Innovative sustainable construction

Together for the low-energy city with a high quality of life

CONCERTO

sesac

THE SESAC PROJECT

Sustainable Energy Cities picking up tempo

Introducing SESAC

Växjö, Delft & Grenoble are showing how the local economy can thrive when combining local climate protection actions and implementing sustainable energy solutions in the built environment. This leads to a win-win situation!

The Sustainable Energy Systems in Advanced Cities (SESAC) project – running from 2006 to 2011 – illustrates many different innovative energy measures in both new buildings and in renovating existing stock, with energy in districts another key area addressed.
Delft (The Netherlands), Grenoble (France) and Växjö (Sweden) carried out multiple demonstration projects together with local partners. These demonstrate how advanced cities and community stakeholders approach current energy challenges, coming up with effective results - in energy savings, the efficient use of energy through improved technologies, and the use of renewable energy for electricity, heating and cooling.
Three associated cities – **Kaunas (Lithuania), Miskolc (Hungary) and Vastseliina (Estonia)** – gained valuable knowledge from the three demonstration cities, as well as useful experience through the performance of their own local energy studies, considering how best to implement sustainable energy in their communities.

SESAC achieved the following:

- enhanced role of sustainable local energy management,
- energy – and cost efficient eco-buildings built / renovated and demonstrated,
- increased local share and integration of renewable energy sources (RES),
- widespread dissemination and training, using local case studies and guidelines, and
- exchanged experiences and expertise, know-how transferred through workshops and study tours.

European Framework

In June 2010, European Union (EU) leaders adopted the "Europe 2020 strategy for smart, sustainable and inclusive growth" for the coming decade. These three mutually reinforcing priorities aim to transform the Union into a highly energy-efficient, low carbon economy.

To this end, the so-called '20-20-20' EU targets were set to be met by the year 2020, through:

- a reduction in greenhouse gas emissions of at least 20% below 1990 levels;
- 20% of final energy consumption to come from renewable sources;
- a reduction in primary energy use of 20% from projected levels to be achieved by improving energy efficiency.

By March 2011, more than 2,300 local authorities have joined the Covenant of Mayors (www.eumayors.eu) – committing to go beyond these targets! Such a voluntary commitment of local decision-makers to support a European policy is probably a first in the history of the EU.

Växjö, Grenoble, Delft and Kaunas have signed the Covenant of Mayors, and thus go beyond the objectives of the EU in terms of reducing their CO_2 emissions through energy demand and renewable energy actions.

European Energy Policy:
http://ec.europa.eu/energy/ energy_policy/ index_en.htm

European Covenant of Mayors:
www.eumayors.eu

Views from the Associated Cities

- "This project has allowed us to increase the capacity of local policies to promote the wider use of local renewable energy resources. In doing so, sustainability in our municipality has been improved as well. We also acquired a better and wider understanding of energy savings in our buildings." ***Raul Tohv, Mayor of Vastseliina***

- "It was a great chance to participate in the SESAC project. We have learnt a lot from the experience of the three advanced cities. Thanks to the last six years I think that the City of Miskolc is now ready to move on from an observer to a demonstration city." ***Ákos Kriza MD, Mayor of Miskolc***

- "... (O)ur participation in the SESAC project has been successful and useful. In the frame of the project we prepared a case study 'Modern gas-boiler houses in Panemune, Kaunas' and organised a SESAC conference in November 2008. Results and experience gained in the project will be useful for our participation in other energy projects." ***Andrius Kupcinskas, Mayor of Kaunas***

What have we achieved in SESAC?

The overall objective was to show how sustainable energy systems can be achieved by combining good governance, innovative cooperation and concrete measures in **Delft, Grenoble and Växjö**, and to transfer knowledge and experiences to other local authorities. A diverse range of demonstration projects were implemented in these three cities, including:

- a district heating system with low temperature waste heat,
- district absorption cooling using RES in summer and district heating in winter,
- the design, construction and operation of (energy optimised) eco-buildings (35-40% lower energy use than national standards),
- building integrated photovoltaics generating electricity,
- demand-side management, such as individual metering (and consumer initiated load control),
- cooperating with energy users, and changing energy behaviour.

We developed tools for effective policy-making, implementation, monitoring and management of the sustainable energy processes.

Researchers and technical specialists analysed results and ensured the quality of measures.

Three associated cities – **Kaunas, Miskolc and Vastseliina** – learned and gathered experiences. They studied the work methods and results. They made local energy flow analyses in order to develop their own CONCERTO proposals at a later stage.

The two city networks – **Energy Cities and ICLEI Europe** – disseminated results, and are encouraging other cities and towns to engage in sustainable energy practices – offering guidance and support to develop their own local climate and energy actions, and encouraging them to join the Covenant of Mayors.

The technical partners – **Energy Agency for South East Sweden and KTH Royal Institute of Technology** – have assisted the partners throughout the project in the development of their demonstration activities and their monitoring.

The CONCERTO Initiative

SESAC is part of the European CONCERTO Initiative which supports accelerated innovation in renewable energy (RE) solutions, advanced energy efficiency (EE) and systems for poly-generation linked together with concepts for eco-buildings. CONCERTO also helps to bring together advanced cities with learning cities – to develop capacity that can support sustainable energy roll-out across Europe.

www.concertoplus.eu

DELFT

THE NETHERLANDS

"SESAC worked as a lever in reaching our climate goals. Working together with international partners created extra ideas and inspiration."

Saskia Bolten,
Vice Mayor of Delft

In the foreseeable future, Delft wants to become a CO_2 neutral city. In relation to that ambition, the City council adopted the Update Climate plan 2008-2012 with the objective to emit 15% less CO_2 by 2012, raise the share of renewable energy to 5% of the total Delft energy consumption in comparison to 1990 and use 15% less energy.

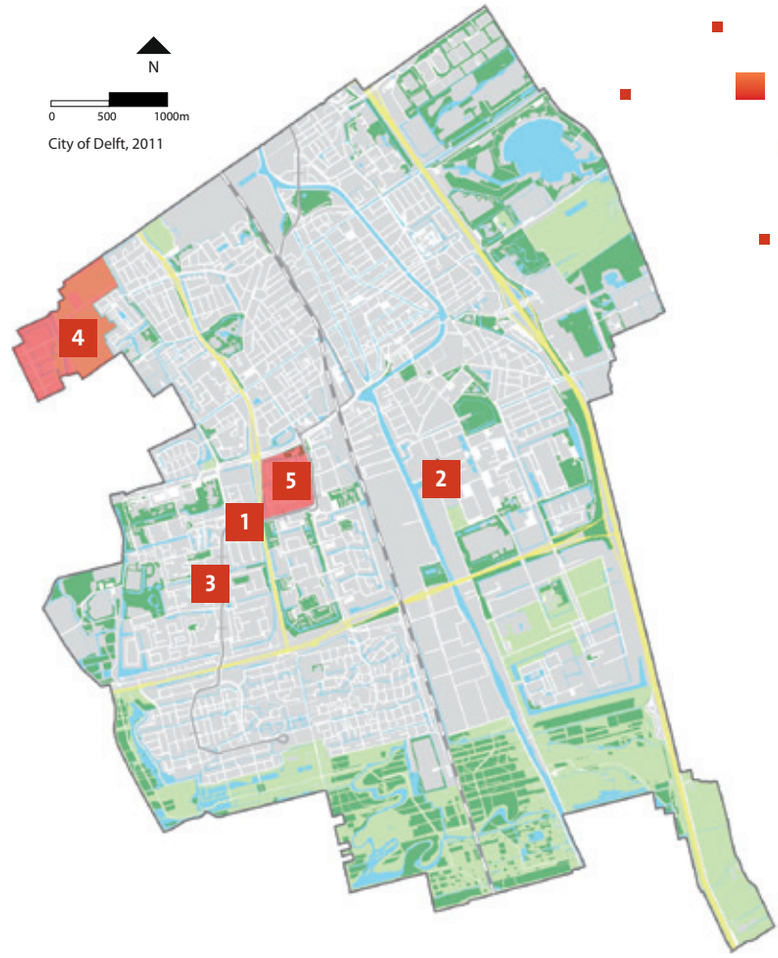
Renewable energy supply

A large part of the CO_2 reduction target is attributed to the district heating company. Current estimations based on the district heating plans show a CO_2 reduction of about 20,000 tonnes per year. The district heating company supplies heat from a Combined Heat and Power plant (CHP) to the southern part of Delft. The Harnaschpolder area, in the northern part of the city will be supplied with heat from the waste water purification plant, using a heat pump.

Rational use of energy (RUE)

Designers have used specific insulation values in the SESAC buildings and have chosen further measures to reach their targets. These targets in CONCERTO demonstration sites go beyond current Dutch regulations. The renovation of social housing dwellings has reached an energy performance equal to the present national standard for new dwellings. A feedback and monitoring system for the occupants will further stimulate energy savings and cost cutting, thereby supporting both GHG emissions reduction and local 'wallets'.

PILOT PROJECTS



1. On your marks, get set, go ... to Delft's energy-efficient Sport Facilities and Student premises!
2. Hot news: a Local District Heating Company establishe
3. Less energy, more comfort in the Health Centre
4. High energy-performance buildings for new housing
5. Low Energy Housing breathes new life into Poptahof

On your marks, get set, go ...

... to Delft's energy-efficient Sport Facilities and Student premises!

Combined energy efficient 2,923 m² sports hall and 88 student premises in 7 floors (3,865 m²), connected to the district heating system.

Low Energy Housing breathes new life into Poptahof

- refurbishment to new standards (84 apartments).
- 9 studios added to renovation building.
- new dwellings (58) infra-red quality control during rebuilding process.
- 10 kWp PV-system on the southern façade of the refurbished apartment building.

Hot news: a Local District Heating Company established

- In the end the equivalent of 20,000 dwellings heat production capacity, equaling at least 18,000 tonnes of CO_2 emissions reduced yearly.
- Very innovative Public Private Partnership, combining one energy utility, two municipalities, three housing associations as partners in a company aiming to reduce CO_2 emissions.

GRENOBLE

FRANCE

"In 2050, 70% of the world's population will live in urban areas. This is the place where we need to reconsider sustainable development in terms of environmental, economic and social issues.
In Grenoble, we plan to continue to innovate, in terms of research as well as quality of life, by experimenting with new self-sufficient models in the heart of the town.
Such a project is neither a 'showcase' nor an urban marketing process but it leads to a new way of living together in the heart of our cities."

Michel Destot,
Mayor of Grenoble

The main objective of the updated Local Climate Plan remains to divide local GHG emissions by a quarter by 2050 and to fulfil the Covenant of Mayors requirements by 2020. The short term target is to reduce CO_2 emissions by 14% until 2014 (compared to 2005), to reduce energy consumption per inhabitant by 2014 and to increase the share of renewable energy to attain a level of 14% of all energy consumed. Between 2004 and 2007, the emissions were reduced by 7%.

Renewable energy supply

The RE supply will be improved through building four photovoltaic (PV) plants for a total of ~315 kWp, using solar thermal energy for domestic hot water on all new buildings, covering around 45% of the domestic hot water requirements and to increase biomass sources for the district heating system. In addition to this, the installation of 9 natural gas mini-CHP units for new buildings in de Bonne will cover half of the heating needs as well as 100% of the electricity needs.

Rational use of energy (RUE)

Energy efficiency will be improved through the French HQE (High Environmental Quality) approach. The design of buildings includes compact dimensions, specific insulation values, double flow ventilation, water and light efficient equipment. All new buildings, whether private or social housing, will be erected with an energy consumption of 40% below applicable dwelling indices. The total consumption of the main buildings will be 75 kWh Primary Energy/m² gross area per year.

Specific innovations & Urban stakeholders training

Innovative methods are developed in Grenoble to address both technical issues (low energy design, high level of RES in buildings, integrated monitoring system etc) and socio-economic issues (tendering procedure, relationship with public and private developers, specific training activities). Dissemination and training activities have been organised for all the stakeholders involved in the construction chain - from property developers to end-users, and building businesses.

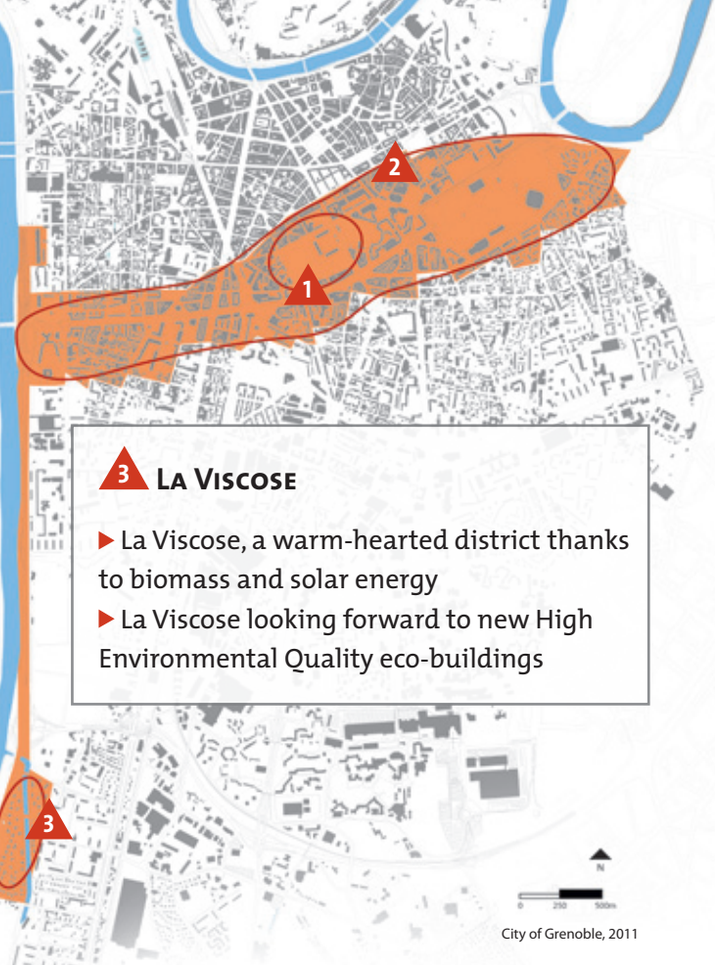
PILOT PROJECTS

1 De Bonne

- Concert'action: Interactive Training Programme
- Heat and power to the people: de Bonne features 9 mini CHP plants
- 12 new eco-buildings in de Bonne: one step closer to Grenoble's 2020 goals
- Energy Efficiency a hands-on experience in de Bonne's new school
- Great place to work: A positive energy office building in de Bonne

2 Grands boulevards

- Thermal and Energetic Improvement in Buildings: an Incentive and Awareness Raising Programme for all actors



City of Grenoble, 2011

Eco-buildings in de Bonne

- 435 apartments funded by CONCERTO in 9 new multi-storey buildings supplied by mini CHP for heat and electricity and by solar thermal panels for 40% of Domestic Hot Water needs.
- 1 new school (15 classrooms) with timber frame and grass roof.
- 1 positive energy office building heated and refreshed by groundwater, with photovoltaic electricity production.

Photovoltaic Plants

- A total of 305 kWp connected to the grid.
- Photovoltaic panels installed on four new buildings (2 office buildings; one shopping area and a stadium).
- Experiment different type of implementation: on metal frame on building façade, standard panels on flat roof, embodied in glass roof or canopy, as a sun protection on a terrace.

La Viscose, a warm-hearted district thanks to biomass and solar energy

- Expand the district heating grid in a new area.
- Substitute a coal by a biomass plant (62 MW).
- Supply 280 existing dwellings and the 60 new apartments built.

VÄXJÖ
SWEDEN

"I have followed the SESAC project during its six years, and I am very proud to see how the project has contributed to local development. The activities that have been demonstrated in Växjö have given experiences that help us developing Växjö even further, and they have also become important and popular showcases for visitors from all over the world. I believe that it is very stimulating and rewarding for all partners to work together in an international dimension."

Bo Frank,
Mayor of Växjö

Växjö seeks to become a fossil fuel free city by the year 2030. The short-term target is to reduce CO_2 emissions per capita by 55% between 1993 and 2015. Until 2009, the result was a reduction of 34%. Another objective is to reduce the energy use per capita by 15% between 2008 and 2015. The SESAC project has been a valuable part of the work to reach these targets.

Renewable energy supply

Absorption cooling, based on biomass, has been introduced in Växjö. As a first step, cooling is distributed to the hospital and the university. The system replaces electric cooling and is at the same time a basis to increase a local electricity production using Renewable Energy Sources. In the sewage treatment plant, food waste and sludge are sources for biogas that is used for polygeneration of heat, electricity and vehicle fuel. PV panels installed on the roofs of two schools produce about 75 MWh of electricity annually, while 20 MWh is produced by a small-scale urban windmill.

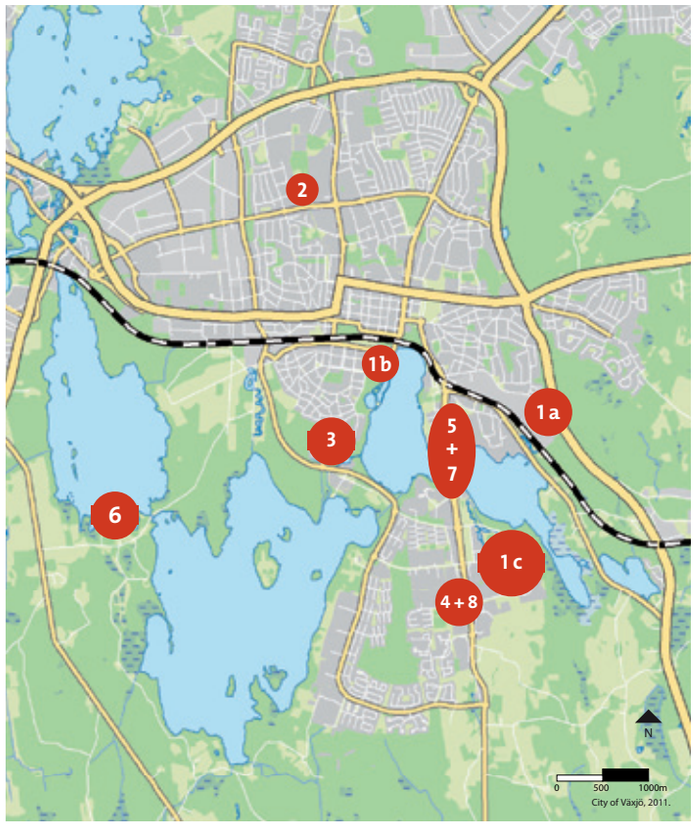
Rational use of energy (RUE)

About 400 energy efficient apartments and one pre-school have been erected. Many of the buildings have a wooden construction, including the eight storey passive houses. The target was to reach 30% less energy use than applicable regulations. In some of the buildings the actual result was much better. The project also included the refurbishment of a school and energy efficiency measures at the sewage treatment plant.

Specific innovations – Changing behaviour

It is important to change the attitudes and behaviour of end-users in order to reach targets for energy efficiency. In Växjö, displays in the apartments as well as web-based tools have helpt tenants to reduce their energy use.

PILOT PROJECTS



1. Absorption cooling
   - a. Sandvik plant
   - b. Hospital
   - c. University
2. The Energy Efficient Araby School: lessons learnt on CO_2 savings
3. Eco-buildings in the garden district Biskopshagen
4. Växjö's first small-scale urban windmill keeps company to eco-buildingsin Blåsbälgen
5. Sweden's largest newly constructed wooden houses built in Limnologen
6. Polygeneration from biological waste
7. Think different, build different: Eco-buildings in Portvakten
8. A gift from the sun: PV Plant in Teleborg School

Absorption Cooling in the Hospital and University

- Use of district heating to produce 6,000 MWh cooling.
- 2 x 2 MW absorption cooling machines installed.
- Replacement of electric cooling by absorption cooling in the university and the hospital.

Eco-buildings

- 28 new buildings (401 apartments).
- 1 new pre-school built and 1 school refurbished.
- 84 kW PV and 5 kW wind installed.

Polygeneration from biological waste

- Biogas, produced at the sewage treatment plant, is used for electricity, heating and vehicle fuel.
- The plant produces about 55% of its own electricity needs.
- This initiative is a basis for a wider biogas investment in Växjö.

CASE STUDIES

DELFT

GRENOBLE

VÄXJÖ

DELFT

D1 ON YOUR MARKS, GET SET, GO ...

...TO DELFT'S ENERGY-EFFICIENT SPORT FACILITIES AND STUDENT PREMISES!

SYNOPSIS

In the Buitenhof area in Delft, a new energy efficient sports hall is built as well as 88 student premises. The building is connected to the district heating and possesses individual meters. The new sports hall is about 78% more energy efficient than the old one.

BACKGROUND

The Buitenhof area was originally built in the 1960s-1970s and was highly energy consuming. A contest was organised and teams of project developers were to take into account the Delft Climate Plan within their proposals for a complete redevelopment of this area. The assets of the total development finance the new sports facilities.

OBJECTIVES

Create an energy efficient building that fulfils the ambitions of the Delft Climate Plan and is connected to district heating.

PROJECT DESCRIPTION

- Student premises demonstrate energy efficiency by means of a high performance, demand regulated individual ventilation system. They have individual metering in a collective heated building.

- Sport facilities have a heat recovery system, high efficiency lighting (presence detection), automated power control on ventilation equipment, double joint sealing and floor heating.

- The facilities are designed in such a way that no cooling is necessary.

- The building is connected to new local district heating network.

RESULTS

The new sports hall consumes about 78% less energy than the old sports facilities. The energy use is 11% less than national regulations in the sports facilities and 23% less for the student premises. The energy performance is 13% better than 2009 Dutch building regulations.

NEXT STEPS

In the next phases of the redevelopment of the Buitenhof area, the targets of the Delft Climate Plan will be taken into account. The whole area will be connected to the district heating system.

RECOMMENDATIONS

A contest for (re)development is a good instrument and phase to introduce energy and climate goals in big projects.

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DELFT

D2 HOT NEWS: A LOCAL DISTRICT HEATING COMPANY ESTABLISHED

SYNOPSIS

A new public private partnership (PPP) district heating company was established in Delft, producing, distributing and supplying an equivalent of nearly 20,000 homes with heat and hot water.

BACKGROUND

The new district heating system is one of the major projects within the Delft Climate Plan. The first idea was a municipal heat company that produced heat from a local industry and sewage plant, transported this heat into town and sold it to a distribution company. Later on, both the production and distribution systems were integrated, as well as technical and business management.

OBJECTIVES

Contribute to the realisation of the local climate goals by establishing a new local district heating network and organisation.

PROJECT DESCRIPTION

The energy utility, Eneco New Energy, is the mother company owning 97% of the shares.
The 3 * 1% priority shares are evenly owned by the municipalities, housing corporations and Eneco again. The priority shares only control the environmental performance, tariffs and service level (including serviced areas) and if applicable the return on investments:

- Delft and Midden-Delfland municipality own 1% priority share that concerns implementation in building projects, local building codes, supporting planning and building activities.
- Housing associations Woonbron, Vidomes, Duwo own together 1% priority share. They represent a large amount of consumers and connections to district heating.
- Eneco New Energy has also 1% of priority share.

Heat is produced in different locations:

- Low temperature residual heat from a sewage treatment plant is upgraded by means of a heat pump and small CHP (combined heat and power) in 2 separated circuits. The heat is used in a new development (equivalent to about 1,600 homes) at 40/70°C.
- A large 24 MW CHP plant supplies heat to new and existing houses, utility buildings and small existing district heating systems in Delft, summing up to 20,000 home equivalents.
- Back-up and peak demand is supplied by gas boilers. The electricity produced is fed into the national grid.

RESULTS

The district heating company ensures a CO_2 reduction of at least 18,500 tonnes.

NEXT STEPS

Eneco Delft will build the production units, the main part of the total distribution grid and connect new buildings and collective boiler systems. Up until 2014 about 2/3 of the total connections will be achieved.
In parallel, Eneco Delft will try to integrate the future geothermal heat source that will be built at Delft University of Technology. Other renewable energy sources are considered to be connected in the future.

RECOMMENDATIONS

In a free energy market, PPPs represent good opportunities to achieve large scale energy production projects. All partners should have a specific role in the partnership, related to their own responsibilities and knowhow. The number, but especially the tempo of connecting (existing) buildings is essential for the performance.

FURTHER INFORMATION

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DELFT

D3 LESS ENERGY, MORE COMFORT IN THE HEALTH CENTRE

Photos: Hans de Lijser

Synopsis

- energy use for heating only 34% of the national building codes
- 12 m² of solar boilers
- 126 kWh heat pump
- 3,5 kWp PV cells

Background

In 2007 Woonbron implemented a strategy in which each of its 5 offices made extra sustainability investments in specific projects to create a significant amount of 'shining examples' in its portfolio.

Objectives

The new non clinical health centre in the Händellaan was planned to become one of Delft's shining examples of low-energy buildings. The building, composed of 21 apartments and 5 studios for medical experts, will give home to mentally disabled individuals and supply them with supervised homes.

Project description

Woonbron used the Dutch GPR-score to take account of its measures on the total palette of the different aspects of sustainable building. The GPR-scores on the following themes have been calculated on a 1-10 scale, 10 being the best attainable, 6 being the legal threshold. Although only the energy measures are official as part of the SESAC project, the produced table is worth looking at:

GPR-scores (1-10 scale)			
Energy	8,3	Waste	8,9
Materials	7,7	Water	8,6

The building itself attained an EPC of 1.03. The Dutch standard for similar buildings is 1.5. So the building is 33% better. Total energy-savings were a calculated 66% for heating, 52% for hot tap water and 8% for the lighting of the common areas compared to the standards.

Results

The main partner is owner Woonbron Delft, one of the largest social housing groups in the Netherlands (top 5). Its working area is the southern part of the Randstad which is the metropolitan region of the Netherlands. Woonbron serves about 50,000 households and has seven offices in Rotterdam, Spijkenisse, Delft and Dordrecht. Woonbron is an innovative organisation and this is reflected in the introduction of the 'For Living' concept (a variation on 'for rent' and 'for sale'). Every year since 2002 several thousand rented homes have been converted to 'For Living'. This option is available for both current tenants and those looking for housing. In three to four years' time Woonbron wants to convert 80% of its property into 'For Living'.

Next Steps

The sustainability group that is making sure no opportunities for sustainable effort are neglected within Woonbron uses buildings as these as shining examples.

Further Information

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DELFT

D4 HIGH ENERGY-PERFORMANCE BUILDINGS FOR NEW HOUSING

Synopsis

300 new eco-building dwellings, with a high percentage of social housing, are constructed in the new housing area of Harnaschpolder, Delft.

Background

In 2003 the City council of Delft approved the Delft Climate Plan. One of the most important projects of this plan has been the realisation of the Delft District Heating Company, using low temperature residual (industrial) heat for the heating of new and existing dwellings and utilities. Combined with high energy efficiency goals for the new housing area of Harnaschpolder and the renovation of the Poptahof neighbourhood the path was paved to participate in the SESAC project.

Objectives

Build 300 new energy-saving dwellings in Delft:

- These dwellings show high energy-performance and are connected to low temperature sourced district heating.
- The aim is to reach an average of the energy demand for space heating of 18-20%. 70% of the heat demand is supplied by Renewable Energy Sources.

Project description

In the newly built Harnaschpolder area in Delft, about 1,300 new dwellings are to be built in the period 2009-2015. The building programme contains 30% of social housing, equally divided by social rental end social-occupied property. The first 274 dwellings of the Harnaschpolder have been built during the SESAC project. They show high energy savings through high insulation measures and connection to the low temperature district heating sources.

Results

The energy performance coefficient is 20% beyond Dutch legislation.

Insulation specifications:

- Façade/wall 0.27 W/(m².K)
- Roof 0.19 W/(m².K)
- Ground floor 0.24 W/(m².K)
- Windows 1.1 W/(m².K) for glazing
- Ventilation rate 0.9 (dm³/s)/m²

The monitoring and evaluation is done by EREA, the local energy agency.

Next Steps

As a spin-off of the SESAC project, the Vidomes housing association decided to enlarge the sustainable character of the dwellings by adding a solar system of 58 kWp. As owners of the properties, housing associations are also working out a way to continue the feedback through behavioural campaigns.

Recommendations

Accept that different partners have different points of view. Discuss them in the beginning of the project and keep them in mind during the hard periods of the project.

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DELFT

D5 LOW ENERGY HOUSING

BREATHES NEW LIFE INTO POPTAHOF

Synopsis

- Refurbishment of 84 apartments and 10 studios to new standards.
- Construction of 58 new energy efficient dwellings and a vertical PV system.
- Step by step infrared quality control during the building process.

Background

During the next 10 years, a large scale upgrading of the Poptahof area in Delft will take place to prevent the neighbourhood from falling in social decline. At present about 2,800 inhabitants of 30 nationalities, live in this area and this number will rise by adding new dwellings. The upgrading is in co-operation mainly among owners, the Woonbron housing association, the Municipality of Delft and to some extent the owner of the Van Der Vorm adherent shopping centre.

Objectives

- Refurbish 94 eco-building apartments to reach national building regulation standards for new dwellings.
- Install a 10 kWp PV system on the southern façade of one refurbished apartment building.
- Build 58 new dwellings having a final energy demand for space heating of 51 kWh/m^2.
- Extend, upgrade and modify the heat distribution system and connect it to the refurbished apartments and the new eco-buildings.
- Connect the modified neighbourhood district heating systems to the central district heating infrastructure based on residual heat.

Project description

The renovation of 800 dwellings in 8 high-rise apartment buildings includes energy savings in the building envelope, together with installations and measures to stimulate energy efficient behaviour. Replacing open tap water boilers with a connection to district heating increases both safety and indoor air quality. New dwellings replace medium size buildings and single-family dwellings for a greater social diversification and more space for elderly people. The total number of dwellings within Poptahof increases from 300 to 1,300. The dwellings are mixed by about 40% low-rent social housing, 20% private owned social housing and 40% private owned housing.

Results

Daily energy use of the tenants is available through specific individual metering both for heating and electricity. The monitoring and evaluation is done by EREA, the local energy agency. Feedback for the tenants is being developed.

Next Steps

Pictures and information on the next steps in the Poptahof are available on www.poptahof.nl.

Recommendations

Specific quality control on energy efficiency measures during the building process is necessary to reach the desired results, especially in refurbishment.

Further Information

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GRENOBLE

G1 CONCERT'ACTION

Interactive Training Programme in de Bonne

Synopsis

Concert'action is a training programme that raises awareness and trains construction companies in energy performance issues.

Background

The sustainable neighbourhood de Bonne in Grenoble is one of the four CONCERTO projects in France. The cities are interested in such a training programme for all actors involved in the construction sector. The new sustainable neighbourhood is built on a former military area of 8.5 ha.

Objectives

Raise awareness and train construction companies in energy performance issues so as to make them implement new and innovative technologies assuring high energy efficiency and use of renewable energy resources.

Project description

The Concert'action training programme was first presented, in November 2007, at a conference for concerned companies and constructors, working in masonry, façades, joinery, electricity, installation and heating.

They were encouraged to attend free training modules which took place in early 2008. Each of the modules consisted of a theoretical part, fieldwork and the visit of a building site. For example, participants assisted in air leak detection by means of a blower door and infrared cameras, showing the performance of the exterior insulation.

Results

Craftsmen, constructors and architects attended the training modules and thus improved their skills.

Positive feedback:

- High number of participants (70 participants, 40 companies).
- High relevance and realistic presentation concerning costs and efficiency.
- Successful awareness raising.

Negative feedback:

- Not enough information material was provided.
- The participation of different kinds of stakeholders was not balanced enough.
- Craftsmen should only participate in the modules that are relevant for their sector.

In 2009, the Concert'action training programme was adopted by two other French cities: for Lyon Confluence, another CONCERTO project, and in the framework of an insulation campaign for private collective housing (co-ownerships) in Grenoble.

Recommendations

Because of their influence, the municipalities have a real role to incite building actors implementing training sessions. Instead of training on site, try to elaborate training sessions in Building Training Centres making the sessions more accessible to a variety of craftsmen. After this training on site, the local Training Center GRETA developped such sessions, accessible for a wider public, on the following topics: outside insulation, air tightness, solar thermal and photovoltaics.

Further Information

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GRENOBLE

G2 HEAT AND POWER TO THE PEOPLE

de Bonne features 9 mini CHP plants

Synopsis

In the de Bonne district, 9 mini natural gas Combined Heat and Power (CHP) are used. They produce efficient energy on-site.

Background

The renewal of the military barracks was launched in 2001, proposing more than 850 dwellings and social diversity (35% of social dwellings). The whole area, composed of new and refurbished buildings, is built according to energy efficiency and high environmental quality measures.
9 eco-buildings dispose of a mini CHP plant, in order to produce on-site heat and electricity for the dwellings.

Objectives

- Demonstrate efficient on-site mini CHP plants providing energy for sustainable buildings.
- Address the EU targets concerning security of supply and distributed CHP.
- Develop technical know-how in France related to mini CHP and motivate the import/distribution market chain for mini CHP.

Project description

These small-scale CHP plants provide heating, Domestic Hot Water (DHW) as well as electricity for new dwellings through feed-in tariff contracts. The total capacity installed amounts at 290 kW electrical energy and 590 kW thermal energy.
Each mini CHP capacity has been adapted to cover 50% of the heating and DHW needs of the buildings. The estimated efficiency is around 85% (35% of electricity and 50% of heat).
Due to financial and technical reasons, the plants are not running during the "summer" period from April to October. Gas boilers and solar panels cover the rest of the needs (extra needs during winter time and all needs during summer time); these solar panels cover about 40% of the total DHW consumption.

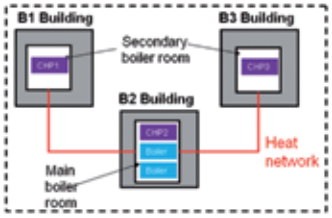
Results

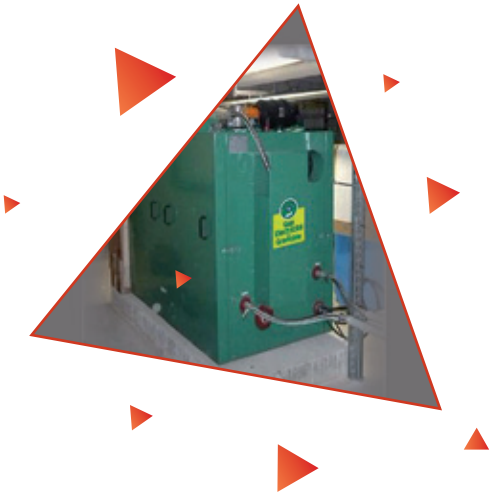
- These 9 mini CHP plants will meet all electricity needs for the new buildings in the de Bonne area (about 840 MWh/year) and half of heating needs in the new dwellings (about 1520 MWh/year).
- Thanks to their use, CO_2 emissions will be reduced by more than 100 tonnes per year.

Recommendations

- The energy specifications need to be fixed and accepted by all early in the planning stage.
- The architects should collaborate with thermal consultants at the beginning of the design stage.
- The follow up of the energy targets has to be ensured during all the building process.

« B » Blocks buildings





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GRENOBLE

12 NEW ECO-BUILDINGS IN DE BONNE

One step closer to Grenoble's 2020 goals

Synopsis

About 12 eco-buildings are built in de Bonne with a minimum of 50% lower energy consumption level than the national average. The buildings present various architectural and technical characteristics.

Background

In 2007 the City of Grenoble drafted its Energy Action Plan, in line with the Metropolitan Climate Plan with the aim to cut by four GHG emissions by 2050. Its objectives for 2020 are the EU's "3x20". As 80% of GHG emissions in Grenoble come from buildings, the City concentrates its efforts on this sector in recent years. Thus, the City of Grenoble has engaged to renew the 8.5 hectares of military barracks and to build 12 eco-buildings in the de Bonne district, representing a total of more than 850 dwellings; 435 are part of the SESAC project.

Objectives

- Erect 8 eco-buildings with an energy performance of 50 kWh/m²/year for heating (40% below applicable building standards in France).
- Educate all the stakeholders involved in the construction of these new energy efficient buildings (from property developer to end user).
- In the long term, speed the introduction of sustainable practices in the private local construction sector.

Project description

The eco-buildings are 7 floors high and contain 17 to 121 dwellings each. They have a compact form, concrete structure with external insulation, low emission glazes with special focus on thermal bridges. Each building is equipped with a double flow ventilation system, solar heating for hot water, a mini CHP boiler and there is a common natural gas boiler in case of extra needs for 2 or 3 buildings.

Results

Consumption per year:

- 50 kWh/m² used floor area, final energy for heating.
- 35 kWh/m² used floor area for hot water.
- 10 kWh/m² used floor area for electricity.

The main success is that this demonstration project develops innovative methods at the local and national levels concerning both technical and management issues.

Recommendations

- The energy specifications need to be fixed and accepted by all actors early in the planning stage.
- The architects should collaborate with thermal consultants at the beginning of the design phase.
- The follow up of the energy targets has to be ensured during all the building process.

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GRENOBLE

G4 ENERGY EFFICIENCY

A HANDS-ON EXPERIENCE IN DE BONNE'S NEW SCHOOL

SYNOPSIS

A new elementary school is built in Grenoble with a 50% lower energy consumption level than the national average.

BACKGROUND

In 2007 the City of Grenoble drafted its Energy Action Plan, in line with the Metropolitan Climate Plan with the aim to cut by four GHG emissions by 2050. The objectives for 2020 are the EU's "3x20". As 80% of GHG emissions in Grenoble come from buildings, the City concentrates has concentrated its efforts on this sector in recent years.
Thus, the City of Grenoble engaged itself to renew the 8.5 hectares of military barracks in the de Bonne district, including the new school.

OBJECTIVES

- Build a new energy efficient 17 class school. The energy consumption sums up to 50 kWh/m²/year for heating. This represents 30% to 40% less than applicable building standards.
- Educate all stakeholders involved: the Municipality of Grenoble, building managers, teachers, school staff and children.
- Raise awareness among parents thanks to a specific children-oriented communication programme on the energy performance of the project.

PROJECT DESCRIPTION

The construction of a new school in de Bonne is linked to the renewal of this district launched in 2001. The school welcomes children who live in the de Bonne area as well as in the surrounding neighbourhoods. It is a 2 floors building with 2973 m² of gross area, mixed concrete and a timber structure with external insulation, low emission glazes, with special focus on thermal bridges, a simple flow ventilation with pre-heated air, low consumption computers and a green roof.

RESULTS

Since the opening a dynamic thermal simulation, an infrared photography campaign and a consumption measurement campaign have been implemented. The final energy consumption is a little more than 50 kWh/m²/year for heating.

RECOMMENDATIONS

- The energy specifications need to be fixed and accepted by all actors early in the planning stage.
- The architects should collaborate with thermal consultants at the beginning of the design phase.
- The follow up of the energy targets has to be ensured during all the building process.

FURTHER INFORMATION

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GRENOBLE

G5 GREAT PLACE TO WORK

A POSITIVE ENERGY OFFICE BUILDING IN DE BONNE

Synopsis

A new positive energy office building is constructed in the de Bonne district in Grenoble. The building produces more energy than it needs and uses 70% less than the value foreseen by the French building regulations.

Background

In 2005 the City of Grenoble drafted its Climate Plan with the objective to stabilise CO_2 emissions till 2010 at the 1999 level and to increase renewables up to 21% of the total electricity consumption. Therefore, this innovative project is meant to contribute to the achievement of the local climate goals in Grenoble.

Objectives

- Build a new innovative positive energy office building with an energy consumption 70% below applicable building standards in France and producing 16,000 kWh of extra primary energy/year.
- Educate all stakeholders involved in the construction of this new energy efficient building, thanks to all energy efficiency efforts and the possibility for visitors to visit the photovoltaic power plant installed on the terrace.
- Create a specific information booklet aimed to spread awareness about energy issues in the building.

Project description

The office is a 4 floors building of 1784 m² gross area with a concrete structure and external insulation (thermal bridges). A focus is made on light control, favouring natural light and otherwise providing artificial light thanks to a solar photovoltaic roof. Innovative windows are installed as well as double flow ventilation for the whole building and a simple flow for each room. The building uses a 425 m² photovoltaic power plant to produce more energy than it is required taking into account all energy efficiency efforts.

Results

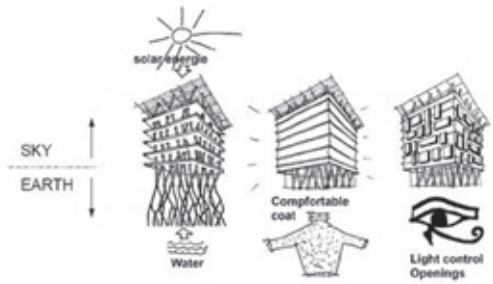
At this stage, the main success is the development of innovative methods at the local level concerning technical issues such as low energy design, thermal bridges and airtightness.

Expected results per year:

- Electricity consumption: 41,300 kWh (i.e. less than 27 kWh/m² representing 6 times less than the consumption of a building complying with the current French thermal regulations).
- Electricity production (photovoltaic power output): 47,500 kWh.

Recommendations

- Energy specifications need to be fixed and accepted by all early in the planning stage.
- The architects should collaborate with thermal consultants at the beginning of the design stage.
- The follow up of the energy targets has to be ensured during the whole building process and with all stakeholders (architects, builders, managers, maintenance staff and inhabitants).



Author: cr&on

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GRENOBLE

G6

THERMAL AND ENERGETIC IMPROVEMENT IN BUILDINGS: AN INCENTIVE AND AWARENESS RAISING PROGRAMME FOR ALL ACTORS

SYNOPSIS

The Thermal and Energetic Improvement in Buildings Programme (OPATB: "Opération Programmée d'Amélioration Thermique et énergétique des Bâtiments") in Grenoble is an incentive and awareness raising programme. It aims to encourage public and private building owners to refurbish and retrofit their real estate.

BACKGROUND

The OPATB programme was launched in 2005. The OPATB area in Grenoble is situated in the district Grands Boulevards, where once stood old military fortifications that have been destroyed in the 1940s-1950s.

OBJECTIVES

The objective is to save about 550 tonnes of oil equivalent (toe) per year, equivalent to a reduction of 500 tonnes of CO_2 per year.

PROJECT DESCRIPTION

The OPATB programme concerns:

- 24,000 inhabitants, representing 16% of the population of Grenoble
- 820 buildings, 14,500 dwellings
- 165 small businesses
- 72 tertiary sector buildings, public and private
- 23 residential buildings, 13 commercial buildings and 8 tertiary buildings

RESULTS

CO_2 emissions have been reduced by 700 tonnes per year but the energy savings made were below the initial objective. In the case of the common properties, the priority given to façade insulation did result in major savings in heating.

	Total for the OPATB	Housing	Small businesses	Tertiary sector facilities
Energy Saving (tep/year)	369	244	18	107
Reduction in CO_2 emissions (tonnes/year)	692	575	21	96

The thermographic image shows the difference between the refurbished dwellings (right) and the non insulated ones (left).

NEXT STEPS

Implement a 4-year-programme (launched in 2010) aiming to improve the thermal performance of 500 dwellings per year until 2013 thanks to financial support for the works as well as communication.

RECOMMENDATIONS

- Commonhold properties: tailor ongoing assistance, technical and financial advice to the residents' needs.
- Small businesses: incorporate energy saving concerns into existing schemes with which small-businesses are already familiar, as it appears that an additional scheme only focusing on energy savings is perceived as too restrictive.
- Tertiary sector: foster deep energy saving considerations especially while major rehabilitation works are being carried out, as they appeared to be taken into account when no such initiatives are planned.

FURTHER INFORMATION

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GRENOBLE

G7 LA VISCOSE

A WARM-HEARTED DISTRICT THANKS TO BIOMASS AND SOLAR ENERGY

Synopsis

In La Viscose area in Echirolles, unaffordable electric heating is replaced by biomass district heating. A similar switch to renewable energy sources is developed in other social housing areas.

Background

La Viscose is a rundown area with many workers on minimum wage and unemployment summing up to almost 13%. There are in total 362 dwellings, all of them social housing and garden plots that may be rented by residents. The flats were heated individually and damp, the peeling paint was evidence of unaffordable heating, poor insulation and inadequate ventilation. The local authority and the social housing company took over the area in 1982 when a comprehensive refurbishment programme began and was completed at the end of the 1990s.

Objectives

Reduce carbon emissions across La Viscose area by using biomass for the district heating system (older buildings) and solar heating (newer buildings).

Project description

The number of dwellings was reduced to increase their size and install a bathroom in every flat. The roofs were refurbished and double glazing and new doors were installed. The insulation comprises an external 10 cm layer of glass wool or polystyrene, which was installed on all but two of the old buildings.

As part of CONCERTO SESAC programme, French consultants visited the City of Växjö in Sweden to get inspired by their district heating system. Three different options were then explored for La Viscose. A solution was adopted, using prefabricated substations in each building, bringing improvements to the traditional French model and saving time and money.

Results

- Energy saved: 5,000 KWh/year.
- CO_2 emissions avoided: 264 t/year.
- Ecological benefits: cost reduction of energy production, conversion to biomass energy, reduction of CO_2 emissions.

Recommendations

EU projects like CONCERTO SESAC enable pan-European collaboration, in this case to implement a Swedish model of district heating in France.

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GRENOBLE

G8 LA VISCOSE LOOKING FORWARD

TO NEW HIGH ENVIRONMENTAL QUALITY ECO-BUILDINGS

Synopsis

59 new dwellings are being built in La Viscose area in Echirolles according to the High Environmental Quality (HQE) French standard and using renewable energy.

Background

La Viscose is a rundown area with many workers on the minimum wage and unemployment summing up to almost 13%. The housing stock at Viscose consists of 58 low-rise buildings completed in 1927 and a further six blocks of flats in 1992/93. Construction works began in May 2008 and finished in April 2010.

Objectives

- Meet the voluntary HQE standard for the 59 new dwellings with a specific approach regarding energy consumption in order to reduce costs for future tenants.
- Educate all stakeholders involved in the construction of this energy efficient building, as part of the "Concert'action" training programme.
- Raise awareness and inform the inhabitants and caretakers by distributing information booklets, in order to limit energy consumption in the building.

Project description

The 59 dwellings are situated in 4 buildings with a total gross area of 5240 m² (4100 m² inhabited area). Buildings are compact with external insulation, double-flow ventilation, solar panels for domestic hot water production and are connected to the district heating network. Special attention was focused to avoid thermal bridges, especially with balconies disconnected from the façade.

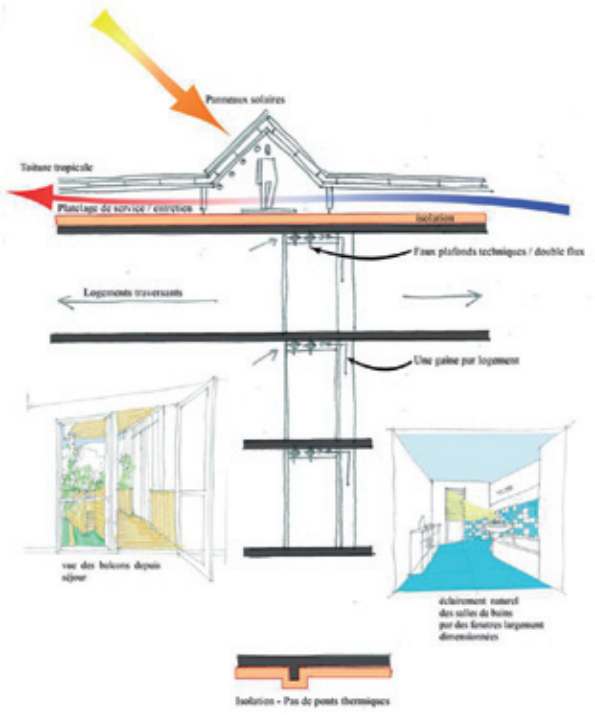
Results

- Energy saved: 292 MWh/year
- CO_2 emissions avoided: 46 tonnes/year

Recommendations

All actors should be aware of the specific (energy) goals of such projects, including for instance training of on-site workers and follow-up with the occupants.

The monitoring of such projects needs to be seriously taken into account, in order to make the appropriate adjustments when measurements differ from the objectives: the first results are never as good as expected.



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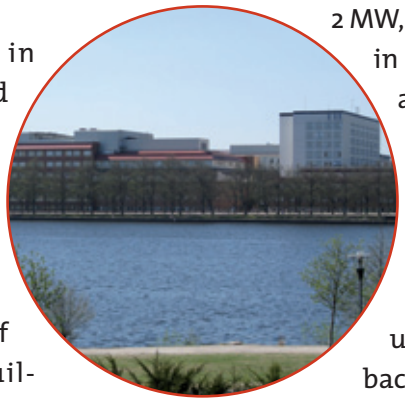
V1 ABSORPTION COOLING
IN THE HOSPITAL AND UNIVERSITY


Credit: Henrik Johansson

Synopsis

District heating produced from biomass in the Combined Heat and Power (CHP) plant in Växjö is used to produce cooling for the hospital and the university via absorption chillers.

Background



The demand for cooling in Växjö is driven by increased indoor temperatures due to several factors: the climate, powerful lighting, the flow of people and widespread use of electronic equipment, excessive solar exposure of glass areas in modern buildings. Electrical systems were commonly used to solve this until now. Växjö Energy Ltd (VEAB) demonstrated that electricity can be saved through absorption cooling, which is driven by district heating produced in the CHP plant. The additional heat production for cooling allows electricity production during the summer period, previously impossible due to too low heat demand in the summer.

Objectives

- Provide new knowledge on heat driven cooling technology coupled with a biomass fired CHP plant, thus creating polygeneration based on renewable energy sources.

The interaction between the load curves for the three products (heating, electricity and cooling) and its impact on technical conditions for optimal system performance are the key issues to be addressed.

Project description

The project has been carried out in close co-operation with the Royal Institute of Technology (KTH). The operation started in June 2007 and the performance was evaluated in order to obtain design criteria for larger chillers.

The hospital and the university were then connected, with plans to extend the district cooling system to more customers later on. Two full scale chillers in the CHP plant, each of 2 MW, produce cooling that is being distributed in pipes to the hospital and the university area. Within the district heating system are also installed 2 MW of free cooling and an accumulator that increases the peak capacity. The result is that the electric driven compressor machines, still in the university and the hospital, are only used for peak loads and as an emergency backup.

Results

The cooling demand from the hospital and the university is estimated to 8,000 MWh per year, of which 6,400 MWh can be supplied by absorption and free cooling. The previous use of electricity for cooling purposes can be reduced by nearly 2,000 MWh per year. At the same time, the use of district cooling makes it possible to produce about 2,000 MWh electricity from biomass in the CHP plant. All in all, this is equivalent to reducing CO_2 emissions by 4,000 tonnes on the European electricity market.

Next Steps

During the coming years, more customers will be connected to the system, such as shopping malls, industries and offices. A fully developed system is estimated to have a capacity of 25 MW.

Further Information

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V2 THE ENERGY EFFICIENT ARABY SCHOOL

LESSONS LEARNT ON CO_2 SAVINGS

Synopsis

The municipal real estate company VöFAB refurbished the Araby school to make it more energy efficient. It installed also a PV plant on the roof, helping the school to produce part of its own electricity needs.

Background

The energy used in buildings (except in households) for heating, electricity and hot water stands for roughly one third of all the energy consumption in Växjö. In Växjö, the energy focus has been mostly directed to new constructions, but the big potential to reduce energy consumption is within the existing building stock.

Credit: Kari Ahlqvist

A long tradition of using renewable energy sources, mainly wood, exists in Växjö. However, it is necessary to also have diversity in the renewable energy sources, meaning that energy sources such as solar and wind must be introduced to a higher extent.

Objectives

- Reach an energy consumption being 21% lower than the national average:
  - Heating: 122 kWh/m²
  - Electricity: 28 kWh/m²
- Demonstrate on-site generation of electricity from PV panels.
- Show that solar energy also has a potential in northern latitudes.

Project description

VöFAB has refurbished four out of five buildings of the Araby school that was built in 1963. The roof and walls have been insulated and the windows have been changed to reduce energy losses. New systems for ventilation, lighting and heat recovery have been installed. The students in the school's science programme have the possibility to study energy and technical installations in a more practical way.

PV panels have been installed on the roof of the school. The PV system has a capacity of 15 kW and represents a total area of 120 m². In order to make the installation and its effects more visible, a display has been installed inside to show the current production, as well as the total production and CO_2 savings.

Results

The PV plant installation was completed in August 2010. The refurbishment is completed in 2011 and the energy targets are expected to be reached.

Next Steps

A further goal is to reduce the energy use even more, so that today's energy requirements for new locations, 130 kWh/m², can be met.

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V3 ECO-BUILDINGS

IN THE GARDEN DISTRICT BISKOPSHAGEN

Credit: Henrik Johansson

Synopsis

In Biskopshagen, a garden district in Växjö, the municipal housing company Växjöhem has built 88 dwellings in 18 buildings and one pre-school with the purpose of having a low energy use.

Background

A long tradition of using renewable energy sources, mainly wood, exists in Växjö. However, it is necessary to also have diversity in the renewable energy sources, meaning that energy sources such as solar and wind must be introduced to a higher extent. The energy used in households for heating, electricity and hot water stands for roughly one third of all the energy consumption in Växjö. In Växjö, the energy focus has been mostly directed to new constructions, but the big potential to reduce energy consumption is within the existing building stock. The important experiences learnt from the construction of the new eco-buildings can be applied when refurbishing the existing building stock.

Objectives

- Build dwellings and a pre-school with an energy consumption that is 35% lower than applicable national indices (in 2005):

	Dwellings	Pre-school
Heating	85 kWh/m²	110 kWh/m²
Electricity	20 kWh/m²	51 kWh/m²

Credit: Henrik Johansson

Project description

Biskopshagen is characterised by being a garden district with rather small buildings. All of them are connected to the district heating system. An integrated building process enabled to reach a low energy consumption, addressing energy and cost efficiency during the entire operation of the project – from the early city planning to the detailed technical design. Houses have high insulation standard with good air tightness and heat recovery. Displays showing the energy use were installed in each apartment so that tenants could maintain this level of consumption. Special training courses directed to the builders were organised in order to raise awareness on energy concerns.
As many families were expected to move into the area, a pre-school was also built within the project.

Results

The houses were built between 2006 and 2008. The energy statistics available in autumn 2010 showed that the use of district heating in the apartments was 71 kWh/m² and the use of electricity was 10 kWh/m². Even if there are variations between different households, it is still very clear that the target was achieved by far. Also the pre-school has better results than the target regarding heat, 90 kWh/m², but the use of electricity is 74 kWh/m². This is explained by the large kitchen which was not properly considered from the beginning.

Next Steps

The experiences retrieved in this building project will be used in future developments.

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V4

VÄXJÖ'S FIRST SMALL-SCALE URBAN WINDMILL KEEPS COMPANY TO ECO-BUILDINGS IN BLÅSBÄLGEN

The windmill is being lifted on top of the roof.

Credit: Carina Herbertsson

Synopsis

The municipal housing company Växjöhem has built an eight storey high low-energy building containing 46 apartments. Växjö's first small-scale urban windmill has been installed on top of it.

Background

Credit: Henrik Johansson

The energy used in households for heating, electricity and hot water stands for roughly one third of all the energy consumption in Växjö. In Växjö, the energy focus has been mostly directed to new constructions, but the big potential to reduce energy consumption is within the existing building stock. The important experiences learnt from the construction of the new eco-buildings can be applied when refurbishing the existing building stock.

Objectives

- Build dwellings with an energy consumption that is 45% lower than applicable national indices (in 2004):
  - Heating: 70 kWh/m²
  - Electricity: 20 kWh/m²
- Demonstrate how a small-scale urban windmill works.

Project description

Växjöhem has erected this eight storey high low energy house that is similar to a passive house, even if it has a traditional heating system. The low energy consumption in the building was achieved thanks to an integrated building process, addressing energy and cost efficiency during the entire operation of the project – using the knowledge and experience obtained from the construction of the other eco-building projects in Växjö. The house has high insulation standard with good air tightness and heat recovery.

In order to help the tenants keeping a low energy routine, displays showing the energy use are installed in each apartment. On top of the house, Växjöhem has installed a 5 kW urban windmill with a vertical axe. It is the second of its kind in Sweden.

Results

The house was built in 2010 and it is estimated that the energy targets will be reached. The windmill is expected to produce 15,000 kWh annually. Blåsbälgen is a very good example showing that even better energy standards can be reached without increasing the costs dramatically.

Next Steps

Växjöhem will follow and monitor the energy use in Blåsbälgen very carefully, in order to learn out of it and apply the results and new knowledge in upcoming projects. If the experiences of the urban windmill are positive, then more urban windmills will be installed in the future.

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V5 SWEDEN'S LARGEST NEWLY CONSTRUCTED WOODEN HOUSES

BUILT IN LIMNOLOGEN

Credit: Henrik Johansson

Synopsis

The private party – Midroc Property Development – has constructed 134 dwellings in four wooden buildings at the building site referred to as Limnologen in Växjö. They are Sweden's largest newly constructed wooden houses.

Background

The energy used in households for heating, electricity and hot water stands for roughly one third of all the energy consumption in Växjö. In Växjö, the energy focus has been mostly directed to new constructions, but the big potential to reduce energy consumption is within the existing building stock. The important experiences learnt from the construction of the new eco-buildings can be applied when refurbishing the existing building stock.

Objectives

- Build dwellings that have an energy consumption 35% lower than applicable national indices (in 2004):
  - Heating: 95 kWh/m²
  - Electricity: 20 kWh/m²

Wooden eco-buildings by Lake Trummen

Credit: Henrik Johansson

Project description

The project includes the construction of 134 apartments in four eight storey high buildings with a wooden frame. The construction of the houses has been studied by many researchers and universities, and they are the largest newly constructed wooden houses in Sweden. In order to avoid moist in the building process, large tents were covering the houses during works. This procedure turned out to be very efficient and has been used also in Portvakten South. High insulation with good airtightness and heat recovery enables a low energy consumption in these buildings. Individual feedback system to the tenants contributes to a low energy use.

Results

The construction of the houses ended in 2008 and 2009. The energy statistics available in autumn 2010 showed that the use of district heating in the buildings was 69 kWh/m² and the use of electricity was 9 kWh/m². This shows that the energy targets were achieved.

Next Steps

The experiences retrieved in this building project are very interesting as a reference for other constructions, and the houses are subject to extensive research.

Further Information

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V6 POLYGENERATION FROM BIOLOGICAL WASTE

Synopsis

The biogas produced by the digestion of sludge and biological waste in the sewage water purification plant in Växjö is used as source of electricity, heat and vehicle fuel.

Background

The heat and electricity produced thanks to the biogas is then locally consumed in the plant. The general demand to also make biogas available as a vehicle fuel for public use and Växjö's ambition to become a fossil fuel free community have brought the need to increase the share of biogas in the energy supply of the plant. This can be done by increasing the amount of biological components treated in the plant and at the same time to have an efficient energy use in the plant.

Objectives

- Demonstrate a cost-effective system for optimised energy use of all available biological waste materials: food waste and sludge from sewage water purification processes will be co-digested and the gas will be used for polygeneration of electricity, heat and vehicle fuel.
- Optimise the flexibility of the system to produce fuel for its technical service vehicles so that the plant can become self-sufficient in heat and produce more than 60% of its own electricity needs.

Project description

In order to increase the production of biogas, the Sundet plant introduced a system for collection, pre-treatment and storage of food waste in large scale kitchens and constructed new reception lines for different types of external sludge. A new gas engine with an electric capacity of 330 kW and a heat capacity of 400 kW heat was installed in 2008, reducing energy losses in surplus situations. Finally, a fuel filling station was constructed and provided with gas upgraded from 60% to 95% of methane. In 2007, the first trial with vehicles using biogas from Sundet was performed.

Credit: Technical department of Växjö

Results

All new installations are in commercial use. The new gas-engine will soon reach 60% self-sufficiency in electric supply on a yearly average. The sewage purification plant has also managed to become self-sufficient in heat, except in peak situations. The market for up-graded biogas for vehicle fuel has grown rapidly and the production is close to its maximum capacity, supplying for now around 50 cars with biogas.

Next Steps

The plan is to collect biological household waste and digest it at Sundet (instead of incinerating it), hence producing biogas from it. Växjö will then be able to produce 2,100,000 Nm^3 of biogas per year. This will be enough to serve the public transport and about 500 cars with vehicle fuel – an important step in the progress toward a fossil fuel free Växjö.

Food waste delivered to the sewage treatment plant is a source for biogas.

Credit: Technical department of Växjö

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V7 THINK DIFFERENT, BUILD DIFFERENT

Eco-buildings in Portvakten


Portvakten North


Portvakten South

Credit: Henrik Johansson

Synopsis

In Portvakten North and South in Växjö, the municipal housing company Hyresbostäder i Växjö AB built 133 apartments, of which 64 are located in passive houses.

Background

The energy used in households for heating, electricity and hot water stands for roughly one third of all the energy consumption in Växjö. The energy focus has been mostly directed to new constructions, but the big potential to reduce energy consumption is within the existing building stock. The important experiences learnt from the construction of the new eco-buildings can be applied when refurbishing the existing building stock.

Objectives

- Build dwellings with an energy consumption 35% lower than applicable national indices (at the time for project application):
  - Heating: 95 kWh/m²
  - Electricity: 20 kWh/m²

Project description

The project includes the construction of 133 apartments in 5 buildings.

The 3 buildings referred to as Portvakten North were built in 2005 and 2006. High insulation with good airtightness and heat recovery enables low energy consumption in these buildings. Displays showing the energy use were installed in each apartment so that tenants could maintain this level of consumption.

In 2009, the 2 houses referred to as Portvakten South, were inaugurated. These eight storey high passive houses with a solid timber frame are air-sealed and connected to district heating for peak load and hot water. The houses are also equipped with heat recovery on the sewage water.

Results

The energy statistics available in autumn 2010 showed that the annual use of district heating in Portvakten North (average for the three buildings) was 65 kWh/m² and the use of electricity was 11 kWh/m². Even if Portvakten North and Portvakten South had the same target specifications in the SESAC project, it was obvious that the actual outcome would be much better in Portvakten South. The annual expected results are 40 kWh/m² for heating and hot water, and 10 kWh/m² for electricity.

Next Steps

Portvakten North was the first site to be built within the SESAC project, meaning that many of the technologies used in these houses were improved when constructing the other buildings in Växjö. The passive houses in Portvakten South have shown that it is possible to think differently in the building process, a fact that will probably impact on Växjö's city planning.

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V8 A GIFT FROM THE SUN

PV Plant in Teleborg School


Credit: Henrik Johansson

Synopsis

The municipal housing company Växjöhem has installed a PV plant on the roof of Teleborg school, which enables the building to produce part of its own electricity needs.

Background

A long tradition of using renewable energy sources (RES), mainly wood, exists in Växjö. In order to have a diversity in the RES used, solar and wind energies have to be introduced to a higher extent. For now, little research related to the use of solar energy for electricity has been carried out in Växjö, contrary to the use of this RES for heating.

Objectives

- Demonstrate the on site generation of electricity from PV panels on the roof of a school.
- Show that solar energy has a potential in northern latitudes as well.

Project description

Växjöhem has installed polytechnic crystal PV panels on the flat roof of Teleborg school. The PV system has a capacity of 69 kW and represents 532 cells with a total area of 528 m². In order to make the installation and its effects more visible, displays have been installed inside and outside in order to show the current production, as well as the total production and CO_2 savings.
Along with the PV plant, six education modules have been designed so that the students can use the solar cells for educational purposes in Mathematics, Physics and English; students describe the installation to foreign visitors and journalists.

Results

The installation was completed in January 2008. In two years the plant has been able to produce around 60 MWh of electricity annually which is equivalent to 1/8 of the school's annual electricity need. Thanks to the installation, students have a great opportunity to learn more about RES, and see how it is working in reality. The PV plant has been visited by many foreign guests and media, for example NBC.

Next Steps

The PV installation at Teleborg school was the first one in Växjö, but the good experiences paved the way for further installations, among them one of the biggest in Sweden.

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This document has been produced with the financial assistance of the European Commission Directorate-General for Energy and Transport (DG TREN) under the "CONCERTO" Programme / Contract reference SESAC 006183. The views expressed herein are those of the SESAC consortium and can therefore in no way be taken to reflect the official opinion of the European Commission.

Co-ordination of the publication: Energy Cities / Contributors: the Project Partners / **Graphic design** by Diane Morel (www.dianemorel.com) / **Photo credits:** Hans de Lijser, Henrik Johansson, Kari Ahlqvist, Carina Herbertsson, Technical department of Växjö; further pictures have been provided by the Project Partners / **Printed by** Imprimerie Simon, Besançon (France) / 2011.