Course syllabus

Offentlig byggnad - integrering av solenergi-, kostnads- och miljöaspekter
Public Building - Integrating Solar Energy, Costs and Environmental Aspects

AEBN21, 15 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED V
Date of Decision: 2023-03-21

General Information

Main field: Energy-efficient and Environmental Buildings.
Compulsory for: MEMB2
Language of instruction: The course will be given in English

Aim

In this course, the students will explore innovative solar energy systems and concepts (active and passive) and test, through computer simulations and calculations, the integration of these systems in a case study project (a public building). The course will also allow analysing the potential of solar energy constraints as a guide in development of configurations, technical solutions and details. Furthermore, the students will study the production of on-site energy and carry out life-cycle and costs analyses of the chosen technology in the studied case. They will also learn to use rules of thumb and tools (computer, hand calculations) for solar design, life-cycle cost and environmental load predictions (acquired in theoretical courses). Finally, they will deepen their understanding and knowledge, and test their capacity to integrate previously acquired concepts regarding building physics, energy use, thermal comfort, moisture safety, ventilation and lighting, using an integrated design process.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- Show the ability to describe and discuss solar energy systems and concepts, the main principles and strategies used today in European buildings;
- Demonstrate an ease to discuss solar aspects of buildings in relation to design configuration, detailing, integration, etc.
- Demonstrate the ability to consider and describe the possibilities and limitations of solar energy systems in the Swedish context;
- Have knowledge of estimations of life cycle economics of different active solar energy systems and configurations;
- Have the capacity to describe and discuss how different parameters of the solar energy system influence the life cycle costs and environmental impacts.

Competences and skills
For a passing grade the student must

- Be able to select an adequate, wisely integrated solution leading to cost-effective energy production, while demonstrating that the other performances of the building (i.e. low energy use, adequate thermal comfort, indoor air quality and visual comfort) are maintained;
- Be able to develop and graphically present a solar energy building concept suitable for the cold or temperate climatic context;
- Demonstrate skills to use tools, energy simulations or hand calculations in a productive way as a support for analysing solar energy effects of own propositions and guide design decisions;
- Show ease to communicate verbally and graphically solar building concepts and systems, using the appropriate vocabulary and fact-based arguments;
- Be able to predict life-cycle costs and environmental impact to reach a certain goal for active solar energy systems in the studied case and similar building with its envelope performance and normal building services;
- Show ease to communicate verbally and graphically the life cycle costs and the environmental impact.

Judgement and approach
For a passing grade the student must

- Show the capacity to critically analyse and discuss solar solutions and systems in terms of efficiency, integration, cost-effectiveness, life-cycle perspectives;
- Show literacy when presenting and discussing the qualities and characteristics of solar building integration, including its life cycle economics and environmental impact;
- Demonstrate an ability to formulate relevant challenges and tasks in connection with solar design and development;
- Be able to discuss current technical and research trends as well as challenges related to the integration and efficiency of solar energy systems in buildings in the temperate and cold climatic contexts.

Contents

This advanced PBL (project-based learning) course will focus on the development of a large public building (e.g. library, school, etc.) with a focus on the integration of passive and active solar strategies, systems and components and the life-cycle perspective through cost analyses and investigation of environmental impact. Concepts related to the integration of solar components, the estimation and utilization of solar radiation, the production of electricity and heat using solar components, etc. are at the heart of this course. This course will thus be strongly and rigorously supported by the theoretical courses “AEBN30 Building Integrated Solar Energy

Systems” and “ABKN05 Life Cycle Perspective and Environmental Impact of Buildings”. The theoretical courses will provide the scientific and technical bases as well as tools (computer, hand calculations) for validating the proposed solutions, using an integrated building approach. This course will also allow deepening and testing the integration of previously acquired knowledge about energy use, thermal comfort, moisture safety, ventilation and lighting/daylighting. An extensive report shall be delivered at the end of the course. The results will be presented orally and critically reviewed by other students.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Active participation and attendance at lectures, tutorials, group meetings, presentations etc is compulsory. The final grade is to 70% based on the written report, to 20% based on the oral presentation and to 10% on the opposition to other's work.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- Submitted exercises in the courses "Building integrated solar energy systems" and "Life-cycle perspective and environmental impact of buildings".

The number of participants is limited to: No
The course overlaps following course/s: AEBN20

Reading list

- Course literature will be available through an electronic course library via the course website.
- A general description of the calculation tools for Cost Benefit Analysis and Life Cycle Assessment of very low-energy houses. IVL, 2010.
- Identification of tools for cost-benefit and LCC analysis and success factors for very low-energy housing. 2010. IVL, 2010.
- Economic and environmental impact assessment of very low-energy house concepts in the North European countries. IVL, 2011.

Contact and other information

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