Master's Degree in Sustainable Electricity Generation

UCAM
UNIVERSIDAD
CATÓLICA DE MURCIA

Structuralia

SUMMARY

STRUCTURALIA

Structuralia is an online school specialized in graduate engineering, infrastructure, construction, energy, building, new technologies, and digital transformation programs and courses. We are dedicated to providing high-quality education for engineers, architects, and STEM (science, technology, engineering, and mathematics) professionals.

Since our creation in 2001, over 200,000 students from more than 90 countries have participated in our virtual classrooms as we disseminate knowledge and guide professionals toward success.

To this effect, we collaborate with leading international experts in each field, which enables our students to specialize under the guidance of active professionals. Our constant interaction with major companies in each sector, as their specialized training provider, enables us to tailor high-quality academic material to meet the current job requirements of our students.

Our master's programs are certified by our partner universities, such as the Universidad Católica San Antonio de Murcia, UDAVINCI, or Universidad Isabel I.

Every day we strive to provide the best training for engineers, architects, and STEM professionals with a clear goal: your professional success.

BRIEF SUMMARY

This master's degree is designed to contribute to the much needed energy transition towards sustainable development and a world with zero CO2 emissions.

The objective of the program is to impart technical, economic, environmental and project management knowledge for the sustainable generation of electricity through the use of renewable energies. As a result, the student will be able to carry out the design and dimensioning of wind farms, photovoltaic solar plants, hydroelectric plants, biomass projects, and other renewable energy initiatives (e.g., Thermoelectric, geothermal, and energy from the sea). Likewise, knowledge on hydrogen energy, and on other renewable gasses (biofuels) will be provided, as well as on the infrastructure to be implemented in the cities of the future (e.g., Distributed generation, smart networks, electric mobility).

WHO IS IT INTENDED FOR?

The following program is aimed at the following audiences:

- Holders of engineering degrees
- Holder of science degrees
- Master and technical engineers
- Technical architects and building engineers
- Professionals from the sector with college education

JOB OPPORTUNITIES

This master's degree seeks to open the doors to the sector of electric energy generation by means of renewable energy sources, and more specifically, to:

- The implementation and management of renewable resource measurement campaigns
- Renewable resource analyses (e.g., wind resource analysis)
- The knowledge of renewable generation technologies, such as wind turbines, solar panels, hydraulic turbines, etc.
- The conceptual, or basic design of renewable energy facilities (e.g, wind farms, photovoltaic solar plants)
- The management of renewable energy and hydrogen energy projects
- The construction of wind farm facilities and photovoltaic solar plants
- The management of distributed generation projects, smart grids, and sustainable mobility

GOALS

The goals of this program seek to enable the student to:

- Understand the energy context in which the world moves and its dependence on fossil fuels, as well as the main policies for the transition from fossil to renewable energies.
- Analyze traditional electricity generation technologies by using coal, natural gas, and nuclear energy
- Learn the new electricity generation technologies through renewable resources: wind, solar, hydraulic, biomass, energy from the sea, etc.
- Study hydrogen energy as a new energy vector and understand its importance in energy storage and transport
- Learn the importance of smart grids, distributed generation, and electric mobility as elements that will transform and make the city of the future more sustainable.
- Learn the management methodology applied to renewable energy projects
- Design and implement a renewable energy project.
- Learn work methodologies (including computer tools) that are currently applied by companies in energy related projects.

PROGRAM

MODULE 1. GLOBAL ENERGY CONTEXT

Unit 1. Energy and development

- Global energy context
- Climate change
- Decarbonisation of the economy and energy transition
- Climate neutrality. The Green Deal
- Smart cities

Unit 2. Sustainable development

- Sustainable development goals
- United nations climate summits. Kyoto protocol and Paris agreement
- Clean Development Mechanisms (CDM) and Joint Implementation (JM)
- Emissions trading
- CO2 capture and usage

Unit 3. The role of renewable energies and other maintenance technologies

- Energy security. Energy policy of the European Union
- Penetration of renewable energy and electrification by 2050
- The importance of hydrogen
- The batteries
- Distributed generation

Unit 4. Other vectors of change

- General aspects of energy efficiency (I)
- General aspects of energy efficiency (II)
- Energy efficiency in transport
- Energy efficiency in buildings
- Circular economy

MODULE 2. CONVENTIONAL HEAT GENERATION

Unit 1. Introduction to thermodynamics. Fuels. The steam power plant

- Introduction to thermodynamics
- Fuels and combustion
- The steam power plant (I). The regenerative Rankine cycle
- The steam power plant (II). General arrangement. Main equipment
- Types of steam power plants

Unit 2. Gas turbines power plants

- The gas turbine. The Brayton cycle

- Types of gas turbines. Parts of the gas turbine. Technologists
- Simple cycle power plants
- Combined cycle power plants
- General arrangement of a combined cycle power plant. Components

Unit 3. Diesel engine power plants. Situation and outlook of conventional thermal generation

- The internal combustión engine. The Otto cycle and the Diesel cycle
- The diesel engine. Types. Technologists
- The engine power plant. Types and configurations
- General arrangement and components
- Situation and outlook of conventional thermal generation

Unit 4. Nuclear energy

- Nuclear energy basic concepts
- Nuclear technology fundamentals
- Conventional nuclear power plants
- Nuclear power plants safety and radiation protection
- The role of nuclear energy in the transition to decarbonization

MODULE 3. HYDROELECTRIC POWER

Unit 1. Introduction to hydropower. Dams and reservoirs

- Introduction and general information on hydroelectric generation
- Typology of hydroelectric power plants
- Hydraulic resource assessment
- Dams and weirs (I). Introduction and typology
- Dams and weirs (II). Actions, landfills and drainage

Unit 2. Hydraulic circuits

- Intake works
- Channels and pressure galleries
- Penstocks
- Gates and valves
- Hydraulic circuit equipment

Unit 3. Hydroelectric turbines and electrical equipment

- Powerhouse and introduction to turbines
- Field of application of turbines and action turbines
- Reaction turbines
- Turbine selection criteria and performance
- Generators, regulation and control

Unit 4. Pumped-storage, project development and environmental considerations

- Pumped-storage power plants
- Feasibility studies

- Sizing example
- Hydroelectric projects
- Environmental evaluation. Environmental impact mitigation

MODULE 4. SOLAR ENERGY

Unit 1. Solar energy

- Introduction to solar energy: the sun
- Fundamental parameters of the path of the sun
- Instrumentation for measuring
- Solar radiation on an inclined surface
- Shading between photovoltaic modules

Unit 2. The photovoltaic cell

- Principle of operation
- Types of photovoltaic cells
- Method of the fill factor
- Representation of the parameters: I-V curve
- Model of the real photovoltaic cell

Unit 3. The photovoltaic module

- Combination of cells
- Obtaining the parameters of the photovoltaic module
- Estimation of instantaneous power: alternative methods
- Accumulators
- Introduction to PVGIS

Unit 4. The photovoltaic system

- Components of the photovoltaic system
- Types of photovoltaic systems
- Sizing of the grid-connected photovoltaic system
- Monitoring and system losses
- System protections

MODULE 5. HYDROGEN AS AN ENERGY VECTOR

Unit 1. Land mobility

- Light transport
- Heavy duty transport
- Captive fleets
- Railway sector
- Infrastructures

Unit 2. Air and maritime mobility

- Energy transition in air transport

- Sustainable aviation fuels
- Energy transition in maritime transport
- Sustainable fuels for maritime transport
- Evolution of air and maritime transport

Unit 3. Hydrogen management

- Risk of hydrogen
- Hydrogen detection
- Security aspects
- Explosive environments
- Hydrogen risk assesment

Unit 4. Transport and logistics

- Hydrogen production pathways
- Distributed generation systems
- Comparison between generation systems
- Environmental, health, and safety aspects of the hydrogen production pathways
- Safety and risks associated with hydrogen transmissionn, distribution and storage

MODULE 6. ALTERNATIVE RENEWABLE ENERGIES. BIOETHANOL, BIODIESEL, BIOGAS, BIOMASS COMBUSTION, AND SOLAR THERMOELECTRIC POWER

Unit 1. Biomass and Biofuels

- Introduction to biomass
- FAME biofuels
- FAME biofuels
- FAME fuels
- Bioethanol fuels

Unit 2. Biofuels

- Bioethanol fuels
- Bioethanol fuels
- HVO biofuel
- Electricity generation from biomass
- Electricity generation from biomass

Unit 3. Biogas and Solar Thermal Energy

- Principles of electricity generation from biogas
- Technologies of electricity generation from biogas
- Projects for electricity generation from biogas
- Solar thermal electric technologies
- Solar thermal electric projects

Unit 4. Marine Energy

- Wave power

- Wave power
- Tidal power
- Tidal power
- Marine current power

MODULE 7. THE ENERGY OF THE SMART CITY OF THE FUTURE

Unit 1. Introduction. The concept of Smart Cities

- Introduction and goals
- Smart cities
- Smart cities. Some experiences
- Energy in cities
- Consumer-centered energy. Smart counters

Unit 2. Sustainable Mobility

- The need of decarbonizing transport
- Possible actions to decarbonize transport
- Electric vehicles
- The electric bus
- New business models

Unit 3. Renewable Distributed Power Generation

- Overview of renewable distributed power generation
- The growth of distributed power generation and self-consumption
- The introduction of self-consumption in the electric system
- Energy communities
- Some experiences

Unit 4. Smart Grids

- Electricity distribution (I)
- Electricity distribution (II)
- Power grids in the face of energy transition
- New tools, and the gain of flexibility
- Smart Grids

MODULE 8. DESIGN AND MANAGEMENT OF ENERGY PROJECTS

Unit 1. Project and its organization

- Renewable energy projects. Definition and type of projects
- Project objectives
- Different organizations and roles in the project
- The project team. The project manager

Unit 2. Project Development

- Site search and land management

- Acquisition of projects in the development phase
- Project analysis. Detailed business plan
- Project processing

Unit 3. Definition of detail and proposal for approval

- Project execution strategy (I)
- Project execution strategy (II)
- Bidding processes
- Contracts
- Risk management (I). Risk matrix
- Risk management (II). Contingency estimation

Unit 4. Project construction and completion

- Project planning
- Project budget and economic control
- Safety and environmental management
- Procurement management and equipment manufacturing control
- Construction and commissioning supervision

- Completion of construction, contracts closing and transfer to operations organization

MODULE 9. WIND ENERGY

Unit 1. Physical and meteorological concepts

- History of wind energy
- Wind meteorology
- The physics of wind resources
- Site selection
- Wind resource measurement campaign

Unit 2. Wind turbine technology and wind data analysis

- Wind resource
- Practical exercise. Wind resource descriptive statistical analysis. Windographer program
- Wind turbines (I)
- Wind turbines (II)
- Wind turbines (III)

Unit 3. Micrositing study through an electric power production computational model

- WASP program. Data analysis model (WASP climate analyst)
- WASP program. Terrain topographic modeling (WASP map editor)
- Exercise. Power curve and thrust coefficient
- WASP program. Power simulation (I)
- WASP program. Power simulation (II)

Unit 4. Windfarm design

- Windfarm construction project
- Windfarm electrical power facilities and installations
- High-voltage electrical power substation
- Overhead high-voltage power line
- Offshore wind power

MASTER´S FINAL PROJECT

The program is subject to possible variations / updates of the contents to improve their quality

AUTHOR PROFILE

DIRECTOR: **Consuelo Alonso**

Consuelo Alonso is an Industrial Engineer from the Polytechnic University of Madrid (Universidad Politécnica de Madrid - UPM), with 25 years of experience in the wind power sector, and who has worked as Engineer and Project Manager in wind and solar energy projects at Naturgy, where she currently works. At the same time, Consuelo has been a professor of Wind and Solar Energy studies at Universidad Europea (European University) for over 10 years, where she has also worked as the director of the Master's degree in Renewable energies for more than 8 years. In addition to all of the above, Consuelo has collaborated in the publication of three books on wind energy: "Energía Eólica" (Wind Energy), "Con el Viento a Favor" (With the wind behind), and "Dominando el Viento" (Taming the wind).

Juan Antonio Arizmendi López

Juan A. Arizmendi is an Industrial Engineer specialized in mechanics, with over 38 years of experience in both national and international electric power plant design and operation. He also holds an MBA, and currently provides expert technical assistance to the Engineering Department of "Empresarios Agrupados Internacional, S.A".

Juan Antonio has dedicated most of his professional career to the engineering department at a large Spanish energy company, where he performs the duties of team leader and coordinates the different disciplines in order to ensure the successful completion of projects. He has also been responsible for business development, Quality assurance, Innovation, and other technical studies.

Additionally, he has been responsible for the management of power generation plant projects with combined-cycle gas turbine technology in all their phases, from feasibility analysis to the commercial operation. Juan Antonio has also collaborated with different studies and steam and nuclear power plant projects with conventional cycle technologies, as well as with renewable, wind, solar photovoltaic and hydroelectric technologies, simple-cycle and combined-cycle gas turbines, and diesel engines. Finally, he has acted as Team Leader in international technical assistance projects for power generation plants funded by multilateral banks and private investors.

Manuel Moral Bonet

Manuel Moral B. is a Civil Engineer (Roads, canals and ports) from the Polytechnic University of Madrid (Universidad Politécnica de Madrid - UPM), with a speciality in Hydraulics and Energy. He also holds a Master 's degree in Finance by the CUNEF (Finance Studies University),and another in Integrated Project Manager by the ICAI (Comillas Univerity's Technical Engineering School) and Structuralia; Moral is also a certified PMP by the Project Management Institute (PMI).

Manuel has more than 20 years of experience in the energy sector, during which he has managed the design and construction of various renewable energy projects, both nationally and internationally, including hydroelectric, wind, and photovoltaic plants, as well as renewable fuel projects and combined-cycle plants.

Presently, he works as the CEO of the company CELMOR Energy, which is dedicated to the engineering, promotion, and operation of renewable energy plants. Previous to this position, Manuel worked for important companies in the sector, especially in renewable energy projects for Iberdrola, Acciona and Initec Energía (ACS group). He currently complements his professional activity with a professor position in the fields of renewable energies in various educational institutions.

Rosa María Illana Alcántara

Rosa M. Illana holds a degree in Industrial electronic Engineering, with a speciality in Solar SIS (SAfety Instrumented systems) from the University of Jaén (2014 - 2019). She is currently pursuing a master's degree in Renewable Energies by the University of Jaén.

Alberto Quintanilla

Alberto Quintanilla is a Telecommunications Engineer with a master 's degree in City Studies from the Polytechnic University of Madrid. He is the founder of Ingenio Core, where he works as Smart City Scientist.

Beatriz Nieto

Beatriz Industrial Engineer with more than 15 years of experience in facility design and commissioning, first in the renewable energy sector, and then in the CNH2, in which she currently worked since 2009. She works as an engineer in the technical department, first in the Unit of Engineering, Assembly and Pilot Plants, later in the Unit of Consulting and Environment, and currently in the Unit of Applied Engineering, where she is carries out tasks for the engineering, the assembly and commissioning of hydrogen production, storage and transformation facilities; she also participates in research and development activities.

As for her education, Beatriz has specific training as a Specialist in Product Environmental Management, and Specialist in Explosive Atmospheres by the Madariaga Official Laboratory, where she conducted numerous studies on the formation of explosive atmospheres. In addition, Beatriz participates in the Spanish Technological Platform for Hydrogen and Fuel Cells (PTEHPC), and in the Technical Committee for Standardization CTN-181 "Hydrogen Technologies''. She has presented around 10 papers at international conferences and collaborated with national projects related to hydrogen technologies such as PSE-H2RENOV, EXPHORENOV, IRHIS, DESPHEGA, etc, and with international projects such as H2PORTS and MACBETH.

Marina Trueba Alonso

Marina Trueba is an Industrial Engineer by the Technical Engineering School of the Polytechnic University of Madrid (ETSII - UPM), with a specialty in Energy Techniques. She has worked in the Special Projects Department at ENUSA Industrias Avanzadas S.A., S.M.E, more specifically in accident analysis at PW plant, and in the Nuclear Technology Department at the ETSII, UPM, more specifically, in severe accident analysis at power plants.

Marina has participated in the international experimental reactor project Jules Horowitz, and currently works as an engineer responsible for the area of thermal hydraulic design and BWR plant safety, and She currently works.

Gabriel Tevar

Gabriel Tevar, PhD in Industrial Engineering in Electric Systems, has been working in different areas within the electricity sector for over 30 years. In the last 20 years, Tevar has participated in the development of several sectoral regulation reforms, many of which are currently in effect in Spain.

Ricardo Izquierdo Labella

Education:

- 85 /86-90/91 - Marine Engineering by the Polytechnic University of MAdrid (Universidad Politécnica de Madrid).

- 2007- Management Development Program Programa de Desarrollo de Directivos at the Instituto de Empresa/London Business School.

- 2010 - Energy business advanced course at the Club Español de la Energía (Spanish Energy Club).

Professional experience

- 2014-2021, GPG/NATURGY - Chief Engineering & Construction Officer

- 2010-2014 Chief Operations Officer

- 2004-2010 - Gas Natural Fenosa Engineering

- 2000-2004 - SOCOIN (Engineering Company of Union Fenosa) - Operations Vice-president

- 1997-2000 - SOCOIN (Engineering Company of Union Fenosa) Procurement, planning and Proposal Development Director

- 1997-2000 - ENSA (Grupo SEPI), Sales Manager in nuclear projects

- 1991-1997 - ENSA (Grupo SEPI) Project Manager

- Present - CEO and Founder of ECB Renovables/ECB Group. Engineering and consulting company of Grupo ECB.

Álvaro Naranjo Villalonga

Alvaro Naranjo holds a bachelor degree in Environmental Science from the European University of MAdrid (Universidad Europea de Madrid), a master's degree in Energy Business by the Club de la Energía (Energy Club), and another master's degree in Environment and Bioclimatic Architecture by the Polytechnic University of Madrid.

Naranjo has been working in the renewable energy sector for 20 years, in the development, launching and operation of biogas, cogeneration, solar, and biomass electricity generation, biocarbon and thermal electric projects. He also has 20 years of teaching and academic content development on Renewable energies for prestigious educational institutions such as the European University of Madrid , and the Industrial Organization School.

METHODOLOGY

At Structuralia, we apply a modern methodology adapted to the process of change we live in today. Our educational environment is based on an online learning system, that is, learning by observing, reflecting, and practicing with an organized and carefully programmed study pace, which comes along with the constant support from our team. Our learning solution is designed to facilitate learning at the student's own pace, with a uniform structure that includes continuous evaluations and practical exercises to reinforce knowledge.

Our program's calendar consists of 9 monthly modules, which are divided into 4 weekly teaching units. In addition, there are 3 months for the Master's Final Project (MFP). This structure may be adjusted depending on the innate complexities of the program.

Each of these units contain introductory videos on concepts, syllabus prepared by our experts (which can be viewed online or downloaded in PDF), and self-assessments. Some units may even have practical exercises or examples, if required by the expert. At the end of each module, there will be a compulsory exam in order to complete the module.

The Director will ask all students to complete a Master's project, in which they will apply everything they have learnt in the previous modules, to practical cases. Students will have 3 months to complete and submit the project, during which they will receive the support from the program's team.

Finally, you will receive the status reports from our team through regular follow-ups throughout the program.

EVALUATION

The assessment will be ongoing throughout the training program and will take into account not only the acquisition of knowledge, but also the development of skills and attitudes.

At the end of each monthly module, the student must answer a test-type exam on the online training platform, in addition to pose a variety of practical cases along the topics and optional unit test so as to achieve the maximum consolidation of technical concepts.

To obtain the degree it will be necessary to pass the assessable modules of the program.

DEGREE

Students who have visualized all the lessons, successfully passed the self-assessments and exams, and submitted the master's final project, will receive Structuralia's certificate and the title of Master of Professional Development by the Universidad Católica San Antonio de Murcia (UCAM), in digital format.

Likewise, the student can request a certificate of completion of his/her master's degree, or a certificate of completion from Structuralia.

The student may also request a the Hague Apostille on his/her certificate of completion from the university an additional fee.

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