

Calculation Tools for the Energy Concept Adviser

Appendix C: How to use the ECA calculation models

A Working Document
of IEA ECBCS ANNEX 36
Mai 2004

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Appendix C: How to use the ECA calculation models

(by Simon Wössner IBP)

Introduction:

The Energy Concept Adviser is a new internet based information tool for decision makers and their technical staff that have to decide about refurbishments in educational buildings.

In front of the description there shall be an introduction, why this was developed.

There is often a high consumption of energy in all types of educational buildings like nursery schools, schools and universities. This is because many were built in times when a low energy consumption was not one of the main criteria while planning an educational building. Now many educational buildings are getting refurbished and so there is the opportunity to think about energy efficient refurbishment.

As the energy consumption is influenced by a lot of parameters like the building itself, the occupation, the heating system, ventilation, lighting,... and all these parameters are influencing the others, it is nearly impossible to estimate the potential of energy savings and investment costs of energy efficient measures without any software tools.

The Energy Concept Adviser (ECA) offers a set of tools that help decision makers through the whole process of thinking about refurbishment. It is easy to use and it can be used at all stages without a detailed knowledge of the actual building.

Structure of the Energy Concept Adviser (ECA)

The Energy Concept Adviser offers tools for every stage of the process of a refurbishment.

If there is an existing problem with the building, a possible solution can be found in the '*Problem Related Recommendations*'. There are over 600 possible solutions for more than 25 problems. The solutions are not restricted to a particular building type. It suggests possible solutions to existing problems.

The next step is a huge information database. It deals on the one hand with the description of some representative refurbishments in the '**Case Study Viewer**' and on the other hand with the technologies for refurbishments in the '**Retrofit Measure Viewer**'. All other elements of the Energy Concept Adviser are linked to this information database, so there is always the possibility to get more background information to the current stage.

Up to this stage, it is quite building independent. If we are now interested in how our building performs in comparison to others, the '**Performance Rating**' gives an answer. The consumption of energy (and for some countries also the consumption

of water) is compared to a national stock of buildings. This results in advice as to whether or not it is worth considering of energy efficient refurbishment .

The '**Energy Concept Development**' is a powerful, but easy to use tool that allows us to develop energy efficient retrofit concepts. The different possibilities for refurbishment can be either explored using a common building or a building that fits an existing building. Finally five different concept can be compared regarding the energy relevant values as well as economic calculations.

The last step is the '**Auditing and Monitoring**' of a refurbishment. To help in this there is the software tool called 'KULU' and several reports available.

Recommendations

Solutions for existing problems
eg IAQ, glare, high energy consumption

Case Study Viewer

Collection of exemplary retrofit of educational buildings sorted by country and building type

Retrofit Measure Viewer

Collection and description of retrofit measures

Benchmarking

Comparison of the consumption of your own building with the typical average consumption figures of your country

Retrofit Concept Development

Starting with a building type you are able to analyse different retrofit measures on your own building. You can create different concepts and look at the energy relevant results as well as on the economic calculations

Auditing & Monitoring

Kulu and Auditing reports

Description of the Energy Concept Adviser (ECA)



ENERGY CONCEPT ADVISER
for Technical Retrofit Measures

country-specific data:



On the first page, the relevant country gets selected. There is no difference in the tools offered only the data behind is country-specific.


By clicking on a country's flag a short introduction into the ECA is shown and the next screen is the main menu of the Energy Concept Adviser.




ENERGY CONCEPT ADVISER
for Technical Retrofit Measures

obtain recommendations for specific problems in your building	Recommendations
study more than 30 retrofitted buildings and retrofit measures	Case Studies & Retrofit Measures
compare your building's consumption to national data	Performance Rating
develop an energy efficient retrofit concept for your building	Retrofit Concept
programs and methods to analyse your building performance	Utilities
any questions	Info & Contact

Problem related recommendations:



Problem Related Recommendation



General Information

This knowledge based list of recommended measures may fit only partly to your building. Select your problem in the left column and in the right column it is possible to group the measures in main groups. Select the useful measures manually and read detailed description in the lower part.

Select the existing problem

General Problems

- Heating energy consumption is high
- Electrical energy consumption is high
- Water consumption is high
- Indoor air quality problems

Specific Problems

- Building envelope not airtight
- Humidity or moisture problems
- Windows need replacement
- Roof covering needs replacing
- Heating controls need upgrading
- Pipework needs replacing
- Boiler or burner needs replacement
- Building fabric insulation is poor
- Pipework needs insulating
- Ventilation uncomfortable due to draughts
- Heating inadequate in winter rooms too cold

Group measures by

No grouping

Possible measures

Close off open chimneys to prevent ventilation losses an...

Payback time: **Very short Term (less than two years)**

Close off unused air grilles behind radiators.

Payback time: **Very short Term (less than two years)**

Weather strip windows and doors and seal gaps in buildi...

Payback time: **Very short Term (less than two years)**

Install manual swimming pool cover.

Payback time: **Very short Term (less than two years)**

Replace existing gas or oil-fired boilers with condensing...

The interface to the problem related recommendations' database has on the left hand side the list of available problems. They are sorted by main problems and then more specific problems. The possible solutions are listed on the right hand side. They can also be grouped by energy technologies so that the list offered is more specific. The solutions are sorted by their payback time; first there are the solutions with the lowest payback time and then increasing.

Select the existing problem

General Problems

- Heating energy consumption is high
- Electrical energy consumption is high
- Water consumption is high
- Indoor air quality problems

Specific Problems

- Building envelope not airtight
- Humidity or moisture problems
- Windows need replacement
- Roof covering needs replacing
- Heating controls need upgrading
- Pipework needs replacing
- Boiler or burner needs replacement
- Building fabric insulation is poor
- Pipework needs insulating
- Ventilation uncomfortable due to draughts
- Heating inadequate in winter; rooms too cold

Group measures by

No grouping

- No grouping
- Building envelope
- Heating systems
- Ventilation systems
- Lighting and electrical appliances
- Management

Weather strip windows and doors and seal gaps in buildi...

Payback time: **Very short Term (less than two years)**

Install manual swimming pool cover.

Payback time: **Very short Term (less than two years)**

Replace existing gas or oil-fired boilers with condensing...

Payback time: **Very short Term (less than two years)**

Active management of controls

Payback time: **Very short Term (less than two years)**

Selected Measure

Replace existing gas or oil-fired boilers with condensing boilers

Payback-time:
Very short Term (less than two years)

Low temperature of pool water enables boilers to operate in most efficient condensing mode

Best carried out when plant needs replacing

Below that selection part, a more specific description of the selected solution is shown with the information when it is carried out best.

Selected Measure

Replace existing gas or oil-fired boilers with condensing boilers

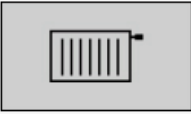
Payback-time:
Very short Term (less than two years)

Low temperature of pool water enables boilers to operate in most efficient condensing mode

Best carried out when plant needs replacing


Related Information

Retrofit Measure Viewer




Heating systems - Heating installations


Case Study Viewer



Exemplary Retrofitting of a School (EROS) in Stuttgart, Germany



A Retrofitting for Energy Conservation including Atria: The Bertolt-Brecht-School in Dres


















Louise Labe, secondary school Lyon, France


Then at least as already mentioned there is the link to the information database. If this solution is described in the 'Retrofit Measure Viewer' or is applied in a case study, the corresponding link is shown below the detailed description.

Case Studies & Retrofit Measures:

The interface to the information database is organised as a matrix of case studies and retrofit measures.

		Case Studies & Retrofit Measures					
Sorting of:							
Case Studies by		<input type="text" value="country"/>					
Retrofit Measures by		<input type="text" value="Energy technologies"/>					
Country	Retrofit Measures		Case Studies				
							
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

To the right the different retrofit measures are listed and downwards the available case studies. There are different sorting criteria, so that different points of interest are possible. A red tick mark indicates if a retrofit measure is applied in a case study or in which case studies a retrofit measure was applied.











Case Studies & Retrofit Measures

Sorting of:



Case Studies by

Retrofit Measures by


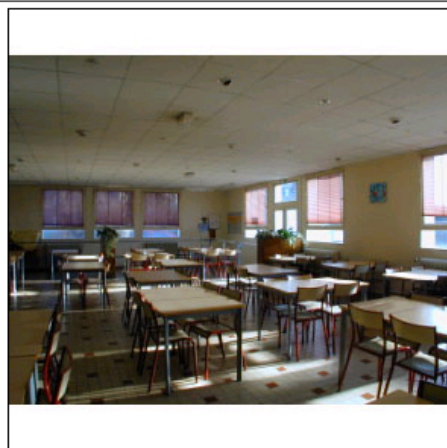
Country	Retrofit Measures ↓ Case Studies	Building Envelope			
		Windows	Insulation materials & systems	Over-cladding systems	Doors
Pre 1930					
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
1930-1950					
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The case studies can be sorted by their country, their age or their typology. The different retrofit measure chapters can be sorted by the energy technologies. If an energy technology is selected, the matrix shows, which sub items of this energy technology are described and where they have been applied.

By clicking on a picture the ‘**Case Study Viewer**’ opens in a separate window.

	Case Study Viewer	Gambetta professionnel high school Bourgoin Jallieu, France	Download of REPORT as PDF																						
<table border="1"> <tr><td>General Data</td></tr> <tr><td>Site, Typology</td></tr> <tr><td>Before Retrofit</td></tr> <tr><td>Retrofit Concept</td></tr> <tr><td>Energy Savings</td></tr> <tr><td>User Evaluation</td></tr> <tr><td>Renovation Costs</td></tr> <tr><td>Lessons Learned</td></tr> <tr><td>Additional Information</td></tr> </table>	General Data	Site, Typology	Before Retrofit	Retrofit Concept	Energy Savings	User Evaluation	Renovation Costs	Lessons Learned	Additional Information	<p>General Data</p> <table border="1"> <tr> <td>Address of project</td> <td>Lycée Gambetta 14, avenue Gambetta 38003 Bourgoin Jallieu France</td> </tr> <tr> <td>Year of construction</td> <td>1930</td> </tr> <tr> <td>Year of renovation</td> <td>1993-1995</td> </tr> <tr> <td>Total floor area</td> <td>9213 m²</td> </tr> <tr> <td>Number of pupils</td> <td>520-540</td> </tr> <tr> <td>Numer of classrooms</td> <td></td> </tr> <tr> <td>Typical classroom</td> <td>35-50 m² 26-28 pupils</td> </tr> </table> <p>Project Summary The project aimed to adapt and refurbish the existing building and add an extension in order to give a more functional school building.</p> <p>Retrofit features</p> <ul style="list-style-type: none"> -vertical wall insulation -double-glazed windows -oil boilers converted to gas available on site -renovated electric and lighting systems -mechanical ventilation -building management system 	Address of project	Lycée Gambetta 14, avenue Gambetta 38003 Bourgoin Jallieu France	Year of construction	1930	Year of renovation	1993-1995	Total floor area	9213 m ²	Number of pupils	520-540	Numer of classrooms		Typical classroom	35-50 m ² 26-28 pupils	 <p>View of the building</p>
General Data																									
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All the information on the case studies is organised in the same structure, so that an easy comparison between different case studies is possible. If there is a need for further information the whole chapter of this case study from the Annex 36 report “Subtask B Report” can be downloaded by pushing the button ‘Download of REPORT as PDF’.



	Retrofit Measure Viewer	Solar control and cooling systems	Download of REPORT as PDF				
<table border="1"> <tr><td>Introduction</td></tr> <tr><td>Shading & glare prot.</td></tr> <tr><td>Cooling systems</td></tr> <tr><td>Air-conditioning</td></tr> <tr><td>Control systems</td></tr> </table>	Introduction	Shading & glare prot.	Cooling systems	Air-conditioning	Control systems	<p>Shading systems and glare protections</p> <p>To choose a solar control device we need to consider: the site latitude, the orientation of the facade, the orientation of the openings, the aesthetic of the facade, the glazing type of the window, the need for daylight, the solar control devices.</p> <p>The overall thermal and optical performance of a solar control device in respect to solar radiation impinging on it is based on the phenomena: primary transmission, reflected transmission, diffuse transmission, solar absorption.</p> <p>The global shading efficiency of a device is the result of all these direct and indirect transmission processes.</p> <p>Shading devices are also essential to avoid glare situations. If their luminous transmittance is too high, the risk of glare is significant. Several types of shading devices are sufficient to avoid glare from the sky: screens, reflective film, ionised film, sealed blinds.</p> <p>Designers and decision makers must be conscious that the performance of the shading assembly might be different in the actual application conditions</p>	 <p>Shading systems and glare protections</p>
Introduction							
Shading & glare prot.							
Cooling systems							
Air-conditioning							
Control systems							

The ‘Retrofit Measure Viewer’ shows the different energy technologies and their sub items. It is again an abstract from the much more detailed chapter of the

Annex36 report “Subtask A Report” and this chapter can be again downloaded by pushing the button ‘Download of REPORT as PDF’.

Performance Rating:

The actual consumption of a building can be compared to a national stock of buildings with the ‘Performance Rating’.

Performance Rating	
	
<p>Building Information</p> <p>The building is a: <input type="text" value="educational building(general)"/></p> <p>It has a heated floor area of: <input type="text" value="5000,00"/></p> <p>Reference climate zone: mean climate</p> <p>Click here to get further Information about the climate zones</p>	
<p>Consumption of electrical energy:</p> <p><input type="checkbox"/> Includes heat energy consumption</p> <p>Unit of the consumption: <input type="text" value="kWh/m²a"/></p> <p>Consumption: <input type="text" value="56,00"/></p>	<p>Consumption of heat energy:</p> <p>Energy source: <input type="text" value="oil"/></p> <p>Unit of the consumption: <input type="text" value="kWh/m²a"/></p> <p>Consumption: <input type="text" value="233,00"/></p>
<p>Consumption of water:</p> <p>Unit of the consumption: <input type="text" value="l/m²a"/></p> <p>Consumption: <input type="text" value="174,00"/></p>	

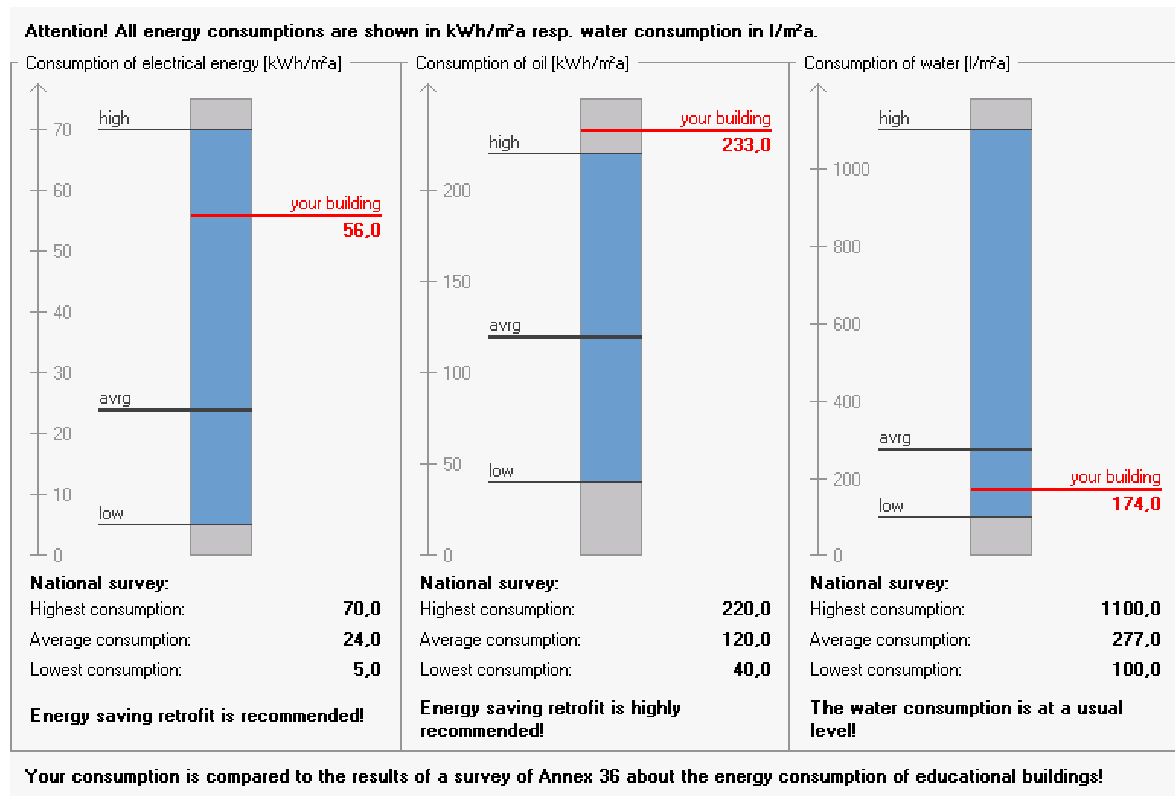
As input are needed:

- the type of building (educational building in general, nursery school, school or university)
- the heated floor area
- the reference climate zone (if more than one available)
- the consumption of electrical energy
- the consumption of heat energy
- if available, the consumption of water

The content might vary from country to country.

Further information on the available climate zones are shown in a separate window by clicking on ‘Click here to get further information about the climate zones’.

If the source for the heat energy is electrical energy and there is only one meter available, the option ‘Includes heat energy consumption’ can be marked. in this case the field for the consumption of heat energy is deactivated and the corresponding diagram disappears. The consumptions can be entered either related to the heated floor area or as absolute values. For the consumption of heat energy this can be entered in unit of the energy source as purchased. The results are always shown as values related to the heated floor area.



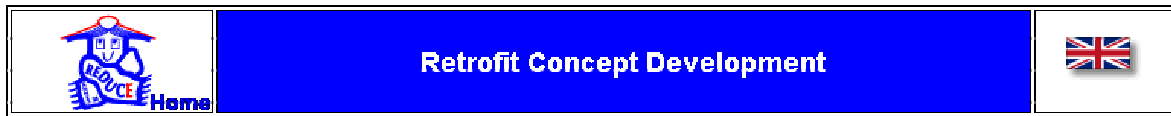
The result is shown in diagrams, where the entered consumption is compared to the highest, the average and the lowest consumption of the survey of Annex36 about the energy consumption of educational buildings. There is also information whether energy saving retrofit is (highly) recommended or if it has only a limited potential.

Retrofit Concept:

With this part of the ECA, energy efficient retrofit concepts can be created and compared with each other. The concepts can be created either for a common building or a specific building. The concepts can be compared by energy relevant values as well as economic calculations.

The whole tool is structured in different parts that can be opened and closed by clicking on the '+/-' button or the title bar and specific help relating to each part is available by clicking on the '?' button.

The development part is structured in the sectors listed in the screenshot. A sector can be opened or closed by clicking on its bar. For all information required (values, costs etc) default values from national studies are included, but can be changed individually by the user, so please check the default values for your confidence. If you need help click on ?



General Information	
The development part is structured in the below listed sectors. A sector can be opened or closed by clicking on its bar. For all needed informations (values, costs, etc..) defined values from national studies are deposited, but could be changed individually by the user, so please check the deposited values for your confidence. If you need help, click on	
Describe the existing building	
Select one retrofit measure for each building element	
Create and compare energy saving concept	
Summary and Report	

The main structure of the ‘Concept Development’ is organised in four parts. First the existing building is described, then a retrofit measure for each part of the building can be defined, then five different retrofit concepts can be created and compared and finally a summary and a report as a PDF-file is available.

Describe the existing building

The building, for which the possibilities for an energy efficient retrofit are to be analysed, is defined in this section. By choosing the basic values a default building is created. This building can be further defied in the lower part of this section

Note: Changes in the ,Further refinement of the building are reset by changing the basic value!

Define key values for a default building

The starting point is the default building. It is defined by a few parameters.

Describe the existing building

How to use this part

The building, for which the possibilities for a energy efficient should be analysed, is defined in this section.
 By choosing the basic values, a default building is created.
 This building can be further defined in the lower part of this section.
Changes in the 'Further Refinement of the building' are reseted by changing the basic values!

Define key values for a default building

Basic Data		Example buildings	
Building Type:	school	Typology:	Side corridor school
Construction year:	1970-1990	<div style="border: 1px solid #ccc; padding: 5px;"> <p>Click on picture to have a look at the case study!</p> <p style="text-align: center;">Primary and Secondary School, Stuttgart-Plieningen, Germany</p> </div>	
Type of Roof:	pitched (heated attic)		
Type of basement:	slab on ground		
Heated floor area [m²]:	6180,00		
Number of storeys:	3		
Orientation:	<p>Click on diagram to select orientation</p>		
Consumption of heat energy:			
Energy source:	Oil	Consumption:	374,00 kWh/m²a

Further Refinement of the building

The basic parameters are:

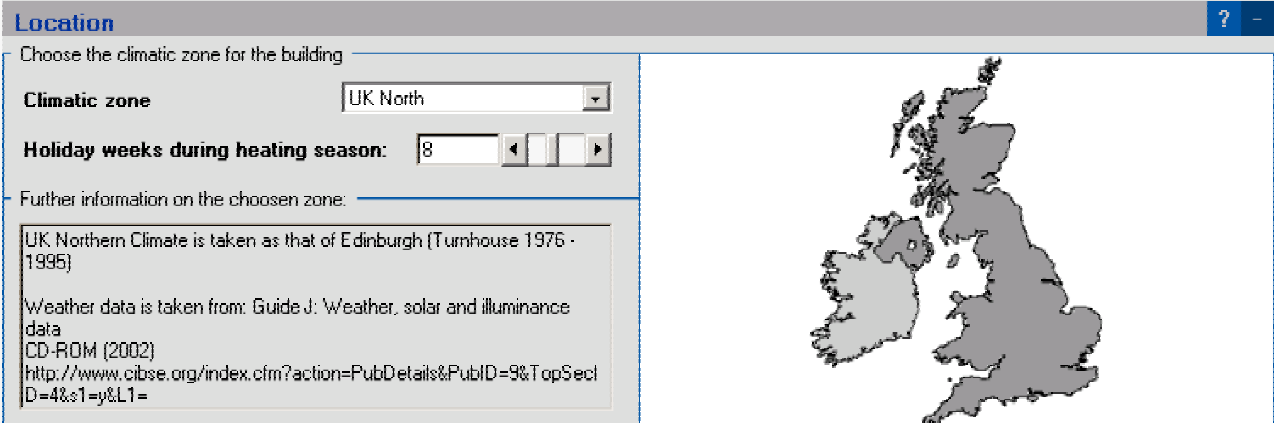
- the building type
- the construction year
- the type of the roof
- the type of the basement
- the heated floor area
- the number of storeys
- and the orientation

Finally the actual consumption should be entered. This information is used for a comparison of the calculated existing building with the real building. If the entered and the calculated consumption are too different, the user is asked to check the input values. On the right hand side, there is again a link to the information database. There are different example buildings available depending on the building typology. The choice 'Typology' is only used for a sorting of the example buildings and has no influence on the default building. By clicking on the picture the '**Case Study Viewer**' is opened with this example building in a separate window.

After the default building is created the development of retrofit concepts can be done. But there is also the possibility to refine the default building to fit it to an existing building.

Further Refinement of the building

Location



Location ?

Choose the climatic zone for the building


Climatic zone UK North

Holiday weeks during heating season: 8

Further information on the chosen zone:

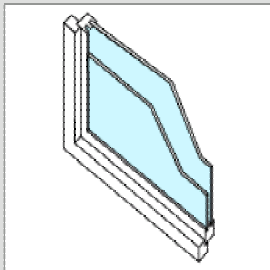
UK Northern Climate is taken as that of Edinburgh (Turnhouse 1976 - 1995)

Weather data is taken from: Guide J: Weather, solar and illuminance data CD-ROM (2002)
<http://www.cibse.org/index.cfm?action=PubDetails&PubID=9&TopSection=4&s1=y&L1=>



If more than one climate zone is available for the selected country, it can be changed in this part. The information on how many holiday weeks are in the heating period between September and March is important if the heating system is operated in the mode 'Holiday setback'.

Geometry and Elements of the Building Envelope

Geometry and Elements of Building Envelope			
Heated volume [m ³]:	33372	Heated floor area [m ²]:	6180
Ratio A/V [m ² /m ³]:	0,32	Area of thermal envelope [m ²]:	10815
Switch through the different envelope elements:			
<input type="button" value=" <"/> <input type="button" value="<<"/> <input type="button" value="external wall"/> <input type="button" value="pitched roof"/> <input type="button" value="ground plate"/> <input type="button" value="window north"/> <input type="button" value="window east"/> <input type="button" value="window south"/> <input type="button" value="window west"/> <input type="button" value=">>"/> <input type="button" value="> "/>			
<input type="button" value="Add element"/> <input type="button" value="Copy this element"/> <input type="button" value="Delete this element"/>			
window			
	Name:	window east	
	Area[m ²]:	194,67	Maintenance Costs: 20,00 €/m ² a
	Structure:	double glazing, wooden or plastic frame, with sealing	
		double glazing, no gas filling, wooden or plastic frame, with sealing	
	Existing U- / g-Value:	2,4 W/m ² K / 0,78	Orientation:
Shading device:	no shading system		
	Additional maintenance costs for shading:		0,00 €/m ² a
<input checked="" type="checkbox"/> This component have to be retrofitted anyway. <input type="radio"/> in a minor refurbishment <input checked="" type="radio"/> in a major refurbishment			

The main geometry is already fixed with the key values, only the gross heated volume can be changed. The gross heated volume is the volume that is enclosed by the heat transfer surface of the building envelope. There are some other geometric values shown, that can't be changed directly. These are heat transferring surface, A/V_e and heated floor area.

In the lower part is the definition of the particular element of the building envelope. These elements are created as default values depending on the building type, the construction year, the type of the roof and the basement, the heated floor area and the orientation of the building. They represent typical constructions and sizes for the building described in the basic input part.

There is an index card for each element. By clicking on the name of an element, it is shown in the lower part. There is the possibility to add new elements and to remove existing elements.

The data are slightly different for transparent and opaque elements as there is for example no shading definition for opaque elements. Everything except the type (external wall, pitched roof, flat roof,...) of the building element can be changed.

The default maintenance costs are country-dependent mean values, that have to be checked carefully to get proper results from the economic calculations.

At the bottom, there is the question if an element of the building envelope has to be retrofitted anyway in a minor or a major refurbishment.

A major refurbishment means a refurbishment, where national regulations eg, for the maximum heat transmission have to be considered. The specific definitions for being a major refurbishment are given in national regulations.

As an example the German definitions for a major refurbishment of an external wall are shown here:

A maximum limit on the heat transmission coefficient of the external wall has to be complied with if:

- a) an external wall is replaced or built for the first time
if it is renewed, the maximum limit has to be complied with if
- b) linings? as boards or board-like elements as well as a curtain wall are applied
- c) on the inner side, linings or boarding is applied
- d) the wall is thermally insulated
- e) the rendering of an existing wall with a heat transmission coefficient of more than $0,9 \text{ W}/(\text{m}^2\text{K})$ is renewed
- f) the infills of half timber framings are replaced

If any of these conditions applies to the refurbishment, the thermal transmission coefficient of the particular external wall must be lower than $0,45 \text{ W}/(\text{m}^2\text{K})$ in cases a), c), f) and $0,35 \text{ W}/(\text{m}^2\text{K})$ in cases b), d), e) for buildings with a normal inside temperature and $0,75 \text{ W}/(\text{m}^2\text{K})$ for buildings with a lower than normal inside temperature.

If there is to be a major refurbishment of an element, the investment costs of all possible retrofit measures for this element are set as marginal costs relative to the defined anyway measure. Anyway measure means a retrofit measure that has to be applied anyway. So there is the possibility to spend some little extra money for a measure with a better energy efficiency, but the additional savings of energy might be worth it.

Heating and ventilation plant

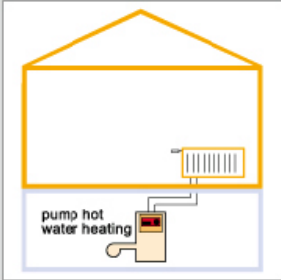
Heating and Ventilation system ? -

Choose the existing plant

The heat energy is generated by:

The type of ventilation is:

Details of selected plant



pump hot water heating

Detailed description of the chosen plant:

pump hot water heating 90/70 °C, high temperature boiler, thermostatic room regulation, natural ventilation

Maintenance Costs: €/m²a

Adjusted setback modes:

Used energy source:

This component have to be retrofitted anyway.

The existing heating and ventilation plant can be chosen here. The plant is set as a default depending on the key value 'Construction year'. There are some plants available and also the energy source for the heating plant can be changed. There is the possibility to choose which type of ventilation there is in the existing building. The default maintenance costs are country dependent mean values, that have to be checked carefully to get proper results from the economic calculations.

The adjusted setback mode of the plant has four possibilities:

no setback	the average temperature is the same as the set-point temperature
night setback	the average temperature is reduced for 7 hours a day to a given temperature, that can differ from country to country. As a default value, it is reduced by 3K to 16°C.
weekend setback	this mode includes the night setback over the weekend. It reduces the temperature on 2 days a week to a given temperature that can differ from country to country. As a default value, it is reduced by 5K to 14°C. The other 5 days a week, the temperature is reduced like the night setback mode.
holiday setback	the temperature is reduced in holiday weeks during the heating season to the value of the weekend setback. In other weeks the weekend-setback mode is applied.

On the bottom line, there is the question whether an element of the building envelope has to be retrofitted anyway in a minor or a major refurbishment. Major retrofit means a refurbishment, where national regulations eg for the maximal heat transmission are given. See also the paragraph 'Geometry and Elements of the Building Envelope' for a further description of a major refurbishment. If there is to be a major refurbishment of an element, the investment costs of all possible retrofit measures for this element are set as marginal costs to a defined anyway measure. Anyway measure means a retrofit measure that has to be applied anyway. So there is the possibility to spend a little extra money for a measure with better energy efficiency, for which the additional savings in energy might be worthwhile.

Lighting

Lighting		?	-
Classrooms			
Fraction of total floor area:	75,0	%	Installed System: Incandescent
Fraction Area window/facade:	50,0	%	Lighting control: Switch with manual control
Mean room depth:	7,50	m	Maintenance Costs: 2,60 €/m ² a
<input type="checkbox"/> This component have to be retrofitted anyway.			

The electrical energy for lighting is calculated for the classroom-area and the remaining area. Only the lighting installations for the classroom-area can be changed. It is assumed that the remaining area is lighted with half of the power of the classrooms with the same controls installed.

At first the geometric attributes, fraction of classroom-area to heated floor area, the fraction of the window area to the façade area and the mean room depth, have to be defined. Then the installed lighting system and lighting control have to be chosen. Finally the maintenance costs for the existing system have to be entered.

The default maintenance costs are country dependent mean values, that have to be checked carefully to get proper results of the economic calculations.

Cost data

Cost data		?	-
General values			
Inflation rate:	2,00	%	Period of analysis: 20 years
Interest rate:	5,00	%	
Energy prices			
Electrical energy	Meter price: 95,00 €/a	Consumption price: 11,00 Ct/kWh	
Oil	0,00 €/a	3,00 Ct/l	
Gas	15,00 €/a	5,00 Ct/m ³	

The values needed for the economic calculation can be adjusted here. First the inflation rate, the interest rate and the period of analysis are defined. They are needed for the

calculation of the net- present value and the present value for investment and maintenance.

The energy prices have to be defined for electrical energy and all possible energy sources for the heating plant.

These cost data are country dependent mean values. To get a proper result from the economic calculations, these values have to be checked carefully.

Select one retrofit measure for each building element

This part is for the selection of retrofit measures for each building element. There are various possible retrofit measures for each element of the building. The measure with the best cost benefit value is automatically selected, but of course the selected retrofit measure can be changed. The overview in the lower part shows the effects for each measure, as if only this measure would be applied in comparison to the unretrofitted existing building.

Select a component

The lower part of this section shows all the possible measures for a single element. All the elements can be chosen in this part. If another element is selected, the two lower parts show this element.

Select a retrofit measure

Select a retrofit measure			
0	low-e-coated double glazing, plastic frame, with sealing		
improved U-Value:	<input type="text" value="1,70 W/m²K"/>	Investment costs:	<input type="text" value="300,00"/> €/m²
improved g-Value:	<input type="text" value="0,65"/>	Maintenance costs:	<input type="text" value="10,00"/> €/m²a
This is the anyway measure! The costs of the other RM are set to marginal costs to this measure.			
<input checked="" type="radio"/> Select this measure as chosen retrofit measure for this element			
1	exchange of glazing while keeping the old frame, low e-coated double glazing, new sealing		
improved U-Value:	<input type="text" value="1,30 W/m²K"/>	Investment costs:	<input type="text" value="220,00"/> €/m²
improved g-Value:	<input type="text" value="0,65"/>	Maintenance costs:	<input type="text" value="20,00"/> €/m²a
<input type="radio"/> Select this measure as chosen retrofit measure for this element			
2	low-e-coated double glazing, plastic frame, with sealing		
improved U-Value:	<input type="text" value="1,30 W/m²K"/>	Investment costs:	<input type="text" value="320,00"/> €/m²

This part shows the available retrofit measures for the selected element. At first the attributes of the existing element are listed, so that there is the possibility to see the improvements of the retrofit measures. Then all the available measures are listed. By default the measure with the best cost-benefit ratio is selected. Another measure can be selected by pushing the button 'Select this measure as chosen retrofit measure for this element'.

If the element has to be retrofitted in a major refurbishment, the first measure is set as an 'anyway-measure'. That means this measure will be applied anyway. The investment- costs of the other measures are only calculated as marginal costs to the investment costs of this measure.

The investment and maintenance costs can also be changed for every measure. The given costs are recommendations based on national knowledge. To get a proper result from the economic calculations, these costs have to be checked carefully.

A change of the selected measure as well as changes in the cost-values are calculated immediately and the results of the changed values are shown in all parts of the ECA.

Overview

Overview			
Retrofit Measures:	Heat Energy demand:	Extra investment costs:	Cost Benefit Value:
Existing Building	437,0 kWh/m²a		
0 low-e-coated double glazing, plastic frame, with sealing	436,0 kWh/m²a <small>This Measure will be applied anyway. Its investment-costs are 58400 €.</small>	0 €	0,00 €/kWh/a)
1 exchange of glazing while keeping the old frame. low e-coated double	434,0 kWh/m²a	-15000 €	-1,00 €/kWh/a)
2 low-e-coated double glazing, plastic frame, with sealing	434,0 kWh/m²a	+3890 €	0,20 €/kWh/a)
3 low-e-coated double glazing, plastic frame, with sealing	435,0 kWh/m²a	+5840 €	0,50 €/kWh/a)
4 low-e-coated double glazing,			

The possible energy savings of single measures only applied to the existing building, the total investment costs and the cost benefit ratio (except for shading) are listed in the 'Overview'. This overview helps you to select the best measure.

Create and compare energy saving concepts

Create and compare energy saving concept ? -

How to use this part -

This part is for the creation and comparison of different concepts for an energy efficient retrofitting. There are possibilities for creating five different concepts. After having selected elements for a concept, the different concepts can be compared in the lower part 'Overview'.

Select elements for the different concepts Choose here, which elements shall be retrofitted within a concept

Overview: Look at the results of the different concepts. Different energy and economic values can be displayed.

Select elements for the different concepts +

Overview +

Five different retrofit concepts can be created and compared in this part. There is the possibility to mark elements that should be retrofitted in the refurbishment.

For the selected elements the retrofit measures chosen in the part 'Select one retrofit measure for each building element' are applied, the other elements are calculated with their existing attributes.

Select elements for the different concepts

Element: Chosen retrofit measure:	Concept				
	1	2	3	4	5
pump hot water heating 90/70 °C Add ventilation system (80% recovery)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ground plate 4 cm mineral wool, screed/floor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
lighting source Compact Fluorescent	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
external wall internal insulation with 6 cm polystyrene, vapour barrier and gypsum board	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
lighting control Occupancy sensor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
window west The measures are sorted by benefit-cost-value					

In this list all elements are listed. They are sorted by their cost-benefit value, best on top. There is an entry for each element with the name of the element and the name of the selected retrofit measure. There are five check boxes on the right hand side of each entry, one for each retrofit concept. If a check box is marked, the element will be calculated as retrofitted with the selected retrofit measure. If a selection is changed, the calculation is performed immediately and the results are shown in the part 'Overview'.

Overview

Overview

Show: Energy values Show Results: related to floor area

Show: Primary Energy Show consumptions Show savings

Primary Energy
All Values are shown in kWh/m²a!

Category	Value
Existing Building	437.0
Concept 1	132.0
Concept 2	336.0
Concept 3	210.0
Concept 4	295.0
Concept 5	338.0

Warnings:

- The input fits to the entered consumption!
- The concept 1 may get overheated in summertimes. Please check possible shadings!
- The concept 2 may get overheated in summertimes. Please check possible shadings!

This part shows the current results of the calculation of the five different concepts. As soon as something is changed, the calculation is executed and the results are updated. There are various results that can be displayed:

- Energy relevant values
 - o Primary Energy
 - o Final Energy
 - o CO₂- Level
- Economic relevant values
 - o Net present value
 - o Present value – Investment
 - o Present value - Operating costs
 - o Simple payback

The corresponding result for the existing building is also shown for the energy relevant values. Additionally there are some options for how the results are presented. There is the possibility to show consumptions or savings and the values can be displayed as total values, related to the heated volume or related to the heated floor area.

Summary and Report

As a last step there is the possibility to get a summary or a report of the calculation. The summary is a listing of all input values, the selected retrofit measures and the main calculation results. It is intended for a quick check of the calculation and it is shown in a pop-up window. There is no possibility to save or print this summary, as Java (the programming language) doesn't offer this possibility. The report is intended for a handout report of the different concepts. It is sent as a PDF-File via email.

Summary and Report ? -

How to use this part

Two different output will be created in this part.

Summary This is a short summary of the input values and the selected retrofit measures. It is shown in a pop-up window.

Report The report is a comprehensive list of the whole concept including input values and results. It is also possible to include the diagrams into the report. The report can include all concepts or just one selected.
The report will be delivered by e-mail as a pdf document.

Options

Summary

Select a concept:

Report

Show: **show Diagramms**

Enter your Email-address:

Options

A summary of the selected concept is shown by pushing the Button 'Show Summary'.

A report is sent after input of an email-address by pushing the Button 'Show Report'. There is the possibility to choose whether the report shall include all concepts or just one and if there shall be diagrams in it or not.

Utilities:

- This part of the Energy Concept Adviser offers a program called KULU (see Appendix B for a description) and all the reports of Annex36 as downloads.

Info and Contact:

If there are any questions regarding the Energy Concept Adviser or the work of Annex36, a list of all members and their contact information is contained within Appendix F.

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