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The European GreenBuilding Programme

2011

Evaluation

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The goal of improving end-use energy efficiency and promoting the use of renewable energy sources is a key component of the EU energy and climate change policies, shared by all EU Member States. The European Commission Directorate general Energy contributes to this goal through a series of actions under the "Intelligent Energy – Europe" Programme. Given the large share of energy consumption in buildings and the large cost effective energy saving potential, special attention has been dedicated to the building sector. To this end a major step forward is represented by the Directive 2002/91/ED on the Energy Performance of Buildings and the Recast of the EPBD 2010/31/EU.

The GreenBuilding Programme (launched in January 2005) is one of these actions, aimed specifically at improving energy efficiency in private and public non-residential buildings.

The GreenBuilding Programme is a European Commission voluntary programme through which non-residential building owners and occupiers, being private or public organization, are aided in improving the energy efficiency and to introduce renewable energy sources into their building stock. Any enterprise, company or organization (hereinafter defined as "organization") planning to contribute to the GreenBuilding programme objectives can participate.

Content

List of Figures

List of Tables

Executive Summary

GreenBuilding is a voluntary programme aiming at improving the energy efficiency of non-residential building in Europe on voluntary basis. The programme addresses owners of non-residential buildings to realize cost-effective measures which enhance the energy efficiency of their buildings in one or more technical services.

The present report summarizes the result of the GreenBuilding Programme achieved in 2011, in terms of main energy efficiency measures in the buildings and related energy savings. Until December 2011, total 362 Partners have joined it with 586 Partner Buildings. The total savings achieved by the Partners are 506 GWh/year. Nearly 74 GWh/year has been saved in 2011. In 2011 80 new Partners joined the Green Building programme with 117 buildings. The average percentage of savings, for this period, amount to 42%, which is well above the GreenBuilding Programme requirements (25%).

In most of the buildings, to achieve the above savings, more than one energy efficiency measures has been implemented. Most often is a combination of three or more measures. The reasons for implementing more measures at once are the economic effectiveness, but also design needs. If not done at once, it may leave some of the measures unimplemented as there will not be a sufficient potential for savings or the payback would result too long. Also, it is clear that it is less effective to change a heating system and only subsequently deal with the building envelope and heating losses.

The economic effectiveness is a prerequisite for joining the GreenBuilding Programme. Therefore, the Partners have rarely reported on the economic features of their projects and all of the projects are supposed (and assumed) to be economically viable.

The GreenBuilding Programme has been successful over its six year operation. The number of Partners is growing on an increasingly growing rate, with a very good result also in 2011.
This third report will analyse the constant improving trend. Nevertheless, in the future, the programme may need to be more widely promoted among stakeholders. This way the Programme can serve as the benchmarking tool and in the same time promote the Partners and their achievements to the general public. Wider publicity of the Programme will help to achieve its main goal: promotion of energy efficiency in buildings.

In this report it has been also compared the results of year 2011 with the ones of 2010 and of the previous period (2005-2009), when possible.

Introduction

In 2005, the European Commission initiated the European GreenBuilding Programme (GBP "Programme")[1]. This programme aims at improving the energy efficiency and expanding the integration of renewable energies in non-residential buildings in Europe on a voluntary basis.

[1] The first stage of the GreenBuilding programme was launched in 2005, but the years 2005 and 2006 are considered as pilot phase of the Programme.

The programme encourages owners of non-residential buildings to realize cost-effective measures which enhance the energy efficiency of their buildings in one or more equipment or system. The programme is managed by the Joint Research Centre (JRC) of the European Commission. It is operational in all 27 European Union (EU) Member States, European Economic Area (EEA) countries, Switzerland, Norway, and accession countries such as Croatia and Turkey.

Any owner of non-residential building is it public or private organization can join the GreenBuilding Programme as a GreenBuilding Partner (the Partner). Partner organizations commit to undertaking energy efficiency actions, which they describe in an action plan. If the action plan is accepted by GreenBuilding, the company is granted Partner status.
Businesses from the building sector, contributing to energy efficiency in the non-residential building sector with their products or services, can join as GreenBuilding Endorsers. The Endorsers help in promoting GreenBuilding Programme to potential participants and support already registered GreenBuilding partners in their efforts to reduce energy consumption. The Endorsers must have assisted at least one building owner in becoming a GreenBuilding Partner and are expected to submit a promotion plan, in which they specify further activities to promote the GBP[2]. In the time writing the report (November 2012) there was a total of 101 GreenBuilding Endorsers.

Next to the main GreenBuilding Programme administration, the Joint Research Centre, the so called National Contact Points (NCP) have been established in the countries participating in the GreenBuilding Programme[3]; the NCPs represent the main intermediary between the JRC and the Partners/Endorsers. They assist the organizations in their efforts to join the GreenBuilding Programme, provide information about the Programme and organize promotional activities.

The GreenBuilding Programme provides support to the Partners in the form of information resources and public recognition, such as press coverings in newspapers and magazines, presentation at fairs and conferences across Europe, a regular newsletter, and a brochure and a catalogue of success stories. The GBP plaque allows Partners to show their responsible entrepreneurship to their clients.

1.Objectives

The aim of the current report is to provide a summary analysis of the results of the GreenBuilding Programme (GBP) in 2011.

[2] List of Endorsers can be found in the Annex and also on the website of the project: http://iet.jrc.ec.europa.eu/energyefficiency/

[3] List of National Contact Points can be found in the Annex and also on the website of the project: http://iet.jrc.ec.europa.eu/energyefficiency/

Up to the end of 2009, 167 Partners joined the programme with 286 buildings coming from various fields and sectors of operation. In the period 2010, 110 new Partners joined the programme, with a total of 167 buildings. In 2011, 80 new Partners joined, with a total of 117 building.

The buildings themselves vary in age, size and use, but they all have in common the energy performance, which goes far beyond the average performance of buildings in the respective sectors in the participating countries.

The present report focuses mainly on the typology of the Partners, on the efficiency measures they have taken (technical equipment, renewable energy sources, etc.) and on the related savings achieved.

2. Methods

Partners who join the GreenBuilding Programme with their buildings include a report to their application, in which they provide information on the level of achieved savings and a description of the efficiency measures through which they achieved the declared savings.

A spreadsheet analysis was made in order to evaluate the results achieved by the Partners.
The buildings are assessed in a database as to their year of construction or year of refurbishment (start and ending).

As there are relatively many type of buildings, the following table (table 1) shows the main categories, into which the buildings were sorted out, in order to allow the analysis, while capturing the prevalent uses of the buildings. The categories have been re-defined in 2011, keeping the possibility to compare them with the ones used in the previous years.

Table 1 Business categories (prevalent in case of multiple categories)

Education	From kindergartens to universities.
Healthcare & Social Work	Hospital, but also clinics, day care and rehabilitation centres.
Hotel & Restaurant	Hotel, restaurants, B&B, accommodations.
Institutional	Prisons, municipality offices and representative places.
Manufacturing Industry	Warehouse, production hall, manufacturing buildings, workshops.
Logistics & Storage	Storage, distribution area, parking area of manufacturing industry.
Offices	Buildings mainly for office use.
Sport & Leisure	Swimming pools, sport centres, leisure centre.
Transport Infrastructure	Airports, railways stations, bus stations.
Wholesale & Retail	Shopping malls but also smaller retails. Commercial centres often comprehensive of restaurants, offices, etc.
Other	Religious buildings, social housing, fire stations, etc.

The achieved savings are analyzed as to their absolute levels (kWh/year) and in relative terms (% of the consumption before refurbishment for existing building and in comparison to the Reference Value of the country for the new building). Also the energy consumption kWh/m^2/year was taken into account for the final evaluations and results.

The efficiency measures varied to certain extent among partners (given the different use, geographical area or year of construction) nevertheless the measures were categorized into 8 main areas, which were found as the common denominator.
The categories were: Heating, Cooling, Ventilation, Electrical equipment, Envelope (U value), renewable energy sources (RES), Control System and Others.

Within the general category of Heating, the followings principal systems were earmarked: district heating, heat pump, CHP (Combined heat and Power generation), boilers (condensation type, natural gas, biomass and oil), heat exchanger and ventilation system.

All the technical measures will be analyzed in the followings chapters.

It is important to emphasize that not all the information was provided from all Partners. Nevertheless, the missing pieces of information were relatively negligible. Yet, as there are different format of the reporting form in the participating countries, for many partners only partial information was provided. In the following analysis this is always acknowledged either including an "n/a" (not available) share or by stating the total population of the sample.

The only section though, where the number of provided sets data is significantly lower is the information on economic characteristics of the projects. This analysis is therefore more of qualitative nature and the conclusions are to be taken with caution.

The report is based on Partner's information only[4]. The reporting forms are always being checked by the National Contact Points for inconsistencies, before being sent to the JRC, and then also checked by the JRC, before granting the Building and the organization a GreenBuilding Programme Partnership status. Nevertheless, the analyzed data has to be taken keeping this limitation in mind.

3. Results – the GreenBuilding Programme

3.1 General description of the Partner buildings

There is a difference between the number of Partners, who joined the GreenBuilding Programme and the number of Partners Buildings, which have received the GreenBuilding Certificate. The GBP Certificate is always granted to a specific building. Therefore one GBP Partner can join the Programme with more buildings. Each of these buildings is assessed separately and receives the certificate on an individual basis.

[4] The obligatory part of the report is % savings, as this is one of the requirements to join the GreenBuilding programme

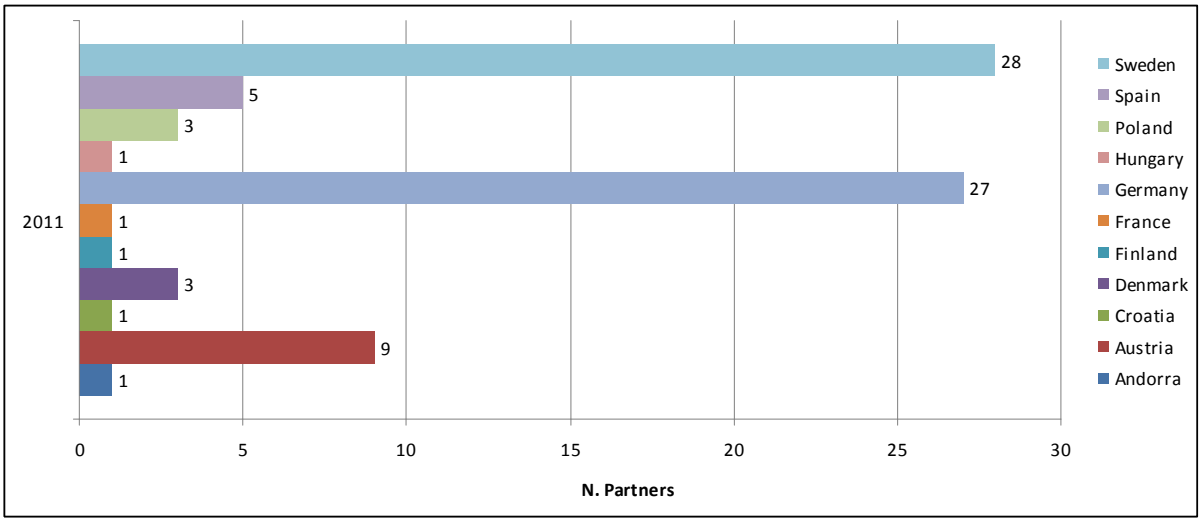
From 2006 to 2009 the total number of Partners amounted to 167 and the total number of GreenBuilding certified building was 286.
In the year 2010, 110 Partners joined the Programme with 167 Building.
In the year 2011, 80 Partners joined the Programme with 117 Building.
The total number of Partners that joined the programme, from the star to the end of 2011, is 362 with a total number of 586 Building.

From the beginning of the programme, Partners come from 18[5] countries, from which 14 are part of the EU. Geographically, both southern and northern countries are represented.

In 2011 the highest number of GBP Partners come from Germany (27), followed by Sweden (26). Austria has 9 and Spain 5 Partners respectively.
International companies, which have joined the GBP in different countries companies, have been considered separately.

[5] Austria, Belgium, Croatia, Cyprus, Denmark, Finland, Germany, Greece, Hungary, Italy, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Turkey, United Kingdom.

Figure 1 Partners per country in 2011



The highest number of Partners has been registered in Germany (27), followed by Sweden with 26 Partners. Also in 2010 Germany has the largest number of Partners (58) who joined the Programme, but the gap between Germany and Sweden (24) was larger then the one of 2011 (Figure 3) where the difference between the two countries is just of 1 Partner. From the start of the Programme in 2006, Germany and Sweden have been the leading countries in the GreenBuilding Programme. In most countries the number of building, to large extent, copies the number of Partner (Figure 2).

Figure 2 Buildings per country in 2011

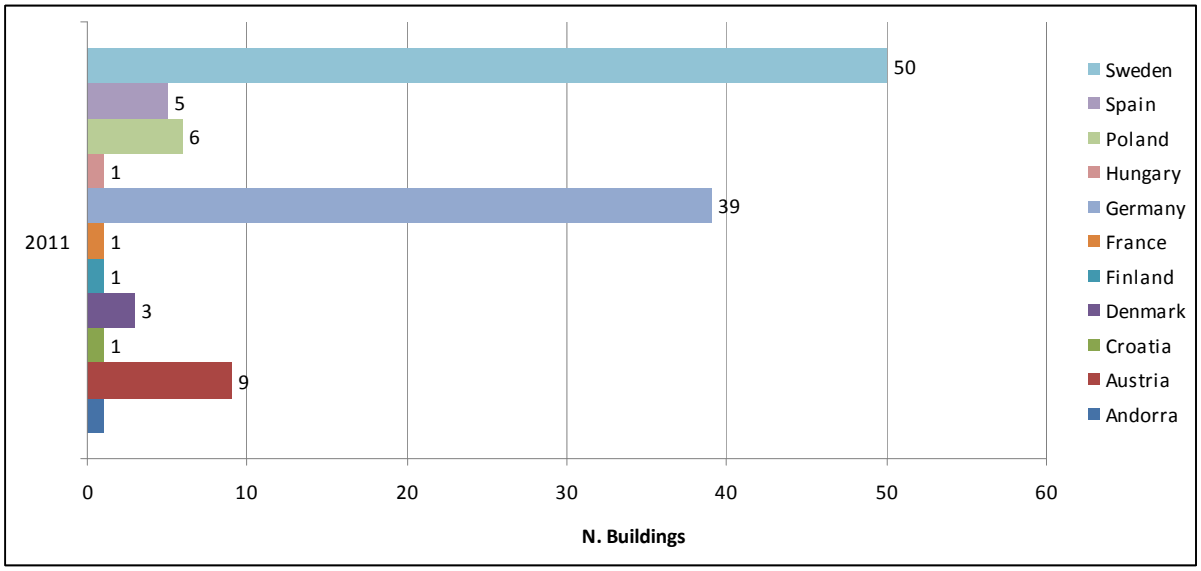
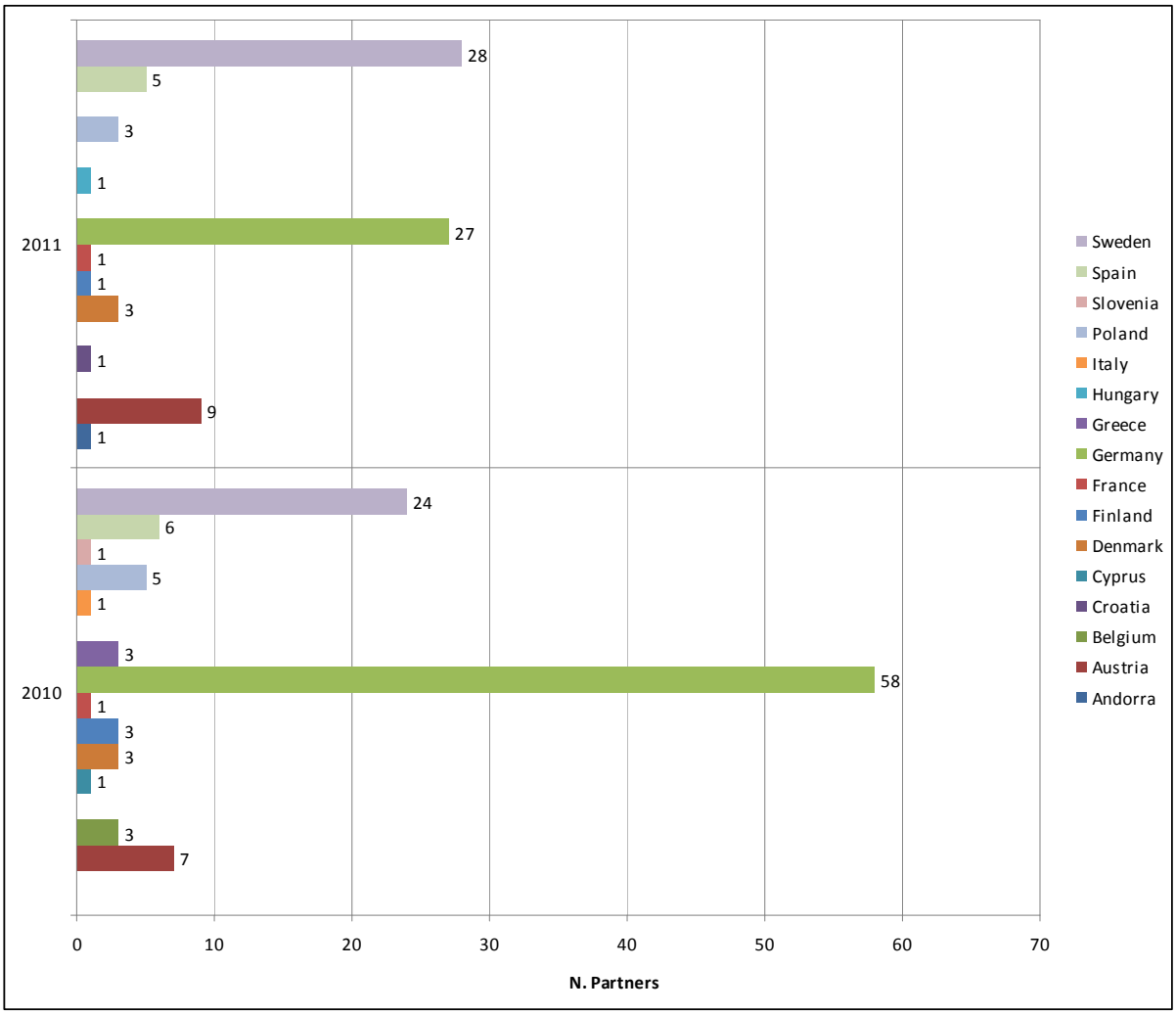


Figure 3 Partners per country – comparison between 2010 and 2011

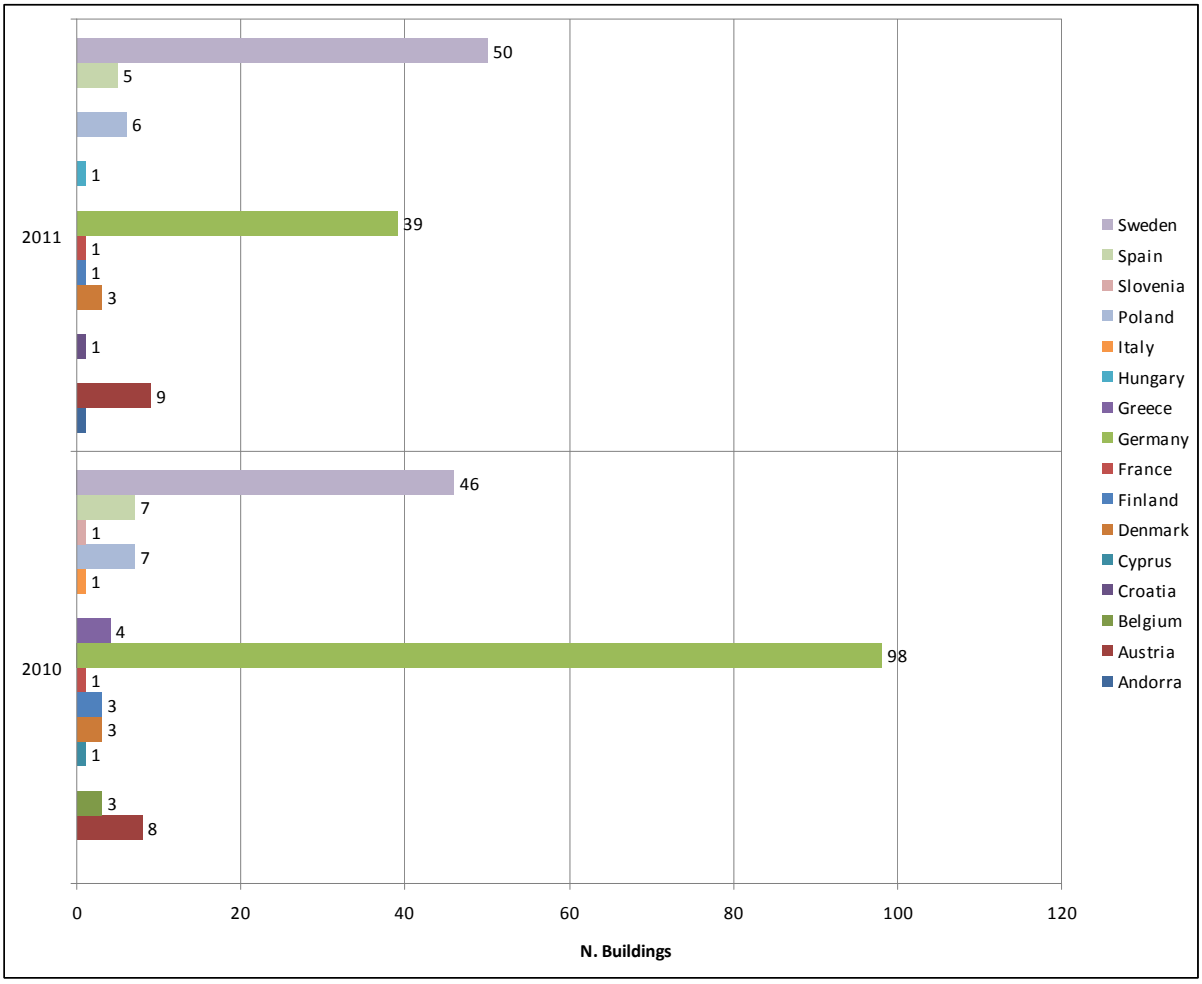


From the graphic above we can see that Germany remains the leading country in terms of number of Partners that joined it. Sweden remains in second position. This trend of Germany participation follows also the first period analysed (2005-2009)[6] where was also the leader country.

As for Germany and Sweden, also Austria follows in the year 2011 the previous trend of 2010. Croatia and Hungary are joining for the first year the programme with one building each. Spain and Poland decrease of some unit their participation, following Austria in number of building joining the GB. No new Partners joined from Slovenia, Italy, Greece and Belgium.

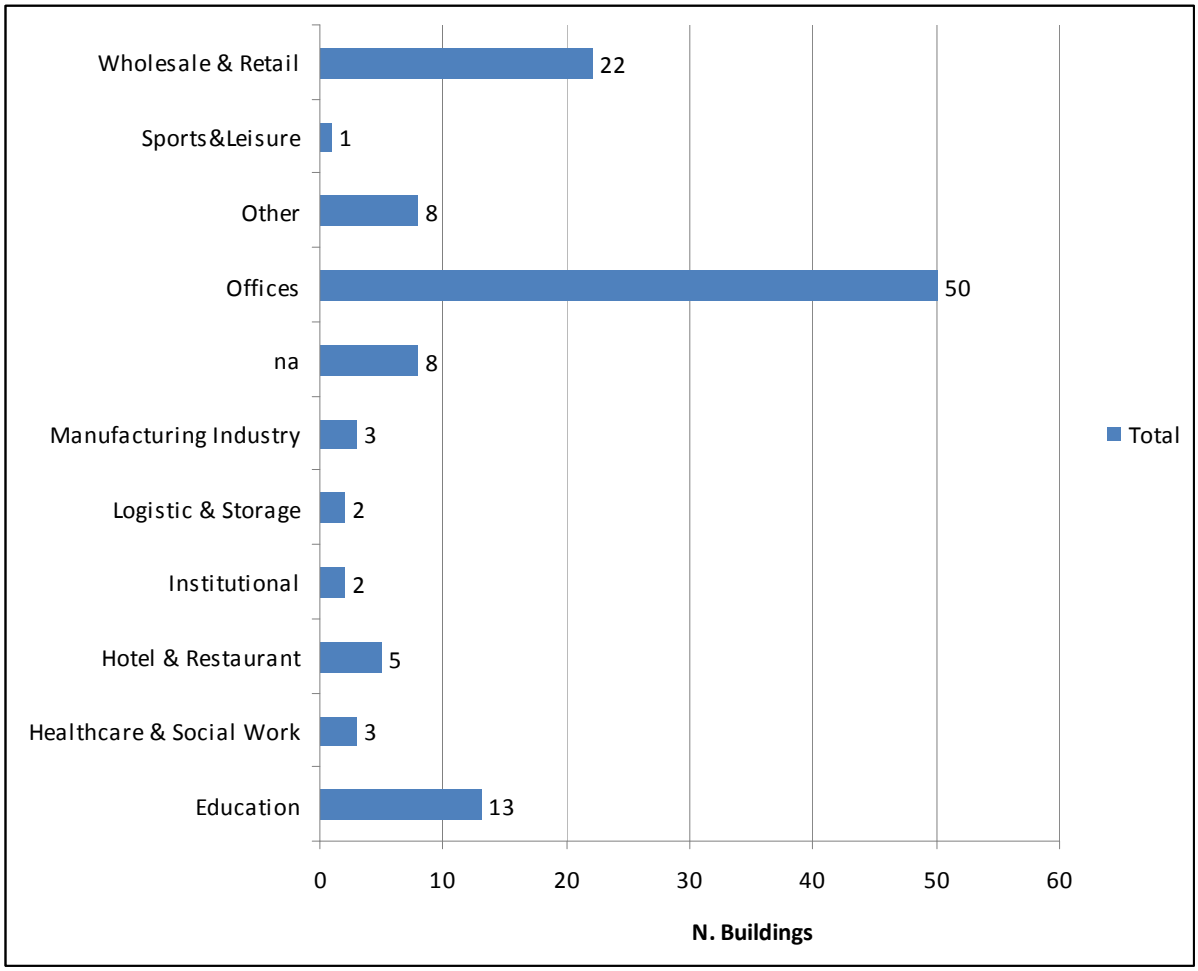
[6] Bertoldi, P.,Valentova,M.: The European GreenBuilding Programme 2006-2009 Evaluation

Figure 4 Building per country – comparison between 2010 and 2011



Sweden has less number of Partners than Germany but more buildings, which means than in some case one single Partner is represented with more buildings. Is the case of Partners as Ludvika Kommun and Lundafastigheter which joined both with 5 buildings each.

Figure 5 Building's business categories 2011



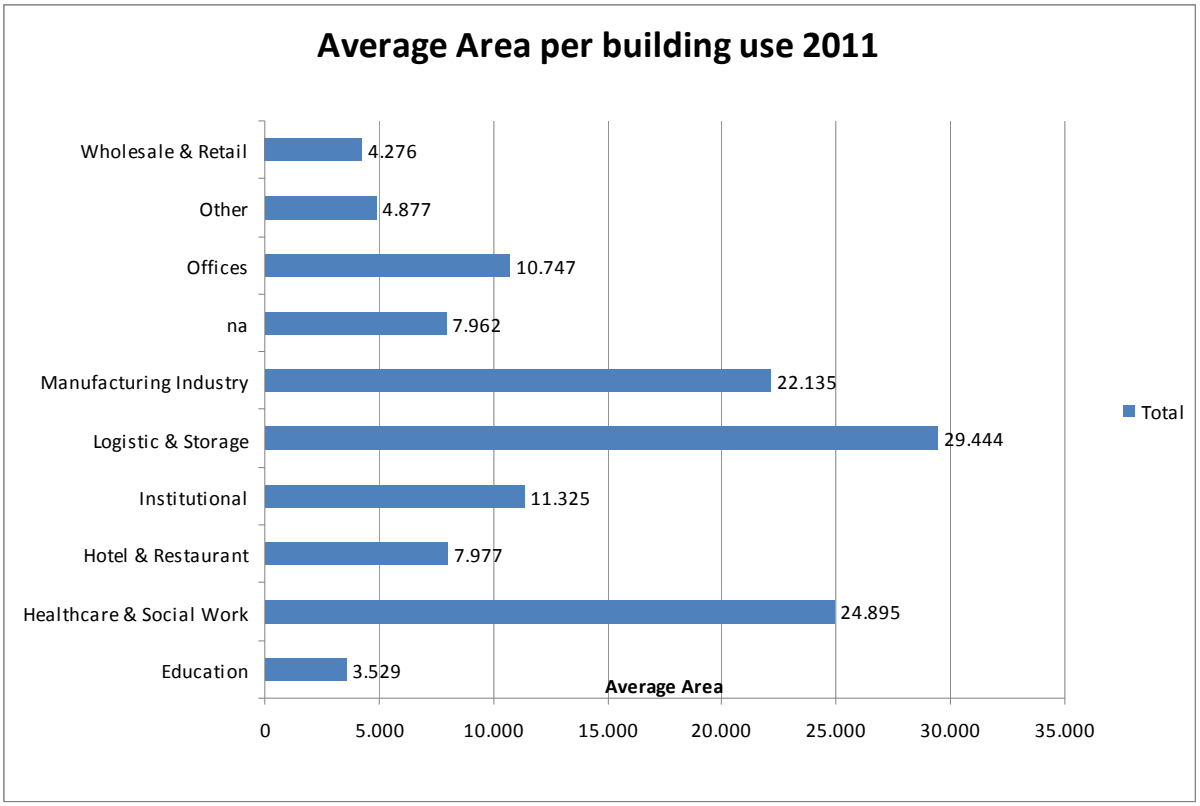
As for year 2010, the majority of the Partners building are offices. Other buildings may (and surely do) include offices as well. However, the offices do not represent the main use of the building and serve more as background space. Offices can be present in the same building with shops, or can be part of an industrial building on annexed to a workshop.

The smallest office registered in the GreenBuilding Programme has an area of 196 m^2, is a new building located in Germany, the largest amounts to about 48.732m^2, is located in Sweden and is also a new building (Uarda 5- Fabege AB).

The second largest group of buildings in 2011 is represented by "Wholesale and Retail" buildings category. This category includes big shopping mall but also small retail shops. Commercial centres are often comprehensive of restaurants and offices. The area's range of these buildings goes from a small retail shop of 430 m^2 to a big shopping mall of about 30.000 m^2 (Shopping centre Riverside - Riverside Besitz und Betrieb GmbH) . Almost all the buildings belonging to this category are located in Germany. Most of them are new buildings.

The third largest group of building are educational buildings. This category includes kindergartens, primary school, high school and university. The area's range of this category goes from 406 m^2 to 11.806 m^2 (Gymnasium in der Au - Innsbrucker Immobilien GmbH & Co.KG).

Figure 6 Average Area of buildings per building use 2011



The category "Logistic and Storage" is represented by only two buildings but with a huge area, one of 10.288 and the second one of 48.600 m^2. Both of them are refurbished building and are located in Sweden.

The category "Manufacturing Industry" is represented by 3 buildings. One is very small, about 1000 m^2, is a workshop and another one, very big, about 53.700 m^2 is a production hall located in Germany. The category "Health and Social Work" has a range are between 891 m^2 and 58.440 m^2. This last one is a new building located in Austria.

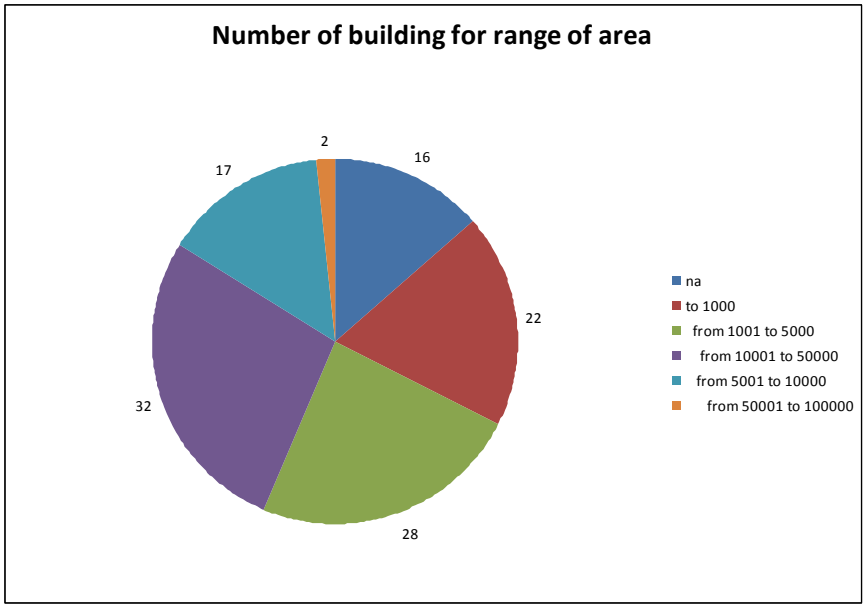
The average area of building for 2011 amounts to 9.141 m^2 (101 buildings over 117 have given the information about the area of the building).
However the median of the sample is 4.666,5 m^2 meaning that 50% of the buildings are actually smaller then 5.000 m^2.

Table 2 Business categories in percentage for Partners in 2011

Education	13	11,1%
Healthcare & Social Work	3	2,6%
Hotel & Restaurant	5	4,3%
Institutional	2	1,7%
Logistic & Storage	2	1,7%
Manufacturing Industry	3	2,6%
na	8	6,8%
Offices	50	42,7%
Other	8	6,8%
Sports&Leisure	1	0,9%
Wholesale & Retail	22	18,8%
Grand Total	117	100,0%

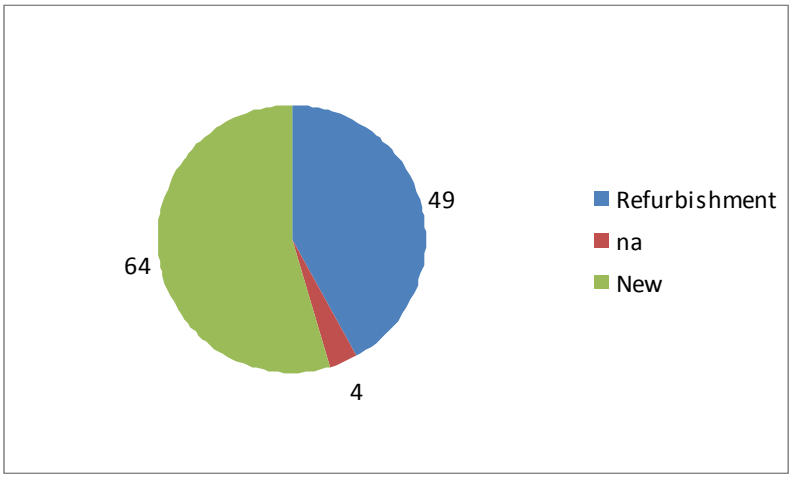
No information was available for the area of 8 buildings.
Most of the buildings have an area range between 10.001 and 50.000 m^2. Most of them are new building for office use. Only two have an area between 50.001 and 100.000 m^2.
An important numbers of buildings are little constructions, smaller than 1.000 m^2. This last category is mostly represented by small retail shops. These shops belong to two main German Partners: TEDI GmbH & CO. Kg and KIK Textilien and Non-Food GmbH.
The building with the largest are that joined the GreenBuilding programme in 2011 belongs to the category "Healthcare & Social Work". It has an area of 58.440 m^2, is a new building located in Austria : CMZ (Chirurgisch-Medizinisches Zentrum) belonging to the Partner KABEG Landeskrankenanstalten-Betriebsgesellschaft.

Figure 7 Number of building for range of area



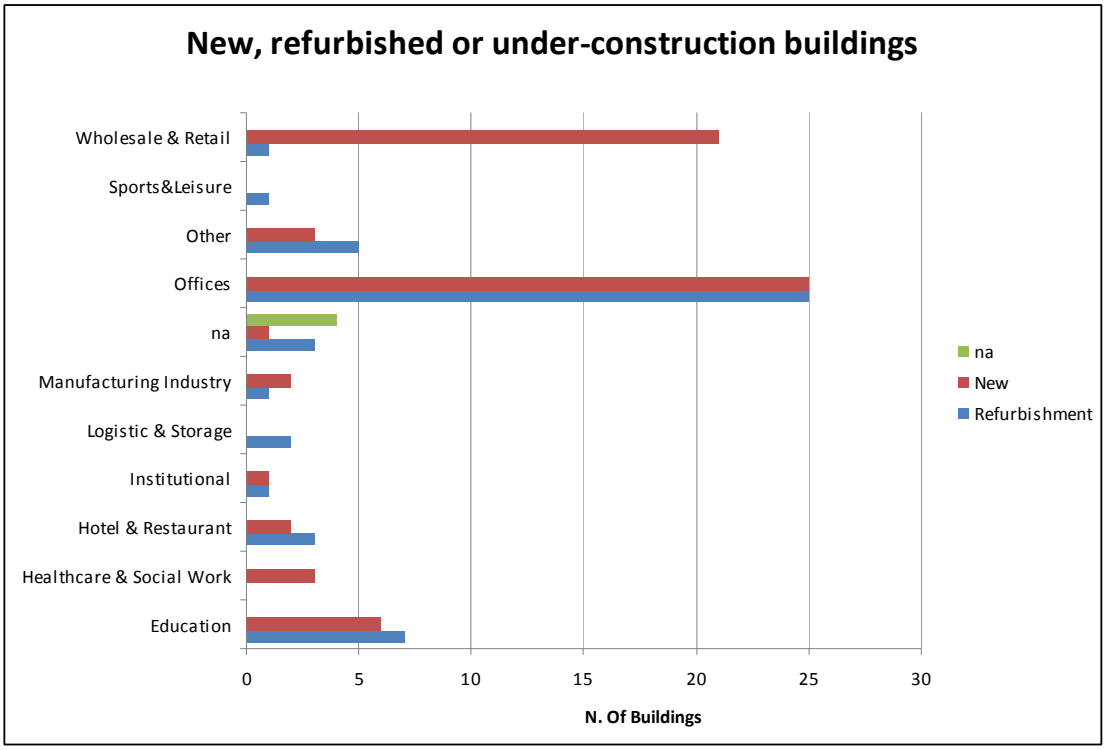
The dimensional information about buildings is specified for heated area, cooled area and lighted area. When these values are different, the analysis takes into account the largest one, where the most quantity of energy is consumed. Also information about climate and site are often specified (climate zone, altitude, latitude, heating and cooling Degrees Days).
The buildings also differ in height. Among the GB buildings there are ground floor buildings but also skyscrapers with 40+ floors.

Figure 8 New or refurbished



For the year 2011 two types of project are reported under the GreenBuilding Programme: New or Refurbished. In 2010 a third category has been considered: Under Construction buildings.
Also in 2011 some of the buildings who joined the Programme where under construction but they have been considered as New buildings.
In the case of new building the primary consumption achieved must be 25% below the relevant building standard in force (legal reference value) or compared to "conventional" new building, if there is no building code available. In the case of refurbishment, the energy consumption before and after the intervention is decisive (again at least 25% of improvement is required).
In 2011 the largest number which joined the GB is represented by new building.
Refurbishing activities can involve all the building or part of it.

Figure 9 New or refurbished buildings per business category



The Figure above shows the distribution, in 2011, of business category for new or refurbished building.
"Offices" is the main category for both of the two sectors. The number of new and refurbished buildings is equal. For the business category "Wholesale & Retail" the new buildings represent the largest part of it.
Refurbished buildings represent the largest number of building in the categories Hotel & Restaurant and the only one for the category Sport and Leisure and Logistic and Storage.
The building belonging to the category Healthcare & Social Work is represented only by new buildings.

3.2 Achieved Savings

The GreenBuilding Partners usually report their savings in two ways: either as absolute yearly savings or as KWh per m^2 and per year. In some case, both sets of data are reported. In case of relative saving (%) it is not important which method or reporting is used. However, if we are to analyze the absolute savings, in case of latter method (reporting KWh/m^2 year), recalculation is necessary.

3.2.1 Absolute savings

Total primary energy savings of the GreenBuilding Programme for 2011 amount to about 74 GWh/year. Summed to the previous period time analysed (432 GWh/year for 2006-2010)

the total saving from the start of the programme until the end of 2011 reached 506GWh/year.

Table 3 Absolute saving and percentage per country (kWh/year)

Country	Absolute Saving (kWh/yr)	%
Andorra	828.625	1,1%
Austria	7.069.231	9,6%
Croatia	130.221	0,2%
Denmark	2.527.259	3,4%
Finland	279.473	0,4%
Germany	12.632.169	17,1%
Hungary	589.257	0,8%
Poland	11.535.194	15,7%
Spain	12.458.101	16,9%
Sweden	25.611.583	34,8%
Total	73.661.113	100,0%

The table above depicts the total saving (kWh/year) per country. Maximum absolute saving was achieved in Sweden with about 26 GWh/year (34,8%). Germany and Spain follows with respectively 12,6 GWh/year and 12,4 GWh/year.

In order to have a correct analysis of absolute savings per country is necessary to enlighten the number of buildings for which we have the absolute savings data.

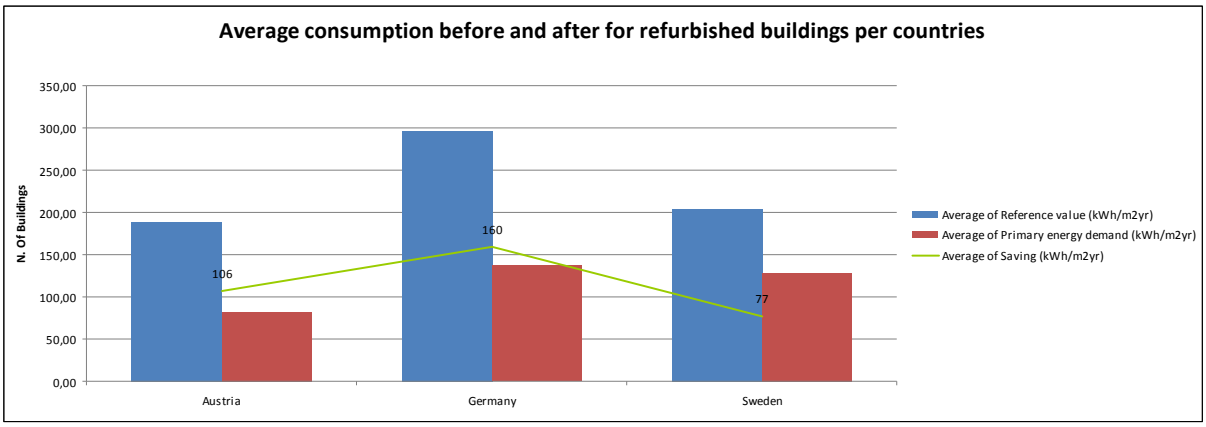
Table 4 Building per country which gave the data for absolute savings

Country	Nr. Of building with absolute saving
Andorra	1
Austria	9
Croatia	1
Denmark	3
Finland	1
Germany	37
Hungary	1
Poland	6
Spain	1
Sweden	38
Total	101

The table above shows the huge difference, in number of building for which the absolute saving is available, between Germany and Sweden compared to other countries. This is also strictly connected to the number of building which joined the programme in these two

countries. For Andorra, Croatia, Finland, Hungary and Spain we have the data for only one building each.
The savings are underestimated to some extent because on a sample of 117 building only for 101 was possible to have (given data) or to obtain (multiplying the saving often available in KWh/m^2 year per the area).

Figure 10 Average consumption before and after for refurbished buildings per countries



The Figure above shows the consumption before and after for refurbished buildings per countries. There are only 3 countries who have refurbished buildings: Austria, Germany and Sweden. Germany achieved the best average consumption in Kwh/m^2/year: 160. For the new buildings category the best result has been achieved in Croatia.

Figure 11 Average consumption before and after for new buildings per countries

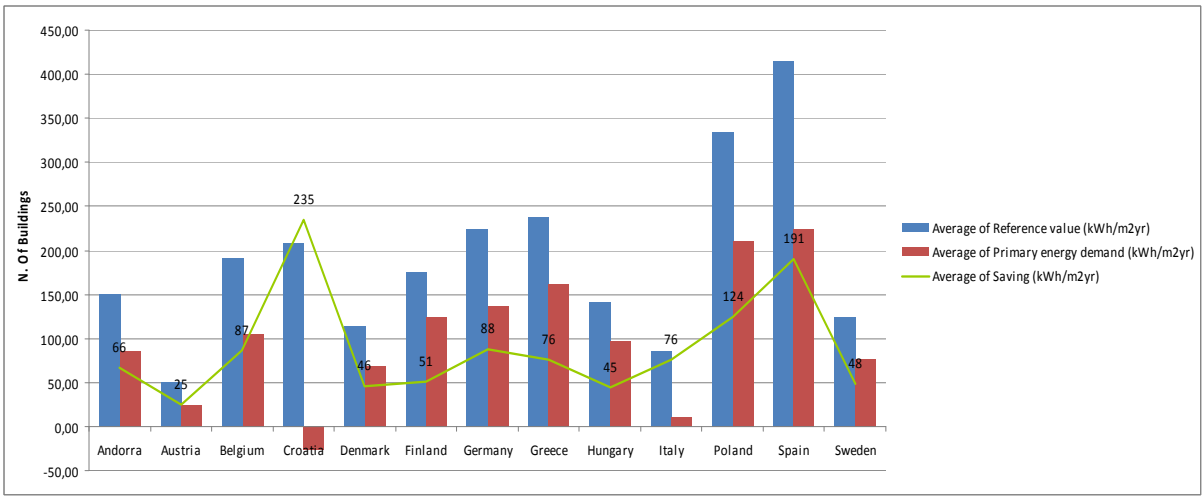


Table 5 Absolute savings for new and refurbished buildings

Project type	Absolute Saving (kWh/yr)	Number of Building
New	45.453.415	63
Refurbishment	28.207.699	37
Grand Total	73.661.113	100

The table above shows the absolute saving for the two categories New and Refurbished buildings. Over 117 the analysis was made on 101 buildings that reported this value. In some cases the Partner reports the consumption before and after in KWh/m2/year, but they do not give the total area of the building; in this case was not possible to calculate the absolute saving of it. We can see that the saving achieved in new building is much higher than in the one achieved in the refurbished building.

Table 6 Absolute savings and average savings per business categories

Business category	Sum of Absolute Saving (kWh/yr)	Number of Building	Total bld. Area (m^2)	Average of Absolute Saving (kWh/yr)	Average of Saving per bld. (kWh/m^2yr)
Education	3.396.585	12	42.350	283.049	97
Healthcare & Social Work	2.203.114	3	74.686	734.371	52
Hotel & Restaurant	7.291.484	5	39.887	1.458.297	181
Institutional	873.170	2	22.650	436.585	77
Logistic & Storage	3.207.965	2	58.888	1.603.982	43
Manufacturing Industry	3.955.824	3	66.405	1.318.608	60
na	1.634.274	3	23.885	544.758	61
Offices	44.069.051	43	462.112	1.024.862	84
Other	2.125.321	5	24.385	425.064	101
Wholesale & Retail	4.904.324	22	94.079	222.924	79
Total	73.661.113	100	909.326	736.611	87

The table above shows the absolute savings, the average absolute savings per business category and the average saving for business category in kWh/m2/year. The highest average for absolute savings per Partners building (1.603.982 KWh/year) is reported in the Logistic and Storage category, although is important to analyse this data keeping in mind that this category is represented by only two buildings. Not very far behind the Hotel & Restaurant category achieved an absolute value of 1.458.297 KWh/year. In this category has been also performed the best average saving per m^2, (181 KWh/m^2/year) which is the most important indicator of energy efficiency. Also the Education category achieved a very good result with its 97kWh/m^2 year saved per building. The average saving in KWh/m^2year is 87 which is much higher compared to this data in 2010 which was 77,5 kWh/m^2/year.

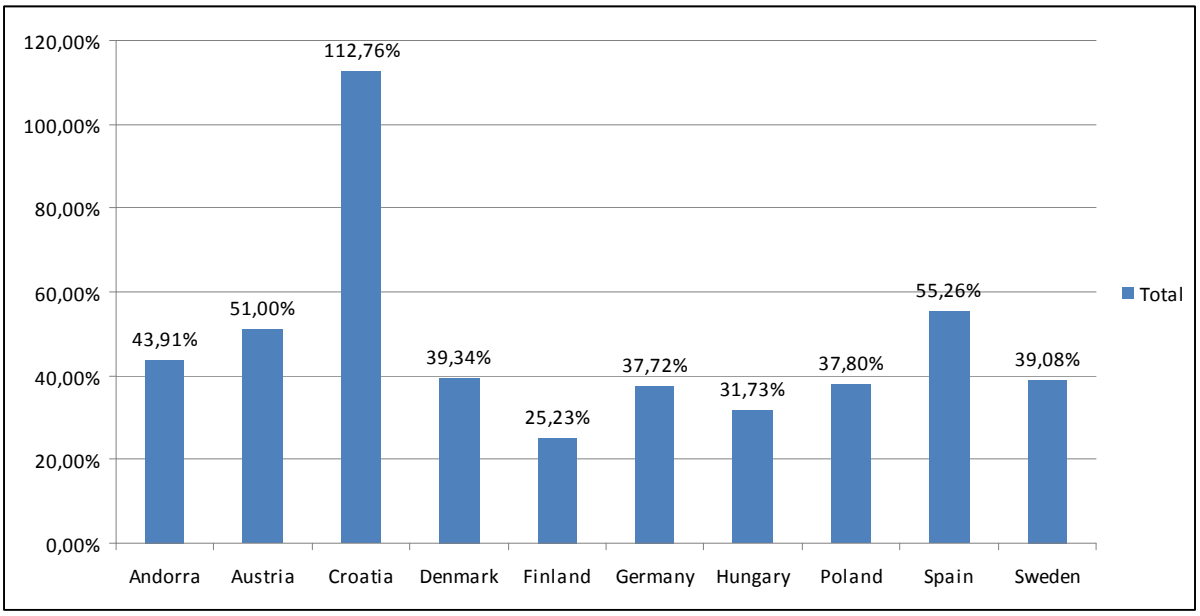
Table 7Average saving per building and per m^2 for different range of area

New Area Range	Count of Building	Sum of Area (m2)	Sum of Absolute Saving (kWh/yr)	Average of Saving (kWh/m2yr)	Average of Absolute Saving per bld (kWh/yr)
to 1.000	22	13.330	1.171.734	93	53.261
from 1.001 to 5.000	28	65.192	6.609.790	99	236.064
from 5.001 to 10.000	17	125.976	6.791.702	54	399.512
from 10.001 to 50.000	31	592.607	55.114.041	94	1.777.872
from 50.001 to 100.000	2	112.222	3.973.846	36	1.986.923
Total	100	909.326	73.661.113	87	736.611

17 buildings on 117, do not have reported the data of the area and of the absolute saving. The best absolute saving has been achieved in the largest building from 10.001 to 50.000 m^2. The best average saving in kWh/m^{2}year, which is the most important indicator for energy efficiency, has been reached in small-medium size building with area between 1.001 and 5.000 m^2. The largest buildings in size have the lowest average saving in kWh/m^2/year. The range of average savings goes from 36 to 99 kWh/m2 year, the average value for all the sample amounts to 87 kWh/m^2/year.

3.2.2 Relative savings and trends

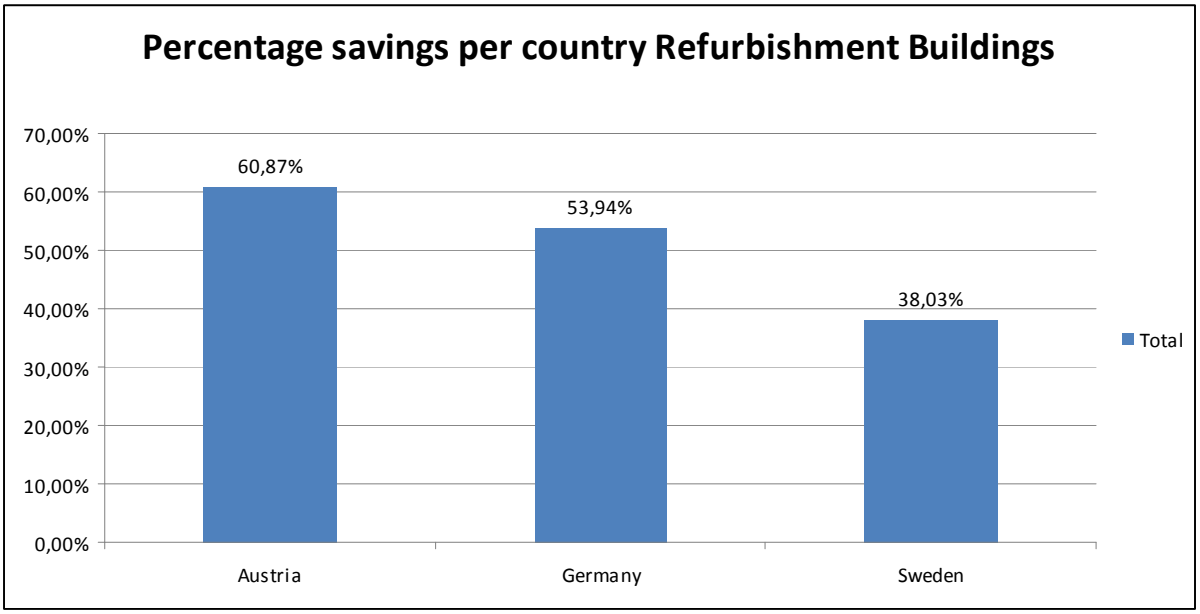
Figure 12 Percentage saving per country for New Buildings



The Figure above shows the percentage savings per country in new buildings. The average percentage savings range from 25,23% (Finland) to 112,76% (Croatia). For 5 Partners buildings no clear information on % savings has been provided, or it could be calculated from

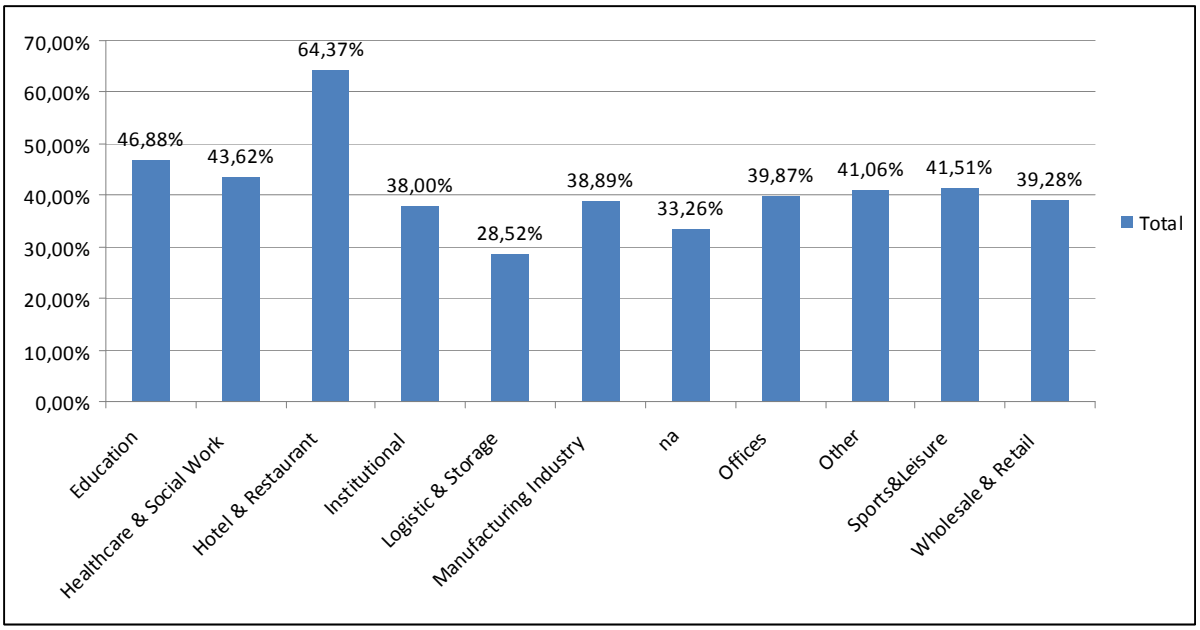
the reported savings. From the total of 112 Partners building who reported the percentage savings, 23 achieved more than 50%. 12 buildings achieved more than 60%. The data must be evaluated keeping in mind the large disparity of number of buildings per country. Croatia, that has the best result in percentage for saving, has just one building participating at the GB Programme. Germany and Sweden with their larger participation gave a more reliable sample.

Figure 13 Percentage saving per country for Refurbished Buildings



The refurbished buildings which joined the GB Programme in 2011 are located in only 3 countries: Austria (3), Germany (7), Sweden (39).
The best result has been achieved in Austria with 60,87%. In this country an office building (Bureau am Belvedere - Immofinanz Montaigne Liegenschaftsvermietungs GmbH) of about 11.000 m^2 achieved an energy saving of 75%.
In Germany the best result (85%) has been achieved by the building: Leibniz-Institut für ökologische Raumentwicklung e.V., which has an area of 2.694 m^2.
The largest number of refurbished buildings is located in Sweden. The best result in this country has been achieved by Hemfosa Fastigheter AB with the office building Gamlestaden 2:8, which obtained a saving of 66%.

Figure 14 Percentage savings per business category



The Figure above shows the percentage saving per business category. The average percentage saving range from 28,52% and 64,37%. Hotel & Restaurant is the business category where the best energy saving's result in percentage has been achieved (64,37%). The category is represented by 5 buildings located in Sweden, Germany, Croatia. The range area goes from little accommodation buildings - 554 m^2- to big size hotels (19.987 m^2). The range of saving in % goes from 30% to 127 %.
Office despite its largest presence in number of building and largest absolute savings, achieved 39,87%, improving its performance compared to year 2010, when the value was 37,21%. The best energy saving in percentage of this category amounts to 85%.

3.2.3 Office Category

Office category is treated apart in this chapter; most of the buildings which joined the GreenBuilding Programme are offices and for this reason they have a special importance in this analysis.
This analysis takes into account only the buildings that have this use as prevalent use, but some other buildings of different category as industry, or hotel have also, as part of their surface, office's areas. These are not taken into account in this particular analysis.

Table 8Absolute saving and percentage saving per office category (new and refurbished)

Project type	Number of Building	Absolute Saving (kWh/yr)	Saving in %
New	25	32.332.270	73,4%
Refurbishment	18	11.736.781	26,6%
Total	43	44.069.051	100,0%

The total number of Office building which joined the GB Programme in 2011 is 50. The absolute saving was available for 43 of them. The largest part of office's buildings is new ones. The below above shows that the largest part of saving is achieved by this category.

Table 9 Average consumption (before, after and saving) in kWh/m^2 year

Project type	Area range m^2	Average primary energy before or reference value (kWh/m^{2}yr)	Average primary energy after of effective value (kWh/m^{2}yr)	Energy saving in %
New	from 10001 to 50000	317,0	201,2	38,9%
New	from 1001 to 5000	175,8	108,2	35,4%
New	from 5001 to 10000	160,5	98,7	40,2%
New	to 1000	109,8	73,5	37,3%
Refurbishment	from 10001 to 50000	178,5	82,1	56,4%
Refurbishment	from 1001 to 5000	241,8	136,6	44,0%
Refurbishment	from 5001 to 10000	133,8	89,5	33,1%
Refurbishment	n/a	156,8	102,7	34,8%
Total		205,7	125,6	39,9%

The table above shows the average consumption in kWh/m^2/year for new and refurbished Office buildings divided per range of area.

Table 10 Maximum and Minimum saving for new and refurbished buildings, per average area.

Area range m^2	Max of Absolute Saving (kWh/yr)	Min of Absolute Saving (kWh/yr)
from 10001 to 50000	**10.767.912**	**142.750**
New	10.767.912	142.750
Refurbishment	2.050.000	866.436
from 1001 to 5000	**587.158**	**57.552**
New	436.010	57.552
Refurbishment	587.158	125.386
from 5001 to 10000	**1.456.132**	**156.000**
New	1.456.132	156.000
Refurbishment	554.165	196.080
to 1000	**40.839**	**4.449**
New	40.839	4.449

The table above shows the maximum and minimum average absolute saving (kWh/year) for the 2 office categories: new and refurbished per area range.

3.2.4 Best Examples of Savings

This section describes the best result achieved both in terms of percentage saving and absolute savings.

Table 11 Best energy saving buildings in percentage

Partner	Building	Saving in %	Business category	Area m^2	New/Refurbished
Megaron Vukovar d.o.o	Vila Vanda	112,7	Hotel & Restaurant	554	New
Derag Hotels	Derag Living Hotel Campo dei Fiori	88,0	Hotel & Restaurant	1.400	Refurbished
Leibniz-Institut für ökologische Raumentwicklung e.V. (IÖR)	Leibniz-Institut für ökologische Raumentwicklung e.V	85,0	Heathcare & Social Work	2.644	Refurbished
Immofinanz Montaigne Liegenschaftsvermietungs GmbH	Bureau am Belvedere	75,0	Office	11.323	Refurbished
NÖ Landesimmobiliengesellschaft mbH (LIG)	Niederösterreichhaus Krems	74,0	Office	9.633	New
TEDI GmbH & Co. KG	TEDi Riedstadt	71,0	Wholesale & Retail	475	New
Constructora D'Aro	Residence Hall ETSAV Campus	71,0	Education	2.860	New
KiK Textilien and Non-Food GmbH	KiK Riedstadt	70,0	Wholesale & Retail	535	New
Hemfosa Fastigheter AB	Gamlestaden 2:8	66,0	Office	20.000	Refurbished

The table above shows the ten best examples of energy saving in percentage. Many different business categories are represented; the best two examples are from the category "Hotel & Restaurant". The majority of the buildings are new ones. The range of the best energy saving examples goes from 112,7 (energy is not only saved but produced) to 66%.
The range area is included between 535 m^2 and 20.000 m^2. For the variety of the sample in terms of typology and area is not possible to enlighten a particular trend.

The best result is achieved by the Partner Megaron Vukovar d.o.o, located in Croatia. The building is a Hotel of 554 m^2. This hotel has been planned with zero-energy standards using renewable energy and high energy efficiency systems. The building is equipped with solar thermal plant (hot water collectors with selective glazing, 70% of nominal efficiency, 30 m^2 of absorbing area), a geothermal plant (slinky closed loop field), a photovoltaic plant (mono crystalline silicon, 85 m^2 of absorbing area) and a biomass boiler. Well dimensioned heat pumps, with power regulation are adopted for the heating and cooling system. The envelope U value is of 0,19 W/m^2K. Thermal bridges have been localised and eliminated. The lighting system is equipped with high efficiency fluorescent lamps.

Table 12 Best energy saving in absolute value

Partner	Building	Saving kWh/yr	% savings	Area m^2	New/Refurbished
Sociedad General De Aguas De Barcelona	Torre Agbar	10.767.912	35,0	24.800	New
Handelhof GmbH/ Stadtbau AG	Handelshof Leipzig	5.221.603	48,0	19.987	Refurbished
Fabege AB	Uarda 5	3.411.380	64,0	48.734	New
Harder Kappa GmbH	Hegele Logistics Center	3.185.490	34,0	53.782	New
Vasakronan AB	Nordstaden 8:27	2.954.880	27,0	48.600	Refurbished
Globe Trade Centre S.A.	University Business Park Building B	2.584.353,6	39,0	18.768	New
Globe Trade Centre S.A.	University Business Park Building A	2.519.244,3	39,0	18.429	New
FN-Byen P/S	UN City Campus 1	2.153.354,8	53,0	42.439	New
Gamlestaden 2:8	Hemfosa Fastigheter AB	2.050.000	66,0	20.000	Refurbished
Astra Park sp. z o.o.	Astra Park	1.984.018,8	25	15.843	New

Table 11 shows the ten best examples of energy saving in absolute values. The best result is achieved in an office building Torre Agbar belonging to the Partner Sociedad General De Aguas De Barcelona, located in Spain. Torre Agbar is a landmark building in Barcelona, with 24.800 m^2 distributed in 34 floors above ground and 4 below ground with a total height of 143 meters. In order to demonstrate that this building is energy efficient, has been made an energetic simulation of it through official software supported by the Spanish Government. This software analyzes the lighting, heating, cooling, thermal envelope and DHW facilities and compares them, in terms of final energy consumption with the reference building.

The building U-value is 0,7 $W/m^2/K$. Heating production system is supplied by well dimensioned electric heat pumps; cooling production system is supplied by air-air heat pumps. Actually, Agbar Tower, is studying the viability to change electrical generation for district heating.

Absolute values are strictly related to the area of the building: the first ten results have an area included between 15.843 m^2 and 53.782 m^2. The Table shows that very high energy saving in absolute value does not necessarily correspond to high percentage of saving.

4. Energy efficiency measures

The energy efficiency measures are what makes the energy efficiency improvement (or energy savings) possible. From the total of 117 Partner Buildings at least one technical measure implemented have been described by 110 of them. (94%)

The measures taken in the period time analysis of this report (2011) have been categorized into 7 main groups:

- Heating system
- Cooling system
- Ventilation system
- Lighting system
- Renewable energy sources
- Control system
- Envelope (walls and windows)

For heating, cooling and renewable energy sources specific subcategories have been made in order to give a better picture of the implemented measure.
The majority of the Partners implemented 4 measures per building. Only 10 buildings implemented 6 measures, the maximum number. For 7 buildings there was no information available on this technical data.

Table 13 Number of measures implemented in the buildings

Nr. Measures Implemented	Nr. Of Buildings	%
1	15	12,8
2	19	16,2
3	19	16,2
4	30	25,6
5	17	14,5
6	10	8,5
n/a	7	6

Table 14 Measures in buildings, types and %

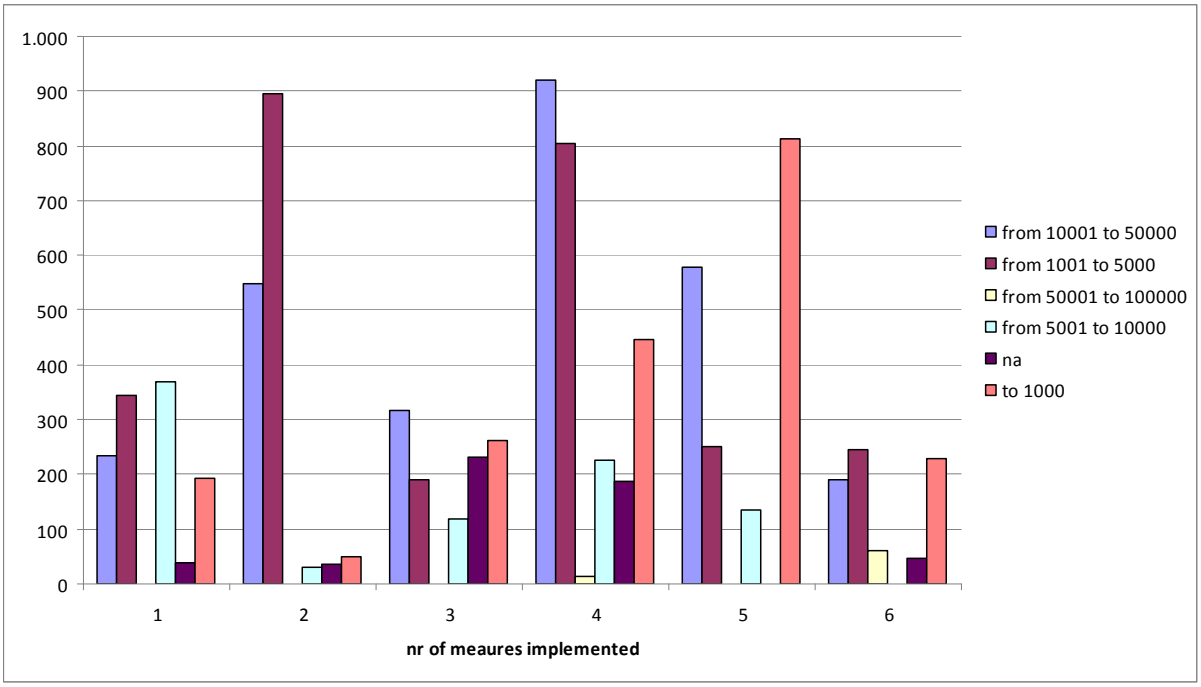
Types of Measures Implemented	Nr. Of Buildings which implemented the measures	%
Heating system	79	67,5
Cooling system	63	53,8
Ventilation system	69	59,0
Lighting system	29	24,8
Renewable energy sources	26	22,2
Control system	52	44,4
Envelope	57	48,7

The numbers of building for which have information about technical measures implemented are 110. Each building can implement one or more measures. Envelope implementation is comprehensive both of walls, roofs, basements and windows surfaces. Partners gave information on U value and/or type of materials used for the construction. Also for windows information can be about U value of the glass surface and/or description of type of glass and frame used (double glass, triple glass, low-e coat glass, etc.). Many buildings are equipped with summer heat protection which basically means external shading devices, to protect the building from excessive summer heat gains.
Control systems are used in heating system, cooling system and ventilation, but most of them are applied to the lighting system (daylight control, occupancy control, etc.).
The relation between number of measures, range of area and saving (in kWh/m2/year) is shown in the table below.

Table 15 Measures implemented in relation to the range of area

New Area Range	Nr of measures 0	Nr of measures 1	Nr of measures 2	Nr of measures 3	Nr of measures 4	Nr of measures 5	Nr of measures 6	Total
na	1	2	3	5	4		1	16
to 1000	1	3	1	4	4	6	3	22
from 1001 to 5000	1	4	7	2	8	3	3	28
from 5001 to 10000	1	4	1	3	5	3		17
from 10001 to 50000	3	2	7	5	8	5	2	32
from 50001 to 100000					1		1	2
Grand Total	7	15	19	19	30	17	10	117

Figure 15 Consumption (kwh/m2/year) for number of measures implemented and range of area.



From the table above we can say that the largest saving is achieved in building in a range of area between 10.001 and 50.000 m2 which implemented 4 measures to improve the energy efficiency in the building. Buildings which implemented 6 measures did not achieved better saving in average of range of area. Very good results are also achieved in building in a range of area between 1.001 and 5.000 which implemented 2 technical measures.

4.1 Heating system

For 79 building over 117, information about heating system adopted is available.
Within the general category of Heating, the followings principal systems were earmarked: district heating, heat pump, CHP (Combined heat and Power generation) and boilers (condensation, natural gas, biomass boiler).
Also other two measures have been identified in order to achieve energy saving in heating: control system and regulation system. Control systems are the following: motion presence detectors, week-end and night drawdown (temperature automatically decreases during the week-end or the night hours). Partners have indicated one or/and more of these measures (Table 16).
The use of heat pumps is the first measure more indicated. Heat pump is a device that diverts heat from one location (the source) at a lower temperature to another location (the sink, or heat sink) at a higher temperature using mechanical work or a high temperature heat source. A heat pump can be used to provide heating or cooling.
40 building are equipped with heat pump. In these types of pumps also geothermal (1) and ground water pump (1) are mentioned. A geothermal heat pump, ground source heat pump

or ground heat pump is a central heating and/or cooling system that pumps heat to, or from, the ground. It uses the earth as a heat source (in the winter) or a heat sink (in the summer).
District heating is the second more used measures for efficient energy supply. 30 buildings are supplied by this type of technical measure.
District heating is a system for distributing heat generated in a centralized location. The heat is often obtained from a cogeneration plant burning fossil fuels. Also biomass, geothermal heating and central solar heating are used.
Far behind the first two heating measures we find Cogeneration plants (CHP – Combined heat and power). Cogeneration is the use of a heat engine or a power station to simultaneously generate both electricity and useful heat. 6 building are supplied by cogeneration. Two with micro-cogeneration and two with tri-cogeneration plant (also called CCHP combined cooling, heat and power).
4 different types of boiler have been indicated among the heating's measures: condensation boiler (2), natural gas boiler (4), and biomass boiler (5).
Others heating measures and supply system have been indicated in the category "Heating Systems", these are: thermostatic valves (8), floor radiators (1). Thermostatic valves have been filled in the table below as regulation systems.

Table 16 Types of building's heating measures

BUILDING'S HEATING MEASURES		
Control systems		
Type	**Nr. of building**	**%**
Night drawdown	**12**	**15,1%**
Week- end drawdown	**12**	**15,1%**
Motion presence detectors	**3**	**3,7%**
Regulation system		
Thermostatic valves	**8**	**10,1%**
Supply and or production systems		
District heating	**30**	**38,0%**
Heat pump	**40**	**50,6%**
Co-generation	**6**	**8,8%**
Boilers	**11**	**13,9%**

4.2 Cooling System

The data on the type of cooling system adopted in the buildings is available for 63 over 117 (total number) of them. Different types of cooling system have been mentioned by the Partners.

Starting from the envelope, one the most mentioned cooling measure (in 23 buildings) is represented by external shading devices mounted on the windows; these elements help to avoid unwanted solar gains, are easy to be adopted and can be planned in new project or added in refurbished buildings.

Free-cooling have been adopted as an energy saving method to cool rooms and offices in 11 buildings. Free cooling is an economical method of using low external air temperatures to assist in chilling water, which can then be used for air conditioning systems. When the ambient air temperature drops to a set temperature, a modulating valve allows all or part of the chilled water to by-pass an existing chiller and run through the Free Cooling system, which uses less power and uses the lower ambient air temperature to cool the water in the system.

Only few traditional electrical powered compressors have been adopted. In all other cases efficient methods have been mentioned. Air-water heat pumps, installed for heating, have been also used, in warmer season, for cooling, when they have a reversible cycle. 19 building are equipped with this system. In heating and air conditioning (HVAC) applications, the term *heat pump* usually refers to easily reversible vapor-compression refrigeration devices that are optimized for high efficiency in both directions of thermal energy transfer. Also ground source heat pump has been used (6). These pumps have higher efficiencies than air-source heat pump.

District cooling is another method used for cooling strategy in 2011 GB programme. Working on broadly similar principles to district heating, district cooling delivers chilled water to buildings needing cooling. Chilled water is delivered via an underground insulated pipeline. Specially designed units in each building then use this water to lower the temperature of air passing through the building's air conditioning system. District cooling can be run on electricity or natural gas, and can use either regular water or seawater. District cooling systems can replace any type of air conditioning system, but primarily compete with air-cooled reciprocating chillers systems serving large buildings which consume large amounts of electricity. 4 building have adopted this system.

Also cooling ceilings are mentioned as energy saving strategy (3). The cooling system consists in a radiant surface connected with a closed circuit containing chilled water. Considering the large surface available for heat exchange, the water temperature is only slightly lower than the room temperature; this small difference allows the use of either heat pump with very high coefficient of performance (COP), or alternative cooling sources.

Other buildings are equipped with a centralized mechanical cooling plant (9). A centralised cooling system has all the plants located in a single area, for example in a basement or roof-top plant room. One, or more, air-handling units condition the air which is then supplied by ductwork to the floors/spaces within the building. The air-handling units typically contain heating and cooling coils, a humidifier, filters, and fans to move the air. One or more chillers

will typically be located nearby to provide chilled water for the cooling coils. Hot water for the heating coils is provided by a heat-raising system (such as gas boilers or heat pumps).
Other cooling measures mentioned by the Partners are the following: chillers with high coefficient of performance (COP) (9), windows with selective glazing (5), shading of the building by surrounding objects – trees, buildings, etc. – (4).

Table 17 Types of building's cooling measures

BUILDING'S COOLING MEASURES		
Control /Regulation systems		
Type	**Nr. Of building**	**%**
Presence sensors/ Temperature control	**11**	**17,4%**
Supply and or production systems		
External shading devices	**23**	**36,5%**
Air-water heat pump	**19**	**30,1%**
Free cooling	**11**	**17,4%**
Cooling ceiling	**3**	**4,7%**
Centralized mechanical system	**9**	**14,2%**
District cooling	**4**	**6,3%**
Ground source heat pump	**6**	**9,5%**
Traditional electrical powered compressors	**2**	**3,1%**
Others	**18**	**28,5%**

4.3 Ventilation

On 69 over 117 buildings information on the ventilation system is available. Most of the measures implemented in the ventilation system concerns heat recovery (57 bld.)

Heat recovery ventilation, also known as HRV, mechanical ventilation heat recovery, or MVHR, is an energy recovery ventilation system using equipments known as a heat recovery ventilator, heat exchanger, air exchanger, or air-to-air heat exchanger which employs a

counter-flow heat exchanger between the inbound and outbound air flow. HRV provides fresh air and improves climate control, while also saving energy by reducing heating (and cooling) requirements. Energy recovery includes any technique or method of minimizing the input of energy to an overall system by the exchange of energy from one sub-system of the overall system with another. The energy can be in any form in either subsystem, but most energy recovery systems exchange thermal energy in either sensible or latent form. An energy recovery system closes the "energy cycle", preventing the input power from being released back to nature and rather be used in other forms of desired work.

HRV can be a "stand-alone" devices that operate independently, or can be built-in, or added to existing HVAC systems. For a small building in which nearly every room has an exterior wall, then the HRV device can be small and provide ventilation for a single room. A larger building would require either many small units, or a large central unit. The only requirements for the building are an air supply, either directly from an exterior wall or ducted to one, and an energy supply for air circulation, such as wind energy or electricity for a fan. When used with 'central' HVAC systems, then the system would be of the 'forced-air' type.

Another measures often mentioned which improved the ventilation performance concerns the adjustment of the operating time of the system and/or the choice of new control and regulation system.

4.4 Lighting System

Lighting also represents one of the most easily achievable energy efficiency improvements with usually very short payback times. 29 of the Buildings in 2011 have included lighting upgrading among the efficiency measures. The measures mostly include use of more efficient lighting (compact fluorescent lamps, efficient fluorescent tubes, electronic ballast, LED lights). New lighting system in Partners buildings are also often managed through motion/occupancy detectors, daylight sensors or through localizing lighting.
Electronic ballast and multi-function devices are also mentioned as improved equipment.

4.5 Envelope

The building envelope represents further significant potential for savings. For 57 buildings the U-value of the structure was available. From 2011 it is compulsory for all new buildings to specify it. The range in 2011 goes from 0,2 to 0,6 W/m^2K. It is likely to read this data as an implemented measure, because of its performance values.
Yet, the scope of improvement in the envelope system differs to large extent. It ranges from a total insulation of the building, including the whole building envelope (roof, façade, ground and windows), to only featuring some part of the envelope (such as better glazing or low U-value of the façade).
Different types of material and techniques have been used such as: mineral foam, mineral wool, polyurethane panels, curtain-type, ventilated glass façade, double shell façade and others. Windows are also a very important element in the envelope insulation. Both in new

or refurbished buildings different type of windows have been installed, however the two most common types are double or triple glazing units. The U value indicated for the windows goes from 0,8 W/m^2K to 1,9 W/m^2K.

In some case the use of ecological and environmentally friendly construction materials is also mentioned, as important part of the energy cost/benefit balance; also the orientation of the building in the planning process in order to gain the maximum benefit in term of solar gains (wanted or unwanted) is considered an important concept for the energy saving performance of the building.

4.6 Renewable energies

26 buildings declared to have adopted one or more system supplied by renewable energy. In many cases one or more renewable energy are used in the same building.
The different types of system mentioned by the Partners are the following: solar thermal plant, photovoltaic system, geothermal plant, boiler supplied with biomass, co-generation plant and wind power plant. Renewable energy is more in new than in refurbished one: 46% in new building, 30,7% in refurbished building. Two or more renewable sources are used in the 34,6% of building which declare to use renewable energy.

Table 18 Types of building's renewable energies

RENEWABLE ENERGIES- TECHNOLOGIES ADOPTED		
Type of technology	**Nr. Of building**	%
Solar thermal plant	**6**	**23,7**
Photovoltaic System	**15**	**57,6**
Geothermal plant	**12**	**46,1**
Biomass Boiler	**7**	**26,9**
Wind power plant	**2**	**7,6**

Below is given a short and synthetic description of the renewable sources used in the GB programme.

Solar thermal energy (**STE**) is a technology used to transform solar energy into thermal energy (heat). Thermal mass materials store solar energy during the day and release this energy during cooler periods. Common thermal mass materials include stone, concrete, and water. The proportion and placement of thermal mass should consider several factors such as climate, day lighting, and shading conditions. When properly incorporated, thermal mass can passively maintain comfortable temperatures while reducing energy consumption. Despite the fact that the effectiveness of solar systems largely depends on climatic conditions, and that normally are mostly used in southern countries, many of the Partners

buildings 2011 equipped with solar panels are located northern (Austria, Germany and Sweden).

Photovoltaics (**PV**) is a method used to generate electrical power by converting solar radiation in to direct current electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic systems are equipped with solar panels composed of a number of solar cells containing a photovoltaic material. Normally these plants are placed on the top of the building's roof.

A **geothermal plant** uses its geothermal activity to generate power. This type of natural energy production is extremely environmentally friendly. To harness the energy, holes are drilled into the earth until a significant geothermal hot spot is found. When the heat source has been discovered, a pipe is attached deep down inside the hole which allows hot steam from deep within the ground to rise up to the surface. Geothermal heat pumps can tap into this resource to heat and cool buildings. A geothermal heat pump system consists of a heat pump, an air delivery system (ductwork), and a heat exchanger-a system of pipes buried in the shallow ground near the building. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide a free source of hot water.

A Biomass boiler and biomass co-generation plants use wood pellets, chip, logs and energy crops as fuel.

4.7 Control systems

The Partners buildings are often using building energy management and control systems. The system (often called Building Energy Management system BEMS) control and monitor all the buildings equipment such as HVAC and especially lighting system. The control system also helps in monitoring and evaluation of the energy consumption of the buildings, which provides a basis for energy savings. 52 buildings over 117 have one or more technical equipment provided with a control system (44%).

Conclusions

The report provides an evaluation of the European GreenBuilding Programme, a voluntary programme, which aims at improving the energy efficiency and expanding the integration of renewable energies in non-residential buildings in Europe. The analysis covers the year 2011 and compares, where possible, the data of this year with the previous period time analyzed 2010.

Until December 2011, total 362 Partners have joined it with 586 Partner Buildings. The total savings achieved by the Partners are 506 GWh/year. Nearly 74 GWh/year has been saved in 2011. In 2011 80 new Partners joined the Green Building programme with 117 buildings. The average percentage of savings, for this period, amount to 42%, which is well above the GreenBuilding Programme requirements (25%).

The category "New Building" is a larger sample (with 64 buildings which joined in this category) than the refurbished one (49 buildings), but still a good balance is maintained between the two type of intervention; this condition allows a varied and interesting overview. Offices represent the biggest category for business type, in both the two categories over mentioned, following the trend of the year 2010.

Still the reported information varied for type and in-depth analysis. But is possible to say, comparing the previous period analyzed (2006-2010), that a harmonization between the reports is improved. From 2011, the compilation of a spread sheet excels, with all the most relevant information has been compulsory in order to join the programme and as a result the technical data collected is more harmonized and comparable.

The analysis offers some general conclusion:

Germany and Sweden are still the leading countries of the GB Programme 2011 (for number of Partners and of buildings who joined the Programme); Croatia and Hungary are new countries that joined the GBP; Office category is the largest category of building joining the GB Pogramme followed by the category Wholesale and Retail.

The largest average area of buildings is represented by the Logistic and Storage category (29.444 m^2).

In 2011 the majority of the building is included in an area range between 10.001 m^2 and 50.000 m^2. The best average saving per building in kwh/year/m^2 and the best energy saving in percentage has been achieved in the category Hotel & Restaurants. The best absolute savings have been achieved in the category Office building.

The technical measures implemented are case specific, the majority of the building implemented 4 measures. These measures can be implemented in heating system, cooling system, lighting system, control system, envelope composition and adoption of renewable energies. Often, a combination of energy efficiency improvements and renewable energy sources was used.

Partners – alphabetical order

Partners and Partners buildings 2011

1	Aberdeen Asset Management
2	AFA Försäkringsaktiebolag
3	Aigües del Prat S.A.
4	Akademikerhilfe Studentenunterstützungsverein
5	Akademiska Hus Norr AB
6	AMI GmbH Projektentwicklungsgesellschaft
7	Amisola Immobilien AG
8	Astra Park sp. z o.o.
9	Burohaus Schwabenhof Gbr
10	Constructora D'Aro
11	Corem Property Group AB
12	Daimler AG (HU)
13	DBW Walther GmbH & Co. KG
14	Derag Hotels
15	Dickenbrok B+B GmbH & Co KG
16	Dr.- Ing. W. Götzelmann & Partner GmbH
17	Echo Investment SA
18	Eklandia Fastighets AB
19	Explorer Hotel Entwicklungs GmbH
20	Fabege AB
21	Fastighets AB Briggen
22	Fastighets AB LE Lundberg
23	Fastighetsaktiebolaget Norrporten
24	FN-Byen P/S
25	Fressnapf Immobilien- und Vermögensverwaltungs GmbH
26	Fundació Esforç
27	Galären i Luleå AB
28	GlaxoSmithKline Laboratories
29	Globe Trade Centre S.A.
30	Gold-Kraemer-Stiftung

1	Kanholds
2	Hilton 3
3	Apoteket 9
4	Svea Artilleri 10
5	Lybeck 2
6	Seu Central d'Aigües del Prat
7	Generalsanierung Studentenheim der Akademikerhilfe
8	Humanisthuset
9	Bürogebäude Goebenstraße
10	Office Building
11	Astra Park
12	Office building Schwabenhof
13	Residence Hall ETSAV Campus
14	Lastkajen 3
15	Admin Building
16	Bürogebäude Münster N 20
17	Derag Living Hotel Campo dei Fiori
18	HF, M. 82 Office and Retail Building
19	Neubau Niederlassung Balingen
20	Park Postepu D
21	Tuve 87:1
22	Explorer Hotel - Fischen im Allgäu
23	Fräsaren 10
24	Uarda 5
25	Reuterdahl 11
26	Råbyholm 5, LUN 4-5
27	Krokslätt 149:16
28	Jönköping Grundlagen 5
29	Kv Gunnar Gröpe 9
30	UN City Campus 1
31	FRESSNAPF Hohen Neuendorf
32	Santa Maria de la Muntanya Hostel
33	Hägern 11
34	Staget 13
35	Headquarter Marly Le Roi
36	Francuska Office Centre Building B
37	Francuska Office Centre Building A
38	University Business Park Building A
39	University Business Park Building B
40	Kindertagesstätte Hürth-Hermühlheim

31 H.H. Holding GmbH
32 Handelhof GmbH/ Stadtbau AG
33 Hantverks-och Industrihus i Göteborg AB
34 Harder Kappa GmbH
35 Hemfosa Fastigheter AB (ex Kefren Properties IX AB)
36 Humlegården Fastigheter AB
37 Immofinanz Montaigne Liegenschaftsvermietungs GmbH
38 Ingenieurbüro Möller + Meyer Gotha
39 Innsbrucker Immobilien GmbH & Co.KG
40 INTERBODEN Objekt Siegburg GmbH & Co. KG
41 Italcommerz Projektentwicklungs GmbH
42 KABEG Landeskrankenanstalten-Betriebsgesellschaft
43 KiK Textilien and Non-Food GmbH
44 Klövern AB
45 KOy Plaza Rondo
46 KPC Herning A/S
47 Kreissparkasse Ahrweiler
48 Kungsleden AB
49 Landschaftsverband Westfalen-Lippe
50 Landstinget i Västmanland
51 Leibniz-Institut für ökologische Raumentwicklung e.V. (IÖR)
52 Leo Frank
53 LFK Mästaren AB
54 LMO
55 Ludvika Kommun
56 Lundafastigheter

41 Kindertagesstätte Hürth-Efferen
42 H.H. Holding Bönen
43 Handelshof Leipzig
44 Idrottshögskolan
45 Hegele Logistics Center
46 Gamlestaden 2:8
47 Ugnen 4
48 Bureau am Belvedere
49 ESS Eis- und Schwimmstadion Köln-Lentstrasse
50 Gymnasium in der Au
51 City Gate Siegburg
52 Forum Schönbrunn, BT2 - Büro
53 CMZ (Chirurgisch-Medizinisches Zentrum), Klinikum-Klagenfurt
54 KiK Riedstadt
55 KiK Harsefeld
56 KiK Peißenberg
57 KiK Meßkirch
58 KiK Neunburg
59 KiK Jestetten
60 KiK Hohen Neuendorf
61 KiK Zerbst
62 KiK Mutlangen
63 Allmogekulturen 5
64 Office Building Rondo
65 Beierholm
66 Hauptsitz der Kreissparkasse
67 Tackan 9
68 Neubau einer allgemeinpsychiatrischen Tagesklinik
69 Västerås Lasarett Nya Vårdbyggnad Hus 83
70 Leibniz-Institut für ökologische Raumentwicklung e.V.
71 Leo's Becher Gewerbehalle
72 Kv Mästaren
73 LMO SØFTEN
74 Nyhammar Brandstation/ Bibliotek
75 Indianberget förskolan
76 Blötbergets skola
77 Malmen (fordon)
78 Junibacken
79 Bollhuset
80 Mejeriet
81 Slangbågen
82 Ladugårdsmarken

57 M.I. Consell General D'Andorra
58 Megaron Vukovar d.o.o.
59 Metropol Development GmbH
60 NCC Property Development (SE)
61 Netto-Supermarkt GmbH
62 NÖ Landesimmobiliengesellschaft mbH (LIG)
63 OBI GmbH & Co. Deutschland KG
64 Objekt Linser Areal Immobilienerrichtungs GmbH & Co.KG
65 Peter Austen wire & cable GmbH
66 Platzer Fastigheter AB
67 Riverside Besitz und Betrieb GmbH
68 Skanska Commercial Development Nordic
69 Sociedad General De Aguas De Barcelona
70 Stadtsiedlung Heilbronn
71 Stockholms Hamn AB
72 SveaReal
73 TEDI GmbH & Co. KG
74 Telge Fastigheter AB
75 Umeå kommun
76 Vasakronan AB
77 Visoren
78 Volksbank Kircheim Nürtingen eG
79 Wihlborgs Fastigheter AB
80 Woolworth GmbH
83 Stadshuset
84 Edifici del M.I. Consell General
85 Vila Vanda
86 Buero- und Geschaeftshaus Antonsgasse, Koeln
87 Company House III-Skejby
88 Maskrosen
89 Netto Markt
90 Niederösterreichhaus Krems
91 OBI Göppingen
92 Shopping Center West, Innsbruck
93 Neubau Lagerhalle mit Buero, Rudolf-Braas-Straße - 2
94 Högsbo 3:9
95 Högsbo 17:7
96 Högsbo 32:3
97 Gårda 1:15
98 Shopping Center Riverside
99 Långhuset
100 Kv Tabellen 4
101 Torre Agbar
102 WTZ 1 Neubau Büro-/ Verwaltungsgebäude
103 Stora Tullhuset
104 Svinbådan 4
105 Particentralen 1
106 TEDI Hohen Neuendorf
107 TEDi Riedstadt
108 TEDi Meßkirch
109 TEDi Jestetten
110 Fornbackaskolan
111 Ålidhems kultur- och resurscentrum
112 Hekla Hus 04-05
113 Nordstaden 8:27
114 Residence Hall Manresa Campus
115 Hauptgeschäftsstelle Volksbank Kircheim Nürtingen e.G.
116 Polisen 3
117 Geschaeftshaus Kaiserstrasse 146-148

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Abstract: GreenBuilding is one of the most important campaigns for the promotion of energy efficiency in non-residential buildings in Europe. The GreenBuilding Programme is a European Commission voluntary programme through which non-residential building owners and occupiers, being private or public organization, are aided in improving the energy efficiency and to introduce renewable energy sources into their building stock
The present report summarizes the result of the GreenBuilding Programme achieved in 2011, in terms of main energy efficiencymeasures in the building and related energy savings.

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