Ecobuildings - an EU demonstration initiative for building concepts that go beyond national energy performance requirements

Demonstration of the successful realisation of building concepts that go beyond the national energy performance requirements is an important instrument to set the path for enforced regulations. Besides many programmes and projects that exist in the different EU Member States, the European Commission has created their own programme for demonstrating new and retrofitted buildings with very low energy consumptions: The Ecobuildings Programme.

1 > Introduction

Ecobuildings (European Commission, 2004) is an energy demonstration initiative of the European Commission (DG TREN) within the sixth Framework Programme. The Ecobuildings projects focus mainly on demonstration but also include also minor parts on research and technical development and on training and dissemination. The EU Ecobuildings concept is expected to be the meeting point of short-term development and demonstration in order to support legislative and regulatory measures for energy efficiency and enhanced use of renewable energy solutions within the building sector, which go beyond the Directive on the Energy Performance of Buildings. The projects aim at a new approach for the design, construction and operation of new and/or refurbished buildings, which is based on the best combination of the double approach: to substantially reduce and, if possible, to avoid the demand for heating, cooling and lighting and to supply the necessary heating, cooling and lighting in the most efficient way and based as much as possible on renewable energy sources and polygeneration.

Since Ecobuildings deal in comparison with Concerto, another EU Commission initiative, (European Commission, 2005) for single buildings, the concept can be applied to any building and in any country. Concerto aims to demonstrate the high potential for energy efficiency and high share of renewables which can be achieved through a fully integrated approach in high performing communities. The concept is therefore mainly applied to new settlements.
Ecobuildings as buildings with an energy performance better than required by the national implementation of the Energy Performance of Buildings Directive (EPBD), include different types of energy efficient buildings such as zero heating energy houses, zero energy houses, passive houses, 3-litre houses, ultra-low energy houses, zero carbon houses, etc.

What makes Ecobuildings as concept especially interesting is that it can be applied to all type of buildings: new buildings, existing buildings, single buildings or combined in Concerto projects. Various energy saving technologies for the building envelope and the installation systems can be used and combined with renewable energies. Particularly the application to existing buildings is important. Today the heating energy consumption of buildings in Germany for example is shaped by the existing building stock. 95% of the heating energy is used for buildings that were erected before 1982, see the figure on the left. Other EU Member States have similar figures. Therefore new buildings even with a very low energy demand can only marginally influence the total consumption of the building stock. The focus has to be on the challenge to reduce the energy consumption of existing buildings.

2 > The 4 Ecobuildings Projects of the 6th Framework Programme

2.1 > Similarities and Cooperation

The 4 Ecobuildings projects within the 6th Framework Programme started under the same call and therefore also roughly at the same time. Their project phases run from 2004 to 2008. The demonstration projects concentrate on different building types, from new buildings to existing buildings, from large cultural buildings to social housings or public buildings. However the work plan in all projects foressees a common dissemination task. Main parts of this task are a website portal for all 4 projects (www.ecobuildings.info), common posters, an Ecobuildings newsletter and a high quality brochure including all demonstration projects. Additionally the project BRITA in PuBs organised the first Common Ecobuildings Symposium in Berlin in November 2005 with presentations from all projects and many interesting discussions (Kratz, Erhorn, 2005). Another Ecobuildings Symposium will be held in Stuttgart on April 7/8 2008. The announcement and the invitation to the Symposium was published on the EPBD Buildings Platform and there will also be a special information paper on the Symposium. The figure on the left shows the actual Ecobuildings poster.

2.2 > Demohouse

The aim of the project is to develop minimum standards and recommendations in connection with healthy, cost effective, energy efficient and sustainable rehabilitation and to facilitate implementation through the development of a "Decision Support Tool". In 6 participating countries, a pilot project and a reference project was defined. The pilot project is the actual demonstration project, where the recommendations of the investigations and research will be implemented. The reference project is a housing complex that has recently been renovated (or which is in the process of renovation) according to the usual local (national) standards. The pilot projects and reference projects are compared in terms of improvement of:

- energy consumption,
- sustainability in general and
- socio-economic aspects.
The demonstration buildings are new or renovated (partly social) housing complexes:

- old urban building in the centre of Bilbao (Spain)
- social housing complex in Budapest (Hungary)
- a development of residential buildings in Attica (Greece)
- suburban housing projects in Copenhagen (Denmark)
- high-rise multi-dwelling houses in Graz (Austria)
- low-rise multi-dwelling houses in Warsaw (Poland)

Besides the demonstration buildings, the project will produce the following results: A common evaluation protocol and a state-of-the-art-in-renovation report.

2.3 > ECO-Culture

The ECO-Culture project addresses demonstration of energy efficient technologies integrated into three high-performing cultural ecobuildings:

- the Danish Royal Theatre, Copenhagen (Denmark)
- the Amsterdam Library, Amsterdam (The Netherlands)
- the New Opera House, Oslo (Norway).

Focus is on investigations, demonstration and testing of the following technologies which have been selected out of the integrated ECO-concepts as being especially innovative and contributing to further development:

- energy storage (“climate belt” with thermoactive slabs, double aquifer)
- heat pump (sea water, ground water)
- advanced demand controlled hybrid ventilation
- building integrated PV systems
- advanced Building Energy Management Systems (BEMS) and benchmarking
- use of environmental friendly concrete for thermal storage in thermoactive slabs.

2.4 > SARA

SARA aims to construct sustainable, cost effective, high energy performance, public-access ecobuildings that can immediately be replicated on a large scale in many locations. The ecobuildings are equipped with advanced sustainable energy technologies integrated by an innovative architectural approach and combined monitoring and building management systems (BMS). SARA involves the demonstration of 7 highly sustainable and replicable public-access buildings in 6 EU Member States and 1 additional country. The key aspects of the project are public-access, innovative yet cost effective and replicable results, consideration of end users and an interdisciplinary team working on various RTD activities. These aspects, applied across various climatic regions produce large scale social, urban and environmental benefits. The project will therefore contribute to future development of European energy policy and legislation that will accelerate market penetration of innovative sustainable technologies. The project includes the following demonstration buildings:

- office and exhibition hall, Sinabelkirchen (Austria)
- primary School, La Tour de Salvagny, (France)
- community centre (refurbishment), Naples, (Italy)
- health centre, Barcelona (Spain)
- supermarket, Ljubljana (Slovenia)
- student service building, Southampton (UK)
- community centre, (refurbishment) Bukara, (Uzbekistan)

In combination with the demonstration buildings the project works on an instant replication potential, an integrated BMS and monitoring, shared solutions and interests and technical advice and support.
2.5 > BRITA in PuBs

The BRITA in PuBs project (Bringing Retrofit Innovation To Application in Public Buildings) aims at increasing the market penetration of innovative and effective retrofit solutions to improve energy efficiency and implement renewables, with moderate additional costs.

In the first place, this is realised by the exemplary retrofit of 8 demonstration public buildings in the four participating European regions (North, Central, South, East). By choosing public buildings of different types such as colleges, cultural centres, nursing homes, churches etc. for implementing the measures it is easier to reach groups of differing age and social origin. Public buildings are used as engines to heighten awareness and sensitize society on energy conservation. Secondly, the research work packages include socio-economic research such as the identification of real project-planning needs and financing strategies, the assessment of design guidelines, the development of an internet-based knowledge tool on retrofit measures and case studies and a quality control-tool box to secure a good long-term performance of the building and the systems. The training and dissemination work contains blackboard information sheets, see figure on the left, an Ecobuildings e-learning module, architectural student courses and a facility managers training based on the results of the demonstration projects.

The demonstration buildings are listed in the following:

- nursing home Filderhof, Stuttgart (Germany)
- city college Plymouth (UK)
- community centre Borgen (Norway)
- church Hol (Norway)
- cultural centre Proevehallen, Copenhagen (Denmark)
- Evonymos ecological library, Athens (Greece)
- students centre “Brewery”, Brno (Czech Republic)
- main building of the Vilnius Gediminas University (Lithuania)

The project website (www.brita-in-pubs.eu) contains a building diary with updated information on the status of the demonstration projects. The figure on the left presents an overview on the buildings.

The general aim of the retrofits at the demonstration buildings is to reduce the primary energy demand for heating, ventilation, cooling and domestic hot water by a factor of 2 and at the same time to improve the user satisfaction also by a factor of 2. All buildings will be monitored for at least one year. The initial results, mainly for the buildings Proevehallen, Borgen and the University of Vilnius showed that the expected energy savings have been realised (see also the respective news at the project website). The demonstration projects have their own national and international dissemination results, for example the community centre in Borgen had Chinese visitors and the wind generators in Plymouth have been presented in television footage by both the BBC and the local commercial television (see project website for the videos).

The project has performed socio-economic research such as an overview report on financial strategies in the different participating countries for the improvement of the energy quality in the existing building stock (Triantis et alii, 2006). A detailed analysis of barriers for the energy efficient retrofit of public buildings was also made (Thunshelle et alii., 2006). Both reports are available on the website together with a communication guide for energy renovations (Moerck et alii, 2006).

The partners of BRITA in PuBs have also written 14 retrofit design guidelines of about 4-8 pages each, focusing on specific technologies like innovative insulation, advanced windows, passive solar heating, reduction of overheating, hybrid ventilation, improved daylighting, solar thermal
systems, solar heating and cooling, photovoltaic integration and heat pumps and on more general items. The latter deal with the interdisciplinary design approach, energy simulation tools, life cycle assessment and long-term monitoring. The figure below shows an extract of one of the design guidelines. The guidelines contain information on why to use the technology, requirements in regulations, current practice, different innovative solutions with their advantages and disadvantages, energy savings and costs, as well as information on maintenance and best practice examples. They are available for download at the project website.

Extract of one of the Retrofit Design Guidelines developed in the BRITA in PuBs project.

An electronic database offers many different types of information for decision-makers on public renovation projects. The BRITA in PuBs information tool BIT (Erhorn-Kluttig et alii, 2008) presents in a clearly structured way all demonstration buildings from the project plus more than 30 educational case study buildings from a just finished IEA project (Erhorn et alii, 2003). In a matrix the buildings are opposed to different retrofit strategies starting with the building envelope, over heating and ventilation systems, solar control and cooling systems, lighting systems to renewables and management methods. The figure on the top of the next page presents the title page of the BIT tool.
The retrofit technologies and the case studies are described in detail in so-called viewers, see figure below. For both the case studies and the retrofit measures, more detailed information is offered as pdf-downloads including the final reports from the demonstration buildings and the retrofit design guidelines.

An additional feature of the information tool is the performance rating tool. Here the user can visually compare the electricity, heating and water consumption of a specific building with the national average for 19 different building types.

Another project result is the quality control toolbox. The energy efficiency of buildings should be confirmed in all major stages of a renovation project: planning and design, implementation, use, operating and maintenance. The energy and facility management costs can be optimized by using BEMS (Building Energy Management Systems). All major stages of a renovation project are described in the toolbox and put into practice by using new auditing tools e.g. review lists. The review lists are introduced in appendixes.
3 > Summary

All four described Ecobuildings projects offer various interesting project results which will be available for use and/or download at the websites after completion of the projects, part of them are already available. The supporting tools for the planning, realisation, commissioning and use of energy efficient buildings can be transferred to comparable buildings throughout Europe. The demonstration buildings can be used as locomotives for the further development of the Energy Performance of Buildings Directive. The main conclusion however is that the Ecobuildings concept by the European Commission is a key solution for the major challenge in building energy efficiency: the existing building stock.

4 > Further Information


Disclaimer: Ecobuildings is a programme European Communities 5th and 6th Framework Programme. The four summarised projects received funding under the following project numbers:
BRITA in PuBs: TREN/04/FP6EN/S07.31038/503135
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ECO-Culture: TREN/04/FP6EN/S07.30902/503079.
SARA: TREN/04/FP6EN/S07.31838/503183

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