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Train-the-trainers (ToT) toolkit

WP4, Task 4.2

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Module: 5

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1. Introduction

Module 5 will empower the student with cutting-edge knowledge and technologies regarding energy efficiency in buildings. State-of-the-art research on energy-efficient buildings will be raised and discussed. The keywords of this module are energy balance calculations, energy-efficient buildings, and indoor climate.

The student will develop competencies in understanding energy use in buildings and performing advanced energy balance calculations, with a focus on the latest technological advancements that enhance energy efficiency and indoor climate. Additionally, you will learn how to design buildings that meet energy-efficiency requirements.

The teaching is based on practical energy calculations for buildings, the development of temperature-duration curves, instruction in using two different software tools, and the analysis of energy-efficiency measures and their potential impact on building performance.

The teaching is supported by a problem-based learning (PBL) approach. Rather than relying solely on predefined calculation procedures, students are presented with realistic and relatively open-ended problems that require them to apply their theoretical knowledge to practical situations. They are expected to identify the necessary input data, make reasonable assumptions where data are unavailable, select appropriate methods and software tools, carry out the required simulations and calculations, and critically evaluate and reflect on their results.

This approach encourages students to take greater responsibility for their own learning and to develop their ability to make well-founded technical decisions. The assignments therefore focus not only on obtaining numerical results, but also on the quality of the modelling process, the justification of assumptions, the level of detail in the simulations, and the students' ability to interpret and critically reflect on the results.

2. Teaching Methodologies

2.1. Learning Objectives

The module will empower students with cutting-edge knowledge and technologies regarding energy efficiency in buildings. State-of-the-art research on energy-efficient buildings will be raised and discussed. The keywords of this module are HVAC, energy balance calculations, energy-efficient buildings, and indoor climate. Learning objectives include:

- Develop in-depth knowledge of energy-smart solutions in the built environment.

- Design heating-, cooling- and ventilation systems for various kinds of buildings.

- Calculate and account for energy in buildings and energy efficiency measures without negative impacts on the indoor climate. perform energy balances and carry out energy calculations.

- Account for the relationship between a building's indoor climate and the dweller's well-being.

- Critically analyze the energy efficiency from a holistic and sustainability perspective.

2.2. Teaching method

Teaching will be based on highly interactive walk-trough lectures, exercises, hands-on exercises and assignment review. The assignment will be based on CBL where tutors will be guided by the teacher.

The assignments are designed in accordance with a problem-based learning (PBL) approach. Rather than following a predefined calculation procedure, students are presented with complex, realistic problems that require them to identify the necessary input data, make justified assumptions where data are unavailable, select appropriate modelling approaches and software tools, and critically evaluate and reflect on their results.

3. Tool Tutorials

3.1. Software #1

The site Energiberakning.se offers a free energy calculation for buildings. The program checks whether the house can be approved by the municipality according to the National Board of Housing, Building and Planning's regulations. BBR 29, 30, 31.

3.1.1. Installation guide

The internet address: https://www.energiberakning.se/default.aspx

3.1.2. Relevant features

Calculation of: U-value, primary energy number, space heating, domestic hot water, electricity

3.2. Software #2: PHPP

PHPP (Passive House Planning Package) is a comprehensive energy calculation tool used to design and evaluate high-performance, energy-efficient buildings. Developed by the Passive House Institute, PHPP helps architects and engineers optimize building performance by assessing heating and cooling demand, energy consumption, indoor comfort, and overall sustainability. It is widely used in Passive House projects and supports the design of buildings with low energy use and high occupant comfort.

3.2.1. Installation guide

Excel-based program, no installation is required.

3.2.2. Relevant features

Calculation of: U-value, space heating, primary energy, primary energy renewable

4. Assessment Strategies

The assessment is based on how well and comprehensively the students have completed their assignments and reflected on their work. The course includes two substantial assignments that students are required to complete using two different software tools for each assignment. The assignments require a considerable amount of input data. Some of these data are provided, while others must be estimated based on reasonable assumptions.

The assessment focuses on how carefully and thoroughly the students have carried out the simulations, including the extent to which they have justified their assumptions, selected appropriate input parameters, and documented the simulation process and results.

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