PHYS-C6370
Fundamentals of New Energy Sources
(5 cr)

Course Outline

Autumn 2020

SCI/PHYS: New and renewable energy technologies, programmes & courses

Courses:

PHYS-C6370 Fundamentals of New Energy Sources (fall semester 2020)
PHYS-C1380 Multi-disciplinary energy perspectives (winter semester)
PHYS-E0483 Advances in New Energy Technologies (winter semester)
PHYS-E6570 Solar Energy Engineering (winter semester 2022)
PHYS-E6571 Fuel Cells and Hydrogen Technology (winter semester 2021)
PHYS-E6572 Advanced Wind Power Technology (fall semester 2020)
PHYS-E0581 Individual Assignment: energy topics (any time)
PHYS-E0582 Special Course in Advanced Energy Technologies, winter semester 2021: Basics of climate change - The science background and implications on technology & business
MOOC: Open Access course on Climate Change: climate.now (3 ECTS)

Programmes:

Energy Science (Minor & Major at BSc and MSc levels)
Multi-Disciplinary Energy Studies (Minor at Master-level, all Aalto U)

Outline of the course

- Aim: "To understand the physical principles of new and renewable energy technologies, their main applications, future potential and trends. To be able to use key analytical tools in this context. To obtain a good insight into new and renewable energy sources, adequate capabilities to apply this knowledge into various research, development or planning tasks of new energy systems"

- First part of the course (assessment focus): global energy system, change drives, penetration of new technologies, diffusion and learning models, energy scenarios; economics
- Second part of the course (technology focus): new energy technologies, bioenergy and biofuels, wave and marine power, geothermal energy, wind power, solar energy, fuel cells and hydrogen, planning of energy systems.

- Linking of the course to your studies
  - Course as part of the basic studies
    - Part of your own major/minor subject
    - Energy Science (PHYS) major or minor
    - Energy Science minor (20 cr, tailormade contents)
    - Aalto Multi-Disciplinary Energy Studies Minor Programme
  - Post-graduate studies

Contents

1) Part I (lectures 1-4): understanding global energy system, drivers of change, and how new energy technologies will fit into the "big picture". Learning key tools to investigate the "Energy Transition". Key topics include: Global Energy Systems and Dynamics; Energy and Climate Scenarios; IPAT-model, Resource models; LCOE;

2) Part II (lectures 5-12): fundamentals, potential, and restrictions of new energy technologies (solar, wind, wave, geothermal, bioenergy/biofuels and biogas, fuel cells and hydrogen). Tools: Renewable Energy Source Assessment and Energy Planning tools; Individual Technology Sections (solar, wind, bio, wave, geothermal, fuel cells).

- Renewable Energy Source Assessment
- Renewable Energy Planning (RETSCREEN, Homer?)
- Technology Sections (solar, wind, bio, wave, geothermal, fuel cells)

Lectures 2020

1	Global Energy System	(9.9)
2	Scenarios	(16.9)
3	Technology Diffusion	(23.9)
4	Economics	(30.9)
5	Wind Power	(7.10)
6	Wave Power and Geothermal	(14.10)
7	Bioenergy	(28.10)
8	Biofuels	(4.11)
9	Fuel Cells and Hydrogen	(11.11)
10	Solar Energy	(18.11)
11	Solar Markets (Guest Lecture)	(25.11)
12	Optional lecture (tbd)	(2.12)

Schedule autumn 2020

Lectures *): Due to the Covid-19 pandemic all lectures will be given remotely through Teams or Zoom (links will be sent separately)

Wed 14:15-16:00 9 Sep – 14 Oct and 28 Oct– 2 Dec 2020

*) Please check from MyCourses lectures as there may be a few changes during the autumn (swapping lecture and exercises). Lectures are NOT compulsory.

Exercises: Thu 12:15-14:00

Exercise #1 is a remote reading tasks with questions.
Exercise #2-12 will be for the time being remotely handled, but we will follow Aalto instructions to update this point, whenever possible.

Workload

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lectures: 24 hours
exercises: 24 hours
project work/preparing for exam: 40 hours
individual reading and homework: 45 hours

Passing the Course

1) 10/12 (max) points from the home-exercises (12). Project work approved (scoring 0-5) with dead-line Dec 20 2020 or Jan 24 2021
/OR/
2) Home-exercises give 0-6 extra points in Exam (Dec 9 and 22 Feb, 2 June)
/OR/
3) Later on, exam only

Project work Assessment:

Due to Covid-19, the group work may need to be done individual only, unless the Aalto guidelines change.