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Fakultät für Naturwissenschaften, Fachbereich Physik

Announcement

Energy Supply, Climate Change and Nuclear Fusion Research

Dr. Thomas Eich (thomas.eich@ipp.mpg.de)

Description

The German government has announced a planned transformation in its energy supply, the so-called ‚Energiewende'. The frequent discussion of this new policy in the German media reflects the importance of energy in our everyday life. Energy heats our homes and moves our cars. It is crucial for industry. Catch-phrases like energy crisis or climate change are regularly appearing in the news.

This lecture course introduces the basics of energy supply in Germany and reports in detail about conventional energy sources such as coal, oil and nuclear, as well as alternatives such as wind, biomass and solar. The flow of energy starting from production in industrial power plants or through small scale local facilities towards its consumption for private households, transport and industry will be discussed.

Alternative energy is only rarely produced in the same region where it is consumed. It is also highly intermittent. Thus a very large expansion of the German power grid and its international connectivity is necessary. This is one of the most difficult challenges within the foreseen turnaround of energy supply.

Particular emphasis will be placed on the extent to which nuclear-fusion-based power plants can contribute to a future CO_2-free energy supply in Germany and worldwide. Towards this end, the physical and technical basics of a nuclear fusion power plant will be presented. One focus will be current nuclear fusion experiments at the Max-Planck-Institute for Plasma Physics in Munich. A further focus will be the large nuclear fusion experiment ITER in France, a major international science project under construction by China, Europe, India, Japan, Russia, South Korea and the U.S., designed to demonstrate the production of 100's of megawatts of heat from the fusion process for periods up to one hour.

Content

- Survey on energy supply and energy consumption in Germany and in the world
- The concept of the individual energy balance sheet for course attendees
- Survey on consumption of fossil energy forms worldwide: coal, gas, oil
- Climate history and radiative forcing, near term projection of global warming
- Natural cycles of CO_2 in the atmosphere, lithosphere and oceans
- The physics of the Greenhouse effect
- Consequences of CO_2-increase and international CO_2-reduction strategies
- Consequences of a Nuclear Renaissance and proliferation risks
- Energy transformation in Germany and necessity for a power grid extension due to the intermittency and localisation of alternative energy such as wind and PV
- Current and future experiments in nuclear fusion research in Europe
- Concept of Nuclear Fusion power plants and potential of Fusion Energy
- Near-term CO_2-free energy, nuclear fission etc. to be handled in the seminar (see list)

Additional Information

Course type: Lecture course with seminar, Attendance time: 3 x 8 hours in block form, **4 ECTS credits**
The marking is based on the seminar talk including discussion and a 3-page handout.

Date / Duration / Location

Pre-Meeting: Friday, 04.11.16, 10.00 – 12.30, location O27: 2203
Course + Seminar: February 2017, exact dates will be discussed. Foreseen dates 03.02,10.02,17.02

Instructor

Dr.Thomas Eich, Max-Planck Institute for Plasma Physics, Garching, Germany

The Seminar talk should not exceed 30 minutes. Additionally to the talk a 3 page hand-out is mandatory which should summarize the content of the talk. The course and the seminar will be held in English. An introduction meeting will be held on the 04.11.2016 in Room O27/2203. The actual course and seminar will be held on 3 full days in February 2017. The exact dates will be discussed during the introduction meeting. The course is restricted to 20 attendees and the below listed topics are available. For topics stating two persons the talk can be given in a team and shall not exceed 60 Minutes.

Topic	Person(s)
Geothermal Energy	1
Fracking	1
Solar-Thermal Energy (roof top solution / updraft power plant)	2
Wind Power	2
Heat Pumps for Smart Heating + Modern Housing	1
Tide Power Plants / Wave power plants	2
Hydro Energy	1
Climate Engineering	1
Photo Voltaic	1
Electro Mobility	1
Major Nuclear Accidents (Fukushima / Chernobyl Desaster)	2
CO_2 – Sequestration (CCS)	1
Energy Storage (power to gas / electrical storage)	2
Bio Mass	2
Nuclear Power Plants 4^{th} Generation	1