IEA ECBCS Annex 46

Holistic Assessment Toolkit on Energy Efficient Retrofit Measures for Government Buildings (EnERGo)

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1. ABSTRACT

The Annex 46, within the IEA ECBCS programme, is meant to influence the decision making process in the retrofit of public and governmental buildings that determines the use of energy-saving measures in building retrofits. This decision making process must improve, if it is to successfully cope with the challenges of increasing energy costs and climate change, and if it is to avoid "locking in" long-term commitment to energy inefficiencies by adopting sub-optimal renovations. Consequently, the target group consists of all actors involved in this decision making process, specifically executive decision makers and energy managers of public and government buildings, performance contractors and designers. The purpose of the IT-Toolkit EnERGo, is to support these different user groups, and facilitate communication between them.

The IT-Toolkit is an electronic tool assisting in the design of renovations/retrofits focussing on energy savings from the government and public buildings. It consists of a collection of different tools and documents which provide potential lists of solutions to specific energy related problems. It contains descriptions of exemplary retrofit/renovation projects and provides a wide and varied selection of energy conservation measures. The tools contained in the IT-Toolkit allow the user to compare an existing building to the national average or to calculate potential energy savings and costs for a given building.

KEYWORDS

Energy efficiency, assesment tool, retrofitting, public and governmental buildings

2. INTRODUCTION

To successfully cope with increasing energy costs and climate change the energy efficiency of public buildings has to be improved. There is a wide variety of possible renovations/retrofits for each given public building. For every possible renovation/retrofit measure there is an installation cost and a payback time which can vary greatly depending on the building type and the climatic zone the building is located in. The combined effect of different renovations/retrofits together can also be far less or more than one of them alone. Once a decision on a renovation/retrofit has been made it often means a long term commitment to this type of renovation/retrofit. So it is very important that suboptimal renovations/retrofits are avoided at all cost.

If limited funding is a problem an energy performance contract (EPC) might be the solution. In an EPC a loan is secured to install energy conservation measures at a site. These conservation measures generate energy-related cost savings, which are then used to pay financing costs on the loan and to fund services such as operations and maintenance (O&M) and measurement and verification (M&V).

The IT-Toolkit provides general guidelines for the whole decision making process as well as information on EPC's and a calculation tool which will allow detailed calculations of planned renovations/retrofit measures. Additionally detailed information on different kinds of energy conservation measures and already existing case studies is also available. A special attention is given to ventilation approaches.

3. THE IT-TOOLKIT

The IT-Toolkit, presented in figure 1, consists of 11 different sections and an additional information section which contains contact information of all the persons involved in the development of the IT-Toolkit.

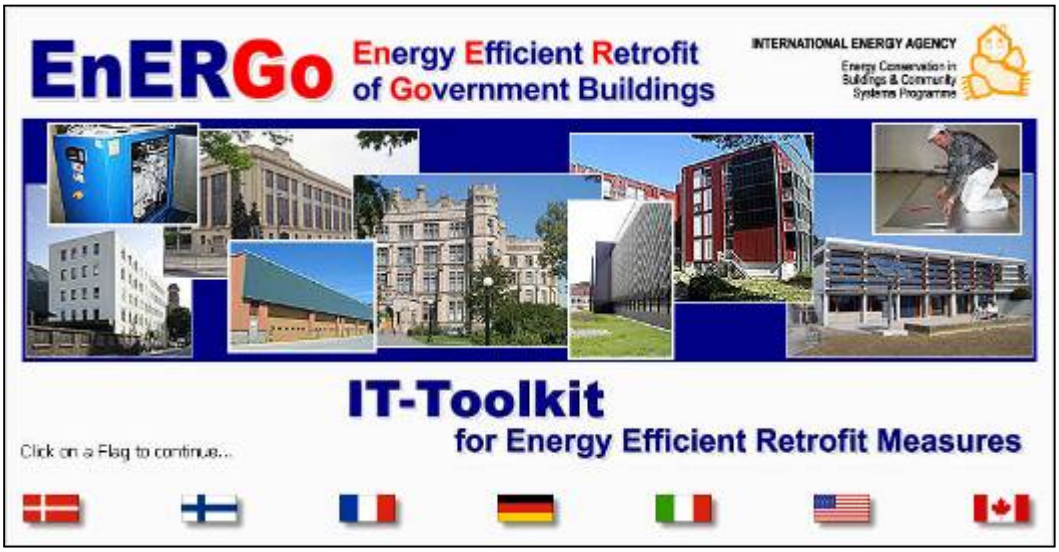

Figure 1: Start screen of the Annex 46 IT-Toolkit

3.1 Performance Rating

The Performance Rating allows the comparison of a given buildings consumption to the national average. Consumption data of heat, electrical and water consumption is provided for different types of buildings, although data on water consumption is not available for every country. Also not every country has provided data on every type of building. In total there is data available for 12 different countries. This data can be displayed in either SI- or US-units. Figure 2 shows the performance rating of the IT-Toolkit.

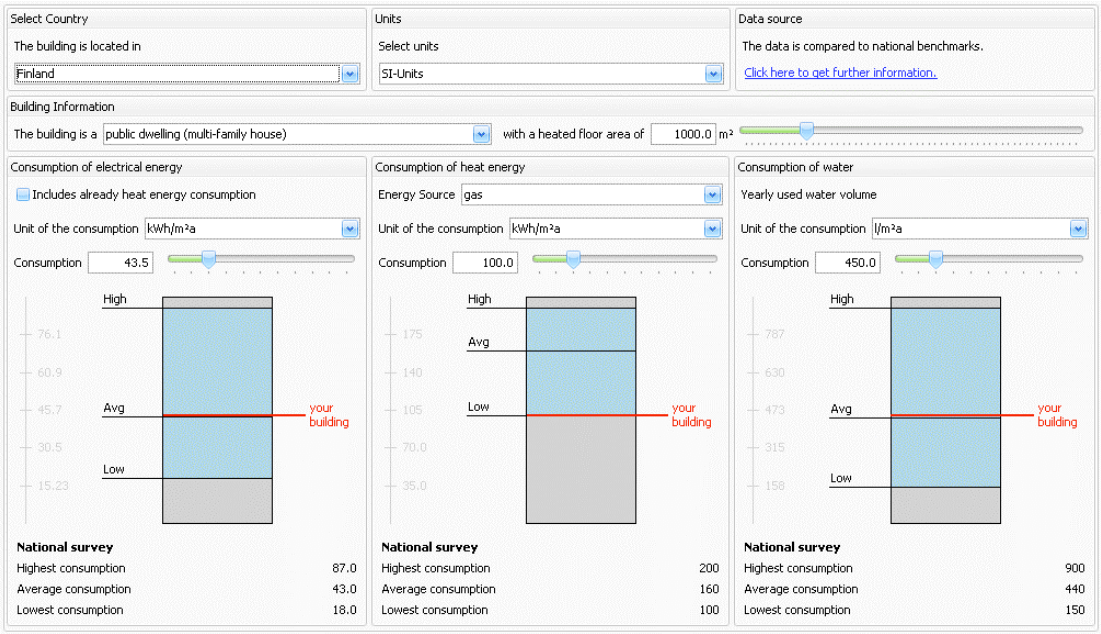

Figure 2: Performance Rating section of the IT-Toolkit

3.2 KULU – Energy Consumption Follow-Up

KULU is a small Finnish tool to monitor and evaluate energy consumption. It is shown in Figure 3.

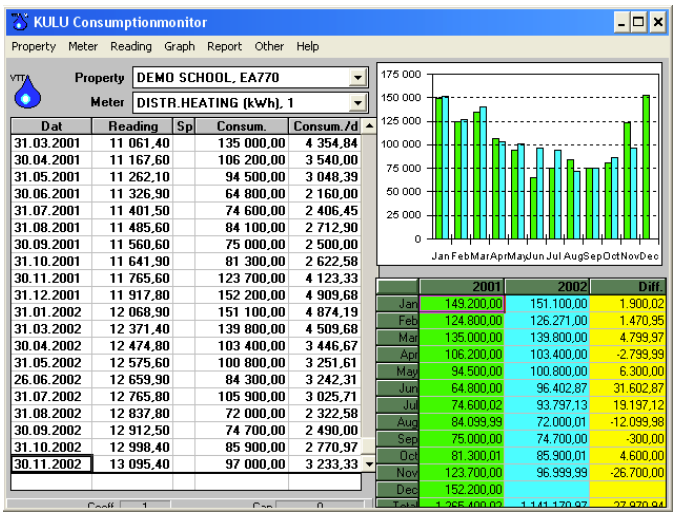

Figure 3: KULU - Energy Consumption Follow-Up

3.3 Electronic Building Inspection Protocol

The electronic building inspection protocol is a tool used for data collection during a building inspection. It also offers advice on how to correctly perform a building inspection. Data collected during the building inspection might then later on be used in the calculation tool of the IT-Toolkit.

3.4 Operation and Maintenance Checklist

The operation and maintenance checklist is a guide to provide the user with useful information about operation and maintenance (O&M) management, technologies, energy efficiency and cost-reduction approaches. It contains information on why O&M is important and the potential for savings from good O&M. Furthermore it defines the major O&M program types and provides guidance on the structure of a good O&M. It also provides information on state-of-the-art maintenance technologies and procedures for key equipment and identifies information sources and contacts to in getting the job done.

3.5 Energy Audit Protocol

An energy audit is an inspection, survey, and analysis of energy flows in a building, process, or system with the objective of understanding the energy dynamics of the system under study. Typically an energy audit is conducted to seek opportunities to reduce the amount of energy input into the system without negatively affecting the output. When the object of study is an occupied building, reducing energy consumption while maintaining or improving human comfort, health, and safety is of primary importance. Beyond simply identifying the sources of energy use, an energy audit seeks to prioritize the energy uses from the greatest to least cost-effective opportunities for energy savings. During recent years, substituting fossil fuels for renewable energies has become an important issue, and during an audit this kind of system change should be investigated as well. Instead of *energy audit*, a phrase generally used in Europe, *energy assessment* may be used. In the energy audit protocol both terms are used to describe activities aiming at recognition of energy use inefficiencies and waste. They allow identification of energy-saving potential in buildings and energy consuming systems and provide the basis for development of energy and other operating cost reduction measures for building retrofits without adversely affecting indoor air quality or the well-being, morale, safety, or productivity of the buildings' occupants. The protocol is based on an analysis of information gathered from literature, training materials, documented and undocumented practical experiences of contributors, and successful showcase energy assessments at U.S. Army facilities. It addresses both the technical and nontechnical organizational capabilities required for successful assessments.

3.6 Retrofit Case Studies

As an extention of the Energy Concept Adviser (ECA) developed in IEA ECBCS Annex 36 and extended in the EU FP 6 BRITA in PuBs project, more than 50 different already existing case studies are included in the IT-Toolkit. The case studies contain information on the site of the building, the retrofit concept, the retrofit cost, energy savings, lessons learned and some general information on the retrofitted building. To better find a suitable case study they can be selected from a selection matrix which shows the type of retrofit measures that were used in the case study. Figure 4 shows the selection matrix.

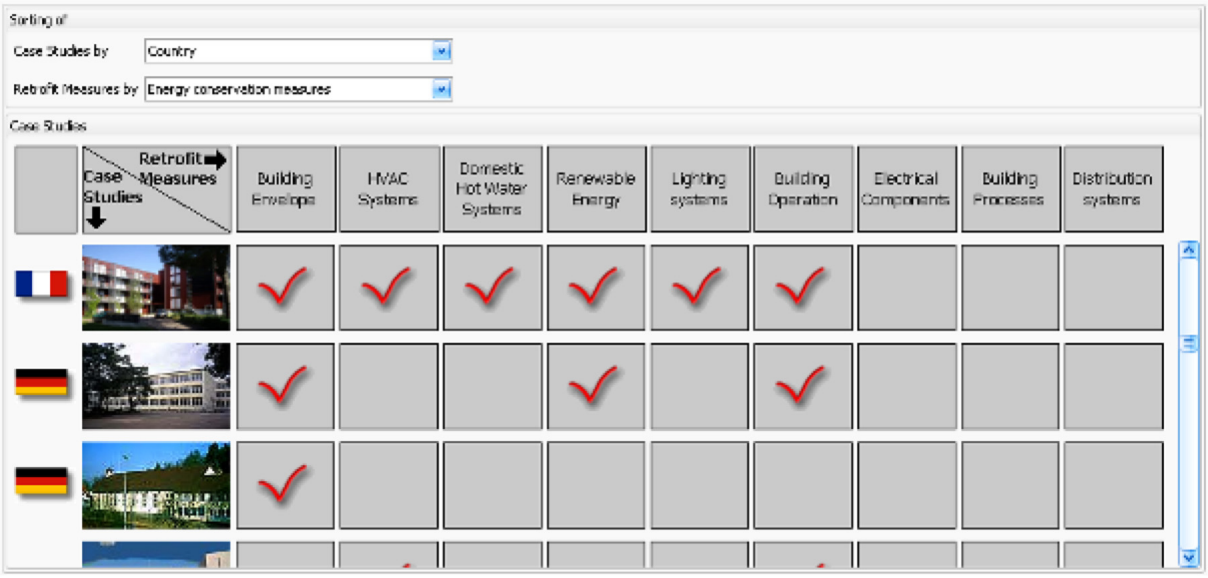

Figure 4: Retrofit Case Studies – Selection Matrix

3.7 Energy Conservation Measures

A database of different energy conservation measures, based on the work of IEA ECBCS Annex 11 and extended in this Annex, is also included in the IT-Toolkit. Different filters allow a fast selection of those energy conservation measures which might be applicable to the building in question. For each energy conservation measure a short description as well as a more detailed PDF-report is available. Figure 5 shows the energy conservation measures section of the IT-Toolkit.

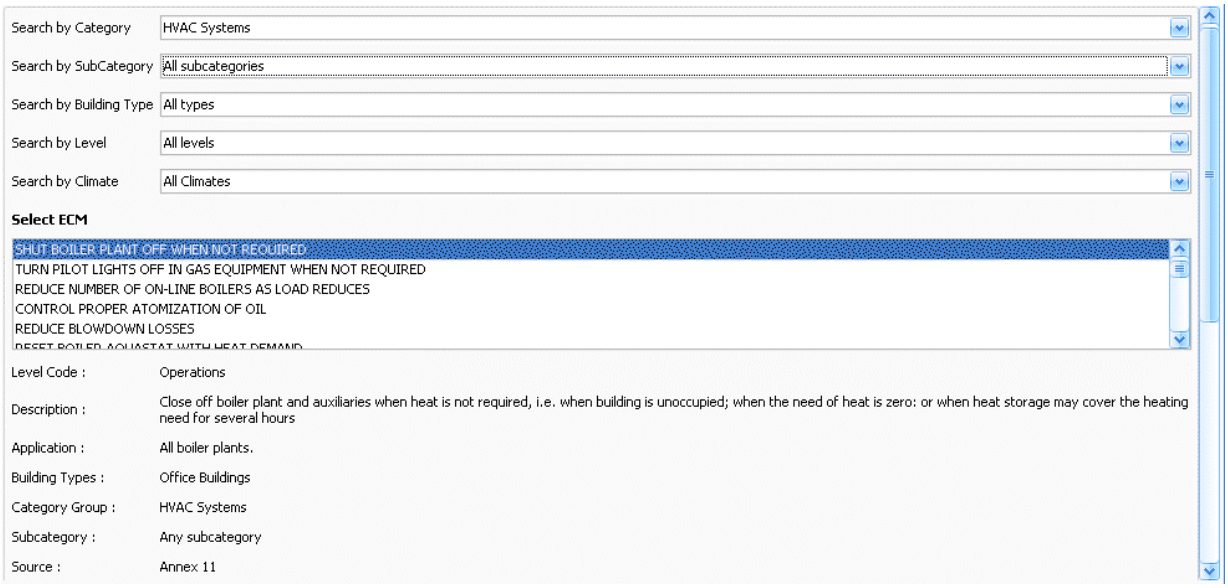

Figure 5: Energy Conservation Measures

3.8 Energy and Efficiency Assessment of Retrofit Measures

In this section a detailed calculation on the impact of different measures to the energy demand of an inspected building can be performed. The calculation tool itself is a special (freeware) version of the commercial German energy assesment tool IBP:18599 adapted for international usage. The tool is based on international standards like ISO 13790 and EN 15603.

3.9 Financial Spreadsheet for Energy Performance Contracts

In an Energy Performance Contract (EPC), a loan is secured to install energy conservation measures at a site. The conservation measures generate energy and energy-related cost savings, which are used to pay financing costs on the loan, and to fund services such as operations and maintenance (O&M) and measurement and verification (M&V). The term of an ESPC is generally thought to begin once the conservation measures are installed and begin delivering savings, and to end once the financing is paid off. A financial spreadsheet for energy performance contracts implements a simple financial model for an energy performance contract. It requires a few simple inputs from which it determines the term of the project in years and the total amount of the payments that are made for interest costs and to support performance period services.

3.10 ESCO Case Studies

Similar to the “Retrofit Case Studies” section above this section provides a bunch of case studies to view. In this case the case studies are for projects performed by an energy service company (ESCO). An ESCO is a professional business providing a broad range of comprehensive energy solutions including designs and implementation of energy savings projects, energy conservation, energy infrastructure outsourcing, power generation and energy supply, and risk management. The ESCO performs an in-depth analysis of the property, designs an energy efficient solution, installs the required elements, and maintains the system to ensure energy savings during the payback period. The savings in energy costs is often used to pay back the capital investment of the project over a five- to twenty-year period, or reinvested into the building to allow for capital upgrades that may otherwise be unfeasible. If the project does not provide returns on the investment, the ESCO is often responsible to pay the difference.

4. CONCLUSION

In conclusion the IT-Toolkit will be a helpful asset in working out energy saving potentials within existing public and governmental buildings during the development of retrofit/renovation projects. The decision-makers will be provided with reliable information on conventional and innovative strategies and technologies and thereby gain improved planning reliability.The development of the toolkit is funded within an international task sharing IEA project with support of the German Ministry of Economy and Technology (BMWi).