Architecture and sustainability in a broader perspective

Michael Christensen, architect maa
Christensen & Co architects, Copehagen
michael@cco.as

Architecture and sustainability in a broader perspective

Introduction and background
Generel reflections
Projects
Two cases

IT – UNIVERSITY COPENHAGEN

ALBANOVA, STOCKHOLM

NORDEA BANK HQ, COPENHAGEN

THE WAVE, VEJLE

Architecture and sustainability in a broader perspective

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Campus Albano

Univercity in Stockholm – 1. prize international competition

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Univercity in Stockholm – 1. prize international competition

Novum Biocity, Huddinge, Sweden

Biomedical research facility, – 1. prize international competition

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Architecture and sustainability in a broader perspective

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SOLCELLER

-CO2 neutral el-produktion
-Dækker 50% af bygningens elforbrug

REGENERATIVE ELEVATORER

-60% lavere elforbrug
-Lavt standby forbrug

ENERGIEFFEKTIV BELYSNING

-Dagslysfaktor over 2 % på arbejdspladser
-Generel belysning
4,5 W/m² ved 200 lux
-Arbejdspladsbelysning
1 W/m² ved 500 lux

CANADISK SOLVÆG

-Forvarmning af ventilationsluft
-Produktion af varmt brugsvand
-soldrevet køleanlæg

HØJISOLEREDE KONSTRUKTIONER

-Lavt varmetab, ingen kuldebroer
-Luftætte konstruktioner

VINDUER

-3-lags rude med lavt varmetab
-Passende energitilskud
-Solafskærmende ruder modvirker overtemperaturer

EFFEKTIV FRIKØLING

-Blotlagte betonflader
-Effektiv natkøling af betondæk forbedrer terminsk indeklima

VINDMØLLE PÅ TAG

-CO2 neutral el-produktion

ENERGIEFFEKTIV VENTILATION

-Lavt elforbrug, høj varmegenvinding
-Kontrolleret luftskifte giver høj indeklimakvalitet

HAVVANDSKØLING

-Høj køleeffektivitet
-Lavere elforbrug til køling

Holiday homes Bodrum, Tyrkiet

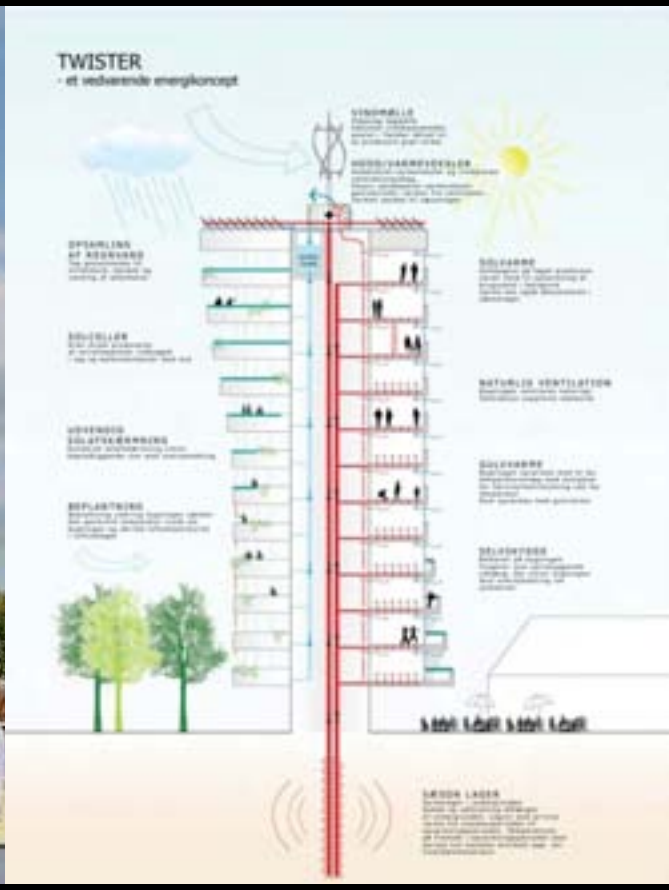
Blue Ocean Beach Development, Turkey

Holiday homes Bodrum, Tyrkiet

Blue Ocean Beach Development, Turkey

Twister tower, Amager Beach park, Copenhagen

Residential tower and culture café in Copenhagen



Holiday homes Bodrum, Tyrkiet

Blue Ocean Beach Development, Turkey

Almere Coast, Holland

Masterplan for Almere costal zone – 1. prize international competition

Almere Coast, Holland

Masterplan for Almere costal zone – 1. prize international competition

New City Hall, Lund, Sweden

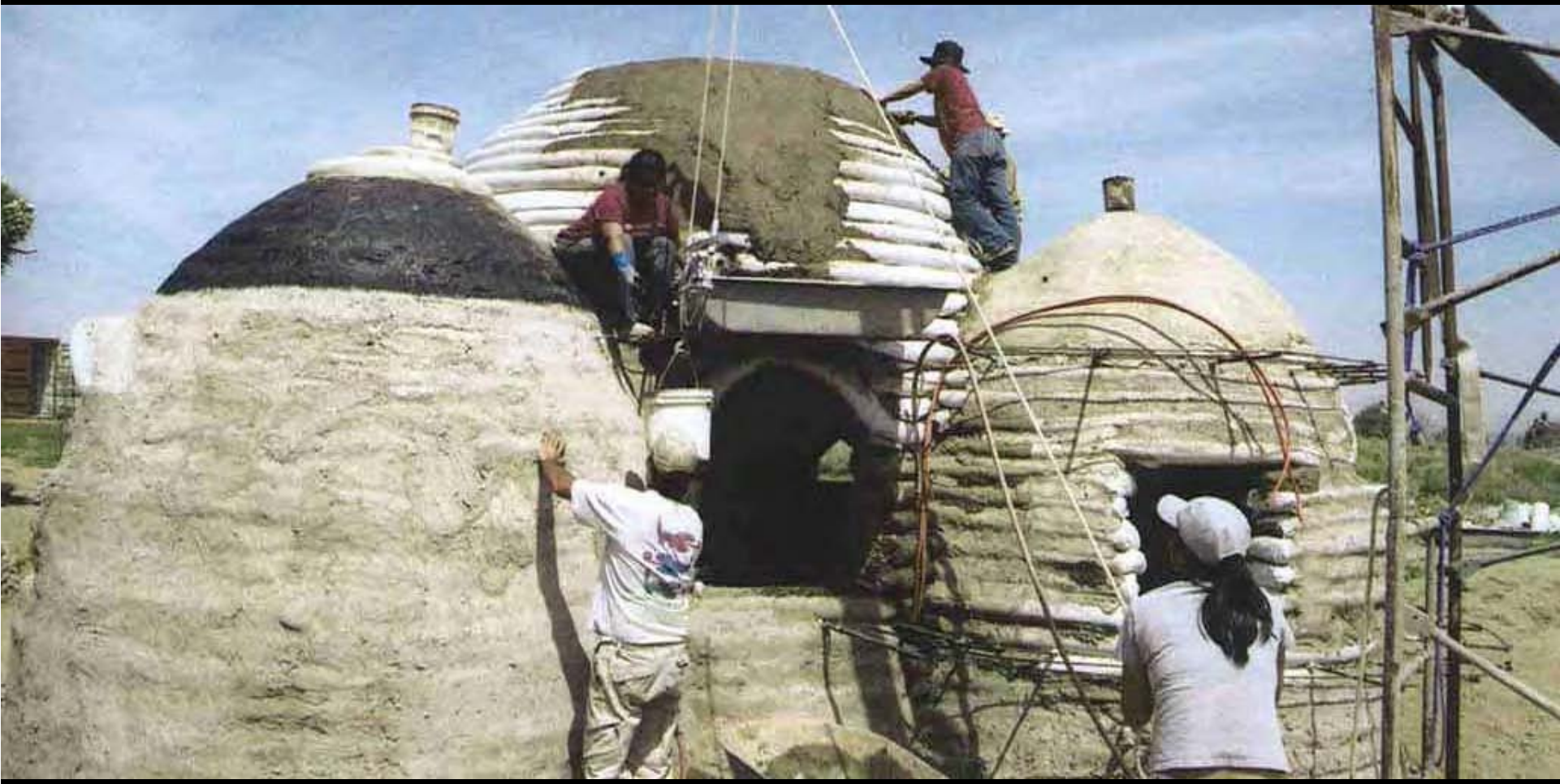
1. prize in international competition – 2010

The Climate is changing…

Svante Ahrenius

"More than 100 years ago the Swedish Nobel Prize recipient, Svante Ahrenius, predicted that the world would experience a rise in temperature very similar to what is happening right now –Mr. Svante got only one thing wrong: he predicted that this would occur in 3000 years from now…

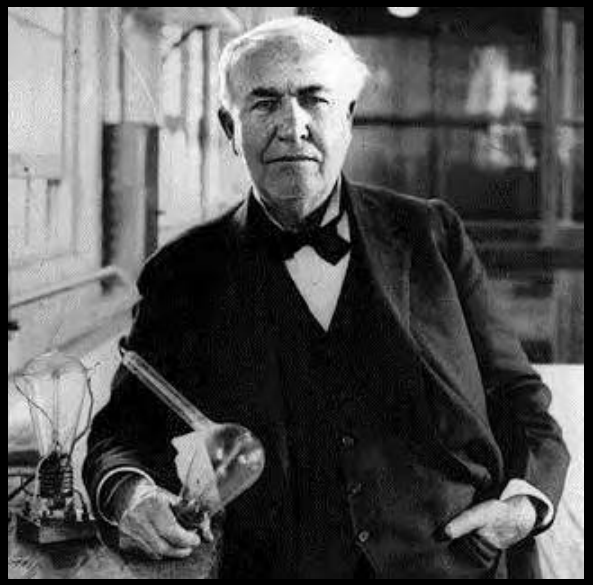
Knowhow….



The challenge..

- 40 % OF ALL ENERGY ARE USED IN BUILDINGS
- 90 % OF OUR TIME IS SPEND INDOOR
- 70 % OF ALL BUILDINGS HAVE POUR INDOOR CLIMATE

It is not rocket science..

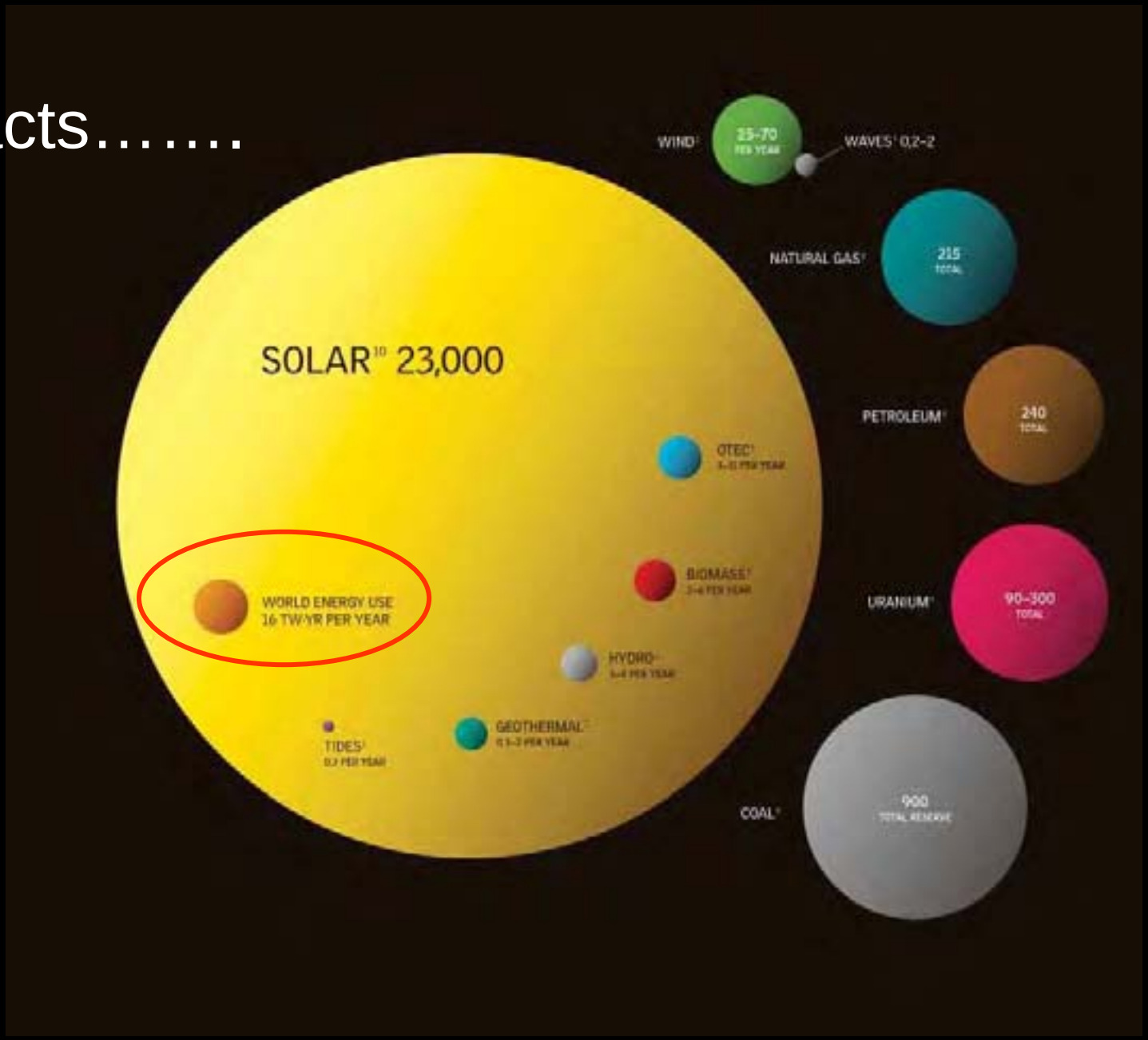


Thomas Edison to Henry Ford and Harvey Firestone in 1931:

”I´d put my money on the sun and solar energy. What a source of power!

I hope we don´t have to wait until oil and coal run out before we learn to tackle that.”

Facts……


WIND
25–70
WAVES 0,2–2
NATURAL GAS
215
SOLAR 23,000
PETROLEUM
240
OTEC
WORLD ENERGY USE
16 TW·YR PER YEAR
BIOMASS
URANIUM
90–300
HYDRO
GEOTHERMAL
TIDES
COAL
900

Framing the green concept.....

- Low energy buildings?
- Passive house standard?
- CO2 neutral buildings?
- Energy producing buildings?
- Energy neutral buildings?
- Energy + buildings?

- Calculating only energy for operating the building?
- Or also the actual use of it – equipment, computers?
- Calculating the actual CO2 footprint – materials, transportation?
- Etc.

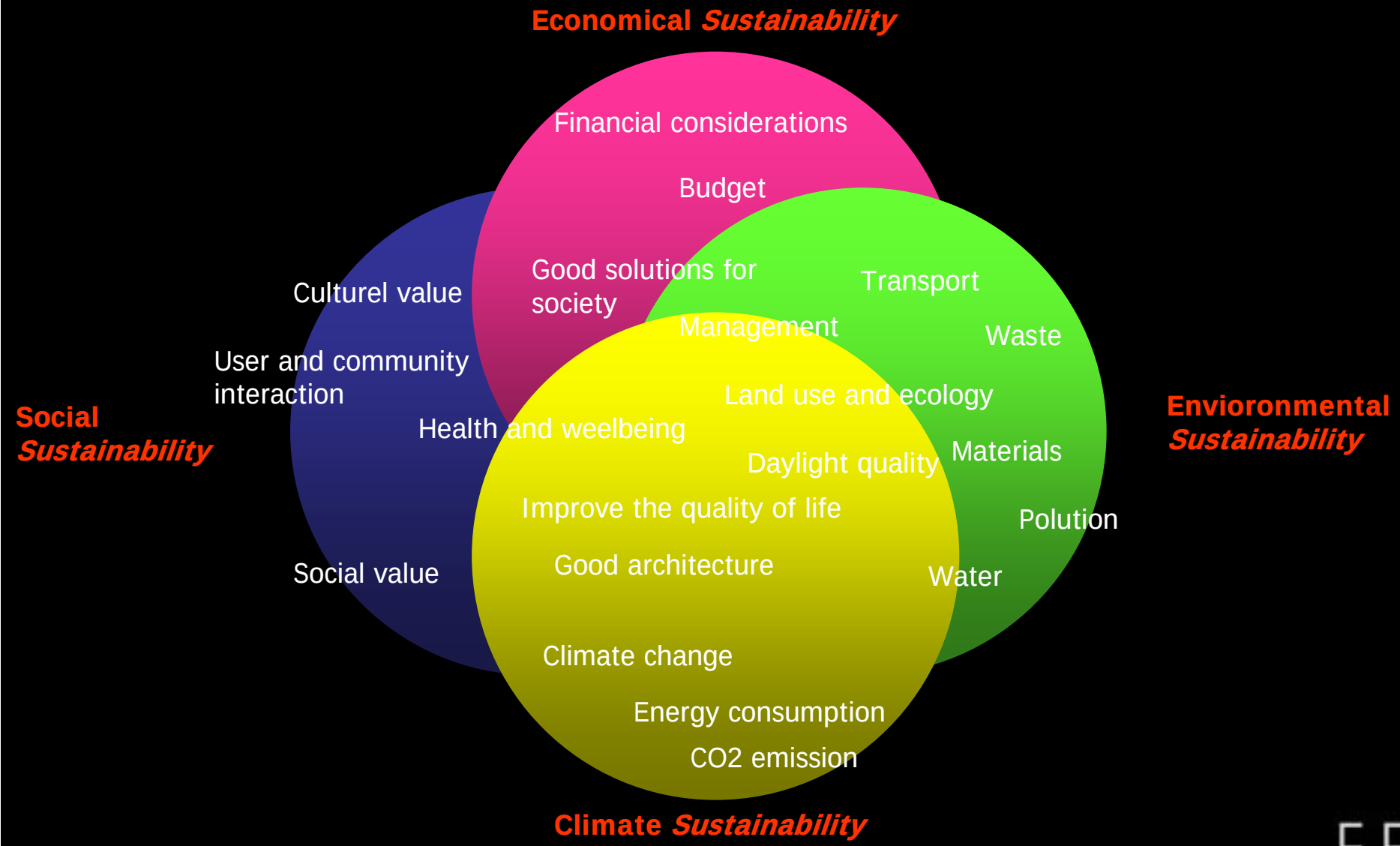
”By claiming green, we are defining green”

Gradle to cradle

BVD

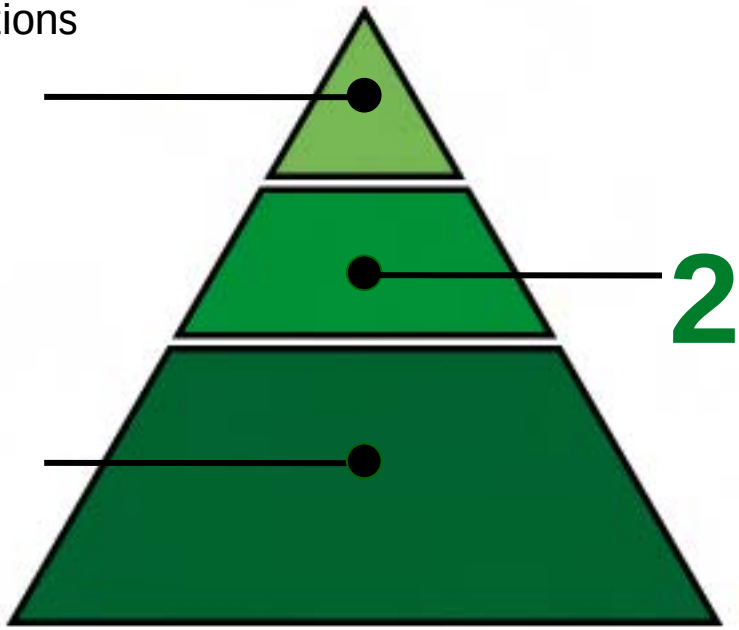
Passive house

Sustainability as design driver?



Kyoto Triangle – Trias Energetica

3 Efficient use of fossil fuels, efficient installations and optimised user behaviour



2 Energy consumption is mainly covered by alternative and renewable sources of energy

1 Need for energy is minimised through architectural design

CASE #1

Climate Friendly Nursery

Children's day care facility

Client: Municipality of Hørsholm with VKR Holding

1. Prize in competition

CHRISTENSEN & CO architects
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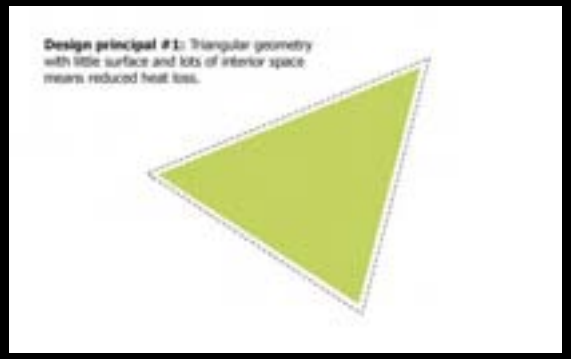
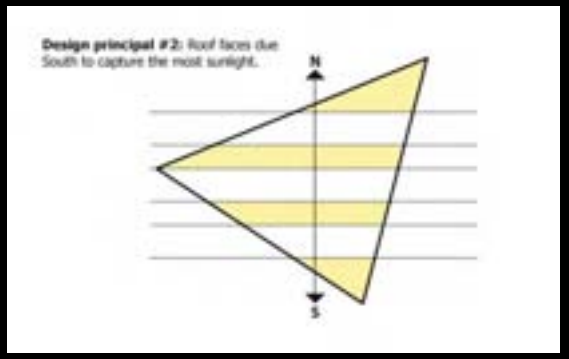
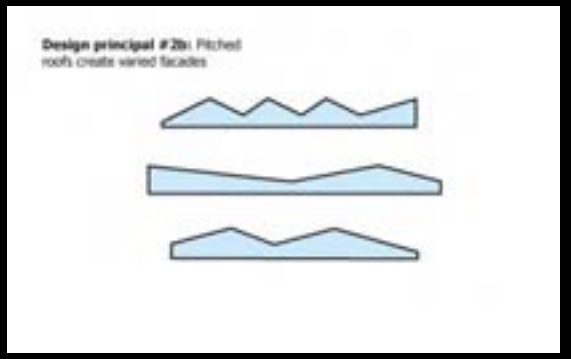
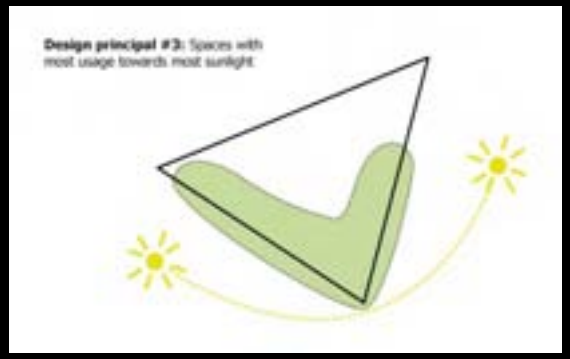
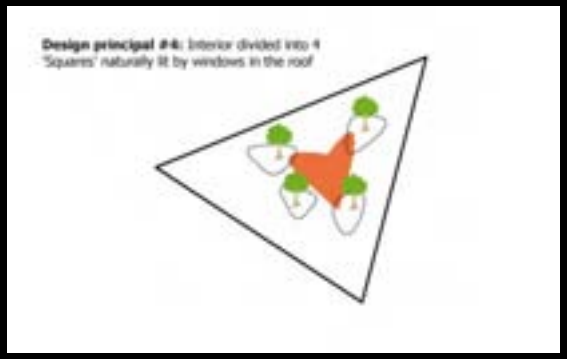
ankomstpladsen
p-plads 25 stk
skoven
vækshus
skur
bakken
vækshus
mosen

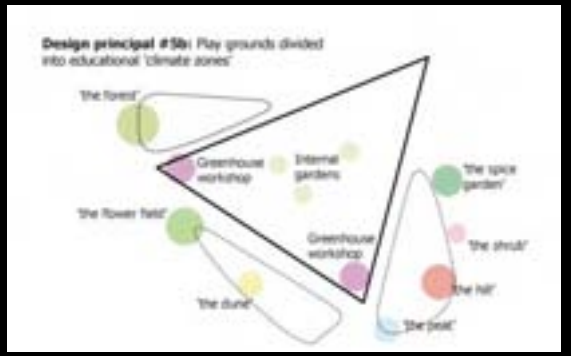

Design principal #1: Triangular geometry with little surface and lots of interior space means reduced heat loss.


Design principal #2: Roof faces due South to capture the most sunlight.
N
S


Design principal #2b: Pitched roofs create varied facades

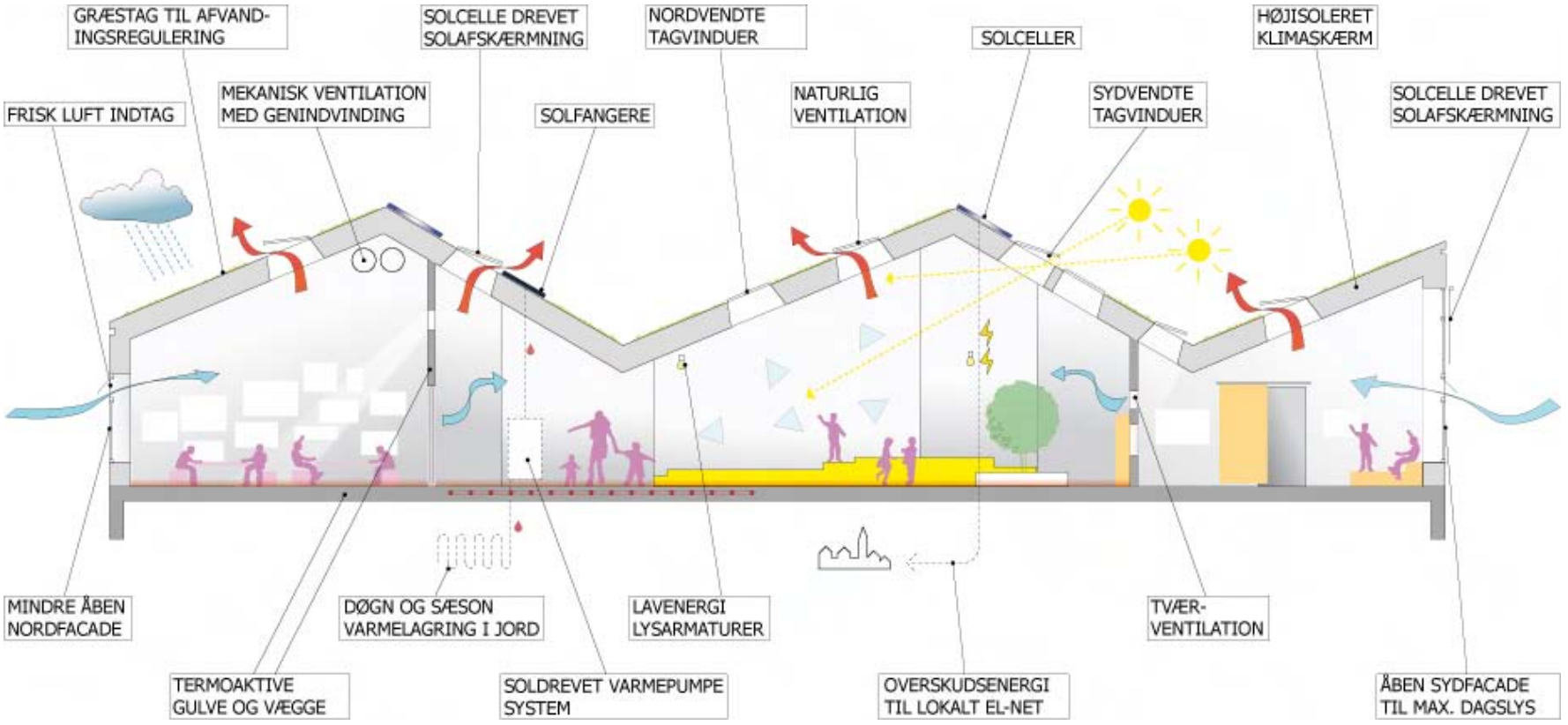

Design principal #3: Spaces with most usage towards most sunlight


Design principal #4: Interior divided into 4 'Squares' naturally lit by windows in the roof

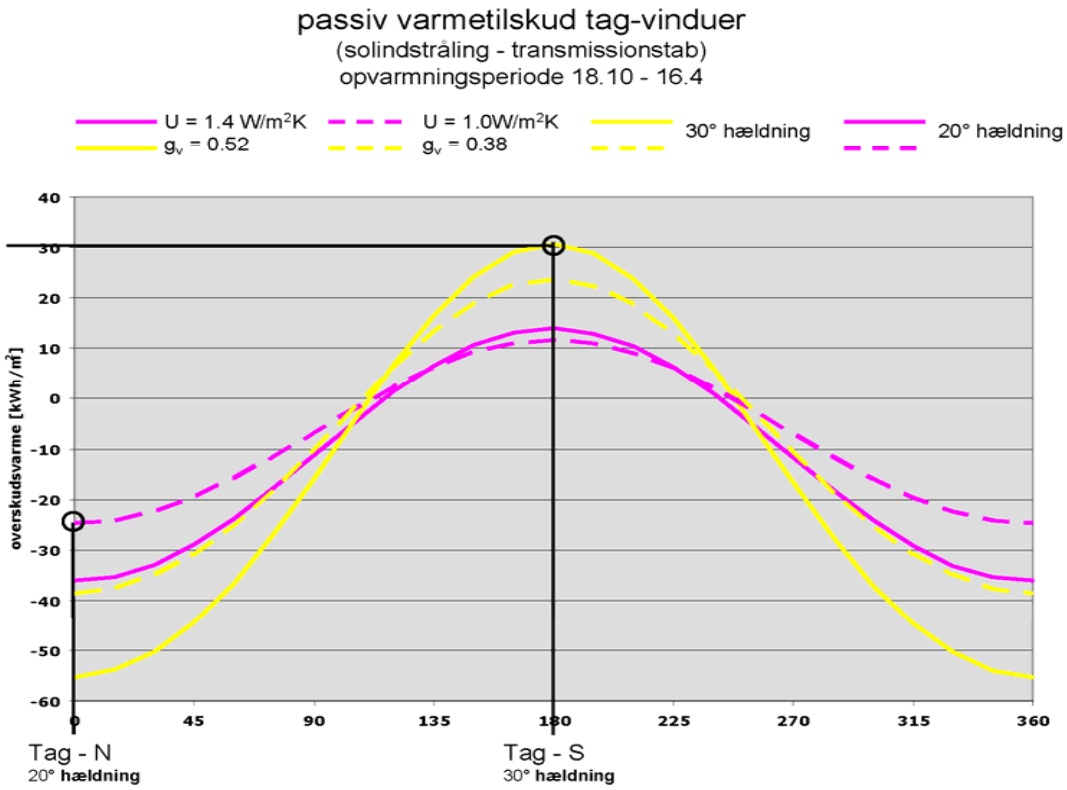

Design principal #5b: Play grounds divided into educational 'climate zones'
'the forest'
Greenhouse workshop
Internal gardens
'the space garden'
'the flower field'
Greenhouse workshop
'the shrub'
'the hill'
'the dune'
'the beat'

The village under the large roof

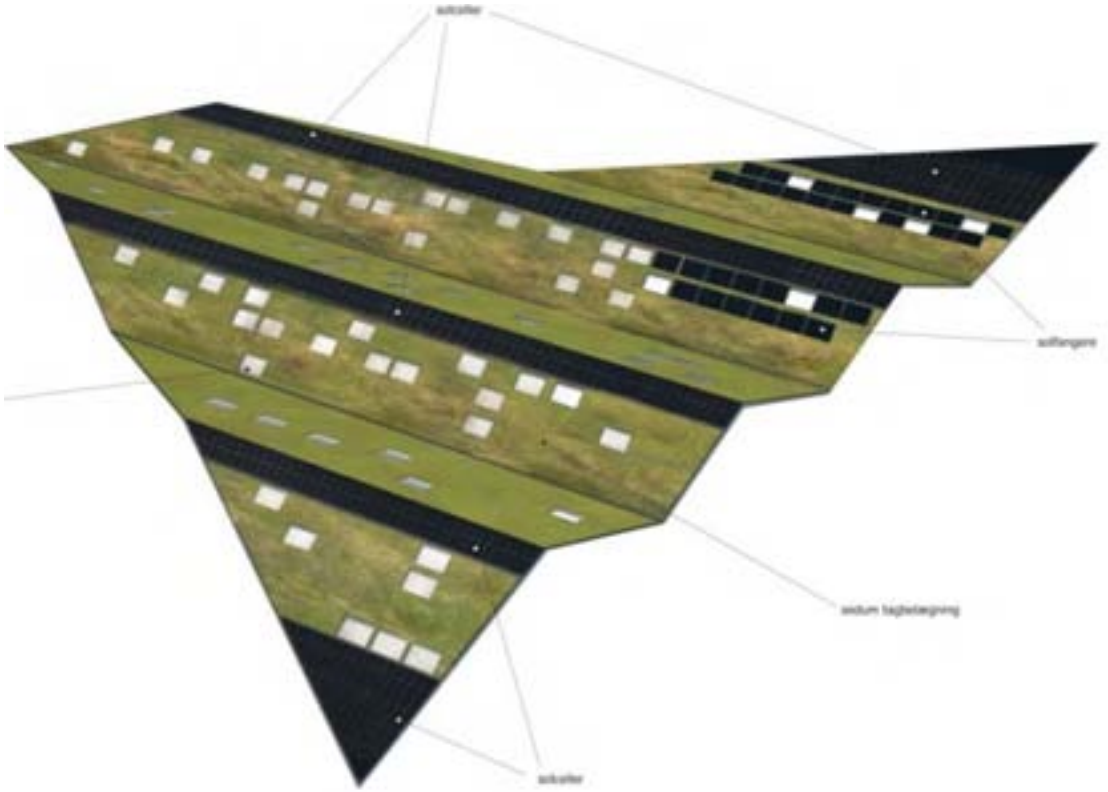
Energy concept



Energy concept – the roof



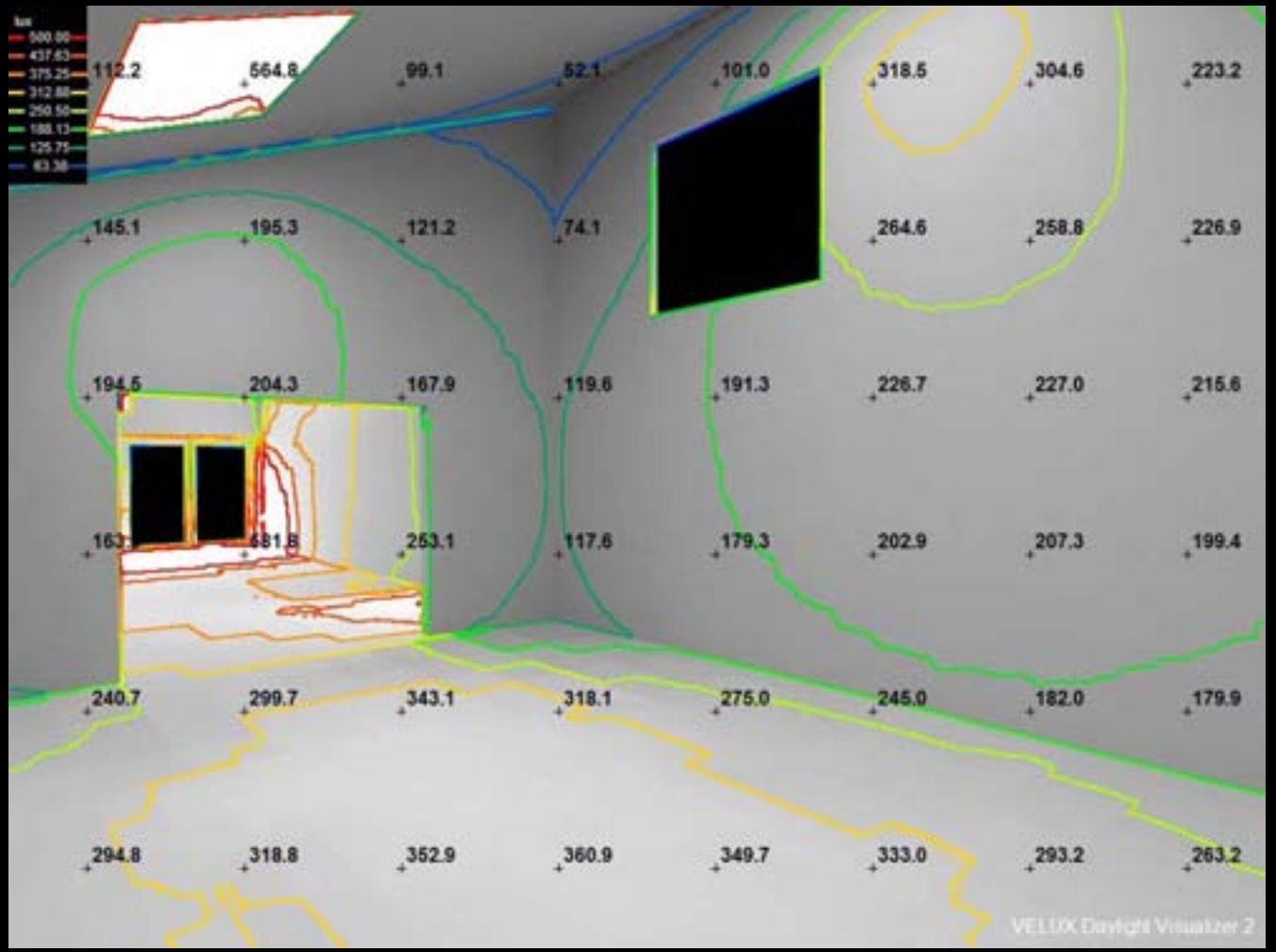
The roof as the power plant



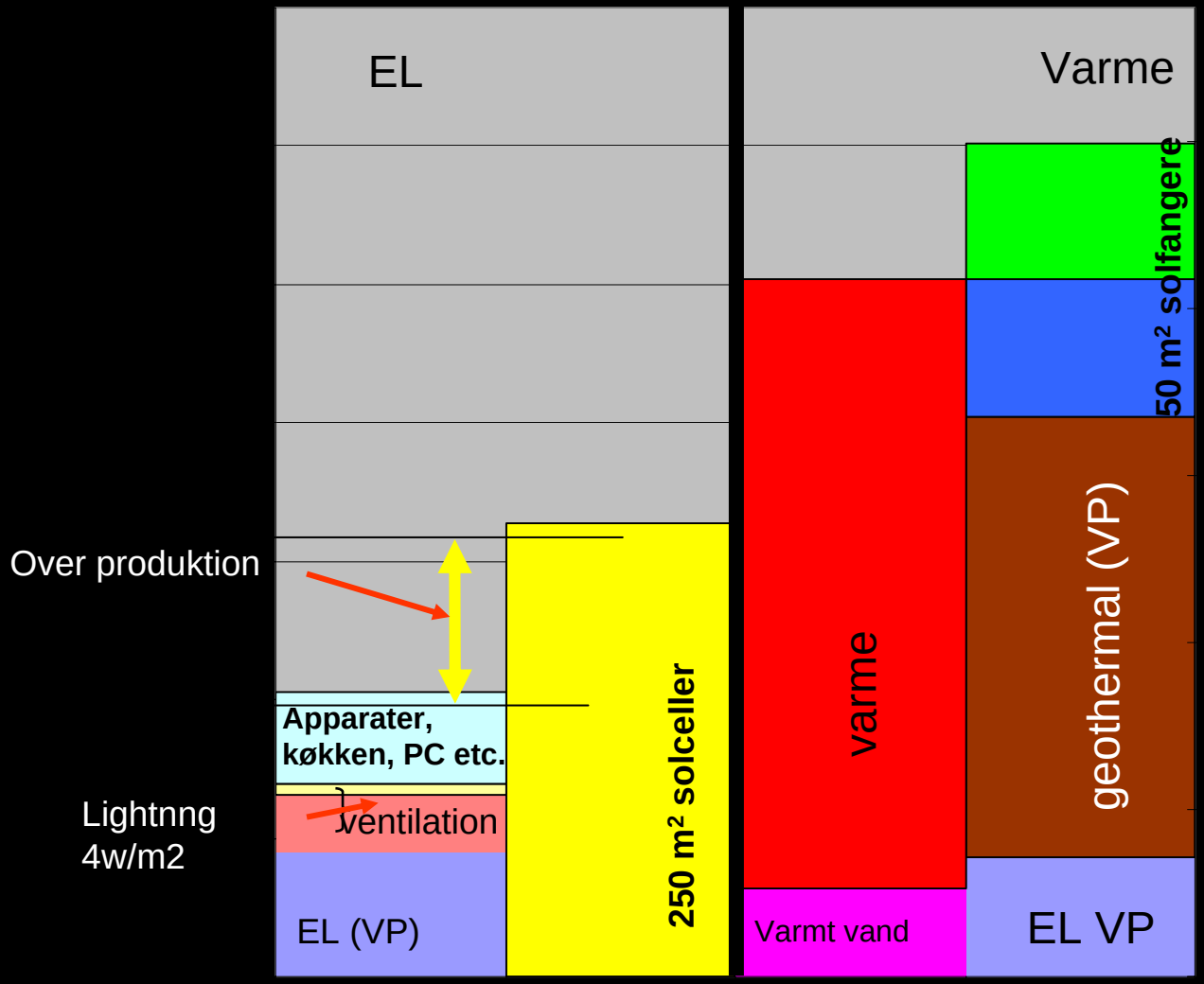
Daylight >7%

VELUX Daylight Visualizer 2

Dagslys visualisering >7%
Gratis program kan hentes på http://viz.velux.com/



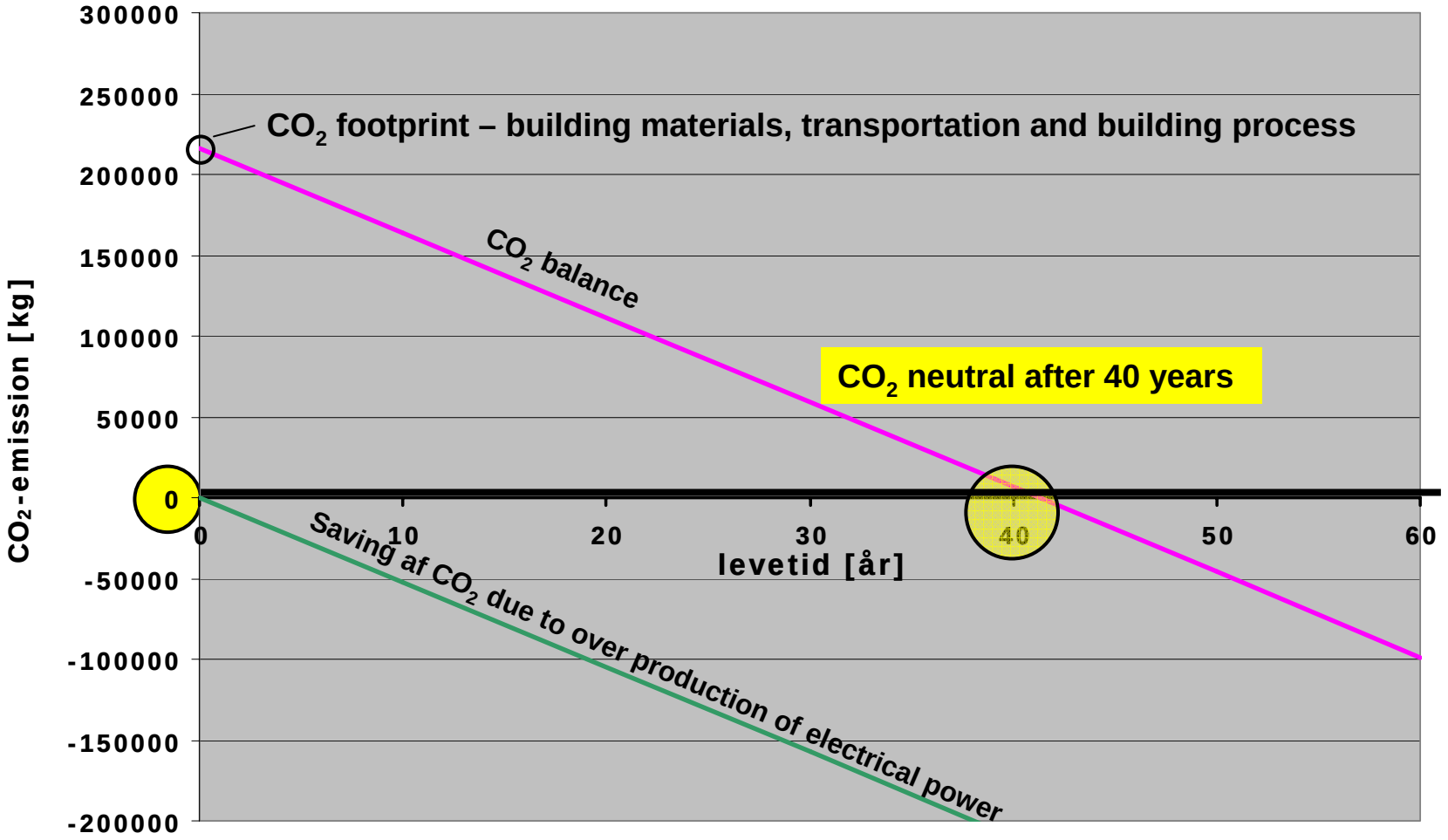
Over production 8 KWh/m2/Year



Over produktion
Til tørreskabe
vaskmaskiner mv.

Buffertank

Over production 8 KWh/m2/Year



CASE #2

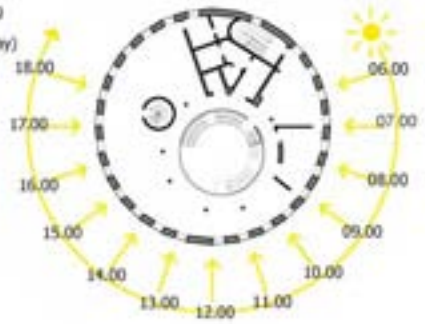
Green Lighthouse

Copenhagen University

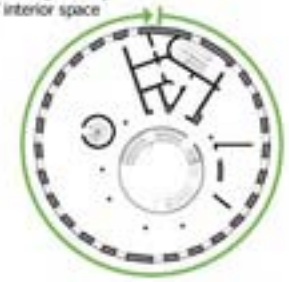
1. Prize in competition

Design principal #1: Cylindrical form and windows allow maximum amount of natural lighting into building

(Sun path on 28. May)



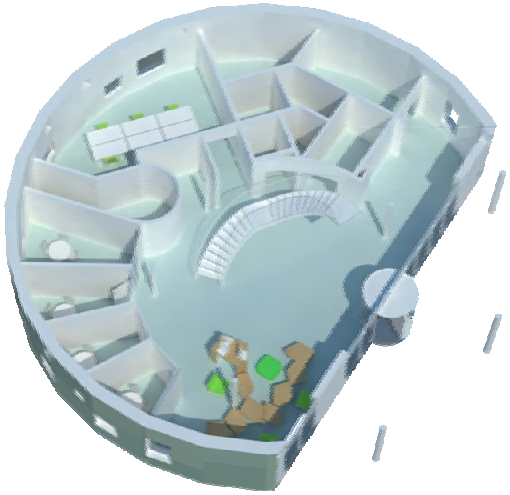
Design principal #2: Cylindrical geometry with little surface and lots of interior space means reduced heat loss.



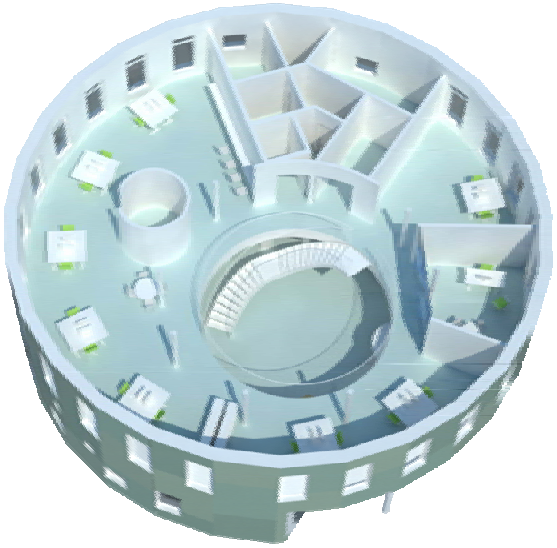
Design principal #3: Roof faces due South to capture most sunlight.

Design principal #4: Internal atrium facilitates natural ventilation and becomes centre of building.

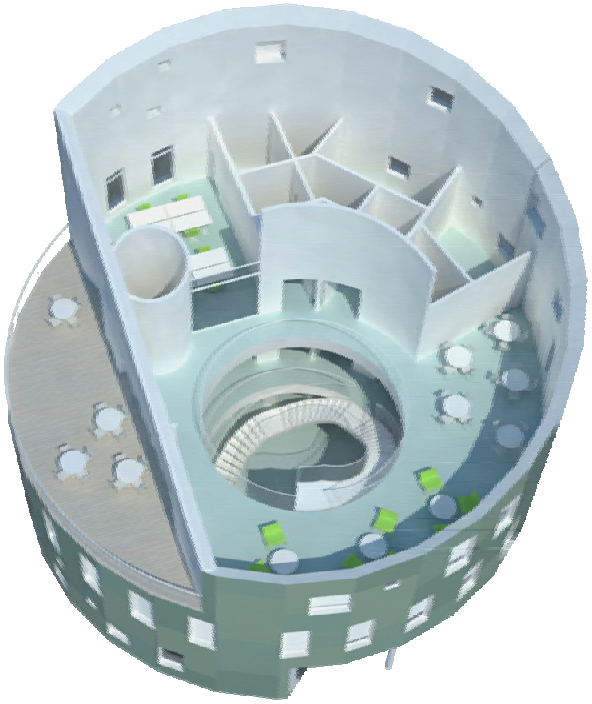
Design principal #5: Spaces with most usage towards most sunlight.



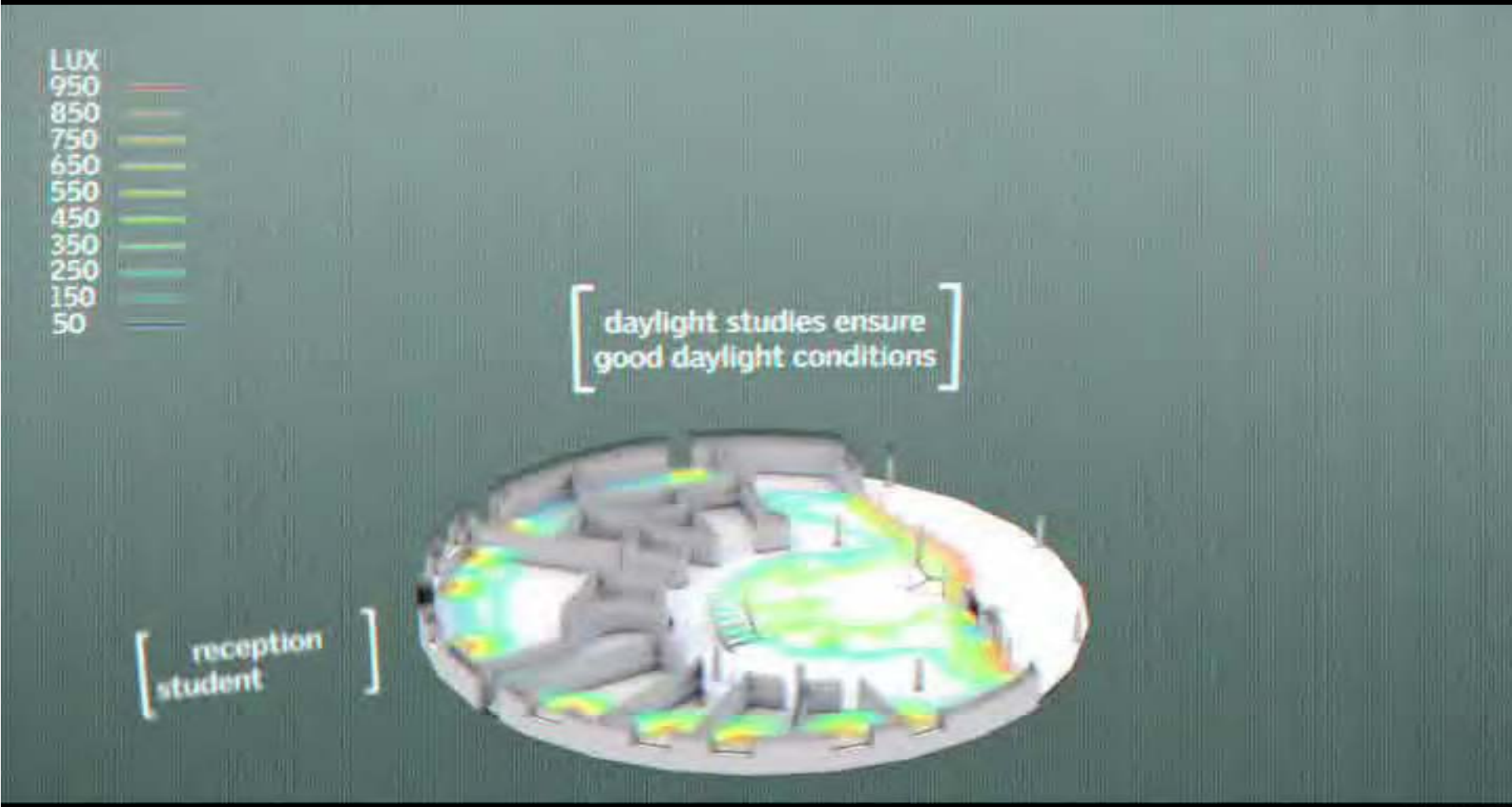
Stueetage – Studenter lounge og møderum



1. sal – Kontorer

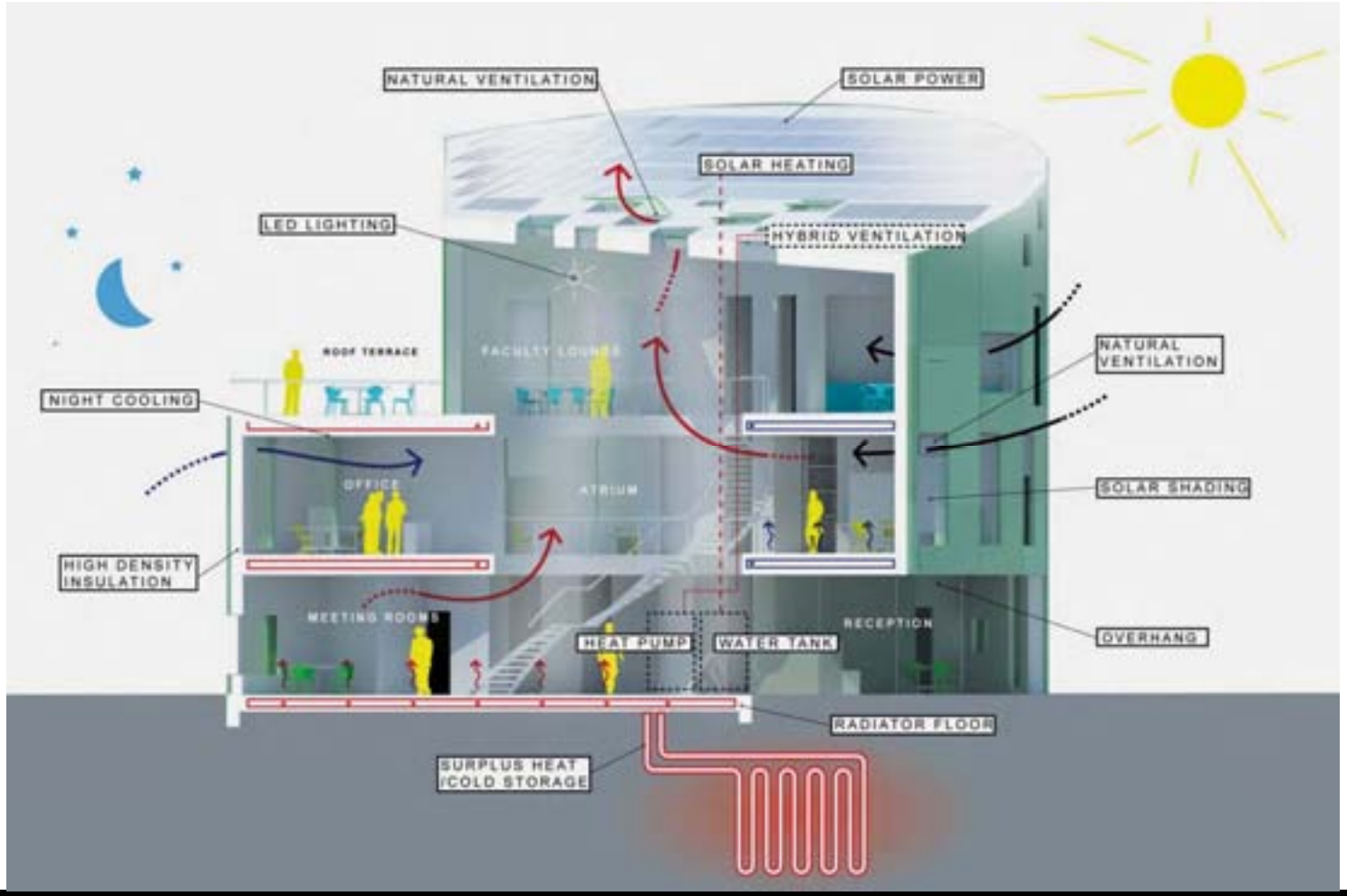


2. sal – Faculty Lounge og tagterrasse

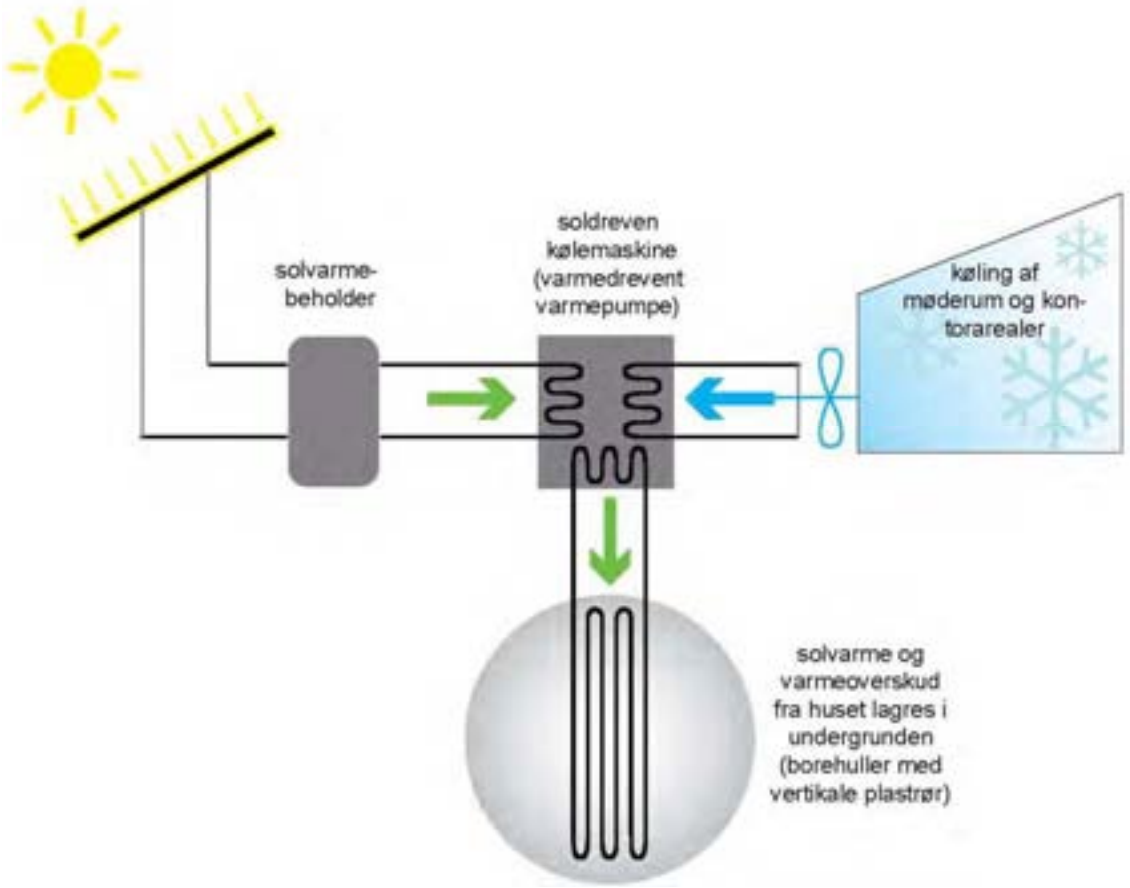

LUX
950
850
750
650
550
450
350
250
150
50
daylight studies ensure
good daylight conditions
reception
student


SEPT
24

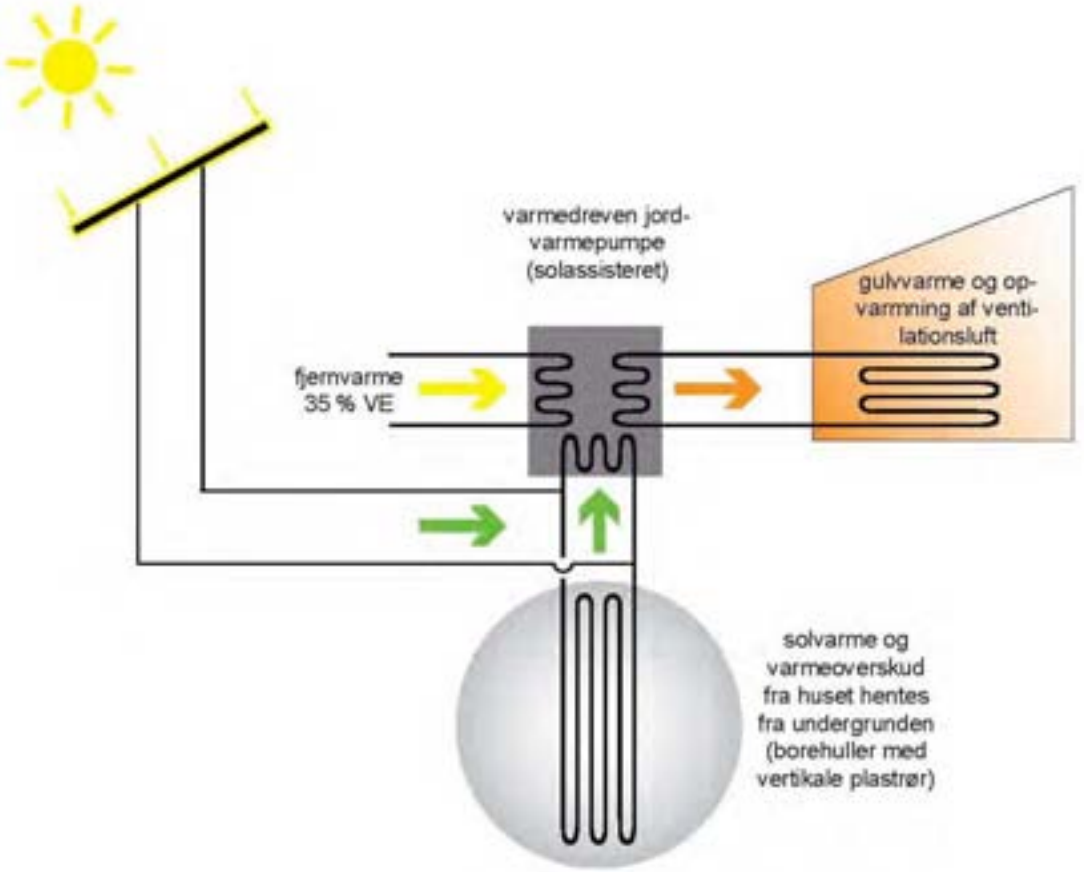
ENERGY CONCEPT



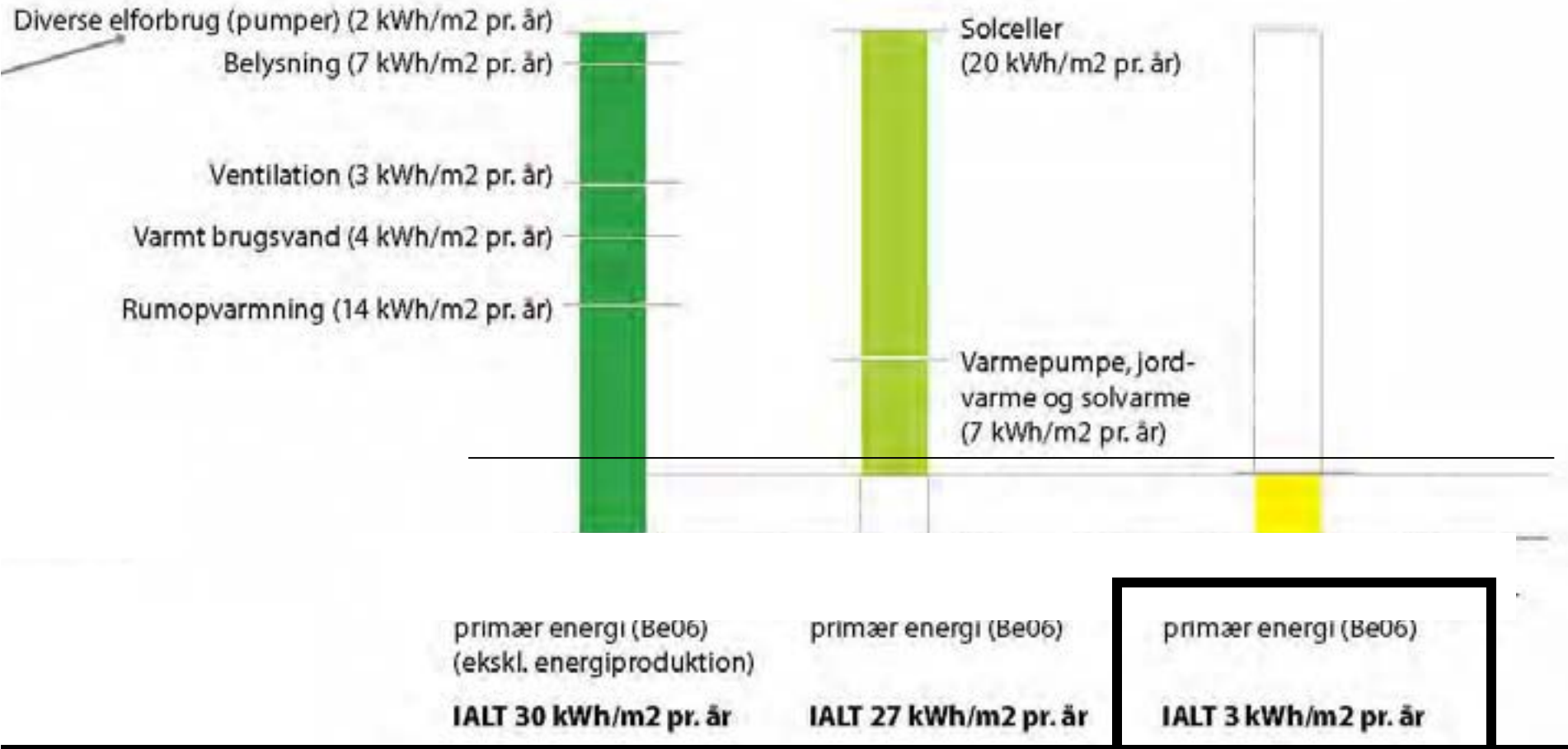
SUMMER: cooling from sun energy + storage



WINTER: Heat from storage + sun + district heating

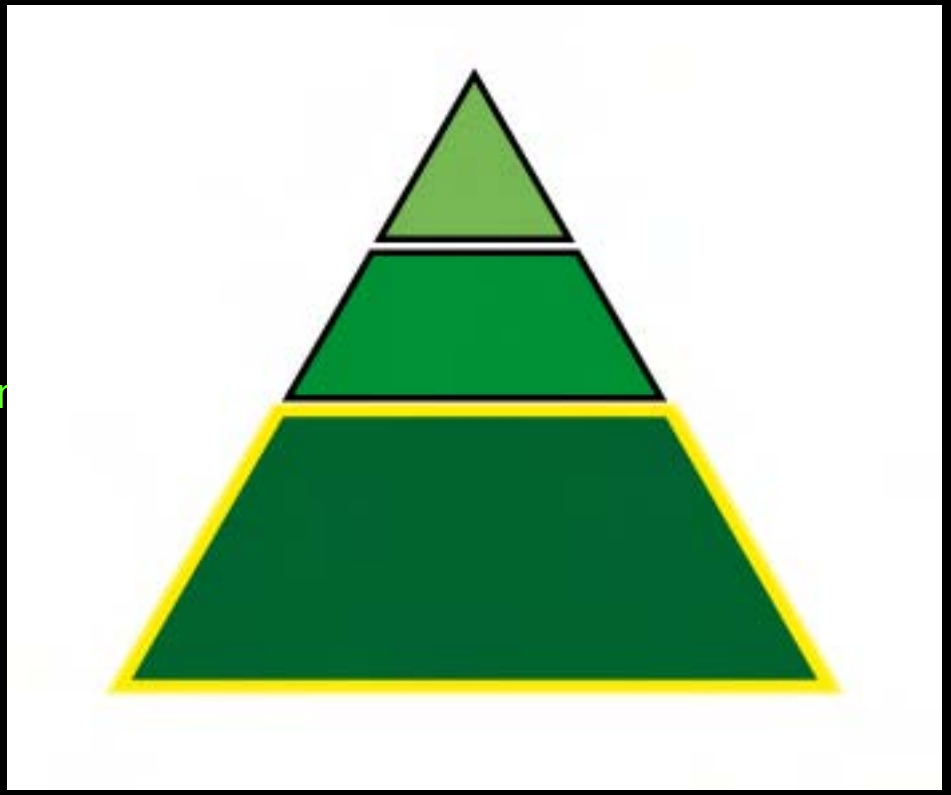


ENERGY CONCEPT



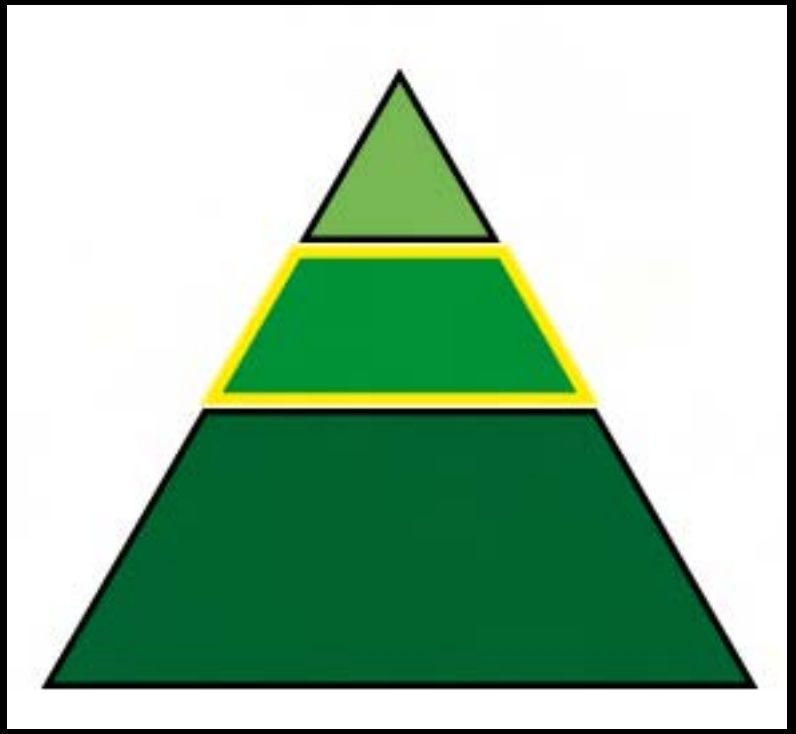
TRIAS ENERGETICA

- Building geometry -compact
- Site orientation
- Building envelope – insulation and sun screening
- Passive solar heat
- Passive accumulation of heat and cooling in constuction, incl. PCM-materials
- Natural/hybrid ventilation in combination with fire ventilation.
- Daylight
- LED lighting with daylight contro
- Energy efficeint mekanical ventilation



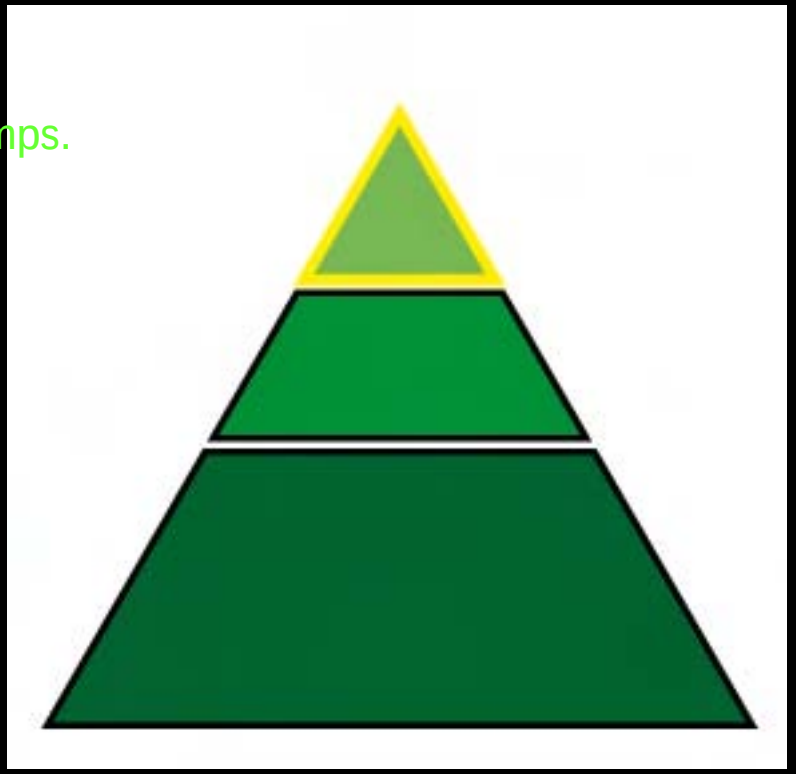
TRIAS ENERGETICA

- Adsorption heat pump driven by district heating for cooling and heating
- Underground storage of surplus heat
- Use of solar panels for both heating and cooling Photovoltacs



TRIAS ENERGETICA

- District heating in stead on power for heat pumps.
- Energy efficient appliances
- Focus on user behavior
- Standby consumption
- Intelligent control



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Green Lighthouse is CO2 neutral.

Its energy consumption is 90% below the current building regulation requirements –it is also lower that the expected requirements in 2020.

The architectural design, without including photovoltaics or other sources of renewable energy, accounts for 75% of this reduction!

Green Lighthouse only need 3 KWh/m2 per year

Including all energy needed for heat, cooling, lightning, hot water and electricity for pumps, solar shading building automatics etc.

This is gained with only 70 m2 of PV cells in a 1 000 m2 building!

The building will on a anual basis save the people in Copenhagen of more than 20 tons of CO2

Green Lighthouse is beeing clasified Gold in LEED


THANKS!