

European Green City

Cenergia & Green City Denmark, Denmark

Summary

European Green Cities is a targeted EU-Thermie project within the building sector, which in project period 1996-2001 received funding of a total of 2.9 million EUR. Cenergia Energy Consultants coordinates the project in cooperation with Green City Denmark. The project focus on large-scale urban renewal plan and new building in 11 European cities and it involves close to 30.000 residences. An important part of the project was to realise local solar energy/low-energy demonstration project with a total of 1000 solar energy/low-energy dwellings in Denmark, France, Spain, Italy, England, Belgium and Austria and also public buildings in Finland and Greece.

The EGC project demonstrates high savings of energy for heating, water and electricity compared with normal practise. New build and renovation projects with different level of energy savings technologies are included in the Target project with different performance and savings.

End-user area	Target Audience	Technical
<input checked="" type="checkbox"/> New buildings	<input checked="" type="checkbox"/> Citizens	<input checked="" type="checkbox"/> Energy efficiency
<input checked="" type="checkbox"/> Refurbishment of buildings	<input checked="" type="checkbox"/> Households	<input checked="" type="checkbox"/> Heating
<input type="checkbox"/> Transport and mobility	<input checked="" type="checkbox"/> Property owners	<input checked="" type="checkbox"/> Cooling
<input type="checkbox"/> Financial instruments	<input checked="" type="checkbox"/> Schools and universities	<input checked="" type="checkbox"/> Appliances
<input type="checkbox"/> Industry	<input checked="" type="checkbox"/> Decision makers	<input checked="" type="checkbox"/> Lighting
<input type="checkbox"/> Legal initiatives (municipal regulations, directives, etc)	<input checked="" type="checkbox"/> Local and regional authorities	<input checked="" type="checkbox"/> CHP
<input type="checkbox"/> Planning issues	<input type="checkbox"/> Transport companies	<input checked="" type="checkbox"/> District Heating
<input checked="" type="checkbox"/> Sustainable communities	<input type="checkbox"/> Utilities	<input checked="" type="checkbox"/> Solar energy
<input type="checkbox"/> User behaviour	<input type="checkbox"/> ESCOs	<input type="checkbox"/> Biomass
<input type="checkbox"/> Education	<input checked="" type="checkbox"/> Architects and engineers	<input type="checkbox"/> Wind
<input type="checkbox"/> Other	<input type="checkbox"/> Financial institutions	<input type="checkbox"/> Geothermal
	<input type="checkbox"/> Other	<input type="checkbox"/> Hydro power
		<input type="checkbox"/> Other



Solar heating system, Vilanova



Solar heating system, Grenoble



Tower block, Portsmouth



Low energy design, Hulshout



Solar energy design, Copenhagen



Renovation project, Copenhagen

Context

Technical solutions in energy efficient buildings have been demonstrated to obtain high degree of savings in energy and water and also to reduce the emission. In the demonstration projects there has been focus on the indoor air qualities. Analysis of the total economy of the new energy technologies has been carried out to get the solution more attractive for the tenants where extra investments are compensated by lower running costs during the operation lifetime. A training process of the authorities, builders and consultants has been established to obtain high performance of the technical solutions and low costs of the installations.

Objectives

The objective of the European Green Cities is to introduce an integrated sustainable global solar low-energy design using best available technologies. The project will be carried out in new-built and retrofit buildings based on energy and environmental assessment together with a total energy and total economy approach, e.g. using new energy saving measures as the background for creating a realistic market for sustainable and energy efficient building. To ensure that the most cost-effective solutions are selected, early price calculations will be performed in cooperation with contractors for all projects.

Early stage education process is established together with leading institutions in Europe. The target groups being city authorities, builders and consultants. Based on this, working groups are established to define improved energy and environmental standards for sustainable and energy efficient building including energy supply systems. Buildings, which meet a certain standard, can, based on this, obtain a "green cities" certificate.

Process

Most of the technical solutions that have been used in the European Green City projects are well-documented and developed on the basis of research and development. When many new technologies are used together there are, however, increased technical risks compared to traditional building projects. The new aspect in this projects is to integrate the many tested technologies in nine different countries to obtain savings of between 40 and 60% of the energy consumption for heating and domestic hot water and between 30 and 35% of the electricity and water consumption. An overview of the energy savings technologies is given in the table below.

	Abruzzo	Brescia	Copenhagen	Grenoble	Herning	Hulshout	Kuopio	Portsmouth	Radstadt	Vilanova	Volos
Energy Savings Technology											
Low energy windows	x	x	x	x	x	x	x	x	x		x
Extra wall insulation	x	x	x	x	x	x	x	x	x	x	x
Solar heating for DHW	x	x	x	x	x	x		x	x	x	x
Solar heating for SH			x				x				
Passive solar		x	x	x	x	x	x		x	x	x
Improved daylight			x				x			x	x
Centralised heating system	x	x	x	x	x		x	x	x		
Condensing gasboilers	x					x					
Combined heat and power			x		x		x	x			
Individual heating control	x	x	x	x	x	x	x	x	x		
Natural ventilation										x	x
Mechanical ventilation		x	x		x	x	x	x	x		
Mechanical ventilation with preheating of air			x				x				
Mechanical ventilation with heat recovery			x		x	x	x	x	x		
PV modules	x		x	x			x	x			
Individual heat meters	x	x	x	x	x	x		x			
Individual water meters		x	x		x						
Water savings			x		x		x	x	x		
Electricity savings	x	x	x	x	x	x	x	x	x	x	x
BEMS	x	x	x	x	x	x	x	x	x		

Main project phases were design, detailed project, tendering, construction, monitoring and finally local training. Parallel to this a Management Team carried out horizontal activities developing tools like OptiBuild (for calculating economic viability of specific chosen low energy building components) and BEAM (assessment of energy and environmental impacts).

The Green City concept of Sustainable Urban Management was used to focus on city politicians and building department key persons being of highly importance as well as builders, architects, engineers and tenants – for promoting rising awareness related to these 11 demo projects.

Problems encountered were primarily the big differences in the 9 countries regarding building technology traditions and energy efficiency awareness between partners and the mentioned focus groups of key persons and end-users.

Important ways to overcome / reduce these differences were common partner meetings in the involved countries throughout project period, where visiting the demo project was combined with local conferences and visit to other local projects. And besides this local training processes were most helpful to promote awareness rising.

Financial resources and partners

Project funding was 2,9 million EUR covering an average of 35% eligible costs of new technologies in the 11 demo projects, and builders of housing associations/cities providing remaining 65% of eligible costs and the rest total building construction costs.

The extra costs of the target projects for new energy saving technologies compared to traditional technology solutions are shown in figure 1. The average extra investment is 9400 Euro per dwelling. Each project has obtained approximately 35% support from the EU Thermie programme and the remaining parts are covered by the builders being housing associations/cities.

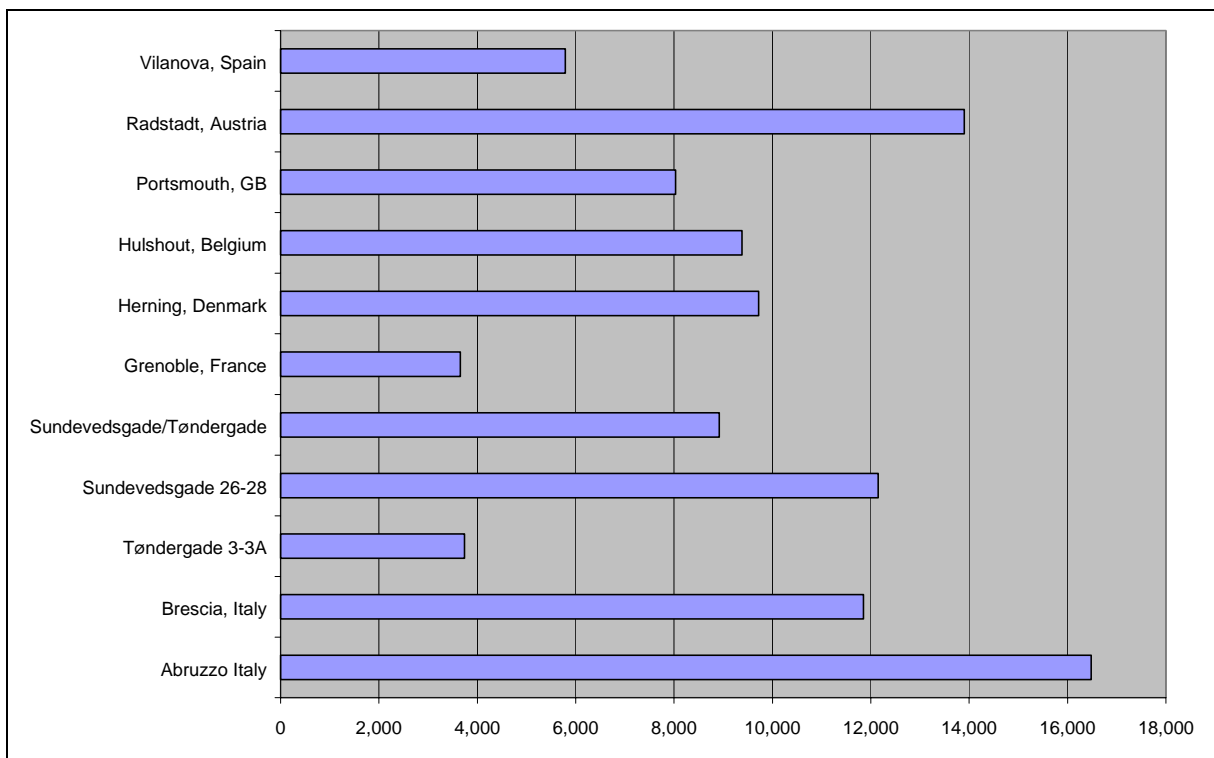


Figure 1: Extra costs (EUR) per dwelling for the new energy saving technologies compared to traditional technology shown for all EGC projects.

Project partners are mainly city representatives from the 11 demo project cities in 9 countries together with housing associations and involved technicians. Project was coordinated by Danish companies Green City Denmark (administrative) and Cenergia Energy Consultants (technical) in a Management Team with Spanish partner Institut Cerda, Barcelona, and Italian partner Metec Engineering, Torino.

Promotion of energy savings etc. has primarily been carried out by builders, technicians and city department key persons involved during project implementation including local training.

Results

The aim of the EGC projects is to make energy efficient buildings. The key figures are the energy consumption for space heating, domestic hot water and electrical appliance. The consumptions during the first operation years are monitored and the results are shown in figure 2 together with what is normal practise in each country (Reference). The savings are very different between projects with a maximum of 70% in the Houtvenne-project (Belgium). Also a high degree of savings in electricity and water is demonstrated in the projects. Some of the projects only demonstrate a small reduction in the total energy consumption mainly because of old housing block with pure facilities for the tenants are transformed to modern dwellings with high level of comfort and indoor air quality.

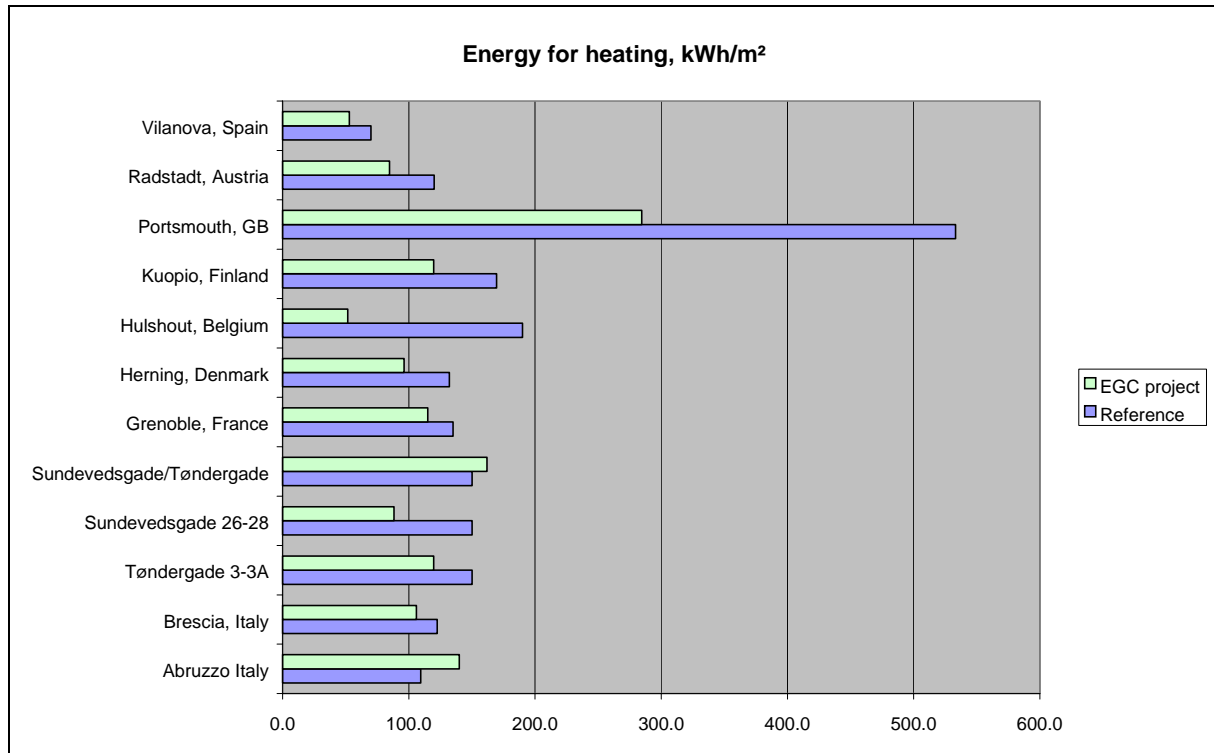


Figure 2. Monitored energy savings of the EGC projects together with normal standard (reference).

The economic viability of the EGC projects is calculated by the Simple Payback Time method. For each project the total costs of the installation, excluding the costs associated with the demonstration, i.e. design, monitoring, and a part of the management and engineering costs are calculated. The yearly savings include annual amount of energy produced or saved and savings in water.

The simple pay back time of the extra investment costs varies between projects. Two of the projects have a total pay back time of 10 years for all used new technologies on the actual project and other projects have a higher total payback time. Each project has used a number of different energy savings technologies with different shorter or longer pay back time than mentioned average/total calculation. During the project period a cost benefit analysis has been carried out with actual input from the demonstration projects, like investment costs and savings. The analysis shows that the most economic attractive investments are different from one project to another depending in local energy costs and the climatic conditions. The analysis include a list for each location with the most economic investment in low energy technologies of today and it is expected it will be extended in the future when the energy costs increase and the investment costs decrease.

The objective of introducing an integrated sustainable low-energy design approach for the use of best available technologies in new-built and retrofit building demonstration projects was met very successfully. Among best documentation is the highly interest within local areas and regions around the 11 demo projects. Most visible seen around the Belgium project in Houtvenne, where Antwerp region as a follow-

up initiative has financed a training centre for promoting low-energy technologies and awareness rising. And around the Austrian project in Radstadt, where Salzburg region has adopted the demonstrated new technologies as kind of minimum recommended standards for future low-energy building strategies. Also to mention the Pierti School demo project in Kuopio, Finland, which has formed general standard for other school renovation or new-built projects, and introduced environmental education as a permanent component on school education programmes.

Lessons learned and repeatability

The costs of the low energy technologies vary between the projects. The cost of the solar system in Portsmouth is more than six times as high as in Abruzzo. There are a number of explanations for these variations. Big central solar systems have lower costs compared with individual systems. A complex design, number of suppliers in the region and the installer's training in installing solar systems has influence on the costs. A more uniform and lower costs can be expected when solar system getting more widespread.

In connection to the European Green Cities project, new tools, which can support global sustainable solar low-energy building policies in practice, have been developed. Examples of this are the Optibuild tool, which can be used to make lifecycle costs optimisation and which can be downloaded e.g. from Cenergia's homepage www.cenergia.dk and the Green Build tool, which works as an energy and environmental checklist and point system that can be used interactively from the www.greenglobal.com website.

Based on the work in the EGC project the Danish energy and environmental specialist company Cenergia has together with the municipality of Copenhagen and other municipalities in the Copenhagen region been involved in practical oriented projects concerning implementation of solar energy and urban ecology planning.

An important basis of this has been the involvement in the European Green Cities cooperation, starting with the European Green Cities EU-Thermie target project from 1996 and followed up in connection to the Green Solar Regions, EU-Energy project from 2000 and new cooperation within the European Green Cities Thematic Network.

In connection to the European Green Cities cooperation the aim has been to work with principles and tools that can be used to promote the use of a global energy and environmental concepts in connection to urban planning in the cities, also aiming at obtaining an improved indoor air climate. As an important inspiration the European Green Cities partners have for several years been inspired from an innovative funding system from Austria which is used to promote good solutions by help of "energy points" as a tool for funding approval.

During the realisation of the European Green Cities project a training process has taken place, going on towards the involved cities and builders and this has lead to and agreement that it is important to focus more on using tools like the developed Green Build tool to promote good energy and environmental solutions in the cities and discussions have taken place of actually use energy and environmental points for this, e.g. by introducing different European Green Cities quality levels by help of the energy and environmental points.

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Printed reports or other literature available:

Title: Inspiration Guide (language versions English, German, French, Italian and Spanish) – can be downloaded from Green City Denmark web site.

Title: Final report – can be downloaded from www.europeangreencities.com (see below)

European Green Cities projects are all shown on web site:

www.europeangreencities.com

with reference to technology manufacturers, builders, city contact persons etc.

This web site is a result of above mentioned European Green Cities Thematic Network financed by EC 5th Framework Programme.