


# Green Lighthouse

by Ida Bjørn-Mortensen / 2015-06-22 09:17:31 / International / 15594 / EN

New Construction



**Primary energy need :**

3 kWhpe/m<sup>2</sup>.year

(Calculation method : Other )

**ENERGY CONSUMPTION**

*Economical building* *Building*

< 50	A
51 à 90	B
91 à 150	C
151 à 230	D
231 à 330	E
331 à 450	F
> 450	G

*Energy-intensive building*

**Building Type** : Office building < 28m  
**Construction Year** : 2009  
**Delivery year** : 2009  
**Address 1 - street** : 2200 KøBENHAVN N, Denmark  
**Climate zone** : [Cfb] Marine Mild Winter, warm summer, no dry season.

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**Net Floor Area** : 950 m<sup>2</sup>  
**Construction/refurbishment cost** : 5 000 000 €  
**Number of Work station** : 37 Work station  
**Cost/m2** : 5263.16 €/m<sup>2</sup>

**Certifications :**




**Proposed by :**



## General information

Green Lighthouse is Denmark's first public carbon-neutral building. The building has been built in less than a year in a close public/private partnership.

Green Lighthouse is an energy-efficient building of great architectural merit, with a high influx of daylight. Inspired by the sundial and the movement of the sun around the building, Green Lighthouse plays on the sun as a source of energy and on its role in science. As sustainable as it is healthy, Green Lighthouse relies on district heating, solar cells, solar heating and cooling, seasonal storage and innovative architecture to create a gorgeous, CO<sub>2</sub>-neutral building.

The partners behind the building both from the public and the private sphere. They are the University of Copenhagen, VELUX, VELFAC, the Danish Building and Property Agency (UBST) and the City of Copenhagen.

## See more details about this project

[http://www.velux.com/sustainable\\_living/demonstration\\_buildings/green\\_lighthouse](http://www.velux.com/sustainable_living/demonstration_buildings/green_lighthouse)

<http://www.greenlighthouse.ku.dk>

## Stakeholders

### Stakeholders

Function : Designer

Christensen & Co Architects

Michael Christensen

<http://www.cco.as>

Function : Contractor

Hellerup Byg

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Function : Other consultancy agency

COWI

Peter Lawaetz

<http://www.cowi.dk>

Energy design

Function : Others

Municipality of Copenhagen

Anne Skovbro

<http://www.kk.dk>

Strategic Partner

Function : Others

University of Copenhagen

Lykke Friis

<http://www.ku.dk>

Strategic partner & Building Owner

### Contracting method

Public Private Partnership

### If you had to do it again?

We commissioned the first year into the turnkey contract, this was a good experience. For next projects, it should be commissioned for 3-5 years.

### Building users opinion

Very good indoor climate, cf interviews made for "Green Buildings Pay" book written by Brian Edwards & Emanuele Naboni, ed. 3, Routledge

## Energy

### Energy consumption

Primary energy need : 3,00 kWhpe/m<sup>2</sup>.year

Primary energy need for standard building : 60,00 kWhpe/m<sup>2</sup>.year

Calculation method : Other

Breakdown for energy consumption : 14 heating;

8 lighting;

5 ventilation;  
3 hot water;  
27 production - solar thermal & PV

## Envelope performance

Envelope U-Value : 0,08 W.m<sup>-2</sup>.K<sup>-1</sup>

More information :

prefabricated; thermoactive slabs ground and first floor

Building Compactness Coefficient : 0,60

Indicator : EN 13829 - n50 » (en 1/h-1)

Air Tightness Value : 0,74

[report from COWI consultants](#)

## Real final energy consumption

Real final energy consumption/m<sup>2</sup> : 44,00 kWhfe/m<sup>2</sup>.year

Year of the real energy consumption : 2 010

## Renewables & systems

### Systems

Heating system :

- Urban network
- Heat pump
- Others
- Solar thermal

Hot water system :

- Urban network
- Heat pump
- Solar Thermal

Cooling system :

- Solar cooling

Ventilation system :

- Natural ventilation
- Double flow heat exchanger

[WindowMaster control system](#)

Renewable systems :

- Solar photovoltaic
- Solar Thermal
- Energy recovery from waste

Renewable energy production : 90,00 %

[district heating in CPH is partly carbon-neutral](#)

Other information on HVAC :

heat pump from Sorttech, fluid/fluid, connected to the grid, and to a seasonal storage

Solutions enhancing nature free gains :

heat pump COP 1,6 on district heating

## Smart Building

BMS :

Window Master system combined with BMS classic

Users' opinion on the Smart Building functions : Easy and adaptive - works from every work station

## Environment

## Urban environment

High density, inner urban Copenhagen

Land plot area : 1 000,00 m<sup>2</sup>

Built-up area : 20,00 %

## Products

### Product

Heat pump and seasonal storage and district heating in combination

Product category :

heat pump designed for solar cooling, used reverse; taking in hot water from the roof - solar thermal, by use of seasonal storage from summer to winter, and then adding the district heating. <http://www.sortech.de/en/>

worked well - only few problems with vacuum

## Costs

### Construction and exploitation costs

Cost of studies : 50 000 €

Total cost of the building : 5 000 000 €

### Energy bill

Forecasted energy bill/year : 2 000,00 €

Real energy cost/m<sup>2</sup> : 2.11

Real energy cost/Work station : 54.05

## Health and comfort

### Indoor Air quality

Based on the relative comfort principle, according to EN 15 251. User is connected to outdoors visually, and also in terms of comfort. During winter, the IAQ is stable based on mechanical ventilation and heat exchange, during summer the users enjoy natural ventilation, combined with night cooling.

### Comfort

**Health & comfort :** The architectural concept of the house is the sun dial; the house follows the sun, also by its window design, where the facade windows and exterior sunscreening follow the path of the sun. The users can follow the seasons changing, and adapt the indoor climate individually. The house is flooded with daylight on all floors, and there is a "cathedral effect" through the central atrium, where users benefit from a 2500+ lux experience, to benefit their well-being and productivity.

Calculated indoor CO<sub>2</sub> concentration :

700 ppm

Measured indoor CO<sub>2</sub> concentration :

650 ppm in average

Calculated thermal comfort : Class 2 in EN 15251

## Carbon

### GHG emissions

## Context

### Building candidate in the category



Health & Comfort



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