



CommONEnergy



DELIVERABLE 5.2

Online shopping mall assessment tool

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CommONEnergy

Re-conceptualize shopping malls from consumerism to energy conservation



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1. Introduction

The European wholesale and retail sector is the biggest marketplace of Europe, contributing with around 11% of the EU's GDP¹ while triggering additional significant contributions through the supply chain economy related to it. More than 6 million companies are acting in the retail sector while around 30 million Europeans works in commerce². Therefore sustainability of the retail sector may significantly contribute to reaching the long-term environmental and energy goals of the EU. Within the retail sector, shopping malls are of particular interest due to their complexity as physical structures and the social multi-stakeholders decisional processes. Shopping malls offer high energy savings and carbon emissions reduction potential and have an important influence in shopping tendencies and customers' lifestyle. Thus, in order to achieve the environmental and energy goals, it is needed to understand the complexity, size, functional and social context of shopping malls.

CommONEnergy focuses on reducing the energy consumption in EU shopping malls by developing smart renovation strategies and solutions. The big challenge is to provide sustainable options that are also cost-effective with an acceptable payback period for this business sector. In order to gain an understanding of the cost-effectiveness of retrofitting measures in shopping malls in the EU-28 and Norway, an economic assessment tool is under development. Thus, Milestone 8 demonstrates the energy-economic evaluation and replication potential.

The Economic assessment tools aims at showing the costs and benefits of investment in the retrofitting solutions and contribute to the achievements of the environmental and energy goals.

The Shopping Mall economic Assessment tool is a convenient and useful instrument to estimate the energy saving potential and economic benefits of retrofitting of shopping malls. The tool targets managers and owners of the shopping centre and allows entering relevant information about their shopping centre. It can be applied for shopping centres located in the EU and Norway, provides quick information on the energy consumption and options to reduce energy demand, CO₂-emissions, the environmental impact, and provides an economic assessment of the investments. Several retrofitting solutions show areas of improvement potential in the shopping centres, benefits and potential energy savings. However, the tool does not replace a detailed analysis of the building by an expert.

¹ http://ec.europa.eu/commission_2010-2014/president/news/archives/2014/03/pdf/services_en.pdf

² http://ec.europa.eu/environment/industry/retail/pdf/issue_paper_1/Energy_Efficiency_en.pdf



2. Aim and objectives of the tool

The aim of the Shopping Mall economic Assessment tool is to investigate the feasibility of shopping malls retrofitting under different surrounding conditions and different climatic zones throughout Europe. The Shopping Mall economic Assessment tool is a convenient and useful instrument to estimate the energy saving potential and economic benefits of retrofitting of shopping malls. The tool targets managers and owners of the shopping centre and allows entering relevant information about their shopping centre giving back potential energy and economic performances, for supporting retrofitting early stage decision process.

The main objectives of the tool are as follows:

- Provides information on the energy consumption of the shopping centers and options to reduce energy demand, CO₂-emissions and economic assessment of the investments
- Gives information on the retrofit solutions developed by the project industry partners and their implementation
- Works as online-tool with possibility to get the results as pdf document
- Can be applied for shopping centers located on one of the EU-28+Norway
- Targets construction managers, owners of the shopping center

3. Methodology

The tool was created following the main steps:

- Conceptualization of the Shopping Mall economic Assessment tool
- Literature review to collect input parameters for techno-economic evaluation, and defined alternative investment strategies.
- Creation of the User interface of the tool
- Implementation of the technical and financial models
- Evaluation of the Results

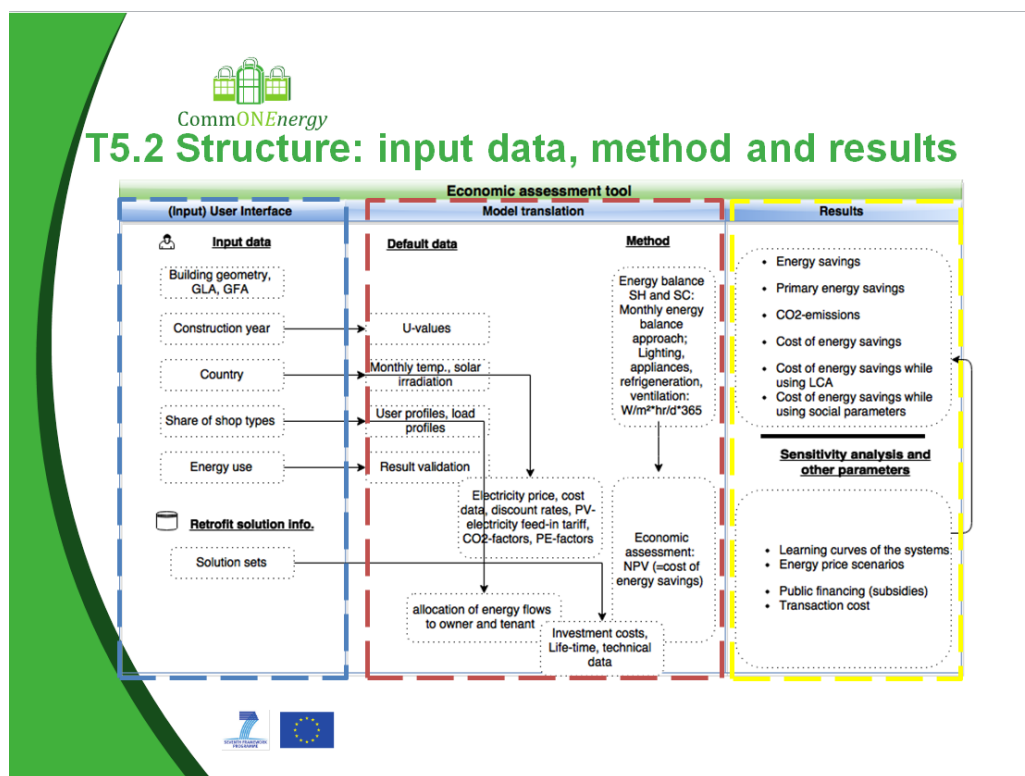


Figure 1 Structure of the Economic Assessment tool

The model can be applied for a specific shopping center building, which is described by the user. Building description covers technical building parameters such as geometry, construction period, HVAC parameters and location. The calculation of the economic feasibility of the solutions is based on disaggregated level of data. The data is partly provided by the user (directly in the tool) and automatically provided by the model from the model database. The user can adapt data in the second part if he/she has more detailed information about the building.

The model consists of the user interface (including database) and method modules. The user interface targets user to describe the building specific data (mandatory input and drop-down menu) and to evaluate model outcomes on energy and financial performance of retrofit packages. The method module is an intern part of the model, which contains database on the input parameters and method part with two main calculation modules. Moreover, the model provides an extra module,

which enables user to do a sensitivity analysis and financial module, which shows the energy- and cost-flows between owner and tenant.

The output field gives the outputs on energy and financial performance of the retrofit packages. The outputs will be presented e.g. in the bar charts and table sheets. The analysis will be made and present for all retrofit solutions (10-20 solutions) which will be compared and ranked according to energy and financial performances.

Techno-economic calculation is performed by using building simulation tool Invert-EE/Lab. Energy demand for space heating, cooling and lighting is calculated using monthly-based energy balance approach according to EN13790. Being the tool targeted on early stage of the decision process on possible shopping centre renovation, the accuracy of a monthly steady state calculation (also considered the very fast elaboration timing) was considered as acceptable.

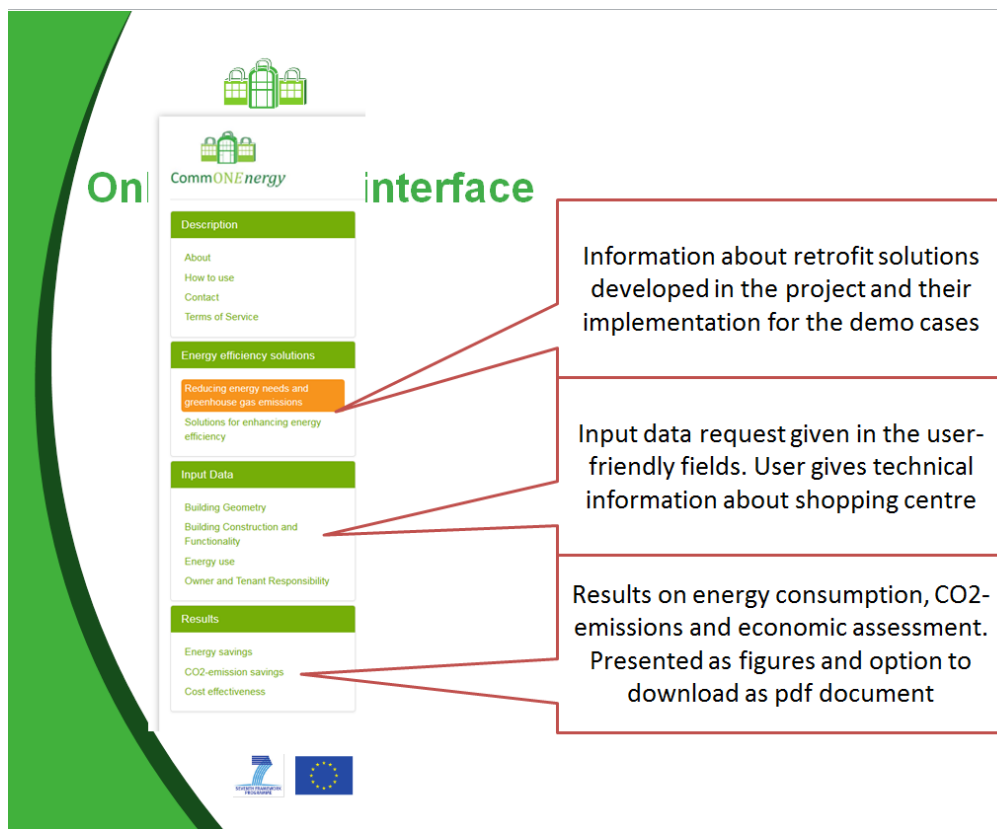


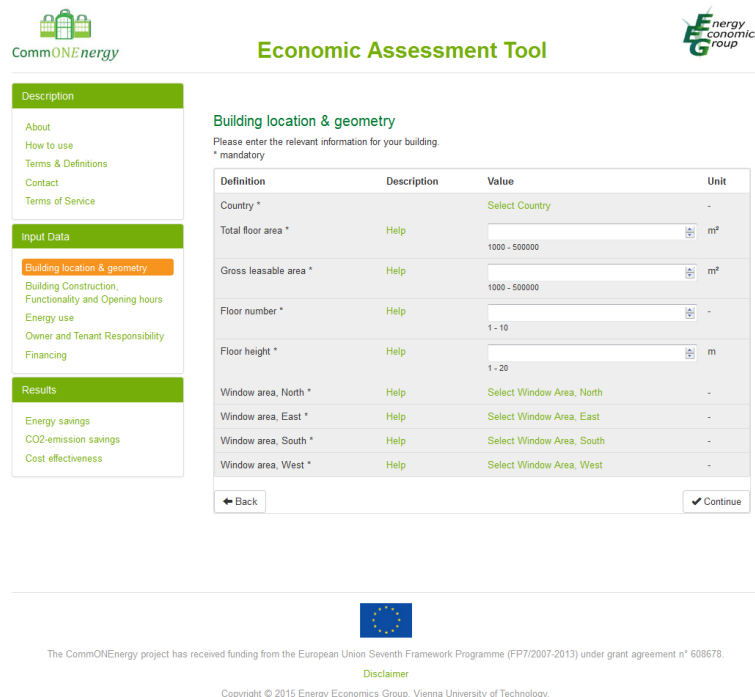
Figure 2 User interface of the Economic Assessment Tool

Model provides three types of results, energy savings of the retrofitting solutions, CO₂-emission savings and cost-effectiveness.

4. Using the tool

The user interface is easy to understand and offers many country-specific default data, which may be altered by the user. The logic is straight-forward and follows this procedure:

- Under the section "Input Data", you will find five different forms, in which you can insert information about your mall:
 1. Building location & geometry,
 2. Building Construction, Functionality and Opening hours
 3. Energy use,
 4. Owner and Tenant Responsibility
 5. Financing
- Navigate through the five different sheets and insert the requested information. Please note that fields marked with an asterisk are mandatory to complete.
- Some of the fields are filled with default values when country and/or construction periods have been chosen. You can change values if needed, however if you change country or construction/renovation periods afterwards, your changes will be overwritten again by that default values.



Economic Assessment Tool

Building location & geometry

Please enter the relevant information for your building.
* mandatory

Definition	Description	Value	Unit
Country *		Select Country	-
Total floor area *	Help	1000 - 500000	m ²
Gross leasable area *	Help	1000 - 500000	m ²
Floor number *	Help	1 - 10	-
Floor height *	Help	1 - 20	m
Window area, North *	Help	Select Window Area, North	-
Window area, East *	Help	Select Window Area, East	-
Window area, South *	Help	Select Window Area, South	-
Window area, West *	Help	Select Window Area, West	-

← Back Continue ✓

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Figure 3 Start screen of the Economic Assessment Tool
(http://eeg.tuwien.ac.at/commonenergy_economic_assessment_tool)

- Based on the entered information, the Shopping Mall economic Assessment tool calculates key performance indicators and suggests suitable actions to reduce energy consumption and costs.
- To get a permanent link to your specific results, click on the **permalink** button on top of the 'results'-pages. You can share the results via email by clicking on the respective button.
- For comparing the impact of various settings on the results (**sensitivity analysis**), run the model with the initial data and **save the permalink**, which is available for 3 months.



5. Summary

The Shopping Mall economic Assessment tool is a convenient and useful instrument to estimate the energy saving potential and economic benefits of retrofitting of shopping malls. The tool targets **managers and owners of the shopping centre** and allows entering relevant information about their shopping centre. It can be applied for shopping centres located in the EU and Norway, and provides **quick information** on the energy consumption and options to reduce **energy demand, CO₂-emissions**, the environmental impact and provides an **economic assessment** of the investments. Several retrofitting solutions show areas of improvement potential in the shopping centres, benefits and potential energy savings. However, the tool does not replace a detailed analysis of the building by an expert.

Renovation solutions: Heating

Total annual energy needs for space heating

This graph illustrates the annual **energy need** reduction for space heating. Every bar marks different **retrofit solutions** and energy need reduction compared to the status quo

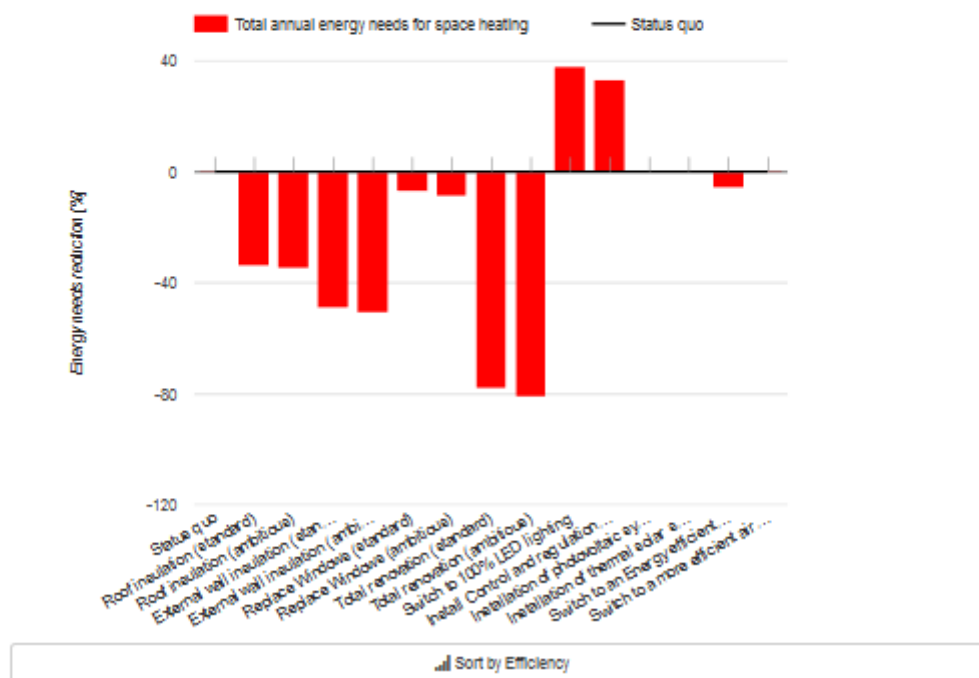


Figure 4 Model results showing energy need reduction by implementing different retrofitting solution sets

The Shopping Mall economic Assessment tool corresponds to the fulfillment of deliverable 5.2 and milestone 8 of the project. It is available via the CommONEnergy website and the following direct link: http://eeg.tuwien.ac.at/commonenergy_economic_assessment_tool