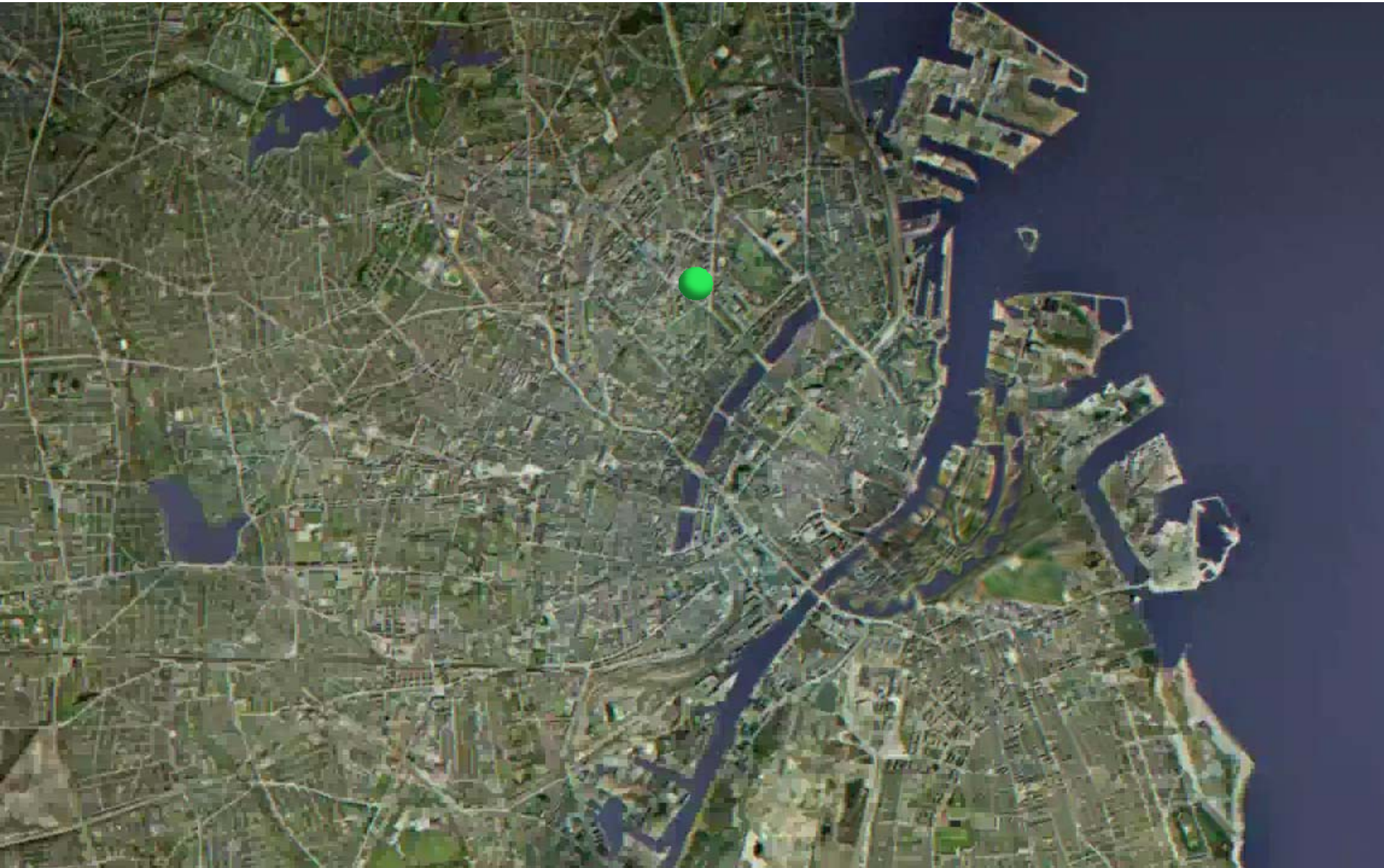
DECEMBER 2009

GREEN LIGHT HOUSE

TAGENSVEJ 16



STRATEGIC PARTNERSHIP

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TIMELINE

December 2007	Formulation of strategic partnership Targets & Objectives
March 2008	Public notification, signing of partner contract Competition on project Green Lighthouse
July 2008	Winning project announced Elaboration & programming
October 2008	Cutting first turf Work planning & initial construction
May 2009	Topping out
October 2009	Grand Opening, public visits Users moving in early November

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VELFAC

Green Lighthouse

STRATEGIC PARTNERS - ROLES

The Ministry of Science, Technology and Innovation is developer and owner of Green Lighthouse. The Ministry has managed the construction process and participated in setting requirements for the energy concept and architecture of the building.

The University of Copenhagen has been one of the initiators of Green Lighthouse and has participated in the entire construction process. Green Lighthouse is part of the University of Copenhagen, and students and researchers of the university will be the daily users of the house.

The City of Copenhagen has participated as an active partner in the process. The close and precise dialogue between the City and the owner in an early phase has optimised the case handling process.

VELUX and VELFAC are vision partners in Green Lighthouse and have contributed with expert competencies, technologies and products that have had a crucial impact on energy balance and indoor climate of the building. VELUX has also been project manager of the steering committee.

PARTNER MOTIVATIONS

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The University of Copenhagen is proud to see the construction of a climate friendly house of the future. Sustainability is a crucial element in campus planning and Green Lighthouse is an innovative and noticeable example. The house is to be the home of, among others, study administration, a Faculty Club, meeting facilities and students' service. This sets high demands for functionality, and it is interesting to combine these factors with the aspect of climate-friendliness.

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Green Lighthouse is part of the new energy strategy of the Ministry of Science, Technology and Innovation which will turn university buildings into zero-carbon houses. As the largest building owner of the country the Ministry of Science, Technology and Innovation and the responsible University and Property Agency can contribute to setting the standard for green building of the future. Knowledge gathered under the Green Lighthouse project can be used in building projects of the future and contribute to the construction sector's knowledge bank in this field. At the same time the aim is to inspire others into zero-carbon construction thanks to a project uniting beautiful architecture and zero carbon in an exquisite manner. This is a responsibility we gladly take upon us. Therefore, the Ministry will soon launch an ambitious energy strategy comprising, among others, the objective that our entire building stock will be zero-carbon in 2028.

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With an ambitious climate plan the City of Copenhagen has launched the wish to make Copenhagen zero-carbon by 2025. This also means that Copenhagen should be a frontrunner within sustainable urban development. The UN Climate Summit in December 2009 will give the City a unique opportunity to raise our profile as one of the ‘environmental lighthouses’ of the world. A city at the cutting edge of new technology and sustainable urban development. Green Lighthouse is an eminent source of inspiration for contractors of the future and the City of Copenhagen has therefore chosen to support the project actively. The close and precise dialogue between the City and the owner in an early phase has optimised the case handling process.

PARTNER MOTIVATIONS

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VELUX has launched a vision for sustainable houses of the future – a concept named Model Home 2020. The aim is a zero carbon house with an optimal indoor climate, fresh air and natural daylight. Green Lighthouse is one of a total of six houses in Europe under Model Home 2020. Each house is an experiment reflecting and responding to various conditions such as climate, architecture and daylight. VELUX supplies six different products to the house – products that VELUX sells today. This shows that with the products we carry already today it is possible to build climate friendly houses of high convenience.

VELFAC

As a player in the construction sector VELFAC considers it a responsibility to contribute to development of new energy-optimised products and construction principles. VELFAC wants to show the way and find opportunities in the development of future energy-correct and holistic building. Therefore we have chosen to test concepts in real-life construction. VELFAC has developed the concept of Home for Life: the energy-producing house of the future where energy, comfort and aesthetics go hand in hand. A house producing more energy than it consumes and where life, light and air are reflected in the energy concept and architecture of the house.

FUNCTION

Green Lighthouse first and foremost belongs to the students. It is a kind of a one-stop-shop: The Faculty of Science is now organised in a way that students must only call in one place to find answers to study-related questions. Therefore, ground floor and first floor will be home of the students' service where students can be assisted with all issues ranging from career planning to deadlines and exams.

On the ground floor an information booth will be located for reception of students and answering of questions. There will also be a small meeting room for common guidance and information events. First floor will be the workplace of staff engaged with students' service. It will also be home of the editorial offices of the website relating to students' service.

Second floor will have a Faculty Lounge where researchers and others connected with the house can meet and network.

The house will have a staff of 19, of which 3 are student assistants.

PROGRAMME FOR GREEN LIGHTHOUSE

The building design should optimise wellbeing for those working and staying in the house. Rooms and light should be attractive, a preferred place to stay creating a good setting for daily functions, events and visitors. The building should have a clear identity, be easily comprehensible and comfortable to use for students seeking guidance as well as for staff and visitors seeking a break or a distraction during a busy day. The building should be open and inviting and have a high level of transparency, making activities visible from the outside.

The building volume should be designed to make it stand out and not seem squeezed by the large neighbouring houses. Daylight and location, fitting and proportions of roof and facade windows should be integrated into the building as an active and central design element just as the design of the house should promote the inclined roof as an active element in the energy design.

The interplay between daylight, artificial light, spaciousness and materials must be dealt with in an innovative manner, both in relation to the functions of the rooms and to the aesthetic experience.

ARCHITECTURAL RESPONSE

Green Lighthouse is a healthy and sustainable house; it is high-ceilinged with open, spacious and roomy coherences. From an architectural point of view the house has been inspired by the sundial and the movements of the sun around the house. The design underpins that the sun is an important topic in science and not least that the sun is one of the most significant energy sources in Green Lighthouse.

The round shape of the sculptural building creates a natural meeting place on campus and the circle is furthermore the most suitable form for a building in terms of energy, where architectural, structural and technical measures interplay in a holistic design ensuring that Green Lighthouse has extremely low energy requirements and that a large part of these requirements are covered by solar energy. The inclined roof collects daylight and the roof surface is also the power plant of the house where solar energy is captured by both solar panels and solar cells.

The building is organised around an inner, light atrium forming the social hearth of the house and uniting staff and visitors under a soothing roof light. This room is also necessary to ensure that the natural ventilation of the house works: fresh air is taken in at the facade, sucked through this room and exhausted through the roof windows at the top.

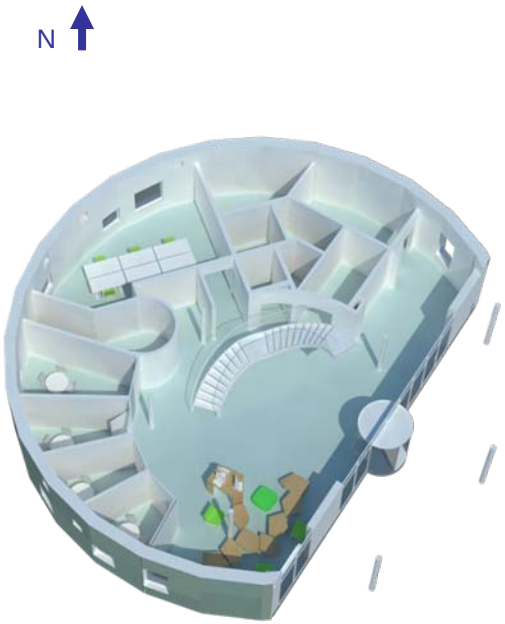
INTEGRATED DESIGN PROCESS

- Architects, engineers, client programme, components producers
- Workshops integrating common knowledge at the first project stages, resulting in:

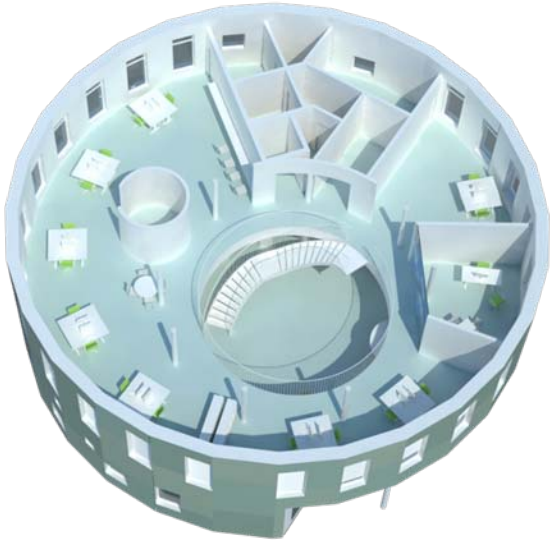
Contribution from design measures with 70% of energy savings in Green Lighthouse

- Building geometry - compact
- Site orientation
- Building envelope – insulation and screening
- Passive solar heat
- Passive accumulation of heat and cooling in construction
- Natural/hybrid ventilation
- Daylight
- LED lighting with daylight control
- Energy efficient mechanical ventilation

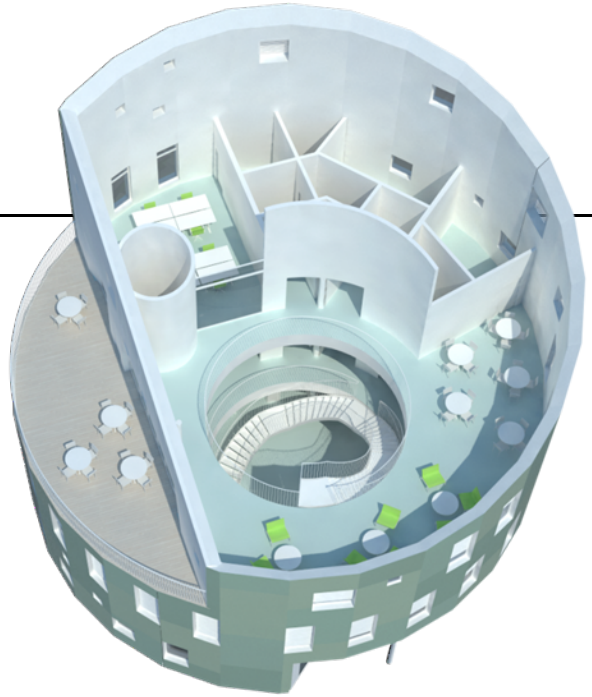
FUNCTIONS



GROUND FLOOR
student lounge and
interview rooms



1. FLOOR
office workspaces and
managers office



2. FLOOR
Faculty Lounge
and roof terrace

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DAYLIGHT AS ENERGY SAVING STRATEGY

Programme requirements:

A daylight factor above 5% is perceived as a well lit room where artificial lighting is normally not needed during the day.*

Requirements for the daylight factor in Green Lighthouse are at least 3% for all permanent workplaces and at least 2% for corridors. Overall, daylight is meant to be the primary light source and is part of the strategy for energy efficiency.

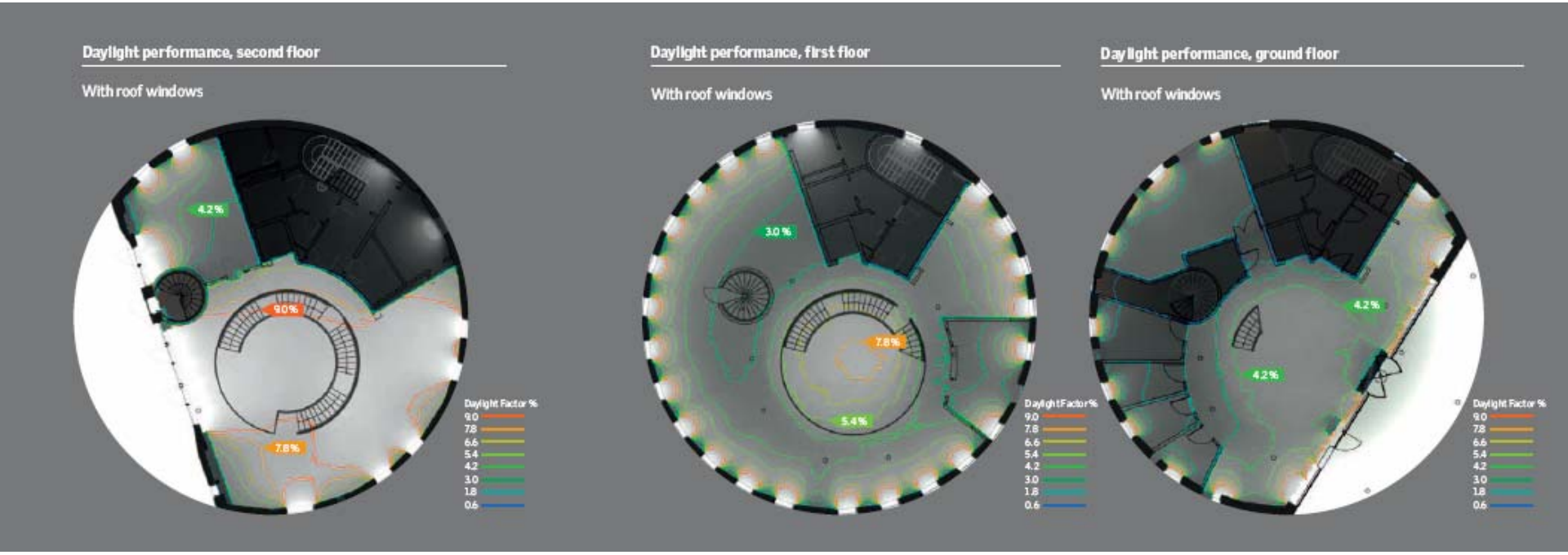
Calculations (using the Radiance programme) have documented that the daylight factor is complied with; in most areas the level of daylight is higher.

At a daylight factor of less than 2% artificial light is necessary and will dominate the room.

* Tregenza and Loe in The design of lighting (1998)

DAYLIGHT DOCUMENTATION

Daylight calculations, made in Radiance



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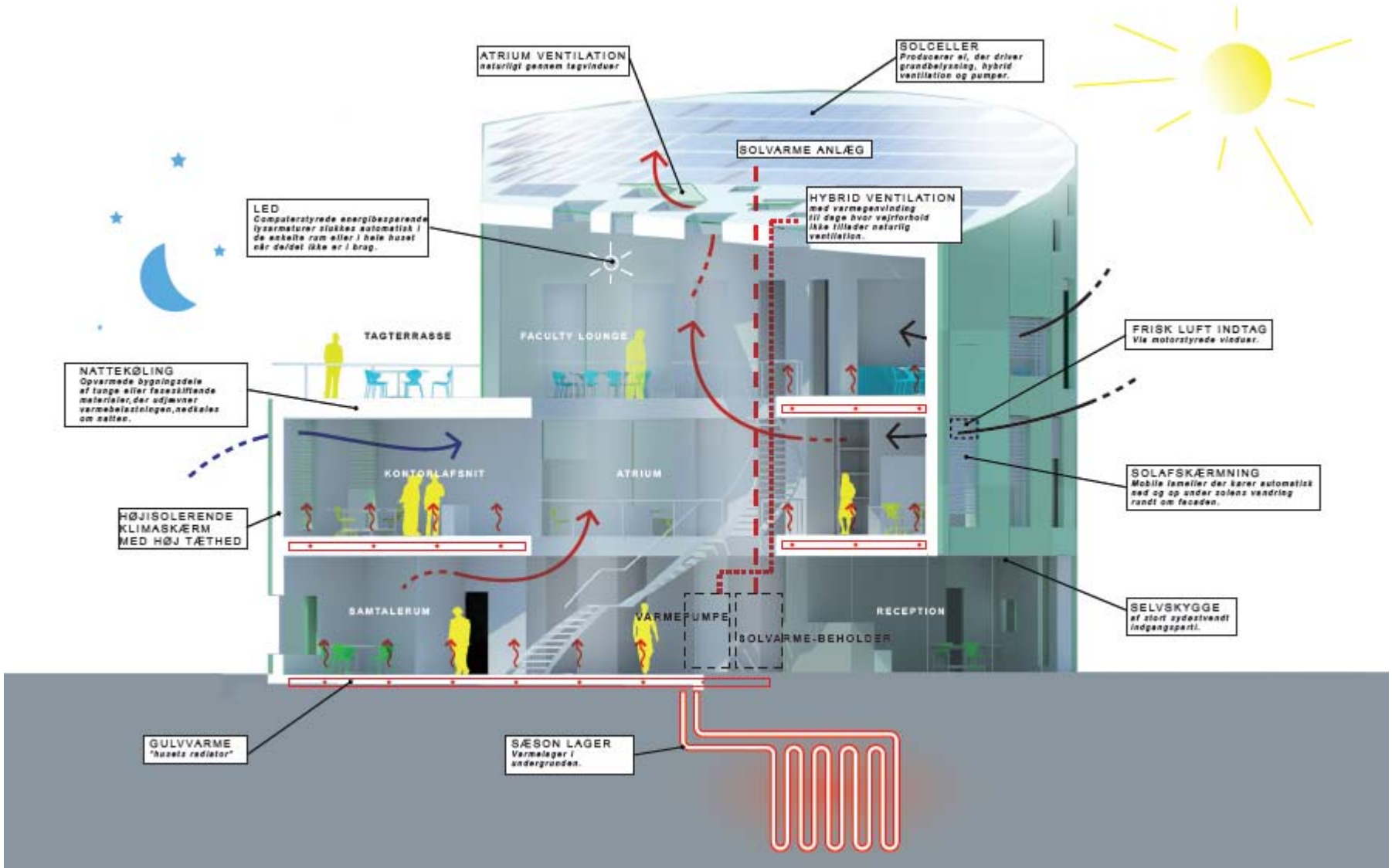
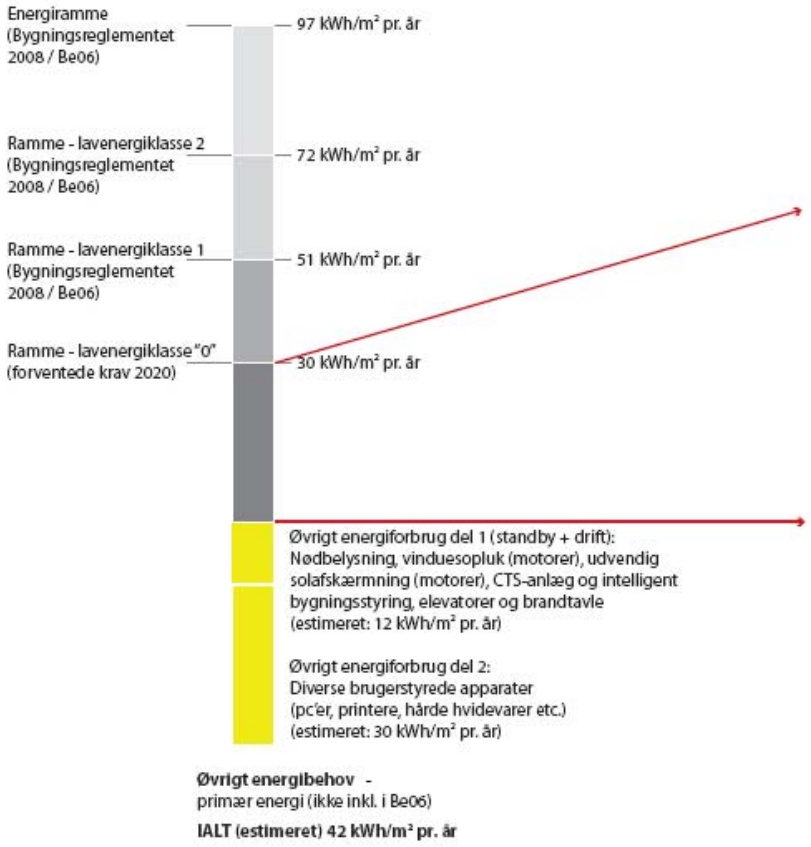
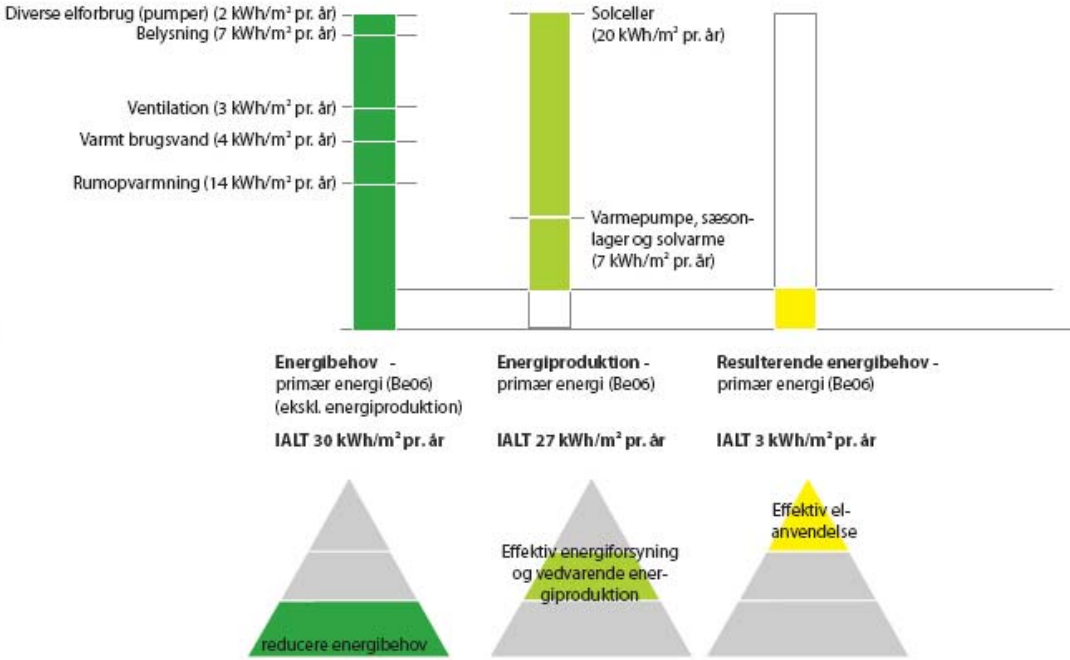
ENERGY CONCEPT PRINCIPLE



ENERGY CONCEPT

Ved beregning af el-forbrug og –produktion anvendt faktor 2.5, som foreskrevet i BE 06. ved udregning af CO2-neutralitet er der anvendt faktor 1 ved såvel forbrug som produktion.





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ENERGY CONCEPT

The aim of the energy concept is to make Green Lighthouse a zero-carbon house.

Green Lighthouse will host a novel experiment with an energy concept consisting of a combination of supplies from district heating, solar cells, solar heating and cooling as well as seasonal storage.
This energy concept, developed by COWI, consists of a novel solution where district heating is used to operate a heat pump. Using district heating instead of electricity gives lower CO2-impacts. Further, district heating ensures a far more efficient energy utilisation. The energy concept ensures optimum use of renewable energy sources and this interplay means that the concept uses the sun for both cooling in summer and for improved heat pump operation in winter. In the concept solar heating energy is used by utilising solar heating from south-oriented windows, for floor heating and seasonal storage in the ground. A heat pump ensures that solar heating, ground heating and cooling circulate in the building. In this way optimum utilisation of district heating is attained, since it is only used when there is no solar heat on stock.

ENERGY BENCHMARKS

In Europe around 40% of total energy consumption is used for operation of our houses. The houses we construct are solid and have a very long useful life; this means that each year only around 1-1.5% of our building stock is replaced. More focus on energy consumption has led to political restraints so that the Building Code today requires that new commercial buildings must not use more than 95 kWh/m2/year (primary energy) for operation. In the Building Code (BR08) low energy classes 1 and 2 have furthermore been introduced; a class 1 building uses less than 50 kWh/m2 for operation (explanation: low energy class 1 is the best low energy class in the Building Code). In 2020 requirements for energy consumption in a new commercial building are expected to be further tightened. Requirements in 2020 will probably be at no more than 30 kWh/m2/year.

This frame for future building has been the starting point of defining the objectives for the energy consumption in Green Lighthouse. The energy consumption in Green Lighthouse for operation is far below the expected frame for new commercial building in 2020 – and thus also significantly below the frame for low energy class 1 (the building will only use around half of the frame for low energy class 1). This energy statement is to be understood before including energy supply from the solar cell facility of the building, which means that Green Lighthouse has a zero-carbon building operation (Be06). Further electricity consumption for equipment such as PCs etc. is not covered by the energy frame of the Building Code and therefore not included in the above. Various equipment is selected on the basis of a demand for highest possible energy savings.

HEATING

Heat supply in Green Lighthouse is expected to consist of the following energy sources:

• 35 percent energy from solar energy deriving from 30 m2 solar panels on the roof and sun stored in the ground through a heat pump,
• 65 percent is eco-friendly district heating, which has today a share of renewable energy of around 35 percent. The share of renewable energy in district heating is expected to double in the next 15-20 years (2025-2030) up to around 70 %. The heat pump increases utilisation of district heating by around 30 percent.
• The major part of electricity for lighting, ventilation and pumps in Green Lighthouse comes from 76 m2 solar cells on the roof.

The price of district heating consumption is around DKK 11,500/year (approx. 1,500 Euro) with current rates (including permanent fees).

The heating demand is 14 kWh/m2/y.

ENERGY PRODUCTION

Heat Pump: All heat runs through the heat pump which is run by district heating, solar panels or heat storage. In this way, heat produced from the heat pump becomes a mix of district heating and heat extracted from the surroundings (ground storage and solar panels). 75 % of the heating requirements for room heating is covered by the heat pump and 25 % is covered by pure district heating.

Solar Panels: It is an assumption in the energy calculations under Be06 that the 30.8 m2 solar panels on the roof with the given inclination produce around 4250 kWh (4,5 kWh/m2/year), which is used directly to cover the needs in the house (heat and hot supply water). In a longer term perspective it is expected that the solar panel facility can produce a further 3500 kWh (3.7 kWh/m2/year) of which the major part can be stored in the ground storage or used in connection with convenience solar cooling.

Solar Cells: The solar cell manufacturer guarantees a minimum production of the facility of 7587 kWh of electricity, converted to 7587 kWh x 2.5 = 18967 kWh (20 kWh/m2/year) of primary energy. (Electricity production from solar cells is converted to ’primary energy’, allowing for a comparison with electricity requirements of the Be06 calculations. In Be06 electricity requirements are converted into ’primary energy’ by multiplying them with a factor 2.5).

ENERGY PRODUCTION

Share of renewable energy?
Today, the share of renewable energy in the district heating supply of Greater Copenhagen attains around 35 %.
http://www.ke.dk/portal/page/portal/Presse/Pressemeddelelser?thingid=1090036&portlet_inst_guid=C51200087C764E97B463C4DEB0EC33FB&page=362

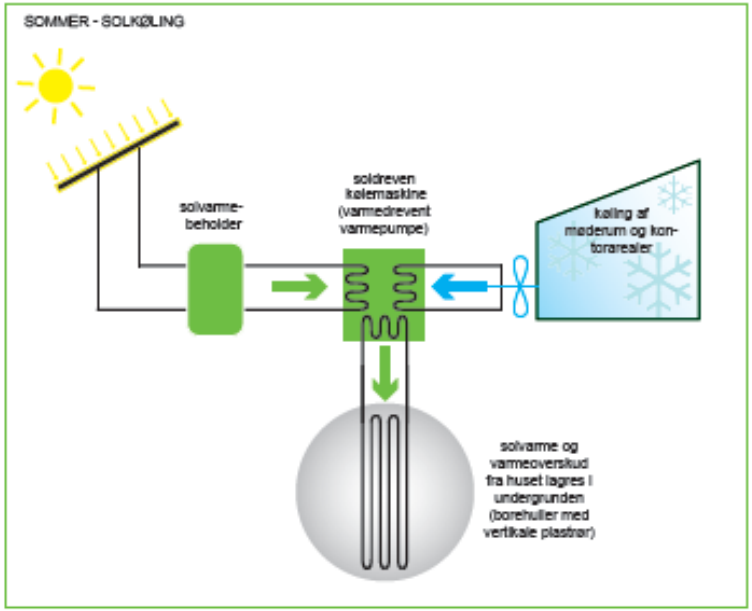
The share of renewable energy in the grid in Denmark attains around 20 %. The preconditions appear from this quote: *"So far, production has adapted to consumption and at the same time we have succeeded in integrating a relatively large share of renewable energy in the electricity system (21 % today). This is only possible because traditional power plants work as a backup supplying power when the wind is not blowing and the windmills do not produce power. At the same time Denmark has exploited the opportunity to export renewable energy-based power when the wind blows too heavily and the windmills produce more power than we can use domestically."*
http://www.danskenergi.dk/Vi_Mener/Vedvarende_Energi/Integration.aspx

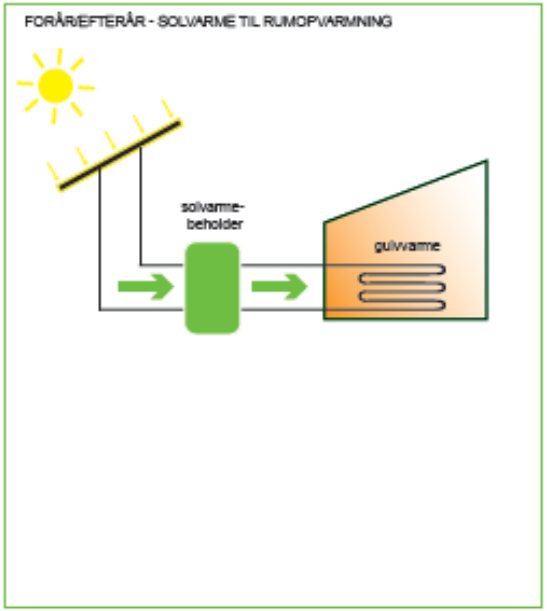
ENERGY PRODUCTION

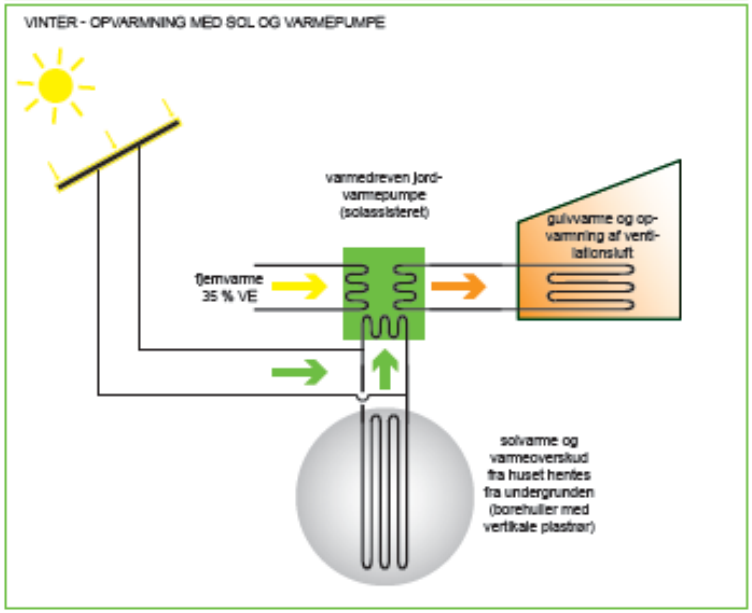
Balance in Energy Performance ?
Cf. the Be06 statement of energy consumption Green Lighthouse must have an annual supply of 11,465 kWh of district heating and 11,900 kWh of electricity in primary energy. If the building had not been equipped with solar panels and heat pump the heating requirement would have been at around 18,240 kWh of district heating.

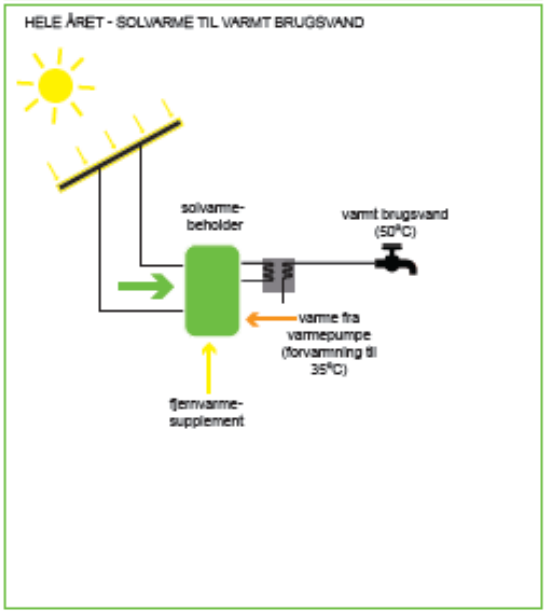
District Heating requirement / costs + kWh / year ?
There is a requirement for 11,464 kWh of district heating annually in Green Lighthouse. According to Copenhagen Energy the price of one kWh of district heating is DKK 0.56 (incl. VAT) (cf. below source). So district heating consumption costs around DKK 11,500/year in Green Lighthouse including fees. (Cooling fee 1000 DKK, permanent fee 4000,- yearly.
(http://ke.mondosearch.com/cgi-bin/MsmGo.exe?grab_id=0&EXTRA_ARG=&CFGNAME=MssFind.cfg&host_id=42&page_id=445&query=fjernvarmepris&hiword=FJERNVARMEPRISEN%20FJERNVARMEPRISER%20).

PRINCIPS









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ZERO-CARBON BUILDING

Zero carbon is a concept that has not been defined in any national or international standard. Grass root organisations and industrial sectors have understandings of the concept, which are however of very diverse nature. In theory, the zero-carbon concept should cover a complete cradle-to-cradle analysis including energy consumed for manufacture, demolition and recycling of construction materials as well as transport to and from the construction site.

Such holistic calculation of zero-carbon building is very complex and subject to major uncertainty. Therefore, this holistic criterion has not been used as the definition of zero carbon in the Green Lighthouse project.

When the construction sector uses the term zero carbon building it covers energy consumption for operation of the building. Zero-carbon in building operation covers in the Green Lighthouse project building operation energy calculated with the Danish energy frame calculation tool (Be06).

The zero-carbon building definition is based on calculated energy consumption for building operation (BE06). Subsequently, associated CO2-emissions are compensated by installation of solar cells. For the Green Lighthouse project CO2-emission values are used cf. Environmental declaration 2007, which was in effect at the start of the project.

Source: COWI

TECHNICAL SPECS

U (roof):	0,084 W/m2K
U (outer walls):	0,095 W/m2K
U (floor slab):	0,085 W/m2K
U (roof terrace):	0,13 W/m2K
U (corbel at entrance):	0,106 W/m2K

FACADE MATERIALS

The facade of Green Lighthouse is constructed with Swissfiber – a composite material consisting of 30 % glass and 70 % polymers. In its simplest form a composite material consists of two components having together stronger qualities than each component by itself. This gives composites a number of features that are difficult – in some cases even impossible – to match with traditional materials such as glass, steel, aluminium or wood. Due to their low weight, high strength and large plasticity composites are today widely used in car, boat and aircraft manufacture. But thanks to their plasticity, durability and low thermal conductivity composites have a large potential to create new form languages in architecture.

In principle you may say that the facade of Green Lighthouse is composite version 1 – soon composites may be delivered based on natural polymers from for instance maize starch and other natural substances. The facade of Green Lighthouse is extremely light and strong and the entire house coating only has a weight of 6 tonnes. In comparison, a tile mantle would have weighed more than 175 tonnes and the higher wall thickness would have occupied space and caused a thicker outer wall.

CCO Architects

INDOOR CLIMATE SOLUTION

Indoor climate in Green Lighthouse is controlled with a NV Advance™ solution supplied by WindowMaster A/S. Total indoor climate supply covers a large number of components, including:

- Chain motor opening and closing windows.
- Temperature, CO2, light and movement sensors.
- Rooftop weather station registering outdoor temperature, wind speed and direction, sunshine and rain.
- Pushbutton operation for individual opening and closing of windows.
- Two information screens – one on ground floor and one on second floor.

The intelligent control solution – NV Advance™– ensures that the least energy consuming energy form is used at any time in the building; this is done through continuous measurements of room temperature, CO2-level, light level and outdoor data from the weather station. Based on these data the NV Advance™ system controls the different facilities in the building by ensuring, for example:

- ventilation of the building in the major part of the year merely through automatic control of windows. The windows are controlled individually in the different rooms/spaces depending on the need for ventilation and fresh air
- change to mechanical ventilation with heat recovery on very cold days. On hot days cooling is ensured in the large meeting rooms
- control of exterior sun screen depending on need for light in building and on sunshine
- heating only on days when it is needed, and lowering of heat when there is no one in the building
- switching on of electrical light only when there is not sufficient natural light in the building and only in occupied rooms.

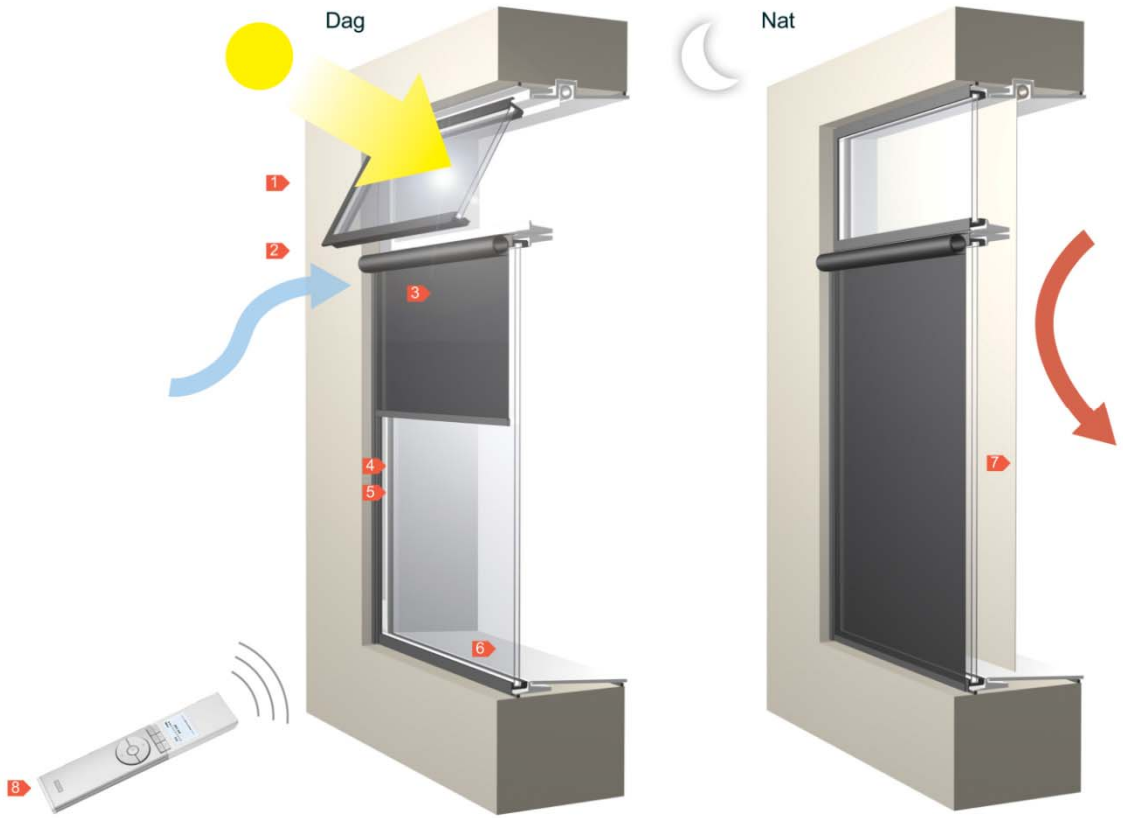
On the two information screens users and visitors can follow energy consumption in the building and energy production in the building's solar cell plant, solar heating plant, seasonal storage and heat pump.

FACADE WINDOWS

VELFAC Helo Panes in Green Light house						Window values	
Window type	**Pane thickness**	**Pane construction**	**Spacer**	**Ug (argon)**	**G-value**	**UW (W/m2K)**	**Eref**
Iplus Neutral 3E (clear/clear)	36 mm	4-12-4-12-4	Termex Spacer	0,72	50	0,93	2,07
ClimaTop Stapid Max (clear/clear)	36 mm	3-0,38-3/10/4/10/3-0,38-3	Swisspacer	0,85	58	1,04	5,5

VELFAC 200i i Green Lighthouse (Hypothetical)						Window values	
Window type	**Pane thickness**	**Pane construction**	**Spacer**	**Ug (argon)**	**G-value**	**UW (W/m2K)**	**Eref**
VELFAC Clear Energy	24	4-16-4	WE	1,11	0,62	1,4	-23,5
VELFAC Energy/Clear/Energy	36	4-12-4-12-4	WE	0,72	0,5	1,1	-16

ENERGY BALANCE



1. **Solens energi**
   Tilskud af dagslys og energi
2. **Naturlig ventilation**
   Automatisk styring af åbne/lukke funktioner
   Godt (sundt) indeklima er sikret
3. **Udvendig solafskærmning**
   Tilførsel af solens energi reguleres
   Op til 88 % af solens varme bremses
4. **Isolering - U-værdi**
   Velisolerende egenskaber
   Stor styrke
   Grundlag for energioptimering
5. **Aktiv vindue**
   Positivt bidrag til energibalancen
6. **Lysningspanel**
   Linietab er reduceret
7. **Natisolering**
   Reduktion af varmetab om natten
   Kontrol af mængden af sollys om dagen
8. **IO styresystem®**

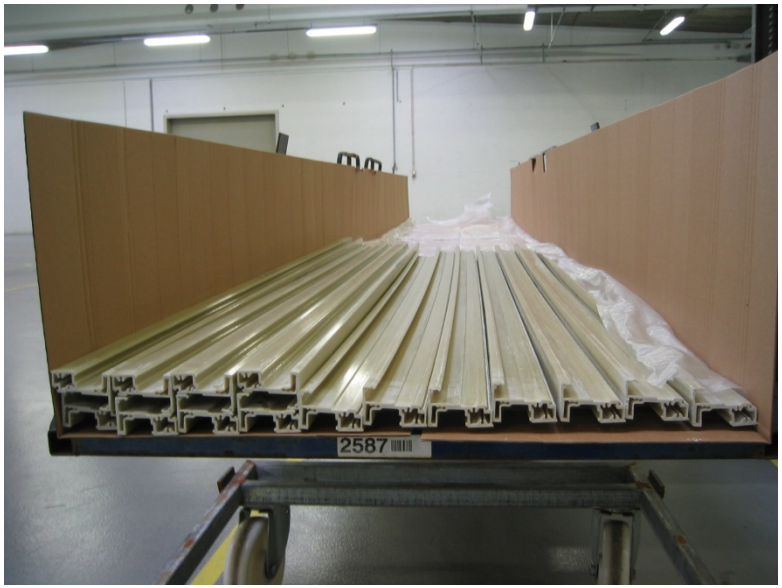
VELFAC Helo and Helo Fibre®

The VELFAC Helo window is made of a revolutionary new material

Helo Fibre®

Helo Fibre has been developed by DOVISTA Innovation Centre and is composed of PUR:

Polyurethane reinforced by fine glass threads



ROOF WINDOWS

18 VELUX roof windows **GGU U08 006530** have been installed:
Outside dimensions:
Width: 1340 mm
Height: 1398 mm

Exterior sunscreening net awning blind, MSL.
Internal comfort screening roller blind, RSL.

Rudetype: 3-lagsrude

	90 grader	15 grader (Green Light House)
Uw	1,0 W/m2K	1,1 W/m2K
Ug	0,5 W/m2K	0,6 W/m2K
g	0,45	0,45
Tau (Lystransmittans)	0,67	0,67

Tilbehør:
Når tilbehøret er rullet ned giver det forbederede egenskaber til vinduet.
Forbedrede egenskaber når tilbehør er rullet ned på den valgte rudetype:

	Uw (15grader)	g	Tau
External Awning Blinds:			
MSL 5060	1.1 W/m2K	0.10	0.12

Control of the windows and accessories

Remote controlled electric windows and accessories, which are powered by a solar cell fitted on the top cover of the window. Consequently, the product does not consume electricity from the mains voltage.

Pane Type: **Triple glazed pane**

90 degrees 15 degrees (Green Lighthouse)

Tau (Light transmittance)

Accessories:
When the accessories are lowered, the properties of the window are improved.

SOLAR PANELS

22 VELUX solar panels CLI S08 4000 have been installed.

The VELUX solar panel is a "Flat bed" solar panel, which can be integrated into the roof with a VELUX flashing element. In Green Lighthouse it has been installed with a kerb.

The solar panel has the following characteristics:

Total area	1,7 m²
Opening	1,4 m²
Absorber area	1,4 m²
Frame measures: Width, height	1140 mm, 1400 mm
Start effectiveness	79% (peak effect approx. 790 W/m²)
Heat loss coefficients: a_1, a_2	3,756; 0,0073
Copper absorber with high selective coating	Absorption 95%, Emission 5 %.
Iron-poor glass with high light transmittance	4 mm, 91%
Mineral wool insulation	50 mm

COSTS

DKK 37 million (approx. 5 mill. Euro) – of which:

Building components and technologies from WindowMaster, Faber, VELFAC & VELUX DKK 3.5 million (approx. 470.000 Euro)

Materials from Rockwool, Veksø, Knauf Danogips DKK 500,000 (approx. 67.000 Euro)

University of Copenhagen pays standard rent for use of the 950 m2 in Green Lighthouse.

The Danish University and Property Agency has drawn on an innovation fund for the construction of Green Lighthouse in view of gathering experience and learning from the different experiments – many of which are tested for the first time.

DECORATION - THE INSTRUMENT

- The Instrument is a structure of aluminium, stainless steel and mirrors. It is conceived around a telescopic arm suspended perpendicularly from the ceiling between the windows and ending in a fitting turning the Instrument in an angle towards the centre of the atrium. From this fitting eight smaller arms form an octagon, umbrella-like structure exposing the Instrument in the field of direct daylight under the ceiling. The arms end in an adjustable T-arm with 30 small round mirrors fitted on a line. The small mirrors can be adjusted individually in any direction.
- The Instrument makes use of direct daylight from the roof windows. The mirrors reflect the light, project it through the atrium and the light hits the floor of the ground floor in a pattern that will travel according to the movement of the sun in the sky. In this way the pattern on the floor will constantly change with the light impacts on the Instrument in each given situation: time of year, time of day, clouds.
- The mirrors of each T arm are adjusted in a way that when the rays of the sun meet all the mirrors at the same time on a certain day they will form 30 light spots on the floor that together form a circle precisely in the middle of the atrium. This will happen twice a year. The circle formed on the floor has a diameter of 1 metre. Each T arm is located in a way that it reflects the light from each its specific window. The reproduction of the circle will become more oval and will slowly move away from the centre of the atrium the further away we are from one of 16 dates selected randomly but evenly over the year.
- A circular aluminium model with 30 holes will be produced to allow for fine-tuning of the Instrument during installation. This model will later be located in the building to be used for future fine-tuning of the Instrument, should it become imprecise over the years. The plan is to hang it on a wall in the ground floor. In this way it can figuratively reproduce ’a circle’ in a more material and solid form and it will represent a material connection to the Instrument suspended under the ceiling.
- Name and expression of the sculpture refer to a scientific experimental set-up presently subject to a long-term experiment.

FACULTY LOUNGE

THE ART

Two representatives of the Royal Academy of Arts have suggested artist Henrik Menné to create a work of art for Green Lighthouse.

Henrik Menné submerged himself in the basic visions for the house and discussed at length with the partners behind the project.

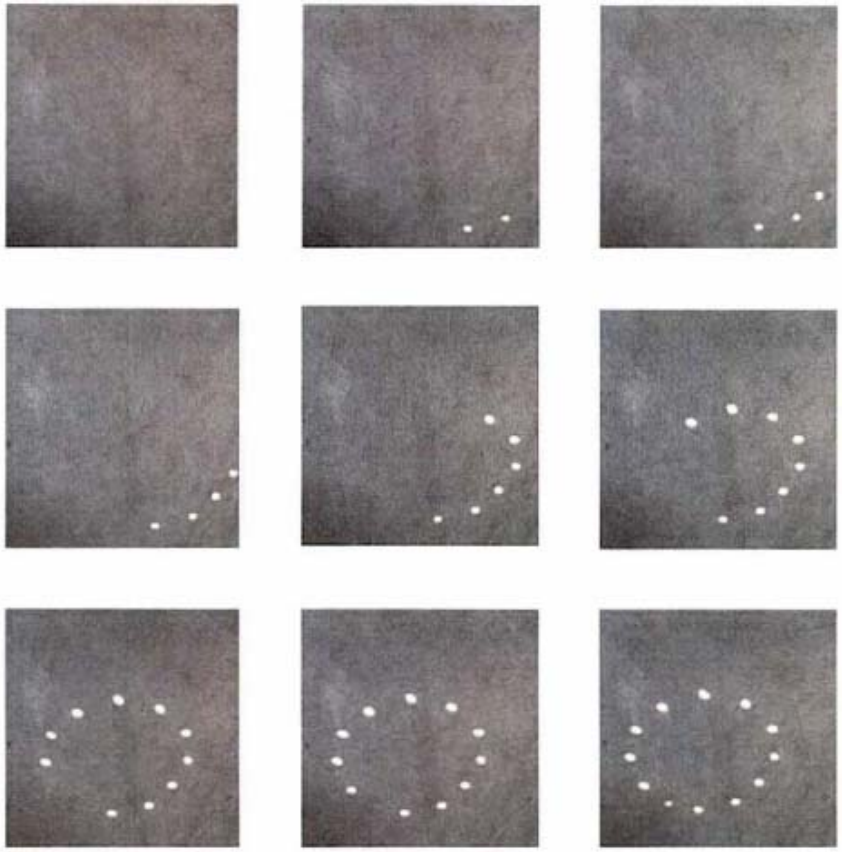


Illustration af lyscirklens dannelse. På billedet ses en række af spejle der reflekterer lyset fra solen, herved opstår en cirkel. Lyset rammer spejlene fra den ene ende, således at der kommer en ny lysplet i cirklen ca. en gang hvert minut. Pletterne forsvinder igen på samme måde.

THE INSTRUMENT

- Arts in Green Lighthouse are financed by the Danish University and Property Agency. In connection with new building funds are allocated for arts in selected buildings.

- VELUX is cooperating partner on draft ideas and first drafts of the arts project.

EUDP

What is EUDP?
EUDP is the Danish Energy Technology Development and Demonstration Programme supporting development and demonstration of new energy technologies. The programme was introduced by law in 2008. It is managed by an independent board appointed by the Minister for Climate and Energy. EUDP is to contribute to attaining Danish energy political objectives.

What is a demonstration project?
Projects testing on an experimental basis technologies, systems or methods under realistic conditions in view of subsequent market introduction or – depending on the result of the demonstration – further development before market introduction.

How can EUDP contribute to the project?
EUDP can contribute to verifying whether the experiment succeeds or not. The final result is a status report. EUDP supports the Green Lighthouse project with assistance during implementation and a follow-up energy measurement programme in a three-year period as well as communication of project results The EUDP project also covers the town hall of Viborg (12000 m2 under construction, COWI is consulting engineer) using an energy concept based on the same principles as in Green Lighthouse.

Partners

STRATEGIC PARTNERS

Universitets- og Bygningsstyrelsen
Ministeriet for Videnskab Teknologi og Udvikling

KØBENHAVNS UNIVERSITET

KØBENHAVNS KOMMUNE

VELUX®

VELFAC®

CONSORTIUM

CHRISTENSEN & CO arkitekter a/s

COWI

HELLERUP BYG A/S

CLIENT ADVISORS

RAMBØLL

Grontmij | Carl Bro

COMPONENT PARTNERS

Window Master. Faber KNAUF DANOGIPS VEKSØ ROCKWOOL

UNIVERSITY OF COPENHAGEN

The University of Copenhagen

- is the largest institution of research and education in Denmark
- eight faculties on four campuses in central Copenhagen
- is among Denmark's largest workplaces
- more than 40,000 employees and students pass through its 1,000,000 square meters on a daily basis.

The University of Copenhagen

- has a comprehensive climate research portfolio from humanties to natur science
- hosted The International Scientific Congress *"Climate Change: Global Risks, Challenges & Decisions"* in March 2009
- aims to become one of Europes greenest campus areas by 2013.
- will by 2013 reduce the university's CO_2 emission from energy consumption to a level 20 % below that of 2006.

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Green Lighthouse

MINISTRY OF SCIENCE, TECHNOLOGY AND INNOVATION

Universitets- og Bygningsstyrelsen
Ministeriet for Videnskab
Teknologi og Udvikling

Ministry of Science, Technology and Innovation new energy strategy will put a focus on low energy buildings.

Ministry of Science, Technology and Innovation is Denmark's largest entrepreneur and administers now 3,5 mio. m2.

Architecture, indoor climate and accessibility as well as energy friendly builidings are topics that are high on the agenda.

Universitets- og Bygningsstyrelsen Ministeriet for Videnskab Teknologi og Udvikling · KØBENHAVNS KOMMUNE · KØBENHAVNS UNIVERSITET · VELUX · VELFAC

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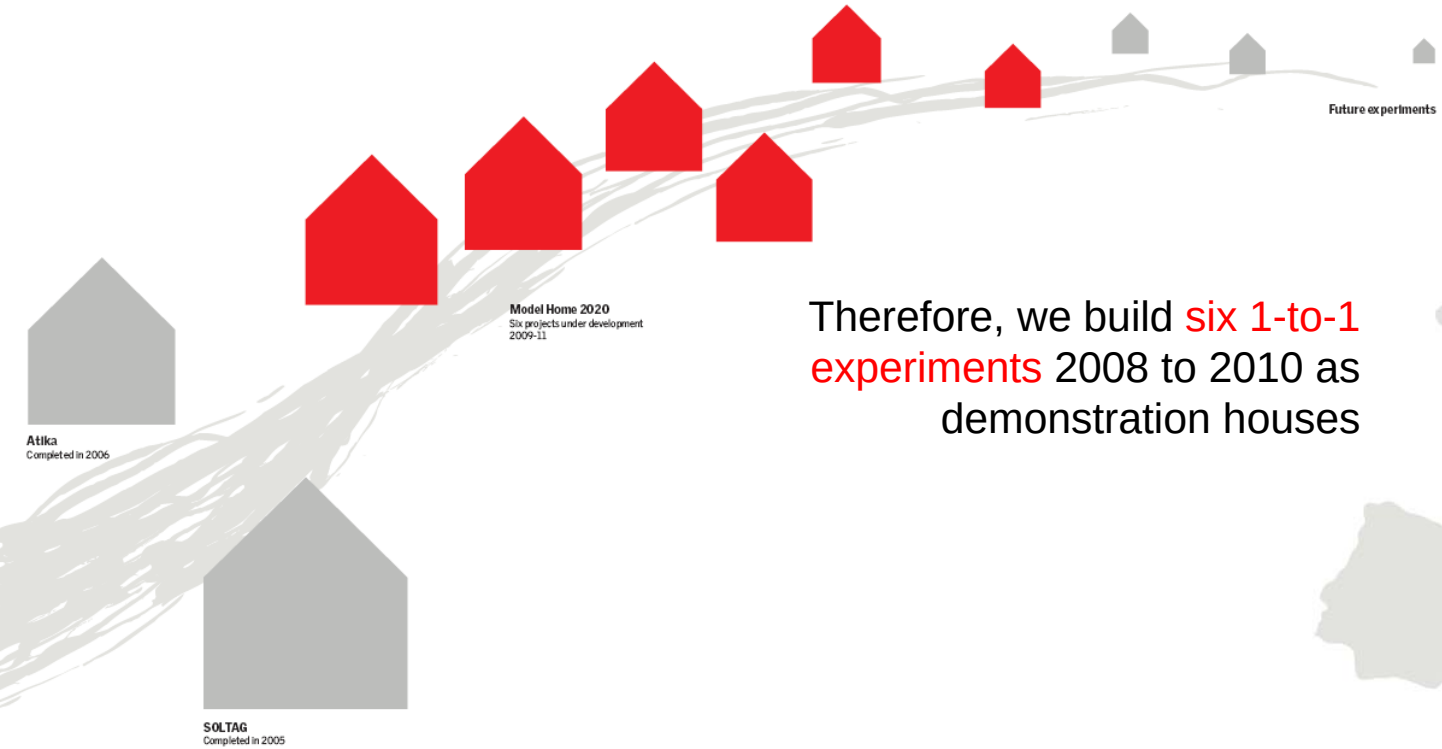
VELUX MODEL HOME 2020

VELUX has launched the project Model Home 2020.
A vision for **0 carbon** buildings with a high **livability**.



Therefore, we build six 1-to-1 experiments 2008 to 2010 as demonstration houses

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VELUX VELFAC

Green Lighthouse

DESIGN & CONSTRUCTION

CHRISTENSEN & CO arkitekter a/s — Architectural design

COWI — Consulting services and energy concept

HELLERUP BYG A/S
Hellerup Byg A/S, Lyngbyvej 421, 2820 Gentofte, DK — Turn-key contractor

CCO arkitekter

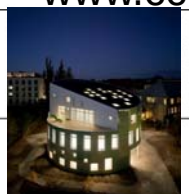
CHRISTENSEN & CO arkitekter a/s

Christensen & Co arkitekter as (CCO) is a young Danish architech company working internationally with architecture and planning.

CCO has 20 employees and roughly half of our projects are placed outside Denmark.

CCO believes that great architecture makes a difference. That the talent of the architect, her will and ability to understand the project can move mountains and create houses which in a positive and active way has an effect on the lives that the architect has created the frame for. CCO has broad competencies within energy- and sustainable solutions when it comes to university and science buildings and cultural and business buildings as well as private houses and masterplans.

www.cco.as



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COWI

COWI is a leading, international consulting group.
We provide services within the fields of:

- Engineering, environmental science and economics
- At year-end 2008, we had **6,734** on-going projects in **119** countries
- 6.000 + employees as pr september 2009
- www.cowi.dk / www.cowi.co
- Since COWI was founded in 1930, we have been involved in:
- more than **65,000** projects in more than **175** countries

COWI assists customers with the development of energy concepts for buildings. The aim of an energy concept is to develop and integrate optimal energy solutions in buildings in terms of energy consumption, environmental impact and lifecycle costs.
COWI has endorsed the climate initiative, Caring for Climate, under the UN Global Compact.

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HELLERUP BYG

Hellerup Byg AS is a medium-sized modern contractor with focus on a dialogue-based construction process.

Hellerup Byg has a staff of around 70 and works primarily in the Greater Copenhagen area. The objective of Hellerup Byg is to make a difference from the ordinary construction process – through an equal and dialogue-based process between the partners; from owner to consultants, suppliers and final users.

We aim at projects and organisations where the competences of Hellerup Byg can be brought into full play – in particular Green Building, Refurbishment/Renovation as well as assignments within service and maintenance.

HELLERUP BYG A/S

NOVEMBER 2009

GREENLIGHTHOUSE.KU.DK