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Green House, Hungary

Case Study 109

Aspects of Sustainability

This project highlights the following:

Green Aspects

Energy

Carbon

Materials

Water

Local Impacts

Social Aspects

Human Resources

Corporate Community Involvement

Business Ethics

Health and Safety

Skanska Color Palette™

Energy

Carbon

Materials

Water

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The Green House is an office building in Budapest that was the first building in Hungary to be pre-certified according to LEED (Leadership in Energy and Environmental Design). The building will be certified according to the EU GreenBuilding Programme and included the first carbon footprint of its kind in Hungary.

Project Introduction

The Green House is a single-phase office development located close to the Váci Street office corridor in the 13th district of central Budapest. The 8-story building includes approximately 17,900 m^2 of leasable high quality office space. The Green House has been occupied since December 2012.

Skanska Property Hungary developed and owns the US$ 41 million office building. Skanska leases the building to various tenants and occupies one of the floors. The building has a U-shaped layout centered around an inner garden. The Green House also has a roof terrace and a three-level underground parking garage for 254 vehicles in total. The ground and first floors are fully glazed and the upper floors have a ceramic façade. The building's structure was constructed with prefabricated reinforced concrete.

The Green House project was designed to achieve LEED Core & Shell Platinum certification, which is the highest level possible, and was the first LEED Core & Shell Platinum pre-certification in Hungary. LEED is a voluntary U.S. Green Building Council (USGBC) certification process intended to encourage and guide the construction of more sustainable and energy efficient buildings. The project will be certified according to the EU GreenBuilding Programme, which is a voluntary initiative that requires buildings to use at least 25 percent less energy than national standards demand in order to be certified.

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Contributing Toward Sustainable Development

The Green House incorporates various green solutions that promote resource efficiency and reduce the building's environmental impact. The energy efficient building uses around 45 percent less energy than a conventional Hungarian office building, and is equipped with a ground source heating and cooling system and a solar hot water heating system. A carbon footprint was conducted for the building, which will be used by Skanska as a benchmark to help identify embodied carbon savings on future projects. The building uses around 50 percent less water than a conventional Hungarian office building, and includes a rainwater harvesting system and a grey water reuse system for toilet flushing. The building also has a green roof, promotes healthy working environments and is designed to promote a long useful lifespan through flexible building design. During construction, Skanska promoted health and safety, sustainable urban development and the regional economy by using local construction workers and regional materials. As the owner of the property, Skanska will continue to work with tenants to enhance occupant environmental awareness and encourage tenants to adopt LEED for Commercial Interiors certification for their own offices.

Green Aspects

Energy

Energy efficiency

The Green House is designed to annually use 72.5 kWh/m^2, which is 45 percent less than the Hungarian building code. The Green House's heating system uses around 70 percent less energy than an office building with a conventional heating system, which equates to total annual energy savings of around 2,850 GJ or around US$ 45,800. The building makes use of efficient municipal district heating and passive solar heating, through glazing and building orientation. An energy efficient low-speed ventilation system and double rotating heat exchangers were installed, which recover approximately 90 percent of the heat from outgoing air. The use of highly efficient heat recovery units avoids the need for air handling units to heat incoming air. The building's envelope is well insulated with an outer wall U-value of 0.25 W/m^{2}K, roof U-value of 0.22 W/m^{2}K and a window U-value of 1.5 W/m^{2}K, compared with the building code, which demands 0.45 W/m^{2}K, 0.25 W/m^{2}K and 2.0 W/m^{2}K respectively. Occupancy sensors activate/deactivate the valves on the radiators to optimize energy use by maintaining lower temperatures when no one is present in the space, and meeting rooms are equipped with CO_2 sensors to ensure ventilation is optimized.

The cooling system uses around 42 percent less energy than a conventional cooling system, which annually saves around 279 MWh. Chilled beams efficiently distribute cool fresh air to realize energy savings of between 25 and 30 percent compared with conventional fan coil units. The chilled beams are also steered by occupancy sensors during the cooling season to optimize energy use.

A 190 kW ground source heating and cooling system was built into the structural foundations during construction to make use of the ground under the building, which is typically between 17-21ºC throughout the year. The system includes 116 polyethylene pipe loops that are 12 to 15 m deep, and is directly connected to the heat exchangers in the air-handling units. The ground source system delivers heats or cools incoming fresh air, and provides around 5 percent of the buildings total energy needs.

The interior lighting system uses around 50 percent less energy than a conventional office lighting system, by incorporating daylight and occupancy sensors and a low power density. The building has also been designed to maximize natural daylighting to reduce the use of artificial lighting by incorporating extensive glazing and by advising tenants on office space layout. Artificial lighting intensity can be controlled locally by the tenant and remotely by the building managers.

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Solar hot water heating system

The building is equipped with a domestic hot water heating system. The system is designed to generate up to 5 m^3 of hot water per day, and is expected to annually provide 41 MWh or 55 percent of the building's total hot water requirements (including the kitchen's hot water needs).

Carbon

Carbon footprinting

The team used Skanska's Group carbon footprinting tool, which calculated the building's carbon footprint to be 8,212 tCO_2e. Emissions related to the embodied carbon of construction materials amounted to 7,341 tCO_2e, material transport to 692 tCO_2e, and subcontractor fuel, electricity and heating use to 180 tCO_2e. The carbon footprint was the first of its kind in Hungary and will be used as a benchmark to help realize carbon savings on future Skanska projects.

Operational carbon

The Green house is designed to use 57 percent less carbon than a conventional Hungarian office building, which amounts to savings of around 1,000 tCO_2e per year.

Materials

Environmentally responsible materials

Materials with low-environmental impact included structural steel made from 100 percent recycled steel, which was also sourced regionally from northern Hungary. The carpets contained 45 percent pre-consumer recycled content, and all adhesives, sealants and carpets were low-VOC (volatile Organic Compound).

Waste management during construction

The team ensured that 83 percent of construction waste avoided landfill. Skanska followed its standard waste management procedures.

Waste management during operation

The building has comprehensive waste management facilities to sort and collect all types of office waste throughout the building.

Water

Water efficiency

The Green House annually uses approximately 8,000 m^3 of water in total, which is around 50 percent less than a conventional Hungarian office

building of similar size. All fixtures and fittings installed are water efficient, including efficient toilets and low-flow taps. A rainwater harvesting system with a 68 m^3 storage tank is designed to meet the building's entire toilet and urinal flushing requirements. Treated grey water from sinks is collected in an additional 4 m^3 storage tank before feeding into the toilet flushing system.

The rainwater harvesting system feeds a landscape drip irrigation system that efficiently irrigates the site's garden.

Actual water efficiency in the Green House is thought to heavily depend on occupant behavior. Skanska consequently provides tenants with information about water efficiency to influence occupants to use less water, and will advise them to also install water efficient fixtures in their own kitchen facilities. In addition, water will be individually measured and billed to tenants to encourage the responsible use of water.

Stormwater management

The rainwater harvesting system reduces stormwater runoff, which can carry contaminants to neighboring sites and into the city's stormwater system if not properly managed. The building also has an extensive green roof, which helps to further reduce runoff by absorbing precipitation.

Other Green Aspects

Green roofing

The building is covered by a 2,551 m^2 of sedum green roof, which amounts to around half the building's total roof area. Green roofing provides additional thermal insulation and extends the roof's lifespan by protecting it from weathering and UV light. In addition, roof vegetation can provide habitats for birds and insects and filter airborne pollution.

Occupant green awareness

Skanska has created a Green Handbook for the building, which informs tenants about the green solutions installed in the building and how to use them correctly. A large screen in reception automatically calculates and displays real-time information on energy use and operational carbon emission savings. Individual tenant energy and water use will be monitored and reported to them, and tenants will be encouraged to make further savings in accordance with annual electricity, heating and water targets for the entire building.

Social Aspects

Promoting more sustainable buildings

The LEED Platinum precertified Green House is a solid foundation for tenants to pursue LEED for Commercial Interiors certification, which can optimize energy use and minimized environmental impacts in their own offices. Information about LEED for Commercial Interiors certification and how it can be achieved is included in the tenant Green Handbook.

Occupational health and safety

There were no serious accidents on site during construction and the Lost Time Accident Rate on the project was 2 per million hours worked.

Healthy working environments

The building has extensive glazing, and over 99 percent of regularly occupied areas have access to external views and around 80 percent are lit by natural light according to LEED standards. Daylight sensors, which adjust artificial lighting according to natural daylight, ensure a constant level of lighting throughout the day. The ventilation system provides 50 m^3 of ventilation per hour per person, compared with the market standard of 40

m^3, and the meeting rooms are equipped with CO_2 sensors to ensure they are optimally ventilated. Lighting and temperature LCD controls allow occupants to customize their indoor environment. The office spaces are zoned into units consisting of three or four workstations, and the lighting and temperature in each zone can be easily controlled to suite occupant comfort. The chilled beams create less noise disturbance than conventional mechanical and fan coil ventilation systems, and they promote occupant comfort by avoiding cold drafts. The landscaped inner garden and roof terrace provide tenants with outdoor space in which to relax and socialize. Vegetation has also been used extensively around the building to enhance the indoor working environment.

Flexible office design

The building is designed to be flexible to facilitate modifications for current and future tenants and to promote a long useful lifespan. The office spaces are open planned and can be easily customized to suit various floor layouts and arrangements. The floors can also be divided to accommodate multiple tenants.

Contributing toward sustainable urban development

The Green House is situated in central Budapest and has excellent access to all necessary services and amenities. The building was constructed on a previously developed site in central Budapest, and consequently did not impact upon natural habitats or greenfield space.

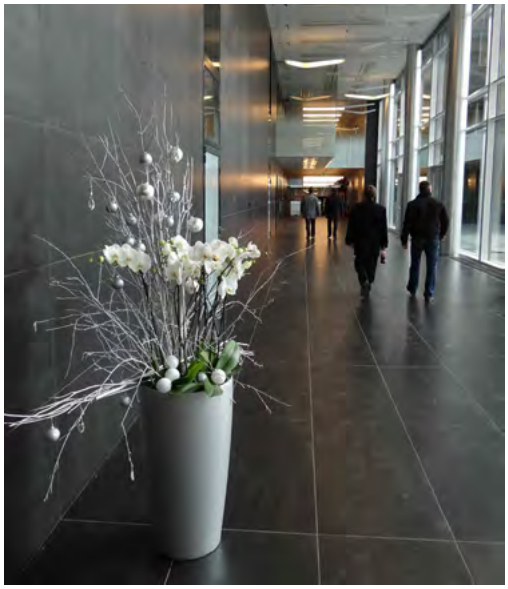
Promoting more sustainable modes of transport

The Green House offers tenants and visitors excellent access to public transport, including two light railway lines, a main metro line and several bus routes. The building has 50 bicycle racks and 8 showers that are primarily intended for cyclists. The main bicycle route to the city centre passes the building's main entrance. The underground parking includes 13 designated spaces for carpools, and two electric vehicle charging stations

Economic Aspects

Regional construction workforce and materials

Approximately 2,000 workers were involved in the construction of the Green House, and around half of the workforce was from Budapest. Many of the subcontractors were local companies, including the mechanical, electrical, façade and structural contractors. Locally sourced materials



included the steel, concrete, glass, insulation, raised flooring, gypsum boards, suspended ceiling frames and bricks.

Financial savings from efficiency measures

The team estimate that the building's initial green investment will be repaid in around five years through resource efficiency and lower operating costs, compared with a conventional office building.

Learning From Good Practice

The LEED Core & Shell Platinum certification process proved to be a useful framework for the team to design and deliver the greenest commercial building in Hungary to date.