sectors. In fact, he has served as **Director of Strategy and Innovation at Orsted**, one of the world's leading renewable energy companies with the largest offshore wind power portfolio.

In addition, Dr. Sivaram has served in the U.S. Biden-Harris administration, as Director General for Clean Energy and Innovation, as well as Senior Advisor to Secretary John Kerry, the Special Presidential Climate Envoy to the White House. In this capacity, he was the creator of the First Movers Coalition, a key initiative to foster clean energy innovation globally.

In the academic field, he has directed the Energy and Climate Program at the Council on Foreign Relations. And his influence in the formulation of government policies to support innovation has been remarkable, having advised leaders such as the mayor of Los Angeles and the governor of New York. He has also been recognized as a Young Global Leader by the World Economic Forum.

In addition, Dr. Varun Sivaram has published several influential books, including "Taming the Sun: Innovations to Harness Solar Energy and Power the Planet" and "Energizing America: A Roadmap to Launch a National Energy Innovation Mission", both of which have received accolades from prominent leaders such as Bill Gates. In fact, his contribution to the clean energy field has been recognized internationally, being included in the TIME 100 Next list and incorporated by Forbes in its Forbes 30 Under 30 list in Law and Policy, among other major accolades.



## Dr. Sivaram, Varun

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- Director General de Energía Limpia e Innovación // Asesor Principal del secretario John Kerry, Enviado Presidencial Especial de Estados Unidos para el Clima, en La Casa Blanca
- Director de Tecnología en ReNew Power
- Asesor estratégico en Energía y Finanzas sobre la Reforma de la Visión Energética (Reforming the Energy Vision) en la oficina del gobernador de Nueva York
- Doctor en Física de la Materia Condensada por la Universidad de Oxford
- Licenciado en Ingeniería Física y Relaciones Internacionales por la Universidad de Stanford
- Reconocimientos: o Forbes 30 Under 30, otorgado por la revista Forbes
- o Grist Top 50 Leaders in Sustainability, otorgado por Grist
- o MIT TR Top 35 Innovators, otorgado por la revista MIT Tech Review
- o TIME 100 Next Most Influential People in the World, otorgado por la revista TIME
- o Young Global Leader, otorgado por el Foro Económico Mundial
- Miembro de:
  - o Atlantic Council
  - o Breakthrough Institute
  - o Aventurine Partners

## Management



### Mr. De la Cruz Torres, José

- ♦ Engineer in the Energy and EE. RR. Division at RTS International Loss Adjusters
- ♦ Engineering Expert at IMIA - International Engineering Insurance Association
- ♦ Technical-Commercial Director at Abaco Loss Adjusters
- ♦ Master's Degree in Operations Management by EADA Business School Barcelona
- ♦ Professional Master's Degree in Industrial Maintenance Engineering by the University of Huelva
- ♦ Program in Railway Engineering, UNED (Spanish Open University)
- ♦ Degree in Physics and Industrial Electronics Engineering by the University of Seville



### Mr. Nieto-Sandoval González- Nicolás, David

- ♦ Energy Efficiency and Circular Economy Engineer in Aprofem
- ♦ Industrial Technical Engineer by the EUP of Malaga
- ♦ Industrial Engineer by the ETSII of Ciudad Real
- ♦ Data Protection Officer (DPO) from the Antonio Nebrija University
- ♦ Expert in project management and business consultant and mentor in organizations such as Youth Business Spain or COGITI of Ciudad Real
- ♦ CEO of the startup GoWork, focused on skills management and professional development and business expansion through hyperlabels
- ♦ Editor of technological training content for both public and private entities
- ♦ Professor certified by the EOI in the areas of industry, entrepreneurship, human resources, energy, new technologies and technological innovation





### Mr. Lillo Moreno, Javier

- ◆ Expert Engineer in the Energy Sector and O&M Manager
- ◆ Responsible for Solarig's Maintenance Area
- ◆ Responsible for the Integral Service of ELMYA Photovoltaic Plants.
- ◆ Project Manager at GPtech
- ◆ Telecommunications Engineer from the University of Seville.
- ◆ Master in Project Management and Master in Big Data & Business Analytics by the School of Industrial Organization (EOI)

## Professors

### Mr. Álvarez Morón, Gregorio

- ◆ Agronomist Engineer specializing in Rural Engineering
- ◆ Lecturer in collaboration with WATS Ingeniería, a Spanish company specialized in water, agronomy, energy and environmental engineering
- ◆ With more than 15 years of experience in public and private companies

### Dr. De la Cal Herrera, José Antonio

- ◆ Bioenergy Consultant at UNIDO
- ◆ CEO and Founding Partner of Bioliza
- ◆ PhD in Electrical Engineering from the University of Jaén
- ◆ Master's Degree in Business Administration and Management from the Escuela Superior de Gestión Comercial y Marketing ESIC

- ◆ Industrial Engineer by the Polytechnic University of Madrid
- ◆ Associate Professor in several Engineering and Architecture programs

### Mr. Díaz Martín, Jonay Andrés

- ◆ Head of Operations at Cubico Sustainable Investment
- ◆ Head of Operations in Solar Thermal Power Plant at Acciona
- ◆ Start-up Operations Manager in Solar Thermal Power Plant at Iprocel
- ◆ Industrial Engineer with specialization in Electricity from the University of Las Palmas de Gran Canaria
- ◆ Professional Master's Degree in International Logistics and Supply Chain Management from EUDE Business School
- ◆ Professional Master's Degree in Integrated Management of Prevention, Quality and Environment by Camilo José Cela University

- ◆ Expert in General and Strategic Management of the Company by the UNED (UNED)
- ◆ Expert in Solar Thermal Energy by the UNED (UNED)
- ◆ Certificate of Internal Auditor in Environmental Management Systems according to ISO 14001 by TÜV Rheinland Europe
- ◆ Certificate of Internal Auditor in Environmental Management Systems according to ISO 45001 by TÜV Rheinland Europe
- ◆ Certificate of Internal Auditor in Quality Management Systems according to ISO 9001 by TÜV Rheinland Europe

#### **Mr. González Cano, José Luis**

- ◆ Lighting Designer
- ◆ Teacher of Vocational Training in electronic systems, telematics (CISCO certified instructor), radio communications, IoT
- ◆ Graduate in Optics and Optometry from the Complutense University of Madrid
- ◆ Technician specialist in Industrial Electronics by Netecad Academy
- ◆ Member of: o The Professional Association of Lighting Designers (Technical Consultant) o Member of the Spanish Lighting Committee

#### **Mr. Granja Pacheco, Manuel**

- ◆ International Business Development Director at Progressum Energy
- ◆ Wind Energy Site Manager at Better
- ◆ Civil Engineer by Alfonso X El Sabio University
- ◆ Master's Degree in Renewable Energy Installation Management and Project Internationalization from CEU San Pablo Universit

#### **Dr. Gutiérrez, María Delia**

- ◆ Engineer at National Environmental Leader
- ◆ Environmental consultant at Cemex Tec
- ◆ Process engineer at Ataltec
- ◆ Process and design engineer at Industrias Islas.

- ◆ Laboratory Instructor at Tecnológico de Monterrey
- ◆ Chemical Engineer at the Universidad Autónoma de Nuevo León.
- ◆ Doctorate in Engineering Sciences with specialization in Energy and Environment
- ◆ Master's Degree in Environmental Systems at Tecnológico de Monterrey

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- ◆ Business developer at Siemens Gamesa
- ◆ Founding partner of KM2.org
- ◆ Account Manager at Ingeteam
- ◆ Engineer at GPTech
- ◆ Industrial Engineer from the University of Cordoba
- ◆ Master's Degree in Electronic Engineering from the University of Seville
- ◆ Master's Degree MBA from the University Camilo José Cela

#### **Mr. Pérez García, Fernando**

- ◆ Insurance Loss Adjuster
- ◆ Specialist in the adjustment and appraisal of industrial risks, technical and energy claims, especially in the renewable energy sector (wind, hydro, photovoltaic, solar thermal and biomass)
- ◆ National Loss Adjuster Expert (NLAE) by the European Federation of Loss Adjustment Experts (FUEDI)
- ◆ European Loss Adjustment Expert (ELAE) by the European Federation of Loss Adjustment Experts (FUEDI)
- ◆ Machinery Breakdown and Renewable Energy Specialist
- ◆ Liability Specialist
- ◆ Specialist in Loss of Profits Associated with Power Plant Losses
- ◆ Specialization Course in Analytical and Financial Accounting
- ◆ Degree in Technical Industrial Engineering, specialized in Electricity, from the University of Zaragoza

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- ◆ Technical engineer at Quetzal Ingeniería
- ◆ Production of a podcast about renewable energies
- ◆ Documentation Technician at AT. Spain Holdco
- ◆ Technical engineer at Ritrac Training
- ◆ Topography projects at Caribersa
- ◆ Technical Engineering in Topography at the Polytechnic University of Madrid
- ◆ Master's Degree in Renewable Energies from San Pablo CEU Universit

**Mr. Serrano, Ricardo**

- ◆ Territorial Director of Andalusia, Willis Towers Watson
- ◆ Regional Director of Musini
- ◆ Technician in the brokerage companies: AON, MARSH Insurance Broker & Risk Management and Willis Towers Watson
- ◆ Design and placement of insurance programs for renewable energy companies and other industrial activities such as Abengoa, Befesa, Atalaya Riotinto

**Mr. Silvan Zafra, Álvaro**

- ◆ Software Business Consultant at Volue
- ◆ Director of Energy and Utilities at Minsait
- ◆ Project Manager at Isotrol
- ◆ Senior Consultant focused on the execution of international E2E projects in the energy sector
- ◆ Energy Engineer at the University of Seville
- ◆ Master's Degree in Thermal Energy Systems and Business Administration

**Mr. Trillo León, Eugenio**

- ◆ CEO of The Lean Hydrogen Company
- ◆ Project Engineer at H2B2
- ◆ Responsible for training at the Andalusian Hydrogen Association

- ◆ Industrial Engineer specialized in Energy from the University of Seville
- ◆ Master's Degree in Industrial Maintenance Engineering from the University of Huelva
- ◆ Expert in Project Management from the University of California
- ◆ Secretary of the Andalusian Hydrogen Association

**Mr. Martín Grande, Ángel**

- ◆ O&M and Commissioning Manager at Solparck
- ◆ Site manager at Sitecma
- ◆ Director in Chile at Reveryg
- ◆ Technical Director at Carloteñas de Energía
- ◆ Industrial Engineer from the University of Seville

**Mr. Despouy Zulueta, Ignacio**

- ◆ Project Manager and Discipline Manager at WSP CHILE
- ◆ Founder and Senior Consultant at Eficiencia Ambiental SpA.
- ◆ Business Developer at Kintlein & Ose GMBH & co. (Joint Venture)
- ◆ Project Manager at Arcadis Chile
- ◆ Degree in Civil Hydraulic Engineering with specialization in Hydraulics, Sanitary and Environmental Engineering from the University of Chile
- ◆ Master's Degree in Environment and Resource Management from Vrije Universiteit, Amsterdam
- ◆ Diploma in European Energy Manager from the Chilean-German Chamber of Commerce

# 05

# Structure and Content

The contents of this Advanced Master's Degree have been developed by the different experts on this course, with a clear purpose: to ensure that our students acquire each and every one of the skills required to become true experts in this field. The content of this Advanced Master's Degree will allow you to learn all aspects of the different disciplines involved in this area. A complete and well-structured program which will take you to the highest standards of quality and success.





“

*Through a very well organized program, you will be able to access the most advanced knowledge of the moment in Renewable Energies and Sustainability in Building Construction”*

## Module 1. Renewable Energies and Their Current Environment

- 1.1. Renewable Energies
  - 1.1.1. Fundamental Principles
  - 1.1.2. Conventional Energy Forms vs. Renewable Energy
  - 1.1.3. Advantages and Disadvantages of Renewable Energies
- 1.2. International Context of Renewable Energies
  - 1.2.1. Basics of Climate Change and Energy Sustainability Renewable Energies vs. Non-Renewable Energies
  - 1.2.2. Decarbonization of the World Economy From the Kyoto Protocol to the Paris Agreement in 2015 and the 2019 Madrid Climate Summit
  - 1.2.3. Renewable Energies in the Global Energy Context
- 1.3. Energy and International Sustainable Development
  - 1.3.1. Carbon Markets
  - 1.3.2. Clean Energy Certificates
  - 1.3.3. Energy vs. Sustainability
- 1.4. General Regulatory Framework
  - 1.4.1. International Energy Regulation and Directives
  - 1.4.2. Auctions in the Renewable Electricity Sector
- 1.5. Electricity Markets
  - 1.5.1. System Operation with Renewable Energies
  - 1.5.2. Regulation of Renewable Energies
  - 1.5.3. Participation of Renewable Energies in the Electricity Markets
  - 1.5.4. Operators in the Electricity Market
- 1.6. Structure of the Electrical System
  - 1.6.1. Generation of the Electrical System
  - 1.6.2. Transmission of the Electrical System
  - 1.6.3. Distribution and Operation of the Market
  - 1.6.4. Marketing

- 1.7. Distributed Generation
  - 1.7.1. Concentrated Generation vs. Distributed Generation
  - 1.7.2. Self-Consumption
  - 1.7.3. Generation Contracts
- 1.8. Emitters
  - 1.8.1. Measuring Energy
  - 1.8.2. Greenhouse Gases in Power Generation and Use
  - 1.8.3. Emission Assessment by Type of Energy Generation
- 1.9. Energy Storage
  - 1.9.1. Types of Cells
  - 1.9.2. Advantages and Disadvantages of Cells
  - 1.9.3. Other Energy Storage Technologies
- 1.10. Main Technologies
  - 1.10.1. Energies of the Future
  - 1.10.2. New Uses
  - 1.10.3. Future Energy Contexts and Models

## Module 2. Hydraulic Energy Systems

- 2.1. Water, a Natural Resource. Hydraulic Energy
  - 2.1.1. Water in Earth. Water Flows and Uses
  - 2.1.2. The Cycle of Water
  - 2.1.3. First Uses of Hydraulic Energy
- 2.2. From Hydraulic to Hydroelectric Energy
  - 2.2.1. Origin of Hydroelectric Development
  - 2.2.2. The Hydroelectric Plant
  - 2.2.3. Current Uses
- 2.3. Types of Hydroelectric Power Plants by Power Output
  - 2.3.1. Major Hydraulic Plant
  - 2.3.2. Mini and Micro Hydraulic Plant
  - 2.3.3. Constraints and Future Prospects

- 2.4. Types of Hydroelectric Power Plants by Layout
  - 2.4.1. Plant at the Foot of a Dam
  - 2.4.2. Flowing Plant
  - 2.4.3. Conduction Plant
  - 2.4.4. Hydroelectric Pump Plant
- 2.5. Hydraulic Elements of a Plant
  - 2.5.1. Catchment and Intake Works
  - 2.5.2. Forced Conduit Connection
  - 2.5.3. Discharge Conduit
- 2.6. Electromechanical Elements of a Plant
  - 2.6.1. Turbine, Generator, Transformer and Power Line
  - 2.6.2. Regulation, Control and Protection
  - 2.6.3. Automation and Remote Control
- 2.7. The Key Element: The Hydraulic Turbine
  - 2.7.1. Operation
  - 2.7.2. Typology
  - 2.7.3. Selection Criteria
- 2.8. Calculation of Use and Dimensioning
  - 2.8.1. Available Power: Flow Rate and Head
  - 2.8.2. Electrical Power
  - 2.8.3. Performance. Production
- 2.9. Administrative and Environmental Aspects
  - 2.9.1. Benefits and Drawbacks
  - 2.9.2. Administrative Procedures. Grants
  - 2.9.3. Environmental Impact
- 2.10. Design and Project of a Mini-Hydroelectric Plant
  - 2.10.1. Design of a Mini-Plant
  - 2.10.2. Cost Analysis
  - 2.10.3. Economic Viability Analysis

### Module 3. Biomass and Biofuel Energy Systems

- 3.1. Biomass as an Energy Resource of Renewable Origin
  - 3.1.1. Fundamental Principles
  - 3.1.2. Origins, Typologies and Current Uses
  - 3.1.3. Main Physical-Chemical Parameters
  - 3.1.4. Products Obtained
  - 3.1.5. Quality Standards for Solid Biofuels
  - 3.1.6. Advantages and Disadvantages of the Use of Biomass in Buildings
- 3.2. Physical Conversion Processes: Pre-Treatments
  - 3.2.1. Justification
  - 3.2.2. Types of Processes
  - 3.2.3. Cost and Profitability Analysis
- 3.3. Main Chemical Conversion Processes of Residual Biomass: Products and Uses
  - 3.3.1. Thermochemicals
  - 3.3.2. Biochemicals
  - 3.3.3. Other Processes
  - 3.3.4. Analysis of Investment Profitability
- 3.4. Gasification Technology: Technical and Economic Aspects Advantages and Disadvantages
  - 3.4.1. Scope of Application
  - 3.4.2. Biomass Requirements
  - 3.4.3. Types of Gasifiers
  - 3.4.4. Properties of Synthetic Gas or Syngas
  - 3.4.5. Uses of Syngas
  - 3.4.6. Existing Technologies at Commercial Level
  - 3.4.7. Profitability Analysis
  - 3.4.8. Advantages and Disadvantages

- 3.5. Pyrolysis: Products Obtained and Costs Advantages and Disadvantages
  - 3.5.1. Scope of Application
  - 3.5.2. Biomass Requirements
  - 3.5.3. Types of Pyrolysis
  - 3.5.4. Resulting Products
  - 3.5.5. Cost Analysis (CAPEX and OPEX). Economic Profitability
  - 3.5.6. Advantages and Disadvantages
- 3.6. Biomethanization
  - 3.6.1. Scope of Application
  - 3.6.2. Biomass Requirements
  - 3.6.3. Main Technologies Co-Digestion
  - 3.6.4. Products Obtained
  - 3.6.5. Uses of Biogas
  - 3.6.6. Cost Analysis: Study of Investment Profitability
- 3.7. Design and Evolution of Biomass Energy Systems
  - 3.7.1. Sizing of a Biomass Combustion Plant for Electric Power Generation
  - 3.7.2. Biomass Installation in Public Buildings: Sizing and Calculating the Storage System Determining Payback in Case of Substitution by Fossil Fuels (Natural Gas and Diesel C)
  - 3.7.3. Calculating Industrial Biogas Production Systems
  - 3.7.4. Assessment of Biogas Production at a MSW Landfill Site
- 3.8. Designing Business Models Based on the Technologies Studied
  - 3.8.1. Gasification in Self-Consumption Mode Applied to the Agri-Food Industry
  - 3.8.2. Biomass Combustion Using the ESE Model Applied to the Industrial Sector
  - 3.8.3. Obtaining Biochar from Olive Oil Sector By-Products
  - 3.8.4. Production of Green H<sub>2</sub> from Biomass
  - 3.8.5. Obtaining Biogas from Olive Oil Industry By-Products

- 3.9. Analyzing the Profitability of Biomass Projects: Applicable Legislation, Incentives and Financing
  - 3.9.1. Structure of Investment Projects: CAPEX, OPEX, Income/Savings, TIR, VAN and Payback
  - 3.9.2. Aspects to be Taken Into Account: Electrical Infrastructure, Access, Space Availability, etc.
  - 3.9.3. Applicable Legislation
  - 3.9.4. Administrative Procedures Plan
  - 3.9.5. Incentives and Financing
- 3.10. Conclusions: Environmental, Social and Energy Aspects Associated with Biomass
  - 3.10.1. Bioeconomy and Circular Economy
  - 3.10.2. Sustainability: CO<sub>2</sub> Emissions Avoided C Sinks
  - 3.10.3. Alignment With UN SDGs and Green Pact Goals
  - 3.10.4. Employment Generated by Bioenergy. Value Chain
  - 3.10.5. Contribution of Bioenergy to the Energy Mix
  - 3.10.6. Productive Diversification and Rural Development

## Module 4. Solar Thermal Energy Systems

- 4.1. Solar Radiation and Solar Thermal Systems
  - 4.1.1. Fundamental Principles of Solar Radiation
  - 4.1.2. Radiation Components
  - 4.1.3. Market Evolution in Solar Thermal Systems
- 4.2. Static Solar Collectors: Description and Efficiency Measurement
  - 4.2.1. Collector Classification and Components
  - 4.2.2. Losses and Energy Conversion
  - 4.2.3. Characteristic Values and Collector Efficiency
- 4.3. Applications of Low Temperature Solar Collectors
  - 4.3.1. Technology Development
  - 4.3.2. Types of Solar Heating and DHW Systems
  - 4.3.3. Sizing Installations



- 4.4. DHW or Air Conditioning Systems
  - 4.4.1. Main Elements of the Facilities
  - 4.4.2. Assembly and Maintenance
  - 4.4.3. Calculation Methods and Control of Facilities
- 4.5. Medium Temperature Solar Thermal Systems
  - 4.5.1. Types of Concentrators
  - 4.5.2. The Cylindrical-Parabolic Collector
  - 4.5.3. Solar Tracking System
- 4.6. Designing Solar Tracking Systems with Cylindrical-Parabolic Collectors
  - 4.6.1. The Solar Field: Main Components of Cylindrical-Parabolic Collectors
  - 4.6.2. Solar Field Sizing
  - 4.6.3. The HTF System
- 4.7. Operation and Maintenance of Solar Systems with Cylindrical-Parabolic Collectors
  - 4.7.1. Power Generation Process through the CCP
  - 4.7.2. Solar Field Maintenance and Cleaning
  - 4.7.3. Preventive and Corrective Maintenance
- 4.8. High-Temperature Solar Thermal Systems: Tower Plants
  - 4.8.1. Designing a Tower Plant
  - 4.8.2. Heliostat Field Sizing
  - 4.8.3. Molten Salt Systems
- 4.9. Thermoelectric Generation
  - 4.9.1. The Rankine Cycle
  - 4.9.2. Theoretical Foundations of Turbine-Generators
  - 4.9.3. Characterizing a Solar Thermal Power Plant
- 4.10. Other High Concentration Systems: Parabolic Disks and Solar Ovens
  - 4.10.1. Types of Concentrators
  - 4.10.2. Tracking Systems and Main Elements
  - 4.10.3. Applications and Differences Compared to Other Technologies

## Module 5. Wind Energy Systems

- 5.1. The Wind as a Natural Resource
  - 5.1.1. Wind Behavior and Classification
  - 5.1.2. The Wind Resource on our Planet
  - 5.1.3. Wind Resource Measurements
  - 5.1.4. Wind Power Prediction
- 5.2. Wind Power
  - 5.2.1. Wind Power Evolution
  - 5.2.2. Temporal and Spatial Variability of the Wind Resource
  - 5.2.3. Wind Power Applications
- 5.3. Wind Turbines
  - 5.3.1. Types of Wind Turbines
  - 5.3.2. Parts of a Wind Turbine
  - 5.3.3. Wind Turbine Functioning
- 5.4. Wind Generator
  - 5.4.1. Asynchronous Generators: Wound Rotor
  - 5.4.2. Asynchronous Generators: Squirrel Cage
  - 5.4.3. Asynchronous Generators: Independent Excitation
  - 5.4.4. Permanent Magnet Synchronous Generators
- 5.5. Site Selection
  - 5.5.1. Basic Criteria
  - 5.5.2. Specific Aspects
  - 5.5.3. Onshore and Offshore Wind Power Facilities
- 5.6. Wind Farm Operation
  - 5.6.1. Operating Model
  - 5.6.2. Control Operations
  - 5.6.3. Remote Operation

- 5.7. Wind Park Maintenance
  - 5.7.1. Types of Maintenance: Corrective, Preventive and Predictive
  - 5.7.2. Main Failures
  - 5.7.3. Machine Improvement and Resource Organization
  - 5.7.4. Maintenance Costs (OPEX)
- 5.8. Wind Power Impact and Environmental Maintenance
  - 5.8.1. Impact on Flora and Erosion
  - 5.8.2. Impact on Avifauna
  - 5.8.3. Visual and Sound Impact
  - 5.8.4. Environmental Maintenance
- 5.9. Data and Performance Analysis
  - 5.9.1. Energy Production and Revenue
  - 5.9.2. KPI Control Indicators
  - 5.9.3. Wind Park Performance
- 5.10. Wind Park Design
  - 5.10.1. Design Considerations
  - 5.10.2. Wind Turbine Arrangement
  - 5.10.3. Effect of the Trails on the Distance between Wind Turbines
  - 5.10.4. Medium and High Voltage Equipment
  - 5.10.5. Installation Costs (CAPEX)

## Module 6. Grid-Connected and Off-Grid Photovoltaic Solar Energy Systems

- 6.1. Photovoltaic Solar Power Equipment and Environment
  - 6.1.1. Fundamental Principles of Photovoltaic Solar Power
  - 6.1.2. Situation in the Global Energy Sector
  - 6.1.3. Main Components of Solar Facilities
- 6.2. Photovoltaic Generators: Operating Principles and Characterization
  - 6.2.1. Solar Cell Operation
  - 6.2.2. Design Rules: Characterizing the Module: Parameters
  - 6.2.3. The I-V Curve
  - 6.2.4. Module Technologies in Today's Market

- 6.3. Grouping Photovoltaic Modules
  - 6.3.1. Photovoltaic Generator Design: Orientation and Inclination
  - 6.3.2. Photovoltaic Generator Installation Structures
  - 6.3.3. Solar Tracking System: Communication Environment
- 6.4. Energy Conversion: The Inverter
  - 6.4.1. Types of Inverters
  - 6.4.2. Characterization
  - 6.4.3. Maximum Power Point Tracking (MPPT) and PV Inverter Performance Monitoring Systems
- 6.5. Transformer Station
  - 6.5.1. Functioning and Parts of a Transformer Station
  - 6.5.2. Sizing and Design Issues
  - 6.5.3. The Market and Choosing Equipment
- 6.6. Other Systems of a Solar PV Plant
  - 6.6.1. Supervision and Control
  - 6.6.2. Security and Surveillance
  - 6.6.3. Substation and HV
- 6.7. Grid-Connected Photovoltaic Systems
  - 6.7.1. Design of Large-Scale Solar Parks: Prior Studies
  - 6.7.2. Self-Consumption
  - 6.7.3. Simulation Tools
- 6.8. Isolated Photovoltaic Systems
  - 6.8.1. Elements of an Isolated Facility: Regulators and Solar Batteries
  - 6.8.2. Uses: Pumping, Lighting, etc.
  - 6.8.3. Solar Democratization
- 6.9. Operation and Maintenance of Photovoltaic Facilities
  - 6.9.1. Maintenance Plans
  - 6.9.2. Personnel and Equipment
  - 6.9.3. Maintenance Management Software
- 6.10. New Lines of Improvement in Photovoltaic Parks
  - 6.10.1. Distributed Generation
  - 6.10.2. New Technologies and Trends
  - 6.10.3. Automization



## Module 7. Other Emerging Renewable Energies and Hydrogen as an Energy Carrier

- 7.1. Current Situation and Outlook
  - 7.1.1. Applicable Legislation
  - 7.1.2. Current Situation and Future Models
  - 7.1.3. Incentives and Financing
- 7.2. Energies of Marine Origin I: Tidal
  - 7.2.1. Tidal Power Origin and Potential
  - 7.2.2. Technologies for Harnessing Tidal Power
  - 7.2.3. Costs and Environmental Impact of Tidal Power
- 7.3. Energies of Marine Origin II: Undimotor
  - 7.3.1. Wave Power Origin and Potential
  - 7.3.2. Technologies for Harnessing Wave Power
  - 7.3.3. Costs and Environmental Impact of Wave Power
- 7.4. Energies of Marine Origin III: Maremothermal
  - 7.4.1. Maremothermal Power Origin and Potential
  - 7.4.2. Technologies for Harnessing Maremothermal Power
  - 7.4.3. Costs and Environmental Impact of Maremothermal Power
- 7.5. Geothermal Power
  - 7.5.1. Potential of Geothermal Power
  - 7.5.2. Technologies for Harnessing Geothermal Power
  - 7.5.3. Costs and Environmental Impact of Maremothermal Power
- 7.6. Applications of the Studied Technologies
  - 7.6.1. Applications
  - 7.6.2. Cost and Profitability Analysis
  - 7.6.3. Productive Diversification and Rural Development
  - 7.6.4. Advantages and Disadvantages
- 7.7. Hydrogen as an Energy Carrier
  - 7.7.1. Adsorption Process
  - 7.7.2. Heterogeneous Catalysis
  - 7.7.3. Hydrogen as an Energy Carrier

- 7.8. Generation and Integration of Hydrogen in Renewable Energy Systems: "Green Hydrogen"
  - 7.8.1. Hydrogen Production
  - 7.8.2. Hydrogen Storage and Distribution
  - 7.8.3. Use and Applications of Hydrogen
- 7.9. Fuel Cells and Electric Vehicles
  - 7.9.1. Fuel Cell Operation
  - 7.9.2. Types of Fuel Cells
  - 7.9.3. Applications: Portable, Stationary or Transport Applications
  - 7.9.4. Electric Vehicles, Drones, Submarines, etc.
- 7.10. Safety and ATEX Regulations
  - 7.10.1. Current Legislation
  - 7.10.2. Ignition Sources
  - 7.10.3. Risk Assessment
  - 7.10.4. Classification of ATEX Zones
  - 7.10.5. Work Equipment and Tools Used in ATEX Zones

## Module 8. Hybrid Systems and Storage

- 8.1. Electric Storage Technologies
  - 8.1.1. The Importance of Power Storage in Power Transition
  - 8.1.2. Power Storage Methods
  - 8.1.3. Main Storage Technologies
- 8.2. Industry Vision of Electrical Storage
  - 8.2.1. Automobiles and Mobility
  - 8.2.2. Stationary Applications
  - 8.2.3. Other Applications
- 8.3. Elements of a Battery Energy Storage System (BESS)
  - 8.3.1. Batteries
  - 8.3.2. Adaptation
  - 8.3.3. Control

- 8.4. Integration and Applications of BESS in Power Grids
  - 8.4.1. Storage System Integration
  - 8.4.2. Applications in Networked Systems
  - 8.4.3. Applications in Off-Grid and Micro-Grid Systems
- 8.5. Business Models I
  - 8.5.1. Stakeholders and Business Structures
  - 8.5.2. Viability of Projects with BESS
  - 8.5.3. Risk Management
- 8.6. Business Models II
  - 8.6.1. Project Construction
  - 8.6.2. Performance Assessment Criteria
  - 8.6.3. Operation and Maintenance
- 8.7. Lithium-Ion Batteries
  - 8.7.1. The Evolution of Batteries
  - 8.7.2. Main Components
  - 8.7.3. Technical and Safety Considerations
- 8.8. Hybrid PV Systems with Storage
  - 8.8.1. Design Considerations
  - 8.8.2. PV + BESS Services
  - 8.8.3. Studied Typologies
- 8.9. Hybrid Wind Systems with Storage
  - 8.9.1. Design Considerations
  - 8.9.2. Wind + BESS Services
  - 8.9.3. Studied Typologies
- 8.10. The Future of Storage Systems
  - 8.10.1. Technological Trends
  - 8.10.2. Economic Outlooks
  - 8.10.3. Storage Systems in BESS

## Module 9. Development, Financing and Feasibility of Renewable Energy Projects

- 9.1. Identifying Stakeholders
  - 9.1.1. Developers, Engineering and Consulting Companies
  - 9.1.2. Investment Funds, Banks and Other Stakeholders
- 9.2. Development of Renewable Energy Projects
  - 9.2.1. Main Stages of Development
  - 9.2.2. Main Technical Documentation
  - 9.2.3. Sales Process: RTB
- 9.3. Renewable Energy Project Assessment
  - 9.3.1. Technical Feasibility
  - 9.3.2. Commercial Feasibility
  - 9.3.3. Environmental and Social Feasibility
  - 9.3.4. Legal Feasibility and Associated Risks
- 9.4. Financial Bases
  - 9.4.1. Financial Knowledge
  - 9.4.2. Analysis of Financial Statements
  - 9.4.3. Financial Modeling
- 9.5. Economic Assessment of Renewable Energy Projects and Companies
  - 9.5.1. Assessment Fundamentals
  - 9.5.2. Assessment Methods
  - 9.5.3. Calculating Project Profitability and Fundability
- 9.6. Financing of Renewable Energies
  - 9.6.1. Characteristics of Project Finance
  - 9.6.2. Structuring Financing
  - 9.6.3. Risks in Financing
- 9.7. Renewable Asset Management: Asset Management
  - 9.7.1. Technical Supervision
  - 9.7.2. Financial Supervision
  - 9.7.3. Claims, Permit Monitoring and Contract Management

- 9.8. Insurance in Renewable Energy Projects: Construction Phase
  - 9.8.1. Developer and Builder. Specialized Insurance
  - 9.8.2. Construction Insurance-CAR
  - 9.8.3. Professional Insurance or CR Insurance
  - 9.8.4. ALOP Clause - Advance Loss of Profit
- 9.9. Insurance in Renewable Energy Projects: Operation and Exploitation Phase
  - 9.9.1. Property Insurance: Multirisk-OAR
  - 9.9.2. O&M Contractor's CR or Professional Insurance
  - 9.9.3. Suitable Coverage: Consequential and Environmental Losses
- 9.10. Damage Assessment and Appraisal in Renewable Energy Assets
  - 9.10.1. Industrial Assessment and Appraisal Services: Renewable Energy Facilities
  - 9.10.2. Intervention and Policy
  - 9.10.3. Property Damages and Consequential Losses
  - 9.10.4. Types of Claims: Photovoltaic, Solar Thermal, Hydroelectric and Wind Power

## Module 10. Digital Transformation and Industry 4.0 Applied to Renewable Energy Systems

- 10.1. Current Situation and Outlook
  - 10.1.1. Current Status of Technologies
  - 10.1.2. Trend and Evolution
  - 10.1.3. Challenges and Future Opportunities
- 10.2. Digital Transformation Applied to Renewable Energy Systems
  - 10.2.1. The Era of Digital Transformation
  - 10.2.2. The Digitization of Industry
  - 10.2.3. 5G Technology
- 10.3. Automation and Connectivity: Industry 4.0
  - 10.3.1. Automated Systems
  - 10.3.2. Connectivity
  - 10.3.3. The Importance of the Human Factor Key Factor

- 10.4. Lean Management 4.0
  - 10.4.1. Lean Management 4.0
  - 10.4.2. Benefits of Lean Management in Industry
  - 10.4.3. Lean Tools in Renewable Energy Facility Management
- 10.5. Mass Collection Systems: IoT
  - 10.5.1. Sensors and Actuators
  - 10.5.2. Continuous Data Monitoring
  - 10.5.3. Big Data
  - 10.5.4. SCADA Systems
- 10.6. IoT Project Applied to Renewable Energies
  - 10.6.1. Monitoring System Structure
  - 10.6.2. IoT System Architecture
  - 10.6.3. Cases Applied to IoT
- 10.7. Big Data and Renewable Energies
  - 10.7.1. The Principles of Big Data
  - 10.7.2. Big Data Tools
  - 10.7.3. Usability in the Energy and REE Sector
- 10.8. Proactive or Predictive Maintenance
  - 10.8.1. Predictive Maintenance and Fault Diagnosis
  - 10.8.2. Instrumentation: Vibrations, Thermography, Damage Analysis and Diagnostic Techniques
  - 10.8.3. Predictive Models
- 10.9. Drones and Automated Vehicles
  - 10.9.1. Main Characteristics
  - 10.9.2. Uses of Drones
  - 10.9.3. Uses of Autonomous Vehicles
- 10.10. New Forms of Energy Commercialization: Blockchain and Smart Contracts
  - 10.10.1. Information Systems Using Blockchain
  - 10.10.2. Tokens and Smart Contracts
  - 10.10.3. Present and Future Applications for the Electrical Sector
  - 10.10.4. Available Platforms and Blockchain-Based Application Cases

## Module 11. Energy in Building Constructio

- 11.1. Energy in Cities
  - 11.1.1. City Energy Behavior
  - 11.1.2. Sustainable Development Goals
  - 11.1.3. ODS 11 - Sustainable Citizens and Communities
- 11.2. Less Consumption or Cleaner Energy
  - 11.2.1. The Social Awareness of Clean Energies
  - 11.2.2. Social Responsibility in Energy Usage
  - 11.2.3. Greater Energy Need
- 11.3. Smart Cities and Buildings
  - 11.3.1. Smart Buildings
  - 11.3.2. Current Situation of Smart Buildings
  - 11.3.3. Smart Building Examples
- 11.4. Energy Consumption
  - 11.4.1. Building Energy Consumption
  - 11.4.2. Measuring Energy Consumption
  - 11.4.3. Knowing Our Consumption
- 11.5. Energy Demand
  - 11.5.1. Building Energy Demand
  - 11.5.2. Calculating Energy Demand
  - 11.5.3. Managing Energy Demand
- 11.6. Efficient Usage of Energy
  - 11.6.1. Responsibility in Energy Usage
  - 11.6.2. Knowing Our Energy System
- 11.7. Energetic Livability
  - 11.7.1. Energy Livability as a Key Aspect
  - 11.7.2. Factors Affecting Building Energetic Livability
- 11.8. Thermal Comfort
  - 11.8.1. The Importance of Thermal Comfort
  - 11.8.2. The Need for Thermal Comfort

- 11.9. Energy Poverty
  - 11.9.1. Energy Dependence
  - 11.9.2. Current Situation
- 11.10. Solar Radiation: Climate Zones
  - 11.10.1. Solar Radiation
  - 11.10.2. Hourly Solar Radiation
  - 11.10.3. Effects of Solar Radiation
  - 11.10.4. Climate Zones
  - 11.10.5. The Importance of the Geographic Location of a Building

## Module 12. Standards and Regulations

- 12.1. Regulation
  - 12.1.1. Justification
  - 12.1.2. Key Notes
  - 12.1.3. Responsible Agencies and Authorities
- 12.2. National and International Standards
  - 12.2.1. ISO Standards
  - 12.2.2. EN Standards
  - 12.2.3. UNE Standards
- 12.3. Building Sustainability Certificates
  - 12.3.1. The Need for Certificates
  - 12.3.2. Certification Procedures
  - 12.3.3. BREEAM, LEED, Green and WELL
  - 12.3.4. Passivhaus
- 12.4. Standards
  - 12.4.1. Industry Foundation Classes (IFC)
  - 12.4.2. Building Information Model (BIM)

## Module 13. Circular Economy

- 13.1. Circular Economy Tendency
  - 13.1.1. Circular Economy Origin
  - 13.1.2. Circular Economy Definition
  - 13.1.3. Circular Economy Necessity
  - 13.1.4. Circular Economy as Strategy
- 13.2. Circular Economy Features
  - 13.2.1. First Principle: Preserve and Improve
  - 13.2.2. Second Principle: Optimize
  - 13.2.3. Third Principle: Promote
  - 13.2.4. Key Features
- 13.3. Circular Economy Benefits
  - 13.3.1. Economic Benefits
  - 13.3.2. Social Benefits
  - 13.3.3. Corporate Benefits
  - 13.3.4. Environmental Benefits
- 13.4. Circular Economy Legislation
  - 13.4.1. Regulations
  - 13.4.2. European Directives
- 13.5. Life Cycle Analysis
  - 13.5.1. Life Cycle Analysis Scope (ACV)
  - 13.5.2. Stages
  - 13.5.3. Reference Standards
  - 13.5.4. Methodology
  - 13.5.5. Tools
- 13.6. Carbon Footprint Calculation
  - 13.6.1. Carbon Footprint
  - 13.6.2. Types of Scope
  - 13.6.3. Methodology
  - 13.6.4. Tools
  - 13.6.5. Carbon Footprint Calculation

- 13.7. CO2 Emission Reduction Plans
  - 13.7.1. Improvement Plans: Supplies
  - 13.7.2. Improvement Plans: Demand
  - 13.7.3. Improvement Plans: Installations
  - 13.7.4. Improvement Plans: Equipment
  - 13.7.5. Emissions Offsetting
- 13.8. Carbon Footprint Records
  - 13.8.1. Carbon Footprint Records
  - 13.8.2. Requirements Prior to Registration
  - 13.8.3. Documentation
  - 13.8.4. Registration Request
- 13.9. Good Circular Practices
  - 13.9.1. Methodology BIM
  - 13.9.2. Selecting Material and Equipment
  - 13.9.3. Maintenance
  - 13.9.4. Waste Management
  - 13.9.5. Reusing Material

## Module 14. Energy Audits and Certification

- 14.1. Energy Audits
  - 14.1.1. Energy Diagnostics
  - 14.1.2. Energy Audits
  - 14.1.3. ESE Energy Audits
- 14.2. Competencies of an Energy Auditor
  - 14.2.1. Personal Attributes
  - 14.2.2. Knowledge and Skills
  - 14.2.3. Skill Acquisition, Maintenance and Improvement
  - 14.2.4. Certifications
  - 14.2.5. List of Energy Service Providers





- 14.3. Energy Audits in Building: UNE-EN 16247-2
  - 14.3.1. Preliminary Contact
  - 14.3.2. Fieldwork
  - 14.3.3. Analysis
  - 14.3.4. Report
  - 14.3.5. Final Presentation
- 14.4. Auditing Measurement Tools
  - 14.4.1. Network Analyzer and Clamp Ammeters
  - 14.4.2. Luxmeter
  - 14.4.3. Thermohygrometer
  - 14.4.4. Anemometer
  - 14.4.5. Combustion Analyzer
  - 14.4.6. Thermographic Camera
  - 14.4.7. Transmittance Meter
- 14.5. Investment Analysis
  - 14.5.1. Preliminary Considerations
  - 14.5.2. Noise Assessment Criteria
  - 14.5.3. Cost Study
  - 14.5.4. Grants and Subsidies
  - 14.5.5. Payback Period
  - 14.5.6. Optimal Profitability Level
- 14.6. Managing Contracts with Energy Services Companies
  - 14.6.1. Energy Efficiency Services: UNE-EN 15900
  - 14.6.2. First Service: Energy Management
  - 14.6.3. Second Service: Maintenance
  - 14.6.4. Third Service: Total Guarantee
  - 14.6.5. Fourth Service: Facility Improvement and Renovation
  - 14.6.6. Fifth Service: Savings and Renewable Energy Investments
- 14.7. Certification Programs: HULC
  - 14.7.1. HULC Program
  - 14.7.2. Data Prior to Calculation
  - 14.7.3. Practical Case Example: Residential Case
  - 14.7.4. Practical Case Example: Small Tertiary Case
  - 14.7.5. Practical Case Example: Large Tertiary Case
- 14.8. Certification Programs: CE3X
  - 14.8.1. CE3X Program
  - 14.8.2. Data Prior to Calculation
  - 14.8.3. Practical Case Example: Residential Case
  - 14.8.4. Practical Case Example: Small Tertiary Case
  - 14.8.5. Practical Case Example: Large Tertiary Case
- 14.9. Certification Programs: CERMA
  - 14.9.1. CERMA Program
  - 14.9.2. Data Prior to Calculation
  - 14.9.3. Practical Case Example: New Constructions
  - 14.9.4. Practical Case Example: Existing Buildings
- 14.10. Certification Programs: Others
  - 14.10.1. Variety in Energy Calculation Programs Use
  - 14.10.2. Other Certification Programs

## Module 15. Bioclimatic Architecture

- 15.1. Materials Technology and Construction Systems
  - 15.1.1. Bioclimatic Architecture Evolution
  - 15.1.2. Most Used Materials
  - 15.1.3. Construction Systems
  - 15.1.4. Thermal Bridges
- 15.2. Enclosures, Walls and Roofs
  - 15.2.1. The Role of Enclosures in Energy Efficiency
  - 15.2.2. Vertical Enclosures and Materials Used
  - 15.2.3. Horizontal Enclosures and Materials Used
  - 15.2.4. Flat Roofs
  - 15.2.5. Sloping Roofs
- 15.3. Openings, Glazing and Frames
  - 15.3.1. Types of Openings
  - 15.3.2. The Role of Openings in Energy Efficiency
  - 15.3.3. Materials Used
- 15.4. Solar Protection
  - 15.4.1. Need for Solar Protection
  - 15.4.2. Solar Protection Systems
    - 15.4.2.1. Awnings
    - 15.4.2.2. Slats
    - 15.4.2.3. Overhangs
    - 15.4.2.4. Setbacks
    - 15.4.2.5. Other Protection Systems
- 15.5. Bioclimatic Strategy in Summer
  - 15.5.1. The Importance of Utilizing Shade
  - 15.5.2. Bioclimatic Construction Techniques for Summer
  - 15.5.3. Good Building Practices
- 15.6. Bioclimatic Strategy for Winter
  - 15.6.1. The Importance the Utilizing the Sun
  - 15.6.2. Bioclimatic Construction Techniques for Winter
  - 15.6.3. Construction Examples

- 15.7. Canadian Wells: Trombe Wall Vegetable Covers
  - 15.7.1. Other Forms of Energy Utilization
  - 15.7.2. Canadian Wells
  - 15.7.3. Trombe Wall
  - 15.7.4. Vegetable Covers
- 15.8. The Importance of Building Orientation
  - 15.8.1. Wind Rose
  - 15.8.2. Building Orientations
  - 15.8.3. Examples of Bad Practices
- 15.9. Healthy Buildings
  - 15.9.1. Air Quality
  - 15.9.2. Lighting Quality
  - 15.9.3. Thermal Insulation
  - 15.9.4. Acoustic Insulation
  - 15.9.5. Sick Building Syndrome
- 15.10. Bioclimatic Architecture Examples
  - 15.10.1. International Architecture
  - 15.10.2. Bioclimatic Architecture

## Module 16. Renewable Energie

- 16.1. Thermal Solar Power
  - 16.1.1. Thermal Solar Power Scope
  - 16.1.2. Thermal Solar Power Systems
  - 16.1.3. Thermal Solar Power Today
  - 16.1.4. Thermal Solar Power Use in Buildings
  - 16.1.5. Advantages and Disadvantages
- 16.2. Photovoltaic Solar Power
  - 16.2.1. Photovoltaic Solar Power Evolution
  - 16.2.2. Photovoltaic Solar Power Today
  - 16.2.3. Photovoltaic Solar Power Use in Buildings
  - 16.2.4. Advantages and Disadvantages

- 16.3. Mini Hydraulic Power
  - 16.3.1. Hydraulic Power in Building
  - 16.3.2. Hydraulic Power and Mini Hydraulic Power Today
  - 16.3.3. Practical Applications of Hydraulic Power
  - 16.3.4. Advantages and Disadvantages
- 16.4. Mini Wind Power
  - 16.4.1. Wind and Mini Wind Power
  - 16.4.2. Update on Wind and Mini Wind Power
  - 16.4.3. Practical Applications of Wind Power
  - 16.4.4. Advantages and Disadvantages
- 16.5. Biomass
  - 16.5.1. Biomass as Renewable Fuel
  - 16.5.2. Types of Biomass Fuel
  - 16.5.3. Biomass Heat Production Systems
  - 16.5.4. Advantages and Disadvantages
- 16.6. Geothermal
  - 16.6.1. Geothermal Power
  - 16.6.2. Geothermal Power Systems Today
  - 16.6.3. Advantages and Disadvantages
- 16.7. Aerothermal Power
  - 16.7.1. Aerothermal Power in Building
  - 16.7.2. Aerothermal Power Systems Today
  - 16.7.3. Advantages and Disadvantages
- 16.8. Cogeneration Systems
  - 16.8.1. Cogeneration
  - 16.8.2. Cogeneration Systems in Homes and Buildings
  - 16.8.3. Advantages and Disadvantages
- 16.9. Biogas in Building
  - 16.9.1. Potentialities
  - 16.9.2. Biodigestors
  - 16.9.3. Integration

- 16.10. Self-Consumption
  - 16.10.1. Self-Consumption Application
  - 16.10.2. Self-Consumption Benefits
  - 16.10.3. The Sector Today
  - 16.10.4. Self-Consumption Power Systems in Buildings

## Module 17. Electrical Installations

- 17.1. Electrical Equipment
  - 17.1.1. Classification
  - 17.1.2. Appliance Consumption
  - 17.1.3. Usage Profiles
- 17.2. Energy Labels
  - 17.2.1. Labeled Products
  - 17.2.2. Label Interpretation
  - 17.2.3. Ecolabels
  - 17.2.4. EPREL Database Product Registration
  - 17.2.5. Estimated Savings
- 17.3. Individual Measurement Systems
  - 17.3.1. Measuring Power Consumption
  - 17.3.2. Individual Meters
  - 17.3.3. Switchboard Meters
  - 17.3.4. Choosing Devices
- 17.4. Filters and Capacitor Banks
  - 17.4.1. Differences between Power Factor and Cosine of Phi
  - 17.4.2. Harmonics and Distortion Rate
  - 17.4.3. Reactive Energy Compensation
  - 17.4.4. Filter Selection
  - 17.4.5. Capacitor Bank Selection

- 17.5. Stand-By Consumption
  - 17.5.1. Stand-By Consumption
  - 17.5.2. Codes of Conduct
  - 17.5.3. Estimating Stand-By Consumption
  - 17.5.4. Anti Stand-By Devices
- 17.6. Electric Vehicle Recharging
  - 17.6.1. Types of Recharging Points
  - 17.6.2. Potential ITC-BT 52 Diagrams
  - 17.6.3. Provision of Regulatory Infrastructures in Buildings
  - 17.6.4. Horizontal Property and Installation of Recharging Points
- 17.7. Uninterruptible Power Supply (UPS) Systems
  - 17.7.1. UPS Infrastructure
  - 17.7.2. Types of UPS
  - 17.7.3. Features
  - 17.7.4. Applications
  - 17.7.5. UPS Selection
- 17.8. Electric Meter
  - 17.8.1. Types of Meters
  - 17.8.2. Digital Meter Operation
  - 17.8.3. Use as an Analyzer
  - 17.8.4. Telemetry and Data Mining
- 17.9. Electric Billing Optimization
  - 17.9.1. Electricity Tariffs
  - 17.9.2. Types of Low Voltage Consumers
  - 17.9.3. Types of Low Voltage Rates
  - 17.9.4. Power Term and Penalties
  - 17.9.5. Reactive Power Term and Penalties
- 17.10. Efficient Usage of Energy
  - 17.10.1. Energy Saving Habits
  - 17.10.2. Appliance Energy Saving
  - 17.10.3. Energy Culture in Facility Management

## Module 18. Thermal Installations

- 18.1. Thermal Installations in Buildings
  - 18.1.1. Optimization of Thermal Installations in Buildings
  - 18.1.2. Thermal Machines Operation
  - 18.1.3. Pipe Insulation
  - 18.1.4. Duct Insulation
- 18.2. Gas Heat Production Systems
  - 18.2.1. Gas Heat Equipment
  - 18.2.2. Components of a Gas Production System
  - 18.2.3. Vacuum Test
  - 18.2.4. Good Practices in Gas Heat Systems
- 18.3. Diesel Heat Production Systems
  - 18.3.1. Diesel Heat Equipment
  - 18.3.2. Components of a Diesel Production System
  - 18.3.3. Good Practices in Diesel Heat Systems
- 18.4. Biomass Heat Production Systems
  - 18.4.1. Biomass Heat Equipment
  - 18.4.2. Components of a Biomass Heat Production System
  - 18.4.3. The Use of Biomass in the Home
  - 18.4.4. Good Practices in Biomass Production Systems
- 18.5. Heat Pumps
  - 18.5.1. Heat Pump Equipment
  - 18.5.2. Heat Pump Components
  - 18.5.3. Advantages and Disadvantages
  - 18.5.4. Good Practices in Heat Pump Equipment
- 18.6. Refrigerant Gases
  - 18.6.1. Knowledge of Refrigerant Gases
  - 18.6.2. Types of Refrigerant Gas Classification

- 18.7. Cooling Systems
  - 18.7.1. Cooling Equipment
  - 18.7.2. Common Installations
  - 18.7.3. Other Cooling Systems
  - 18.7.4. Refrigeration Component Overhaul and Cleaning
- 18.8. Heating, Ventilation and Air Conditioning HVAC Systems
  - 18.8.1. Types of HVAC Systems
  - 18.8.2. Home HVAC Systems
  - 18.8.3. Correct Use of HVAC Systems
- 18.9. Domestic Hot Water Systems DHW
  - 18.9.1. Types of DHW Systems
  - 18.9.2. Home DHW Systems
  - 18.9.3. Correct Use of DHW Systems
- 18.10. Thermal Installation Maintenance
  - 18.10.1. Boiler and Burner Maintenance
  - 18.10.2. Auxiliary Components Maintenance
  - 18.10.3. Refrigerant Gas Leak Detection
  - 18.10.4. Refrigerant Gas Recovery

## Module 19. Lighting Installations

- 19.1. Light Sources
  - 19.1.1. Lighting Technology
    - 19.1.1.1. Properties of Light
    - 19.1.1.2. Photometry
    - 19.1.1.3. Photometric Measurements
    - 19.1.1.4. Lighting
    - 19.1.1.5. Auxiliary Electrical Equipment
  - 19.1.2. Traditional Light Sources
    - 19.1.2.1. Incandescent and Halogen Lamps
    - 19.1.2.2. High- and Low-Pressure Sodium Steam
    - 19.1.2.3. High- and Low-Pressure Mercury Steam
    - 19.1.2.4. Other Technologies: Induction, Xenon

- 19.2. LED Technology
  - 19.2.1. Operating Principle
  - 19.2.2. Electrical Properties
  - 19.2.3. Advantages and Disadvantages
  - 19.2.4. LED Lighting: Optics
  - 19.2.5. Auxiliary Equipment: Driver
- 19.3. Indoor Lighting Requirements
  - 19.3.1. Standards and Regulations
  - 19.3.2. Lighting Projects
  - 19.3.3. Quality Criteria
- 19.4. Outdoor Lighting Requirements
  - 19.4.1. Standards and Regulations
  - 19.4.2. Lighting Projects
  - 19.4.3. Quality Criteria
- 19.5. Lighting Calculation Software: DIALux
  - 19.5.1. Features
  - 19.5.2. Menus
  - 19.5.3. Project Design
  - 19.5.4. Obtaining and Interpreting Results
- 19.6. Lighting Calculation Software: EVO
  - 19.6.1. Features
  - 19.6.2. Advantages and Disadvantages
  - 19.6.3. Menus
  - 19.6.4. Project Design
  - 19.6.5. Obtaining and Interpreting Results
- 19.7. Lighting Energy Efficiency
  - 19.7.1. Standards and Regulations
  - 19.7.2. Energy Efficiency Improvement Measures
  - 19.7.3. Integrating Natural Light

- 19.8. Biodynamic Lighting
  - 19.8.1. Light Pollution
  - 19.8.2. Circadian Rhythms
  - 19.8.3. Harmful Effects
- 19.9. Indoor Lighting Project Calculation
  - 19.9.1. Residential Buildings
  - 19.9.2. Corporate Buildings
  - 19.9.3. Schools and Education Centers
  - 19.9.4. Hospital Centers
  - 19.9.5. Public Buildings
  - 19.9.6. Industries
  - 19.9.7. Commercial and Exhibition Spaces
- 19.10. Outdoor Lighting Project Calculation
  - 19.10.1. Street and Road Lighting
  - 19.10.2. Facades
  - 19.10.3. Signs and Illuminated Signs

## Module 20. Control Installations

- 20.1. Home Automation
  - 20.1.1. State of the Art
  - 20.1.2. Standards and Regulations
  - 20.1.3. Equipment
  - 20.1.4. Services
  - 20.1.5. Networks
- 20.2. Building Automation
  - 20.2.1. Characteristics and Regulation
  - 20.2.2. Building Automation and Control Systems and Technologies
  - 20.2.3. Building Energy Efficiency Technical Management
- 20.3. Teleprocessing
  - 20.3.1. Determining the System
  - 20.3.2. Key Elements
  - 20.3.3. Monitoring Software

- 20.4. Smart Homes
  - 20.4.1. Features
  - 20.4.2. Equipment
- 20.5. The Internet of Things: IoT
  - 20.5.1. Technological Monitoring
  - 20.5.2. Standards
  - 20.5.3. Equipment
  - 20.5.4. Services
  - 20.5.5. Networks
- 20.6. Telecommunication Installations
  - 20.6.1. Key Infrastructure
  - 20.6.2. Television
  - 20.6.3. Radio
  - 20.6.4. Telephony
- 20.7. KNX and DALI Protocols
  - 20.7.1. Standardization
  - 20.7.2. Applications
  - 20.7.3. Equipment
  - 20.7.4. Design and Configuration
- 20.8. IP Networks WiFi
  - 20.8.1. Standards
  - 20.8.2. Features
  - 20.8.3. Design and Configuration
- 20.9. Bluetooth
  - 20.9.1. Standards
  - 20.9.2. Design and Configuration
  - 20.9.3. Features
- 20.10. Future Technology
  - 20.10.1. Zigbee
  - 20.10.2. Programming and Configuration Python
  - 20.10.3. Big Data



“

*A comprehensive specialization program that will take you through the necessary training to compete with the best in your profession”*

06

# Methodology

This academic program offers students a different way of learning. Our methodology uses a cyclical learning approach: **Relearning**.

This teaching system is used, for example, in the most prestigious medical schools in the world, and major publications such as the **New England Journal of Medicine** have considered it to be one of the most effective.







“

*Discover Relearning, a system that abandons conventional linear learning, to take you through cyclical teaching systems: a way of learning that has proven to be extremely effective, especially in subjects that require memorization"*

## Case Study to contextualize all content

Our program offers a revolutionary approach to developing skills and knowledge. Our goal is to strengthen skills in a changing, competitive, and highly demanding environment.

“

*At TECH, you will experience a learning methodology that is shaking the foundations of traditional universities around the world"*



*You will have access to a learning system based on repetition, with natural and progressive teaching throughout the entire syllabus.*



*The student will learn to solve complex situations in real business environments through collaborative activities and real cases.*

### A learning method that is different and innovative

This TECH program is an intensive educational program, created from scratch, which presents the most demanding challenges and decisions in this field, both nationally and internationally. This methodology promotes personal and professional growth, representing a significant step towards success. The case method, a technique that lays the foundation for this content, ensures that the most current economic, social and professional reality is taken into account.

“*Our program prepares you to face new challenges in uncertain environments and achieve success in your career”*

The case method is the most widely used learning system in the best faculties in the world. The case method was developed in 1912 so that law students would not only learn the law based on theoretical content. It consisted of presenting students with real-life, complex situations for them to make informed decisions and value judgments on how to resolve them. In 1924, Harvard adopted it as a standard teaching method.

What should a professional do in a given situation? This is the question that you are presented with in the case method, an action-oriented learning method. Throughout the program, the studies will be presented with multiple real cases. They will have to combine all their knowledge and research, and argue and defend their ideas and decisions.

## Relearning Methodology

TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

We enhance the Case Study with the best 100% online teaching method: Relearning.

*In 2019, we obtained the best learning results of all online universities in the world.*

At TECH, you will learn using a cutting-edge methodology designed to train the executives of the future. This method, at the forefront of international teaching, is called Relearning.

Our university is the only one in the world authorized to employ this successful method. In 2019, we managed to improve our students' overall satisfaction levels (teaching quality, quality of materials, course structure, objectives...) based on the best online university indicators.



In our program, learning is not a linear process, but rather a spiral (learn, unlearn, forget, and relearn). Therefore, we combine each of these elements concentrically.

This methodology has trained more than 650,000 university graduates with unprecedented success in fields as diverse as biochemistry, genetics, surgery, international law, management skills, sports science, philosophy, law, engineering, journalism, history, and financial markets and instruments. All this in a highly demanding environment, where the students have a strong socio-economic profile and an average age of 43.5 years.

*Relearning will allow you to learn with less effort and better performance, involving you more in your training, developing a critical mindset, defending arguments, and contrasting opinions: a direct equation for success.*

From the latest scientific evidence in the field of neuroscience, not only do we know how to organize information, ideas, images and memories, but we know that the place and context where we have learned something is fundamental for us to be able to remember it and store it in the hippocampus, to retain it in our long-term memory.

In this way, and in what is called neurocognitive context-dependent elearning, the different elements in our program are connected to the context where the individual carries out their professional activity.



This program offers the best educational material, prepared with professionals in mind:



### Study Material

All teaching material is produced by the specialists who teach the course, specifically for the course, so that the teaching content is highly specific and precise.

These contents are then applied to the audiovisual format, to create the TECH online working method. All this, with the latest techniques that offer high quality pieces in each and every one of the materials that are made available to the student.



### Classes

There is scientific evidence suggesting that observing third-party experts can be useful.

Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.



### Practising Skills and Abilities

They will carry out activities to develop specific skills and abilities in each subject area. Exercises and activities to acquire and develop the skills and abilities that a specialist needs to develop in the context of the globalization that we are experiencing.



### Additional Reading

Recent articles, consensus documents and international guidelines, among others. In TECH's virtual library, students will have access to everything they need to complete their course.





#### Case Studies

Students will complete a selection of the best case studies chosen specifically for this program. Cases that are presented, analyzed, and supervised by the best specialists in the world.



#### Interactive Summaries

The TECH team presents the contents attractively and dynamically in multimedia lessons that include audio, videos, images, diagrams, and concept maps in order to reinforce knowledge.

This exclusive educational system for presenting multimedia content was awarded by Microsoft as a "European Success Story".



#### Testing & Retesting

We periodically evaluate and re-evaluate students' knowledge throughout the program, through assessment and self-assessment activities and exercises, so that they can see how they are achieving their goals.



07

# Certificate

This Advanced Master's Degree in Renewable Energies and Sustainability in Building Construction guarantees you, in addition to the most rigorous and updated training, access to a Advanced Master's Degree issued by TECH Global University.







“

*Successfully complete this program  
and receive your university degree  
without travel or laborious paperwork”*

This program will allow you to obtain your **Advanced Master's Degree in Renewable Energies and Sustainability in Building Construction** endorsed by **TECH Global University**, the world's largest online university.

**TECH Global University** is an official European University publicly recognized by the Government of Andorra (**official bulletin**). Andorra is part of the European Higher Education Area (EHEA) since 2002. The EHEA is an initiative promoted by the European Union that aims to organize the international training framework and harmonize the higher education systems of the member countries of this space. The project promotes common values, the implementation of collaborative tools and strengthening its quality assurance mechanisms to enhance collaboration and mobility among students, researchers and academics.

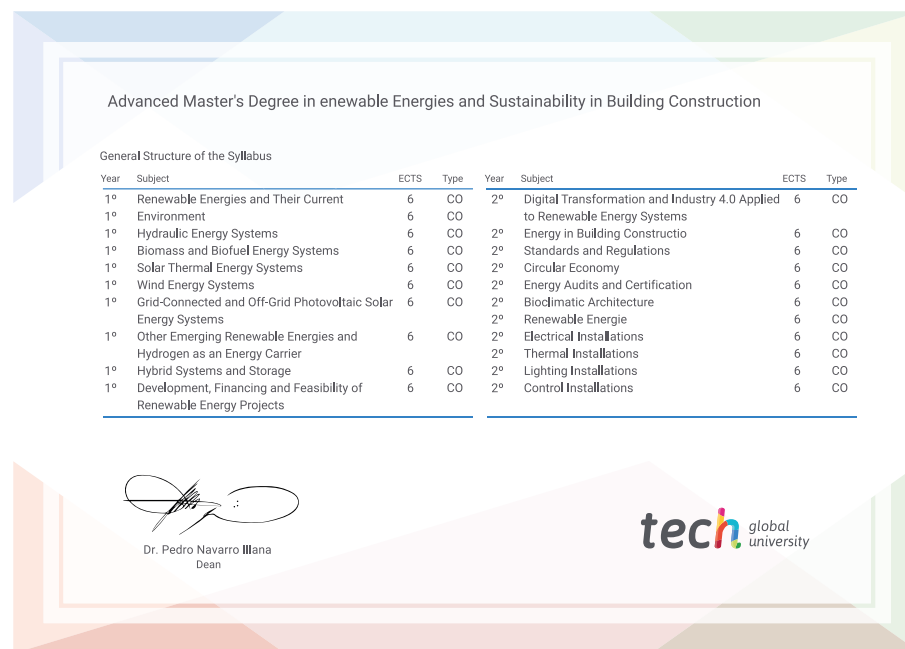
This **TECH Global University** title is a European program of continuing education and professional updating that guarantees the acquisition of competencies in its area of knowledge, providing a high curricular value to the student who completes the program.

Title: **Advanced Master's Degree in Renewable Energies and Sustainability in Building Construction**

Modality: **online**

Duration: **2 years**

Accreditation: **120 ECTS**



\*Apostille Convention. In the event that the student wishes to have their paper diploma issued with an apostille, TECH Global University will make the necessary arrangements to obtain it, at an additional cost.

future

health confidence people

education information tutors

guarantee accreditation teaching

institutions technology learning

community commitment

**tech** global  
university

personalized service innovation

knowledge presence quality

online languages

development

virtual classroom

## Advanced Master's Degree

Renewable Energies and Sustainability  
in Building Construction

- » Modality: online
- » Duration: 2 years
- » Certificate: TECH Global University
- » Credits: 120 ECTS
- » Schedule: at your own pace
- » Exams: online

# Advanced Master's Degree

## Renewable Energies and Sustainability in Building Construction