SUSTAINICUM COLLECTION
LEHRMATERIALIEN FÜR BILDUNG ZUR NACHHALTIGKEIT

# Fundamentals of Building Optimization (GO-0)

(Resource ID: 215)

**Roman Smutny,**
**Markus Gratzl-Michlmair**
**Roman Smutny**
romansmutny(at)yahoo.de
This teaching resource is allocated to following University:
**BOKU - University of Natural Resources and Life Sciences Vienna**

http://www.sustainicum.at/en/modules/view/215.Fundamentals-of-Building-Optimization-GO-0

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**Individual work**
**Work in pairs**
**Group work**

**Independent of the number of students**

**Up to 3 lecture units**

**English, German**

This teaching module is part of a module series on "building optimization" and is suitable for courses addressing the issue of sustainability, in particular energy efficiency and climate protection, and wish to examine the building sector. The Building Optimization series of modules is intended to convey the essential relationships of energy-efficient construction. Students can explore the optimization potentials of energy efficiency on their own using the GO tool. The purpose of this module is to understand key energy efficiency parameters and construction standards (passive houses, plus energy houses, zero carbon houses). The module is designed for a teaching unit of about half an hour in length (expandable to a one-hour teaching unit), and can be

implemented regardless of the number of participants.

### Content of Module

Information and recommendations for class instructors
Teaching materials and script: PowerPoint presentation (PPP) with instructions
Teacher's manual: PPP with notes (questions, answers, interpretation) and supplemented with results sheets for class instructors
GO tool based on MS Excel

The GO Tool is a tool for rating the energy efficiency of buildings. It can be used without special knowledge of building technology.

This module conveys the basics of using GO tools. It introduces the criteria and eco-indicators using a sample case. Working on their own, the students can become familiar with the composition and function of the tool, while gaining an understanding of assessment parameters.

### Suggested Teaching Order

Time for introduction (sections 1-3): about 10 minutes.
This section can be shortened to the overlays with the brief description of the energy efficiency parameters as necessary.

1. Explanation of goal and sequence of material (the first transparencies (slides) on PPP)
2. Presentation of the basics of sustainable construction
3. Presentation of the fundamentals of energy efficiency metrics A longer and more detailed introduction can be given as necessary: see the long version PPP.

Time required for instructions and the "Zero Carbon Buildings Standard" exercise: about 20 - 30 minutes

4. Overview of building standards, objectives and criteria
5. Ask the students to open the GO tool and to form small working groups as desired.
6. Manual: presentation of energy parameters in the GO tool
7. GO Tool "zero carbon house" example. Information and tasks according to PPP. Results displayed in documents for LVA guides
8. Interpretation of the results, suggested discussion topics (questions to students)

### Pre-requisites for Implementation

MS Excel: ideally two students to one computer
There are no pre-requisites for understanding the teaching module.

This teaching module forms the basis for understanding the subsequent teaching modules in "Building Optimization", GO-1, GO-2, and GO-3, and the teaching module by Alexander Passer (Technical University of Graz) and Heimo Staller (AEE INTEC).

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## Teaching Tools & Methods


Computer program


Simulation program


Written material


Simulation

## Learning Outcomes

The assessment tool is intended to convey the essential relationships of energy-efficient construction. The students gain an understanding of energy efficiency by working independently. Armed with a brief introduction to sustainable construction, students explore the essential parameters of energy efficiency and how they may be illustrated by a simulation tool. The practice game encourages an understanding of building standards (passive house, plus-energy house, zero carbon home). Intended learning outcomes include:
1. How energy efficiency and ecological impact are evaluated in the building sector
2. Differentiating useable energy, end-user energy and primary energy assets 3. Effects of different energy supply on the rating parameters.
4. Energy efficiency classes, such as passive houses, zero carbon houses

## Relevance for Sustainability

The building sector exerts a strong influence on key areas of sustainable development: consumption of non-renewable resources, climate change, waste disposal, life cycle costs, job creation, indoor air quality (health), and user comfort. Their long service life means buildings have a direct impact on future generations. Many successfully tested strategies are available for increasing the sustainability performance of buildings. The building sector offers the greatest potential for optimization with regard to climate protection and energy efficiency (see publications by the IPCC and IEA). LCA (life cycle assessments) of buildings show that, in most cases, the

performance of user energy is the dominant factor of environmental impact (see for example the 2008 Michlmair thesis, TU Graz). Therefore, the energy efficiency of buildings is the most important starting point for improvements in environmental performance.

## Related Teaching Resources

No specific previous knowledge / related resources required

## Preparation Efforts

Medium

## Access

Free

## Sources and Links

Programming:
Markus Gratzl-Michlmair
Gratzl Engineering, Engineering Office for Building Physics
markus.gratzl@gratzl.co.at

Concept and Supplementary Materials:
Roman Smutny
romansmutny@yahoo.de

The building optimization tool is based on the OIB-training tool for non-residential buildings (see: www.oib.or.at) created by Christian Pöhn, MA39, and thus is based on the calculation rules of the energy certificate updated January 2010 (incl. ventilation according to ÖNORM H 5057, cooling according to ÖNORM H 5058, and lighting according to ÖNORM H 5059).

The OIB tool was adapted for use in architecture competitions within the IEAAC (Integration of Energy-related Aspects in Architecture Competitions) project by F&E and has been successfully implemented many times. The project was developed by IFZ Graz (architect Heimo Staller, project director), TU Graz, and BOKU Vienna, sponsored by FFG and Klima- und Energiefonds and the results are available online free of charge:
www.ifz.tugraz.at/Projekte/Energie-und-Klima/EZ-IEAA

A series of enhancements and simplifications were necessary to make it usable as a simplified teaching tool for residential buildings as part of the SUSTANICUM program. These involved the following areas:

- Active solar energy use, detailed lighting plans, shade and shadow illustration
- Ventilation system input

The conversion factors for primary energy demand and carbon dioxide emissions come from the OIB Guideline 6 (October 2011 issue). The PV of income are credited with the Austrian electricity mix. The conversion factors of the comparison values for travel are from the database ECOINVENT, V.2.