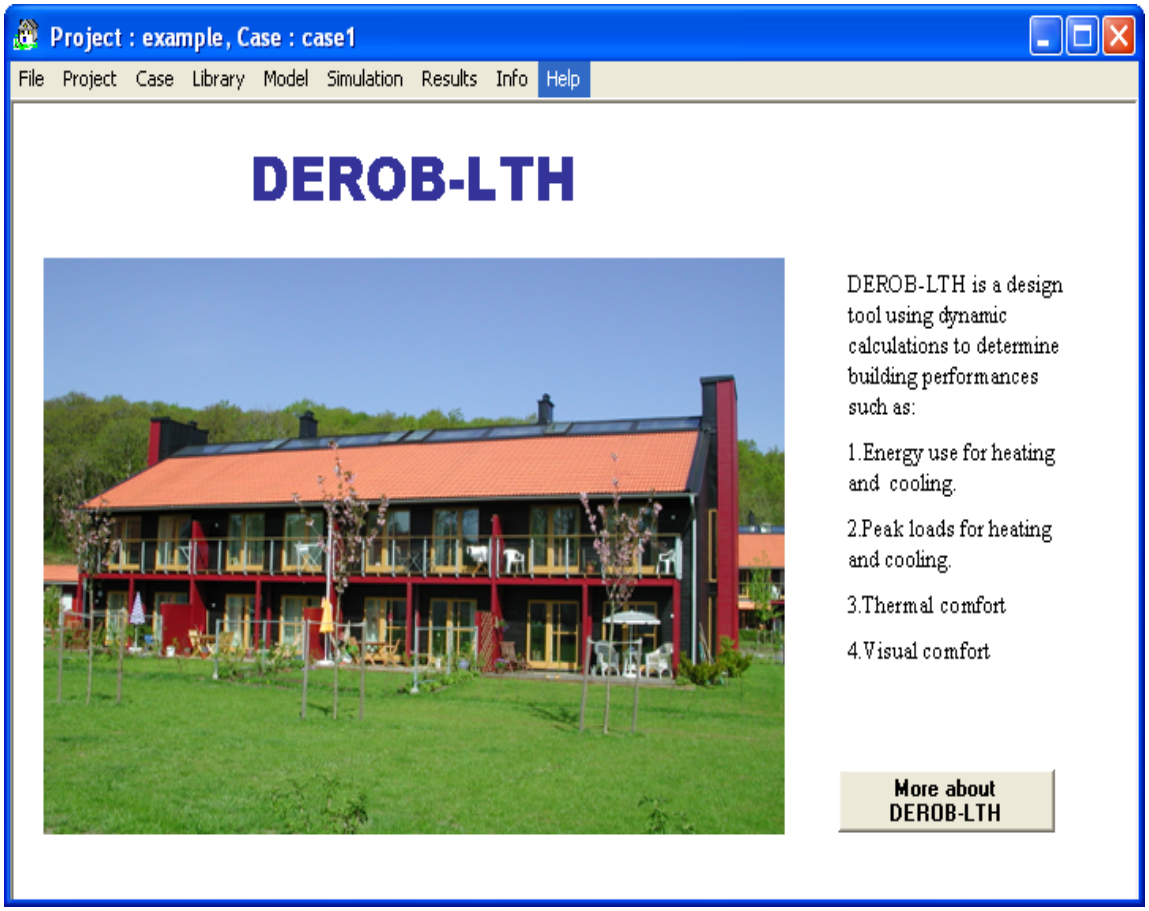
DEROB-LTH



Background

DEROB-LTH, which is an acronym for Dynamic Energy Response of Buildings, originates from the University of Texas and is written for the English language only. It is a design tool with possibilities to explore the complex dynamic behaviour of buildings for different designs. The tool is under continuous development at the division of Energy & Building Design at Lund University. The form of the building can be modelled in a flexible way with a number of 3-D surface geometries from triangles to five-sided polygons. The number of zones is maximized to 8. Libraries for opaque and transparent materials and constructions are included and can be modified according to special needs. The program has a semi-transparent building element type that can be used for modelling a shading screen, e.g. an awning. The calculations, based on an energy balance model, uses a time step of one hour and calculates different types of building energy performance parameters in response to hourly values of climatic data, scheduled input for indoor temperatures, max power for heating and cooling, internal loads, airflow rates and window openings.

The tool can simulate a wide spectrum of building types and is principally developed for target groups as students, researchers, architects and energy consultants.

Even if DEROB-LTH is relatively easy to use the advanced simulation models used demand that the users are familiar with the input parameters used and how they interplay.

A demo example is included with the installation of the program. This example is activated from the main function *File*.

Main functions
The work in DEROB-LTH is grouped into seven main functions: *File*, *Project*, *Case*, *Library*, *Model*, *Simulation* och *Results*.
More detailed information about the different functions is found in associated forms.

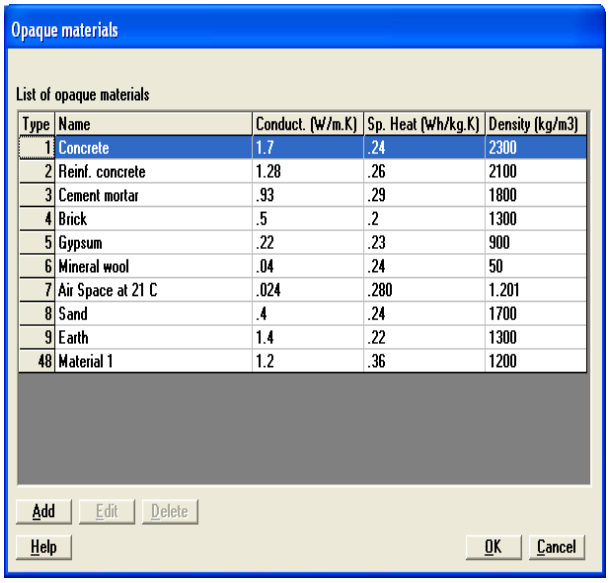
- **File**
  Functions to select a project directory and to activate the demo example is included in the main function *File*. The project directory can be regarded as a container for a set of design projects. Each design project comprises building models and libraries global to a design project.

- **Project**
  The main function *Project* manages design projects.

- **Case**
  Case is used to manage individual building models in a design project and requires a design project to be activated (opened).

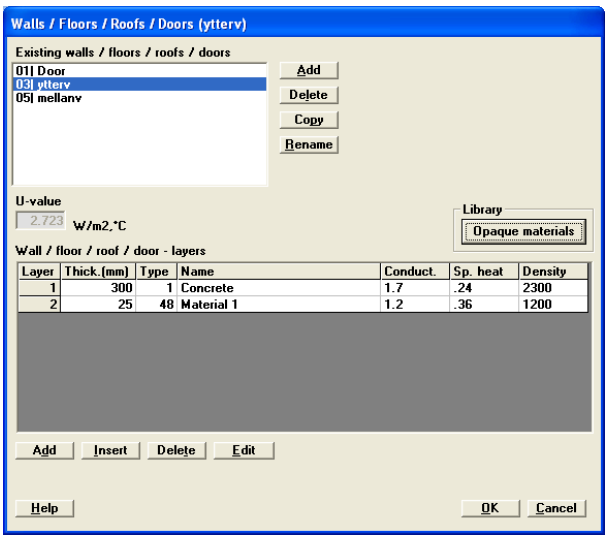
- **Library**
  This main function manages libraries for materials, constructions for roofs/walls/floors, doors and windows. A library for curtains is also included. *Library* requires a design project to be activated (opened). Below are some examples of forms.

  Opaque materials



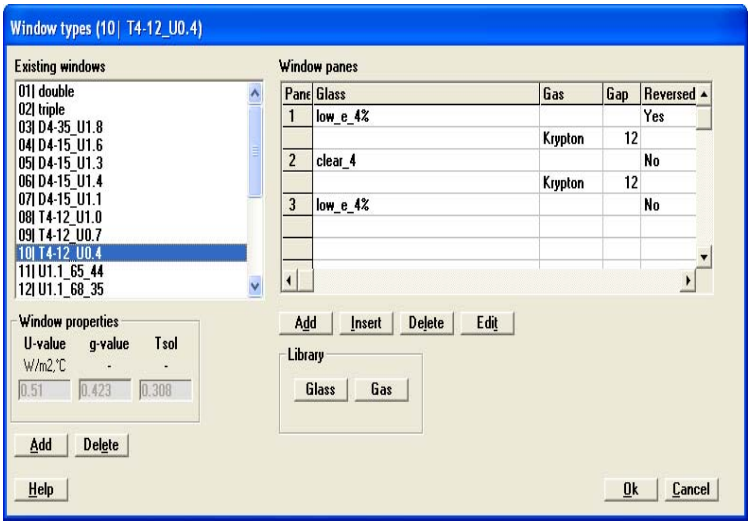
  This form is activated from the form *Walls / Floors / Roofs / Doors*

Walls / Floors / Roofs / Doors



The function to manage opaque materials is included in this form.

Windows



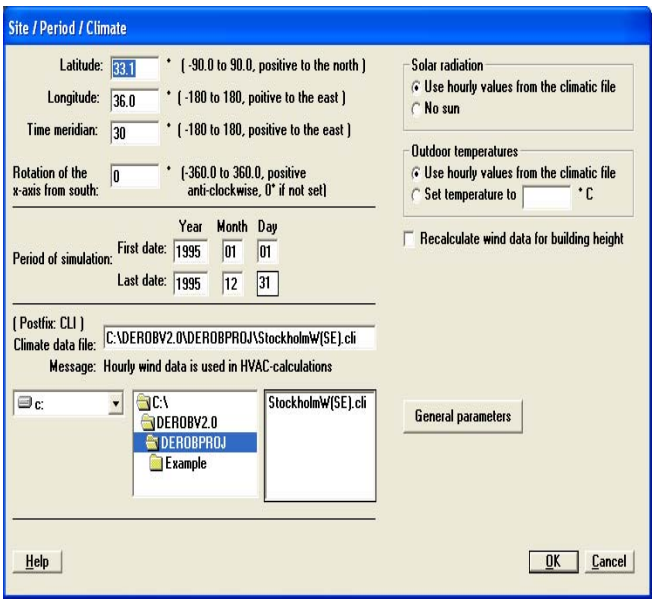
When a window is selected a calculation of the U-value, g-value and Tsol-value for the window package is done. g-value stands for the total solar energy transmission and Tsol for the primary solar energy transmission. The calculation is done according to the standard ISO 15099.

- **Model**

Model manages the selection of a site and its climatic data, opaque/transparent building elements, the building geometry and hourly schedules for different input data with influence on energy performance and indoor climate.

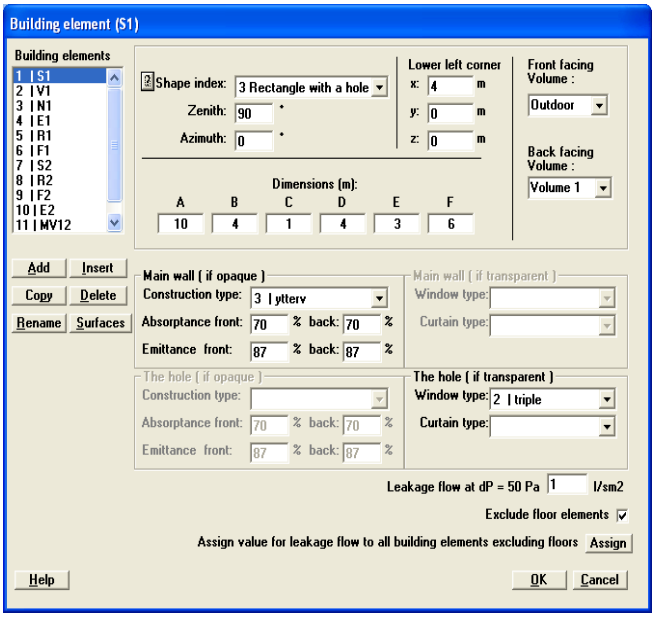
DEROB-LTH uses relatively advanced models for natural ventilation. The choice of input data and the interpretation of the results demands satisfactory understanding of the underlying principles of building physics. Below are some examples of forms.

Site and climatic data



The climatic data file should include data for wind-speed and wind-direction to be used for the calculations of natural ventilation. It's however working even if these data are missing, but with loss of accuracy in the results.

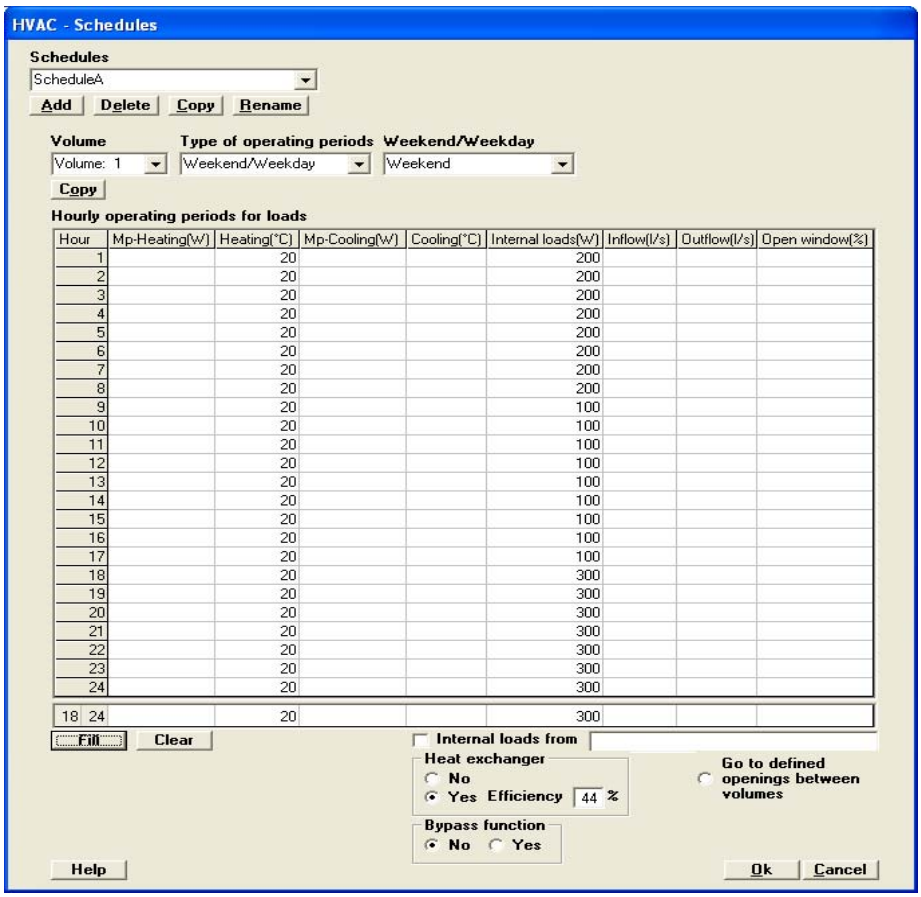
Building elements and building geometry



The building geometry is flexible. At the beginning a new user can have a feeling that the way the 3-D geometry is specified is cumbersome. The user has to give some input data to locate the surfaces in 3-D. This requires some spatial thinking. After a while however this way of working is no obstacle to the user.

Shading screen (sunshade) is a type of building element with optical properties.

Schedules



The number of schedules is limited to 4 and there are three types of schedules: *Weekend/Weekday*, *Daily* and *Monthly*. Each volume (room) is assigned one of these types.

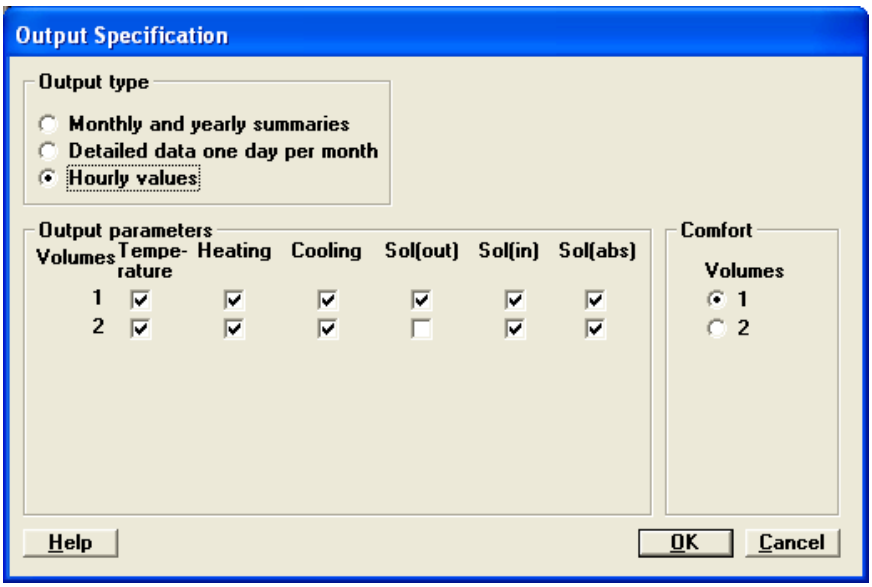
It's among other things possible to specify hourly operating periods for

1) opening percentage of external windows / doors
2) opening percentage of internal doors / windows between volumes (rooms).

- **Simulation**

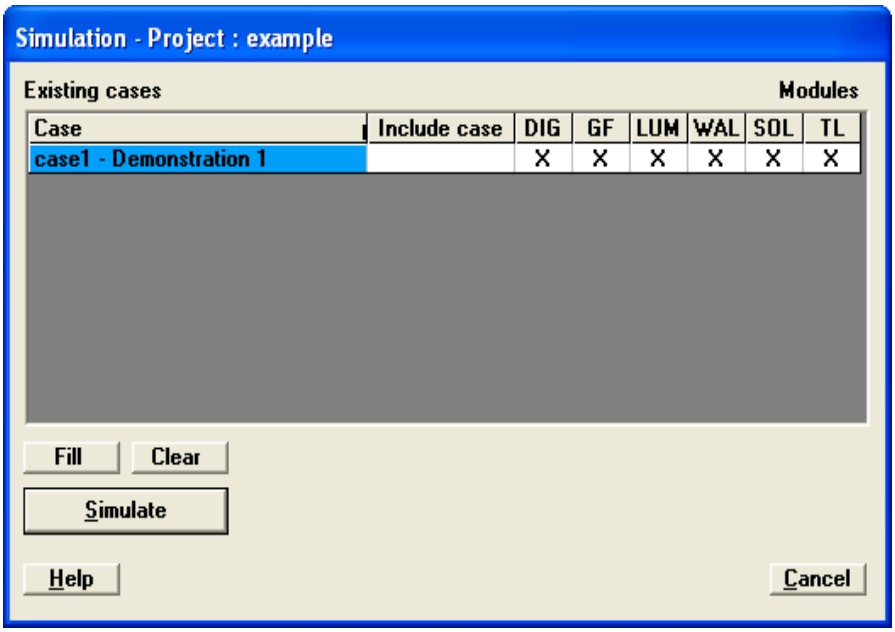
  Simulation includes functions to specify type of results and to start a simulation. Below are some examples of forms.

Output specification



Results can be written on a monthly or hourly basis depending on the user's need. Output parameters can be selected for each volume (room) in the building.

Simulate



The DEROB-LTH program is built up of six different calculation modules. The models are automatically checked. A complete simulation includes all modules. It's however possible for an experienced user to manually select modules to be run. The list 'Existing cases' contains one or more cases (building models) located in the opened design project. One or more of these can be checked to be simulated.

- **Results**

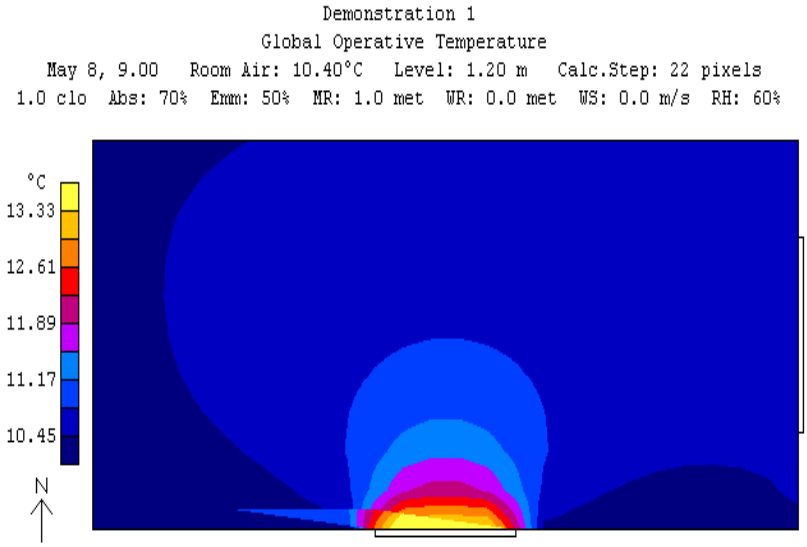
The main function *Results* manages the presentation of simulated results. Results are presented in different ways such as listings, Excel sheets, diagrams and a 3-D picture of the building geometry.

If hourly output is selected then it's possible to run two post-processors for calculation of thermal- and visual comfort in one of the volumes (rooms) in the building. The two post-processors limit the geometry of the studied room. It must be

rectangular with its surfaces parallel to the axes in the right-angled building coordinate system. Only one room can be studied at a time.

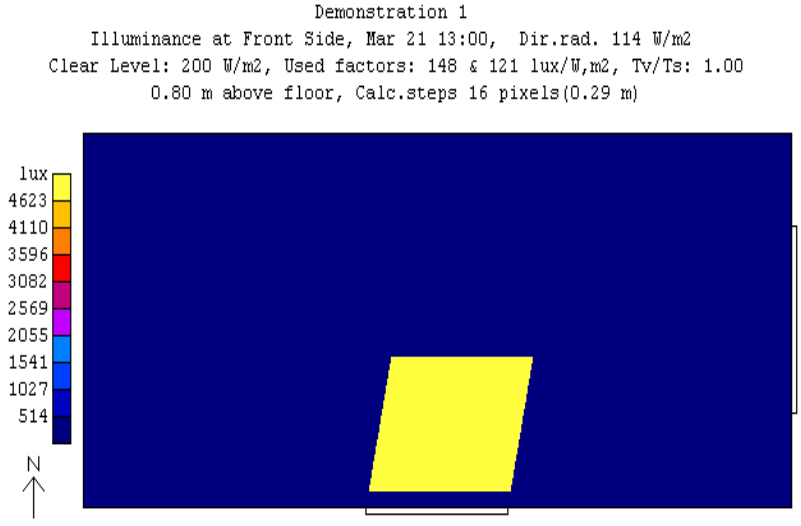
Below are some results from the two post-processors and a 3-D picture of the building model.

Post-processor: Thermal comfort



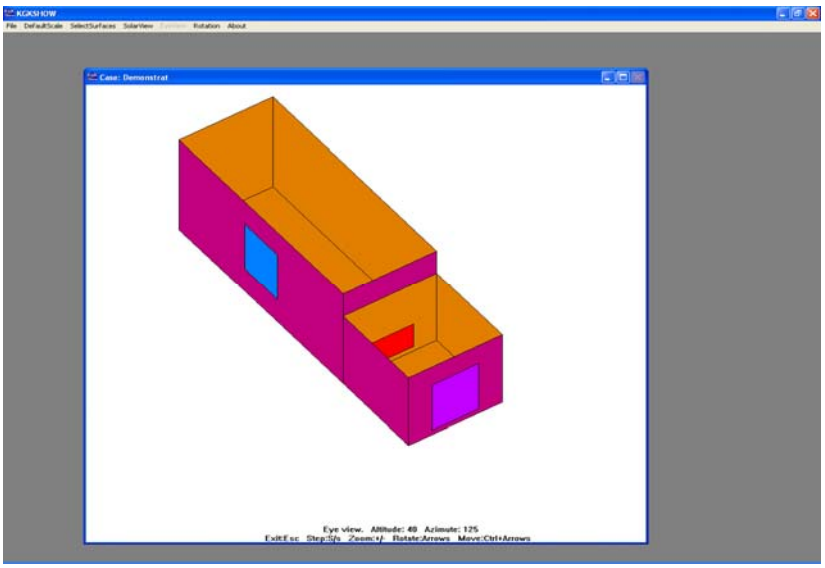
The installation of DEROB-LTH include a technical description of the post-processor for thermal comfort. The name of the document is *CD_Kgkcomf.doc* and is located in the directory *\Document*.

Post-processor: Visual comfort



The theory behind the calculation of indices for visual comfort is described in the report *Energy-Efficient Window Systems* (TABK-01/1022) by Helena Bülow-Hübe, Energy and Building Design.

3-D view



With this function it's possible to rotate the building in all directions and visibly remove arbitrary surfaces to be able to look into the building. The 3-D view function is especially useful in the build-up of the building geometry. Then it's important to check that surfaces are located in the correct position and orientated as intended.

Downloading DEROB-LTH

The program can be downloaded from the adress: *http://www.derob.se/* **.**
DEROB-LTH is not free of charge and a userid and password are needed. If you get in contact with Energy and BuildingDesign it's possible to download a demo version of the program.