High performance logistics centre in upper Austria

CHRISTIANE EGGER
OÖ Energiesparverband
Christiane.egger@esv.or.at

CHRISTINE ÖHLINGER
OÖ Energiesparverband
christien.oehlinger@esv.or.at

MEGAN GIGNAC
OÖ Energiesparverband
megan.gignac@esv.or.at

POPPE*PREHAL ARCHITEKTEN
office@poppeprehal.at

The Austrian company Schachinger Logistik's new logistics park in Hörsching, Upper Austria, is one of Europe's most sustainable high-bay warehouses. The 11,790 m² wood construction, called "Lighthouse 1" (LT1), complies with passive building standards. Planned and implemented by Poppe*Prehal Architekten in a time span of only one year, the project has already received various awards.

Keywords: Nearly Zero Energy Building, passive building, logistics, new build, Upper Austria, wood construction, industrial building.

High thermal quality and energy efficiency lowered the building's energy demand by 60% compared to some of Schachinger's other standing infrastructure. The project's overall investment of around 9 million Euro represents only 6% additional costs over conventionally-built similar buildings. By making building ecology, energy efficiency, job quality and cost savings equal planning pillars throughout the whole project, LT1 has become an ecological and economic flagship project in the logistics industry.

Main entrance of the office wing and delivery area.

Since its inauguration in September 2013, the logistic park has been in full function – serving as a central warehouse for Metro Österreich (Cash and Carry Wholesale), Schachinger's cooperation partner.

About Schachinger

Founded in 1939, *Schachinger Logistik*'s is an Austrian family-owned business with headquarters in Hörsching, Upper Austria. The company owns a fleet of 100 transportation vehicles and an aggregate of 400,000 m² of floor area, 200,000 m² of which are storage area.

Schachinger has an annual turnover of around 181 million Euro and employs over 500 people throughout its 15 locations in Austria, Hungary, Czech Republic, Slovenia and Croatia. The LT1 project was an initiative of Max Schachinger, one of the company's managing directors.

Project objectives and pillars

Maximum use of environment-friendly materials, high functionality and high energy efficiency were main objectives of the LT1 project. The goals were achieved through a combination of environmentally-friendly building materials, state-of-the-art technologies and the consideration of building biology principles.

Ecological building materials

Life-cycle cost analysis was made an integrated part of the project. Already in the preliminary planning phase, the project leaders worked with a specialist to define minimal requirements of all building materials that could be used in the construction. These requirements were included in all of the project's tenders. They were also considered in the selection for the professionals and companies that worked on the project. Furthermore, particular attention was paid to the choice of energy mix that would support LT1's operations.

Process efficiency

Assuring high functionality and minimising the building's future operational costs were main focal points. Applied measures include: maximum use of the building's height, optimal shelf height for palletted merchandise, aisle and corridor width tailored to individual purposes, minimised transportation distance between the loading docks and storage shelves, and the construction of an intermediate level/mezzanine to permit co-packing.

Energy efficiency

Achieving very high energy efficiency was considered as equally important as assuring smooth business operations. Storing food in logistic halls requires specific climatic conditions, namely in this case, 14–18°C and 40–60% relative humidity. The merchandise often arrives at different temperatures than that at which it is stored – resulting in significant extra heating or cooling demands. The building's design and the choice of materials and technical systems needed to maintain these parameters in spite of the location's daily product turnover of around 400 tonnes. This represented an important challenge for the architects.

LT1, which complies with passive building standards, has an energy performance indicator for heating (heating energy demand) of 8.9 kWh/m² (office wing). This was achieved through a combination of high thermal properties of the building envelope and efficient energy systems.

Interior of the warehouse with a detailed view of the wood structure.

East façade with its barcode-like appearance.

A 400 kWp roof-top photovoltaic-system will be installed in 2014. This will permit on-site generation of around 65% of the building's 510 MWh yearly electricity consumption. Purchased eco-electricity will supply the remaining 35% of the electricity demand – resulting in 100% coverage of the electricity demand through renewable sources.

Architectural design

Building characteristics

The total construction covers 11,790 m². The 9,440 m² and 14 m high warehouse can store around 20,000 pallets. It is accompanied by a 1,490 m² assembly/distribution area. The climate in the warehouse is maintained between 14–18° C and 40–60% relative humity. The building also houses 860 m² of office space in its 3-storey office wing.

The entire project, including the conceptual exterior design, is the work of the Upper Austrian architectural company Poppe*Prehal (www.poppeprehal.at). One of the building's destinctive features is the outer fassade's

barcode-like appearance – representing how barcodes are an essential part in the logistics process.

Main structure and building shell

Wood construction was chosen for wood's carbon-neutral characteristics. Untreated wood from indigenous species (spruce and silver fir) and low-carbon cement were used. The flooring has Cradle-to-Cradle® certification. The laminated timber flat roof with massive wood supports is insulated with 28 cm of mineral wool. A water-tight finishing was achieved with an EPDM foil. Outer walls were erected in lightweight timber construction and contain 24 cm of mineral wool. All windows consist of high-quality triple-glazed windows with wood-aluminium frame. As shown in the **Table 1**, U-values greatly superior to those required by Upper Austrian building regulations were achieved. Inflatable door seals at the docking stations also enabled to reach a very high airtightness (blower-door results exceed minimal requirement by 30%).

Technical systems

Cooling is partly achieved by taking advantage of natural ventilation. When outdoor conditions are suitable, the controlled ventilation automatically switches to free-cooling. The remaining cooling demand is covered through cold supplied from the groundwater by means of a heat pump (~ 70%) and free-cooling circuit (~ 30%). The free-cooling circuit permits the direct use of the already cold groundwater.

Heating demand is supplied by two ground water source heat pumps. Heat is distributed to the ambient air through trench heaters in the office wing and recirculating air heaters in the storage area.

Heat and moisture recovery through a rotary heat exchanger increases the building's overall energy efficiency and regulates the indoor air parameters – helping to prevent dryness in winter. Periodic activation of ceiling fans in the warehouse move the air and prevent temperature layering.

The building's indoor lighting system (office wing and storage hall) is mostly equiped with daylight- and demand-controlled LED lamps. The use of LED-technology helps minimise the building's cooling demand. Windows are equipped with automatic blinds.

Interior finishing

The company's vision of an environmentally and worker friendly construction did not stop at the building shell and technical systems. The interior installations and design were also thought out for their energy efficiency and user friendliness. All working stations were designed according to ergonomic and EPD (Environmental Product Declarations) criteria. The height-adjustable tables and stools were purchased from regional producers. Numerous windows permit employees to enjoy the surrounding landscape and follow natural daylighting phases, the interior colour-scheme follows Feng Shui design and waterless and CO_2-neutral-produced urinals were installed in the washrooms.

Table 1. U-values of LT1 and, in comparison, the minimum legal building requirements. (Oö. Bautechnikverordung 2013)

	U-Value [W/m²K]	
	LT1	**Legal building requirements**
Exterior walls – warehouse	0.14	0.35
Exterior walls – office wing	0.185	0.35
Roof – office wing	0.141	0.20
Windows – office wing	0.84	1.70

Energy savings and investments cost

The construction and design of LT1 permits significant energy- and CO_2-savings. Its energy demand (prorated to building area) lays 60% below that of Schachinger's conventionally-built building in Stockerau (built in 2008). The new building is also completely supplied by renewable energy sources. Overall, this represents a saving of approximately 400 tonnes of CO_2 per year.

Overall investment cost, including planning, construction and interior installations amounted to around 9 million Euro. In spite of the building's extensive NZEB measures, this represents only 6% additional costs (when compared to the construction costs of Schachinger's most recent conventional building with similar layout).

Conclusion

LT1 has become an ecological and economic flagship project in the logistics industry. It demonstrates that high energy-efficiency is achievable in large-scale industrial construction. Requiring only 6% higher investments costs than a similar conventional construction, this project is an example of how long term energy and CO_2 savings can be ensured with little additional investment costs. The project was awarded, among others, the 2014 Upper Austrian Energie-Star – the Upper Austrian award for sustainable energy projects. ■