



Efficient Light

(Resource ID: 182)

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This teaching resource is allocated to following University:

BOKU - University of Natural Resources and Life Sciences Vienna

Institution:

Firma Innovative Elektronik

<http://www.sustainicum.at/en/modules/view/182.Efficient-Light>



Individual work



**Independent of
the number of
students**



**Up to 3 lecture
units**



English, German

The “Efficient Light” module focuses on the physical properties of light, parameters of usefullight, and the characteristics of different light sources. Interesting experiments are used to measure the fluctuation of a light source, light intensity, and total luminous flux.

This is an in-depth teaching module belonging to the Energy group of modules. It is beneficial for students already familiar with the basic terms and contexts of the issue of energy. The module focuses on the subject of light, light sources, and lighting. The rapidly growing use of light is contributing to the increasing demand of electricity, and the question of the disposal of used resources. It also raises new issues, such as the problem of “light pollution”. The module begins by dealing with the physical nature of light and its chief properties, and explaining key variables, such as luminous flux and light intensity, or illuminance, and how

they are measured. In the experimental portion, students make measurements of the high-frequency fluctuation behavior of different light sources. A light-integrating sphere (Ulbricht sphere), which can be used to carry out comparative measurements of the total light output of different light sources, is included. The module further addresses several important methods of generating light, highlighting their physical limitations and development opportunities of interest.

The module is designed to make students aware of the use of light and give them a basic understanding that will enable them to identify and implement ways to use it efficiently in their personal environments.

Overview of Contents

- Properties of light
- Parameters of light sources
- Measurement of illuminance
- Fluctuation of light sources (experiment)
- Measurement of luminous flux (experiment)
- Methods of producing light
- Ways to improve efficiency

Execution

A brief discussion of the rapidly increasing production of light and its impact on the environment and energy will serve as an introduction to the module. Then, students are asked to become familiar with some key terms of lighting technology, so that they can apply them in the measurements in the experimental section that follows. The accompanying materials offer a possible framework of presentation. For each transparency (or slide) of the presentation, there is a page of notes with precise details that can reduce the preparation time to a minimum. In the notes pages, you will also find background information and instructions for experiments and demonstrations. (The instructor should take time to study them carefully before the demonstration). Students may also bring their own light sources for a comparative survey of light behavior or light output. The entire module will take up at least one but not more than two double class periods to present.

The module may be broken up into independent segments or presentations (e.g. flux behavior, measuring the light beam, etc.) and used accordingly, with the prerequisite that the relevant photometric terms are explained as well.

Although the focus of the module is on technical aspects of light sources, the other options presented in the materials of intent dealing with light should also be noted, especially since this efficiency potential can usually be easily (re-)identified and accessed in practice.

Insights to Be Conveyed to Students

Basic knowledge of the useful parameters of light
Guidance on the best use of light sources
Awareness of wasted light and the efficient use of light

Documents, Materials

A set of presentation transparencies along with comments and notes is included that provides a coherent presentation framework. Each instructor will have their own preferences in terms of emphasis, of course, and they may wish to supplement or modify the materials with their own knowledge, as time allows.

Hardware

Oscilloscope, Light Converter as a Probe Head for the oscilloscope, light intensity sensor, model construction with integrated sphere for measuring luminous flux, digital multimeter, light source for pre-calibration (800 lumens), various light sources for comparison.

Teaching Tools & Methods



Written material `formteaching_experiment`

Contact details for borrowing physical devices

Office.ie@gmx.at

Learning Outcomes

Understanding of physical properties of light
Familiarity with key photometric variables of useful light
Overview of the important methods of generating light
Awareness for the efficient use of light

Relevance for Sustainability

Electric power must be generated in order to produce light. Any increase in lighting efficiency and conservation of lighting usage will therefore significantly affect the total consumption of energy. However, in terms of sustainability, life cycle and problematic lighting materials are also important issues when assessing different light sources.

Related Teaching Resources

No specific previous knowledge / related resources required

Preparation Efforts

Medium

Access

Free

Sources and Links

- W. Elenbaas, J.Funke: Leuchtstofflampen und ihre Anwendung, 1962, Philips Verlag
- M.A. Cayless, A.M. Marsden: Lamps and Lighting, 1982, Edward Arnold Verlag
- Brian Cook: „New Developments and Future Trends in High Efficiency Lighting“, Engineering Science and Educational Journal, October 2000
- V.A. Godyak: “Bright Idea: Radio Frequency Light Sources“, IEEE Industry Applications Magazine , May/June 2002 p42 ff

Internet:

- LED: http://en.wikipedia.org/wiki/Light-emitting_diode
- Lightbulb: http://en.wikipedia.org/wiki/Incandescent_light_bulb
- General information about light: <http://www.licht.de/en/>
- Light pollution:
<http://homepage.univie.ac.at/thomas.posch/endedernacht/Vortraege/Klagenfurt.pdf>