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Kvarteret Seglet, Sweden

Case Study 33

Kvarteret Seglet is an energy efficient 44-apartment building in Karlstad, Sweden, which was the first Swedish high-rise building to be constructed with a passive heating system.

Aspects of Sustainability

This project highlights the following:

Social Aspects

Human Resources
Corporate Community Involvement
Business Ethics
Health and Safety

Environmental Aspects

Energy and Climate
Materials
Ecosystems
Local Impacts

Economic Aspects

Project Selection
Supply Chain
Value Added



Project Introduction

Kvarteret Seglet is a twelve-storey apartment block in Orrholmen, Karlstad, Sweden. Seglet (“The Sail”) consists of 22 one-bedroom and 22 two-bedroom rental apartments. The project is part of an ongoing programme in Karlstad to overcome a shortage of housing and to offer a greater choice of accommodation in the city.

Skanska Sweden was the general contractor of the US\$ 8.8 million project and worked in close partnership with the client, Karlstads Bostads AB (KBAB). Work on the project began in 2004 and was completed in March 2007. Seglet includes 11 apartment floors, 2 lifts, resident storage space on the ground floor and an underground car park.

Seglet is Sweden’s first high-rise building with a passive heating system. The building does not have a conventional heating system, but is equipped with under floor heating to provide

additional heat if necessary. Seglet is the second phase of KBAB’s new house building scheme, partially funded by the Swedish National Board of Housing, Building and Planning, aimed at developing new construction techniques for energy efficient residential buildings. Seglet consumes almost half the energy of the first phase of the project completed in 2005 (56 kWh/m²), and the next phase intends to build on the experience of Seglet to identify where further improvements can be made.

Contributing Toward Sustainable Development

Seglet is an energy efficient building, which recycles waste energy from neighbouring buildings and will use 100% renewable electricity by 2009 by securing a new contract for wind energy. The building ensures a high quality living environment

for residents and has contributed toward sustainable planning and urban redevelopment by reusing an urban brownfield site. During the design and construction phases, Skanska and the project partners developed simple techniques that could be easily replicated in other energy efficient residential projects, such as an energy efficient ventilation system. Project partners and suppliers were heavily involved in the development of the project, contractors received special training in energy efficiency construction and site safety was prioritised. Seglet has also been used to raise awareness of more energy efficient buildings within the construction industry and among Karlstad's residents. The project benefited the regional economy by employing local people and by sourcing materials from regional suppliers. Suppliers met high environmental standards and environmental impacts were minimised by reducing disturbance and construction material waste.

Social Aspects

Stakeholder communication

Community meetings were held to inform local people of the project and neighbouring residents were informed of any potential disturbances during construction.

Project partner collaboration

All project partners and suppliers were involved in the Seglet project from the outset, which led to the development of the innovative solutions and techniques used on the project. A temporary construction laboratory was established on the site for project partners to work together to develop new energy efficient construction techniques and to conduct full-scale tests. The Seglet project is part of a series of residential construction projects in Karlstad known as *several projects in one*, which is intended to continuously built on the experience and expertise of the same project partners and suppliers to develop how energy efficient buildings are constructed.

Development of simple building technology

Simple innovative solutions were developed for energy efficient residential buildings, which can be easily replicated on other projects, such as an under floor heating system. Each apartment is also equipped with a simple ventilation system, which consists of only one fan in the exhaust air duct. Outgoing air is replaced with new fresh air from a plate heat exchanger and brush strips over the bedroom windows.

Occupational health and safety

There were no serious site accidents and the Lost Time Accident Rate for the project was 3 per million man-hours. Established safety routines were closely followed and site safety checks were conducted on a weekly basis. First aid education was also provided to construction workers.

Raising awareness of more sustainable buildings

The Seglet project was used to inspire the construction industry to adopt a longer-term perspective on projects by considering construction materials and operational energy consumption from a life cycle perspective. In 2006 a 30-minute documentary film *Seglet: a super insulated high-rise building* was created to help raise awareness of the project within the construction industry. 300 DVD copies were distributed and the film was used during project study visits, which were led by both Skanska and KBAB. Skanska conducted around 10 presentations for local schools, concerning the sustainability features of the building. The universities of Karlstad and Lund have also received governmental funding to conduct analyses of Seglet's energy efficiency, ventilation and indoor environmental quality to assess the building's performance and to raise awareness of the project.



High quality indoor environment

Seglet was designed for optimal living comfort and tenants can easily control the indoor climate to suit their needs. Unlike conventional Swedish apartments, which only have ventilation in the bathroom and kitchen, all rooms are ventilated to ensure good air circulation and quality. The apartment windows are also operable to allow fresh air ventilation in warm weather, and large windows ensure good access to natural light.

Sustainable urban planning

Situated approximately 1km south of the Karlstad city centre, Seglet is close to services, amenities and public transport. The apartments will allow more people to live relatively central in the city and reduce the need for private vehicles. Bicycle storage is provided outside the entrances of the building.

Economic Aspects

Local construction employment

Approximately 40 construction workers worked on the Seglet project at the height of construction. Around 80 percent of which were from the Karlstad area.

Regional material suppliers

Locally sourced materials included the frame of the building, which was prefabricated by a supplier in Karlstad.

Contractor site training

Training sessions concerning the special construction techniques of the Seglet project were held for construction workers. Nine hour-long sessions were conducted in total, which were held during breakfast to ensure a high attendance.

Financial savings due to energy efficiency

Seglet uses over four times less energy per m² for heating and hot water than the 2006 Swedish energy standards for new buildings (130 kWh/m²), which reduces operational costs and adds value for tenants. An individual electricity billing system is used, which acts as an incentive for tenants to save energy. KBAB's experience has shown that individual billing reduces the consumption of heating on average by 20 percent. A digital information panel in each apartment displays energy consumption information, and allows tenants to monitor their own usage. Karlstad University is conducting a follow up energy efficiency study to measure and analyse Seglet's operational costs during the first three years of operation.

Urban redevelopment

Seglet has revitalised Orrholmen and has strengthened the neighbourhood as a residential area. The design, which was intended to preserve the identity of Orrholmen and blend into the 1960s architecture typical of the area, has received positive feedback from local people. The height of Seglet was also limited so as not to dominate the Karlstad skyline. Prior to the development a vacant shop stood on the site.

Environmental Aspects

Minimising environmental disturbance during construction

The site was sectioned off from the public roads and walkways during construction to reduce public disruption. Drills with industrial vacuum cleaners were used on site to minimise dust pollution.

Environmentally responsible construction materials

Prefabricated construction materials were used to reduce the quantity of materials transported to the site and the energy consumed. Environmentally responsible materials included the wall and roof insulation, which was made from cellulose fibres from recycled paper.

Construction material waste

Waste was reduced as part of the project's objective to minimise the total energy consumed during construction. Waste was limited to approximately 2 percent of the construction materials used on the project by prefabricating materials, using surplus materials such as insulation and by placing accurate orders.

Energy efficient housing

Seglet consumed approximately 32 kWh/m² of energy for heating and hot water in 2007. This figure is 25 percent of the Swedish National Board of Housing, Building and Planning requirements for new residential buildings. Seglet is equipped with a passive heating system, energy efficiency fixtures, super-insulation, energy efficient windows and each apartment has an energy efficient ventilation system. The passive heating system does not require energy for heating under normal circumstances. The heat generated by human occupants and electrical equipment is sufficient to heat the apartments, although an efficient under floor heating system can provide additional heating if necessary. Energy saving fixtures include an award-winning tap, which must be continuously held to allow the flow of very hot water.

The building is airtight and includes 45cm of wall insulation and 80cm of roof insulation to minimise heat loss. The triple glazed windows with approximate U-values of 1.0 W/m²/K are insulated with argon and krypton and have been customised depending on how much sunlight they receive. The energy efficient ventilation systems are powered by a single exhaust duct fan, which creates a negative pressure difference that draws in fresh air into the building.

Waste heat recycling

Seglet reuses waste heat from other KBAB buildings in the neighbourhood for the water heating and under floor heating systems, which would otherwise be returned to the district heat supplier. Waste heat, at approximately 35 degrees Celsius, provides 75% of the energy needed to produce hot water for the building. The remaining energy for hot water is produced by an efficient electric heat pump.

Water efficiency

Seglet is equipped with water efficient taps and toilets, which reduce water consumption by approximately 30 percent. The building annually uses around 1000 m³, or 23 m³ per apartment.

Sustainable living awareness

The Seglet project has participated in the EU programme Energy-Conscious Households in Action, which aims to promote more sustainable living across Europe. 101 families in Karlstad took part in the programme in 2007 by increasing their awareness of environmental issues and by participating in activities such as cycling to work, recycling household waste and reducing their carbon dioxide emissions.

Renewable energy

KBAB has secured a deal for Seglet to be supplied with 100% wind-generated electricity in 2009. Seglet uses waste heat from neighbouring buildings, which is originally generated by a refuse-fuelled district heating system.

Learning From Good Practice

Innovative solutions and techniques were developed by working closely with and building upon the experience and expertise of project partners and suppliers. As part of the *several projects in one* initiative the same project team will bring their knowledge and experience to the next phase of the energy efficient residential building project in Karlstad, which intends to further improve on the progress made by the Seglet project.