With the support of Intelligent Energy Europe

ESAM project
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Deliverable 12/15: "Book of recommendations to create and implement an ESAM tool"

(Germany)

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1. Initial state of strategic issues

Energy Strategic Asset Management (ESAM)

The ESAM project is focused on the development and the implementation of strategic asset management (SAM) methods and tools for SHO's, which will include an energy dimension (ESAM). It is based on the assumption that SHO's face similar problems in different contexts, and that some solutions can be developed in common, at least to a certain extent. Before starting with the integration of energy in SAM it is necessary to define what SAM is and how it works in each SHO.

The energy performance of buildings can be integrated in strategic asset management in different ways which will depend on the situations and objectives of each SHO:

- It can be integrated at all steps of the SAM process: that is the **"ESAM in SAM"** case. The precondition for this case is that a SAM already exists (or will be implemented soon).
- It can be used on its own to define an investment plan for the energy retrofitting of the housing stock. That is the **"Energy alone"** case. This case is suitable for (smaller) companies with no existing SAM system.
- Energy can also be taken into account only in the implementation phase of SAM, through the use of specific tools to maximize the energy efficiency of the refurbishments for example. That is the **"Energy after SAM"** case. This case is suitable if a running SAM system is not to be changed.

Based on the book of specifications, methodologies and information systems have been developed for the integration of energy assessment and calculation tools into the strategic asset management system of social housing operators.
Energy diagnosis tools for the housing stock have been implemented to identify cost and energy-efficient measures for real estate investment in order to define a global strategy for upgrading the energy performance of the housing stock.
In-house development of tools, which define energy retrofitting potentials of each estate by combining them with a detailed database containing all building specific information, has been put into operation.
The interconnectivity of the tools, enables the housing operators to rate each individual estate, in order to define adequate objectives and strategies and to decide what type of solution should be implemented on a specific building or estate, taking into account its social, market and financial situation.

Nassauische Heimstätte has most of its dwellings at Rhein-Main Area. Because of the strong demand on the housing market, the company does not actually need to improve competitiveness, for example by the ESAM system.

Our strategy and participation at ESAM Project is future foresight. Caused by the increasing energy costs, the running costs will exert more and more influence on the total price (= Warmmiete) of our product.
Resulting from that, we are sure that there has to be a paradigm shift.
Up to now, the mainstream philosophy in German housing industry defines running costs as an “external factor”, which is neither under the responsibility nor under influence of the SHO.
This is no longer true. The market will enforce energy-efficient dwellings. The misclassification of energy saving investment being non economical will itself become no economical. The taking over of responsibility for climate protection by running a responsible and sustainable portfolio maintenance strategy will lead to positive image and to improved competitiveness of the housing stock.
Following this approach will necessarily lead to an systematically designed and strategically integrated portfolio management – in other words: to ESAM-Systems.

Nassauische Heimstätte assumes, that this will also be a relevant component in presenting the company as a friendly and likeable market participant.

Using ESAM shaped tools will definitively become (increasingly urgent) an economical requirement for adequate competitiveness on the market.

NH already has had a working portfolio management (SAM) creating the basis for operational transparency. This is why **NH** decided pragmatically – at the beginning of the project - to use the **“Energy after SAM”** system. This case seemed to be suitable; if a running SAM system should or could (i.e. because of the right to use the software) not be customised.

In the course of the project the SAM-department of NH became familiar with the ESAM-system (in terms of the philosophy and the technical approach of ESAM) and “discovered” the impact of the inclusion of energy(-cost) items into the portfolio management system of NH.

To incorporate the existing portfolio management into the Multi Criteria Method Module, the already calculated capital expenditures have been aligned with SAM Calculations.

The process of implementation of energy criteria to the SAM-system of Nassauische Heimstätte actually leaded to the conclusion, that “Energy after SAM” will not be the

best solution – nevertheless it is a suitable, good and pragmatic solution. This perception is based on the fact, that the energetic retrofitting of a building is influencing relevant criteria included in the SAM-Assessment of the housing stock. This means that there is a sort of repercussive functional chain of enhancement of value for the SAM-assessed real estate, which has to be looped back from the energy assessment into the SAM-assessment. Currently NH is investigating how to manage this “new” requirements for the design of the revised “Energy influenced SAM”. Anyway – as the originally intended result of the ESAM project - NH will currently have a viable “Energy after SAM” system. Further improvements are already on the agenda.

SAM »property business« applications (NH)

Portfolio segmentation
Module for extensive portfolio segmentation via adjustable scorecard models. The module includes a simple location assessment.

»Easy« portfolio management
Compact module for simple portfolio segmentation and quick investment planning. The module includes a simple location assessment.

Investment planning
Module for the quantitative analysis of a property or a group of properties in several scenarios including prospective data on the basis of financial mathematics methods (discounted cash flow, complete overview of costs ...).

Evaluation
Module for the evaluation of each property or for groups of properties in several scenarios in accordance with different methods (gross rental method, asset value method, broker factor, discounted cash flow value with perpetual annuity, IAS 40 ...).

Rental projections
Module for predicting rental income and vacant spaces on the basis of the existing rental agreements (index, graduated ...), as well as assumptions about the future risks for each type of use (current rent, vacancies, loss of rent ...).

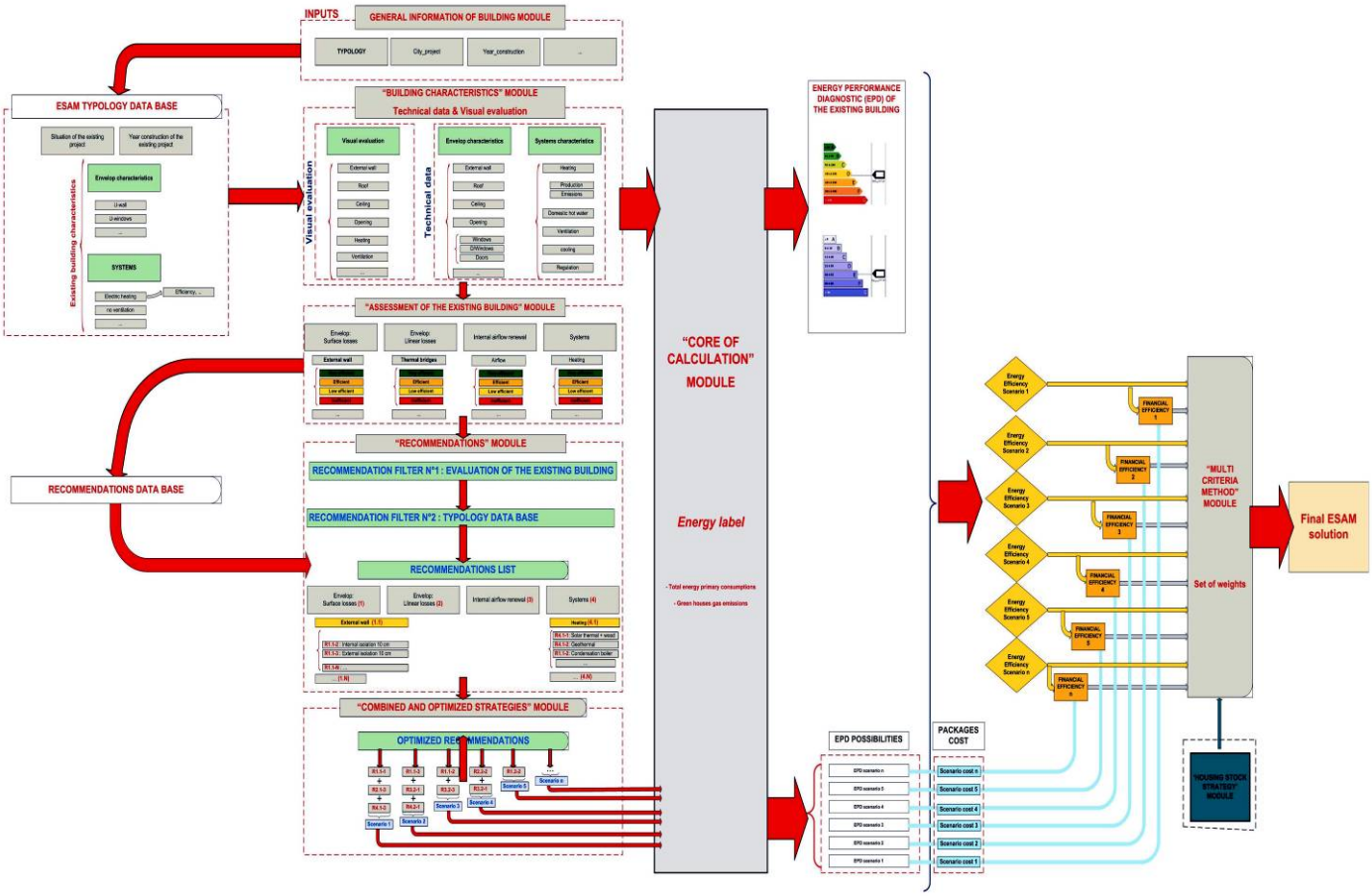
P&L
Module for company planning in several scenarios, taking account of property-planning scenarios.

Location assessment
Module for extensive location assessment via adjustable scorecard models.

Statistics
Module for establishing missing output data on the basis of the statistical methods of correlation and regression.

Components of the information system

The general architecture of the PDBM Tool was specified in Work package 3 and defines the basic principles of the information system. The set of tools of the information system were elaborated and integrated into a general system as follows.



2. Objectives

The objective of the development of an information system was to

- minimise the effort for the calculation of the energy performance of a building
- to link the energy performance assessment with an economical assessment
- to integrate the additional information into the existing portfolio management of NH (« energy after SAM »)

The product results provide much more transparency in the procedure of companies. ESAM tools will improve the efficiency of long-term planning and will contribute to sustainable development of housing stocks. The project facilitates co-operation between all parties. In this respect all involved people will benefit from ESAM.

The target groups of the project outcomes are:

- Housing cooperatives and associations:
- Municipalities and other political authorities (e.g. local and regional governments)
- Real estate developers
- Financing institutes

The end users are the people who live in housing cooperatives and associations.

Dissemination:

- Nationwide congress “Energy.City.Money” („Energie.Stadt.Geld“ => pronounced in German language the conference title sounds like „energy instead of money“), Frankfurt am Main, 30.-31.10.2008
- Expert-conference „Working group ‘Energy-Consulting’“ (“Arbeitskreis Energieberatung”), Darmstadt, 22.10.2008
- Professional articles in „Polisvision“, the periodical of NH for municipalities and real estate experts
- Professional articles in “area” , the nationwide periodical of ZIA (Zentraler Immobilienausschuss e.V.), one of the head organisations of real estate enterprises in Germany
- Several “in-house” presentations of the ESAM tools in front of line executives and employees of Nassauische Heimstätte.
- Presentations and seminar papers in several conferences of head organisations of SHOs and real estate developers will follow.

Transfer to the actual Political situation:

To clarify the urgency of energetic innovative action from SHO's we refer to a proposal of resolution for the state parliament by the SPD chairwomen and (meanwhile former) candidate for Prime Minister of Hesse, Mrs. Ypsilanti.

In this resolution, the social democratic party asks the state parliament to demand all Social Housing Operators of Hesse to give a statement about improving their energy performance of their housing stocks and how to relieve the tenants from extreme high running costs.

Explicit they are asked about the necessity of energy-retrofitting of their own housing stock to achieve the national and European climate goals. This resolution will in all likelihood be accepted by the parliament of Hesse.

ESAM will be the tool the meet the requirements of political and public pressure on improving energy efficiency in housing stock. Resulting from ESAM assessment processes and based on the experiences at the pilot site in Frankfurt am Main, NH will be able to develop strategic investment plans to optimize expense and revenue in terms of financial resources and CO_2 reduction.

3. IS integration methods & organization

General implementation steps

Preliminary remarks: The legal situation is urging the company to generate energy certificates. Resulting from that, there was already an external pressure to act. Therefore - in this specific situation - it was quite easy to achieve acceptance for the implementation of a new tool, because measures had to be taken anyway to meet the legal obligations. I.e. the implementation of the ESAM tools was understood by the staff as an activity, that has to be carried out anyway anyhow. The decision of combining these externally triggered activities with additional ESAM-work resulting in additional value for the company appeared to be comprehensible. Without this external pressure it would have been much harder to argue, that there is a need to use financial and personal resources of the company (and implicitly of the stakeholders) to implement a tool, which is actually not urgently necessary for the improvement of competitiveness (because of the sustainable strong demand for flats in our regional markets).

Regardless of the remarks above, the steps of implementation are:

1. Decision taking about the need of a strategic tool for energetic investment.
2. Decision taking on the integration of energy certificates in the implementation process of ESAM tools.

3. Selection of an adequate tool for the generation of suitable energy certificates – in terms of energetic investment objectives.
4. Selection of an suitable method for the definition of energetic modernisation measures/modules.
5. Selection of an adequate tool for financial calculations.
6. Selection of a typical pilot site for pre-testing the tools.
7. Definition of a building typology and of modernisation measures as a basis for diverse strategic considerations.
8. Pilot site (pre-test) implementation of the tool for the generation of energy certificates (in our case: simplified method of IWU).
9. Pilot site (pre-test) Implementation of the calculation tool.
10. Test calculations and quality checking of the results.
11. Analysis of the pre-test and - if necessary – adjustment of the applied tools.
12. Definition of quality checking methods for quality assurance of the tools in every day business.
13. Instruction and (partly) training of the involved staff for the over-all roll-out of the tool.
14. In-house dissemination activities in preparation for a broad understanding and acceptance of the tools.
15. Over-all implementation of the tools for every day use.

Technical database NH

NH internal has a detailed database, which concerns the concatenation and the classification of the existing building characteristics including envelop and systems according to their shape. As well it contains all Information about every single dwelling. Starting by the year of construction, the building equipment, actual refurbishment condition, energy consumptions, heating costs and so on. Because of this, it is very easy to keep track of the housing conditions and the future retrofitting measures to reach the energy performance requirements of the EU directives.

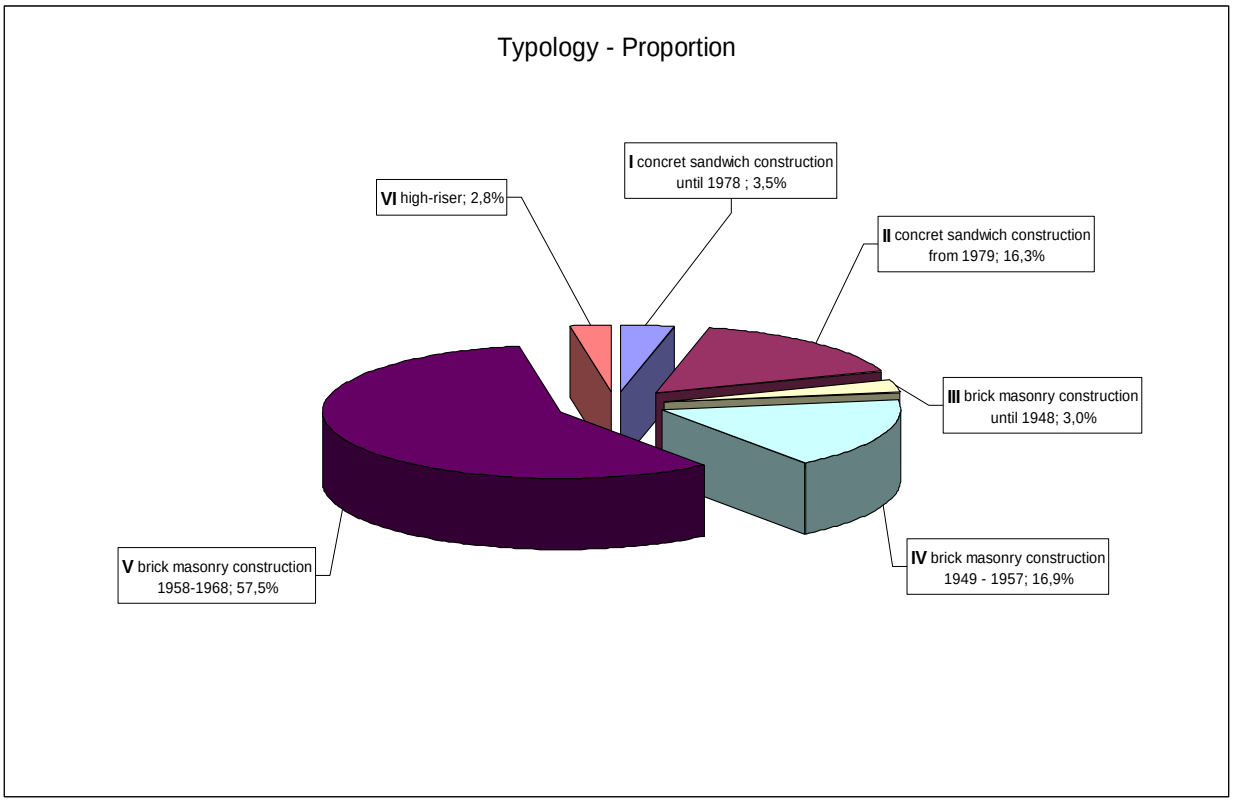
Building typology NH

The typology developed by NH and IWU is at first based on the age of construction. Six types of buildings are defined (see table below). These were built between 1930 and 2004. Within the pilot area we have small multiple-family dwellings with 8 residential units, larger buildings with 24 residential units, as well as a tower block with 48 residential units. There are two main types of structure: brick masonry construction and concrete sandwich construction. The brick masonry constructions have both flat roof designs and designs with tiled pitched roofs. All the houses were built with cellars. Neither the cellars nor the upper attics are heated.

Typology Database six different general types of Buildings

I	sandwich construction Holzmann-Coignet Zur Frankenfurt 199-205, FFM multiple-family dwelling - 32 units year of construction 1966	
II	sandwich construction Holzmann-Coignet Am Waldgraben 10-12, FFM multiple-family dwelling - 16 units year of construction 1981	
III	brickwork until 1948 Silcherstraße 33-35, FFM multiple-family dwelling - 12 units year of construction 1930	
IV	brickwork from 1949 to 1957, Rheinlandstraße 52-54, FFM multiple-family dwelling - 24 units year of construction 1952	
V	brickwork from 1958 to 1968, Heinrich Seliger Straße 85-89, FFM multiple-family dwelling - 45 units year of construction 1958	
VI	high-riser Henriette-Fürth-Straße 14, FFM multiple-family dwelling - 48 units year of construction 1968	

The graph represents the sharing out of the building stock of NH sorted by type.



4. Description of the IS

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

Methodical Approach

One starting point for the making of the tool was the „Simplified Energy Profile Procedure“ („Kurzverfahren Energieprofil”[1]) 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 [2].

Furthermore IWU has developed an economic calculation model which is able to make a rough description of the profitability of an energy saving investment. The so called “calculation model” contains several calculation methods based on dynamical investment calculation.

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.

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

[1] see research report http://www.iwu.de/datei/iwu-kurzverfahren_energieprofil-endbericht.pdf and attached English abstract

[2] http://www.iwu.de/datei/iwu-kurzverfahren_energieprofil.zip in German language

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.

USER

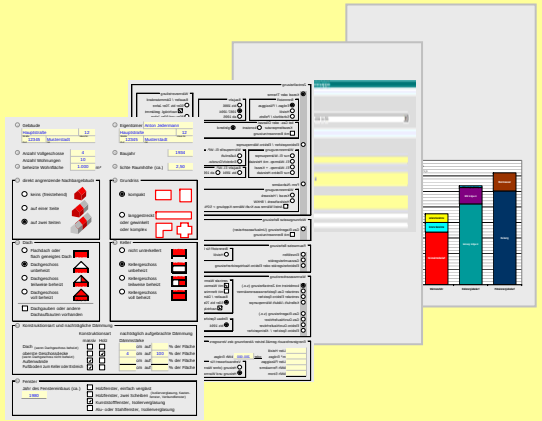
standard application:

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

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

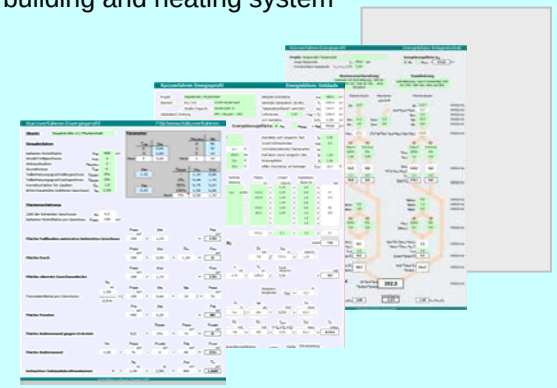
- **building**
- **measures**

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



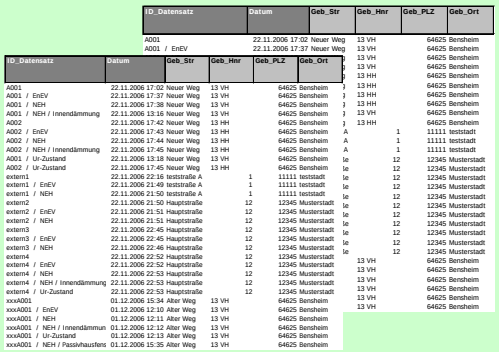
energy input data

input data for actual state and selected variants

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

energy balance calculation results

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



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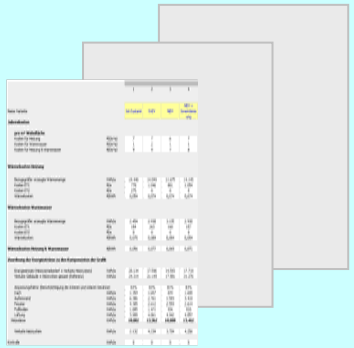
economical basic data

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



economical results

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).

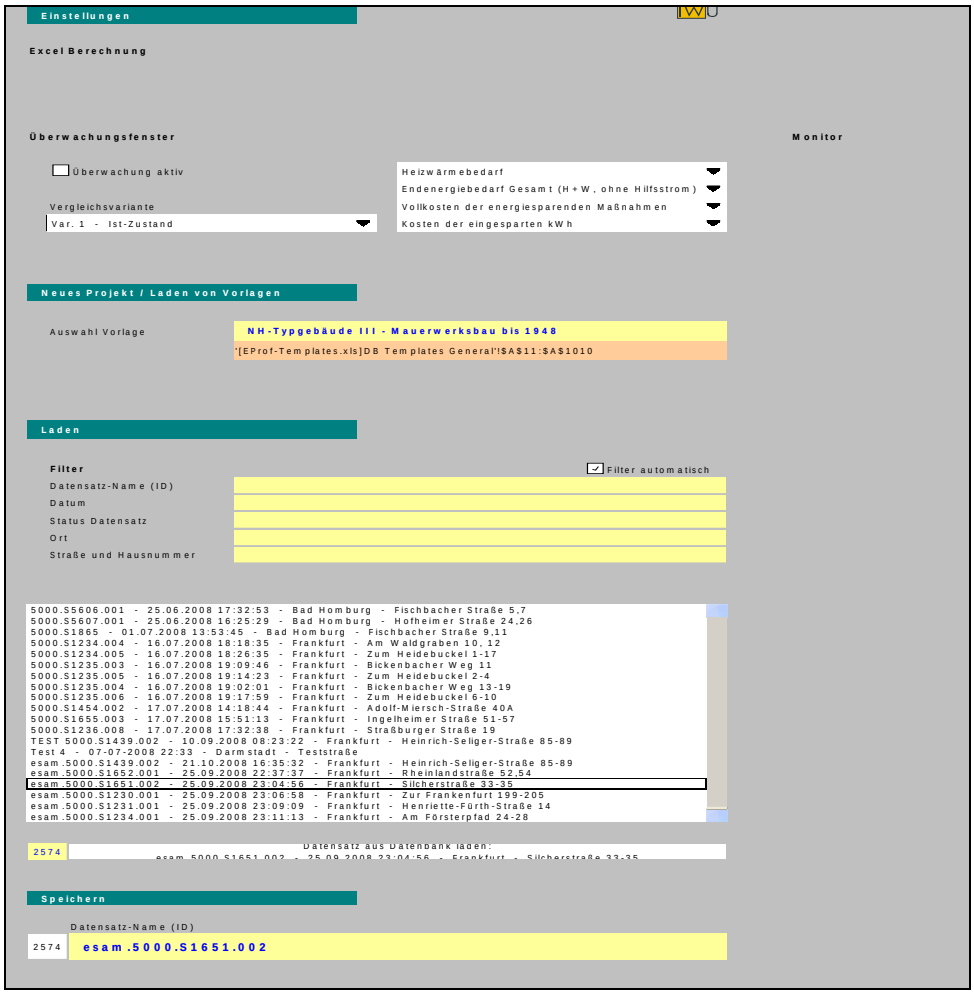
In the standard user mode the data and calculation sheets are hidden. If necessary the user can unhide the required sheets. This facilitates the comprehension of the calculation, and the control of input and output data.

Within the workbook "EnergyProfile.xls" four forms have to be fulfilled:

1. Form „general data":

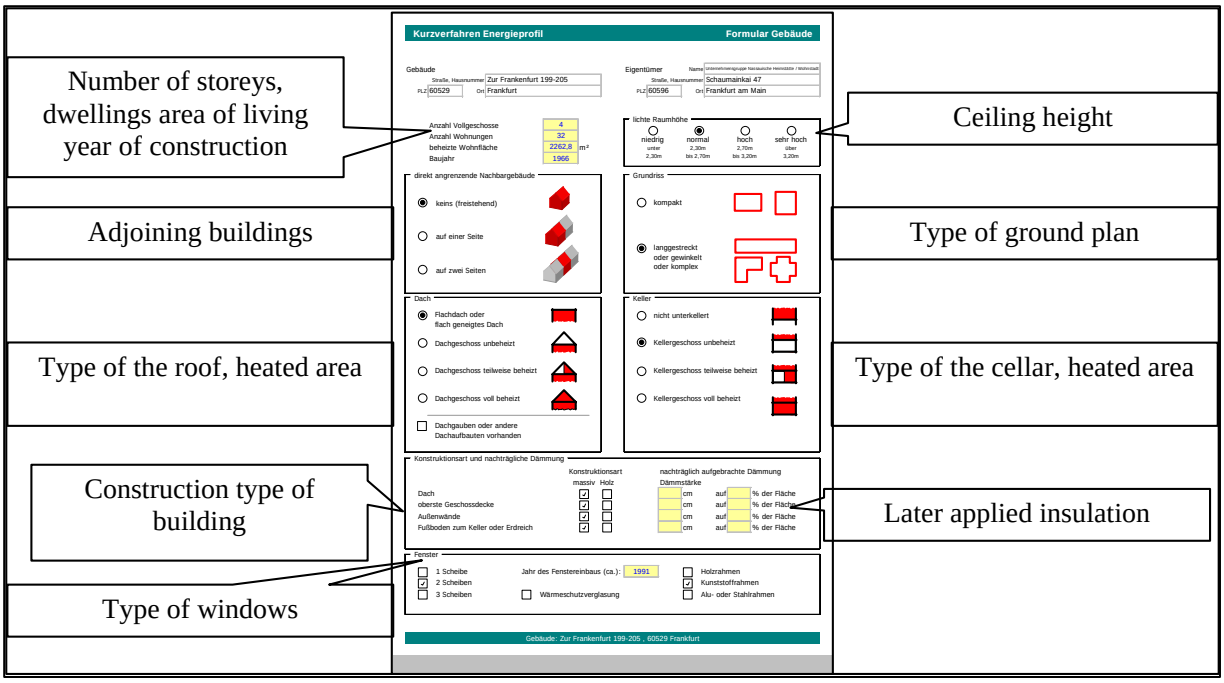
The form „general data" has the following functions:

- entering new building data sets
- uploading and saving of existing building data sets
- input of general data like address and owner of the building
- input of general data for energy certification



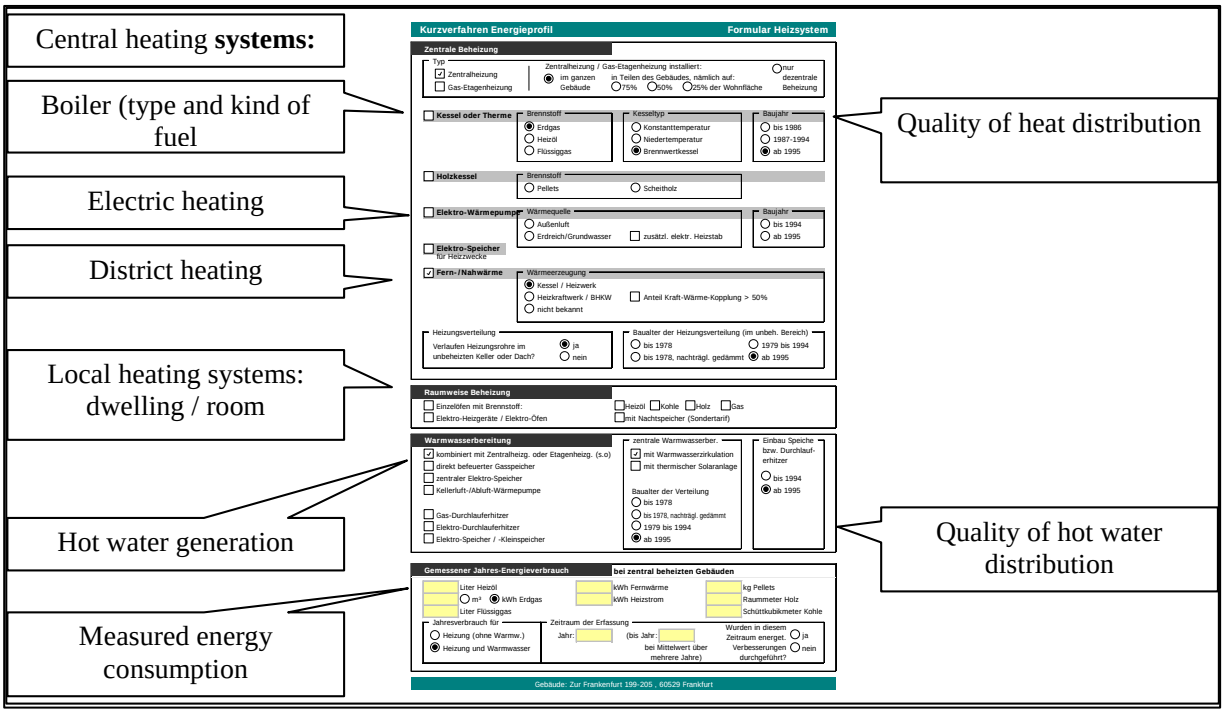
2. Form „building“:

The form „building" is used for the input of data about the thermal envelope of the building like total floor space, year of construction, number of flats, kind of construction of building elements and later applied insulation, thermal quality of windows. The results of the calculation are presented in diagrams (transmission losses, heat energy demand).



3. Form „system“:

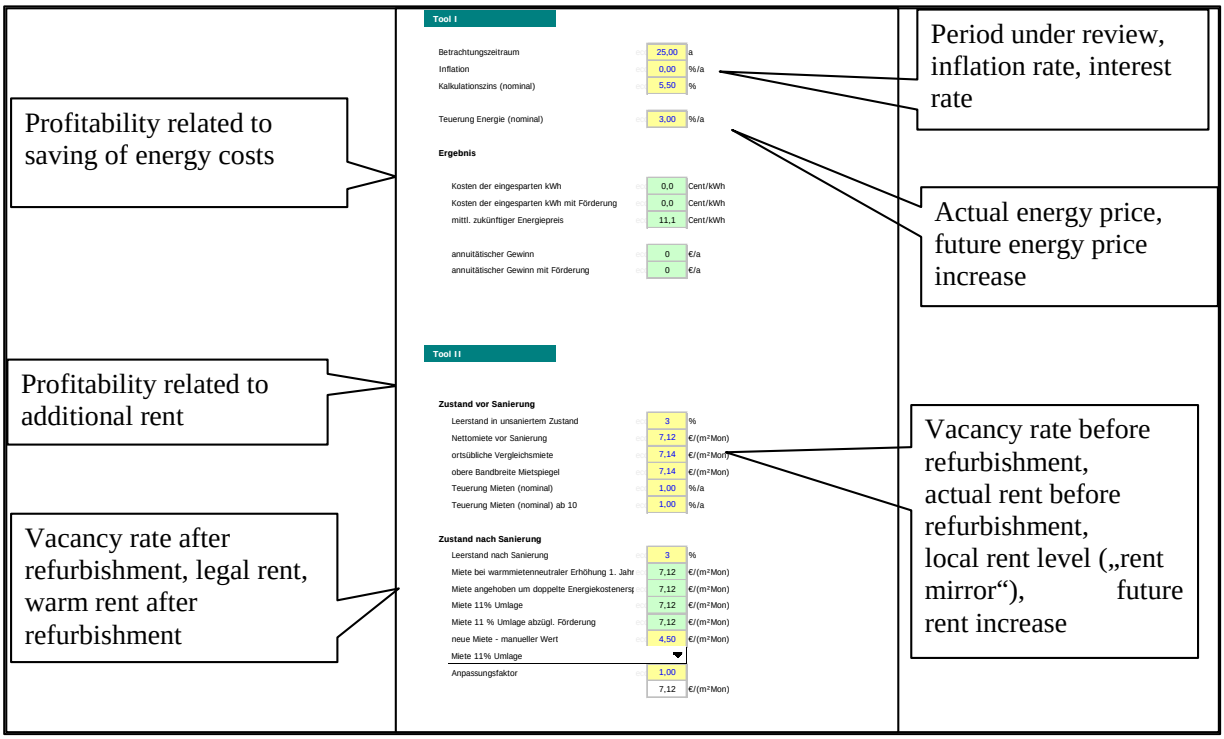
The form „system" is used for the input of data concerning the quality of the heating system and the quality of the hot water generation. The results of the calculation are presented in diagrams (primary energy, end energy demand for heating and hot water).



Besides the input of data about the present state of a building an 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) is also possible by using the forms “building” and “system”. This procedure is linked with an assignment of typical costs to the refurbishment measures. Sets of measures can be defined as standard refurbishment strategies. The sets can be edited or expanded by the expert user.

4. Form „economy“:

The form „economy" is used for the input of data about the profitability of the energy saving measures like actual and future energy prices, costs and rents before and after refurbishment. The data set describes the present state of a building or a building variant. The results of the calculation are shown in diagrams (costs of the saved kWh end energy, net present value).



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

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

5. Evaluation of the tool

Final ESAM solution

Because of the already existing and working SAM system of NH, the company decided to implement an “energy after SAM” system as defined in the book of specifications (Workpackage 3).

For NH, this is a suitable system for daily use which helps to take well-founded investment decisions. Implementing “energy after SAM” results in a valuable management tool to maximize the energy efficiency of the refurbishments and (for the first time ever) provides the SHOs with a strategic tool to handle the running costs (zweite Miete) as a inseparable part of the total costs which the tenant has to pay for renting a flat.

NH intents not only to use this tool for the optimization of its own housing stock of about 66,000 flats, but also to provide nationwide consultancy to SHOs and other similar real estate companies based on the developed energetic information system.

At this stage, the company wide energy management at NH is not yet affected relevantly. But the ESAM project has proved at the pilot site undoubtedly, that the ESAM tools have the potential to improve significantly the decision taking process in terms of optimizing investment activities. ESAM tools and methods will definitively become an integrated part of future decision taking processes at Nassauische Heimstätte. The according decisions of the managing directors of NH have already been taken.

The developed tools can definitively be applied in other housing companies. Our investigations in this field leaded to the conclusion, that there is a great variety of existing SAM approaches and of relevant expertise in German housing estate companies. Based on that variety and enforced by disparate local market situations and competitive situations, we assume, that there should be a specific and individual customization process in setting up adequate ESAM systems, i.e. the parameters and the assessment criteria of the SAM systems and the weighting of energy criteria needs professional expertise to ensure useful and feasible outcomes of the ESAM tools and methods. We guess, that the viability of ESAM applications could be significantly advanced if specific and experienced “face-to-face-consultancy” will be available for interested housing estate companies. Nevertheless the developed tools are universally applicable, even in very different usage conditions.

Difficulties with the establishment of the IS:

- SAM denotes a disempowerment of the technical department, because for the first time technical decision criteria are systematized and available of the financial Department
- Insufficient empathy of employees to handle the additional amount of work
- Difficulties by integrating the system are-wide in the company
- Market demand in the Rhein-Main Area doesn't really urge the company to optimized their decision making system (similar to Salzburg)
- Although the Board Directors of NH has decided to investigate the complied Housing stock until summer next Year by using the developed PDBM-tool.

Achievements:

- Two other SHO company's in Germany (Hessen) already showed there interest in service agreements.
- SAM department of NH sees the potential in this system to reach complete dependence from the technical department for the preparation of the investment decisions. Because this tool provides the possibility of strategic assessment of technical methodologies.