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Badedammen, Norway

Case Study 17

Badedammen Vest is an energy efficient residential development in Stavanger, Norway, which sources renewable heating and cooling from a seawater heat pump 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

The Badedammen Vest residential development has been constructed close to the city centre of Stavanger, Norway. The development consists of five seafront apartment blocks, which are architecturally innovative with distinctive brick facades. Badedammen is named after an old swimming pool nearby and has contributed toward alleviating the shortage of city centre apartments in Stavanger.

Skanska Norway designed and constructed the US\$ 80 million project for Skanska Residential Building (Skanska RDN) in four stages between 2000 and 2006. The Badedammen development includes 324 apartments of varying size with a total living area of 27,000 m² for around 1,000 residents. The project involved partially extending the site into the sea and Skanska created garden and

recreational areas around the buildings and an adjacent marina with 73 moorings.

Badedammen was designed around the concept of smart living by incorporating energy efficient solutions and utilising renewable energy from the sea. Skanska established a partnership with the state owned energy company, Statoil, which financed and installed a seawater heat pump system.

Contributing Toward Sustainable Development

Badedammen is an energy efficient development that sources renewable heating and cooling from a seawater heat pump system. The project has also contributed toward sustainable urban planning by redeveloping an old inner-city industrial district and by enabling more people to live in central

Stavanger. During construction, Skanska built up long-term relationships with project partners and developed innovative construction techniques to overcome potential difficulties, such as damp and water damage. Skanska also implemented special measures to avoid building defects, enhance site safety and reduce public disturbance. The regional economy was supported during the construction by utilising local workers, subcontractors, suppliers and regionally sourced materials. Environmental impacts were minimised by recycling construction waste and using environmentally responsible construction materials.

Social Aspects

Project partner collaboration

Skanska developed the project with a core team of long-term project partners and subcontractors. The quality of staff and subcontractors was valued and was considered to be a key to the success of the project. The project team developed routines and techniques from the experience of previous stages of the project, as all five blocks were almost identical. The scheduling of deliveries, for example, was made more efficient in the later stages of the project.

Minimising public disturbance during construction

Before June 2003 the site and surroundings were entirely industrial and there were no neighbouring residents to consider. Residents were not moved into the first Badedammen apartment block until the adjacent building was completed in order to reduce noise disturbance for residents during the construction of the other apartment blocks. No complaints regarding noise were received from the new residents during the construction.

Reducing building defects

90 percent of the apartments were declared defect free and 240 apartments were completed in succession without defect in the final 3 years of the project. Defects were avoided in the final stages of the project by handing the responsibility to resolve any defects to the original workers. This policy ensured that workers were made aware of and learnt how to correct any errors resulting from their work, and acted as an incentive for the entire workforce to work conscientiously. Subcontractors improved their production processes as a result of the policy in order to avoid defects and potentially costly rework.

Occupational health and safety

No serious accidents occurred during the project and four minor site injuries were reported in total, resulting in a Lost Time Accident Rate of 6 per million hours worked. Three of the minor injuries occurred in the initial building period and one during the third stage. All workers underwent a safety induction, site safety inspections were conducted each week and safety issues were discussed in every site meeting. A zero accident initiative was implemented in the fourth and final construction stage, which involved developing greater safety awareness among the workforce, and appointing safety ambassadors to monitor and assess working practices. No accidents were reported following the introduction of the zero accident initiative.

Development of innovative construction techniques

In consideration of the heavy rainfall typical of the Norwegian west coast, the buildings were constructed from the roof downward to reduce the risk of damp and water damage during construction. Steel roof supports were developed for the project rather than wooden supports, which are typically used in construction projects in Norway. The supports enabled the roof to be constructed first and avoided structural moisture damage.

Healthy indoor environments

The Badedammen apartments promote healthy indoor environments by providing access to natural light and clean air, and by facilitating occupant environmental control. Large windows and glass balconies were used to enhance the level of indoor natural light, and many of the balconies have sea views. Each apartment is equipped with a fresh air ventilation system and low VOC materials and substances were used within the apartments to minimise indoor pollution. The smart living apartment control system enables occupants to regulate the heating, lighting and ventilation to create a comfortable indoor environment.

Sustainable urban planning

The Badedammen development reused a brownfield site and has created a new inner-city residential district with parks, recreational areas, footpaths and amenities. Badedammen is located within a 10-minute walk of the city centre and reduces the need for private vehicles. There is less than one car parking space per apartment and Badedammen has both indoor and outdoor cycle storage. Badedammen has good pedestrian access



and is located at the eastern end of the 4 km Blue Promenade coastal walking route, which has become a popular pedestrian route for residents and visitors to Stavanger.

Economic Aspects

Local construction employment

On average there were around 70 workers on the site, and 120 during the most intense periods of construction. Around 90 percent of the workforce was from the Stavanger area.

Regional materials and subcontractors

Around 65 percent of the subcontractors involved in the project were from Stavanger. Most of the construction materials were also sourced from local suppliers, although only around 15 percent of the materials were manufactured in the Stavanger area. The majority of materials originated elsewhere in Norway, such as timber, bricks and doors. Some specialist materials were purchased from abroad as they were not available in Norway, such as the prefabricated bathrooms from Denmark.

Resident energy efficiency savings

The apartments consume around a third less energy than a typical Norwegian apartment, which reduces operational costs for residents. Each apartment is also equipped with electricity meters to ensure that residents only pay for the energy they use, instead of paying a flat fee based on apartment size, which is common in Norway. The meter system enables residents to monitor and manage their energy use, and is estimated to have

reduced energy consumption in Badedammen by around 10 percent.

Heat pump instillation agreement

Skanska made a unique agreement with Statoil, the Norwegian state-owned energy company, to pay for the instillation and maintenance of the heat pump system in return for the right to sell energy to the Badedammen residents. The agreement, a first for Statoil, saved Skanska instillation costs, as the instillation of seawater heat pump systems can be expensive. The agreement also ensures that Statoil provides residents with the lowest market price for electricity, heating and gas.

Supporting first time buyers

Many of the apartments are designed to be small yet practical and are part of the Skanska You Live concept in Norway, which is aimed at younger first-time homebuyers, aged 18 to 34. Skanska Bolig also offers attractive financial packages with low monthly costs aimed at young people who want to enter the property market but who do not have a home of their own to sell.

Local economic development

The Badedammen development has contributed toward the redevelopment of an old industrial district in Stavanger by creating a vibrant and attractive sea-front residential area. The development has consequently attracted businesses and amenities into the area to serve the 324 new apartments. Badedammen also contributed toward alleviating the shortage of apartments in Stavanger. Around 80 percent of Stavanger's residents live in houses and there is a strong demand for apartments in the city.

Environmental Aspects

Environmentally responsible construction materials

Natural and renewable materials, such as timber, were prioritised for the Badedammen project. Construction materials with recycled content included bricks and the external aluminium panelling. Sections of the buildings, such as the bathrooms, were prefabricated off-site to minimise the creation of waste on site.

Waste management

During construction, waste materials such as plastic, timber and steel were recycled on site, and approximately 60 percent of construction waste was recycled in total. All apartments have individual waste sorting facilities and each apartment block has recycling facilities.

Renewable energy

The seawater heat pump system annually provides 1,500 MWh of heating and cooling energy, which amounts to around two thirds of Badedammen's total energy consumption and reduces the need for traditional fossil fuels. Badedammen's heat pump plant extracts geothermal energy from seawater in Stavanger's fjord and is connected to a water central heating system that distributes the energy within the buildings. The system is a renewable and emission-free method of providing reliable heating and cooling. Badedammen is equipped with a backup propane gas heating system to support the heat pump system when required.

Energy efficiency

Badedammen annually consumes approximately 100 kWh/m² - 20 to 40 kWh/m² lower than a typical residential building in Stavanger. The apartments are well insulated and are equipped with energy efficient under floor heating. The fresh air ventilation system transfers heat energy from the outgoing air to the incoming fresh air to reduce energy loss. The smart living system facilitates control of the lighting, heating, ventilation and the domestic appliances, and can contribute toward energy savings by disabling specific systems when not required. The system can also be pre-programmed, remotely controlled via mobile telephone or the Internet, and sensors can activate systems based on space occupancy.

Energy efficiency awareness

The Badedammen development has raised energy efficiency awareness among residents, Skanska RDN sales personnel and the wider public. All the apartments were provided with a resident

handbook, which informs residents of the energy efficient features of the building and explains how to make best use of them. Skanska RDN sales personnel underwent training on the energy efficient features of the Badedammen apartments and the related environmental and economic benefits. The Badedammen development has featured in several national and international journals, which detailed the energy efficiency features and the seawater heat pump system.

Learning From Good Practice

Skanska established a unique partnership with Statoil to install and maintain the seawater heat pump system, which provides Badedammen with renewable heating and cooling. The agreement is beneficial to all parties and ensures that residents pay the lowest price for energy.

