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Name of Course	Fuel Cell Technology_Lecture notes.
Author / Institution	Prof. Dr. Ing R. Ruderich, University of Applied Science Ulm, Germany.
Language	German
Date of Creation	2008
Short Description	Chapters 01 Introduction 02 The Polymer Elektrolyte Membrane (PEM) Fuel Cell 03 Atomic and molecular thermodynamics 04 Fuels and chemical equations 05 The first law of chemical thermodynamics 06 Entropy and the second law of chemical thermodynamics 07 Gibbs function or free enthalpy 08 Characteristic diagram of a PEM Fuel Cell 09 Hydrogen as fuel
Number of:	Course consists of presentations, lectures, tutorials and practical sessions.
- Modules	Courses usually over 3-5 days
- Slides	
- Hours	
Target Group	Vocational traning students
Where is it applied	Materials where provided during the lectures
Credits	The attendees gets 2 credit point
Public Materials	The material is not public and protected by copyrigh
Contact	www.hs-ulm.de
Comments	The material as part of same named lecture provides a deeply rooted knowledge of chemical und thermodynamic processes in fuel cells. Moreover the student will be able to determine the parameter for optimal fuel consumption.

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Name of Course	Hydrogen Technology, Master of Science
Author / Institution	DIU/ Dresden International University
Language	German
Date of Creation	Duration of the study. 2 years.
Short Description	Modules 01 Physics, Chemistry and Thermodynamics of Hydrogen 02 Generation of Hydrogen 03 Energy industry 04 Storage and handling of Hydrogen 05 Hydrogen applications to power cars 06 Fuel Cells 07 Safety aspects of hydrogen/ nuclear fusion 08 Hydrogen application in aeronautics and shipping 09 National and international activities at the intersection between science and politics
Number of: - Modules - Slides - Hours	The study program is divided into 9 modules. The knowledge will be tested by written and/or oral exams
Target Group	Engineers, Graduates
Where is it applied	Materials where applied during the study program at DIU
Credits	The attendees gets the academic degree Master of Science (M.Sc.)
Public Materials	The modules were provided as lectures for enrolled students
Contact	www.dresden-international-university.com
Comments	The aim at this unique study program "Hydrogen Technology" (M. Sc.) is a related to practice combination of all hydrogen aspects supported by experiments and excursions.

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Name of Course	H2-Employment Teaching modules for Hydrogen technolog
Author / Institution	Partners of the EU-Project H2-Employment: Colegio Oficial de Ingenieros Técnicos Industriales de La Rioja (SP), Fundación San Valero (SP), Servicio Riojano de Empleo(SP), Environment Park (IT), WBZU (GE), HyCent (Austria)
Language	Spanish, English, German, Italian
Date of Creation	2011
Short Description	Chapters 01 Environment, Energy and Hydrogen 02 Production of Hydrogen 03 Storage of Hydrogen 04 Handling of Hydrogen 05 Fuel Cells Fundamentals 06 Application of Fuel Cells 07 Batteries and e-Mobility 08 Hydrogen Internal Combustion Engines 09 Regulations and Codes 10 Exam
Number of: - Modules - Slides - Hours	The 10 modules summarize about 250 ppt slides and a multiple choice test. The materials enable courses with 2 or 3 days of teaching.
Target Group	Technicians
Where is it applied	In the connection with the EU project a pilot action with three units took place in Logrono, Spain. One unit summarized 8 hours of teaching (starting Friday afternoon, ending Saturday morning). The target group were unemployed engineers.
Credits	Certificate of attendance
Public Materials	The modules are provided as web-based-training. Students who register can download the slides and ask their questions to tutors.
Contact	www.h2employment.eu
Comments	The teaching modules developed in the frame of the EU project are singular at the moment which means that they are currently used in pilot actions and individual seminars. They are not standardized by an accreditation body and implemented in a professional or academic curricula. Due to the different educational systems in the European countries (Compare Deliverable 2) the accreditation of the teaching materials was not the aim of the project. In coordination with the different responsible bodies each EU country has to define its own way of implementing the topic in existing curricula. For this 'implementation process' the results of this procect can give important hints which topics could be considered in existing curricula

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Name of Course	Higher Vocational Training Programme in Energy Efficiency and Hydrogen Technology
Author / Institution	Partners of the EU-Project H2-Training: Fundación San Valero (SP), Hydrogen foundation of Aragon(SP), Environment Park (IT), WBZU (GE), Cardiff Metropolitan University (UK), Eco4ward(Austria), Grazer Energie Agentur(Austri), Kolping Bildungswerk(GE),FAST(IT)
Language	Spanish, English, German, Italia
Date of Creation	2008
Short Description	Chapters 01 Background. Hydrogen based economy 02 Hydrogen Features 03 Application of Hydrogen 04 Fuel Cells 05 Hydrogen production 06 Hydrogen storage 07 Handling of hydrogen 08 Security and healthness 09 Regulations and Codes
Number of: - Modules - Slides - Hours	The 9 modules summarize about 220 pages handbook . The materials enable courses with 40 hours of teaching
Target Group	Teachers
Where is it applied	The recopilation compound a handbook as a proposal of study material for teachers formation
Credits	Certificate of attendance
Public Materials	The material is a reference to furter formation program
Contact	www,h2traning.eu
Comments	The aim of independent curriculum vocational training is that all citizens who follow this training achieve capacities and competences which allow them to: a) Develop the general competence equivalent to professional qualification or qualifications included in its equivalent further education award. b) Understand the organization and characteristics of a specific productive sector, as well as the professional mechanisms involved; to be familiar with the basic working legislation, rights and duties from a working relationship. c) Achieve knowledge and the necessary abilities to work in healthy and safe

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Name of Course	Hydrogen and Fuel Cell Teaching modules for SEAS courses
Author / Institution	SEAS estudios abiertos
Language	Spanish
Date of Creation	2010
Short Description	Chapters 01 General Knowledge 02 Production of Hydrogen 03 Storage of Hydrogen 04 Applications fuel cells 05 Security 06 Project managementAre
Number of: - Modules - Slides - Hours	The 6 modules summarize pages handbook. The study is supported on a online platform from wich students progress is followed. The materials enable courses with a duration of 80 hoursNumber
Target Group	Technicians
Where is it applied	The teaching materials are applied by an online platform. Where the student can study on his own and take contact with teachers online or by phone.
Credits	Certificate from Avila Catholic University and certificate by SEAS
Public Materials	The materials are for teachers and students.
Contact	http://www.seas.es/cursos/hidrogeno-y-pilas-de-combustible
Comments	During the course, they use programs and GRHYSO and HOGA (only supported for all versions of windows), for simulation and economic evaluation of hybrid systems optimization of renewable sources in off-grid systems and connected to the grid, respectively.

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Name of Course	FEHY-1 Advanced technology on fuel cells
Author / Institution	LUCAS-NULLE
Language	Spanish, English, German, Italian, French
Date of Creation	2011
Short Description	Components 01 Fuel cell with DC converter 02 Electronic load 200W/20V/10A 03 Metal hydride storage cell with solenoid valve 04 Electrolyser, 30 Normlitre/hour (1.06 cubic feet/h, 7.93 gallons/h, 30000 cc/h) 05 Monitoring software 06 CD-ROM with theory related modules as a courseAre
Number of: - Modules - Slides - Hours	The theory consists on 8 modules with practices explained and a multiple choice test.
Target Group	Technicians
Where is it applied	This material can be applied in all kind of courses related to beginning in knowledge on fuen cells technology. Short courses and seminars as demonstrations equipment
Credits	There are non certificated materials. There are from market manufacturer.
Public Materials	The material is public and and fixed to market and trade specifications.
Contact	http://www.lucas-nuelle.com/316/apg/1266/EHY+1+Advanced+fuel+cell+technology.htm
Comments	The generation of electrical energy using fuel cells continues to develop into a significant area with diverseapplication potential in electrical engineering and automotive technology. The training panel system permits asafe experimenting environment in connection with hydrogen and fuel cells. At the same it permits interestinginvestigations and is well suited for both practical lab work as well as demonstrations. Animated theory,experiment guidelines and information including results are supplied using the “Interactive Lab Assistant”.

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Name of Course	hydrogen industry
Author / Institution	Johnny Deschamp, ENSTA
Language	French
Date of Creation	2008
Short Description	Chapters : - production - storage - distribution - application - economy
Number of: - Modules - Slides - Hours	It depends on the framework. 21H/32h and the number of slides varies between 50 to 100.
Target Group	University students, Engineering students
Where is it applied	These materials are applied in several programs, they are adapted according to the audience. The different frameworks are : master on renewable energy, option in the school ENSTA, in-training formation.
Credits	The number of ECTS credits varies between 2 to 5 for the module hydrogen according to the framework i is applied.
Public Materials	No
Contact	deschamps@ensta-paristech.fr
Comments	In some engineer schools in France, the students have to note the courses they follow. The courses on the hydrogen receive good notations.

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Name of Course	hydrogen industry
Author / Institution	Christophe Turpin, INPT
Language	French, English
Date of Creation	2008
Short Description	The materiel is composed by : - general knowledges on fuel cells : application, use, production - operating principles of the different kinds of fuel cells Number
Number of: - Modules - Slides - Hours	12h divided into the theorical part and the practicle part. 50 slides
Target Group	Engineering students
Where is it applied	The materials are applied within a formation that bring together students of engineer school and student of a master 2 on renewable energy
Credits	These courses are part of the module "electrochemical components" which represent 3 credit ECTS. Students also learn basis in electrochemistry and in electrical interface and electrocatalysis.
Public Materials	No
Contact	turpin@laplace.univ-tlse.fr
Comments	

Name of Course	Hydrogen industry
Author / Institution	Helion (subsidiary company of AREVA)
Language	French
Date of Creation	2008
Short Description	Contents : <ul style="list-style-type: none">• A 1 kW electrical and 1 kW thermal fuel cell• A fuel cell simulator• Educational content integrating typical works, courses updated by teachers or students
Number of: <ul style="list-style-type: none">- Modules- Slides- Hours	There is a software containing different type of simulating conditions
Target Group	Teachers
Where is it applied	It constitutes a complete teaching aid for the practical exercises on fuel cell.
Credits	This didactic test bed has been labeled by the cluster "Capenergies" specialized in the clean energies.
Public Materials	No, it is commercialized by helion
Contact	http://www.helion-hydrogen.com/
Comments	The elaboration of this didactic test bed has been the outcome of a project supported by the unique interministerial funds (FUI), and held by helion. Academic partners and a SME have also participated to the project.

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Name of Course	Renewable Energy Flexible Training Programme (REFLEX)
Author / Institution	Institute is Newcastle University
Language	English
Date of Creation	Intake for course taken on every yearRenewable
Short Description	The REFLEXprogramme consists of 12 modules of which one module is Hydrogen & Fuel Cell technology. Components of this module consist of: Appropriate physical chemistry, Electrochemical Power sources, reactor engineering, hydrogen reforming technology, hydrogen storage, hydrogen production, hydrogen economy, fuel cell technology, battery technology, supercapacitor technologyAre
Number of: - Modules - Slides - Hours	The theory consists of 5 days intensive learning via lectures, presentations, case studies and practical training
Target Group	Technicians
Where is it applied	In an existing course ie REFLEX, via lectures, presentations and discussions.
Credits	Hydrogen and Fuel Cell module forms part of either a Post Graduate Certificate, Post Graduate Diploma and MSc in Renewable Energy. The 12 modules can be taken as individual modules however ther will be no associated accreditation associated with this.
Public Materials	No
Contact	http://www.ncl.ac.uk/sage/postgrad/taught/reflex/
Comments	REFLEX is an innovative postgraduate programme in Renewable Energy offered by Newcastle University. First delivered in 2005, the programme offers MSc, Postgraduate Diploma and Postgraduate Certificate qualifications, delivered by a combination of distance learning and intensive school. In addition, all modules are available as stand alone continuing Professional Development (CPD) modules. The course provides a fully integrated programme covering mechanical, electrical, chemical, marine engineering, geothermal energy, PV, Policy, Ethics and Energy Management.

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Name of Course	Fuel Cell Introduction course Not
Author / Institution	Pure Energy Centre, Shetlands, Scotland
Language	English
Date of Creation	Usually once a year
Short Description	Hydrogen Safety Fuel Cell Introduction Fuel Cell System Fuel Cell Market and Application Hydrogen Storage Fuel Cell Lab Site visit and FC demonstration Fuel Cell Install guide
Number of: - Modules - Slides - Hours	Course consists of presentations, lectures, tutorials. Courses usually over 2-3 days
Target Group	Engineers, Technicians
Where is it applied	Material applied via lectures, presentations, demonstrations. These are stand alone courses and not linked with any existing courses
Credits	Not sure regarding certificate (perhaps a certificate of attendance), however this course is not accredited
Public Materials	No
Contact	http://www.pure.shetland.co.uk/html/Training_courses.php
Comments	Course benefits Transfer of knowledge for designing a hydrogen fuel cell project <ul style="list-style-type: none">· Acquire an understanding on how to install a fuel cell· Learn the basic principles of hydrogen fuel cells technologies· Become hydrogen safety conscious· Learn the unique hydrogen properties for a safe design of an installation· Look at an operational renewable hydrogen facility· Reduce project implementation timeframes by learning from practical experience

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Name of Course	International Short Course and advanced research workshop
Author / Institution	University of Ulster
Language	English
Date of Creation	Once a year
Short Description	Subjects covered include: Introduction to fuel cells and hydrogen, basic thermodynamics and system analysis of fuel cells, hydrogen as an energy carrier production utilisation, hydrogen storage technologies - compatibility of materials with hydrogen, safety-hydrogen release & dispersion, hydrogen storage, distribution & infrastructure, tutorial in unignited jets, overview on polymer electrolyte fuel cells, high temperature proton exchange fuel cells, safety-hydrogen fires, tutorial on hydrogen fires, safety-deflagration, safety-detonations, molten carbonate fuel cells & solid oxide fuel cells, practical work, tutorial on polymer electrolyte fuel cells, European projects & politics, information sources and networks, fuel cell application and development challenges, practical work, tutorial on deflagrations and detonations
Number of: - Modules - Slides - Hours	Course consists of presentations, lectures, tutorials and practical sessions. Courses usually over 3-5 days
Target Group	Engineers
Where is it applied	Existing course via presentations, lectures, tutorial and practical work. These are stand alone training courses on Hydrogen safety, however they also form part of a University of Ulster Post Graduate Certificate, Diploma, MSc in Hydrogen Safety.
Credits	yearNot sure regarding certificate (perhaps a certificate of attendance), however this course could form part of an academic MSc which has the possibility of being accreditedAre
Public Materials	No
Contact	http://hysafer.ulster.ac.uk/
Comments	The HySAFER centre at the University of Ulster focuses on the area of hydrogen safety and the phenomena associated with potential hydrogen accidents (leaks, explosions, fires etc.). In addition to research, the centre is actively involved in the development of education programmes in hydrogen safety, including short courses. The research activities of HySAFER range from fundamental work to ground breaking applications and primarily include computer simulations, and consequence modelling, of potential accident scenarios.
