

# “EnergyProfile.xls”

## *Excel Tool for strategic portfolio energy assessment*

### – Description –

## 1 Overview

The Excel tool “EnergyProfile.xls” was developed in order to enable the assessment of the energy performance of a set of buildings in an easy way. The target groups are mainly consultants or staff members of housing companies. The software consists of the following modules:

- a user oriented interface for the intake of the building data, the display of results and for saving and loading of data sets;
- a calculation module for the determination of the annual demand of delivered energy and primary energy by using typological data for the thermal envelope area, for the U-values and for the system performance;
- a database where the data input and calculation output is stored

## 2 Methodical Approach

One starting point for the making of the tool was the „Simplified Energy Profile Procedure“ („Kurzverfahren Energieprofil“<sup>1</sup>) developed by IWU in the last years. The method consists of the following items:

- procedure for estimation of the building envelope area (“area estimation procedure”);
- standard U-values depending of building type and age (“U-value catalogue”);
- standard performance values of the supply system (“system efficiency catalogue”).

The scientific report was published in 2005 [IWU 2005]. A number of applications of the method have been realised since then in Germany. The method is materialised in form of an MS Excel Tool which is available for free download in the internet <sup>2</sup>.

<sup>1</sup> see research report [http://www.iwu.de/datei/iwu-kurzverfahren\\_energieprofil-endbericht.pdf](http://www.iwu.de/datei/iwu-kurzverfahren_energieprofil-endbericht.pdf) and attached English abstract

<sup>2</sup> [http://www.iwu.de/datei/iwu-kurzverfahren\\_energieprofil.zip](http://www.iwu.de/datei/iwu-kurzverfahren_energieprofil.zip) in German language

In the frame of the project the existing Excel tools for both procedures were linked and adapted to the needs of the energy related portfolio analysis. Furthermore data transfer functions were integrated which enable saving and re-loading of input data, loading of template data for measures and costs, saving of the results of energy and economy analyses as well as batch job calculation of a set of buildings.

### **3 Calculation performance**

#### **Energy performance assessment**

- Calculation of energy demand for heating and domestic hot water (based on the procedure "Kurzverfahren Energieprofil"; extended calculation of supply systems which enables a combination of different systems)
- Simple additional procedure for considering mechanical ventilation with or without heat recovery;
- Additional calculation procedure: Energy balance calculation according to the German Energy Saving ordinance EnEV 2007 (direct input of thermal envelope areas, standard U-values, system efficiency values, boundary conditions for calculation); output of the data necessary for the making of energy performance certificates.

#### **Energy saving measures and costs**

- Additional procedure for the application of predefined energy saving measures (e.g. additional insulation with distinct thermal conductivity, installation of a condensing boiler, of a solar DHW system); single measures or combination of measures can be applied.
- Assignment of typical costs to the refurbishment measures; possibility of editing and saving different sets of costs data.
- Sets of measures can be defined as standard refurbishment strategies. The sets can be edited or expanded by the expert user.

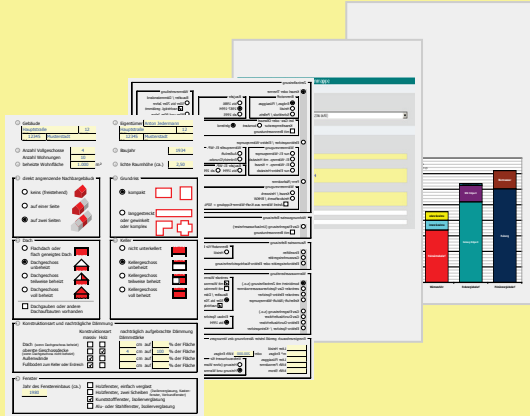
#### **Economical assessment**

- Tool I (criterion: Cent / kWh saved energy): This method compares the additional costs of the energy saving measures with the saving of heating costs (ratio of annual costs of the energy saving measures and the kWh of saved energy per year). A refurbishment investment is efficient if the price for the unit of saved energy is lower than the expected price for the energy to be paid at each future time period.
- Tool II (criterion: net present value): The net present value of cash outflow (the additional costs of the energy saving measures) is subtracted from the present value of cash inflow (mainly the additional rent). A positive NPV means that the investment should be made (is profitable). Different rent levels can be considered by manual input.

**standard application:**

- input of building data (technical and economical)
- selection of predefined measures
- visualisation of results
- control of data transfer (save, load)

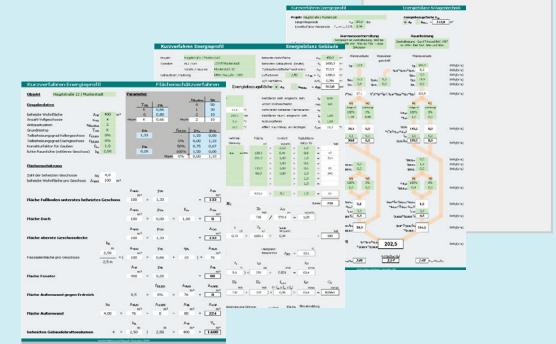
**user-oriented interface**  
sheets: envelope, system, economics, selection of variants & data management



**control:**  
calculation or recalculation of one building or a selected set of buildings

**energy balance calculation core (Kurzverfahren Energieprofil)**

simplified energy profile procedure:  
sheets for envelope estimation, U-value and system efficiency value tables, calculation of building and heating system



input data for  
actual state and  
selected variants

actual state and  
variants of the  
building (input and  
results)

energy  
input data

energy balance  
calculation results

**expert application:**

editing, copying,  
deleting of data sets  
directly in the Excel  
data sheets  
(if required by user)

- building
- measures

**building data sheets**

(datasets in rows, one column for each variable) sheets: building data, measures / predefined variants

IS_Datensatz	Datum	Geb_Str	Geb_Hnr	Geb_PLZ	Geb_Ort
AD01	22.11.2006	17:02	Neuer Weg	13 VH	64625 Bensheim
AD01 / EnEV	22.11.2006	17:02	Neuer Weg	13 VH	64625 Bensheim
AD01 / NEH	22.11.2006	17:38	Neuer Weg	13 VH	64625 Bensheim
AD02 / NEH / Innendämmung	22.11.2006	13:16	Neuer Weg	13 VH	64625 Bensheim
AD02	22.11.2006	17:42	Neuer Weg	13 VH	64625 Bensheim
AD02 / EnEV	22.11.2006	17:42	Neuer Weg	13 VH	64625 Bensheim
AD02 / NEH	22.11.2006	17:44	Neuer Weg	13 VH	64625 Bensheim
AD02 / NEH / Innendämmung	22.11.2006	17:45	Neuer Weg	13 VH	64625 Bensheim
AD02 / Ur-Zustand	22.11.2006	13:18	Neuer Weg	13 VH	64625 Bensheim
AD02 / Ur-Zustand	22.11.2006	17:45	Neuer Weg	13 VH	64625 Bensheim
extem1	22.11.2006	22:16	Teststraße A	1	11111 Teststadt
extem1 / EnEV	22.11.2006	21:49	Teststraße A	1	11111 Teststadt
extem1 / NEH	22.11.2006	21:50	Teststraße A	1	11111 Teststadt
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extem2 / EnEV	22.11.2006	21:51	Hauptstraße	12	12345 Musterstadt
extem2 / NEH	22.11.2006	22:45	Hauptstraße	12	12345 Musterstadt
extem3	22.11.2006	22:45	Hauptstraße	12	12345 Musterstadt
extem3 / EnEV	22.11.2006	22:46	Hauptstraße	12	12345 Musterstadt
extem3 / NEH	22.11.2006	22:52	Hauptstraße	12	12345 Musterstadt
extem4	22.11.2006	22:52	Hauptstraße	12	12345 Musterstadt
extem4 / EnEV	22.11.2006	22:52	Hauptstraße	12	12345 Musterstadt
extem4 / NEH	22.11.2006	22:53	Hauptstraße	12	12345 Musterstadt
extem4 / NEH / Innendämmung	22.11.2006	22:53	Hauptstraße	12	12345 Musterstadt
extem4 / Ur-Zustand	22.11.2006	15:34	Alter Weg	13 VH	64625 Bensheim
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xxa001 / EnEV	01.12.2006	12:10	Alter Weg	13 VH	64625 Bensheim
xxa001 / NEH	01.12.2006	12:11	Alter Weg	13 VH	64625 Bensheim
xxa001 / NEH / Innendämmung	01.12.2006	12:12	Alter Weg	13 VH	64625 Bensheim
xxa001 / Ur-Zustand	01.12.2006	12:13	Alter Weg	13 VH	64625 Bensheim
xxa001 / NEH / Passivhaute	01.12.2006	15:35	Alter Weg	13 VH	64625 Bensheim

**economical calculation**

formulas based on IWU calculation tool  
sheets for estimation of costs, energy saving  
and economical assessment

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AD02 / Ur-Zustand	22.11.2006	13:18	Neuer Weg	13 VH	64625 Bensheim
AD02 / Ur-Zustand	22.11.2006	17:45	Neuer Weg	13 VH	64625 Bensheim
extem1	22.11.2006	22:16	Teststraße A	1	11111 Teststadt
extem1 / EnEV	22.11.2006	21:49	Teststraße A	1	11111 Teststadt
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extem4 / NEH	22.11.2006	22:53	Hauptstraße	12	12345 Musterstadt
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xxa001 / NEH / Passivhaute	01.12.2006	15:35	Alter Weg	13 VH	64625 Bensheim

## 4 Modules

The tool consist of a MS Excel workbook with a user-friendly interface, calculation sheets, data sheets and a VBA code for data transfer.

### **User oriented interface (workbook “EnergyProfile.xls”)**

Standard users work with an interface that allows for:

- data intake (technical and economical data of the building);
- definition of variants with improved insulation and system features;
- selection of predefined measures or sets of measures (insulation measures, modernisation of supply system)
- visualisation of results by standard charts and a result window
- control of data transfer (save, load) for single buildings and for a selected set of buildings (batch job).

In the standard user mode the data and calculation sheets are hidden. If necessary the user can unhide the required sheets. This facilitates the comprehension of the calculation, and the control of input and output data.

### **Building data sheets (workbook “EProf-Data.xls”)**

The input and result data are saved in structured sheets. The datasets are arranged in rows. The first row of the sheet comprises the data field names, the first column the data set names. There are data sheets for the building and system input data, for the measures and costs in form of predefined variants (with one or several measures) and for the output data. Editing, copying, deleting of data sets is possible directly in the Excel data sheets.

### **Pre-defined data sheets for measures and methods (workbook “EProf-Templates.xls”)**

Here the expert user can define templates for measures, costs, data intake types and energy balance methods. The templates are then available for the standard user.

### **Energy balance calculation (workbook “EProf-Calc.xls”)**

The energy balance calculation is based on the existing simplified energy profile procedure and comprises the following sheets:

- envelope estimation,
- U-value tables
- system efficiency value tables
- calculation of the building heat demand
- calculation of the delivered energy and primary energy demand of the supply system

### **Economical calculation (workbook “EProf-Economy.xls”)**

The formulas of the economical calculation are based on a workbook developed earlier by IWU. There are two main calculation sheets (see above):

- Tool I: calculation of the costs per saved kWh energy
- Tool II: determination of the net present value: capitalised value of additional rent less capitalised value of additional costs of energy saving measures

## **5 Application**

### **Standard application**

- intake of the data of a single building
- assessment of the energy performance of the actual state of the building
- selection of single measures or a set of measures and calculation of the energy saving
- economical assessment of the selected measures
- saving of intake and result data

### **Experts application (additional features)**

- unhiding of data sheets in order to control or edit datasets
- unhiding of calculation in order to retrace the calculation steps
- modification and creating of measure data sets; definition of different refurbishment strategies
- calculation of the impact of refurbishment strategies by applying a set of measures to a set of buildings
- copying of input and output data sheets for further evaluation

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Institut Wohnen und Umwelt

Tobias Loga

### **References**

[IWU 2005]

Loga, Tobias; Diefenbach, Nikolaus; Knissel, Jens; Born, Rolf: Kurzverfahren Energieprofil. Ein vereinfachtes, statistisch abgesichertes Verfahren zur Erhebung von Gebäudedaten für die energetische Bewertung von Gebäuden; Bau-forschung für die Praxis / Band 72; Fraunhofer IRB-Verlag, Stuttgart 2005