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SEMERGY.net – efficient web-based planning of construction and retrofit projects

Buildings are major contributors to greenhouse gases. That's why reduction of energy consumption of buildings is a central goal of the European climate and energy policies. Space heating and cooling are the most energy-intense requirements in buildings, therefore thermal insulation of the building envelope is essential for sustainable reduction of energy consumption and the associated expenses.

A variety of computer tools are available which help to evaluate insulating designs and energy saving measures. However, these tools are either mainly addressing expert users, and require the installation of specific software or focus on energy certification of buildings. None of them offers a comprehensive and automatical computation of construction alternatives, based on actual building products available in the market and price lists associated.

Objectives

At the Information and Software Engineering Group at Vienna University of Technology, Dr. Stefan Fenz pursued the idea to overcome the deficiencies of the current systems. The new tool was not only to address novice and experienced designers alike, but also attract various companies in the construction domain.

The new system was expected to respond to the following questions:

- Which specific construction designs help to achieve a certain energy performance level?
- Which expenses are associated with these interventions, in view of the expected long-term energy savings?
- Do the proposed measures fulfill legal requirements?

Approach

A suitable building data model, complying with the informational requirements of high resolution performance had to be developed - today even shading calculations are covered. Towards this end the department of building physics and building ecology of the institute of architectural sciences at TU Wien contributed its know-how. Development of an algorithm, to arrive at optimal insulation solutions from an immense pool of potential combinations in less than two minutes computation time, was a challenge. A simple and intuitive user interface was required to make the new tool easy to use for everyone.

SEMERGY.net was developed in collaboration between TU Wien and Xylem Technologies, a Vienna based start-up. The project was funded by the Austrian Research Promotion Agency (FFG).

The planning of insulation for retrofit projects as well as new construction can be achieved in five steps only:

Step 1: Basic data: According to the year of construction, typical construction configurations for walls, floors, and roofs are pre-selected. The selected constructions can be manually modified and adjusted. The specified construction system influences the identification of the potential alternatives.
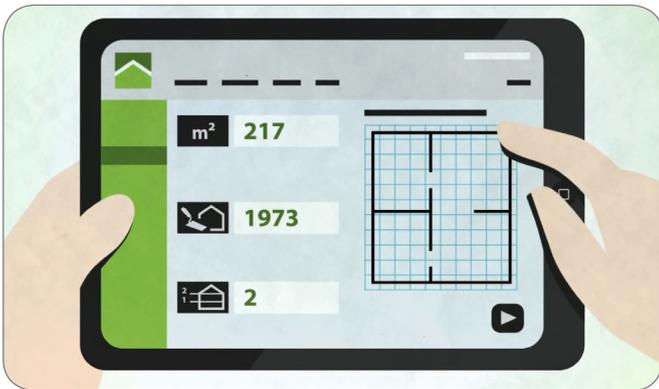
Step 2: Roof type : The exact calculation of the roof surface area and volume is a complex task. SEMERGY automatically calculates a reasonable estimation of these values, based on minimal input information such as roof type and building outline shape.

Step 3: Building geometry, constructions: Building geometry is provided through a simple drawing wizard and/or with the help of pre-defined templates. A zoom-able window, displays the location and facilitates the precise placement of walls, windows and doors.

Step 4: Status Quo: based on the building's geometry, selected constructions and location-dependent climate data, SEMERGY calculates the heating demand of the building, as well as the heating expenses, which depend on the heating system. This provides a basis for the computation of optimal insulation strategies within the limits of the available budget.

Step 5: Optimization: Within the given financial limits, SEMERGY computes and identifies specific well suited construction and retrofit solutions.

Results

SEMERGY.net offers a globally unique system for optimization of the building's thermal envelope. To identify the most promising intervention potentials, SEMERGY takes into account environmental aspects of the considered building products, and verifies them for compatibility with each other and for compliance with existing building codes.

The user is enabled to simulate various construction or retrofit scenarios, and may select the appropriate alternative. For each solution, the rate of return on investment is visualized.

As a result, the user is offered a specific package of measures, which can be refined or readjusted by specialists later on. For German speaking countries (Germany, Austria and Switzerland), SEMERGY includes detailed information on actual building products and price information as well as legal guidelines. For other regions and countries, by demand, a comprehensive system can be prepared and made available within a short time.

Benefits for you

- For the first time, experienced constructors as well as novice planners, can easily arrive at tailored insulation solutions

- The transparency of expenses, insulation possibilities and energy saving potential is significantly enhanced

- The optimized individual insulation solution is selected from a pool of 155,000 building products and around 8 billion combinations possible.

- Applicable building regulations, such as upper limits of U-values of building elements, are automatically taken into consideration.

- A realistic estimation of the rate of return of the initial investments for various alternatives is provided to determine the pay-back time of the insulation project.

- The entire system is available online through internet browsers and requires no software installation.

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