

# JouleWall

heating and cooling technology  
designed for building integration

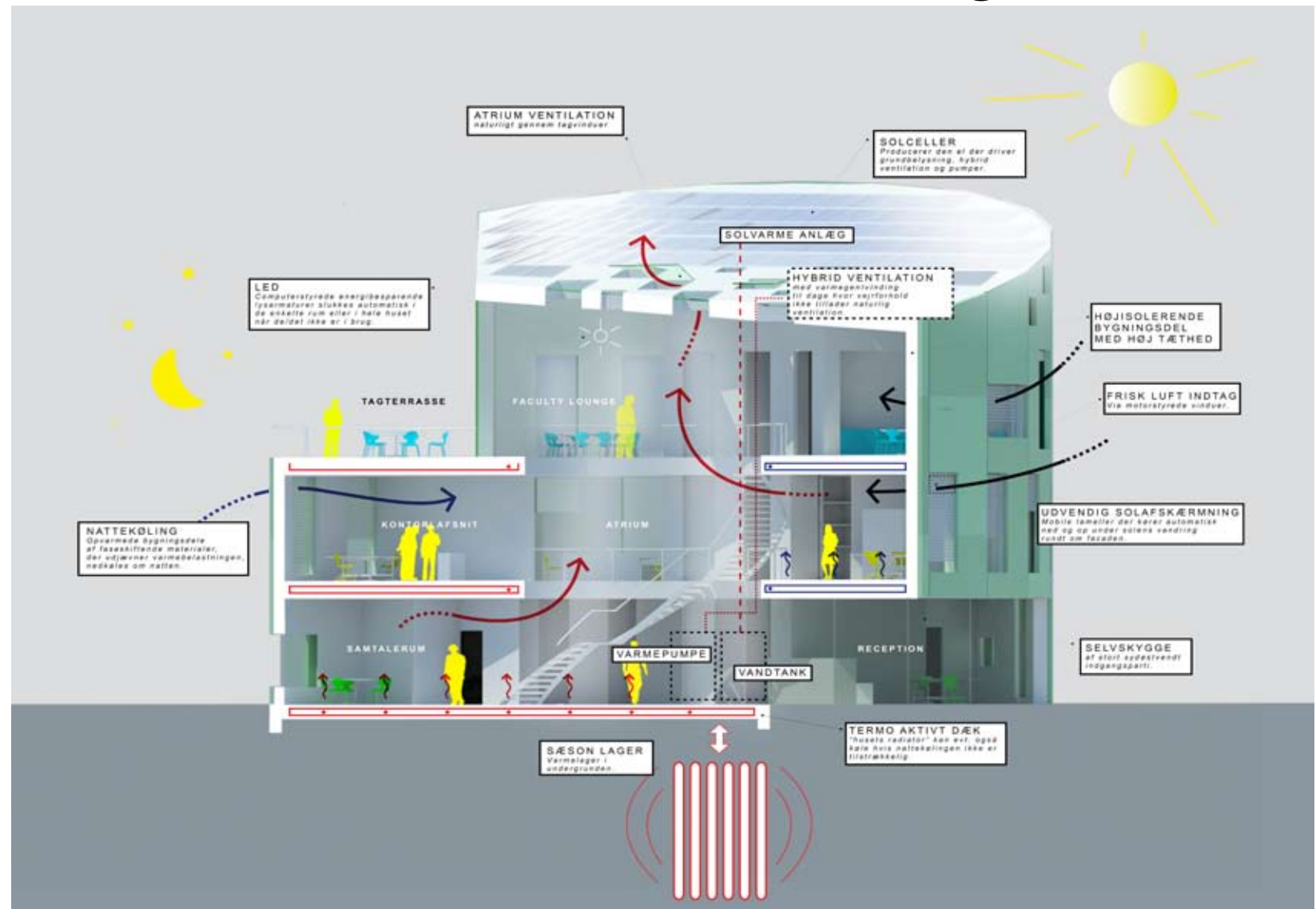


The new Green Light House energy consumption is impressive 22 kWh/m<sup>2</sup>/year for 950 m<sup>2</sup>. No information is though available about the number of people planned working in the building, but appears to be low. No information was available about the use of electricity for light and computers, but appears to be low. Vast use of PCM is included in the building. Use of single heat exchanger thermo-active-deck. Cost of the building is unknown.

Typically the internal wall and ceiling surfaces is not sufficient for air conditioning in medium to high load office, industrial building areas, ranging 60-100 W/m<sup>2</sup> heat load. Maximum 40 W/m<sup>2</sup> cooling and 25 W/m<sup>2</sup> heating capacity is obtainable with present thermo-active building parts. Which is also mentioned on the green\_lighthouse\_energiplanche.jpg available on <http://greenlighthouse.ku.dk>

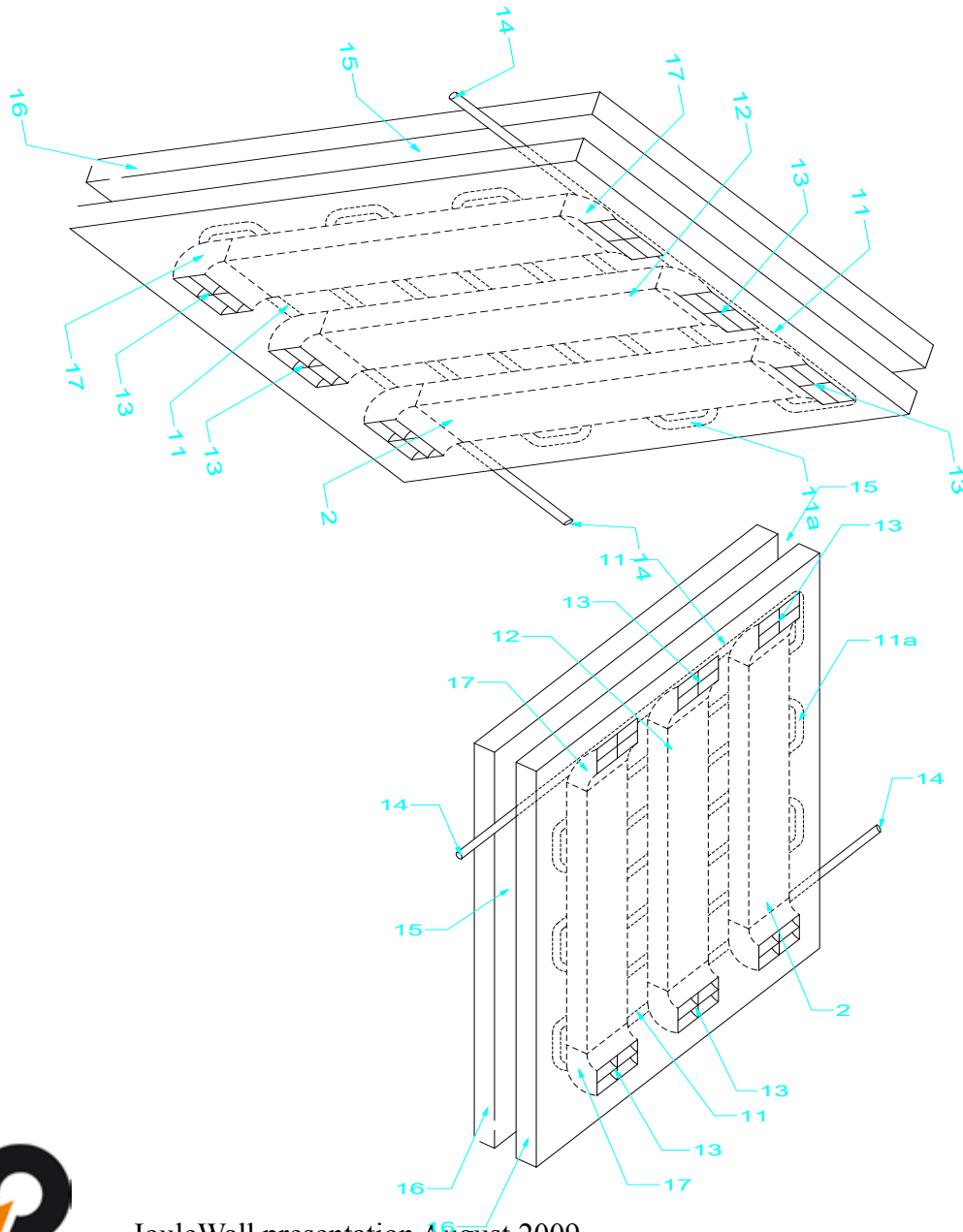
So why not use double heat exchanger thermo-active building parts?

# Green Light House



# What's a JouleWall?

Next level of Thermo-Active Building System parts. Double or triple heat exchanger in the building parts



COWI and others promoted the Thermo-Active Building Systems.

Current limitations to TABS are:

- Maximum heating / cooling capacity is not enough for office buildings
- Only few buildings have access to sea water for cooling.
- Acoustics difficult to solve as the only radiant surface needs to be covered
- Market introduction depending on traditional thinking
- IPR?

JouleWall and JouleCeiling add one or more heat exchangers to known technologies and overcome the above limitations.

- Build-in mass-to-air surface in the construction and the cooling / or heating capacity becomes limitless
- Build-in extra heat exchangers and the noise reduction returns to standard methods
- Build-in surface integrated heat exchangers in the building for harvesting and losing energy



A low temperature “solar panel” able to be a part of the air conditioning - that’s big news!

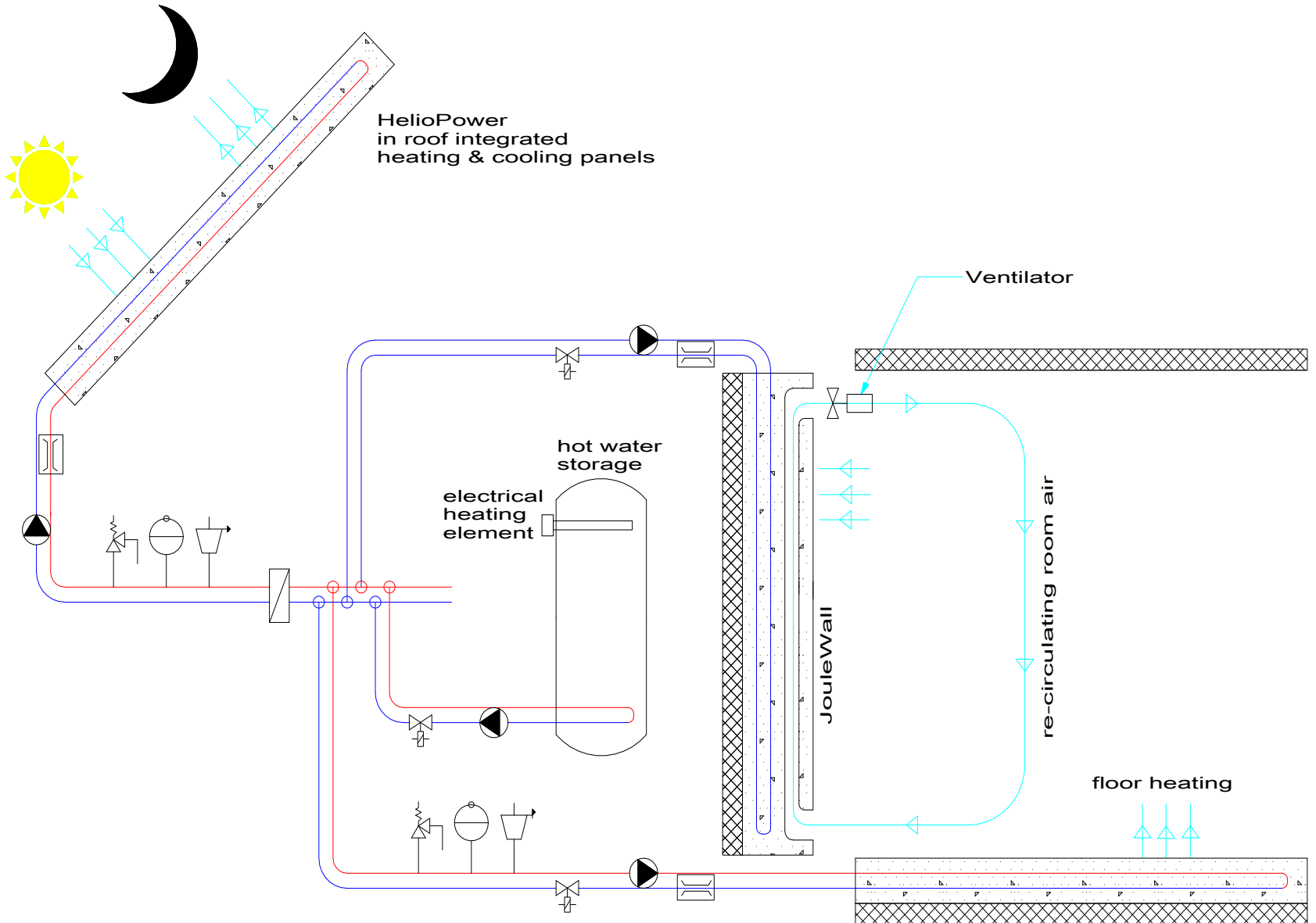
# Combined HelioPower and JouleWall

Fluid diagram of the basic elements and functionality of the combined HelioPower in roof or wall integrated heating/cooling panels combined with the in wall, floor or ceiling integrated JouleWall.

During the day time the sun heats up water for the bath room hot water and keep the floor at 25°C for improved comfort.

During the night time the night sky cools through the “solar panels” one or several building parts with thermal mass for storage of low temperature energy (18°C) for the next day comfort. If the floor is to hot than its cooled and kept at 25°C for improved comfort.

No traditional air condition system with all the costly ducting and low comfort is needed!



# Simple exchange and storage of energy!

Combine the HelioPower technology with the JouleWall technology  
- the future integration of various building parts into an overall energy management -  
and obtain the lowest investment, operating cost and carbon foot print.

Traditional visible high temperature solar panels for high temperature needs

PV cells for less dependance of the local grid and power supply to in house energy management

In the roof and wall integrated HelioPower heat exchanger for day time heating and night time cooling

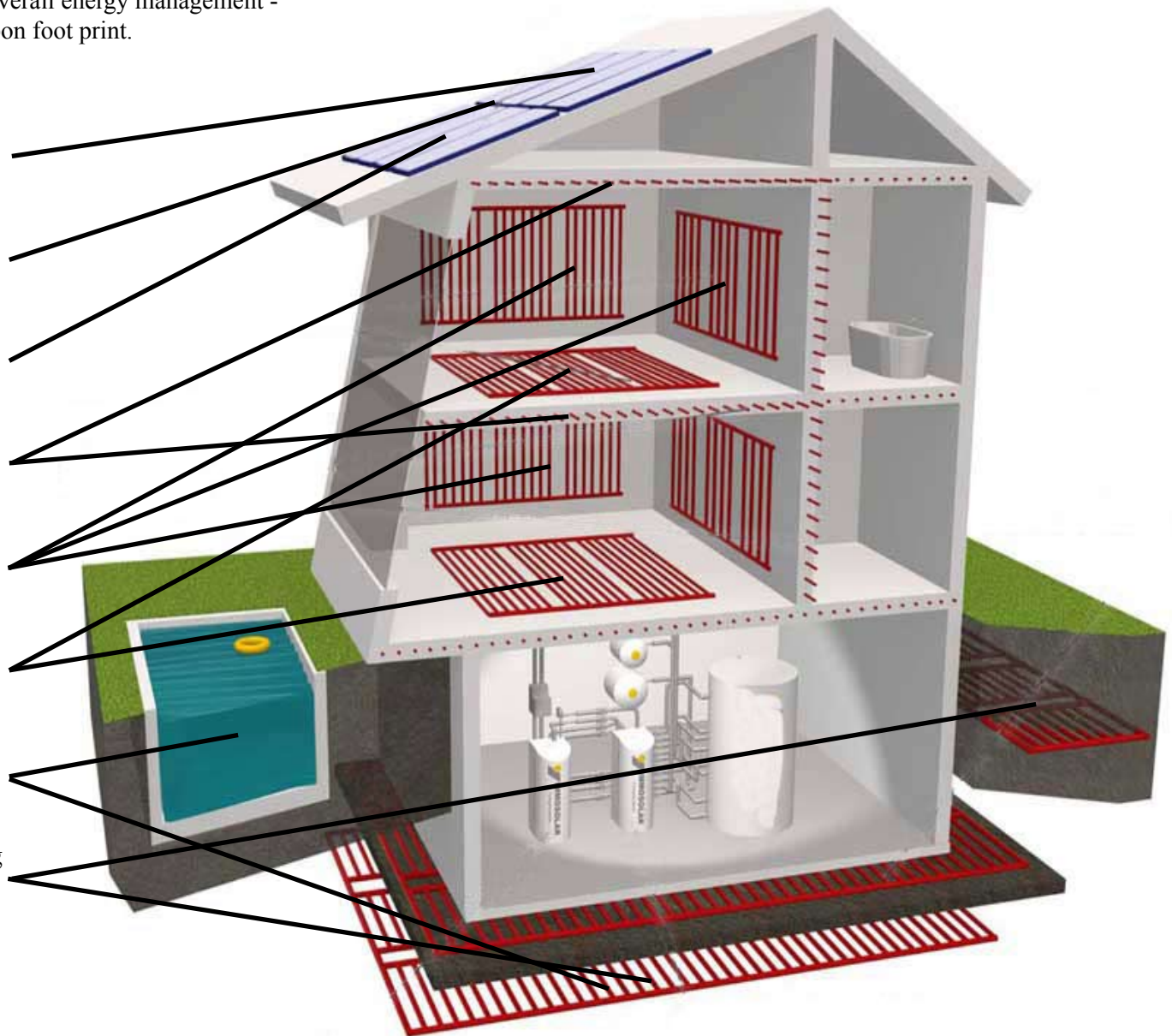
JouleCeiling for heating or efficient cooling depending on time of year and geographical location

JouleWall for heating or efficient cooling depending on time of year and geographical location

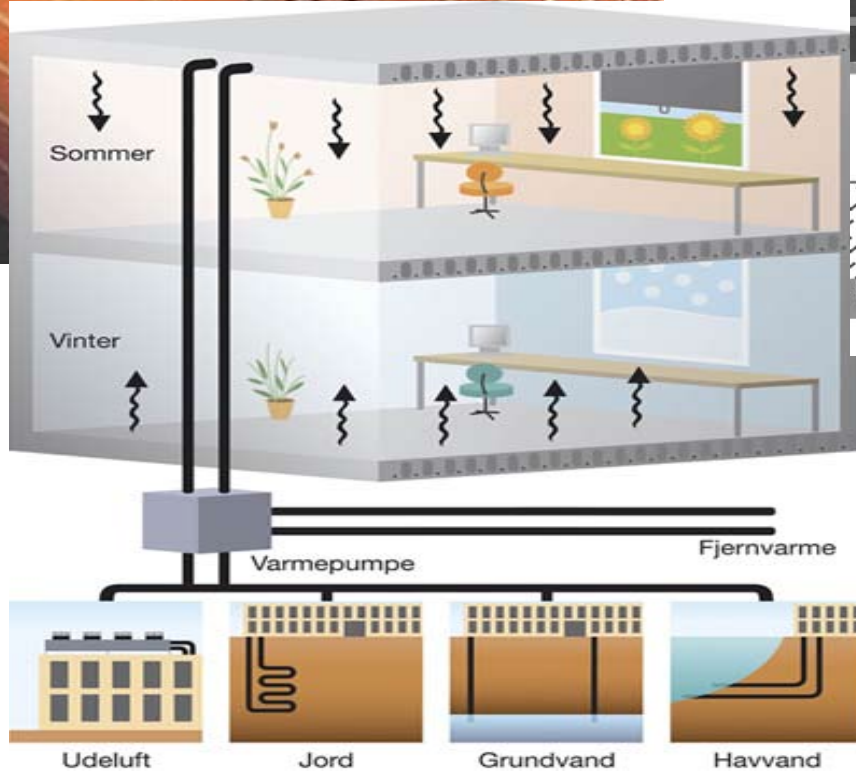
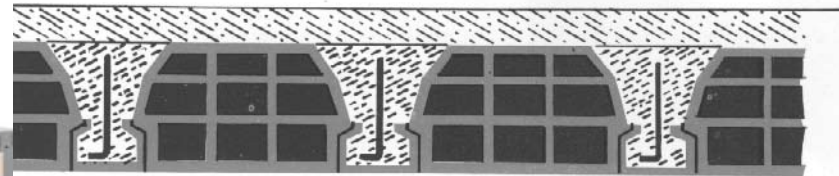
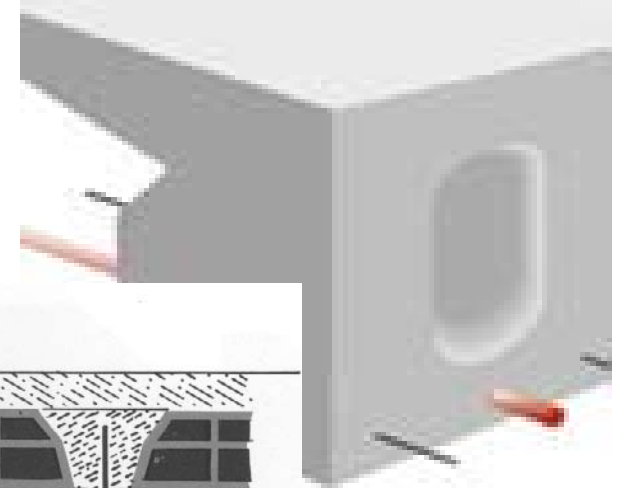
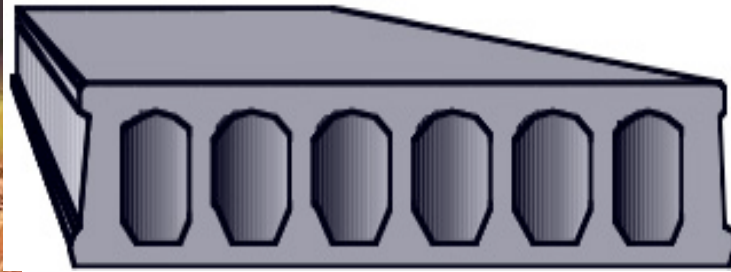
Floor heating based on fluid conveying tubing cast into the deck

Excess energy supplied either to the ground stora or the pool

Ground, soil storage of energy for heating or cooling purposes



# Known products to modify



# How to lower both the building and operating cost

The JouleWall & JouleCeiling concepts are simple technologies and few modifications are needed to typical traditional buildings materials. Any trained craftsman is able to install the products in homes, apartments, offices, hotels and industrial buildings. Optimum performance is depending on geographical location.

The JouleWall & JouleCeiling concept integrates:

- simplified **energy exchange** - with other innovative building parts
  - compartment **ventilation** - now performed in each room by local low power ventilators
  - room **air-condition** - performed from externally technical devices with water and only locally/internally with air
  - room **noise reduction** is not influenced as the ceiling surface is only partly needed or not needed at all for air-conditioning
- all obtained within the walls, floors and ceiling building materials

The JouleWall & JouleCeiling concept simplify the construction and offer huge reduction in building investment as to:

- significant reduction or complete elimination of traditional air condition heat pump based systems
- no limits in cooling and heating capacity
- vastly reduced need for expensive ducting
- elimination of expensive lowered ceilings to cover the ducting for office, hotel, apartment buildings and industrial buildings

The JouleWall & JouleCeiling concept reduces the operational cost by:

- huge reduction on the power bill as no electricity consuming heat pumps is needed to keep to compartments cool - when the building mass is kept conditioned
- eliminating the bulky and electricity consuming centrally located ventilators - and convert to locally small ventilators in each compartment
- reducing the mass to be transferred from air to water - and pump 3500 less volume

The JouleWall & JouleCeiling concept significantly improve the comfort by:

- obtaining the preferred room “air-condition” temperature without the annoying noise during the night
- avoiding the cold breeze from a single ventilator, which gives you the flu anyway
- enjoying the same comfortable temperature anywhere in the compartment without any cold breeze at all

Energy Management combined with Innovation Building Materials is by far the future ambition for lower carbon-foot-print for the modern building design!



## Office buildings, hotels, industrial building internationally

Electricity consumption for traditional WACS or AACS cooling systems in office building, hotels, etc are ranging 0.5 kWh/m<sup>2</sup> (roughly 150 kWh/m<sup>2</sup>/year) or 0.5 kWhx24x365 being impressive 4.38 MWh/m<sup>2</sup> electricity consumption per year.

Roughly 1 MW/h of produced electricity from a natural gas fired power plant emits app 600 kg CO<sup>2</sup>/h compared to app 1,100 kg of CO<sup>2</sup>/h when based on coal, as the energy source.

For ease of use then air-con units emit 5 ton CO<sup>2</sup>/m<sup>2</sup>/y !!!

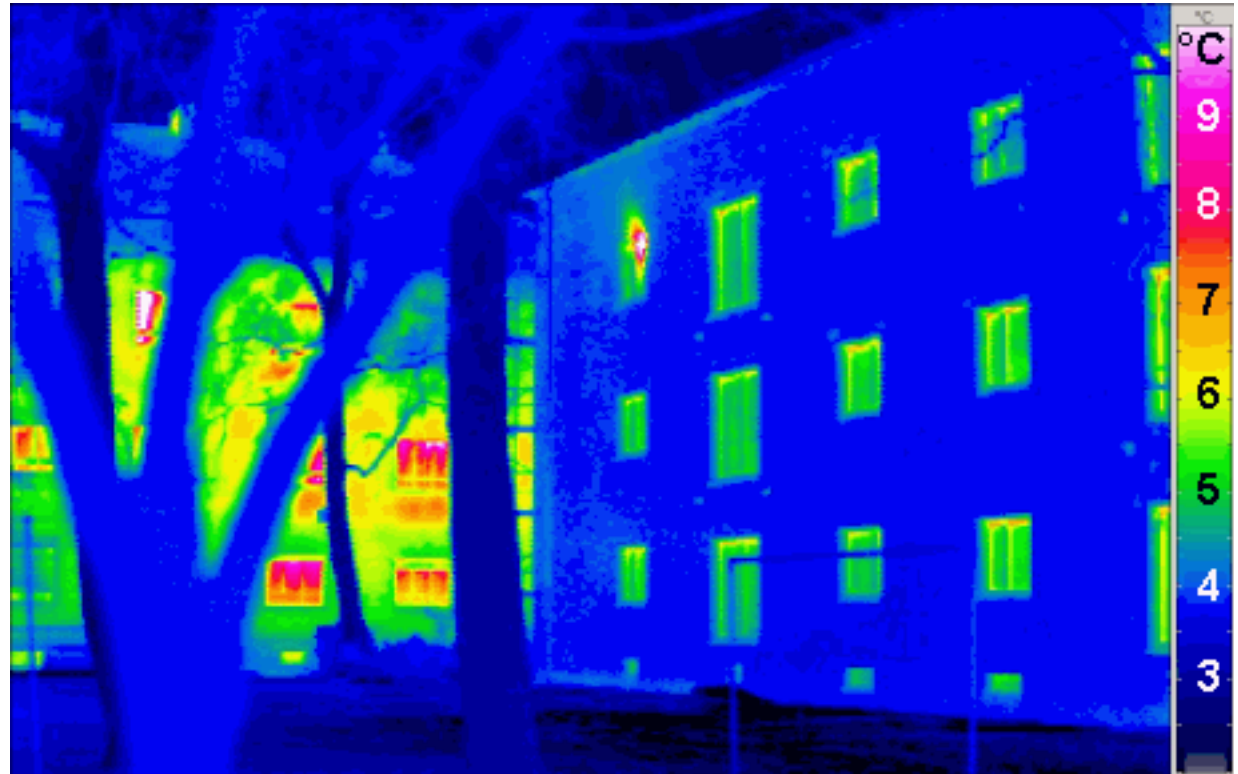
In warmer areas (south of Denmark!) roughly 40% of the energy consumed is for driving air conditioners!

Traditional ducting in office buildings, hotels for ventilation and temperature control covers 50% of the typical total installation cost ranging 2,000 to 5,000 Euro/m<sup>2</sup> including heat pumps, tubing, ducting and lowered ceiling grid system.

Compared to traditional office buildings, hotels, industrial building the JouleWall concept should **save >10% in investment:**

- Reduced compartment high = lower building
- Elimination or reduced use of lowered ceiling
- Elimination or reduced use of ducting
- Faster completion of the building

and further **lower the electricity consumption with as much as 85%** as to elimination of compressor based heat pump and ventilators air-con systems.



## Residential homes in Europe

Passive house / standard for central Europe requires that the building fulfill among others the following requirements:

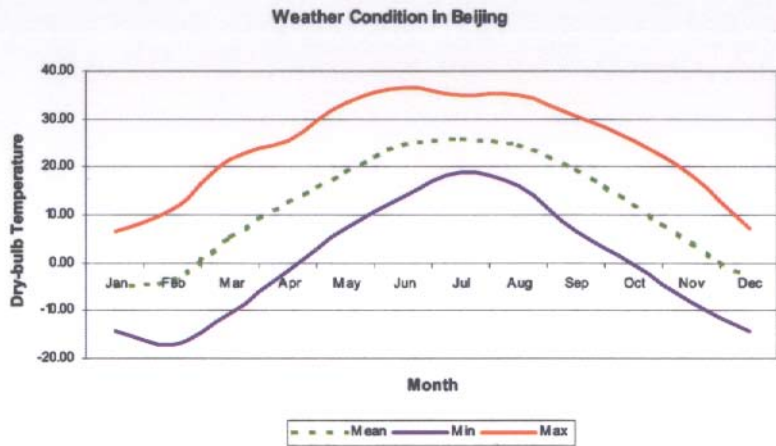
- The building must not use more than 15 kWh/m<sup>2</sup> per year energy for heating and/or cooling
- Total energy consumption (energy for heating, cooling, hot water and general electricity) must not be more than 42 kWh/m<sup>2</sup> per year.

One way of improving comfort and save at the same time is to make the building materials smarter. Reduce the investment and at the same time **lower the electricity consumption with as much as 85%** .

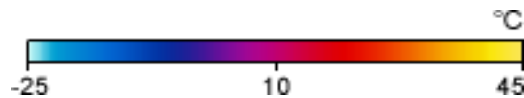
# Customer benefits







LST - LandSurfaceTemperature  
night time June 2000

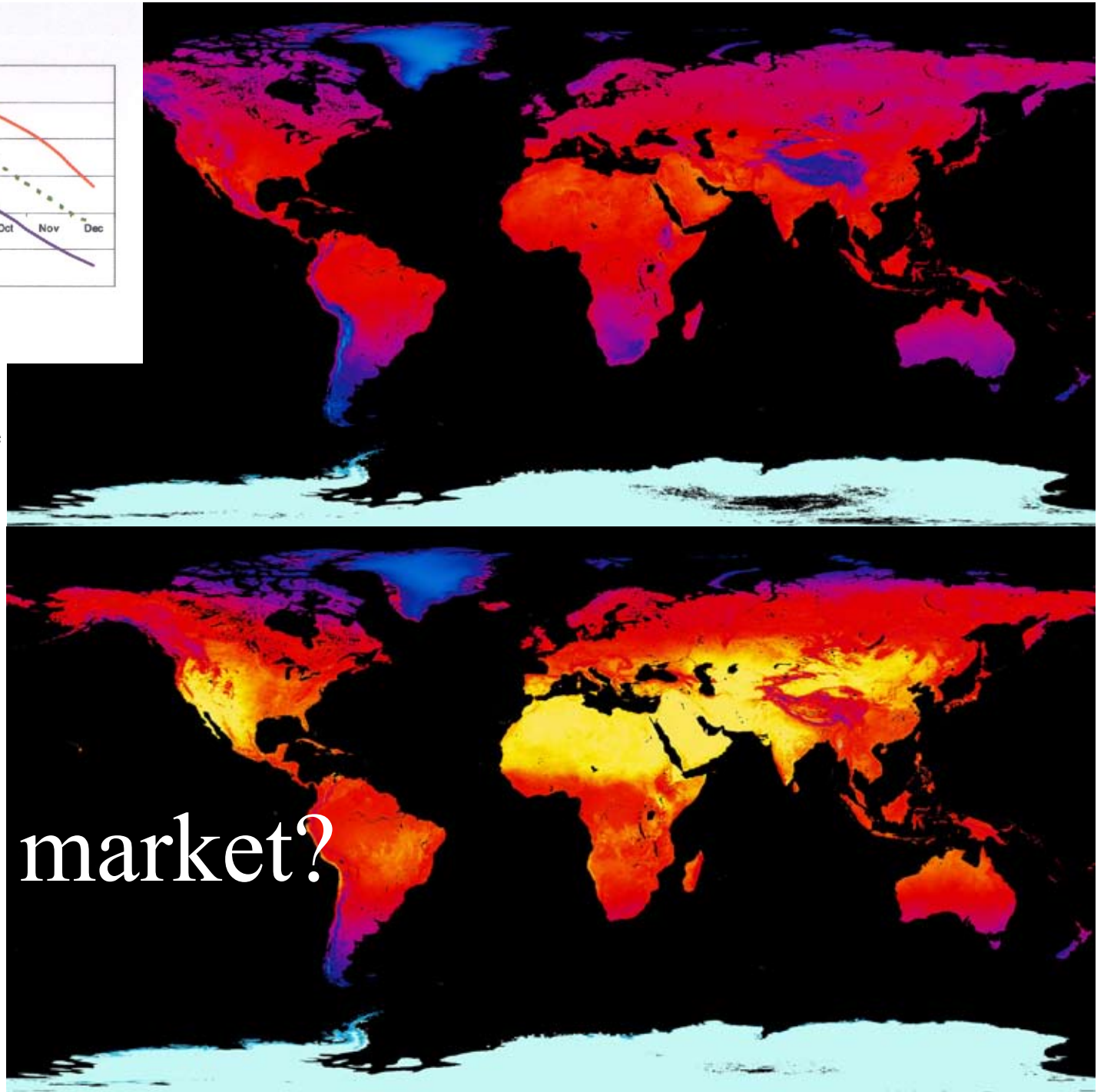


LST - LandSurfaceTemperature  
day time June 2000

60 mio residential air-con systems in the US require some 60 GW of installed power plants with CO<sub>2</sub> emission ranging 500 MMton/year!

# Where is the market?

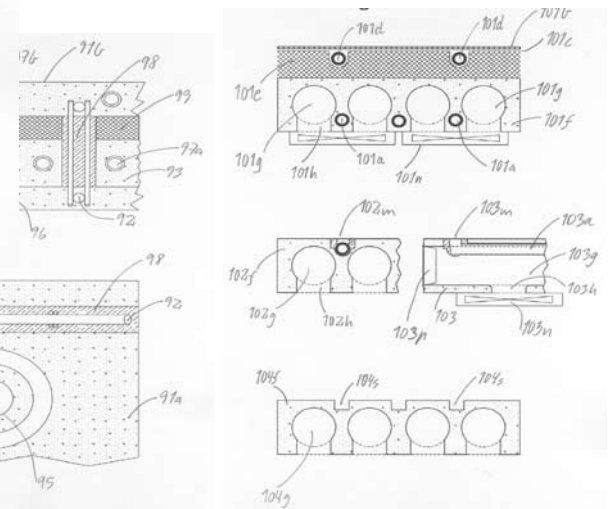
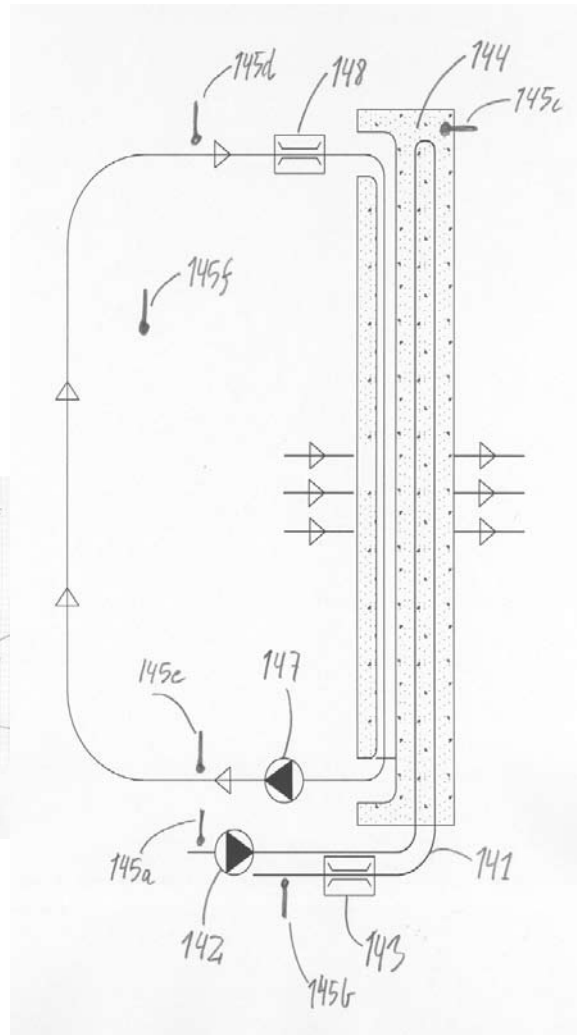
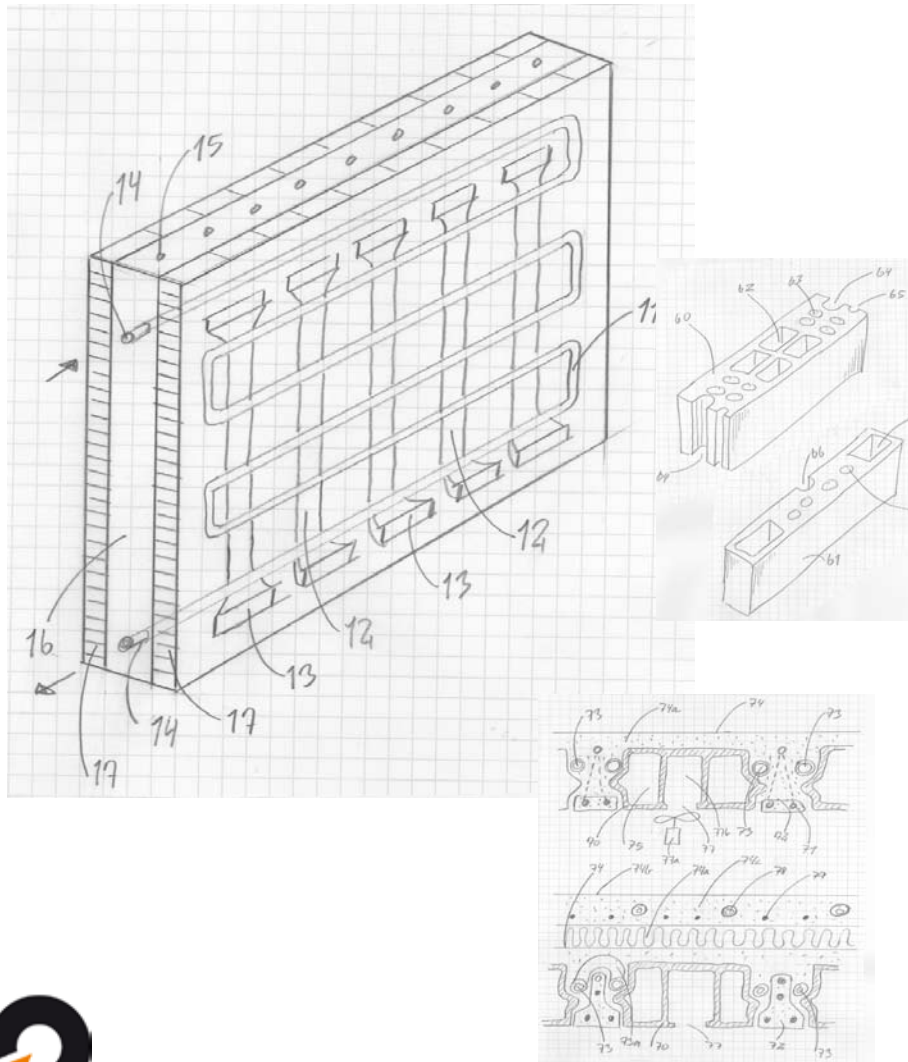
Geographical areas with high day time and less than 17°C night time temperatures are the markets for the JouleWall technology.



# How is the IPR / Patent situation?

The JouleWall & JouleCeiling concepts are registered and carefully patented by Stobbe Tech A/S

A few preliminary sketches displayed !!



Title: Building part with the ability to exchange and store energy  
Ref: JouleWall-9

**Field of the invention**  
The present invention relates to the area of multi functional active building parts designed for the exchange of energy and storage of energy in a building for improved human comfort in said building at vastly reduced electricity consumption and improved use of renewable energy.

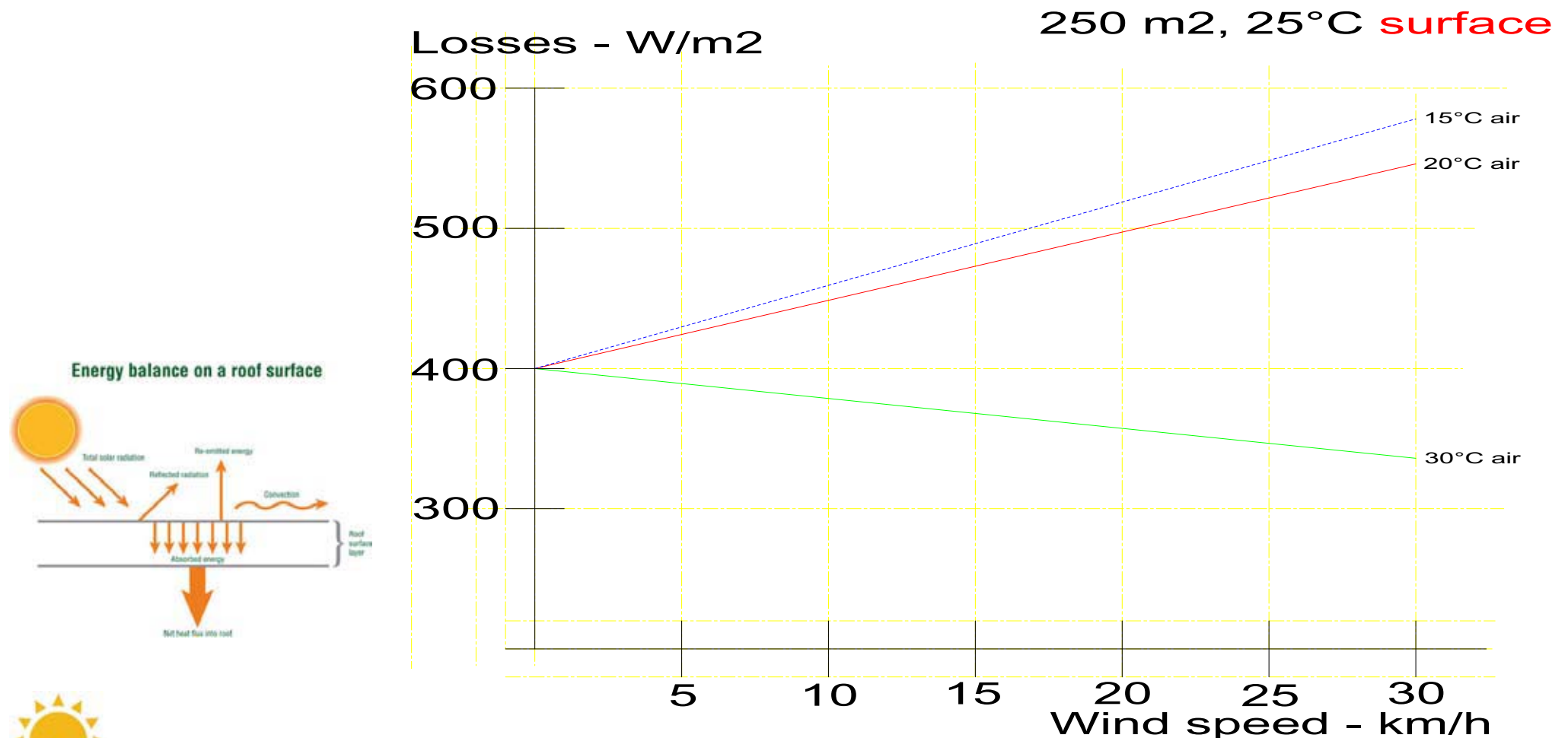
**Background of the invention**  
Traditional (heat pump based) air conditioning systems for personal comfort are a major source of electrical energy consumption world wide. And using air to warm or cool a space or compartment is extremely inefficient compared to the use of water. Typically room heating is needed in the night time and cooling in the day time – completely opposite as to when the low or high temperature are available from either the sun or the nature. By storing energy and release energy for use when needed improved comfort at lower energy consumption is possible. Room cooling or heating are vastly depending on the building insulation value, the building tightness, the solar energy passing through windows, quality of craftsman's ship, etc.  
In general the residential home should have high mass building parts inside the building and low mass building parts as climate shield for improved comfort. The high mass internal building parts for slow and minor temperature variation. The low mass building parts externally for reduced influence from the weather and the sun and potentially lower cost. PCM material containing building parts depend on air as conducting media reducing the energy transfer significantly and hereby severely limiting the performance.



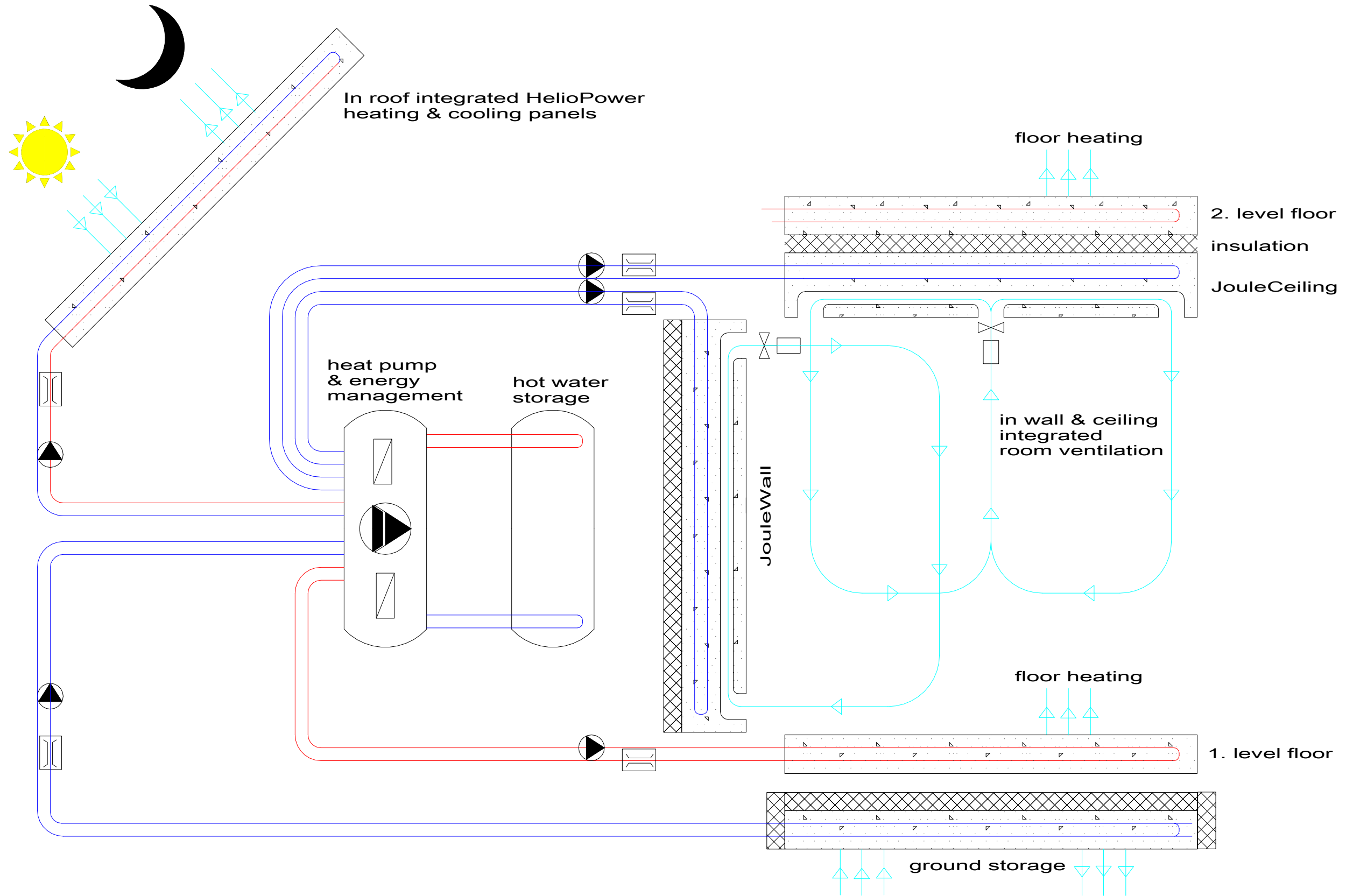
# Loosing energy - cooling performance

Comments to calculation:

- Thermal efficiencies ranging 35-60%
- Highest energy losses are by radiation = 400 W/m<sup>2</sup>
- Losses by convection determined by wind effect which adds further 200 W/m<sup>2</sup>
- 250 m<sup>2</sup> HelioPower roof do have the cooling effect of impressive 100 kW



# Stobbe Tech A/S - Confidential



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