

# GreenBuilding

enhanced energy efficiency for non-residential buildings

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### Imprint

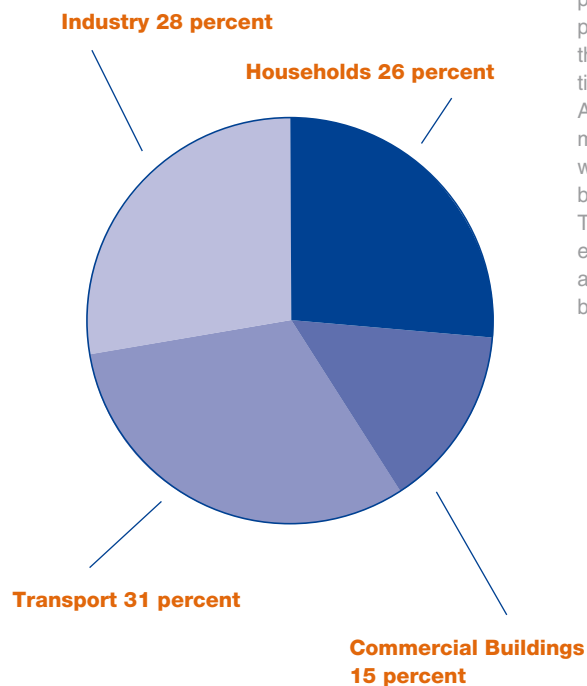
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# Energy efficiency in **non-residential buildings**

## Energy consumption Million tons of oil equivalent



## The savings potential

The building sector accounts for more than 40 percent of the end-energy consumed in the European Union. This is about 10 percent more than the transport sector's total end-energy consumption.

And the saving potentials until 2020 are enormous for buildings – for commercial buildings it is with 30 percent even higher than for residential buildings.

The largest potentials for energy savings can be exploited by e. g. optimizing the building envelope and by improving heating and cooling systems of buildings.

End energy consumption EU.  
Source: EU Commission 2006

# The GreenBuilding Programme

## **The EU GreenBuilding Programme**

In the face of constantly rising oil prices, reduced amounts of fossil fuels and serious impacts of the climate change all over the world, the European Member States are determined to substantially raise energy efficiency and to promote the use of renewable energy sources.

The voluntary GreenBuilding Programme is the EU Commission's action aimed at private and public non-residential buildings. It awards a building's substantial reduction of energy consumption and CO<sub>2</sub> emissions. It serves with a Good-Practice-Database, the GreenBuilding Diplomas and the accompanying PR as a platform that promotes and communicates forward looking organizations for their efforts – thereby enhancing their market situation.

## **GreenBuilding Benefits**

GreenBuilding motivates building owners to invest in energy efficiency and renewable energies. GreenBuilding:

- involves participant in broad PR and presents them on the European website and on national websites,
- creates publicity and recognition for companies investing energy efficiency and for their supporters (planners, energy consultants etc.) and strengthens the participants competitiveness and
- provides information about energy efficiency and renewable energies in non-residential buildings.

# how to join



## **Becoming a GreenBuilding Partner**

Every enterprise, company or organization that improves the efficiency and introduces renewable energy sources in its building stock can be rewarded with the GreenBuilding Partner Status. Provided that the minimum requirement of a reduction of the total primary energy demand by at least 25 percent is as fulfilled for:

- new buildings: compared to the legal regulations in force
- refurbishment: compared to the demand before and after the optimization

As a certified GreenBuilding Partner your company can present its actions for enhanced energy efficiency are European-wide.

## **Becoming a GreenBuilding Endorser**

Organizations concerned with engineering consultancy, construction, architecture, design or energy services can be rewarded with the GreenBuilding Endorser Status. In this function they have to assist customers to improve the energy efficiency of their building stock and to introduce renewable energies. Being a GreenBuilding Endorser gives a company the opportunity to advertise its awarded competence, actions and services in an European context and to acquire clientele.

## **Participate!**

There are two options how to participate in GreenBuilding.

Being awarded either as

- GreenBuilding Partner (applies to the owner of nonresidential buildings) or
- as GreenBuilding Endorser (applies to supporting planners, architects, energy consultants etc.).

# Warehouse Banco Sabadell



Banco Sabadell is a financial company in Spain which planned a new warehouse for documentation and utilities. The new warehouse was developed in collaboration with Coperfil (endorser of the GreenBuilding program). The goal was to achieve a low consumption of energy.

The building's main characteristics to achieve energy efficiency are:

- Increase of sky domes and windows in façade.
- Low level lightning, daylight use at the working place
- Lightning regulation with the human presence
- Photovoltaic installation.

And complemented with other measurements the energy demand was reduced by 56,7 percent

The building has a good level of insulation and it maintains a comfortable temperature, without heating or air conditioned in the warehouse, only in the picking and office areas.



[www.bancsabadell.com](http://www.bancsabadell.com)

## Building data

### Building type

Industrial Warehouse (new building)

### Size

12,046 m<sup>2</sup>

### Year of construction

2005

### Measures performed

- Façade: Metallic insulated facade (type sandwich)
- Roof 10 percent sky domes
- Vertical windows, 5 percent surface
- Natural lighting by sky dome system and human presence detection
- Air conditioning only in picking and office areas
- 12 kWp photovoltaic roof system and solar thermal water heating System

### Energy savings

- Primary energy demand: 1,377,358 kWh/a compared reference building
- Electricity demand: 468,000 kWh/a compared to reference building)

- Total energy savings: 265,633 kWh/a
- CO<sub>2</sub>-savings: 121 t/a



# Headquarter Complexo Carris



## Partner mission and strategy

Companhia Carris de Ferro de Lisboa is the Public Surface Transport Company of Lisbon. Founded on 18th September 1872, the company is closely connected to the development of the City of Lisboa. Furthermore, Carris main objectives are to improve its economic efficiency supply of transport, to enhance the quality of service on offer, to protect environmental quality and to adjust the service to new situations in the city and new customer needs. The building Edifício "A" do Complexo Carris is the partner's headquarter and main service center. It has three floors that cover 2,038 m<sup>2</sup>.



[www.carris.pt](http://www.carris.pt)

## Building data

### Building type

Office building (refurbishment)

### Size

2,038 m<sup>2</sup>

### Year of refurbishment

2005

### Measures performed

- shading devices in South and East façades and internal blinds to control lighting level and uniformity
- double wave form roof; garden terrace in the west area of the roof and use of vegetation to shade surfaces in summer and reduce air temperature around the building (in South and West facades) via evaporation and transpiration
- reduction of 1/3 of windows previous height; installation of double glazing with low thermal transmittance values
- electronic ballasts and energy efficient lamps
- air handling unit (AHU) in the roof that permits interior air renewal and quality

- Energy management system:
- maintenance of buildings and systems at optimal energy consumption levels.
- assess performance by evaluating energy use for all major facilities and functions in the organization.

### Energy savings

- Annual primary energy demand for heating 26.8 kWh/m<sup>2</sup>a
- Annual primary energy demand for cooling 35.6 kWh/m<sup>2</sup>a
- Annual total energy savings: 137,2 MWh



# Office Building Montana



Montana is a spectacular building outside Stockholm that belongs to Fastighets AB Brostaden. With its bold architecture and exclusive façade of polished granite, aluminium and glass it has a very strong profile. 5 floors are combined of offices- and storage space plus cellar, with a lettable area of 4043 m<sup>2</sup>. The house was built in 1990 and is in a good condition with a high standard both inside and outside.

Fastighets AB Brostaden real estate portfolio consists of office and retail properties as well as warehouse and industrial properties concentrated in expansive inner suburbs with good service and communications. The through routes in Greater Stockholm locate nearby the warehouse and industrial properties. Brostaden's headoffice is in Stockholm.

## Building data

### Building type

Office and storing (refurbishment)

### Size

4043 m<sup>2</sup>

### Year of refurbishment

2002 and 2007

### Measures performed

- Heating system: Geothermal energy
- Façade made of polished granite, glass windows
- Roof made of concrete tiles and glass
- Basement
- Insulation windows
- Lighting system: Fluorescent lamps
- Ventilation: Supply-air/Exhaust-air with heat exchanger
- Air condition: Cooled air via fans by the windows



### Energy savings

- Primary energy demand 246 kWh/m<sup>2</sup>a 2002, 112 kWh/m<sup>2</sup>a 2008
- Electricity demand 35 kWh/m<sup>2</sup>a
- Total energy savings 134 kWh/m<sup>2</sup>a
- CO<sub>2</sub>-savings: CO<sub>2</sub> emissions 54 percent lower



# Office Building Manschein



The office building of the company Manschein was built in 1999. During the last years it was several times enlarged. In 2007 it was decided to undertake an extensive renovation. The focus of this renovation was primarily a solar architectural aspect. It included insulation and tightness of the building envelope, mass storage optimization, sunscreen planning and of course the interior comfort (natural light, indoor air quality, organic materials, ...). This was related to the heating demand a Passive House. The objective of the efforts was to have the own office building representing a model for innovative building solutions. The concept stands for a balanced energy for heating and cooling as well as the 100 percent utilization of solar potential. Through simulation glazing, sunscreen, lighting and daylight quality the energy consumption was optimized further.

## Building data

### Building type

Office building (refurbishment)

### Size

307 m<sup>2</sup>

### Year of refurbishment

2007

### Measurements performed

- 32m<sup>2</sup>-thermal solar collectors for heating and cooling, 750 m<sup>2</sup> soil collector field for the heat pump for additional heating and passive building component cooling Floor heating, very low temperature dimensioning radiator and air heaters
- Highly insulated façade (0.18 W/mK) and roof (0.12 W/mK)
- Thermal insulation windows (0.6 W/mK)
- Ventilation with high efficient circulating heat exchanger (83 percent heat recovery); regulation of the fresh air with a CO<sub>2</sub> 42 m<sup>2</sup>-PV-unit (5 kWp) produce 100 percent of the electricity for the heat pump (790 kWh), refrigerant machine (329 kWh) and ancillary units (2,146 kWh)



- Energy monitoring support the improvement of the whole system over the life time.

### Savings

- Energy demand: For heating after refurbishment : 4,600 kWh/a
- Saving heating 28,551 kWh/a
- Saving electricity 3,309 kWh/a
- Total 31,860 kWh/a
- CO<sub>2</sub>-savings: 8,667 kg/a





# Prison

## JVA Schwalmstadt



The buildings of JVA Schwalmstadt (Schwalmstadt Prison) were built in several stages between the 12th century and 1986 and have a gross floor area of 27,468 m<sup>2</sup>. JVA Schwalmstadt is a closed institution of the highest security level with an affiliated closed section of a lower security level. At present, approx. 300 prisoners are imprisoned at the JVA.

Lately large refurbishments in the heating, cooling, electricity, automation and energy controlling sections were performed.

The energy modernisation of the JVA Schwalmstadt reduced the primary energy consumption by approx. 60 percent and the annual carbon dioxide emission decreased by approx. 1,000 tons. The focus of the modernisation was the renewal of the heating facilities. In order to generate heat and electricity, a natural gas block heat and power plant with 238kW<sub>el</sub> and 363 kW<sub>the</sub> was installed, too.

### Building data

#### Building type

Penitentiary (refurbishment)

#### Size

27,468 m<sup>2</sup>

#### Year of refurbishment

2007

#### Measurements performed

- Installation of a new natural 700kW gas fired condensing boiler
- Modernization of the heating distribution system
- Hydraulic adjustment of the heating system
- Optimization of the outgoing temperature
- frequency changer for the ventilators
- Demand-orientation of the air supply and outlet air
- Reduction of the flow rate
- Installation of a natural gas block heat and power plant with 238kW<sub>el</sub> and 363kW<sub>the</sub>
- Building automation (Installation of consumption meters);
- Energy controlling (continuous energy consumption recording)

#### Savings

Primary energy demand for heating 690 MWh/a

- primary energy demand for electricity 915 MWh/a
- the negative figure of primary energy consumption is a result of covering the whole energy consumption (heat +electricity) of the building by co-generation and feeding in of surplus electricity into the grid
- CO<sub>2</sub>-savings of 930 t/a



# Passiv House Office

## Wangen



The Brothers Karl and Jakob Immler have been working in the building and construction industry for more than 30 years. Shortly before starting the construction it was decided to build the office according to the Passive House Standard. Compared to an average office building the energy demand for heating is reduced by 73 percent.

### Building data

#### Building type

Office building (new building)

#### Size

1,089.16 m<sup>2</sup>

#### Year of construction

2007

#### Measurements performed

- High efficient condensation boiler
- Façade with thermal insulation composite system 24 cm
- Roof with thermal insulation composite system 22 - 24 cm
- Triple pane insulation windows
- Energy saving light bulbs
- Ventilation system with heat recovery (80 percent)
- Building achieved passive house standard through high air tightness of the building envelope, highly insulated construction components

#### Savings

- primary energy demand of 33,6 kWh/m<sup>2</sup>a (62,2 percent below the maximum legal value)
- CO<sub>2</sub>-savings: 16,088 kg



www.immler.com



# Office Building Piraeus Bank



Piraeus Bank is one of the 3 largest private banks in Greece. Piraeus Bank Group has a growing international presence, focused in Southeastern Europe and Eastern Mediterranean, but also in the financial centres of London and New York.

It is participating in several energy related projects. It has been a Greenlight member since 2002, has received the EU GreenLight Award for the same building in 2007. It has also has received numerous national awards.

The Bank is developing a strong and ambitious energy management program, including the installation of a pilot BMS system, tele-controlling 40 branch offices, installing demonstration PV systems, analysing and optimising the energy consumption of all its branch offices and large buildings etc. The refurbishment of the specific building, designed by the GB endorser Thelcon Ltd, started in 2008 and is expected to be completed at the end of April 2009.



www.piraeusbank.gr

## Building data

### Building type

Office Building (Refurbishment)

### Size

19.250 m<sup>2</sup>

### Year of refurbishment

2008/9

### Measurements performed

- Replacement of all AHUs, fan coils
- new Ventilation system with heat recovery
- Multi-zone system fully BMS controlled
- Installation of regulated venetian blinds in the internal space.
- Energy saving lighting system with local switches in all working spaces
- Utilisation of natural lighting using light sensors and dimmable ballasts for perimetrical light fixtures
- Movement sensors in WC, archives and conference rooms
- high efficient cooling towers
- Monitoring of indoor temperature, humidity etc. and controlling relevant subsystems (heating, cooling, lighting etc.)
- Photovoltaic System

### Savings

- Primary energy demand 238 MWh/a
- Electricity demand 2375 MWh<sub>el</sub>/a
- Total energy savings 480 MWh<sub>el</sub>/a
- CO<sub>2</sub>-savings 480 t/a



# University Library SPLIT



University of Split was founded in 1974 and consists of 9 Faculties, an Academy of Arts and several institutes and scientific facilities. Scientific work is in the field of natural, historic, social, economic and other disciplines characteristic of Croatian, Adriatic and Mediterranean area.

The University library in Split uses alternative energy sources and high efficient systems with heat recovery.

The building is completely ventilated and air-conditioned for specific purpose (underground archive) and better indoor environment conditions.

Total net building surface is 13.700 m<sup>2</sup>. There are three main areas: lower building with 6 underground levels and upper building with 7 levels.



www.unist.hr

## Building data

### Building type

Library (new building)

### Size

13.700 m<sup>2</sup>

### Year of construction

2008

### Measurements performed

- Heating system: heat pumps (also for air-condition system using exhaust air and air from underground levels)
- double skin glass façade with inner space 80 cm width in which natural air is circulating providing buffer zone both in winter and summer.
- Ventilation system with heat recovery of 80 to 92 percent
- Cooling energy is supplied by adiabatic process and mechanical cooling integrated in air-conditioning system and compact cooling device
- CCMS coordinates air-condition system, heat energy production, cooling energy production and individual indoor environment conditions



### Savings

- Primary energy demand of 806.400 kWh for heating and cooling is 51 kWh/m<sup>2</sup>a
- Total energy savings of about 79.800 €/a, estimated to 35 percent
- CO<sub>2</sub>-savings of 149.600 kg/a

# Research Centre

## ITCLab



Situated at the eastern end of the Kilometro Rosso Scientific Technology Park in Stezzano (Bergamo, Italy), the Italcementi Centre for Research and Innovation (ITCLab) is the new iconic building designed by the American architect Richard Meier for Italcementi Group.

The building is "V"-shaped in plan and it accommodates a laboratories building in a wing and an administrative building in the other; a central atrium, sited in the centre of the two wings, contains a public reception, a security control and provides a circulation space for both wings of the ITCLab.

The building benefits from a high insulated envelope. The flat concrete roof has an important exposed thermal mass that ensures a large inertial behaviour. Over it, a Sarnafil membrane with solar reflectance of 83 percent has been proposed to reduce absorbed solar energy in order to minimize solar loads transmitted into air-conditioned spaces during summer.

[www.italcementigroup.com](http://www.italcementigroup.com)

### Building data

#### Building type

Research Centre (new construction)

#### Size

Total floor area 17 000 m<sup>2</sup> (including parking);  
conditioned net floor area 9 759 m<sup>2</sup>

#### Year of construction

2009

#### Measurements performed

- thermal system bases on 3 geothermal heat pumps with an additional condensing boiler
- Variable speed drives for HW pumps
- External walls, roof and ground floor built with thermal resistance
- Roof has Sarnafil membrane with solar reflectance of 83 percent
- Transparent building envelope composed of triple and double pane windows and skylights
- fluorescent tubes powered by electronic ballasts
- Occupancy sensors in enclosed offices, conference rooms and laboratories
- Daylight dimming controls in perimeter spaces and spaces with skylights
- Ventilation: Variable speed tower fans

- geothermal system covers part of the cooling demand in addition to two chillers Wet-bulb reset control for condenser water temperature
- solar thermal panels which have to supply 87 percent of the domestic hot water;
- 422 roof-mounted photovoltaic

#### Savings

- Primary energy for heating about 408 MWh/a (41.8 kWh/m<sup>2</sup>a.)
- Total energy saving of 27 percent compared to legal value
- CO<sub>2</sub>-savings of 28.4 t/a



# Care Center

## Augustijnslei



The GreenBuilding partner Rotonde vzw is a Belgian non-profit organisation taking care of mentally handicapped adults.

Energy management is a core element of the general policy of the organisation. The energy management policy is described in the formal key-documents of the organisation. The organisation Rotonde is recognised in Belgium as a pioneering organisation concerning energy management in its sector.

The organisation has two sites, both located in the neighbourhood of the city of Antwerp. On the site 'Campus De Vluchtheuvel', they recently constructed two new buildings according to the 'Passive house' concept.

The second site 'Centrale campus Augustijnslei' exists out of several individual buildings (office space, care centre, palliative unit,...). A wide range of energy saving measures were successfully performed on this site. The measures vary from the installation of a high efficient heating system to the installation of energy saving light bulbs.



[www.rotonde.eu](http://www.rotonde.eu)

### Building data

#### Building type

Care centre for mentally handicapped adults (refurbishment)

#### Size

7,314 m<sup>2</sup>

#### Year of refurbishment

2003 – 2010

#### Measurements performed

- Heating system: condensation boiler which with improved control of space temperature in the separate buildings
- 12 cm insulation on the roof
- high performance double glazing windows
- energy saving lamps
- 11.2 kW<sub>p</sub> photovoltaic
- professional energy monitoring system
- high performance pumps for central heating system

#### Savings

- 3,316,000 kWh (consumption) primary energy demand
- 372,000 kWh/a (consumption) electricity demand
- 1.500.400 kWh/a (or 45 percent) primary energy savings
- 18 percent electricity savings and 56 percent savings of natural gas
- CO<sub>2</sub>-savings: 309,000 kg/a



# how to contact GreenBuilding

For the up-to-date list of GreenBuilding National Contact Points, please consult the internet site <http://www.eu-greenbuilding.org> or <http://energyefficiency.jrc.ec.eu.int/greenbuilding/>



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