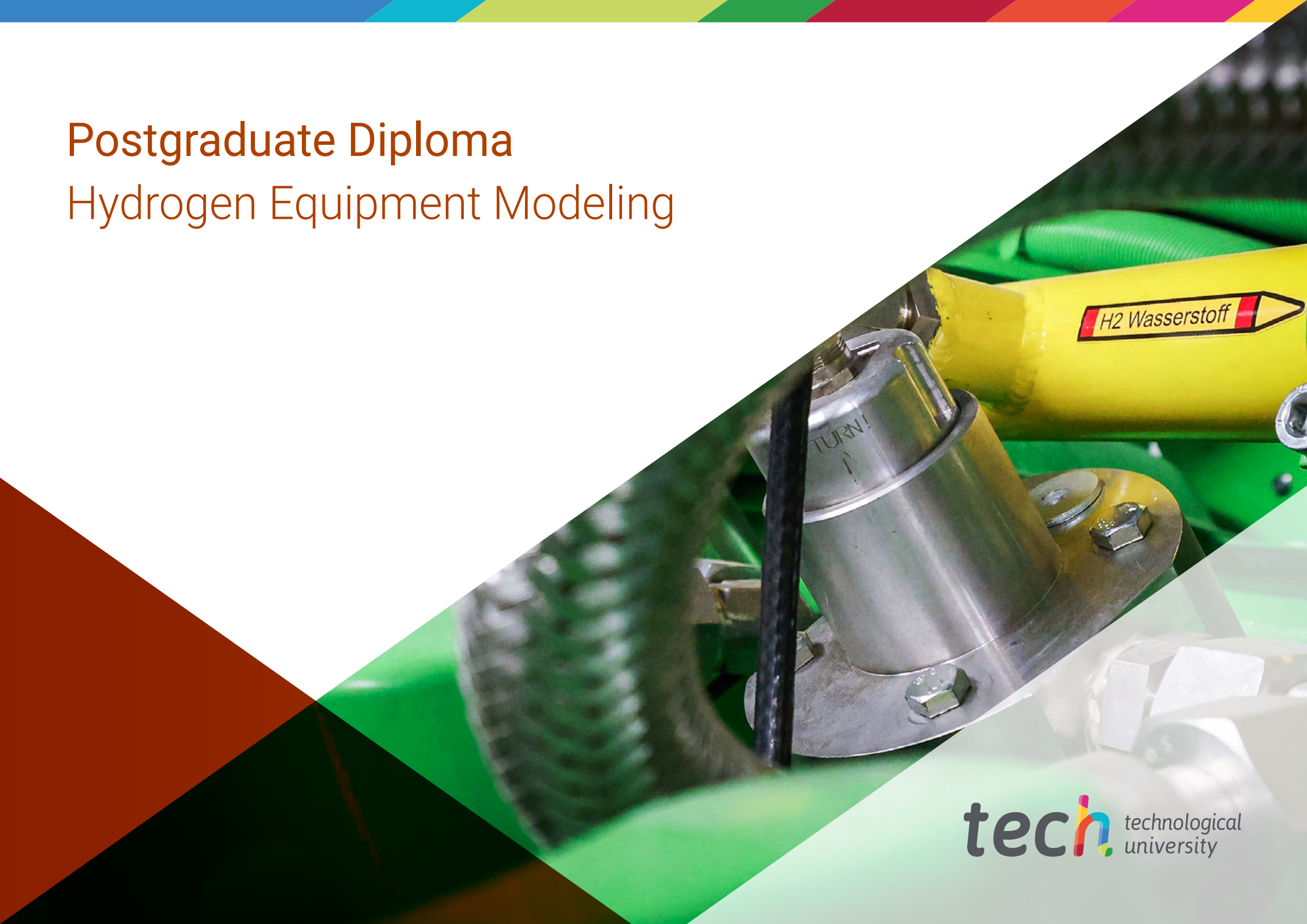
Postgraduate Diploma

Hydrogen Equipment Modeling



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Postgraduate Diploma

Hydrogen Equipment Modeling

- Modality: **online**
- Duration: **6 months**
- Certificate: **TECH Technological University**
- Schedule: **at your own pace**
- Exams: **online**

Website: **www.techtitute.com/engineering/postgraduate-diploma/postgraduate-diploma-hydrogen-equipment-modeling**

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01

Introduction

Asia, Europe and North America lead the global market for fuel cell deployment in the transportation sector. The benefits of this chemical reaction between hydrogen and oxygen have led to its use in a wide range of stationary and transportation applications. The absence of carbon emissions and the double efficiency compared to traditional combustion make it a preferential option in sectors such as the automotive industry. Given this reality, TECH has created this program, which offers engineering professionals the most advanced knowledge on the use of this electrochemical device, hydrogen production and developments around the refueling stations for hydrogen vehicles All this, moreover, through a 100% online academic format, intensive and with quality content prepared by professionals specialized in this sector.

This Postgraduate Diploma will lead you to be able to model the behavior of fuel cells in a technical and economical way"

In recent decades, major automobile companies have promoted projects focused on the creation of hydrogen-powered fuel cell vehicles. Likewise, the scientific community is also working on this alternative to traditional combustion, obtaining important results in extending the life of these new electrochemical devices. This advance not only affects this sector, but has also found great business and expansion possibilities in transport vessels, which has given the definitive push in the commitment to this energy.

In a current scenario where sustainability, care for the environment and innovative development prevail, the engineering professional, who specializes in the use of hydrogen, has an excellent opportunity to grow professionally in a booming sector. That is why this academic institution has created this Postgraduate Diploma in Hydrogen Equipment Modeling, where you will find the most advanced and current agenda, prepared by experts with extensive experience in the field of management and development of hydrogen-based projects.

In this way, over 6 months, the graduate will learn, through quality multimedia resources, the electrochemistry that governs the reactions, the assembly of the cells to form the *stack* and its peripherals. In addition, you will be able to delve into the operation of fuel cells and the current state of deployment of hydrogen refueling stations, as well as the procedure for filling vehicles and the design of the different elements of the system to adapt to the different needs of each particular case.

In addition, the *Relearning* method, based on the reiteration of content, will allow you to progress naturally through the subject matter, even reducing the long hours of study so frequent in other types of education.

A Postgraduate Diploma 100% online, which will lead students to advance significantly through a program that can be accessed easily, whenever and wherever you want. All you need is a cell phone, computer or tablet with an Internet connection to view, at any time, the syllabus hosted on the virtual platform. In this way, without the need for attendance or classes with fixed schedules, this program becomes an ideal option for those who seek to combine quality education with their work and/or personal responsibilities.

This **Postgraduate Diploma in Hydrogen Equipment Modeling** contains the most complete and up-to-date scientific program on the market. The most important features include:

- Case studies presented by engineering experts
- The graphic, schematic and practical contents of the book provide technical and practical information on those disciplines that are essential for professional practice
- Practical exercises where self-assessment can be used to improve learning
- Its special emphasis on innovative methodologies
- Theoretical lessons, questions to the expert, debate forums on controversial topics, and individual reflection assignments
- Content that is accessible from any fixed or portable device with an Internet connection

This program will lead you to investigate the applications of fuel cells in mobility, power generation or thermal generation"

With this program you will learn with the most advanced content in the design of the membrane-electrode assembly in PEMFC and in the operation of the fuel cell stack"

Thanks to the Relearning method used by TECH allow you the long hours of study and memorization. Enroll now.

Specialize with this program in modeling the operation of a hydrogen refueling station.

The program's teaching staff includes professionals from the industry who contribute their work experience to this program, as well as renowned specialists from leading societies and prestigious universities.

The multimedia content, developed with the latest educational technology, will provide professionals with situated and contextual learning, i.e., a simulated environment that will provide immersive learning, designed for specialize oneself in real situations.

This program is designed around Problem-Based Learning, whereby the professional must try to solve the different professional practice situations that arise during the academic year For this purpose, the student will be assisted by an innovative interactive video system created by renowned and experienced experts.

02

Objectives

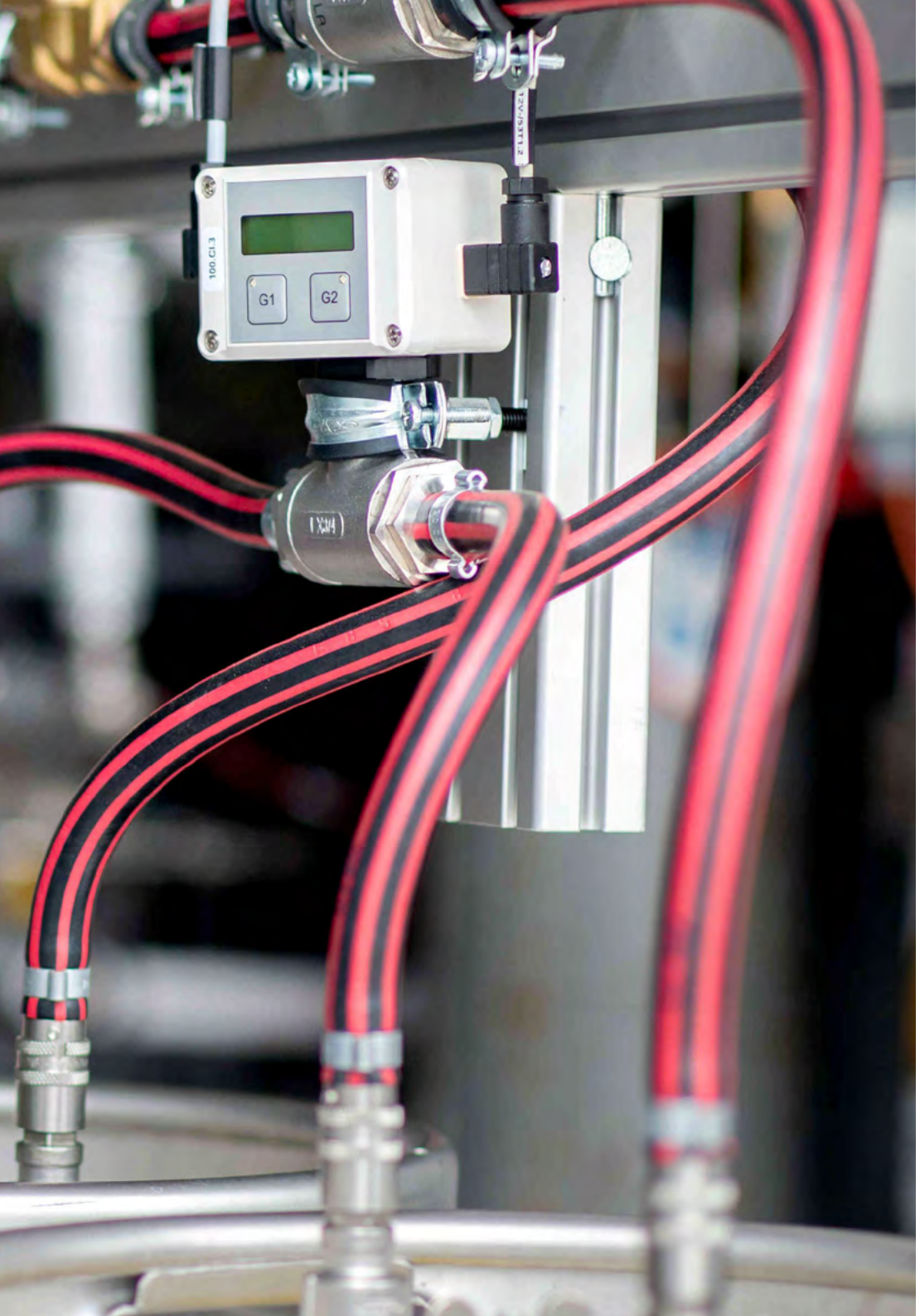
Undoubtedly, the case studies provided by the experts that make up this program, will serve for students to obtain a practical vision and effectively integrate the techniques and methodologies shown in the projects based on hydrogen equipment. This will also be possible thanks to the pedagogical tools provided by TECH, which has used the latest technology applied to academic teaching. With this theoretical-practical vision, students will obtain a significant professional growth in an expanding sector.

TECH provides you with the best pedagogical tools to obtain the knowledge you need to specialize in Hydrogen Equipment Modeling"

General Objectives

- Examine the electrochemistry behind electrolysis processes
- Conduct technical-economic modeling of an electrolysis system
- Determine fuel cell integration by end-use
- Conduct technical-economic modeling of fuel cell operation
- Master the concepts of safety and associated regulations
- Specialize the student in modeling the operation of a hydrogen refueling station

This university course provides an in-depth look at the design parameters of hydrogen vehicle refueling stations"



Specific Objectives

Module 1. Hydrogen Production and Electrolysis

- Determine the methods of hydrogen production from fossil fuels
- Analyze the mechanisms of hydrogen generation from biomass
- Establish the modes of biological hydrogen formation
- Differentiate the different electrolysis technologies for hydrogen production

Module 2. Hydrogen Fuel Cells

- Analyze the chemistry that governs the operation of PEMFCs
- Train students in the design of the PEMFC membrane-electrode assembly
- Understand the operation of the PEMFC fuel cell stack
- Analyze the characteristics of other types of fuel cells
- Establish the sizing of the fuel cell system according to the end-use application

Module 3. Hydrogen Vehicle Refueling Stations

- Establish the different typologies of hydrogen refueling stations
- Establish the design parameters
- Compile storage strategies at different pressure levels
- Analyze dispensing and its associated problems

03

Course Management

This academic program includes the most specialized teaching staff in the current educational market. They are specialists selected by TECH to develop the whole syllabus. In this way, starting from their own existence and the latest evidence, they have designed the most up-to-date content that provides a guarantee of quality in such a relevant subject.

TECH offers the most specialized teaching staff in the field of study. Enroll now and enjoy the quality you deserve"

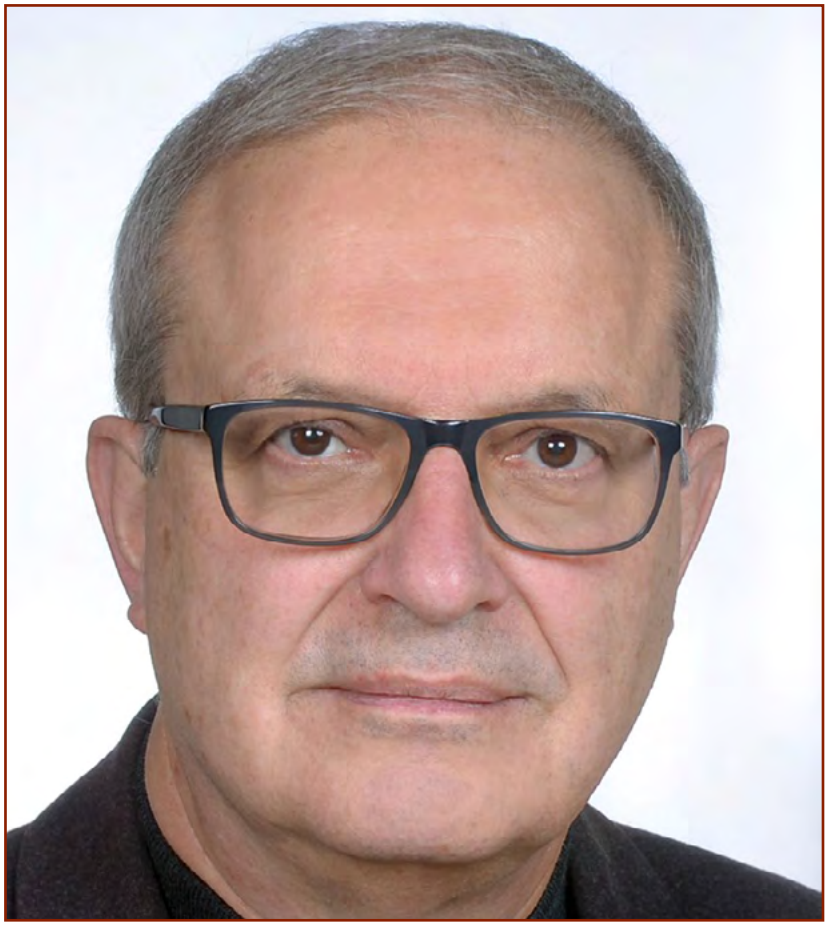
International Guest Director

With an extensive professional background in the energy sector, Adam Peter is a prestigious **electrical engineer** who stands out for his commitment to the use of **clean technologies**. Likewise, his strategic vision has driven innovative projects that have transformed the industry towards more efficient and environmentally friendly models.

In this way, he has worked in leading international companies such as **Siemens Energy** in Munich. In this way, he has held leadership roles ranging from **Sales Management or Corporate Strategy Management to Market Development**. Among his main achievements, he has led the **Digital Transformation** of organizations in order to improve their operational flows and maintain their competitiveness in the market in the long term. For example, he has implemented Artificial Intelligence to automate complex tasks such as **predictive monitoring** of industrial equipment or optimization of **energy management systems.**

In this regard, it has created multiple **innovative strategies** based on advanced **data analysis** to identify both patterns and **trends** in electricity consumption. As a result, companies have optimized their informed decision-making in real time and have been able to reduce their production costs significantly. In turn, this has contributed to companies' ability to adapt nimbly to market fluctuations and respond with immediacy to new operational needs, ensuring greater resilience in a dynamic working environment.

He has also led numerous projects focused on the adoption of **renewable energy sources** such as wind turbines, photovoltaic systems and cutting-edge energy storage solutions. These initiatives have enabled institutions to optimize their resources efficiently, guarantee a sustainable supply and comply with current environmental regulations. Undoubtedly, this has positioned the company as a reference in both **innovation** and **corporate responsibility**.



Mr. Peter, Adam

- Head of Hydrogen Business Development at Siemens Energy, Munich, Germany
- Sales Director at Siemens Industry, Munich
- President of Rotating Equipment for Upstream/Midstream Oil & Gas
- Market Development Specialist at Siemens Oil & Gas, Munich
- Electrical Engineer at Siemens AG, Berlin
- Degree in Electrical Engineering at the University of Applied Sciences Dieburg

Thanks to TECH, you will be able to learn with the best professionals in the world"

04

Structure and Content

The syllabus of this Postgraduate Diploma has been designed to offer in only 6 months, the most comprehensive and intensive knowledge of the academic panorama around Hydrogen Equipment Modeling. This is possible thanks to the syllabus developed by an expert teaching team with extensive professional experience in this field. In this way, students will learn about hydrogen production and electrolysis, the operation of fuel cells and the existing possibilities in the development of refueling stations for hydrogen vehicles. In addition, thanks to the Relearning method, you will advance naturally through the program and reduce the long hours of study and memorization.

An extensive library of multimedia resources is available to you 24 hours a day, 7 days a week"

Module 1. Hydrogen Production and Electrolysis

1.1. Fossil Fuel Production
- 1.1.1. Hydrocarbon Reforming Production
- 1.1.2. Generation by Pyrolysis
- 1.1.3. Coal Gasification

1.2. Production From Biomass
- 1.2.1. Hydrogen Production by Biomass Gasification
- 1.2.2. Hydrogen Generation by Biomass Pyrolysis
- 1.2.3. Aqueous Reforming

1.3. Biological Production
- 1.3.1. Water Gas Shift Reaction (WGSR)
- 1.3.2. Dark Fermentation for Biohydrogen Generation
- 1.3.3. Photofermentation of Organic Compounds for Hydrogen Production

1.4. By-Product of Chemical Processes
- 1.4.1. Hydrogen as a By-Product of Petrochemical Processes
- 1.4.2. Hydrogen as a By-Product of Caustic Soda and Chlorine Production
- 1.4.3. Synthesis Gas as a By-Product Generated in Coke Ovens

1.5. Water Separation
- 1.5.1. Photolytic Hydrogen Formation
- 1.5.2. Hydrogen Generation by Photocatalysis
- 1.5.3. Hydrogen Production by Thermal Separation of Water

1.6. Electrolysis: The Future of Hydrogen Generation
- 1.6.1. Hydrogen Generation by Electrolysis
- 1.6.2. Oxidation-Reduction Reaction
- 1.6.3. Thermodynamics of Electrolysis

1.7. Electrolysis Technologies
- 1.7.1. Low Temperature Electrolysis: Alkaline and Anionic Technology
- 1.7.2. Low Temperature Electrolysis: PEM
- 1.7.3. High Temperature Electrolysis

1.8. Stack: the Heart of an Electrolyzer
- 1.8.1. Materials and Components in Low-Temperature Electrolysis
- 1.8.2. Materials and Components in High-Temperature Electrolysis
- 1.8.3. Stack Assembly in Electrolysis

1.9. Balance of Plant and System
- 1.9.1. Balance of Plant Components
- 1.9.2. Balance of Plant Design
- 1.9.3. Balance of Plant Optimization

1.10. Technical and Economic Characterization of Electrolyzers
- 1.10.1. Capital and Operating Costs
- 1.10.2. Technical Characterization of an Electrolyzer Operation
- 1.10.3. Technical-Economic Modeling

Module 2. Hydrogen Fuel Cells

2.1. PEMFC (Proton-Exchange Membrane Fuel Cell) Fuel Cells
- 2.1.1. Chemistry Governing PEMFCs
- 2.1.2. PEMFC Operation
- 2.1.3. PEMFC Applications

2.2. Membrane-Electrode Assembly in PEMFCs
- 2.2.1. MEA Materials and Components
- 2.2.2. PEMFC Catalysts
- 2.2.3. Circularity in PEMFC

2.3. PEMFC Cell Stacks
- 2.3.1. Stack Architecture
- 2.3.2. Assembly
- 2.3.3. Power Generation

2.4. Balance of Plant and PEMFC Stack System
- 2.4.1. Balance of Plant Components
- 2.4.2. Balance of Plant Design
- 2.4.3. System Optimization

2.5. SOFC (Sodium Oxide Fuel Cells) Fuel Cells
  2.5.1. Chemistry Governing SOFCs
  2.5.2. SOFCs Operation
  2.5.3. Applications
2.6. Other Types of Fuel Cells: Alkaline, Reversible, Direct Methanation, Direct Methanation.
  2.6.1. Alkaline Fuel Cells
  2.6.2. Reversible Fuel Cells
  2.6.3. Direct Methanation Fuel Cells
2.7. Fuel Cell Applications(I) In Mobility, in Electric Power Generation, in Thermal Generation
  2.7.1. Fuel Cells in Mobility
  2.7.2. Fuel Cells in Power Generation
  2.7.3. Fuel Cells in Thermal Generation
2.8. Fuel Cell Applications (II). Technical-Economic Modeling
  2.8.1. Technical and Economic Characterization of the PEMFC
  2.8.2. Capital and Operating Costs
  2.8.3. Technical Characterization of the Operation of a PEMFC
  2.8.4. Technical-Economic Modeling
2.9. Dimensioning of PEMFC for Different Applications
  2.9.1. Static Modeling
  2.9.2. Dynamic Modeling
  2.9.3. PEMFC Integration in Vehicles
2.10. Stationary Fuel Cells Grid Integration
  2.10.1. Stationary Fuel Cells in Renewable Microgrids
  2.10.2. System Modeling
  2.10.3. Technical-Economic Study of a Fuel Cell in Stationary Use

Module 3. Hydrogen Vehicle Refueling Stations

3.1. Hydrogen Refueling Corridors and Networks
- 3.1.1. Hydrogen Vehicle Refueling Networks. Current State
- 3.1.2. Global Hydrogen Vehicle Refueling Station Deployment Targets
- 3.1.3. Cross-Border Hydrogen Refueling Corridors

3.2. Hydrogen Plant Types, Modes of Operation and Dispensing Categories
- 3.2.1. Hydrogen Refueling Station Types
- 3.2.2. Operating Modes of the Hydrogen Refueling Stations
- 3.2.3. Dispensing Categories According to Standards

3.3. Design Parameters
- 3.3.1. Hydrogen Refueling Station. Components
- 3.3.2. Design Parameters according to Hydrogen Storage Type
- 3.3.3. Design Parameters according to the Station's Target Use

3.4. Storage and Pressure Levels
- 3.4.1. Storage of Hydrogen Gas at Hydrogen Refueling Stations
- 3.4.2. Gas Storage Pressure Levels
- 3.4.3. Liquid Hydrogen Storage in Hydrogen Refueling Stations

3.5. Compression Stages
- 3.5.1. Hydrogen Compression. Necessity
- 3.5.2. Compression Technologies
- 3.5.3. Optimization

3.6. Dispensing and Precooling
- 3.6.1. Precooling according to Regulations and Vehicle Type. Necessity
- 3.6.2. Hydrogen Dispensing Cascade
- 3.6.3. Thermal Phenomena of Dispensing

3.7. Mechanical Integration
- 3.7.1. Refueling Stations with On-Site Hydrogen Production
- 3.7.2. Refueling Stations without Hydrogen Production
- 3.7.3. Modularization

3.8. Applicable Regulations
- 3.8.1. Safety Regulations
- 3.8.2. Hydrogen Quality Standards, Certificates
- 3.8.3. Civil Regulations

3.9. Preliminary Design of a Hydrogen Plant
- 3.9.1. Presentation of the Case Study
- 3.9.2. Development of the Case Study
- 3.9.3. Resolution

3.10. Cost Analysis
- 3.10.1. Capital and Operating Costs
- 3.10.2. Technical Characterization of a Hydrogen Refueling Station Operation
- 3.10.3. Techno-Economic Modeling

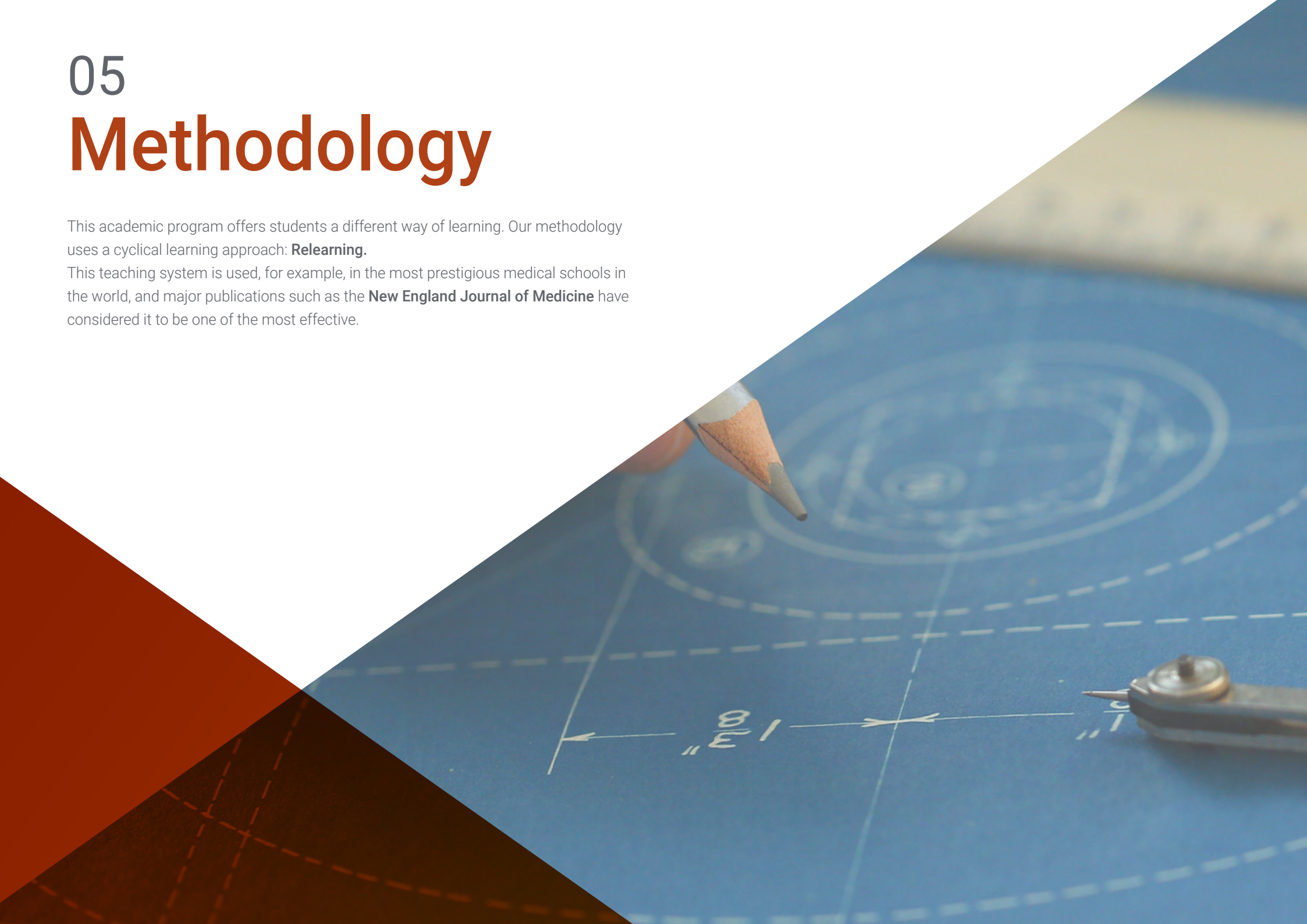
This program will take you delve into the electrochemistry that governs the reactions, the assembly of the cells to form the stack and its peripherals"

05

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

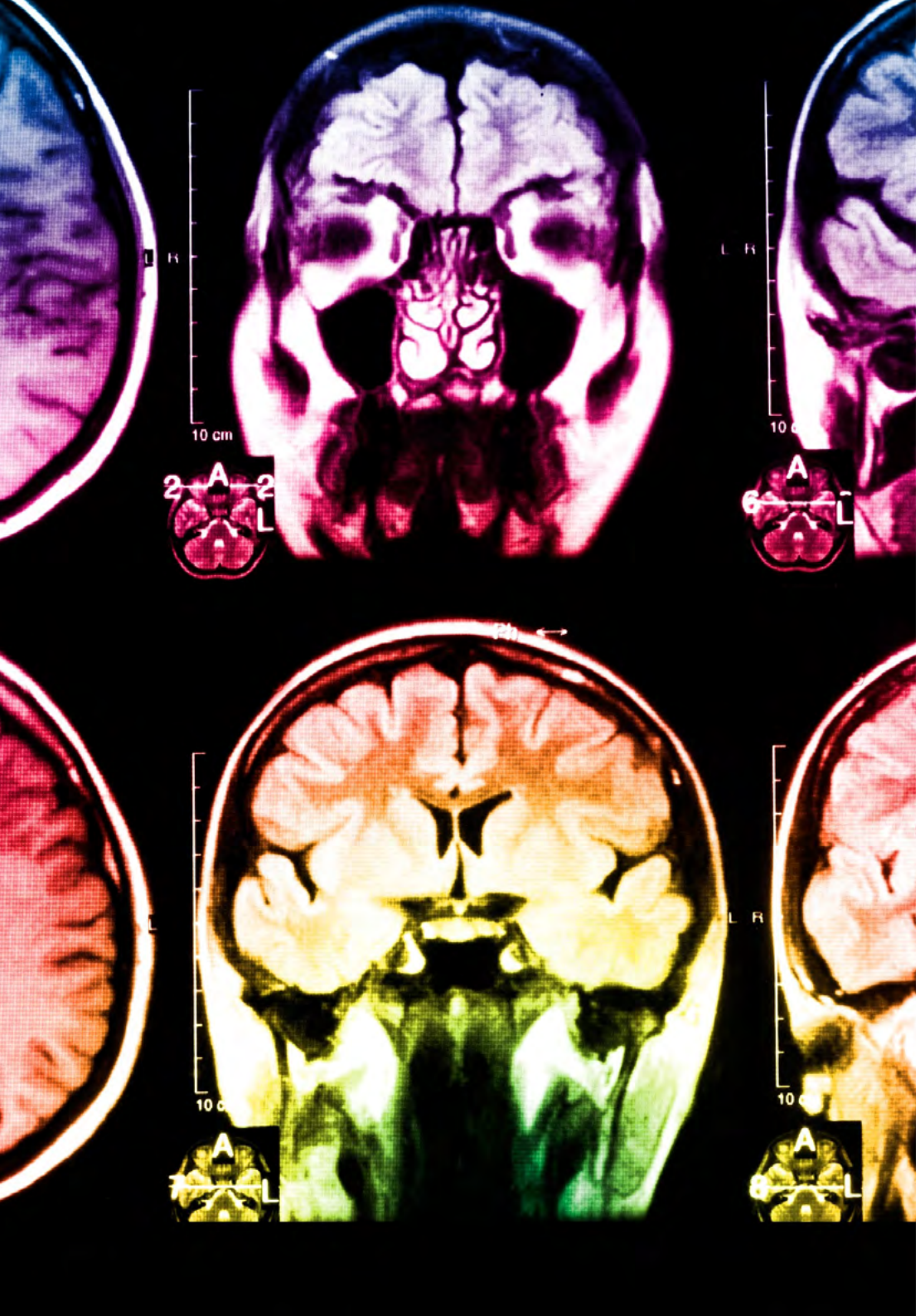
TECH effectively combines the Case Study methodology with a 100% online learning system based on repetition, which combines 8 different teaching elements in each lesson.

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 re-learn). 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 e-learning, 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.

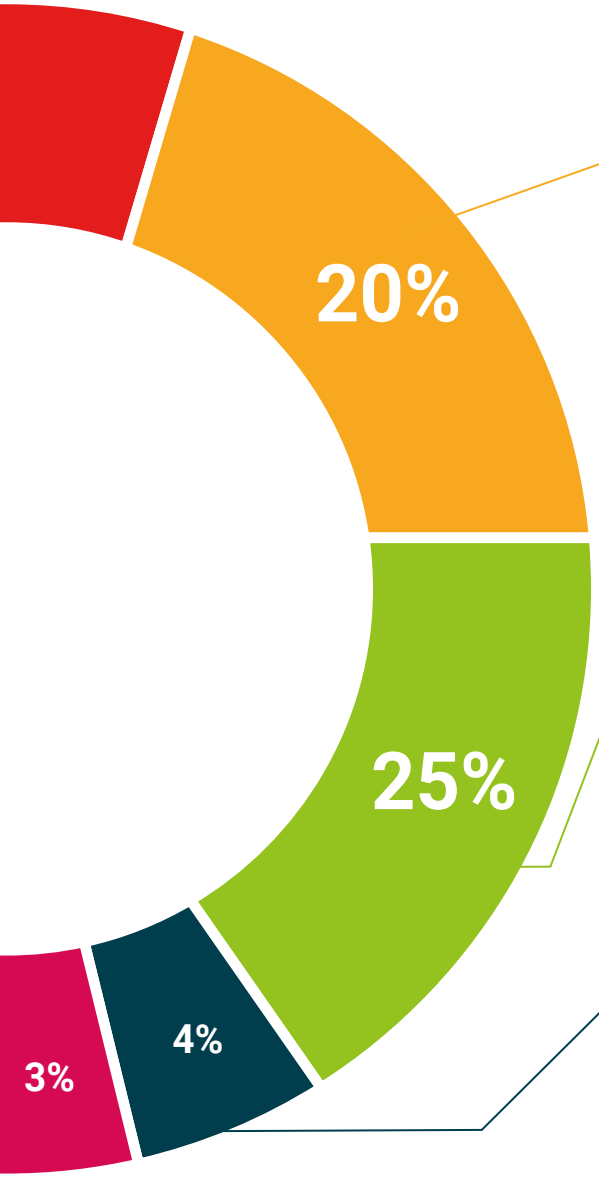
Learning from an Expert strengthens knowledge and memory, and generates confidence in future difficult decisions.

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.

06

Certificate

The Postgraduate Diploma in Hydrogen Equipment Modeling guarantees students, in addition to the most rigorous and up-to-date education, access to a Postgraduate Certificate issued by TECH Technological University.

Successfully complete this program and receive your university qualification without having to travel or fill out laborious paperwork"

This **Postgraduate Diploma in Hydrogen Equipment Modeling** contains the most complete and up-to-date program on the market.

After the student has passed the assessments, they will receive their corresponding **Postgraduate Diploma**, issued by **TECH Technological University** via tracked delivery*.

The diploma issued by **TECH Technological University** will reflect the qualification obtained in the Postgraduate Diploma, and meets the requirements commonly demanded by labor exchanges, competitive examinations, and professional career evaluation committees.

Title: **Postgraduate Diploma in Hydrogen Equipment Modeling**

Modality: **online**

Duration: **6 months**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Awards the following

DIPLOMA

to

Mr./Ms. _____, with identification number _____.

For having passed and accredited the following program

POSTGRADUATE DIPLOMA

in

Hydrogen Equipment Modeling

This is a qualification awarded by this University, equivalent to 450 hours, with a start date of dd/mm/yyyy and an end date of dd/mm/yyyy.

TECH is a Private Institution of Higher Education recognized by the Ministry of Public Education as of June 28, 2018.

June 17, 2020

Tere Guevara Navarro

Dean

This qualification must always be accompanied by the university degree issued by the competent authority to practice professionally in each country. Unique TECH Code: AFWORD23S techtitute.com/certificates

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

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Hydrogen Equipment Modeling

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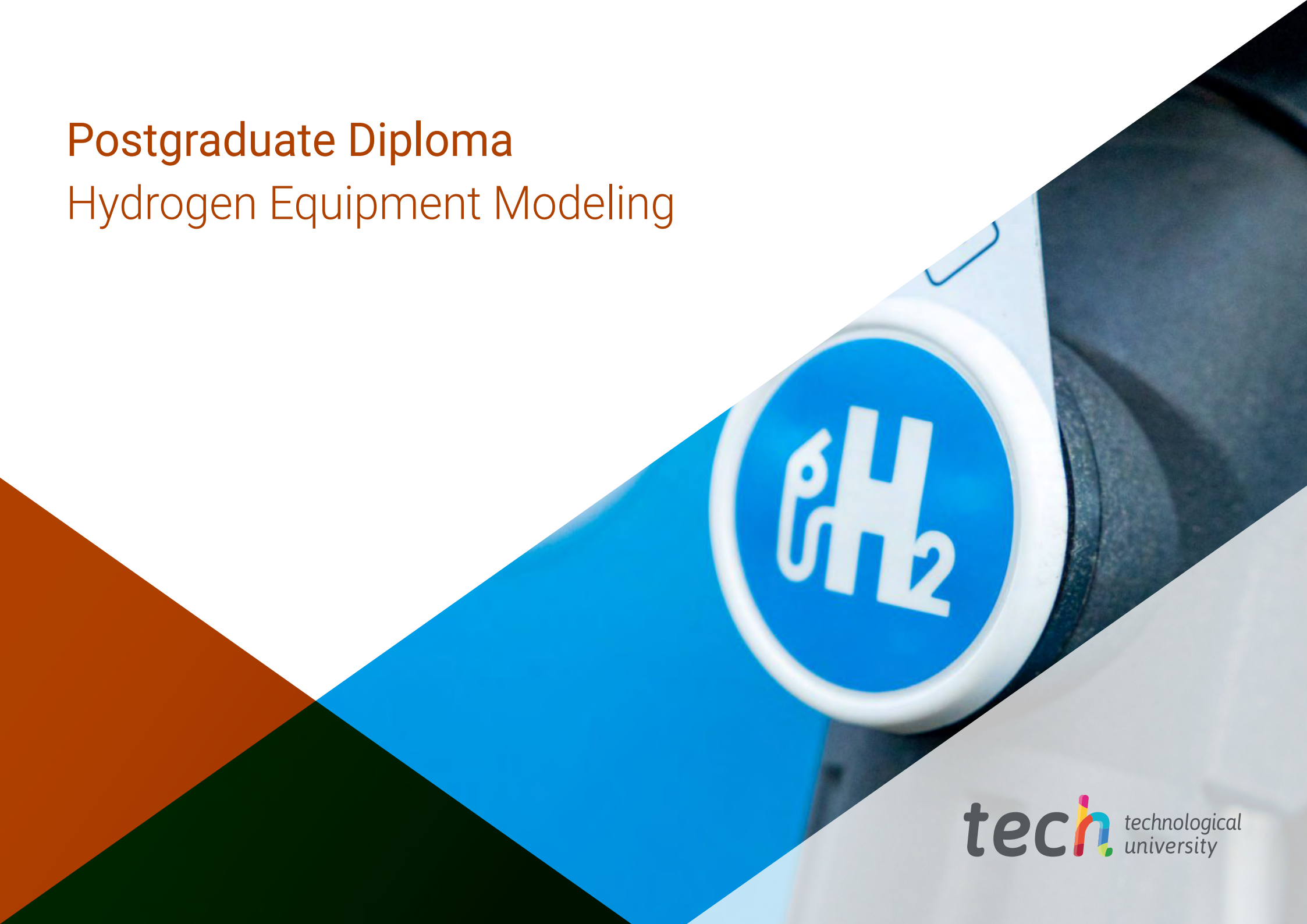
Postgraduate Diploma

Hydrogen Equipment Modeling



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