

Research – Development – Innovation – Implementation

# Swedish Sustainable Building



# SB11

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### **Swedish Sustainable Building**

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# Swedish sustainable building

Sustainable habitats make heavy demands, for example, on planning, construction and management of both new and pre-existing settlement. Quality, knowledge and competence in the construction industry have a very important part to play in this connection.

Housing and commercial premises account for roughly 30 per cent of Sweden's end use of energy and for about 7 per cent of its total emissions of greenhouse gases. Electricity accounts for nearly half the sector's energy use, followed by district heating (30 per cent) and biofuels (10 per cent).

The aim is for energy use in homes and on commercial premises to be reduced by 20 per cent by 2020 and 50 per cent by 2050 compared with 1995. The Government's Energy Agreement further lays down that the use of fossil fuels for heating is to be phased out by 2020.

## Support for sustainable cities

In 2008 the Government set up a Delegation for Sustainable Cities, uniting state, business enterprise and local government as a national platform for sustainable urban development, part of the intention being to deploy investment programmes and support to encourage urban development projects which will improve the environment, reduce climate impact and facilitate Swedish exports of environmental technology.

With spearhead technology and proactive planning, well-functioning and attractive urban environments can be created in which high quality of life goes hand in hand with a better environment, social cohesion and minimised climate impact. Several projects can also demonstrate how the technical systems are interlinked. Major synergistic effects can be achieved by co-ordinating the management of energy, waste, water and wastewater.

## The Million Homes Programme

In order to create the sustainable city and achieve its climatic objectives, Sweden will have to transform existing townships,

◁ The Government Offices  
at Rosenbad in Stockholm.  
Architect: Ferdinand Boberg.



People continue to visit **Hammarby Sjöstad, Stockholm**, to study integrated environmental management. Several modern areas of Sweden are eager to carry on where Hammarby Sjöstad leaves off.

in particular those developed in the 1960s and 70s under the Million Homes Programme. In 1965 the Swedish Riksdag resolved to overcome the severe housing shortage and raise housing standards by building at least a million new homes in 10 years. The programme mostly involved flats, but terrace housing and detached houses were also included.

Home from the Million Homes Programme constitute one-third of Sweden's present building stock. There are more than 200 million Europeans living in similar areas.

Many of these buildings are now in need of renovation and at the same time of energy efficiency improvement. The Swedish renovation projects are coupled with high aspirations. Järva in Stockholm and Rosengård in Malmö are just two instances of the response to the national climate objectives in underprivileged areas and of efforts which are being made to involve residents in the shaping of their housing and everyday conditions. Many renovation and rebuild projects are also serving as demonstration objects for disseminating knowledge, experience and Swedish environmental technology, not least internationally.

## Energy-efficient solutions

Sweden has dramatically reduced its dependence on oil. Today, 40 per cent of energy supply derives from renewable sources. By 2020, it is estimated that 50 per cent will be.

The Swedish municipalities have played an important part in this development. Sustainable development is nowadays mainstreamed in their regular activities.

Swedish industry has also been at the forefront in developing energy-efficient technology solutions. Important applications have, for example, included urban infrastructure solutions for water, energy and waste. Close and long-term co-operation between different municipal departments, housing organisations, planning and engineering consultancies and the manufacturing industry has been a key factor in delivering many of the solutions that are established today.

District heating is today established in large parts of Sweden and serves 90 per cent of all multi-family housing. Bio-fuelled combined heat and power plants and the use of surplus industry heat increasingly constitute efficient and sustainable

energy supply. Since 1990, the share of fossil fuel for district heating has been reduced from 80 to less than 13 per cent.

The introduction of the carbon tax in the 90s and the European emissions-trading system have been two of the driving forces in the transformation of Sweden's energy system.

The Swedish Government has recently drawn up a broad-based national environmental strategy banking on research and innovation and also on exports. This strategy permeates the remits of various governmental agencies in the field of environmental technology, establishing a clear and distinct division of tasks. Business enterprises have a pivotal role to play in this connection.

## SymbioCity

Many countries have shown interest in Sweden's great knowledge and experience of sustainable cities, not least during Expo 2010 in Shanghai, when Sweden and China's Ministry of Housing and Urban-Rural Development jointly organised SymbioCity – Sustainability by Sweden.

## Global development co-operation

Growing urbanisation in developing countries means greater demand for technology exchange and tailored policy measures and investments in various types of infrastructure. Sweden's international development co-operation without strings has contributed towards technology transfer, e.g. by building up reference plants of different kinds in Sweden's partner countries. Development co-operation can also operate catalytically through capacity building, i.e. the development of institutions, regulatory instruments and standards. The Swedish International Development Co-operation Agency, Sida, has been active in sustainable urban development for many years.

The Swedish national policy for global development, which aims at co-ordinating different policy areas for coherent development activities, highlights sustainable urban development as one prioritised focus area. Sweden has long been a major donor to and co-operates with both UNEP and UN-Habitat, the two UN organisations established after the Stockholm Environment Summit in 1972.



### Ecoservice free of charge.

A bumble bee can pollinate more than 2,500 flowers in a day. Green areas and corridors are important elements in city planning to preserve biological diversity.

### The SymbioCity Platform

gathers Swedish urban planning expertise and a network of more than 700 environmental technology firms, and serves to facilitate the international activities of the Swedish environmental technology industry. The SymbioCity concept builds on the increased environmental, economic and social performance that can be achieved, e.g. by integrating the different parts of the urban infrastructure systems through smart urban planning. It also includes a computer simulation with challenges for the players.

[www.sweden.gov.se](http://www.sweden.gov.se)  
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[www.symbiocity.se](http://www.symbiocity.se)  
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# Housing in a holistic perspective

Conversion of Million Homes Programme estates into lean, creative neighbourhoods. Green blocks and knowledge lanes. Communities that relocate. Many investment and planning projects in this and other sections of the brochure have come in for government funding support through the Delegation for Sustainable Cities.

The city of Örebro is tackling the Million Homes estates of the Vivalla township head-on and holistically. First in the field is the municipal housing utility, Örebrobostäder, with My Green Block in the Vivalla township.

## My Green Block

This block conversion project comprise climate and energy consumption, user participation and lifestyle conditioning, integration and employment, and heritage conservation. In addition a bid is being made to enhance the status of the neighbourhood, e.g. through participation by both artists and the Public Employment Service.

My Green Block, comprises upwards of 120 flats in single- and two-storey buildings, communal laundries and a precinct social facility. There is also a car and bicycle pool. Energy is to be conserved and the proportion of renewable energy increased, partly by means of solar cells, wind turbines, solar panels, lean laundries and an industrial energy control system. Walls and roofs are to be retro-insulated and doors and windows replaced. Residents can meter their own water consumption. Meetings and technology demonstrations are being arranged in a mobile eco-building.

About 40 of the Vivalla flats are to be constructed as low-energy buildings, in collaboration with other members of the European network Eurhonet.

Experience gained will be disseminated within Örebrobostäder's own property stock and further afield in Sweden and abroad, partly through collaboration with the Cesam research institute, Örebro university.



Single-family house in Vivalla.

◁ Augustenborg township in Malmö.  
An example of local disposal of storm water.



**Cycle more.** The Delegation for Sustainable Cities provides funding support, for example for cycle paths, cycle-parking facilities and cycle wardrobes in many Swedish cities.

## Knowledge Lane in Lund

One of Sweden's most interesting employment zones for research, high technology and entrepreneurship is springing up along a 4 km "lane" from the centre of Lund to Brunnshög on the outskirts of the city which also includes high-quality housing. There are today some 25,000 people employed along the lane, and the ultimate number of workplaces has been estimated at close on 50,000. The lane is held together by an integral city tramway. An extensive climate planting, with green walls and space for urban growing, is planned at the far end of the lane. This will also be a world arboretum, featuring trees from various parts of the world.

## Sustainable Järva

Järva, located in the west of Stockholm, comprises the Rinkeby and Tensta townships south of Järfvafältet, one of Stockholm's green corridors, and the townships Kista, Husby and Akalla to the north of it, and has roughly 60,000 residents. They are younger than the average city population and include many new Swedish citizens. The City is working to create good opportunities for integration in the area.



Typical apartment blocs in Akalla and Husby.

Sustainable Järva is also a part of the City of Stockholm's commitment to improving the energy efficiency of Million Homes estates. Various methods of energy-efficient renovation are being tested, and the experience gained will be utilised in the refurbishment of all the City's Million Homes Programme estates. In connection with the upgrading of Järva's housing, energy use is to be more than halved, to 88 kWh/m<sup>2</sup> annually, as compared with the national stipulation of not more than 110 kWh/m<sup>2</sup> annually for new buildings. A local wind farm is also planned for Järva, and solar cells and collectors will be integrated with the buildings. KTH (the Royal Institute of Technology) is evaluating the project both technologically and behaviourally.

The municipal's new cycle traffic plan is based on a comprehensive analysis. For example, the link between the northern and southern parts of Järva is being improved by upgrading existing roads and constructing new cycle paths with energy-efficient lighting. A bike-borrowing service is established and every year an activity week is arranged, featuring a bike school for adults, cycling proficiency certificates for children and cycle repair courses.

The *Järva Dialogue* enables residents to have a say in renovation decision-making. This area has twice the normal rate of hot water consumption, partly because, on average, Järva has more residents per dwelling unit than other townships. Technical solutions can eliminate some of the environmental impact, but in order to go further, the project is committed to information and participation. Residents are being trained as environmental ambassadors, partnering the Svenska Bostäder housing utility's local managers in distributing information and hints to every household on the subject of a sustainable lifestyle. Environmental education programmes are on offer to clubs and societies, schools and preschools. The Stockholm City Museum is boosting knowledge about Järva and pride in living there. The *Path of Time* is a new heritage route across Järvafältet, with information boards illustrating past and present.

## Gällivare relocating

Mining development in the Municipality of Gällivare means thousands of people having to relocate, due to large areas being absorbed by mining operations.

The municipality's location in an Arctic climate impacts on localisation, design and materials. The positive micro-climatic effects can be maximised by locating low-rise buildings to the south and higher ones to the north.

In the course of two workshops, each with about 250 residents taking part, the municipality has canvassed answers as to what factors will make Gällivare more attractive in the future. This work, which also involved all 15-year-olds in the municipality, resulted in both visionary narratives and a film focusing housing, employment and education as important considerations.

Not many of the world's cities are in a position to adopt such a holistic approach to the energy issue as Gällivare is now able to. What has now arisen is a unique opportunity of planning early for social, ecological and energy-efficient housing construction. Well-insulated buildings with heat recovery, known as passive buildings, can be used. Materials and procedures are important considerations. It is also important to plan the localisation of buildings, function and activities so that they can be pooled for the best possible energy efficiency.



On the move!

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











# Further developments in the city of Malmö

Malmö has transformed from industrial city to one based on knowledge. This is clearly illustrated in the Western Harbour. Efforts are also being made to knock down the physical and mental barriers between different townships and integrate the whole city. Dialogue processes with the construction companies are crucial in this work.

Malmö embarked on its journey to a sustainable city in 2001, the year of the Bo01 housing exposition. The district is well known both in Sweden and internationally, and many groups visit the Western Harbour to study its high environmental and architectural standard. One of the biggest achievements was the energy solution that in full supplied the first generation of buildings with renewable energy. This energy concept still holds and functions as envisaged from the beginning. In the second generation of housing energy efficiency requirements have been adjusted and likewise the green space factor and the “green points”, which the developers committed themselves to, guaranteeing high biodiversity.

## Western Harbour expanding

A third and fourth generation of housing are now under construction. The third district, *Fullriggaren*, will consist of around 600 flats, 75 per cent of which will be rental accommodation. Waste mills will be installed in the flats to collect organic waste which will be used to produce biogas. The district will become the area in Sweden with the highest number of passive houses, and at least two-thirds will be low-energy houses. In Fullriggaren, electricity will be produced through PV installations and four small-scale urban wind power plants. The number of parking spaces is restricted so as to give car pooling an advantage from the very beginning. In the fourth generation district, *Kappseglaren*, offices and 320 flats will be built by ten construction companies with much focus on sustainability and zero carbon construction of passive houses. In addition to passive housing, green roofs and façades, the district will have a car as well as a bicycle pool and a bike repair facility for residents.

◁ Turning Torso in the Western Harbour, one of Europe's biggest and most comprehensive sustainable urban developments - a national as well as international attraction.





#### The biggest low-energy district.

Malmö remains committed to sustainable development in the Western Harbour. The Fullriggaren project amounts to the development of the largest area in Sweden with energy-efficient buildings. Here a mixed township is under construction, with housing, offices, preschool, housing for persons with functional impairment and multi-storey car parks.



**Near the Continent.** Following completion of the City Tunnel, the City of Malmö resolved to create a profile area for the whole of the Öresund region- Hyllie township, with 9, 000 homes and the same number of workplaces, plus Malmö Arena and a water park.

## Environmental Building Programme

The Environmental Building Programme, introduced in Malmö City and neighbouring Lund, currently includes four focus areas: energy, indoor air quality, moisture control and biodiversity. Other municipalities in the region will introduce the same programme. Many construction companies have already codified their first-hand experience of the challenges posed by these lofty aspirations. Many of them are taking the concept even further and implementing measures to reach building standards that qualify for international certification schemes such as LEED or BREEAM. The use of the Environmental Building Programme is for free, and it provides a lot of guidance towards award-based certifications. The country's first areas to be certified according to BREEAM Communities will be in the Western Harbour.

## Urban transformation in Rosengård

Gradually a wider network of axes is being developed, aimed at uniting all of Malmö. At the same time as Fullriggaren is emerging in the Western Harbour, sustainable, mixed and living townships are being created in *Rosengård*, in the eastern parts of the city, the aim being to break the segregation of this Million Homes Programme estate. In the *Rosengård axis initiative*, meeting point and activity areas with innovative, lean lighting will lead to greater security and more frequent use of the axis for both pedestrians and cyclists.

The measures now being taken in Rosengård include an ecological total renovation of nearly 800 flats belonging to the HSB housing co-operative *Hilda*. In the municipality's apartment bloc *Herrgård* tenants are being helped, through education and information, to reduce their water consumption. Low-energy single-family dwellings with modern environmental technology solutions are under construction in the same district.

The Rosengård indoor ice rink and the one of the larger schools are being renovated with special emphasis on greater energy efficiency. The *Climate Smart Food Centre* initiative entails educational activity for kitchen staff, educators and children. This centre is also developing urban growing concepts as meeting points and a platform for ecological thinking.



A new railway station is being established and a mass transit thoroughfare is under preparation for track-bound traffic. Rosengård serves as a test bed for interesting environmental technology which is being marketed both nationally and internationally, and a small-scale Expo is being arranged in 2014.

Through *Focus Rosengård*, Malmö aims to create an internationally leading demonstration area focusing on climate and environmental technology, with the additional benefit of a dynamic physical environment inspiring investment partnership between local government and business enterprise. The visibility of the city's refurbishment is expected to have positive economic and social effects. Job opportunities are created, moving to a new home is made easier, running costs are reduced, attractiveness and security are enhanced and the media image and self-image are strengthened. Many Swedish and other European cities are facing the same challenges, and the aim is to find solutions which are economically viable for larger-scale use.

A successful outcome for this project hinges on co-operation and participation across administrative boundaries, and a dialogue with residents and others active in the township. The many agents collaborating in Rosengård include the district authority, five municipal engineering authorities, an energy company, a municipal housing utility, a tenant-owner housing co-operative and other associations.

The project bears promise of several gains for the future. The climatic effect, for instance, is estimated at not less than 400 tons CO<sub>2</sub> equivalents annually. Residents will be more actively involved in energy supply through local production and through commitment to wind power with new forms of ownership.

A reinforced system perspective is being introduced in the district, with locally produced solar heating (the surplus being transferred to the district heating network and solar energy being used on the spot for direct current applications within the properties concerned) and organic waste being turned into biogas. A lower total energy rating requirement, especially in wintertime, is one important synergy effect, which will make the system less vulnerable.



**Community spirit.** Housing from the Million Homes Programme is being upgraded in the Rosengård township, Malmö. The project includes still more allotments, both for the sake of the environment and with a view to community spirit and participation.



**Rosengård's self-image.** Upgrading homes dating from the Million Homes Programme, raising energy efficiency and making people proud of their township will only be possible with greater participation by residents and others active in this district, where innumerable different cultures and over a hundred languages are represented.

[www.malmo.se](http://www.malmo.se)  
[www.hallbarastader.gov.se](http://www.hallbarastader.gov.se)



# Comprehensive knowledge of building and housing

Typical houses, segregation, environmental indicators. The Swedish National Board of Housing, Building and Planning commands a comprehensive knowledge of building and housing in Sweden. The Board has also a sectoral responsibility for environmental issues, including the national environmental quality objectives, and special responsibility for the objective entitled A Good Built Environment, which incorporates several national environmental objectives relating to the construction, property and facilities management sector.

In 2007 and 2008 Boverket carried out a nationwide survey, the *Betsi Survey*, of Sweden's building stock. Some 1,800 buildings in 30 municipalities were inspected and measured, and residents were asked to complete questionnaires concerning their experiences of the indoor environment and furnishing particulars concerning their health.

A special effort was made to compile documentation concerning damage, maintenance defects, energy use, damp, mould, roof safety and deficiencies of the indoor environment. Particulars for developing the Swedish environmental objective A Good Built Environment were also gathered in. These will be used for checking the objectives for the indoor environment – e.g. concerning radon, ventilation and energy use – against the actual situation and for formulating new objectives, e.g. concerning damp, mould and noise indoors, as well as presenting any connections between shortcomings of the indoor environment and perceived ill-health.

## Segregated housing

Boverket has compiled a state-of-the-art report primarily addressing socio-economic aspects of sustainable urban development, focusing on underprivileged housing areas and possible ways of preventing segregation and promoting integration, the aim being to present a coherent picture of the current state of knowledge regarding socially sustainable urban development in Sweden, with examples also taken from other countries. The survey report also gives an account

**Energy reduction investments**

The Swedish Riksdag has enacted an environmental quality objective whereby total energy use per heated unit of area in urban settlement is to be reduced by 50 per cent by 2050 compared with 1995. The Betsi survey has shown that the capital cost of this objective would exceed 2, 000 billion Euro.

of socio-economic development in townships with local development agreements and of procedures for cost-benefit analysis of measures for alleviating social problems. The material builds mainly on literature studies, comprehensive development plans and other strategic municipal documents, surveys and other reports, interviews and other contacts.

**Environmental indicators for the construction industry**

A research group at KTH (the Royal Institute of Technology, Stockholm) was commissioned by Boverket to devise a method for describing the environmental impact of the construction and property sector. Its report shows the sector to be responsible for a substantial share of Sweden's environmental impact. The most important aspects include energy use, greenhouse gas emissions and air contaminants such as particles and nitrogen oxides, as well as waste generation and use of hazardous chemical products. Where these parameters are concerned, the construction and property sector accounts for between 10 and 40 per cent of Sweden's environmental impact.

On the basis of this study, Boverket has picked out six environmental indicators – energy use, emissions of greenhouse gases, emissions of nitrogen oxides, atmospheric emissions of particles, waste generation and use of health-endangering chemical products – to gauge the development of environmental impact between 1993 and 2007. These environmental indicators show, for example, that emissions from the production of building materials and transport now exceed those from the heating of buildings, partly because the latter have diminished. Use of hazardous chemical products in the construction and property sector has increased and, according to the report, now stands at some 1.5 million tons annually for the construction industry. Emissions of air contaminants, e.g. particles and nitrogen oxides, did not change very much during the period in question, while total energy use in the sector remained practically unchanged.

Both studies of environmental impact and environmental indicators are based on life cycle analysis, LCA. This means that the environmental impacts of production, use and final disposal of various products used in the construction and property sector have all been taken into account.



## Moisture Research Centre

More than 80 per cent of all damage to buildings is estimated to be caused, directly or indirectly, by moisture. In many cases, mould and other moisture problems impair the indoor environment and cause health problems, both of which things can be avoided by getting the structural designs right first time. About 20 per cent of all attics, the most damage-prone structure, are damaged by moisture. The rendered, single-insulated stud wall is a very damage-prone outer structure which has been widely used in recent years.

The Betsi survey report shows about 751, 000 buildings with moisture damages capable of adversely affecting the indoor environment. This is roughly 36 per cent of all buildings (not including schools and preschools). Most cases of moisture-related damage are to be found in single-family dwellings.

In order to ensure a proper remediation of moisture damages in buildings, Swedish researchers from the Lund, Gothenburg and Stockholm Institutes of Technology are working with the SP Technical Research Institute of Sweden and others co-operate to disseminate information concerning the right methods for tackling the problem.



### The average Swedish single-family house

- Built 1953
- 1½-storey house with basement
- Wooden façade
- Ridged roof with concrete tiles
- Heated area, Atemp, 160 m<sup>2</sup>
- U-value of outer walls 0.334 W/(m<sup>2</sup> · K)
- 2.3 persons living in the house.



### The average Swedish apartment block

- Built 1959
- Basement, plus three storeys above ground
- Brick or rendered façade
- Ridged roof with concrete tiles
- Heated area, Atemp, 1,426 m<sup>2</sup>
- U-value of outer walls 0.411 W/(m<sup>2</sup> · K)
- 14.55 dwelling units per building
- 1.7 persons per dwelling unit

[www.boverket.se](http://www.boverket.se)  
[www.fuktcentrum.se](http://www.fuktcentrum.se)



# Growing demand for environmental certification

There is a fast and growing demand for eco-labelling of buildings in Sweden. Companies within the Swedish construction and property sector, municipalities and government authorities have also started to work with a system for sustainability certification of entire urban areas. A Swedish rating system is handled by the Sweden Green Building Council.

Kista, Stockholm, is a dynamic growth area with a focus on technology and development, especially IT. The office building *Modemet 1* is located in this area. It was built by the Swedish Vasakronan company and combines advanced modern architecture and technology with well-planned environmental adaptations.

## Certified in Green Building...

An environmental certification facilitates an objective assessment of how environmentally sustainable a building is. Modemet has been environmentally certified in accordance with the EU Green Building certification system. The European Union launched this programme to reach the goal of reducing CO<sub>2</sub> emissions as well as dependence on imported sources of energy. Buildings certified with GreenBuilding use at least 25 per cent less energy than an ordinary newly constructed Swedish building.

Two more buildings in Stockholm, certified in Green Building, are *Pelarbacken* (client: AMF), constructed in 1961 and completely renovated in 2010, and *Havsfrun* (client: Wallfast).

## ...and Miljöbyggnad

Modemet has also been certified in accordance with the new Swedish *Miljöbyggnad* (Environmental Building) rating system, which focuses on energy, indoor environment and materials. It goes beyond the EU Green Building rating system, not only rating the energy use, but also the indoor environment and chemical substances in the building.

◁ Transparency? *Modemet* accommodates working areas for around 1 500 people, distributed over eight floors. The building has been certified in accordance with the Swedish Miljöbyggnad rating system, where it achieved a gold rating.





**Modemet**, Stockholm, accommodates working areas for around 1,500 people, distributed over eight floors. Designed by Wingårdh Arkitektkontor AB. The building has been Gold-certified by the Swedish Miljöbyggnad assessment system.



**Villa Trift 3.0** in Lund, single-family house, Silver-certified by Miljöbyggnad.

**Stockholm Royal Sea Port.** Blocks planned along the water front between the cities of Stockholm and Lidingö. The Delegation for Sustainable Cities has provided funding support for this prestigious environmental development, which is also one of 18 Clinton Foundation projects fighting for global climate change.

In 2010, two buildings were the first in Sweden to be certified in the Swedish “Miljöbyggnad” rating system. *Hagaporten III* in Stockholm was the very first building. *Villa Trift 3.0* in Lund was Silver-certified by Miljöbyggnad in 2010 and is still today the only certified residential home.

## Four systems for Sweden

Miljöbyggnad is a Swedish assessment system, which is adapted to Swedish conditions. Applications for Miljöbyggnad rating are handled by the Sweden Green Building Council. This non-profit organisation owned by its members – companies and organisations within the Swedish construction and property sector, aims at developing and influencing environmental and sustainability work in the industry.

There are also many other certifications, and three more have been selected that can be adapted to suit different kinds of Swedish buildings and property owner.

- GreenBuilding, which has been developed by the EU and is already established on the Swedish market.
- BREEAM from Great Britain, the most used environmental assessment system in the world.
- LEED, developed in the US and the internationally best-known assessment system.

To create urban areas that are environmentally, economically and socially sustainable, increased coordination between all involved parties is needed. A certification system will be a useful tool in this coordination. Due to this fact, evaluation will be made of whether BREEAM Communities can be adapted to Swedish conditions. In a next step, other systems will be evaluated, including LEED Neighbourhood Development.





## Stockholm Royal Seaport

Värtahamnen, at the Stockholm water front line facing Lidingö City, is above all known as an industrial area and ferry terminal. To this area are now being added thousands of new homes – rental and tenant-owner housing as well as student accommodation – to form a waterfront township. *Stockholm Royal Seaport* (Norra Djurgårdsstaden) is located right next to the Ecopark, the first national city park in the world. Plans include the planting of oak trees and the creation of wetlands.

Stockholm Royal Seaport has been selected as one of Stockholm's new environmental profile districts. The Sweden Green Building Council is actively involved and is monitoring developments.

The vision is to create a climate positive township meeting exacting targets of environmental quality and sustainability, e.g. by being fossil-free in 2030. Passive buildings and energy-plus buildings are under construction, with self-contained water, waste disposal and energy systems. Electricity is generated by micro-production and smart power networks. For each dwelling unit there are more parking spaces for bikes than for cars. Public transport is being developed, for example, through the introduction of boats running on biogas.



### Miljöbyggnad's indicators

Researchers in collaboration have developed Miljöbyggnad with companies in the construction and real estate business. The system offer awards Gold, Silver or Bronze and is used for both residential and commercial buildings, newly constructed as well as already existing. The system focuses on the three areas of energy, indoor environment and materials. These areas are then sub-divided into 15 indicator categories. The aggregation is made in several steps.

#### Energy

- Purchased energy
- Heat loss number
- Solar heat load
- Fraction of energy carriers

#### Indoor environment

- Noise
- Radon
- Ventilation
- N2O to indoor air
- Moist security
- Thermal climate winter
- Thermal climate summer
- Daylight
- Legionella

#### Materials

- Documentation of building products
- Absence of hazardous substances

[www.sgbc.se](http://www.sgbc.se)  
[www.hallplatsen.nu](http://www.hallplatsen.nu)  
[www.stockholmroyalseaport.com](http://www.stockholmroyalseaport.com)



# Sustainability – a competitive edge

Several Swedish construction companies take the concept of environmental certification even further and implement measures to reach building standards that qualify for international certification schemes. Skanska is a company that has realised that environmental certification gives a competitive edge.

An increasing number of construction companies now want to develop and construct in a more sustainable way. They also want to help people become a part of sustainable development – today and for generations to come.

Skanska is one of those modern city builders, and is it also one of the companies that founded the Sweden Green Building Council. Today, Skanska develops and constructs schools, homes, hospitals, offices, roads and railways. Through the Skanska Green Initiative, the company aspires to always present to its customers the incentives to go green.

## Lustgården

The engineering of the building in *Lustgården* in Stockholm is now in full swing. The interesting thing about Lustgården is that the ground and foundation work will include drilling 140 holes that will be used for geo-thermal cooling. This cooling system is called Deep Green Cooling.

At a depth of 220 metres, the ground maintains a constant temperature of 10 degrees Celsius. During summer the building is cooled by the storage and in the winter the storage is charged by cold outdoor air and the building is at the same time preheated by the storage. This will reduce the building's energy needs to at least 50 percent less than the national standard.

Lustgården will be the first building in Stockholm to be Platinum-classified in accordance with Leadership in Energy and Environmental Design, LEED. The building will also be certified according to the Swedish system Miljöbyggnad (see page 21).

◁ Bromma Blocks. An old airport hangar has been turned into a new Stockholm shopping mall. The project includes reducing the carbon footprint.



**Hestra Parkstad.** In the Municipality of Borås, Skanska is building passive apartments near the city centre.

## Passive houses

The first passive house in Sweden with pre-fabricated concrete sections is in the municipality. It was completed by Skanska in 2010 for Marks Bostad. The pre-fabricated frame and walls have resulted in lower construction costs compared to conventional Swedish apartment buildings.

One of the passive house projects is the pioneer refurbishment of *Brogården*, a residential area in Alingsås owned by the public housing company Alingsåshem. The residential area consists of around 300 apartments in 16 buildings. The neighbourhood, constructed in the 1970s, was a part of Sweden's Million Homes Programme.

After extensive renovation with passive house techniques, Brogården's energy use dropped in phase one from 215 to 88 kWh/m<sup>2</sup>. The capital outlay on passive house techniques will be repaid in 10–20 years, thanks to energy cost savings. The socio-economic factors are also encouraging.

## Low energy buildings

One of the larger city areas in Stockholm, which Skanska develops, is *Linabergskajen*. The multi-family houses have an average calculated energy demand of 65 kWh/m<sup>2</sup> Atemp/year. No electrically heated towel driers are allowed nor is comfort heating in the bathrooms based on electricity. There will also be energy-efficient appliances in the kitchen and water efficient toilets and taps will be installed. To further encourage the residents to live more sustainably a smart home display will be installed in each apartment. This will help the residents to keep individual track of heat and hot water use.

The buildings will also be equipped to facilitate installation of locally produced renewable heating or electricity in the future. Furthermore, a vacuum system for waste recycling will be installed to reduce the amount of transports in the area.

## Reducing carbon footprints

Skanska has developed a tool for analyzing carbon footprint of a construction project – ECO<sub>2</sub>. The information is used to measure the impact of different design, construction materials and work methods. ECO<sub>2</sub> is also used for infrastructure projects.





*Bromma Blocs* in Stockholm are developing from an old airport hangar into a modern and energy efficient shopping mall in 2010. Together with the client KF Fastigheter, Skanska reduced the carbon footprint from the construction process by approximately 500 tons CO<sub>2</sub> from transports and 700 tons CO<sub>2</sub> from materials. This also resulted in cost savings.

**New Karolinska Solna University Hospital.** About 98 per cent of the hospital's energy use will be green; the remaining two percent refer to the emergency backup energy systems based on diesel.

Low-carbon solutions include better logistics, consolidated deliveries and replacing road transport with rail or sea transportation. Electricity and site heating from environmentally responsible sources, bio-fuels in vehicles and the reuse of excavated material on site further reduced emissions.

## Drilling for energy

*New Karolinska Solna University Hospital* is designed to be one of the world's most energy-efficient hospitals. The ambition is to cut the need for purchased energy compared with other hospitals by half, and to use 40 percent less compared with the Swedish building code. One of the low energy solutions is energy recycling, including windows that let the light in but keep the heat out. Only renewable energy will be used in terms of both purchased and produced on site.

At New Karolinska Solna University Hospital the heat pump facility will be used to recover the thermal heat and cooling water. 154 holes are being drilled on site. The holes are 220 metres deep and will be used to store the summer heat for use in the winter and cooling in the summer.

[www.skanska.se](http://www.skanska.se)



# Boost for local environmental efforts

Swedish climate investment programmes, Klimp, are administered by the Swedish Environmental Protection Agency. Through these programmes municipalities, county councils, companies and other local agents have obtained grants towards long-term investment for reducing emissions of greenhouse gases.

Government grants to investment programmes have given local environmental efforts a massive boost in the last ten years. They represent Sweden's biggest single effort to augment the ecological sustainability of human settlements. The investment programmes are estimated to reduce greenhouse gas emissions by around 2 million metric tons carbon dioxide equivalents a year, corresponding to approximately 3 percent of Swedish greenhouse gas emissions.

## Energy efficiency, transports and waste

The majority of the projects supported by the Klimp programmes are relevant to the sustainability of urban areas and are related to the built environment. The Klimp investments are being made in the sectors with the heaviest impact on climate, above all through measures in the transport and energy sectors.

These include the expansion of district heating and cooling, substitution of fossil fuels using bio fuels, digestion of organic waste to biogas, energy efficiency measures and local information on the climate issue and the ongoing projects.

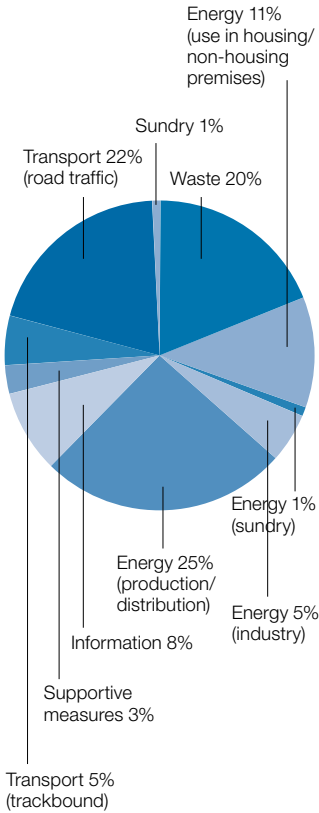
Roughly one-third of the grants have gone to biogas initiatives, e.g. in the form of production facility investments. The Klimp programmes are estimated to give an annual energy saving of 1.2 TWh. The biggest energy reductions will be in the transport sector (road traffic) and the energy sector (production/distribution).

## A local climate policy

Through the climate investment programmes, municipalities, county councils, companies and other local agents have obtained

< District cooling. A district cooling system in Stockholm is using cool Baltic Sea water stored underground.

**Klimp grants by policy measure category, 2003-2008**



**Climate investment programmes**

Altogether 126 climate investment programmes and 23 freestanding measures have been awarded grants, distributed between 67 municipalities, 6 inter-municipal associations, 5 county councils and 3 business undertakings in all the counties of Sweden. The programmes comprise about 879 policy measures and have a combined investment volume of around SEK 8 billion.

The Klimp projects are expected to reduce emissions of greenhouse gases by approximately 1 million metric tons of carbon dioxide equivalents annually. This equals approximately one-third of the Swedish climate target, which is to reduce Swedish greenhouse gas emissions by 4 per cent between 2008 and 2012 in relation to their level in 1990.

grants towards long-term investment reducing emissions of greenhouse gases.

Between 2003 and 2008 the Swedish government contributed MSEK 1,800 towards the Klimp programmes. The focus of the programmes is on investments reducing greenhouse gas emissions and aimed at increasing energy efficiency or achieving an energy conversion to renewables. The investment support is helping to achieve Sweden's climate target, but also strengthening local climate policy work and partnership between different stakeholders. The projects should all be fully implemented in 2012.

**Lessons learned**

A larger number of evaluations have been conducted to analyse the results and processes of the local projects. They show that in general the programmes have resulted in or had the following interesting effects. Knowledge and experience concerning climate investments are a stimulus to continuing climate policy work in different parts of the country, and independent evaluations have shown the grants to raise the level of aspiration and the pace of ecological adjustment

The major challenges were in some cases that it was difficult to assess ex ante the environmental effects of a particular local project. Another problem was that the programmes tend to strengthen the larger municipalities that already have high environmental ambitions, and tends to be less favourable to smaller municipalities with less experience and ambitions of environmental projects.

**Acknowledged strengths in the programmes**

- They support holistic systems thinking.
- Considerable environmental improvements are attainable at reasonable cost and using already accessible technology.
- The investment programmes have kick-started some applications with high commercial potential, e g biogas and bio-energy.
- They support local cooperation and the role of the municipalities. It is often known at the local level what needs to be done, how and by whom.
- They support a long-term strategic perspective, via the programme approach.
- Investments pay back over time.



- They stimulate investments in technologies that are not economically viable today, but might be so in the near future.
- Environmental demo projects attract attention from media and incite study visits, leading in many cases to the replication of good project results in other regions and other countries.

## Active dissemination

Learning from large programmes through evaluations, the dissemination of experiences gained and lessons learned and showcasing the best practical results is important in the promotion of urban sustainability. Good project results, demonstration facilities and the development of urban areas in the forefront of sustainability are all essential parts of development towards sustainable cities.

The Swedish Environmental Protection Agency has selected some of the most interesting and successful environmental projects from the investment programmes to form a knowledge base – the Best Practice Examples. The agency wants to focus attention on the local stakeholders' environmental activities, disseminate knowledge and stimulate replication.



**Smart street lighting** saves energy and reduces maintenance costs.

[www.swedishepa.se/investments](http://www.swedishepa.se/investments)  
[www.swedishepa.se/bestpractice](http://www.swedishepa.se/bestpractice)  
[www.swedishepa.se/mir](http://www.swedishepa.se/mir)





# Energy for generations to come

Construction of low energy buildings. Cross-sector international co-operation. The Swedish Energy Agency is a governmental agency for national energy policy issues which encourages energy-efficiency and supports dissemination and implementation of research and development results.

The EU and the Swedish Riksdag have set targets for more efficient energy use and more renewables. The Swedish Energy Agency's mission is to help Sweden and industry to achieve those targets, with profitability and greater competitive strength as outcomes. Sustainable energy systems are to meet the need of the present without compromising the ability of future generation to meet their own needs.

## Milparena

The *Milparena* project present results from measures to increase energy efficiency in building. The first step is a number of pilot projects, e.g. concerning ways in which renovation can change pressure and humidity and thereby affect heating demand, the durability of the structure and the indoor environment. Then the project systematically describes how to avoid any risk of undesirable consequences by studying the structural status of the renovation. Simulations of the hygro-thermal conditions for various alternative restoration techniques, monitoring and verification of the results in the construction and operation phase are also presented. A number of methods are presented for retro-insulating, replacing windows and making the climate shell airtight. The project also presents existing heat recovery systems, and development of new ones, for the ventilation systems typical of Million Homes Programme buildings, as well as a systematic review of existing heating and hot-water systems and new ones under development.

This work was based principally on three completed projects: *Gårdsten* (Gårdstensbostäder), *Brogården* (Alingsåshem) and *Backa Röd* (Bostads AB Poseidon), all of them best practices.

◁ Cities are big energy consumers. However, they also have a large potential for energy conservation.





Roof-integrated solar collectors.



Rosta township in Örebro.



Gårdsten township in Gothenburg.

## Long-term national programme

Milparena projects are a part of the long-term national programme *Cerbof*, which the Swedish Energy Agency has initiated to promote research, development and innovation concerning energy efficiency in the built environment. One overarching goal is to contribute to the fulfilment of Sweden's energy efficiency and environmental targets, while at the same time strengthening the competitiveness of Swedish industry.

*Cerbof*'s secretariat is hosted by the Swedish Centre for Innovation and Quality in the Built Environment (IQS). The Centre represents the joint interest of actors in all parts of the value chain in relation to research and innovation activities in the built environment.

*Cerbof* encourages sector actors and research groups in Sweden to actively collaborate with international frontline companies and research organisations. One notable arena for such encouragement is the European Commission Energy Efficient Buildings (EeB) public-private partnership.

International collaboration and initiatives supported by the Swedish Energy Agency primarily include the IEA (International Energy Agency), e.g. research programmes directed to building and construction, and the EU.

## 50 research and innovation projects

During its first stage 2007–2009, *Cerbof* funded 50 research and innovation projects with a total of roughly €5 million, including projects tied to the EeB consortia. With sector financing included, projects amount to €12.5 million for this first phase of operation. For the second phase 2010–2014, the Swedish Energy Agency has pledged €1 million annually to support the participation of Swedish sector actors in the EeB consortia together with partners from the EU and other parts of the world.

## Analysis of energy performance

Energy performance analysis furnishes guidance for verifying the achievement of energy requirements. This guide, compiled under the *Sveby* development programme, short (in Swedish) for “Standardising and verifying the energy performance of buildings” is operated by the construction



and property sector and part-funded by Cerbof. The programme is intended as a practical tool for analysing whether the cause of a discrepancy between contracted and observed energy performance can be traced back to users, activities or extra demand for cooling in a very hot year.

## Inspiration for low-energy buildings

A support programme called *Lågan* has been launched, to encourage the building sector to increase the construction of low-energy buildings. This programme provides financial support for demonstration projects and local and/or regional collaboration initiatives. It also encourages new thinking by evaluating and disseminating information from demonstration projects, and by supporting development projects.

The programme is intended to encourage new construction of and conversion to, energy-efficient buildings, foster a national market for low energy buildings, and assist in the establishment of an extensive national body of reliable suppliers of products and services.

In 2010 the construction of low-energy buildings exceeds all expectations. The proportion of low-energy apartments accounted for more than 11 per cent of all new-built apartments and the proportion of commercial and similar premises built as low-energy premises amounted to 8 per cent of the total area. The website *Låganbygg* will serve as an important follow-up of the national implementation of near zero-energy buildings. The recast of the EU directive on the energy performance of buildings will require a number of support measures and a tightening up of regulations relating to both new buildings and renovation of existing buildings. . Continuously updated information on the market situation will help in the formulation of a national strategy for energy efficient buildings. Knowledge exchange between suppliers and both clients and contractors will be facilitated with the help of *Lågan*. Increased knowledge about products and services will in the end lead to better business opportunities in the construction sector.

*Lågan* is a collaborative project between the Swedish Energy Agency, the National Board of Housing, Building and Planning, the Swedish Research Council Formas, the Västra Götaland Region, the Swedish Construction Federation, as well as clients, contractors and consultants.

### Website

*Låganbygg* – a website showing good examples of low-energy buildings in Sweden. The aim is to strengthen the market by showing which regions and actors are actively working on energy efficiency. Today, the website demonstrates techniques and energy performance for over 80 buildings and links to more than 100 actors involved in the projects.

[www.energimyndigheten.se](http://www.energimyndigheten.se)  
[www.cerbof.se](http://www.cerbof.se)  
[www.laganbygg.se](http://www.laganbygg.se)



# Sustainable building in a cold climate

The year 2020 will see the Umeå region leading the world in sustainable building and management in a cold climate. This is a Swedish vision, to be realised partly through a network representing all links in the construction chain. The Ålidhem township will set an example to others.

The destruction by fire of an entire housing block in Ålidhem, near the Umeå university, at Christmas 2008, generated the idea of building Norrland's biggest low-energy project and at the same time starting to upgrade the township's other Million Homes Programme properties and creating more pleasant and safer outdoor environments. The scheme involves over 500 dwelling units, 140 of them new, low-energy flats. Today this is called Sustainable Ålidhem.

## District heating and solar cells

Ålidhem is part of the city of Umeå, located in a region with a cold climate but with an advanced district heating network and up to 99 per cent non-fossil fuelled. New dishwashers and washing machines, for example, are to be installed so as to cut domestic electricity consumption; instead of heating the water electrically, the new machines will be served by the district heating system. The buildings will be given new ventilation with heat recovery and low-energy LED lighting.

Ålidhem is part of the Swedish Government's commitment to sustainable cities. More than 400 dwelling units here are being renovated and their energy efficiency improved, and they will also be provided with the biggest solar cell installation in Sweden.

## Inspiring commitment

The aim is to facilitate more active environmental awareness on the part of residents. Among other things, equipment for individual metering and invoicing of electricity and of hot and cold water is to be installed in the flats. To facilitate recycling, the old refuse storage rooms are being replaced with modern, functional recycling units.

◁ Ice sculpture by Reidar Rova, Umeå.



Up till now, the township residents have shown little interest in traditional colloquies, and so this time a new mode of communication is being employed. For example, Bostaden, the municipal housing utility, has arranged sustainability and safety walks, and also, in collaboration with Umeå University students and Ålidhem's Skuggteatern (Shadow Theatre), dialogues with residents and other interested parties in the township.

### **Testing ground for new solutions**

When Umeå becomes the European Capital of Culture in 2014, Ålidhem will be presented as a model development.

The township will also play an important role in the city's ongoing development. Co-operation with, for example, the Umeå Institute of Design, the Umeå Institute of Technology, the Umeå Academy of Fine Arts and the Umeå School of Architecture will make the township a testing ground for new projects aiming for sustainable urban development.

### **Easy and fun, being ecological**

Ålidhem is now being converted into a sustainable district, with its own wind farm, solar cells and innovative insulation methods. Being ecological there is to be made both easy and enjoyable. Energy use is to be halved, partly with the aid of innovative insulating and sealing methods. Internal insulation is being tested, with a view to preserving the original brick façades. In the first pilot house, an assessment made in 2011 proved that energy use had decreased by 50 per cent.

The flat roofs of the buildings in the township are being converted into pitched ones with integral solar cells, but this is being done carefully, the roofs being also an important part of the district's original architecture. The aim is to preserve the beholder's perception of the characteristic flat roofs from ground level. The district is also to be supplied with energy from two wind farms under construction close by.

A glazed winter garden is being built, and a pleasant temperature will be maintained inside this glass building by using residual distinct heat from the flats. A new common meeting point will be created here for local residents, affording new recreational opportunities. All the year round.



Studentvägen at present is a busy street and a barrier cutting Ålidhem off from neighbouring districts. Heavy traffic is therefore being transferred to more suitable roads. The conversion of Studentvägen into a town street will reduce the barrier effect and make way for new forms of housing and activity – pedestrian and bicycle traffic and, above all, people.

## Network in cold climate

A building with a badly constructed climate shell can still be well insulated per se, but in the long term condensation will form, due to differences between indoor and outdoor temperatures, in which case the consequences can be very expensive. This is especially noticeable in a cold climate, and perhaps good transparency between and within all the different links of the construction chain is extra important here.

With this in mind, the Network for Sustainable Building and Management in a Cold Climate was established in Umeå in 2009, aimed at creating favourable business opportunities in sustainable building by reinforcing competence and working methods throughout the industry. Now, in 2011, the Network has over 60 member firms representing all links of the construction industry chain, from planning of new housing estates to design, construction, management, regulation, industrial education and marketing and finance. The Swedish Energy Agency, through its Lågan and Cerbof programmes, has provided funding support for monitoring, educating and evaluating six pilot building projects in a cold climate.

Other ongoing development initiatives in Umeå include *Island Startup* (Nyetablering på Ön), comprising 3,600 dwelling units, *Umeå Infill* (Fördjupningen av Ume), with 55,000 new homes to be built, and MIKS – Industrial Building in Wood.

Kompetensspridning i Umeå AB is the Network's co-ordinator. The Aim of the Network, coordinated by Kompetensspridning i Umeå AB, is to disseminate and export competence in the field of building sustainable cities. Through partnership with the Technical Visits project, an arena is being offered for exporting and disseminating regional competence in and outside Sweden.



### Construction links united.

The Network for Sustainable Building and Management in a Cold Climate is based in Umeå and represents all links of the construction industry, from planning of new housing estates to design, construction, management, regulation, industrial education, marketing and finance.

[www.umea.se](http://www.umea.se)  
[www.hallbarahus.se](http://www.hallbarahus.se)  
[www.technicalvisitsumea.se](http://www.technicalvisitsumea.se)  
[www.hallbarastader.gov.se](http://www.hallbarastader.gov.se)



# Wooden buildings from north to south

Four regions, 17 municipalities and four research institutes make up Trästad 2012, extending from Kalix in the north to Växjö in the south of Sweden. This is a venture in modern, industrial building with wood. This co-operative project aims to achieve cost control, climate effects and quality improvement by utilising new techniques.

Even though Sweden has a deeply rooted tradition of building with wood, some 85 per cent of all apartment blocks today are built of concrete. Earlier restrictions on large-scale building with wood have inhibited a natural development of wood building technology, resulting today in an unjustifiably small proportion of wooden structures. Trästad 2012 wants to inflect this trend and promote the qualities of building in wood.

Today a wooden apartment block can be up to eight storeys high, or perhaps taller still, given the right concrete reinforcement. Wood is found suitable for apartment blocks, indoor car parks as well as concert halls. It is also suitable for supplementing existing buildings.

## Renewable resource

Two of the reasons for starting Trästad 2012 were that extraction from Sweden's forests is falling short of growth and that wooden building systems are cost-effective and present unique environmental benefits.

Wood is a renewable resource and its processing extremely energy efficient. Moreover, new materials and methods are spurring development in architecture and design, and industrial working methods are reducing defects and damage.

## Industrial production

Building has gathered speed in Sweden, but only in growth centres and even there not fast enough. At the same time, there are many municipalities where growth is being held

◁ Prefab is ideal for wood – an easily transportable material.





Adventure centre in the winter resort Sälen.

up by housing shortages and the halting of housing production. In many municipalities, steadily climbing costs are an obstacle to increased building output, to the disadvantage, not least, of young home-seekers.

In the Wooden Town project, municipalities are joining forces to find models for joint procurement and to achieve cost-effective solutions through an industrialised building process. Trästad 2012 believes that industrial building presents opportunities for reiteration, quality assurance and active development, and in this way can help to improve both the cost-effectiveness and the quality of building production.

Construction time can be considerably reduced by industrial building. To further stimulate this development, public and private clients need to redouble their efforts to devise new models for the planning and procurement of construction projects.

## More competition

The construction sector in Sweden is dominated by a handful of construction companies. Only a few players can deliver both framework and modular wooden structures – holistic building solutions based on an industrial process. A far greater number are suppliers of detached houses and firms which are subcontracted by bigger construction enterprises and are not individually capable of tendering for major construction projects. Within the Trästad 2012 project, several efforts are being made to induce small and medium sized enterprises (SMEs) to form clusters and in this way augment their prospects of tackling major construction projects. What today is in many ways a homogeneous construction market would then be made more competitive.



Modern wood apartment bloc.



## Wooden housing areas

All over Sweden, many examples are already to be seen of buildings produced with modern, industrial wood construction technology. Indeed, complete housing estates are being planned where the degree of sustainability is being raised by combining pre-existing environmental stipulations on energy and resource consumption with climatic thinking in the construction process.

Through new calculation models and examples, the project is seeking to attain guidelines and incentives for calculating the environmental and climatic load of buildings for the whole of their lifecycle, including the construction phase. Quite naturally, a closer look is in many cases being taken at such as aspects as security, architecture, gender equality, diversity and residential satisfaction. Through Trästad 2012 a new and modern urban structure is emerging – that which we term the Good City.

In Värmland, the project entitled the *Wood Region* has launched a sister project aimed at boosting output of wooden components within the region.

## Wooden light-weight structures

Schools, caring institutions and indoor sports facilities in many places are in need of renewal or replacement by facilities which are both bigger and more practical.

Industrial wood building technology using light-weight structures makes it possible to build on pre-existing volumes. This technology is also suitable for renovation, for infill development and for demolition and replacement building within a very short time.

Good raw materials, a strong timber industry, a high level of competence in industrial building and well-run construction enterprises mean that Sweden and the whole of the Nordic area could become a driving force in the emergence of large-scale European building with wood.

Trästad 2012 is intent on disseminating knowledge and greater awareness concerning building with wood in Sweden, the aim being for all municipalities in the project to have strategies for the pursuit of sustainable urban development.

*Trästad 2012 (Wood based buildings)* is a joint project involving 17 municipalities, the Västerbotten, Dalarna and Kronoberg County Administrative Boards, the Västra Götaland region and the Swedish Wood Building Council. The purpose of the project is to augment competence and insight concerning ways in which modern wood building systems can renew urban environments and create attractive, sustainable cities with low climate impact. The project is funded by the participants and by EU Objective 2.

*En investering för framtiden*



The Swedish Wood Building Council is a resource for all initiatives to do with wood based building and offers knowledge support to clients, architects, structural engineers and other decision-makers. Special attention is being paid to multi-storey buildings, public buildings and main bridges for road traffic.

Trästad 2012 co-operates with representatives of industry, policy-makers, interest organisations, researchers, research funding agencies and other interested parties. The potentialities of the municipalities taking part vary according to size but also depending on whether the municipality concerned is a growth centre, a sparsely populated rural area or located in south or north of Sweden. These differences notwithstanding, the exchange of knowhow is invaluable when it comes to augmenting knowledge, devising concepts for future building development and forming clusters.

[www.trastad2012.se](http://www.trastad2012.se)  
[www.trabyggnadskansliet.se](http://www.trabyggnadskansliet.se)  
(in Swedish)



# Energy-efficiency in Western Sweden

A regional programme for strengthening the market for energy-efficient buildings – passive buildings, for example – was already adopted by the Västra Götaland Region in 2007, at the same time as funding resources were stepped up for creating demonstration objects. The current second stage of the programme heavily emphasis renovation.

The Västra Götaland Region has committed a total of MSEK 42 to energy-efficient buildings. All the projects supported have been co-funded by the project owner and by other funding agencies.

## Passive buildings

The energy-efficient buildings programme is aimed at reducing climate impact through more efficient energy use and also at stimulating innovations, new jobs and greater competitive capacity in the Western Swedish construction industry. Several of the interim objectives from the first stage have been overshoot. At least ten per cent of all new homes are being constructed as passive buildings. The figure in 2010 was eight per cent. There are at least ten new demonstration objects for energy-efficient buildings. In the event, eleven such projects materialised, including Sweden's largest passive building, the *Hamnhuset* apartment block in Göteborg, and *Brogården* in Alingsås, a Million Homes Programme estate which has now been elevated to passive-building standard. A third example is *Villa Malmborg* in Lidköping, constructed in 2007 as the first passive detached house in Sweden.

Low-energy dwelling units in the region accounted for 24 per cent of new output in 2010. The corresponding figure for the whole of Sweden was just over 11 per cent.

At least 50 new Western Swedish housing and construction players are to operate in the market for energy-efficient buildings. Between 2007 and 2009 in the region, 23 firms were started in that market. Most of them are consulting firms, a large proportion specialising in energy declaration, but they also include a number of suppliers and construction companies.



A passive multi-family house in Kungshamn.

Virtually 90 businesses, most of them focusing on energy declaration, have since 2007 branched out into energy-efficient buildings, suggesting that more and more firms are perceiving business opportunities in this field.

## Active municipalities

Most municipalities in the Västra Götaland region are actively moving towards energy-efficient buildings. When the programme started in 2007, only the Municipality of Alingsås could with certainty be said to be aiming for a greater number of energy-efficient buildings, through directives to owners and stipulations in connection with land allocation. In the beginning of 2011 there were 17 municipalities moving in various ways towards energy efficiency. The list includes, for example, the City of Göteborg, with a programme for environmentally appropriate housing construction, Uddevalla, which is building energy-efficiently under its own auspices, and the Municipality of Mark, which is also attaching stipulations to land allocation and, moreover, is included in the region's climate strategy.

The Municipality of Kungälv, acting in collaboration with the programme, has studied how the entire new township of *Kongahälla* can be made as energy efficient as possible, the aim being to create an "active" township, i.e. one delivering more energy than it uses. The study shows the technical solutions, funding prerequisites and stipulations which a municipality needs to include in its planning work, so as to create the energy-efficient buildings of the next generation. Joint levels of aspiration/guidelines, formulated in agreements between region and municipality, are mirrored vis-à-vis the market by planning provisions, land allocation agreements, development agreements and building permits.



Brogården in Alingsås.

## International and national co-operation

Together with international agencies, the programme seeks to demonstrate corporate competence, investigate export opportunities and bring about an interchange of experience. The Västra Götaland region has since 2008 been running the EU project Build with CaRe, aimed at promoting lower energy consumption in both new and re-existing buildings. Within Sweden, the Environmental Secretariat has collaborated with the Swedish Energy Agency, e.g. under its national programme for passive and low-energy buildings and through the energy-efficient building programme *Lågan* (see page 35).



Hamnhuset i Göteborg.



## Research and development

A number of R&D projects are following up the latest innovations with regard to technical solutions, products and construction methods. One example is *Milparena* – short (in Swedish) for the Million Homes Project Arena – which is being run by the Chalmers University of Technology and the SP Technical Research Institute of Sweden together with a number of municipal housing utilities. Several renovation projects are included for evaluation, as well as new buildings, e.g. Sweden's first passive buildings in Lindås. (Read more about Milparena on page 33).

One important task is to disseminate relevant research findings to the construction sector and to strengthen co-operation between research and practice. The *ChuE (Collaborated Learning)* educational initiative has an important part to play in studying political and other impediments to energy efficient improvement.

## System integration in Kvillebäcken

Kvillebäcken is the first phase of *Centrala Älvstaden*, under construction near downtown Göteborg. Today the area presents a motley array of businesses and commerce of various kinds, including demolition sites in need of soil decontamination. But here an attractive and living township is now being created and scheduled for completion in 2018.

In Kvillebäcken a total of 1, 600 dwelling units and 24, 000 sq. m. of non-housing property is scheduled for completion between now and 2018. A preseparating suction waste collection system with several fractions is being installed throughout the area. Items unamenable to suction removal, such as glass and metal, will also be uniformly treated. The aim is to achieve a high concentration of biomass for more efficient production of biogas. A special system stores energy in the district heating network. Public transport is to be further developed by means of passenger boats running on biogas.

**Smart Energy** is a Climate Strategy for the Västra Götaland region. The overall aim is a fossil free region in 2030. Energy-efficient building, green logistics and increased production of renewable energy are examples of focal areas.

**Passive Buildings Centre** (Passivhuscentrum) based in Alingsås, is the single largest and most comprehensive project in the Västra Götaland Region's environmental programme. This centre of competence for both the construction sector and interested members of the general public provides training and information on passive building technology and its possibilities.

[www.vgregion.se](http://www.vgregion.se)  
[www.passivhuscentrum.se](http://www.passivhuscentrum.se)  
[www.hallbarastader.gov.se](http://www.hallbarastader.gov.se)



# Cutting edge research and development

Collaboration with the Swedish building industry. European co-operation within building research and innovation. Strong scientific environments. These are areas supported by Formas – the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning.

In the European Union, the construction industry represents 10 per cent of GDP and 7.3 per cent of the total employment. The construction sector is also significant for environmental impacts. Buildings are responsible for 40 per cent of the EU's energy consumption and one-third of its greenhouse gas emissions. Moreover, more than 50 per cent of all raw materials are transformed into construction materials and products.

## Strategic networking

The European Commission has focused on overcoming fragmentation in European Research Areas, ERA, since 2004. The so-called ERA-Nets are initiatives to address this problem, as components of a European innovation system for research and development.

The first ERA-Net on construction, Erabuild, became a strong platform for development of transnational R&D programme and for funding research, development and implementation in the construction sector.

The second ERA-Net on construction, Eracobuild, started in 2008 and includes 35 partners responsible for research programmes in 21 countries. Sweden is represented by Formas together with the Swedish Centre for Innovation and Quality in the Built Environment, IQS and the Swedish Energy Agency. The challenge lies in the combination of different policy fields, such as economic, environmental and RDI at national, transnational and European levels.

◁ *Kuggen* in Gothenburg is the Swedish entry nominated for the international IABSE Outstanding Structure Award for 2012. Architect: Gert Wingårdh. Client: Peab. Owner: Chalmers Fastigheter. The Homes for Tomorrow research group has played a part in developing this building, which will serve as a meeting point for the academic community, business enterprise and society at large.



Staircase in the Kuggen building.

Two thematic frameworks for co-operation have been defined:

- *Sustainable renovation*, aimed at improving the building quality and energy-efficiency of the existing European building stock.
- *Value-driven processes*, aimed at improving the supply chain and client integration and adding value to the processes and outcomes of the sector.

## Sustainable renovation

The emphasis in construction is moving from new buildings towards maintenance and renovation. The overarching goal of the thematic framework for Sustainable Renovation has been to increase both the quality and the quantity of building renovation activities in Europe, and to improve the resource efficiency of existing buildings. To ensure a potential impact on the existing building stock, the thematic framework has a broad scope including technological innovation, socio-economic concepts and supporting measures. Growing renovation rates mean that improvement of technologies and processes are needed to meet the market demands.

Two calls for research and innovation projects for sustainable renovation have been launched within Eracobuild. Two examples of projects funded are:

- *Policy instruments for innovation of energy efficient retrofit measures in existing buildings*. The overall objective is to identify cost-effective energy-related retrofit strategies and to assess policy instruments, networks and learning processes for the development and implementation of retrofit measures. Such instruments take as their starting point the fact of growing renovation rates challenging different actors to overcome a variety of institutional, economic, informational and social hurdles.
- *Strategies for Integrated Sustainable Renovation*. The project shows that there is no contradiction between necessary actions to deal with energy-efficiency and the safeguarding and evolution of socio-cultural values. The complex and multi-layered interaction of material and immaterial values related to sustainable management of existing housing highlights the need for integrated strategies.

A long-term goal of the project is to translate and adapt the strategies to suit all parts of the existing building stock as well as new building.



## Collaboration with industry

Formas has long experience of collaborating with the building industry. Over the last years, there have been a number of joint calls for research grant applications, the aim being to combine efforts to give Swedish construction research a strong position, both nationally and internationally. So far, fourteen joint calls have been completed – half of them international – within Erabuild/Eracobuild. Some 115 projects have been funded together with the building industry. One example is *Renobuild* – Sustainable Renovation of Buildings supported by a decision support tool in the early stage of the project planning process. The purpose of the project is helping the building owners to make decisions on efficient and sustainable renovation process and measures taking into consideration a number of criteria, such as architectural quality, aesthetics, energy efficiency, indoor environment, material damages, durability, life cycle analysis, life cycle costs, and health and security.

## Homes for Tomorrow

Formas is supporting several strong research environments. One of them – *Homes for Tomorrow* at the Chalmers University of Technology – supports future homes in the global era with new technologies, materials and spatial structures that radically reduce resource, material and energy intensity. Scientific activities focus on the following issues:

- *Active multifunctional building envelopes*. The aim is to develop thin novel insulating materials and smart design components, such as aerogel.
- Development of *novel concrete composites* of modern engineered textiles with nano-modified and/or polymer modified cementitious binders.
- A new concept – *the water sensitive home*.
- Light and structures to create *restorative environments* using novel materials and building concepts by providing solution for better acoustic environment, ventilation and daylight indoor lighting.
- New ways for the Swedish building industry to create an *arena for knowledge production and dissemination*.

**Swedish Centre for Innovation and Quality in the Built Environment (IQS)**, was founded in 2010 as a result of a merge between the Swedish Construction Sector Innovation Centre (BIC) and the Council for Constructing Excellence. Formas collaborates with the Swedish construction sector within the framework of IQS in order to encourage research, implementation of research results, quality work and innovation processes.



Scientific activities are based on engineering and humanizing systems approach.



The Homes for Tomorrow research team is co-operating with Mölndal City in their exploitation of the a former industrial area.

[www.formas.se](http://www.formas.se)  
[sustainability.formas.se](http://sustainability.formas.se)  
[www.iqs.se](http://www.iqs.se)  
[www.eracobuild.eu](http://www.eracobuild.eu)

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# Sustainability

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### ABOUT THE JOURNAL

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This brochure presents some of Sweden's joint efforts towards achieving a sustainable built environment. Examples are given of ongoing activities by governmental authorities, networks and companies in the fields of planning, construction and facilities management.



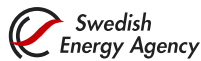
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