DK_Copenhagen N_Green Lighthouse

Image 01: Front view ©Adam Mørk	**Image 02:** Terrace on the top floor ©Adam Mørk	**Image 03:** Atrium with staircase ©Adam Mørk
		

Building Specifications

Address	Tagensvej 16, 2200 Copenhagen N, Denmark
Building Category	Education
Year of Construction	2009
Special Qualities	Denmark's first CO2 neutral public building
Location	56° northern latitude, 13° eastern longitude, in highly densed urban area. The building is surrounded by other educational buildings of approximately the same size
Climate	Cfb (warm temperate climate, moist with adequate precipitation in all months and no dry season, warm summer with the warmest month below 22°C)

Vent. Cooling Site Design Elements (Solar Site Design and Wind Exposure Design, Evaporative Effects from Plants or Water)

n/a

Vent. Cooling Architectural Design Elements (Form, Morphology, Envelope, Construction &Material)

Form: Three-storey cylinder shape building with a single slope roof facing south. There is a west facing terrace placed on the top floor.

Morphology: Internal core of the building is used for supporting the central staircase and serves as a stack for natural ventilation system

Envelope: Energy efficient windows (U – value of 1.0 to 1.1 W/m^{2}K). Automatic external solar screening, which is following the path of the sun, is installed on the windows

Construction: Heavy mass construction

Vent. Cooling Technical Components (Airflow Guiding Components, Airflow Enhancing Components, Passive Cooling Components)

Airflow Guiding Components: Air supply for the comfort ventilation is provided by electrically operated windows (natural ventilation). The air exhaust is ensured by electrically controlled roof windows in the atrium. Night ventilation is performed by opening automated windows using the stack effect created in the open staircase located in the building centre.

Actuators, Sensors and Control Strategies

Chain actuators operate façade windows and roof openings. The windows are controlled depending on every zone's individual needs.

The solar shading is automatically controlled by presence detectors and lux sensors located in the rooms in interaction with the artificial lighting. Room sensors for temperature, CO2 concentration.

Outdoor sensors for temperature, humidity, CO2, wind, rain and irradiation

The building is using NV Advance™ control system to control natural ventilation, mechanical ventilation, solar shading and lighting.

Building Energy Systems (Heating, Ventilation, Cooling, Electricity)

Energy system of this building is a combination of geothermal heat pump, solar thermal collectors, district heating, solar cooling, solar cells, and seasonal storage of heat in the underground.

Heating in the building is provided by a geothermal heat pump, solar thermal collectors and district heating connection. Surplus heat from the solar collectors produced during the summer period is stored in underground heat storage for later use during the cold season.

The thermal solar collectors on the roof of the building and underground heat storage ensure 35% of heating energy. The rest 65% of the heat is received from a combination of district heating and the heat pump, where the heat pump accounts for 30% of the heat produced. Thermo-active slabs (heated floors) heat the internal space of the building. The slabs can also be used for space cooling if night cooling is not efficient enough

76 m2 of PV solar cells on the roof of the building cover the building's base needs for lighting, ventilation, pump operation, etc.

Energy efficient lighting solutions based on LED technologies

Building Ownership and Building Facility Management Structures

The building is occupied by the University of Copenhagen.

Architect: Christensen & Co Architects

Acknowledgements

The building was part of the VELUX model home 2020-research project. Extensive monitoring has been carried out.

Datasheet Source:

Velux Danmark A/S, WindowMaster A/S