

Renewable Energy Science Courses

RES601	Energy – Past, Present, and Future
RES602	Energy Technologies – Conversion, Storage & Energy Systems
RES604	Life-Cycle Assessment & Energy Efficiency Analysis
RES603	Carbon Capture & Sequestration Technologies
RES605	Geothermal Energy
RES606	Fuel Cell Systems & Technologies
RES607	Hydropower
RES608	Biofuels & Bioenergy
RES609	Solar Energy
RES610	Wind & Wave (Tidal) Power
RES611	Study Tour

Renewable Energy Science Courses

Energy - Past, Present & Future

Course content includes historical and current energy use, fossil fuel resource base estimation, and energy demand forecasting, including future imbalance between supply and demand. The course will also take on the new energy paradigm and local energy resource availability in different countries.

Emphasis will be made on the need to reduce CO₂ and other greenhouse gas emissions, including different scenarios and policies as well as implications of global warming and climate change. Special focus will be on political and economic implications of increasing scarcity of conventional oil, including energy security of supply. Finally the course will take on the importance of renewable energy, principles for sustainable energy development and - if that is possible - how it can be accomplished.

February 2009

Course Number: RES601
Course Duration: 2 Weeks
ECTS Credits: 4
Time Schedule: 09/02 - 20/02
Full Course Fees: EUR 1200
Students & Affiliates: EUR 600

Lecturing Professor:

Dr. Dean Abrahamson

Professor Emeritus at
University of Minnesota
Hubert H. Humphrey Institute of Public Affairs
United States

For registration, course fees and additional information

please contact: res@res.is or visit: www.res.is/graduateschool/page/course_catalog

Renewable Energy Science Courses

Energy Technologies - Conversion, Storage & Energy Systems

Course content includes a review of some of the main principles of physical thermodynamics, heat and mass transfer, and fluid dynamics. The following two weeks focus on a comparative analysis of the main physical and chemical characteristics and environmental impacts of fossil fuel resources, new generation of nuclear power plants and nuclear fusion, as well as clean coal technologies and their future importance.

The course also takes on energy conversions and energy systems – combined heat and power (CHP), tri-generation systems (power, heating, cooling), and hybrid systems (energy conversion efficiencies), energy networks (grid connected systems and distributed generation), smart electricity transmission networks and scenarios of energy infrastructure evolution.

Finally the course will take on energy storage technologies and innovative energy storage solutions.

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February - March 2009

Course Number: RES602
Course Duration: 3 Weeks
ECTS Credits: 6
Time Schedule: 23/02 - 13/03
Full Course Fees: EUR 1800
Students & Affiliates: EUR 900

Lecturing Professors:

Dr. Dusan Holoubek

Professor at Technical University of Kosice,
Department of Furnaces & Heat Technique,
Slovakia

Dr. Roman Domanski

Professor and Head of Department at
Warsaw University of Technology
Institute of Heat Engineering
Poland

Dr. Piotr Furmanski

Professor at Warsaw University of Technology,
Poland

Renewable Energy Science Courses

Life-Cycle Assessment & Energy Efficiency Analysis

Course content includes principles and methods of industrial ecology and life-cycle assessment (LCA) and applications for energy systems; introduction to the advanced SimaPro LCA software. Cost-benefit analysis (CBA) and cost-efficiency analysis of various energy scenarios and renewable energy choices; cost-effective energy efficiency measures; and future energy conservation scenarios.

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March 2009

Course Number: RES604
Course Duration: 2 weeks
ECTS Credits: 4
Time Schedule: 16/03 - 27/03
Full Course Fees: EUR 1200
Students & Affiliates: EUR 600

Lecturing Professors:

Dr. Paulo Ferrao

Professor and Director at the Technical
University of Lisbon
Instituto Superior Tecnico (IST)
MIT - Portugal Program
Portugal

Dr. Sergio Pacca

Assistant Professor at The School of Science,
Arts & Humanities
University of Sao Paulo
Brazil

Renewable Energy Science Courses

Carbon Capture & Sequestration Technologies

Course content includes advanced pollution prevention technologies in energy generation; advanced pre-combustion separation techniques; separation techniques in solid, liquid and gaseous fuel generation. CO₂-capture, transportation and sequestration techniques (CCS); CO₂-storage technologies in various geological environments; CO₂ use in EOR (Enhanced Oil Recovery); economic assessment and regulatory activities for CO₂-capture and storage.

Case studies, including CO₂ storage into glassy basaltic formations in Iceland and the Norwegian Sleipnir CO₂-injection project in the North Sea.

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March - April 2009

Course Number: RES603
Course Duration: 1 week
ECTS Credits: 4
Time Schedule: 30/03 - 03/04
Full Course Fees: EUR 1200
Students & Affiliates: EUR 600

Lecturing Professors:

Dr. Sigurdur R. Gislason

Research Professor at University of Iceland,
Institute of Earth Sciences

Dr. Klaus Lackner

Professor and Chair at Columbia University,
Department of Earth &
Environmental Engineering,
The Fu Foundation School of Engineering &
Applied Science
United States

Geothermal Energy

Course content includes a review of the main characteristics of geothermal systems - low-temperature and high-temperature geothermal fields. Brief overview of the methodology of geothermal exploration and exploitation. Geothermal resource utilization in Iceland and elsewhere.

Some of the technical applications covered in this course will be geothermal district heating systems, geothermal heat pumps, and power plants; combined heat and power systems (CHP); Energy efficiency, costs and environmental impact assessments; Future prospects of geothermal energy.

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April 2009

Course Number: RES605
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 14/04 - 18/04
Full Course Fees: EUR 600
Students & Affiliates: EUR 300

Lecturing Professors:

Dr. Axel Bjornsson

Professor at University of Akureyri
Iceland

Dr. Hrefna Kristmannsdottir

Professor at University of Akureyri
Iceland

Dr. Pall Valdimarsson

Professor at University of Iceland
Department of Mechanical & Industrial
Engineering

Renewable Energy Science Courses

Fuel Cell Systems & Technologies

Course content includes review of the main characteristics of fuel cell systems and technologies. Hydrogen production and storage systems. Utilization of hydrogen and fuel cell technology in transportation, shipping, industrial and residential settings.

The course will also study the Icelandic ECTOS project and Iceland's transition to a hydrogen-based economy, hydrogen storage problems, energy efficiency, costs and environmental impact assessments, and the future prospects of fuel cells.

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April 2009

Course Number: RES606
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 20/04 - 24/04
Full Course Fees: EUR 600
Students & Affiliates: EUR 300

Lecturing Professors:

Dr. S. David Dvorak

Professor at University of Maine
School of Engineering Technology
United States

Dr. Thorsteinn I. Sigfusson

Director of Iceland Innovation Center &
Professor at University of Iceland

Renewable Energy Science Courses

Hydropower

Course content includes review of global water resources and the hydrologic cycle, and impacts of climate variability and climate change on hydrological resources. Water resource management. Characteristics of hydropower - methodology of hydropower assessments, hydropower plants, systems and technologies.

Other topics to be covered are the use of hydropower in Iceland and elsewhere, energy efficiency, costs and environmental impact assessments, future prospects of hydropower.

April 2009

Course Number: RES607
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 27/04 - 30/04
Full Course Fees: EUR 600
Students & Affiliates: EUR 300

Lecturing Professor:

Dr. Jonas Eliasson

Professor Emeritus at University of Iceland
Faculty of Engineering, Civil &
Environmental Engineering

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Renewable Energy Science Courses

Biofuels & Bioenergy

Course content includes an assessment of different biomass resources, yields and exploitation. Characteristic of anaerobic digestion. Types of liquid and gaseous biofuels and production technologies.

Methods of practical application covered include advanced energy conversion technologies and biosystems; biofuels production in Iceland and elsewhere; energy efficiency, costs and environmental impact assessments; future prospects of biofuels and bioenergy.

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May 2009

Course Number: RES608
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 04/05 - 08/05
Full Course Fees: EUR 600
Students & Affiliates: EUR 300

Lecturing Professors:

Dr. Johann Orlygsson

Professor at University of Akureyri
Iceland

Mr. Asgeir Ivarsson

Chemical Engineer at Mannvit Engineering
Iceland

Dr. Agusta S. Loftsdottir

Manager for Alternative Fuels at the
National Energy Authority
Energy Utilization Department
Iceland

Renewable Energy Science Courses

Solar Energy

Course content includes a review of solar radiation, solar resource distribution, and seasonal variation. Solar thermal power plants (CSP). Solar electricity and characteristics of photovoltaic cells (PVs) - physics and design of PV cells; multilayer solar cells; photovoltaic systems and collectors.

Also covered in this course will be solar water heating systems; Solar architectural designs; Case studies from Europe and the U.S. Energy efficiency, costs and environmental impact assessments; Future prospects of solar energy.

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May 2009

Course Number: RES609
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 11/05 - 15/05
Full Course Fees: EUR 600
Students & Affiliates: EUR 300

Lecturing Professor:

Dr. Michael J. Brandemuehl

Associate Professor at
University of Colorado, Boulder
Department of Civil, Environmental &
Architectural Engineering
United States

Renewable Energy Science Courses

Wind & Wave (Tidal) Power

Course content includes a brief review of the nature of atmospheric winds and ocean waves; basic wind and wave statistics - wind and wave mapping; resource assessments and energy potential; tidal behavior and tidal power. Also, principles of wind turbine technologies, onshore and offshore wind farms, wave and tidal power technologies and power plants, and ocean thermal energy conversion systems. Renewable or “green” islands.

Case studies from Europe and the U.S. Energy efficiency, costs and environmental impact assessments. Future prospects of wind and wave energy.

May 2009

Course Number: RES610
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 18/05 - 22/05
Full Course Fees: EUR 600
Students & Affiliates: EUR 300

Lecturing Professor:

Dr. Hans C. Soerensen

CEO at EMU and SPOK ApS,
Founder of Wave Dragon ApS,
Wave Dragon Ltd., Wave Dragon Wales Ltd.
and TECDRAGON SA
Copenhagen, Denmark

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Renewable Energy Science Courses

Study Tour

The study tour, at the beginning of summer, takes students to several interesting sites in Iceland which are involved in harnessing the country's renewable energy sources.

The tour includes visits to high- and low-temperature geothermal fields, geothermal and hydropower plants, geothermal district-heating operations, research laboratories, various facilities utilizing hydroelectric, geothermal, biomass and hydrogen energy, as well visits to Iceland's leading energy companies and institutions.

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June 2009

Course Number: RES611
Course Duration: 1 week
ECTS Credits: 2
Time Schedule: 06/06 - 14/06
Full Course Fees: EUR 600
Students & Affiliates: EUR 300
Additional Fees: Travel and Accommodation

Lecturing Professors:

Dr. Axel Bjornsson

Professor at University of Akureyri, Iceland

Dr. Hrefna Kristmannsdottir

Professor at University of Akureyri, Iceland

Dr. Johann Orlygsson

Professor at University of Akureyri, Iceland

Dr. Thorsteinn I. Sigfusson

Director of Iceland Innovation Center &
Professor at University of Iceland