




EUROPEAN HIGH QUALITY LOW ENERGY BUILDINGS

www.EULEB.info

Final report

February 28th, 2007

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Intelligent Energy  Europe

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Abstract

The European research project “EULEB – European high quality Low Energy Buildings” intends to provide information about good examples of energy efficient buildings in use, in order to reduce prejudices and lack of knowledge of many key actors of the building market.

Therefore, a multilingual CD and website was produced, containing detailed information about 25 buildings from all over Europe including measured data about energy consumptions, construction costs, comfort and user acceptance.

150.000 copies of the CD resulting from this work have been disseminated in the beginning of 2007 through European magazines reaching the target groups of architects and engineers as well as investors and property developers all over Europe. Furthermore, all information is available on the website www.EULEB.info.

The project was performed by a European consortium of five Universities and a European umbrella organisation and it was partly funded by the “Intelligent Energy Europe” programme.

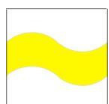
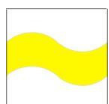
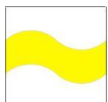


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INTRODUCTION

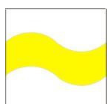
The energy consumption in Europe is rising from year to year. The replacement of limited fossil fuels by renewable energies is proceeding slowly. As a result, the reduction of CO₂-Emissions is proceeding slowly, too.

The building sector plays an important role in the total energy consumption. In order to tap this potential for energy savings and reduction of CO₂-emissions the energy-efficiency of buildings has to be improved as soon as possible.

One important measure to achieve these goals is the legislation for new and existing buildings. With the European “Energy Performance of Buildings Directive” (EPBD), which has to be turned into national laws by the European member states, an important step into this direction has been done.

But unfortunately energy efficient buildings are sometimes facing prejudices and image problems resulting from bad examples from the past. Many people mistrust the real energy efficiency in use, the quality of architecture, the user comfort and the cost effectiveness. Other people just have concerns about energy efficient buildings as a result of lack of information.

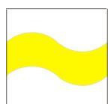
These prejudices and the lack of information can be reduced and eliminated by providing information and detailed data of existing good examples to key actors of the building market. With a collection of 25 European high quality low energy buildings and detailed information about their architecture, their building concept, their measured energy performance and their building costs, EULEB helps to improve the image of energy efficient buildings and supports the implementation of the EPBD.

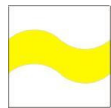


1. Project team

The EULEB project team consists of five European Universities of which the University of Dortmund coordinated the project and one international association. The Universities are represented by different institutes, which are working in the field of energy efficiency of buildings. They have formed a successful research and teaching network in which several projects already have been performed. The excellent knowledge of the team's national building stock allowed a detailed identification of buildings from the five largest European countries.

The sixth partner was REHVA, the Federation of European heating and air-conditioning associations. REHVA is a 43 year old umbrella organisation, representing 30 member associations of European experts for building services. Thus, REHVA has direct contact to about 110.000 key actors of the European building market. They supported the project with the expert knowledge and their network which was used for disseminating the results.



Tab. 1: Project partners


Universität Dortmund
Lehrstuhl für
Klimagerechte Architektur
(Project coordinator)

Prof. Dr.-Ing. Helmut F.O. Müller
Dipl.-Ing. Jörg Schlenger (Management)
Collaboration:
Dr.-Ing. MA Heide Schuster
Dipl.-Ing. Oliver Klein
Andreas Preißler
Anneke Bintig
Dana Augsten
Heike Theilenberg



London Metropolitan University
LEARN

Prof. Michael Wilson
Dott.Arch. Livio Venturi
John Solomon



Università degli Studi di Firenze
ABITA

Prof. Marco Sala
Dott. Arch.Lucia Ceccherini Nelli



Université de La Rochelle
LEPTAP

Prof. Francis Allard
Cristian Ghiaus
Agota Szucs



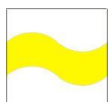
Universitat Politècnica de Catalunya
AiE

Prof. Helena Coch
Arch. Eulalia Cunill
Arch. Oriol Paris



Federation of European heating
and air-conditioning associations

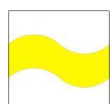
Prof. Olli Sepänen



2. Selection of buildings

A total of 50 public buildings have been identified, predominantly from the countries where the University Partners are situated. To cover the large variety of climatic conditions in Europe, buildings from the very far north (Scandinavia) as well as from the very south of Europe, (Mediterranean countries), were included. Out of the identified buildings, there had to be a selection of five buildings per University Partner for further examination.

For the selection of buildings a simple evaluation system was designed. In this first step, each building was evaluated concerning its qualification to the project. Seven categories (such as quality of architecture, energy consumption, availability of monitored data etc.) with different weightings were used in this subjective evaluation methodology. Low ratings in some of the criteria had to lead to a direct exclusion of a project (for example lack of monitored data).




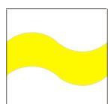
| EULEB - First evaluation of buildings | | | | |
|--|---|--|-------------|-----------------|
| Building information: | | | | |
| Short Name: | Examp |  | | |
| Name: | Example building | | | |
| Country: | no man's land | | | |
| Climatic zone: | Alwaysnice | | | |
| Occupancy: | Educational | | | |
| Evaluation: | | | | |
| No. | Criterion | rating 1 (bad) to 10 (good) | weighting | weighted rating |
| 1) | Good Design, preferably award winning buildings | 5 | 20% | 1,0 |
| 2) | Low Energy Consumption (heating, ventilating, cooling, lighting) | 8 | 20% | 1,6 |
| 3) | Advanced technologies for building and services | 2 | 15% | 0,3 |
| 4) | Renewable energy utilisation and integration (solar thermal, PV, biomass, geothermal etc) | 9 | 15% | 1,4 |
| 5) | High comfort solutions (thermal, ventilation and lighting) | 1 | 10% | 0,1 |
| 6) | Availability of monitored energy consumption or easily measurable | 8 | 10% | 0,8 |
| 7) | Availability of financial data relating to energy saving features (RUE and RES) | 4 | 10% | 0,4 |
| Overall rating | | | 100% | 5,6 |
| This evaluation systems leads to comparable evaluation of the suitability of buildings for the EULEB-project. Within the different climatic zones in Europe (south, middle, north), the buildings with the highest overall-ratings should be selected for further treatment. Therefore, the different climates, building technologies and cultural aspects of the European Countries have to be taken into account for the assessment of the several criteria. | | | | |

Fig. 1: First evaluation of buildings

After having evaluated the 50 identified buildings, a ranking of the buildings identified by each partner could be established, showing which buildings fulfilled the overall criteria best. This process led to the selection of 25 buildings from all over Europe (see table 2).

Tab. 2: List of buildings selected for EULEB

| No. | Name | Occupancy | Country | City |
|-----|---|-------------|---------|-----------------------------------|
| 1 | Gebhard-Müller-Schule | Educational | Germany | Biberach |
| 2 | Fraunhofer ISE | Office | Germany | Freiburg |
| 3 | FH Rhein-Sieg | Educational | Germany | St. Augustin |
| 4 | EnergieForum Berlin | Office | Germany | Berlin |
| 5 | Main Office and R.C. of Finnish Forest Research Institute | Office | Finland | Joensuu |
| 6 | BRE Office | Office | England | Watford |
| 7 | Elizabeth Fry | Educational | England | Norwich |
| 8 | Great Notley School | Educational | England | Braintree |
| 9 | Kunst Museum | Leisure | Sweden | Kristinehamn |
| 10 | Tanga School | Educational | Sweden | Falkenberg |
| 11 | Maison de la region Alsace | Office | France | Strasbourg |
| 12 | Malta Stock Exchange | Office | Malta | La Valetta |
| 13 | County Hall La Rochelle | Office | France | La Rochelle |
| 14 | Lycée Polyvalent Albert Camus | Educational | France | Fréjus |
| 15 | Lycée Pic St-Loup | Educational | France | St Clément de Rivière |
| 16 | New Meyer Hospital in Florence (CSPE project) | Educational | Italy | Florence |
| 17 | Bardini Museum | Leisure | Italy | Florence |
| 18 | Guzzini headquarters | Office | Italy | Recanati |
| 19 | «AVAX» S.A. Headquarters | Office | Greece | Athens |
| 20 | Primary School in Empoli | Educational | Italy | Empoli |
| 21 | Ethnographic Museum | Leisure | Spain | Güímar, Tenerife (Canary Islands) |
| 22 | Centre of Nature | Leisure | Spain | Les Planes de Son (Lleida) |
| 23 | SANITAS-BUPA Headquarters | Office | Spain | Madrid |
| 24 | National Centre of Renewable Energies | Office | Spain | Navarra |
| 25 | Association of Telephone Telecommunications group for Aid and work insertion to Physical Handicapped. | Educational | Spain | Sevilla |



3. Selected information

The EULEB project should address to different target groups, namely architects, engineers, investors and property developers. All these groups have a very different knowledge background as well as different interests in terms of building information. As EULEB could never satisfy 100% of the different interests in all details, the challenge was to provide a basic set of general building information. A number of details should address the different target groups and raise the user's interest to search for more information.

The 25 selected buildings were grouped in the three categories "Office", "Education" and "Leisure", whereas office and education buildings have been represented stronger than leisure facilities.

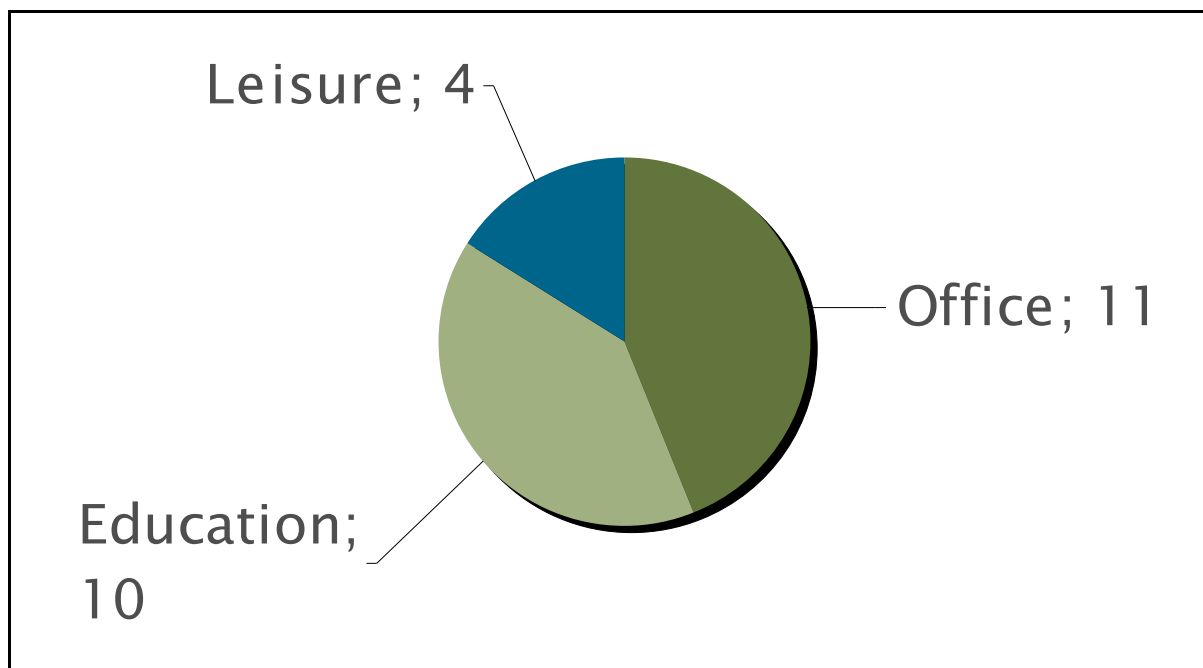


Fig. 2: Distribution of selected buildings to building types

Besides the different building use, the locations of the buildings from all over Europe result in a large variety of differences of the buildings' boundary conditions,

especially in terms of climate. Therefore a visualisation of the buildings locations with reference to the climatic zones of KOEPPEN was used to introduce the user to the influence of locations on the building design and building energy consumption.

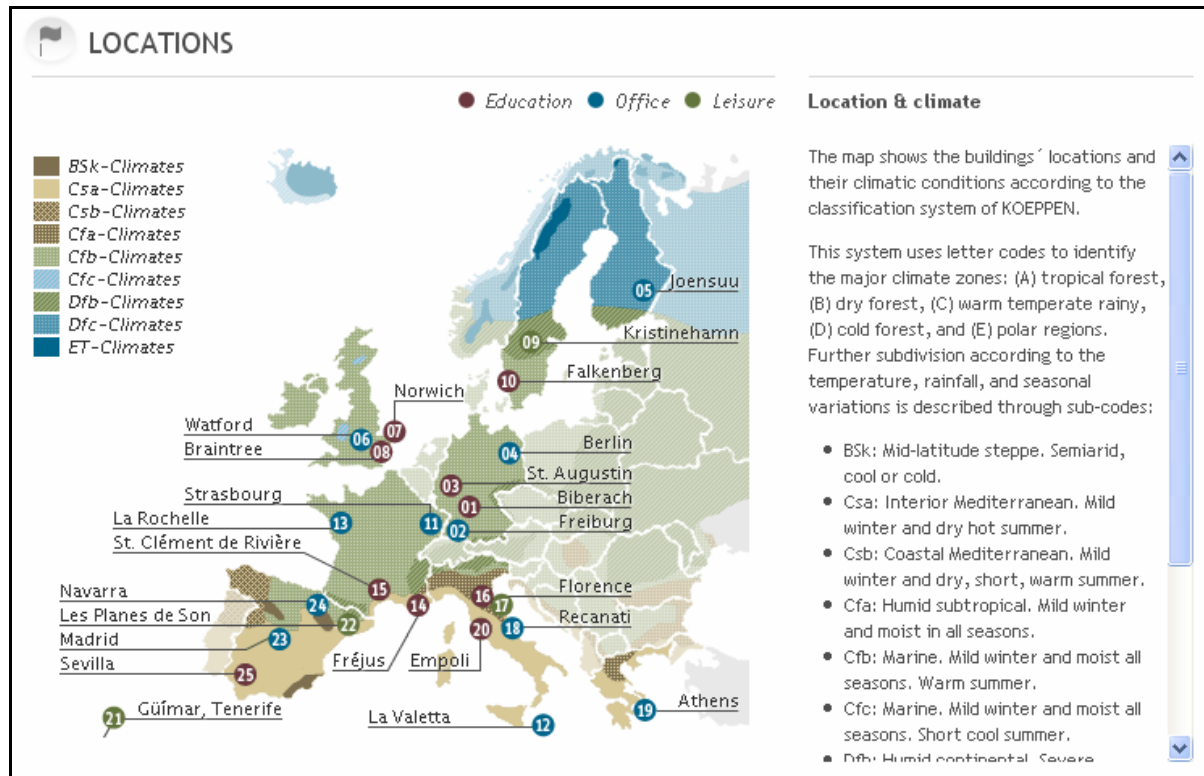


Fig. 3: Locations and climatic zones of selected buildings

Each building presentation starts with some general information about the exact building name, location address, relevant persons involved in the design and construction, information about the buildings' areas and volumes etc. These information are accompanied by images (external and internal views) and plans (site maps, floor plans, elevations and sections) visualising the architecture of the building. To visualise the appearance and the atmosphere of the buildings, short professional video clips provide extra impressions beyond the static images and plans.

The climatic conditions are described in more detail by statistical diagrams and some figures, like the ASHRAE classification which relates the climate to the energy consumption of buildings. The next sections give general descriptions of the build-

ing construction including the thermal quality of the building envelope and the general energy concept and technical systems.

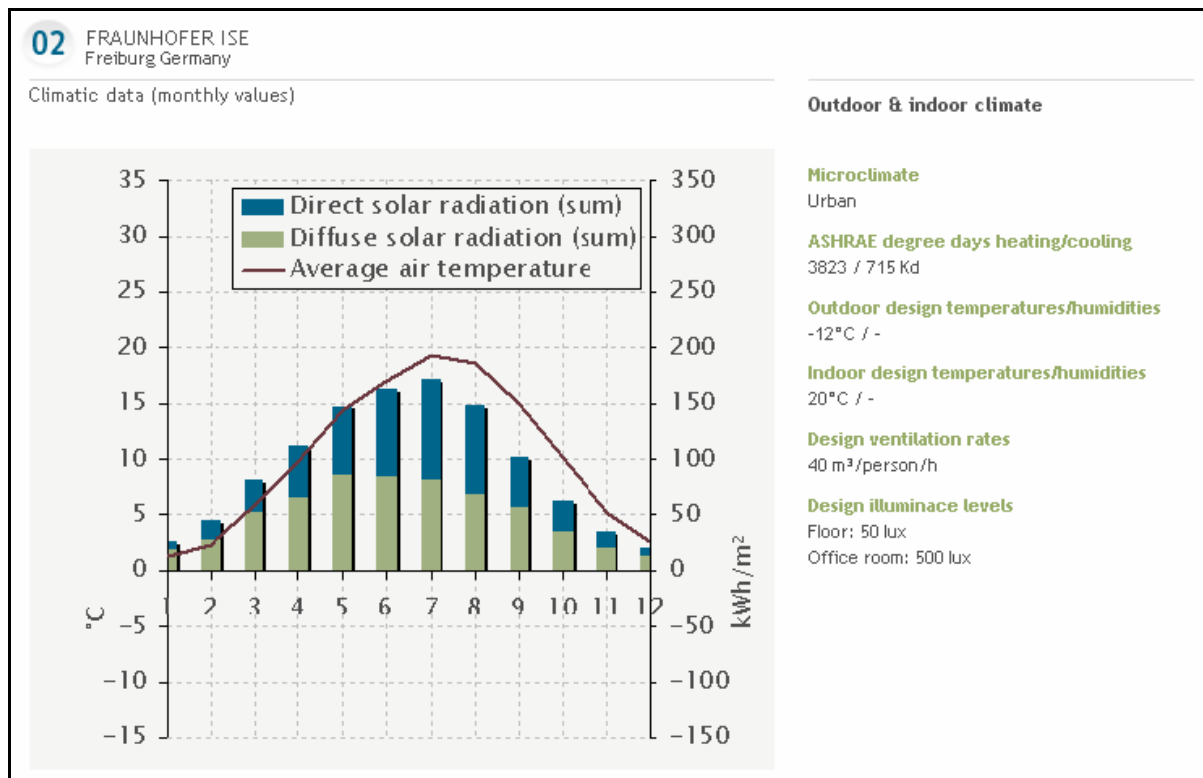


Fig. 4: Climatic conditions in EULEB

Special features of the building concept, which are significant for the energy efficiency of the building, are described and visualised in more detail. These features have been grouped to the categories Insulation, Solar control, Lighting, Heating, Cooling, Ventilation, Materials, Renewable energies, Co-Generation and Rainwater use.

The energy performance of the buildings is evaluated with measured energy consumption. Where available, the consumption is separated by fuel type (electricity, gas, oil etc.) and load type (heating, cooling, ventilation, lighting etc.). This allows giving a detailed overview on the building's energy performance and calculating the respective partly and total primary energy consumptions. All values are related to

the building's usable floor area and compared with national average and standard values where available.

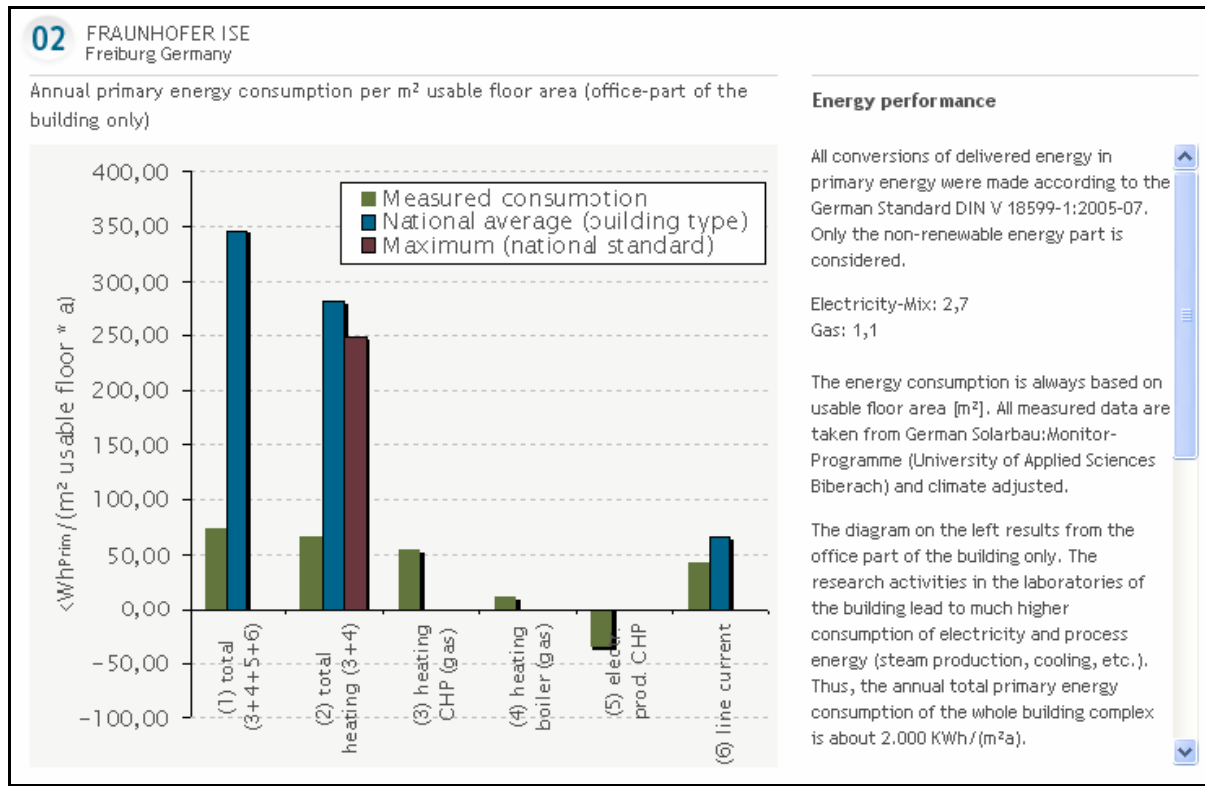


Fig. 5: Energy performance in EULEB

The visual comfort has been measured by luminance pictures, which have been taken and processed for all buildings in the course of the EULEB-project. They give an impression of the luminance and possible glare effects in a typical room of the building.

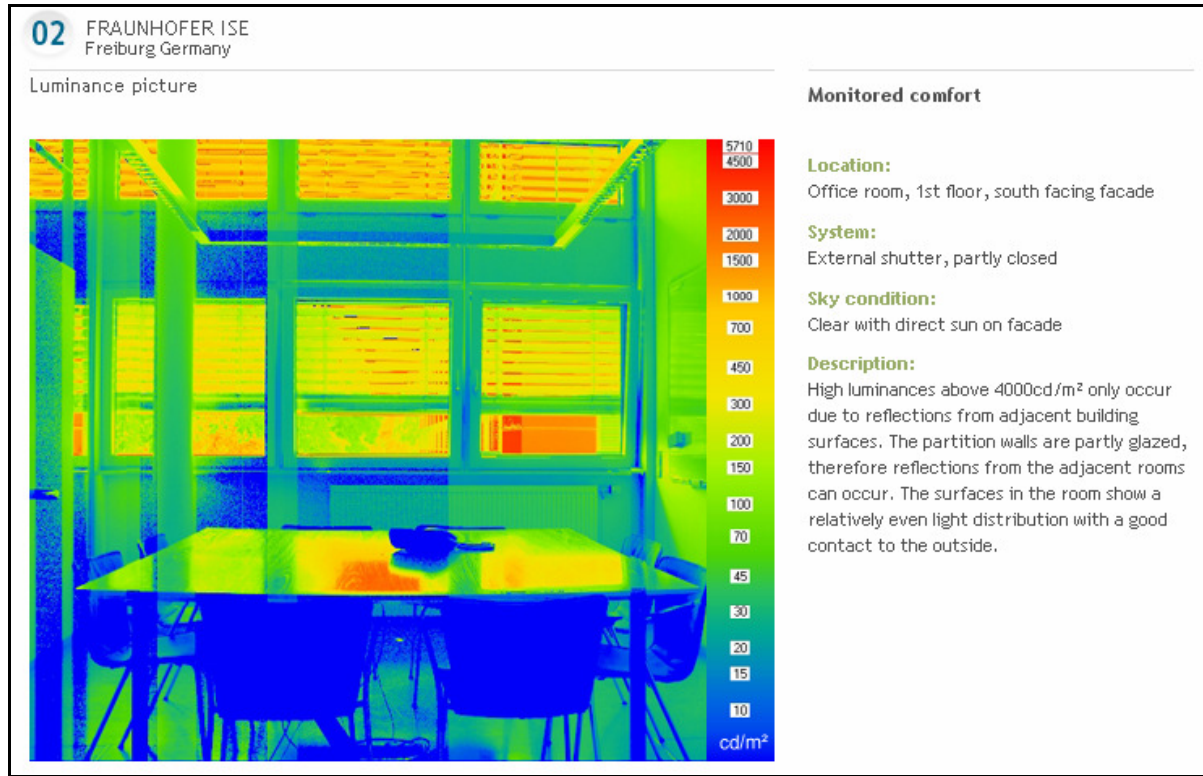


Fig. 6: Visual comfort expressed by luminance pictures

In order to evaluate the quality of the buildings, user acceptance studies have been performed in all 25 buildings. Using a simple questionnaire with 12 questions concerning temperatures, air quality, lighting, comfort, user influence, architecture etc. allowed creating a detailed evaluation and an overall user acceptance.

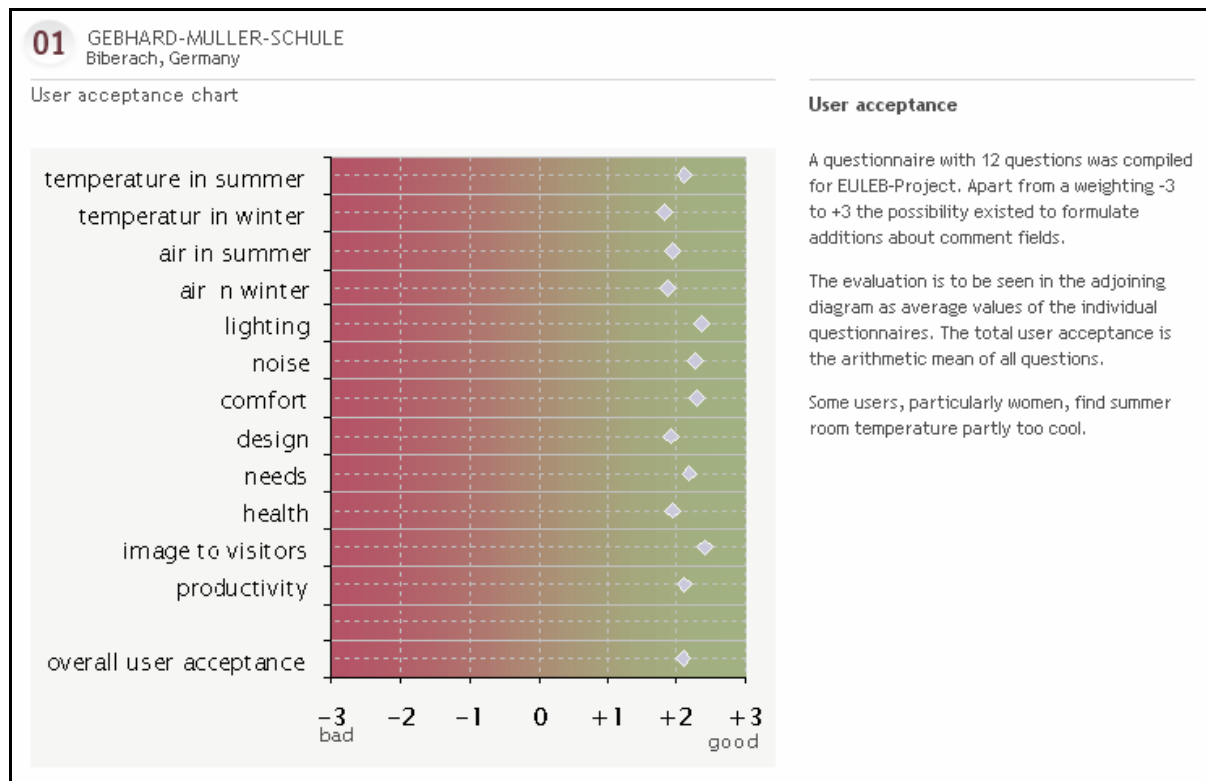


Fig. 7: Results of post occupancy studies

The real building costs have been documented in relation to the usable floor area of the building. Where available, the total costs are divided by cost categories and national average costs for a similar building have been used for comparison.

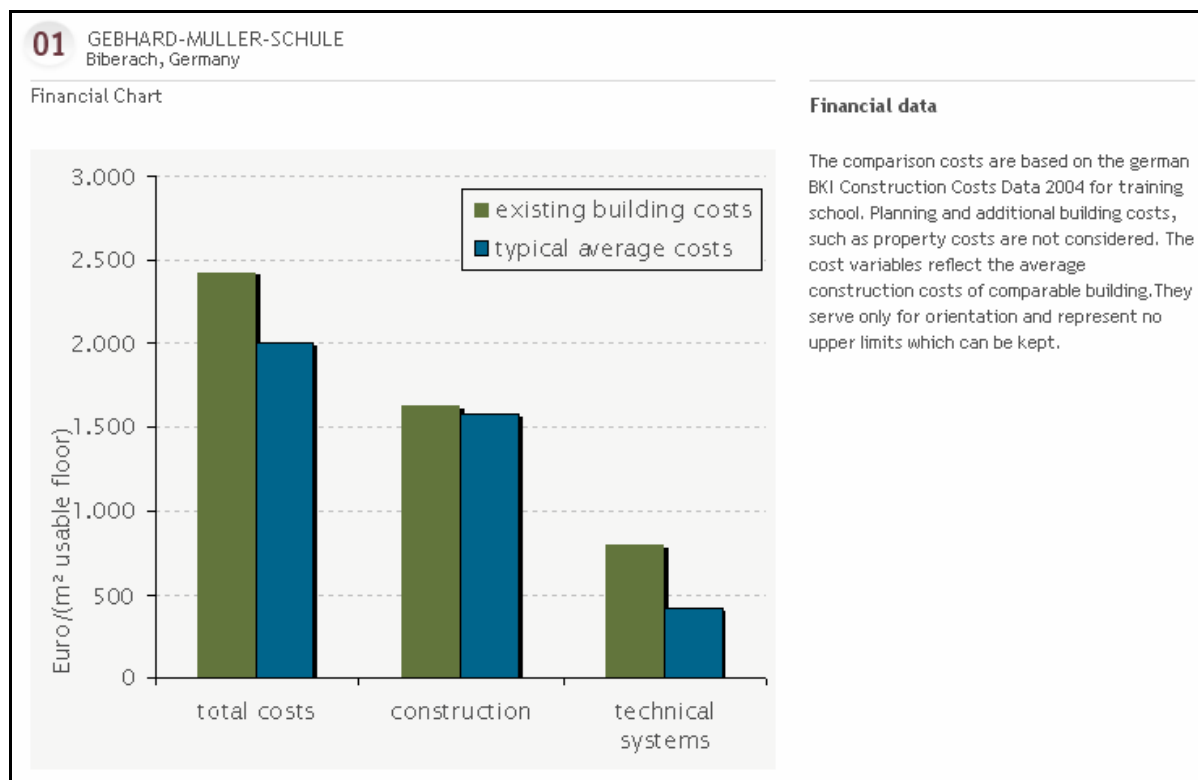


Fig. 8: Building costs in EULEB

Based on the building data described above, the “Benchmarking” section provides a comparison of the building costs, the energy performance and the user acceptance of all 25 buildings. These characteristics depend on many variables such as building use, climatic conditions etc. which have to be taken into account. Thus, in EULEB the buildings have been grouped according to building type and climatic zone. Although this of course does not take into account all relevant parameters (user influences, etc.) a rough comparison could be established.

With this compilation of building data, the general and specific interests in terms of design, technical details, energy performance and costs of the target groups Architects, Engineers and Property Developers have been addressed as much as possible.

4. Access to information

4.1 Multilingualism

The access to the information and data available on the EULEB-Website and -CD should be easy and specific for the various interests and needs of the users from the different target groups.

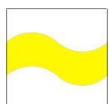
As EULEB addresses key actors from all over Europe, the first priority was to provide all information in the five languages English, German, French, Italian and Spanish. From any point in the CD or website, EULEB allows to swap to the same page in another language by clicking on the flags in the bottom left corner.

4.2 Access by location and building type

The second requirement coming from the European scale of EULEB was to establish a selection according to the buildings' locations, because each building has to be seen against its local background in terms of national standards, culture, climatic conditions etc. Thus, interactive maps showing the 25 buildings together with country borders and climatic zones have been created, allowing a visual grouping of the projects.

Three colours have been allocated to the three building types "Office", "Education" and "Leisure". This colour code is used continuously in all parts of the database and allows fast orientation and differentiation between the building types.

Each building has been given a unique number which is also used continuously for identification of the respective building.



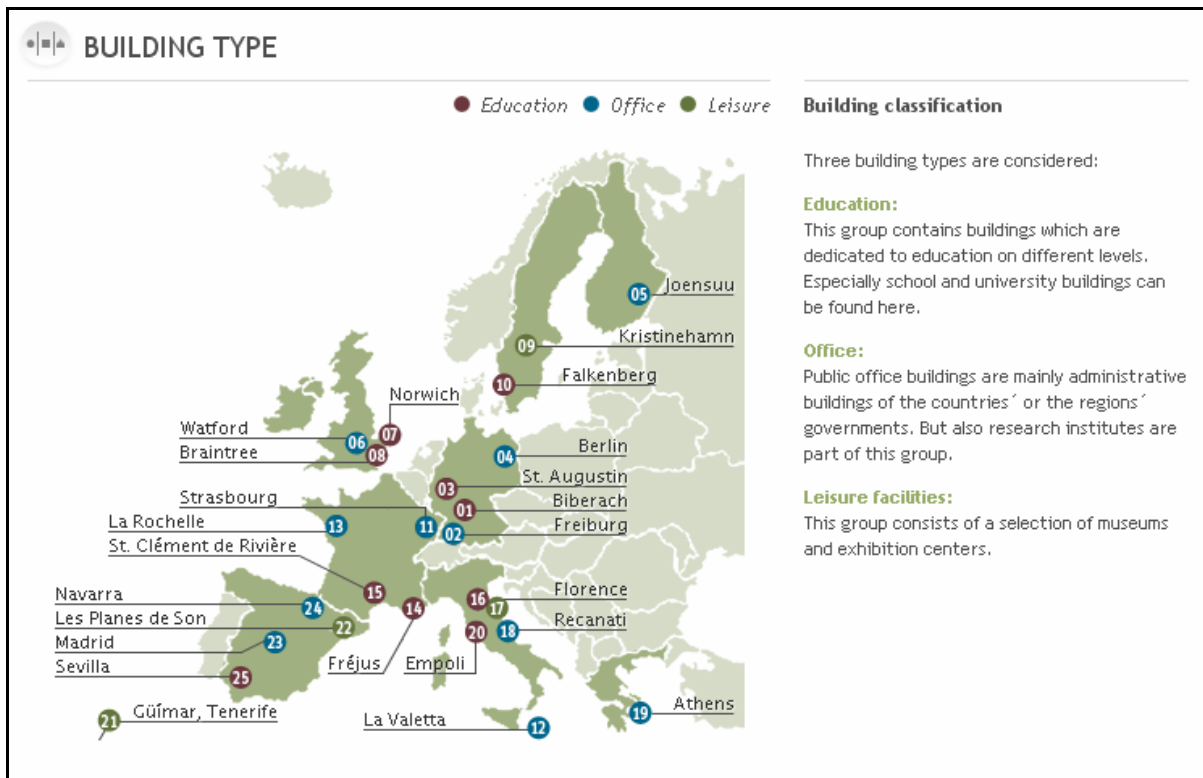


Fig. 9: Interactive map with building locations

4.3 Access by technologies

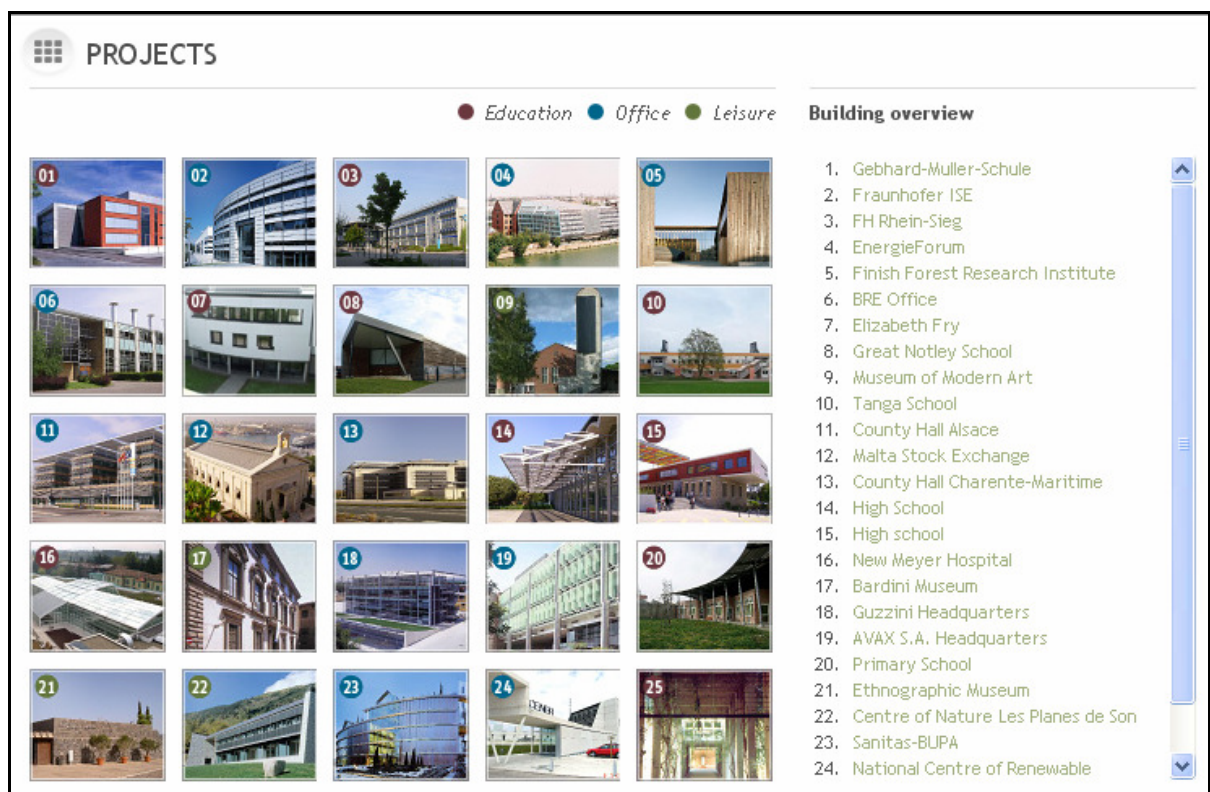
For users with interest in certain technologies, the buildings can be displayed in ten different groups depending on the special features applied in the buildings: Insulation, Solar control, Lighting, Heating, Cooling, Ventilation, Materials, Renewable energies, Co-Generation and Rainwater use. Therefore, the selection of one of these categories reduces the interactive maps to those buildings, where a special feature of the respective category is applied in. By clicking on a building location in these maps, the user can navigate directly to the description of the respective technology in a building.



Fig. 10: Interactive map with certain technologies in buildings

4.4 Access by Architecture

To allow a selection by visual impressions of the buildings, a project overview with images of the 25 projects has been established. This interactive matrix gives a quick overview and is supplemented by the colour code of the building types, the building numbers and names. This visual selection is also important for the easy recognition of the projects and to retrieve certain information when using EULEB again.



The screenshot displays an interactive matrix titled 'PROJECTS'. It features a grid of 25 numbered images of buildings, each with a small colored circle indicating its type: red for Education, blue for Office, and green for Leisure. To the right of the grid is a 'Building overview' list with 24 numbered entries. A vertical scrollbar is visible on the right side of the list.

Building overview

1. Gebhard-Muller-Schule
2. Fraunhofer ISE
3. FH Rhein-Sieg
4. EnergieForum
5. Finish Forest Research Institute
6. BRE Office
7. Elizabeth Fry
8. Great Notley School
9. Museum of Modern Art
10. Tanga School
11. County Hall Alsace
12. Malta Stock Exchange
13. County Hall Charente-Maritime
14. High School
15. High school
16. New Meyer Hospital
17. Bardini Museum
18. Guzzini Headquarters
19. AVAX S.A. Headquarters
20. Primary School
21. Ethnographic Museum
22. Centre of Nature Les Planes de Son
23. Sanitas-BUPA
24. National Centre of Renewable

Fig. 11: Interactive matrix with images of the architecture

5. Data collection

5.1 General data

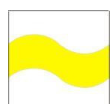
The basic data stock for the building descriptions consists of images, plans and design parameters. As a result of the requirement, that monitored data from at least two years of building use had to be available, all buildings from the building selection had a certain minimum age. Therefore many materials already existed from previous publications.

The material had to be obtained from architects and engineers involved in the planning process, as well as from the building owners and users. Fortunately, most of them appreciated the idea of the EULEB-project and supported the EULEB by providing the required information as far as possible. Still, in some cases external legwork was necessary and had to be contracted.

Based on the availability of information from the selected buildings, the definitive EULEB-contents could be defined. To obtain a homogenous set of data, the collected materials very often had to be adapted to unique standards, which had been agreed within the team. This affected recalculation of values to agreed units, transforming absolute to specific values (for example per m² usable floor area), redrawing of plans and adaptation of images for optimised use in the HTML-surrounding.

5.2 Measured consumptions

The availability of measured energy consumption data was a crucial for the selection of the 25 buildings. Nevertheless, the easiness accessing the data and the available grade of detail varied a lot. Some buildings had perfectly monitored data available, coming from either complex monitoring programmes with a scientific background or just from a detailed facility management system. Other buildings had nothing but bills from the energy delivery available. This made a subdivision by energy use difficult or sometimes even impossible.



Generally it seems that especially for large buildings it becomes a standard to have a detailed building energy management system (BEMS), which provides all data required in a certain grade of detail.

Besides this technical aspect of the data collection, of the agreement of the building owner and / or user to provide these data is essential. As EULEB focussed on public buildings and the agreement was checked in advance, this was not major problem.

5.3 Luminance pictures

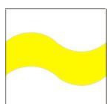
The visual comfort is an important part of building comfort, which very often is neglected when planning or evaluating a building. Nevertheless, the visual conditions have a strong impact on user acceptance, productivity etc. An appropriate measure to evaluate the visual comfort is taking luminance pictures displaying luminances in false colours.

In the 25 EULEB-buildings such pictures have been taken in typical rooms of each building. This was done on the one hand using special cameras, allowing to record the required data in one shot, and analysing the images with a special software. The second technique applied for EULEB was to take a series of exposure bracketed images using a “conventional” digital camera and to create a high dynamic range (HDR) images using the WebHDR-tool developed by London Metropolitan University.

Both methods create luminance pictures allowing to analyse the luminance of any point of the view and thus to evaluate glare effects and other reasons for visual discomfort.

5.4 User acceptance

The user acceptance was analysed by performing post-occupancy-studies in order to evaluate the comfort in the buildings as well as the fulfilment of the requirements of use.



In some buildings the user surveys already had been done using the questionnaires and analysis methods of “Building Use Studies Ltd.”, UK. For the other buildings, an easy questionnaire had been developed, translated to English, French, German, Italian and Spanish and has been used to get comparable feedback from the buildings’ users.

The questionnaires consisted of some easy questions on thermal comfort in summer, thermal comfort in winter, indoor air quality in summer, indoor air quality in winter, visual comfort, acoustic comfort, global estimation of comfort, architectural conception of the building, fulfilment of the users’ expectations, influence of the building on the health of the users, impression of the visitors on the building and influence of the building on the productivity.

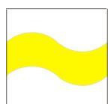
All questions had to be answered by ticking a scale from -3 to +3. The results have been evaluated statistically and an overall user acceptance per building has been calculated.

5.5 Video clips

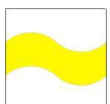
The video clips have been created by three professional teams coming from three different countries. In order to achieve a basic homogeneity of the clips, a basic script for the video clips had been agreed within the team.

For technical reasons, it was decided to have clips without any spoken commentary , interviews or subtitles, which allowed having one language-independent file per building. Still the clips should give a fascinating impression of the buildings in use, the atmosphere, the quality of the architecture and the special features which make these buildings energy efficient.

The result of this challenging task was a new concept, which has been developed in close cooperation between the Chair for Environmental Architecture at the University of Dortmund and the Chair for “camera and film” at the University of Applied Sci-



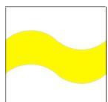
ences, Dortmund. Spoken information have been replaced by a selection of appealing video shots supported by so called “Soundscapes” creating an acoustic atmosphere which fits to the buildings’ atmospheres.



6. Comparison of buildings

The comparison of different buildings generally is a very sensitive process as many different boundary conditions like the use of a building, the climatic background etc. Still then, other factors like the occupants' behaviour will have influences on the results and are very difficult to separate.

In the EULEB project, the 25 buildings have been compared in the section "Benchmarking" in the three main categories "Economy", "Energy" and "Quality". The buildings have been grouped by building type and by climatic zone. The climatic zones have been defined according to the ASHRAE-classification system. This method takes into account the heating and cooling degree days of a certain location and thus takes into account a building's energy demand resulting from climatic conditions.



The Economy–Benchmarking shows a significant variance of the total building costs, within one building type and on climatic zone. But discounting some extreme values, general statements can be found: The total building costs for office buildings constitute generally about 1400 and 2100 €/m² usable floor area). For the educational buildings this value generally reaches between 1000 and 1500 €/m² usable floor area).

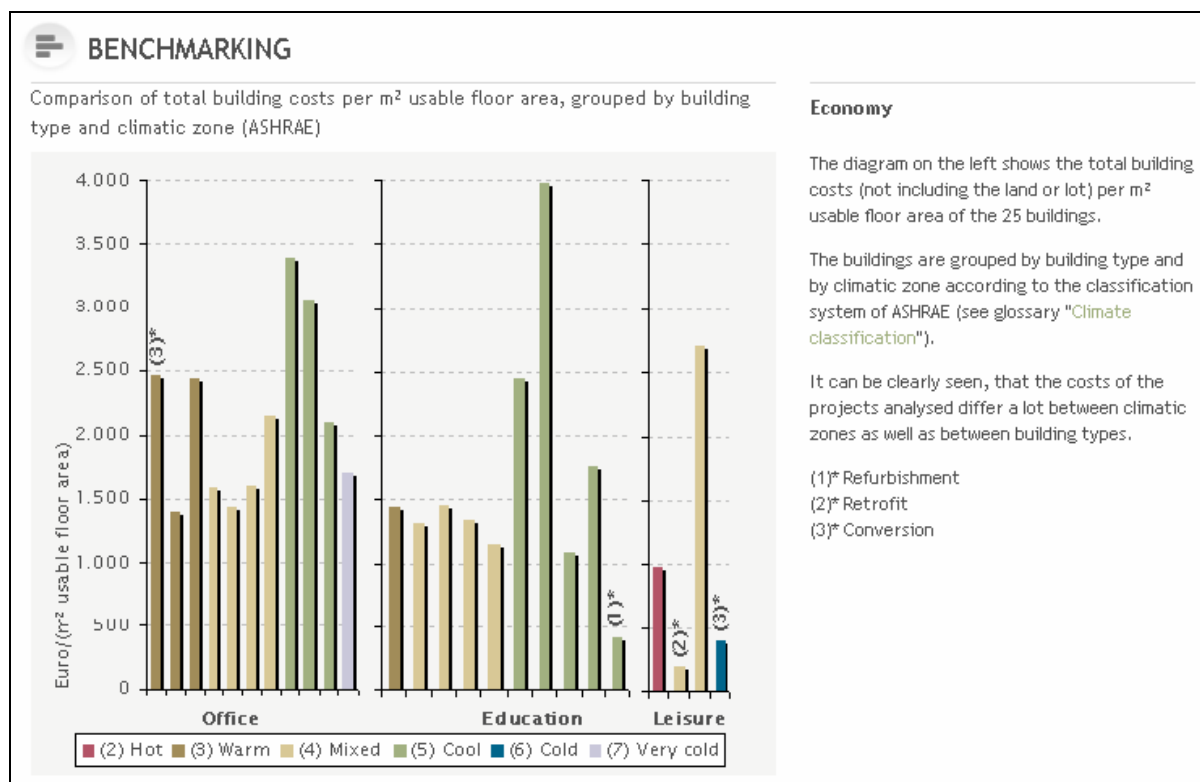


Fig. 12: Comparison of building costs in EULEB

Comparing the energy consumptions of the 25 buildings again brought a significant variance even within one building type and climatic zone. But again, a general statement could be, that for example for all three building types, a total primary energy consumption between 100 and 220 kWh_{Prim}/(m² usable floor area) can be achieved.

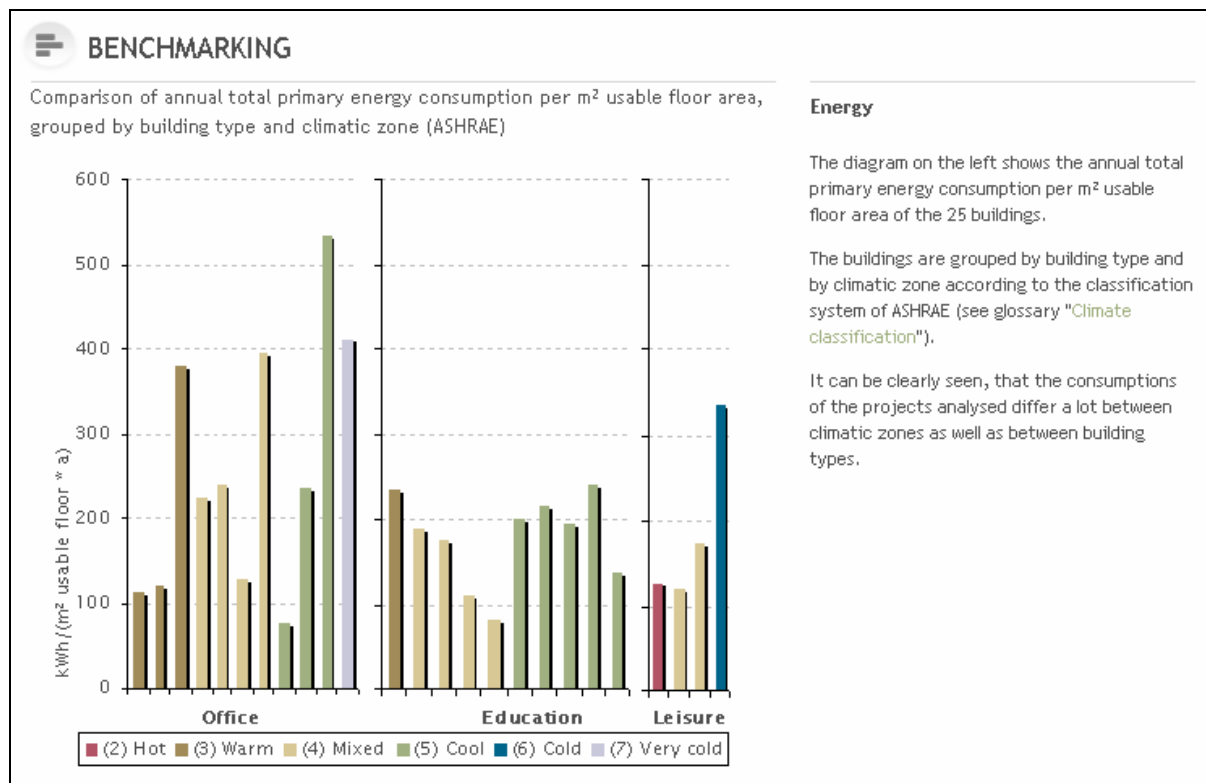


Fig. 13: Comparison of energy consumptions in EULEB

The overall user acceptance has been compared in the Quality benchmarking diagram. Generally positive results are obvious, independent of the building type and the climatic zone.

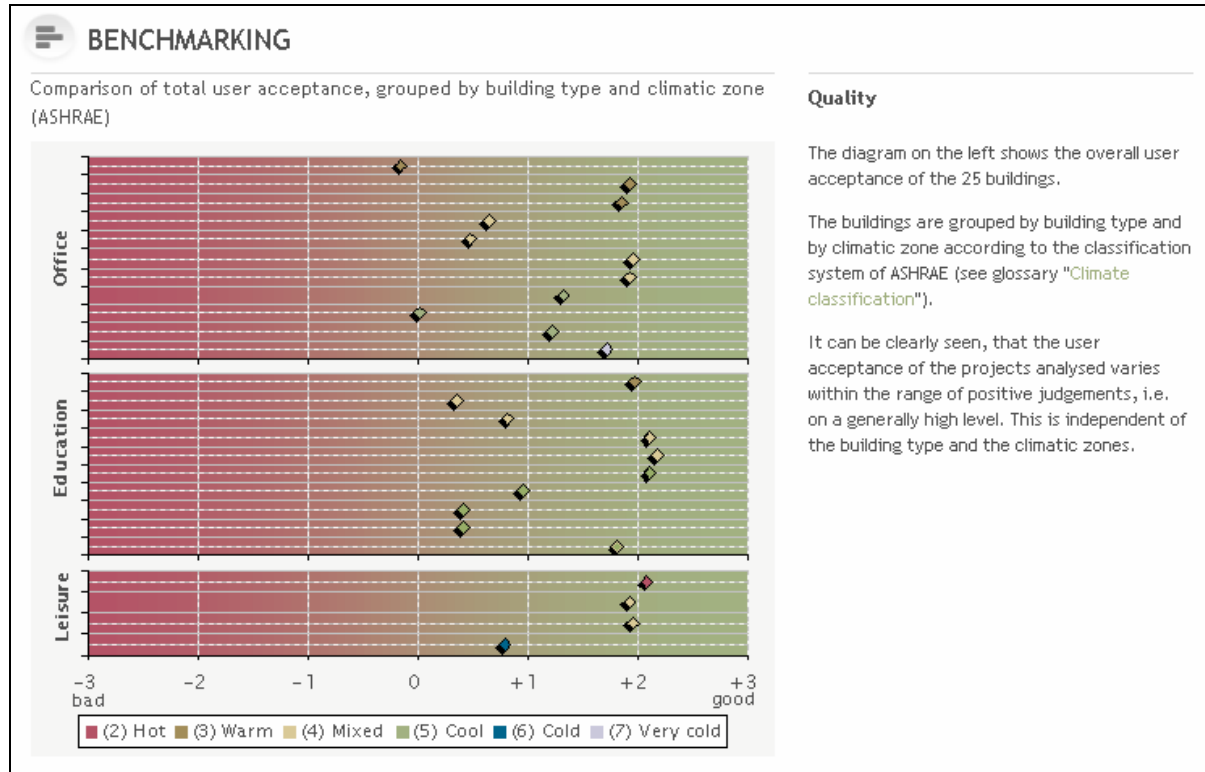


Fig. 14: Comparison of overall user acceptance in EULEB

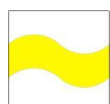
7. Dissemination of results

During the two years duration of the EULEB–Project permanent dissemination activities have been performed in order to arouse interest, inform about the work progress and get feedback from target persons.

With contributions to national and international conferences a large number of target persons could be reached.

Tab. 3: Conferences attended for EULEB–dissemination

| Conference | Location | Date |
|---|----------------------|---------------------|
| Palenc 2005 | Santorini, Greece | 19–21 May 2005 |
| WREC 2005 | Aberdeen, UK | 22–27 May 2005 |
| AIVC conference | Brussels, Belgium | 21–23 Sept. 2005 |
| 8th REHVA World Congress/ Clima 2005 | Lausanne, France | 9–12 Oct. 2005 |
| Plea 2005 | Beirut, Lebanon | 13–16 Nov. 2005 |
| International Solar Cities Congress 2006 | Oxford, UK | 3–6 Apr. 2006 |
| Energy Performance and Enviromental Quality of Buildings (EPEQUB2006) | Milos Island, Greece | 6–7 Jul. 2006 |
| WREC 2006 | Florence, Italy | 19–25 Aug. 2006 |
| The European City | Sofia, Bulgaria | 2–9 Sept. 2006 |
| PLEA 2006 | Geneva, Switzerland | 6–8 Sept. 2006 |
| CLIMAMED | Lyon, France | 20–21 Nov. 2006 |
| EPIC | Lyon, France | 20–21 Nov. 2006 |
| 5 Oceans Velux | Bilbao | 22–23 Oct. 2006 |
| Environment 2007 | Abu Dhabi | 28–1 Jan 2007 |
| International congress of HVAC&R | Belgrade, Serbia | 30 Nov – 2 Dec 2005 |
| Healthy Building conference | Lisbon, Protugal | 4–8, June 2006 |



Additionally, several fairs have been attended and information about EULEB have been presented.

Tab. 4: Fairs and exhibitions attended for EULEB–dissemination

| Fair / Exhibition | Location | Date |
|-------------------------|---------------------|----------------------|
| BAU2005 | Munich, Germany | Jan. 2005 |
| MIPIM | Cannes, France | 14–17 Mar. 2006 |
| 7. TIP Dialog Frankfurt | Frankfurt, Germany | 18. May 2006 |
| EXPO REAL 2006 | Munich, Germany | 23–25 Oct. 2006 |
| Mostra Convegno fair | Milan, Italy | 28 Feb– 4 March 2006 |
| Light & Building fair | Frankfurt, Germany | 23–27, April 2006 |
| Klima Forum | Ljubljana, Slovenia | 28–29, Sept 2006 |

Articles in relevant magazines have been used to announce the project and also to disseminate the 150.000 copies of the EULEB–CD.

Tab. 5: Magazines used for EULEB–dissemination

| Magazine | Date |
|--|-------------------------|
| XIA–Intelligente Architektur + Sonderdruck | 07–09/2006 |
| XIA–Intelligente Architektur | 21.02.2007 |
| Industriebau | 06.03.2007 |
| Immobilienwirtschaft | 02.03.2007 |
| Uni–Zet | 02.07 |
| FMJ | FEB 07 |
| GUARDIAN WEEKLY SPECIAL ENERGY EDITION | 10 th FEB 07 |
| L'ARCA Edizioni | |
| ALINEA Edizioni | |
| ACCA Software | |
| EDICOM Edizioni | |
| CVC | 15.02.2007 |
| Instalatorul | 25.02.2007 |
| REHVA Journal | 15.03.2007 |
| El Instalador | 01.03.2007 |
| El Instalador | 03/2007 |

| | |
|-----------------|----------------|
| El Noti Actecir | 04/2007 |
| Arquitectos | 06/2007 |
| Rehva Journal | June 2005 |
| Rehva Journal | September 2006 |
| Rehva Journal | December 2006 |

Several national seminars have been arranged during the project as well as at the end to present the final CD.

Tab. 6: Seminars arranged for EULEB–dissemination

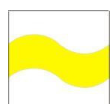
| Seminar–name | Location | Date |
|---|------------------|------------|
| EULEB | Frankfurt | 08.12.2006 |
| EULEB | London | 17/1/07 |
| EULEB | Catania | 25.11.2006 |
| EULEB | Palermo | 6.09.2006 |
| EULEB | Cagliari | 1.10.2006 |
| Revival | Athens | 7 Nov 2006 |
| Eco–construction | Saintes | 16.01.2007 |
| EULEB | Barcelona, Spain | 13/12/2006 |
| EULEB workshop (during REHVA Clima2005 International HVAC Congress) | Lausanne | 11.10.2005 |

Besides that, other activities completed the dissemination bundle in order to reach as many target persons as possible:

Lectures in the Partners' Universities addressed to architectural and engineering students, the future's key actors for building design.

Each project partner maintained a website, informing about the project and linking to the general website www.EULEB.info.

The website www.EULEB.info, as a central access point to information about the project, shows a significant variance in use. Although it is difficult, to allocate exactly



one of the numerous dissemination activities to a monthly number of hits, the link between both is obvious.

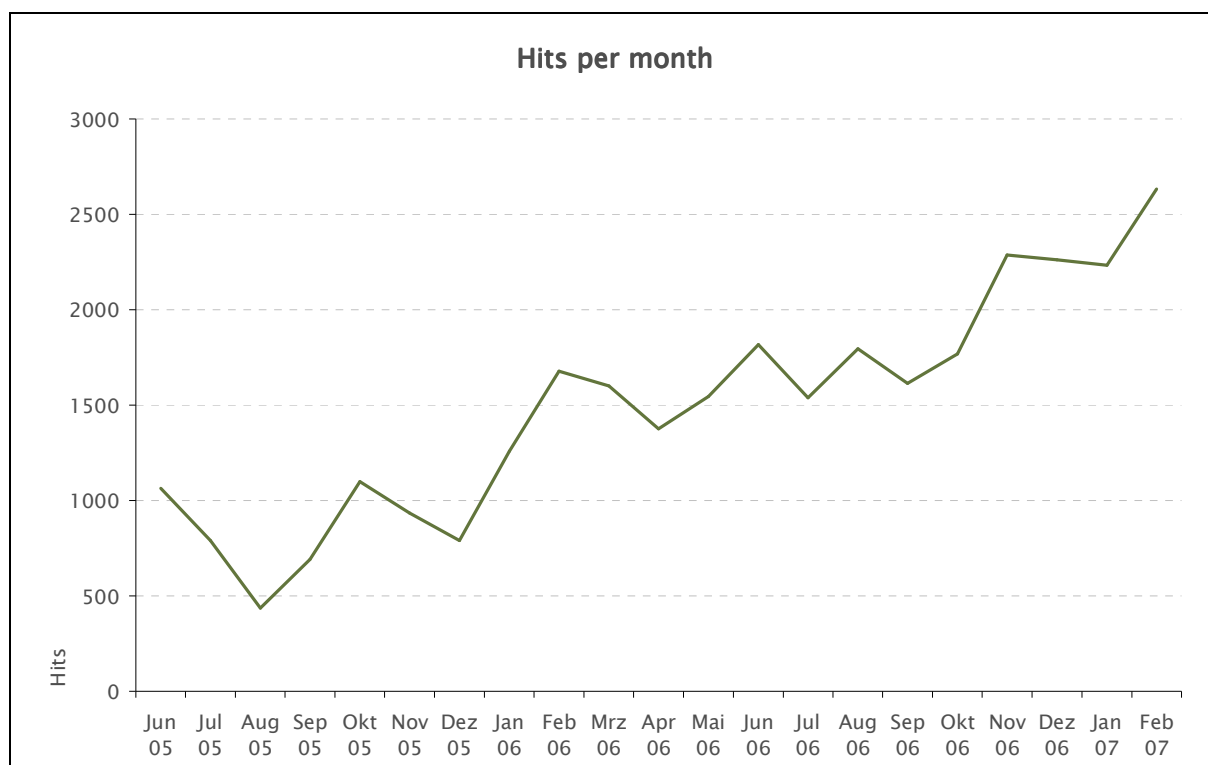


Fig. 15: Hits per month on www. EULEB.info

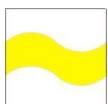
For example the peak in October 2005 can be seen as a result of the successful presentation and workshop during the AIVC conference in Brussels and the 8th RE-HVA World Congress/Clima 2005 conference in Lausanne.

The increase in May and June 2006 might be a result of the presentations during the Light&Building fair, the Healthy Building conference and the 7th TIP-Dialog.

October and November 2006 was the time of an article "XIA-Intelligente Architektur", the EPIC/AIVC- and ClimaMed-Conference and a series of seminars in Cagliari, Athens and Catania.

Generally an increasing mainstream trend can be clearly seen. When this report was written, most of the final articles (accompanied by the 150.000 CDs) have not been

published yet. Thus a further increase in the months following Feb 2007 can be expected.



Discounting the “Unknown”, “Network”, “Commercial” and “International” domains, which can not be allocated to countries for technical reasons, the distribution by visitor domains / countries shows a predominant interest coming from the European countries of the project partners. But also visitors from other European countries as well as from outside Europe could be recorded. Again, this can be expected to increase in the months following February 2007.

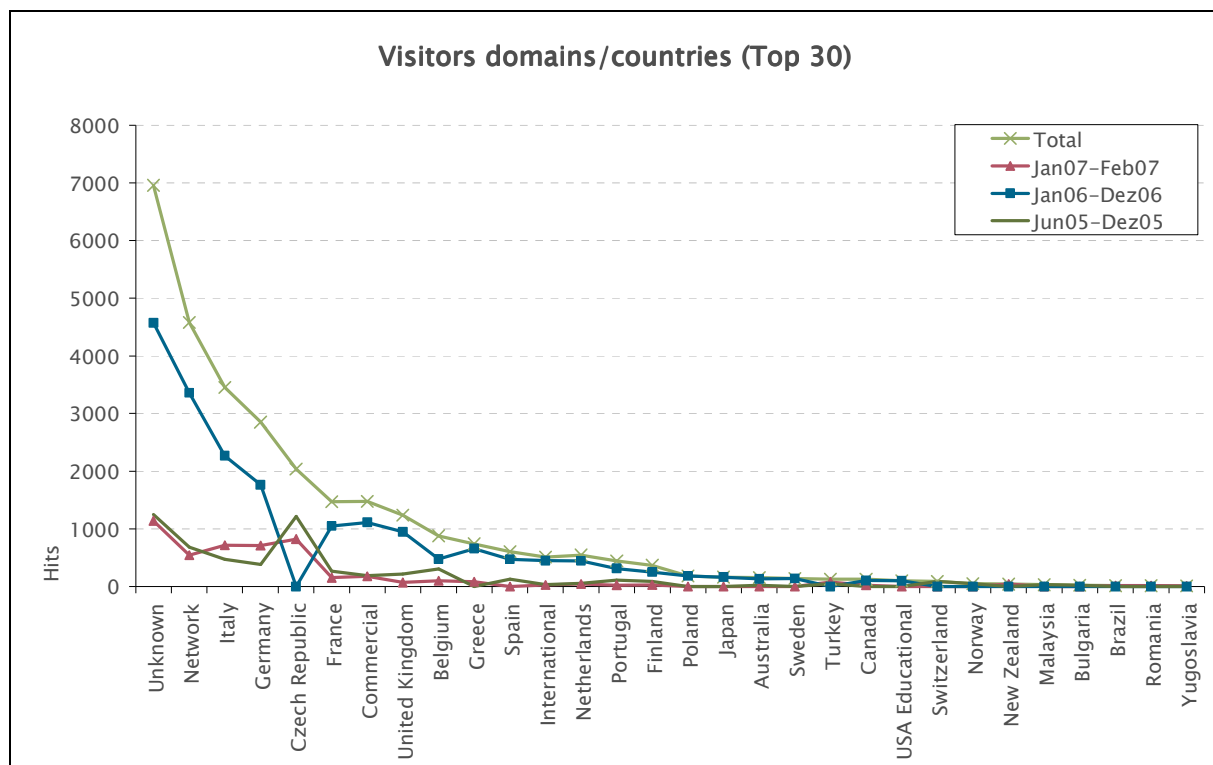


Fig. 16: Hits on www.EULEB.info by visitor domains / countries

8. Conclusions

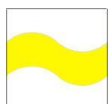
During the two years period of the EULEB project, an enormous interest in the topic has been experienced. The collection of information on positive examples of energy efficient buildings has been very important for all different kinds of key actors in the building market. In particular there is a strong demand for the combination of “theoretical” information and practical experiences about buildings in use.

This proof for the quality, efficiency and user friendliness of energy efficient buildings was obviously (and still is) of great interest for the target groups addressed by EULEB. The main prejudices in terms of poor architecture, bad energy efficiency, high costs and low comfort could be vitiated, thus the project has been successful.

The availability of building performance data was a crucial precondition for this success. The predominantly public ownership of the EULEB-Buildings was certainly helpful concerning the willingness to provide the required data.

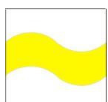
For the future it will be important to make such information publicly available from private buildings, too. This would allow interested key actors of the building market to learn from the experiences of their colleagues and thus would accelerate the improvement of building energy performance.

The upcoming energy labelling of buildings postulated by the Energy Performance of Buildings Directive (EPBD) can be seen as a very important step towards this goal. From the results of the EULEB project, this can be seen very helpful to increase the acceptance and spread of energy efficient buildings and help to reduce the energy consumption and the CO₂-emissions of buildings.



9. Disclaimer

The sole responsibility for the content of this report lies with the authors. It does not represent the opinion of the European Communities. The European Commission is not responsible for any use that may be made of the information contained therein.



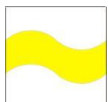
10. Annex / Deliverables

The annex lists the deliverables according to the Grant Agreement. Some deliverables will just refer to the EULEB-CD and -website, as the results of the work can be found there. All other deliverables will be submitted electronically with the filenames listed in the following tables.

10.1 WPO – Management

| Deliv. Name | Partner | Details | | | |
|---|---------|-------------|------------------|--------------|--|
| | | Meeting No. | Meeting location | Meeting date | Filename |
| Attendance list and minutes of meetings | | | | | |
| | UDO | 01 | London | 12.01.2004 | Minutes_Prelim-Meeting_London_20050121.pdf |
| | UDO | 02 | Dortmund | 21.03.2005 | Minutes_Meeting02_Dortmund_20050321.pdf |
| | UDO | 03 | Santorini | 18.05.2005 | Minutes_Meeting03_Santorini_20050518.pdf |
| | UDO | 04 | London | 27.06.2005 | Minutes_Meeting04_London_20050627.pdf |
| | UDO | 05 | Florence | 15.07.2005 | Minutes_Meeting05_Florence_20050715.pdf |
| | UDO | GD01 | Dortmund | 26.09.2005 | Minutes_Meeting GD01_Dortmund_20050926.pdf |
| | UDO | 06 | Lausanne | 13.10.2005 | Minutes_Meeting06_Lausanne_20051013.pdf |
| | UDO | 07 | Barcelona | 16.02.2006 | Minutes_Meeting07_Barcelona_20060216.pdf |

| | | | | | |
|---------------------------------|-----|-----------------------|-----------------------------|----------------------------|---|
| | UDO | 08 | La Rochelle | 17.07.2006 | Minu- tes_Meeting08_La_Rochelle_20060 717.pdf |
| | UDO | 09 | Brussels | 30.10.2006 | Minu- tes_Meeting09_Brussels_20061030 .pdf |
| | | | | | |
| | | Report no. | Reporting period | Submission date | Filename |
| Interim report | | | | | |
| | UDO | IR | 01.01.05– 31.03.06 | 14.09.2006 | Various, N/A |
| | | | | | |
| | | Report no. | Reporting period | Submission date | Filename |
| 6-month progress reports | | | | | |
| | UDO | PR1 | 01.01.05– 30.06.05 | 08.09.2005 | various, N/A |
| | UDO | PR2 | 01.07.05– 31.12.05 | 18.04.2006 | various, N/A |
| | UDO | PR3 | 01.01.06– 31.06.06 | 14.09.2006 | various, N/A |
| | | | | | |
| | | Report no. | Reporting period | Submission date | Filename |
| Final report | | | | | |
| | UDO | FR | 01.01.05– 31.12.06 | 28.02.2007 | various, N/A |



10.2 WP1 – Identification of buildings

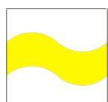
| Deliv. Name | Partner | Details |
|---|---------|---|
| | | filename |
| Assessment system for selection of identified buildings | | List_of_criteria_for_evaluation.pdf |
| | | filename |
| List of chosen buildings and design matrix | | List_of_identified_&_selected_buildings-03_20070228.pdf |
| | | filename |
| List and short presentation of buildings not chosen | | Evaluation_of_identified_buildings_UDO_20051006.pdf |
| | | Evaluation_LMU.pdf |
| | | Evaluation_of_identified_buildings Univ La Rochelle.pdf |
| | | Evaluation_of_identified_buildings_ABITA.pdf |
| | | Evaluation_sp_buildings.pdf |
| | | Suggestions_REHVA_all.pdf |

10.3 WP2 – Data collection

| Deliv. Name | Partner | Details |
|--|---------|-----------------|
| | | filename |
| Set of high quality data and documentation for each building | | See EULEB-CD |

10.4 WP3 – Visualisation of data

| Deliv. Name | Partner | Details |
|--|---------|-----------------|
| | | filename |
| High quality diagrams and graphics of energy saving methods and energy consumption | | See EULEB-CD |



10.5 WP4 – CD content management system

| Deliv. Name | Partner | Details |
|--|---------|-----------------|
| | | filename |
| Content management system and graphic design | | See EULEB-CD |

10.6 WP5 – Creation of videos

| Deliv. Name | Partner | Details |
|--|---------|-----------------|
| | | filename |
| Edited high quality video clips of all buildings | | See EULEB-CD |

10.7 WP6 – CD construction

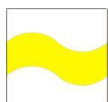
| Deliv. Name | Partner | Details |
|--|---------|-----------------|
| | | filename |
| Complete CD with high quality data of 21 – 24 buildings in English version | | See EULEB-CD |

10.8 WP7 – Translation

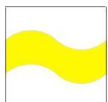
| Deliv. Name | Partner | Details | |
|---|---------|---|-----------------|
| | | contribution | filename |
| Translated CD content from English to French, German, Italian and Spanish | | | |
| | UDO | Translation to German | See EULEB-CD |
| | ABITA | Translation to Italian | See EULEB-CD |
| | ULR | Translation to French | See EULEB-CD |
| | UPC | Translation to Spanish | See EULEB-CD |
| | REHVA | Checked translations in English of CD ("English washing") | See EULEB-CD |

10.9 WP8 – Dissemination

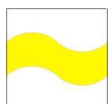
| Deliv. Name | Partner | Details | | | |
|--|---------|------------------------------|---|---------------------|-------------------------------------|
| | | Magazine | Article | Date of publication | filename |
| Production of 150000 CD´s with high quality data and insertion in relevant magazines, accompanied by article presenting the project. | | | | | |
| | UDO | XIA-Intelligente Architektur | Energieeffiziente Nicht-wohngebäude in Europa | 21.02.2007 | UDO_EULEB_Intell-Arch-58.pdf |
| | UDO | Industriebau | Energieeffiziente Nicht-wohngebäude in Europa | 06.03.2007 | U-DO_EULEB_Industriebau_02-2007.pdf |
| | UDO | Immobilienwirtschaft | Energieeffiziente Nicht-wohngebäude in Europa | 02.03.2007 | UDO_EULEB_Immob-Wirtsch_03-2007.pdf |
| | Abita | L'ARCA Edizioni | | | Abita_EULEB article.pdf |
| | Abita | ALINEA Edizioni | | | Abita_EULEB article.pdf |
| | Abita | ACCA Software | | | Abita_EULEB article.pdf |
| | Abita | EDICOM Edizioni | | | Abita_EULEB article.pdf |
| | ULR | | | | bonCdem-seigneur25283_Lemon.pdf |
| | UPC | El Instalador | | 03/2007 | UPC_Elinstalador.pdf |
| | UPC | Arquitectos | | 06/2007 | UPC_journal_ES_PUB.pdf |
| | | | | | |



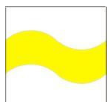
| | | Association | Way of distribution | Date of distribution | filename |
|--|-----|-------------|--------------------------------|----------------------|---------------------------------------|
| Information about the project and the CD distributed to associations of target groups in Europe. | | | | | |
| | UDO | FIEC | E-Mail | 20.04.2005 | UDO_E-Mail_FIEC_Paetzold_20050420.pdf |
| | ULR | REHVA | REHVA Journal. | | bonCdem-seigneur25278_REHVA.pdf |
| | | | | | |



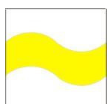
| | | Magazine | Number of CDs | Date of agreement | filename |
|--|-------|--|---------------|-------------------|---|
| Copies of agreements / contracts with the magazines. | | | | | |
| | UDO | XIA-Intelligente Architektur | 17800 | 06/12/2006 | UDO_EULEB_Intell-Arch-58.pdf UDO_agreements_xia_06-12-06.pdf |
| | UDO | Industriebau | 3200 | 07/12/2006 | U-DO_EULEB_Industriebau_02-2007.pdf U-DO_agreements_Industriebau_07-12-06.pdf |
| | UDO | Immobilienwirtschaft | 1800 | 06/12/2006 | UDO_EULEB_Immob-Wirtsch_03-2007.pdf U-DO_agreements_Immob-Wirtsch_06-12-06.pdf |
| | LMU | FMJ | 13000 | AS INVOICE | |
| | LMU | GUARDIAN WEEKLY SPECIAL ENERGY EDITION | 19000 | AS INVOICE | |
| | Abita | L'ARCA Edizioni | 5100 | 22/12/2006 | Abita_L'arca.pdf |
| | Abita | ALINEA Edizioni | 15000 | 11/12/2006 | Abita_Alinea.pdf |
| | Abita | ACCA Software | 8000 | 21/12/2006 | Abita_Acca.pdf |
| | Abita | EDICOM Edizioni | 1900 | 23/12/2006 | Abita_Edicom.pdf |
| | ULR | El Instalador | (ES) | | bonCdem-seigneur25281_El_Instalador.pdf |
| | ULR | Instalatorul | (RO) | | bonCdem-seigneur25280_ARTECNO.pdf |
| | ULR | CVC | (FR) | | Order_Climagora_1525€.pdf |
| | UPC | El Instalador | 18000 | 03/2007 | UPC_Elinstalador.pdf |
| | UPC | Arquitectos | 45000 | 06/2007 | UPC_journal_ES_PUB.pdf |



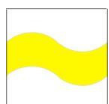
| | | | | | |
|--|-------|---------------|--|---------------|--|
| | REHVA | Rehva Journal | Agreement between ULR and the publisher of REHVA Journal to use Rehva Journal to publish CD Rom + Article presenting EULEB project (see ULR) | December 2006 | |
| | | | | | |



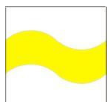
| | | Association | Number of CDs | Date of distribution | filename |
|--|-----|-----------------------------------|---------------|----------------------|--------------------------------------|
| Distribution list of direct distributions to key actors associations. 18 | | | | | |
| | UDO | REHVA | 150 | 29.01.2007 | UDO_Letter_CDs_to_REHVA_20070129.pdf |
| | ULR | Distribution list | | | REHVA_Members.pdf |
| | | | | | |
| | | | | | |



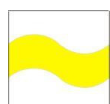
| | | Magazine | | Date of publication | filename |
|--|-------|--|--|-------------------------|--|
| Articles in relevant magazines (minimum 1 per partner during the 1 year of the project, and 1 per partner to disseminate the results). | | | | | |
| | UDO | XIA-Intelligente Architektur + Sonderdruck | | 07-09/2006 | U-DO_Sonderdruck_XIA_TIP-Forum.pdf |
| | UDO | XIA-Intelligente Architektur | 17500 | 21.02.2007 | UDO_EULEB_Intell-Arch-58.pdf |
| | UDO | Industriebau | 3200 | 06.03.2007 | U-DO_EULEB_Industriebau_02-2007.pdf |
| | UDO | Immobilienwirtschaft | 9000 | 02.03.2007 | UDO_EULEB_Immob-Wirtsch_03-2007.pdf |
| | UDO | Uni-Zet | | 02.07 | UDO_UniZet_Seite7_02-07_NR.388.pdf |
| | LMU | FMJ | | FEB 07 | eulebdis.pdf |
| | LMU | GUARDIAN WEEKLY SPECIAL ENERGY EDITION | | 10 th FEB 07 | eulebdis.pdf pointer ad.pdf |
| | Abita | L'ARCA Edizioni | | | Abita_EULEB article.pdf |
| | Abita | ALINEA Edizioni | | | Abita_EULEB article.pdf |
| | Abita | ACCA Software | | | Abita_EULEB article.pdf |
| | Abita | EDICOM Edizioni | | | Abita_EULEB article.pdf |
| | ULR | CVC | | 15.02.2007 | EULEB_4_journal_FR.pdf |
| | ULR | Instalatorul | | 25.02.2007 | EULEB_4_journal_RO.pdf |
| | ULR | REHVA Journal | | 15.03.2007 | Pages_from_rehva_journal_122006.pdf |
| | ULR | El Instalador | | 01.03.2007 | |
| | UPC | El Instalador | | 03/2007 | UPC_Elinstalador.pdf |
| | UPC | El Noti Actecir | | 04/2007 | UPC_finalflyer.pdf |
| | UPC | Arquitectos | | 06/2007 | UPC_journal_ES_PUB.pdf |
| | REHVA | Rehva Journal | Presentation of EULEB project (1 page) | June 2005 | Rehva Journal June 2005 - Cover.jpg Rehva Journal June 2005 - EULEB page 15.jpg |



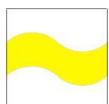
| | | | | | |
|--|-------|---------------|---|-------------------|--|
| | REHVA | Rehva Journal | Presenta- tion of EULEB pro- ject results (4 pages) | September 2006 | Rehva Journal September 2006 – Cover.jpg Rehva Journal September 2006 – EULEB page 25.jpg Rehva Journal September 2006 – EULEB page 26.jpg Rehva Journal September 2006 – EULEB page 27.jpg |
| | REHVA | Rehva Journal | Presenta- tion of EULEB pro- ject results (3 pages) | December 2006 | Rehva Journal December 2006 – Cover.jpg Rehva Journal December 2006 – EULEB page 23.jpg Rehva Journal December 2006 – EULEB page 24.jpg Rehva Journal December 2006 – EULEB page 25.jpg |
| | | | | | |
| | | | | | |



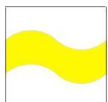
| | | Seminar-name | Location | Date | filename |
|--|-------|---|------------------|-------------|---|
| National seminars arranged by the partners (minimum 1 per partner and minimum 20 key actors present), | | | | | |
| | UDO | EULEB | Frankfurt | 08.12.2006 | U-DO_Seminar_Frankfurt_Teilnehmerliste.pdf |
| | LMU | EULEB | London | 17/1/07 | Meeting flyer.pdf meeting report.pdf |
| | Abita | EULEB | Catania | 25.11.2006 | Abita_conference letter participation.pdf |
| | Abita | EULEB | Palermo | 6.09.2006 | Abita_conference letter participation.pdf |
| | Abita | EULEB | Cagliari | 1.10.2006 | Abita_conference letter participation.pdf |
| | Abita | Revival | Athens | 7 Nov 2006 | Abita_conference letter participation.pdf |
| | ULR | Eco-construction | Saintes | 16.01.2007 | Seminar.pdf |
| | UPC | EULEB | Barcelona, Spain | 13/12/2006 | UPC_sessiopresentacio131206.pdf |
| | REHVA | EULEB workshop (during REHVA Clima2005 International HVAC Congress) | Lausanne | 11.10.2005 | EULEB workshop programme_Lausanne 2005 |
| | | | | | |
| | | | | | |
| | | Seminar-name | Location | Date | filename |
| Participation in minimum 1 seminar, workshop, conference in all countries with projects represented in the CD. | | | | | |
| | Abita | EULEB | Florence | 21.12.2006 | |
| | LMU | Comfort and Energy Use in Buildings | | 27-30/4/06 | http://nceub.org.uk/uploads/conf_brochure_21feb_06.pdf |
| | | | | | |



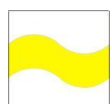
| | | Conference | Location | Date | filename |
|---|-----|--|----------------------|------------------|---|
| International conferences with minimum 150 participants (minimum 1 per partner) | | | | | |
| | UDO | Palenc 2005 | Santorini, Greece | 19–21 May 2005 | UDO_EULEB_Full-paper_PALENC2005.pdf |
| | UDO | WREC 2005 | Aberdeen, UK | 22–27 May 2005 | U-DO_WREC2005_Poster_Euleb.pdf |
| | UDO | AIVC conference | Brussels, Belgium | 21–23 Sept. 2005 | U-DO_Poster_EPBD_20052508_4_A3.pdf |
| | UDO | 8th REHVA World Congress Clima 2005 | Lausanne, France | 9–12 Oct. 2005 | UDO_WS11-EU-LEB_Programme_20050929.pdf UDO_WS11-attendance_list.pdf UDO_WS11-EU-LEB_Workshop_Report.pdf |
| | UDO | Plea 2005 | Beirut, Lebanon | 13–16 Nov. 2005 | UDO_PLEA2005_P106-v2-t10.pdf |
| | UDO | International Solar Cities Congress 2006 | Oxford, UK | 3–6 Apr. 2006 | UDO_9D-2-115_EULEB_ISCI2006_JS.pdf |
| | UDO | Energy Performance and Environmental Quality of Buildings (EPEQUB2006) | Milos Island, Greece | 6–7 Jul. 2006 | UDO_EPEQUB2006_Paper_EULEB.pdf |
| | UDO | WREC 2006 | Florence, Italy | 19–25 Aug. 2006 | Abita_conference letter participation.pdf |
| | UDO | The European City | Sofia, Bulgaria | 2–9 Sept. 2006 | UDO_E-Mail Akivanov_20060724.pdf |
| | UDO | PLEA 2006 | Geneva, Switzerland | 6–8 Sept. 2006 | U-DO_PLEA2006_PAPER782.pdf |
| | UDO | CLIMAMED | Lyon, France | 20–21 Nov. 2006 | UDO_EULEB_ClimaMed2006_v2.pdf |



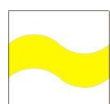
| | | | | | |
|--|-------|---|----------------------|------------------------|---|
| | LMU | Palenc 2005 | Santorini, Greece | 19–21 May 2005 | |
| | LMU | 8th REHVA World Congress Clima 2005 | Lausanne, France | 9–12 Oct. 2005 | |
| | LMU | EPIC | Lyon, France | 20–21 Nov. 2006 | |
| | Abita | WREC 2006 | Florence, Italy | 19–25 Aug. 2006 | Abita_conference letter participation.pdf |
| | Abita | 5 Oceans Velux | Bilbao | 22–23 Oct. 2006 | Abita_conference letter participation.pdf |
| | Abita | Environment 2007 | Abu Dhabi | 28–1 Jan 2007 | Abita_conference letter participation.pdf environment.pdf |
| | ULR | 8th REHVA World Congress Clima 2005 | Lausanne, France | 9–12 Oct. 2005 | |
| | REHVA | Palenc 2005 | Santorini, Greece | 19–21 May 2005 | |
| | REHVA | AIVC conference | Brussels, Belgium | 21–23 Sept. 2005 | |
| | REHVA | 8th REHVA World Congress Clima 2005 | Lausanne, France | 9–12 Oct. 2005 | |
| | REHVA | CLIMAMED | Lyon, France | 20–21 Nov. 2006 | |
| | REHVA | International congress of HVAC&R | Belgrade, Serbia | 30 Nov – 2 Dec 2005 | |
| | REHVA | Healthy Building conference | Lisbon, Protugal | 4–8, June 2006 | |
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| | | Fair / Exhibition | Location | Date | filename |
|---|-------|----------------------------|------------------------|-------------------------|---|
| Participation in various fairs, exhibitions, etc. | | | | | |
| | UDO | BAU2005 | Munich, Germany | Jan. 2005 | UDO_Project- Fly- er_BAU2005_deutsch.pdf UDO_Project- Fly- er_BAU2005_englisch.pdf |
| | UDO | MIPIM | Cannes, France | 14-17 Mar. 2006 | UDO_E- Mail_Merschhemke_2006 0419.pdf UDO_Project- Flyer_MIPIM_english.pdf UDO_Project- Flyer_MIPIM_fr.pdf U- DO_MIPIM2006_Images.p df |
| | UDO | 7. TIP Dialog Frankfurt | Frankfurt, Germany | 18. May 2006 | UDO_TIP- Forum_poster_A3.pdf UDO_TIP- Fo- rum_SonderdruckXIA.pdf |
| | REHVA | Mostra Con- vegno fair | Milan, Italy | 28 Feb- 4 March 2006 | |
| | REHVA | Light & Building fair | Frankfurt, Germany | 23-27, April 2006 | |
| | REHVA | Klima Forum | Ljubljana, Slovenia | 28-29, Sept 2006 | |
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| | | Title of lecture | Location | Date | filename |
|---|-------|---|---|-------------|---|
| 1 regular annual lecture by each university partner. | | | | | |
| | UDO | EULEB | Dortmund, Germany | 04.12.2006 | UDO_Lecture_WS06-07.pdf |
| | Abita | EULEB | Florence | 20.12.2006 | Abita_conference letter participation.pdf |
| | ULR | Eco- constructions | La Rochelle | 27.10.2007 | http://www.univ-lr.fr/poles/sciences/formations/gc/i3er.html |
| | UPC | Projecte EULEB | Barcelona, Spain | 20/12/2007 | UPC_informacio_seminari 201206.pdf |
| | | Title | URL | | |
| Updated project web-page containing all relevant project documents, Cdcontent etc. (links from partners homepages). | | | | | |
| | UDO | EULEB- Projectoffice | http://www.bauwesen.uni-dortmund.de/lehrst/b1/ka/EULEB/ | | |
| | UDO | Research projects in Environmental Architecture | http://www.bauwesen.uni-dortmund.de/lehrst/b1/ka/english/research/ka_research.htm | | |
| | LMU | EULEB | http://www.learn.londonmet.ac.uk/portfolio/2005-2009/euleb.shtml | | |
| | ABITA | EULEB | http://web.taed.unifi.it/abitaweb/euleb/euleb.htm | | |
| | REHVA | EULEB website, creation, maintenance and update | www.euleb.info | | |
| | REHVA | EULEB project webpage on REHVA website | www.rehva.eu | | |
| | | | | | |



| | | Type of event | Type of document | Date | filename |
|--|-----|-------------------------|--|------------------|--------------------------------------|
| Copies of articles, lectures , agenda and participation list from conferences, and minutes from meetings, and questionnaires in national seminars. | | | | | |
| | LMU | Cd presentation seminar | Seminar papers available at: www.nceub.org.uk | | Seminar participation.pdf |
| | UPC | Lecture | List of participants | 13/12/2006 | UPC_assistence131206.pdf |
| | UPC | Lecture/ Seminar | Announcement | 13 & 20 /12/2006 | UPC_anunci_presentacio13-201206.pdf |
| | UPC | Lecture/ Seminar | Participation | 13/12/2006 | UPC_certificat_assistencia131206.pdf |

