RENEWABLE ENERGIES, ENERGY STORAGE AND HYDROGEN ECONOMY

Broad Context: Future industrial development of the World's Nations has to face the great challenges of our time, such as climate change, population growth, scarcity of primary resources, unquenchable demand for energy etc., by securing a sustainable handling of the resources of our planet. The main target is to secure the wellbeing and happiness of future generations. From this point of view the transition from fossil fuels to renewables is a key development step, but it also implies a disruptive transformation of the energy services system with political and economic implications; and it will be a long and difficult process.

Objective of the course: The main objective is to illustrate the advances in the technologies and processes for generating renewable electricity (from solar and wind energy, biomass etc.), the options to manage the power flow and store electricity, and the conversion into storable chemicals, such as hydrogen and other synthetic fuels. The interconversion between electricity and hydrogen is in fact a key element in distributing renewable energies wherever needed with the highest flexibility and security for the energy system.

Topics of the course are:

- Hydrogen economy and circular economy: relationship, social and economic aspects and issues.
- Production of Hydrogen from renewable resources: electrolysers, solar thermal cycles, photocatalysis, bio-H_2.
- Materials for the production and storage of H_2.
- H_2 and hydrogen-based fuels for fuel cell technologies (stationary and automotive applications).
- Decarbonisation and H_2 economy.
- Comparison and competitiveness evaluation with traditional and alternative technologies.

The course has been conceived in the context of the European TeacHy project, which has the mission of building a cluster of universities and other educational institutions coordinating and developing educational programmes on Fuel Cells and Hydrogen at the qualification level of undergraduate, graduate and PhD training. The course addresses the new generation of engineers (BS/MS and PhD student), scientists, economists and professionals involved in the future energy sectors. The learning outcomes of the topics covered will be verified by class tests and a final exam.

ADMISSION AND ACCOMMODATION

The course is manly addressed to doctoral students on first come first served basis.

The registration fee is 400,00 Euro + VAT taxes*, where applicable (bank charges are not included).

The registration fee includes a complimentary bag, four fixed menu buffet lunches, coffee breaks, downloadable lecture notes and wi-fi internet access.

Applications should be made on-line through our web site:
https://www.cism.it/en/activities/courses/E2002/
A message of confirmation will be sent to accepted participants. Information about travel and accommodation is available on our web site, or can be mailed upon request.

A limited number of rooms is available at our Guest House at the rate of Euro 30,00 per person/night.
Applicants may cancel their course registration and receive a full refund by notifying CISM Secretariat in writing (by email) no later than two weeks prior to the start of the course.
If cancellation occurs less than two weeks prior to the start of the course, a Euro 50,00 handling fee will be charged.
Incorrect payments are subject to Euro 50,00 handling fee.

* Italian VAT is 22%.

For further information please contact:
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ACADEMIC YEAR 2020

University of Udine
International Centre for Mechanical Sciences

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Centro Internazionale di Scienze Meccaniche
International Centre for Mechanical Sciences

RENEWABLE ENERGIES, ENERGY STORAGE AND HYDROGEN ECONOMY

CISM-UniUD Joint course
coordinated by

Marta Boaro
University of Udine, Italy

Massimo Santarelli
Polythecnic of Turin, Italy

Robert Steinberger-Wilckens
University of Birmingham, UK

CONFINDUSTRIA Friuli Venezia Giulia

MIUR

TeacHy

Udine ***August 24 - 28*** **2020**

LECTURERS

Prof. Fausto Gallucci
Eindhoven University, The Netherlands
2 lectures on:
Towards a zero-carbon society: CO_2 utilization technology and H_2 uses; Membranes for the purification of H_2.

Prof. Vladimir Molkov
Ulster University, United Kingdom
2 lectures on:
Fundamentals of H_2 safety; H_2 safety design tools

Prof. Massimo Santarelli
Politecnico di Torino, Italy
2 lectures on:
Power to X systems based on hydrogen; Energy storage by power to gas and power to power systems.

Prof. Aldo Steinfeld
ETH Zurich, Switzerland
4 lectures on:
H_2 production technologies using solar energy and other renewable energy sources; Thermochemical H2 production; Thermochemical water splitting.

Prof. Robert Steinberger-Wilckens
University of Birmingham, United Kingdom
4 lectures on:
Renewables and energy storage strategies; H_2 and fuel cell technology; FC and biomass utilisation; Energy security and hydrogen – societal implications.

Prof. Jan Van Herle
Swiss Federal Institute of Technology EPFL, Lausanne, Switzerland
3 lectures on:
Electrolysers: Principles and fundamentals; Electrolysers: applications; Materials for hydrogen storage.

Prof. Peter Hugh Middleton
University of Agder, Norway
2 lectures on:
International developments towards a hydrogen economy; Energy system cost analyses and comparison for electricity and hydrogen.

PROGRAMME

Monday, August 24

12:30 - 13:30 Registration

13:30 - 14:00 Course Introduction

14:00 - 14:45 L1 Steinberger-Wilckens "Renewables and energy storage strategies"

14:45 - 15:30 L2 Steinberger-Wilckens "H_2 and fuel cell technology"

15:30 - 16:00 Coffee break

16:00 - 16:45 L3 Steinfeld: "H_2 production technologies using solar energy and other renewable energy source"

17:00 - 17:45 L3 Steinfeld: "H_2 production technologies using solar energy and other renewable energy sources"

17:45 - 18:00 L4 Gallucci "Towards a zero carbon society: CO_2 utilisation technology and H_2 uses"

Tuesday, August 25

8:30 - 9:15 L5 Van Herle "Electrolysers: principles and fundamentals"

9:15 - 10:00 L6 Van Herle "Electrolysers: applications"

10:00 - 10:30 Coffee break

10:30 - 11:15 L7 Molkov "Fundamentals of H_2 safety"

11:15 - 12:00 L8 Molkov "H_2 safety design tools"

12:00 - 14:00 Lunch

14:00 - 14:45 L9 Van Herle "Materials for hydrogen storage"

14:45 - 15:30 L10 Steinfeld "Thermochemical H_2 production"

15:30 - 16:00 Coffee break

16:00 - 16:45 L11 Steinfeld "Thermochemical water splitting"

16:45 - 17:30 L12 Professors meet students: questions or exercises sections

19:00 - 23:00 Social dinner

Wednesday, August 26

8:30 - 9:15 L13 Santarelli "Power to X systems based on hydrogen"

9:15 - 10:00 L14 Santarelli "Energy storage by power to gas and power to power systems"

10:00 - 10:30 Coffee break

10:30 - 11:15 L15 Middleton "International development towards a hydrogen economy"

11:15 - 12:00 L16 Gallucci "Membranes for the purification of H_2"

12:00 - 14:00 Lunch

Wednesday, August 26

14:00 - 14:45 L17 Steinberger-Wilckens "FC and biomass utilisation"

14:45 - 15:30 L18 Middleton "Energy system cost analyses and comparison for electricity and hydrogen"

15:30 - 16:00 Coffee break

16:00 - 16:45 L19 Steinberger-Wilckens "Energy security and hydrogen - societal implications"

16:45 - 17:30 L20 Written or oral exam

Thursday, August 27

8:30 - 9:15 L13 L21 Preparation of the design project: forming student groups and getting organised

10:00 - 10:30 Coffee break

10:30 - 12:00 L23/24 Student working time

12:00 - 14:00 Lunch

14:00 - 15:30 L25/26 Student working time

15:30 - 16:00 Coffee break

16:00 - 17:30 L27/28 Presentation of results of student projects

Friday, August 28

9:00 - 9:45 L29 Presentation of TeacHy project to the students, UniUD Departments and Academies

9:45 - 10:30 L30 Update meeting of TeacHY project

10:30 - 11:00 Coffee break

11:00 - 11:45 L31 Update meeting of TeacHY project

11:45 - 12:30 L32 Update meeting of TeacHY project

12:30 - 14:00 Light lunch