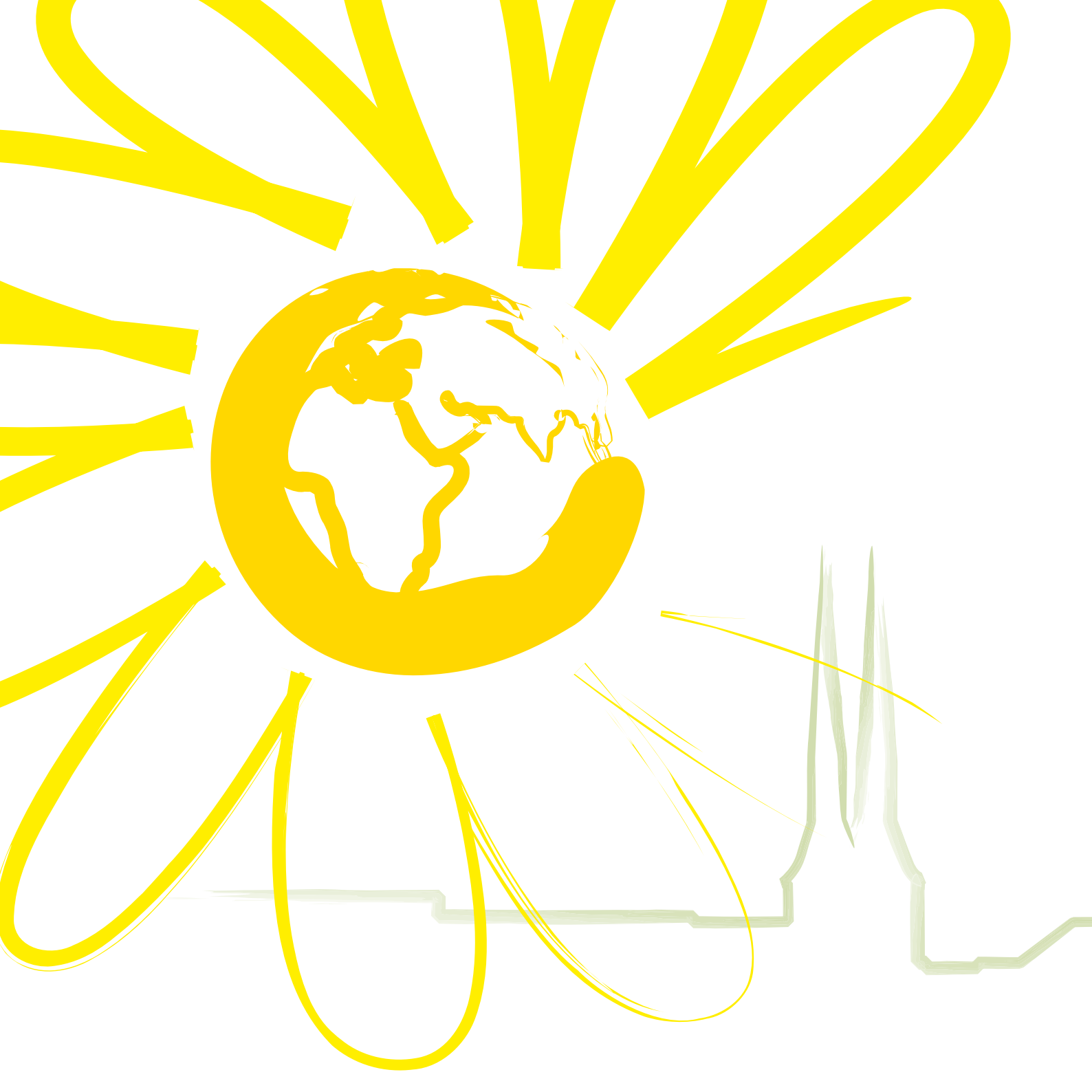


*SESAC*

# Sustainable urban energy development



Concerto is co-funded by  
the European Commission



# Växjö – The Greenest City in Europe

**FOR ME, SUSTAINABLE DEVELOPMENT** has been the most natural way forward, ever since studying Ecology and Sociology in the 70s. We have perhaps not always realised the long-term consequences of different decisions, I admit, but our direction and purpose is clear: Växjö shall be the Greenest City in Europe.

In the Greenest City in Europe we cannot afford to waste energy, even if it comes from renewable forest. There must be sufficient bio-fuel for a whole range of areas when we reorganize the energy system. They say that nothing is ever for free, but this is not true; the efficient use of energy and the optimisation of energy are just two examples. The EU SESAC project is our instrument to be able to achieve an optimised energy system in the Greenest City in Europe. Within SESAC we construct energy-efficient buildings – some of them even without heating systems at all – and we produce cooling, heating, electricity and bio-gas, all from renewable raw materials. At the same time, our collaborating cities, Delft and Grenoble are running similar projects in their cities and we are all learning from each other. This is exactly how the EU should work – supporting collaboration and sustainable development.

**Bo Frank**, Mayor



Photo: Mats Samuelsson



# Intense environmental activities rewarded

SUSTAINABLE ENERGY EUROPE



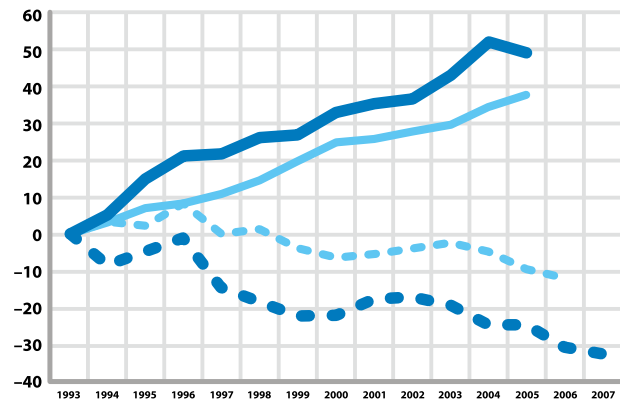
IN 2007 THE MUNICIPALITY OF VÄXJÖ received two major international environmental awards: the Union of Baltic Cities Award and the EU commission's Sustainable Energy Europe Award. The international media has proclaimed

Växjö to be "The Greenest City in Europe" for its far-reaching climate goals and long-term and successful climate activities.

The environmental activities within the municipality started as early as the 1970s with lake restoration and continued with district heating from bio-fuels in the 80s and Agenda 21 in the 90s. The municipality is now closing in on its vision for a Fossil Fuel Free Växjö where each inhabitant of the municipality has a low energy consumption and effect on the climate. Växjö has succeeded in combining reduced carbon dioxide emissions with increased growth – known as de-coupling.

## Facts

<b>County</b>	The County of Kronoberg
<b>Area</b>	1,925 km <sup>2</sup> (land 1,674 and water 251)
<b>Population</b>	80,000
<b>Climate goal</b>	-50 percent CO <sub>2</sub> /inhabitant by 2010 and -70 percent CO <sub>2</sub> /inhabitant by 2025, compared to 1993
<b>CO<sub>2</sub> emissions</b>	3.1 ton/inhabitant 2007 – a reduction of 32 percent/inhabitant



Growth and climate impact, development in %

— GDP/inhabitant Växjö      - - - CO<sub>2</sub>/inhabitant Sweden  
- - - GDP/inhabitant Sweden      - · - · CO<sub>2</sub>/inhabitant Växjö

*In Växjö we have increased growth by 50% and at the same time reduced carbon dioxide emissions by 30%.*

# SESAC builds sustainable cities

**WITH THE HELP OF THE EU'S SESAC PROJECT**, sustainable energy systems are being built in Växjö, Delft in the Netherlands and Grenoble in France. The sustainable cities will become a reality through an increased use of renewable fuels and a more efficient consumption of energy. The project shall also ensure that all parties, from the making of a decision to its implementation, do the right thing at the right point in time. In Växjö the project shall:

- Reduce fossil energy consumption in the participating areas, by 75 percent, compared to if new buildings would have been heated by oil.
- Ensure that energy consumption in energy efficient buildings is 37 percent lower than Swedish Building regulations require.
- Increase production of renewable sources of energy by 15,000 MWh/year.

To achieve this, SESAC works with everything from information, management and planning for the building of energy efficient houses and plants that produce renewable fuels.

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For further information see:

[www.concerto-sesac.eu](http://www.concerto-sesac.eu), [www.concertoplus.se](http://www.concertoplus.se) and [www.vaxjo.se/miljo](http://www.vaxjo.se/miljo) or contact the project coordinator, **Torun Israelsson**, at the Municipality of Växjö, [torun.israelsson@kommun.vaxjo.se](mailto:torun.israelsson@kommun.vaxjo.se)

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## Facts

**SESAC, Sustainable Energy Systems in Advanced Cities**, is part of the sixth framework programme for research and development and is a part of the EU Commission's Concerto initiative. The project will run from 2005–2010 and the budget is approximately 25 million Euros. Växjö is the project coordinator and the main partners are the cities of Grenoble in France and Delft in the Netherlands. In addition there are three associated cities – Miskolc in Hungary, Vastseliina in Estonia and Kaunas in Lithuania. In total, 19 partners are participating.



*View over the CHP plant, with Växjö in the background.*

Photo: Bergslagsbild AB

# Energy efficient building

IN VÄXJÖ 400 ENERGY EFFICIENT HOMES and a nursery school are being built and planned with the support of SESAC. Common to all these buildings is that energy consumption will be 30–40 percent lower than the national recommendations and that 90 percent of the energy supply will come from renewable sources of energy. A low consumption of energy will be achieved by means of an integrated building process and an emphasis on energy and cost effectiveness through the whole of the process, from early town planning, to construction, operation and maintenance.

Experience from building projects clearly show the importance of, at as early a stage as possible, to take energy issues into account, set concrete goals and continually follow up how work is progressing. All consultants and architects have been obliged to take energy consequences into consideration when they have chosen the method of construction, materials and installations. Meetings with construction workers during the on-going process have been necessary in order to provide them with information as to how the energy goals shall be achieved.



Photo: Anders Nordensköld

*Växjöhem's buildings at Biskopshagen.*

## Biskopshagen – homes and nursery school in energy efficient buildings

### *Växjöhem AB*

In the Biskopshagen area in Växjö, 88 apartments in 18 blocks and a nursery school have been built to demonstrate how it is possible to build with energy efficiency. The buildings have been constructed with good insulation, the recycling of heat from extraction air and individual metering of heat, water and household electricity.

#### Facts

	Energy goal, kWh/m <sup>2</sup> /year:	Actual consumption, kWh/m <sup>2</sup> /year:
<b>Apartments</b>		
Heating & hot water	85	75
Property electricity	20	12
<b>Nursery school</b>		
Heating & hot water	106	
Property electricity	51	

## Limnologen – one of Europe's tallest modern timber blocks of flats

*Växjö Kommunföretag AB (VKAB) and Midroc*

In the Limnologen area, 134 energy efficient apartments, in four eight-storey blocks are being built with a load bearing framework of solid timber. Limnologen is a part of Välle Broar: By far the most cohesively planned timber project in Sweden. During the construction a gantry tent is used to protect the buildings from the vagaries of the weather. This also saves energy during the buildings' drying-out periods. To achieve low energy consumption individual metering has been installed in all apartments.

During construction the site has been an arena for contractors who want to further develop timber construction for multi-storey buildings. In order to be able to receive field study visits as effectively as possible, an information pavilion has been built adjacent to the buildings. Limnologen and other interesting building projects will also be followed up with research, education/training and the spreading of knowledge.

*Midroc builds the Limnologen area by the lake Trummen.*

Photo: Anders Nordenskiöld

## Portvaktén Norr – energy efficient apartments

### *Hysesbostäder i Växjö AB*

In the Portvaktén Norr area, 69 apartments in three blocks have been built. The buildings have been constructed with good insulation, the recycling of heat from extraction air and individual metering of electricity and water. The residents can monitor their consumption via a display in the apartment and pay only for what they consume.

#### Facts

	Energy goal, kWh/m <sup>2</sup> /year:	Actual consumption, kWh/m <sup>2</sup> /year:
<b>Heating &amp; hot water</b>	95	75
<b>Property electricity</b>	20	12–18
<b>Household electricity</b>		27



*The passive houses in Växjö are unique.*

## Portvaktén Söder – Sweden's highest passive building of timber

### *Hysesbostäder i Växjö AB*

In the Portvaktén Söder area, 64 apartments in two eight-storey buildings are being built, with no traditional heating system. The goal is a total energy consumption that is only half the national regulations. The energy consumption for heating is estimated to one third of the regulations.

The buildings are very air-tight, the windows are energy efficient and the heat from extraction air is recycled. The heating will be produced by the residents themselves, electrical household apparatus and lamps. The insulation means that almost all heat remains in the building. In addition, the heat from waste water will also be recycled. For hot water and to heat the building during periods of extreme cold, bio-fuel based district heating is used. Individual metering of water and electricity consumption will be installed in all apartments.

By constructing the buildings with timber frames instead of concrete, reduces the net emissions of carbon dioxide by between 749 and 1032 tons. The temporary increase of carbon deposits is 186 tons. This has been shown by calculations from the Mid Sweden University. It is estimated that the buildings will be ready for occupation in June 2009.

For further information contact:

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Hyresbostäder's Portvakten Norr in Växjö.

# The production of renewable energy

**TODAY, 54 PERCENT OF THE ENERGY** used in Växjö for heating, electricity and transport, comes from renewable sources of energy. But more measures are needed to achieve the goal to reduce fossil fuel carbon dioxide emissions per inhabitant by at least 70 percent by the year 2025, compared to 1993. Three such measures are being implemented with the support of SESAC.



*PVs at Teleborg senior school.*

## Renewable energy as a teaching aid

### *Växjöhem AB*

On the roof of the Teleborg senior school, Växjöhem AB has installed 532 solar panels that, in total, produce 58,000 kWh/year. The teachers and the 700 pupils use the equipment to learn more about renewable energy. Six educational modules have been produced specially for the school. Pupils can make calculations in mathematics, gain knowledge about renewable energy in physics and practice their English when they present the installation for foreign visitors.

To capture the interest of the pupils and the general public, the production and reduction of carbon dioxide emissions is displayed on two screens both inside and outside the school building. Växjöhem AB estimates that the installation will produce one eighth of the school's electricity requirements per year, which saves 70 tons of carbon dioxide being emitted into the atmosphere.

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VEAB is demonstrating absorption cooling.

## District heating solves the increased requirement for cooling

### Växjö Energi AB (VEAB)

Global warming, lighting and electrical equipment, have increased the need for cooling. District cooling based on absorption cooling is one way of reducing the needs for electricity for air-conditioning equipment. Cooling is produced by Växjö's district heating plant, Sandviksverket. The technique for absorption cooling is similar to that of air conditioning in cars. The process is driven by the district heating rather than by electricity. Cold water is then transported through the network in the same way as district heating.

A demonstration installation of 300 kW has been built and a larger plant of 2,000 kW is planned in the west of Växjö to supply the Västra Mark industrial estate and Arena City with cooling.

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For further information contact:

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Bio-gas is now available as a vehicle fuel in Växjö.

## Bio-gas makes the sewerage plant self-sufficient

### The Municipality of Växjö

By extracting energy from food waste and the sludge from soil and waste water, and at the same time make energy more efficient, the Sundet sewerage works in Växjö will become self sufficient in terms of heating and produce more than 60 percent of its own electricity. Food waste and sludge decomposes to produce bio-gas and is used to generate electricity, for vehicle fuel and for heating. Since the summer of 2007 Kronoberg's first fuel station for vehicle gas has been operational at the sewerage works. The fuel, so far, is used primarily for the Municipality of Växjö's own vehicles.

The project is working to make the whole of the chain function: to increase the supply of decomposable materials and to establish routines for the collection, pre-treatment and storage of food waste from commercial kitchens. A gas engine that produces electricity and heating from bio-gas (from decomposed material) has been installed. To increase the utilisation of energy a complementing gas purification plant has also been installed. In total 2 million Euros is being invested in reception facilities, gas engines, gas purification and fuel station.

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For further information contact:

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# To learn and inform

**AS ENERGY SYSTEMS** are usually built around fossil fuels and easily accessible energy, activities with renewable sources of energy and making energy more efficient need to be implemented with force and determination. The message must be communicated simply, to awaken interest and to lead to changes in behaviour. To switch over to a sustainable society requires good planning, good management, new knowledge and the exchange of experiences. A long-term view and follow-up are essential. Växjö has several instruments at its disposal within SESAC.

## Technical visits and training tell of the possibilities

*The Municipality of Växjö, Växjö University  
and Energikontor Sydost AB*

Interest in visiting "The Greenest City in Europe" is huge: in 2007–2008, 113 different groups visited Växjö and that is double the amount of the previous year. With the support of SESAC the municipality shall strengthen the surrounding organisation and further develop technical visits. In addition, a short training course is being created in order to spread the knowledge about the technologies and management for sustainable cities. The training is held via the Internet and is combined with technical visits. After completed training, participants receive a training certificate from the Energikontor Sydost AB, Växjö University and the Municipality of Växjö.

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Photo: So He Kim-Hellström

*A steady stream of foreign visitors want to know more about Växjö's environmental work.*

## Timber building construction – good for the environment and the wallet

### *Växjö Kommunföretag AB (VKAB) and Växjö University*

The advantages of using timber as a building material are many: less energy is used during construction and during the life cycle of the building, which generates less carbon dioxide emissions. There is also less wastage. The remains of timber left over from the construction can be used in local energy production.

But all the advantages of timber buildings are not so well known. To support development, Växjö University is to investigate just how energy efficient a timber building is, what the market potential looks like and in a scientific manner, fully explain the basic facts and thereby how knowledge can increase and provide the necessary basic data for decision makers and investors. The overall goal with increased timber building is to reduce the emissions of greenhouse gasses.

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For further information contact:

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## Environmental Management System – supporting the municipality's sustainable operations

### *The Municipality of Växjö*

An environmental management system is an important aid for operations to change to a sustainable energy system. It makes clear the connections between political decisions, goals, measures to be or already taken and follow-up. The Municipality of Växjö has positive experiences of its ecoBUDGET environmental management system. Within SESAC the system is being evaluated and further developed.

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## SAMS – committed Växjö residents save energy

### *Växjö Energi AB (VEAB)*

Working with behavioural issues makes it possible to achieve great savings in energy. VEAB has developed a method that will encourage Växjö residents to reduce their energy consumption by 5 percent. Residents are engaged in three stages. The possibilities for saving energy are shown. The feeling of belonging to the city is awoken by using the Municipality of Växjö's slogan "The Greenest City in Europe". The next stage is to make it possible to follow up their own energy consumption and compete to reduce it. The savings are reported via the media and in advertisements.

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For more information contact:

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## Making energy more efficient in Västra Mark

### *Växjö Energi AB (VEAB)*

VEAB shall help property owners on the Västra Mark industrial estate to reduce their use of electricity for lighting from 9,000 MWh/year to 8,540 MWh/year. When VEAB extend their district cooling network in the area, property owners will have the opportunity to evaluate lighting, in-house climate and the personnel's use of lighting, to reduce the need of cooling. To evaluate the need and at the same time sell district cooling makes it easier to achieve the goals for a good in-house climate.

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For further information contact:

**Lars Ehrlén**, VEAB, [lars.ehrlen@veab.se](mailto:lars.ehrlen@veab.se)

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## Working for sustainable behaviour gives a 16 percent reduction in energy consumption

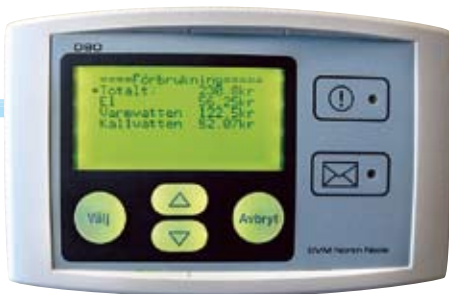
### *Växjö Energi AB (VEAB)*

Individual metering of heating, electricity and hot water and knowledge of the people who use the meters – that is the starting point in the work to reduce apartment dweller's energy consumption. By means of simple information and the ability to compare, measure and compete makes residents more interested in energy and in saving.

An Internet-based system has been developed, where residents can follow their energy consumption every hour. The goal to reduce energy consumption by 10 percent has been exceeded: residents who have had a display installed and who have been informed about energy have reduced their energy consumption by 16 percent. If the residents' energy consumption is compared with that of equivalent households in the rest of Sweden, then it is 34 percent lower! Measurements and electricity bills can be directly compared. The next stage is to further develop the Internet-based system.

For further information contact:

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tina.forsell@hyresbostaderivaxjo.se



*The display helps the residents to reduce the energy consumption.*

## Sharing good technical solutions

### *Energikontor Sydost AB*

Many of SESAC's participants have similar questions about techniques and behaviour, for example, about cost effective conversion to renewable energy, collaboration with residents, energy-efficient building, ventilation, heating and temperature. To develop and share good examples between participants reduces the risk of duplication and paves the way for a time and cost-effective realisation of all measures. A number of workshops have been held for the sharing of knowledge and experience.

One conclusion reached is that continuity is essential to achieve real change. Only by regularly reminding all parties in, for example the building process, about the aim of SESAC, the goals will be reached.

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## Procurement and agreements well adapted to the purpose

### *Energikontor Sydost AB*

Energikontor Sydost AB develops innovative collaborative contracts with a focus on cost effectiveness. In a building and development process, land owners, financiers, the building industry, energy companies and innovative small companies reach agreement that a certain project shall be realised. Through meetings, dialogue and feedback Energikontor Sydost AB has offered all participants information about energy services and other possible collaborative models. The experiences gained will be summarised in a list of good examples.

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# A brief presentation of local partners and their roles in the project

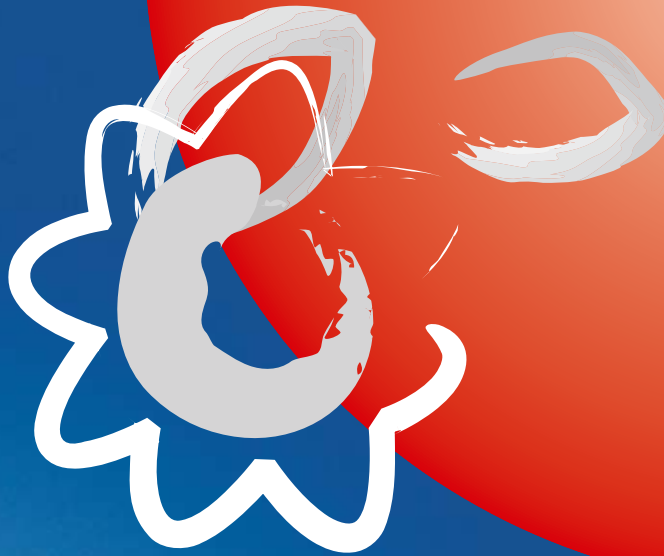
**THE MUNICIPALITY OF VÄXJÖ** is the project manager and also works with energy management systems, bio-gas production, technical visits and the spread of information.

**VÄXJÖ KOMMUNFÖRETAG AB (VKAB)** works with energy efficient timber building construction. Subsidiaries **VÄXJÖHEM AB** and **HYRESBOSTÄDER I VÄXJÖ AB** build energy efficient homes with individual metering. Växjöhem AB has also installed PVs at a school.

**VÄXJÖ ENERGI AB (VEAB)** is the municipal energy company. Within SESAC, VEAB is the financial coordinator and works with the campaign for greater efficiency of energy, individual metering, lighting and district cooling. VEAB is also a subsidiary of VKAB.

**ENERGIKONTOR SYDOST AB** is a regional energy office that works for a sustainable energy system. Within SESAC Energikontor Sydost AB is the technical coordinator and also works with the spreading of good examples and collaborative modelling.

**KUNGLIGA TEKNISKA HÖGSKOLAN (KTH)** – The Royal Institute of Technology – shall summarise the results of the SESAC project in Växjö and analyse both the energy flow and the socio-economic effects.



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