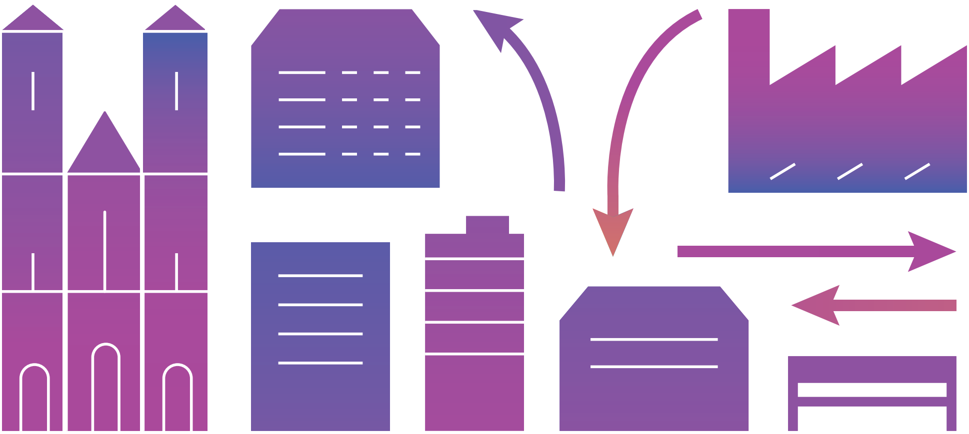
2016

EeB PPP Promising Technologies

HVAC & Lighting Solutions



ENERGY EFFICIENT BUILDINGS
AN ECTP COMMITTEE FOR INNOVATIVE BUILT ENVIRONMENT

DEEP GREEN COOLING
Self-regulating cooling system in building

Deep Green Cooling is a systemic package designed to provide cooling for sustaining high indoor building environmental quality, but is also usable for process and machine (e.g. server) cooling. The system is based on tens of bore holes a few hundred meters deep, connected to a closed cooling circuit supplying the buildings. The main components of the solution are the self-regulating cooling system in the building, which operates with chilled water temperatures at room temperature level, and the ground storage, which operates with chilled water temperatures at normal ground temperature level.

The ground is used as a source for cooling the building in the summertime. In the winter, the temperature in the ground is restored by outdoor ambient temperature. The heat stored in the ground during summer can be preferably used to preheat the incoming ventilation air in the winter, while at the same time the storage is cooled down by the ventilation air.

This solution can cover the entire annual cooling demand of a building without using chillers. It needs specific conditions of the difference between the annual mean ground and indoor temperatures, ground conditions, as well as specific building load profile. This solution is simple and robust since it is operated by traditional circulation pumps instead of by compressors.

The Deep Green Cooling system is compatible with almost all building energy efficient measures. However a comprehensive control strategy needs to be implemented in the BMS, and this, by collecting data through an effective monitoring network and by continuously measuring the building behaviour.

- **Integration of the heating and cooling system using renewable energy sources such as ground thermal capacity for geothermal Electricity production through PV panels**

- **Cooling heat recovery and energy storage to reduce non-renewable energy demand**

- Technical completion: between 1 and 2 years
- Can be used in new constructions
- Compatible with existing solutions

Project: BUILDSMART, Energy efficient solutions ready for market.
www.buildsmart-energy.eu

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BUILDSMART
Energy efficient solutions ready for market

GUIDED NATURAL LIGHT, LED TECHNOLOGY AND MOTION DETECTORS WITH DAYLIGHT COMPENSATION

Advanced low energy lighting solutions

Lighting inside often causes cooling needs. Here low energy lighting is used to lower the heat gained by lighting. Indeed, the building lighting system is controlled through sensors which can detect movement and daylight. The deployed lighting system is formed by low energy consumption LED lamps (with the exception of some outdoor lights, based on high efficiency fluorescent technology lamps). The control of the lighting system is based on strategies and control mechanisms that enable to provide artificial lighting only during the periods with actual demand (actual presence of people on the rooms), including:

• Lighting status control in common areas according to the presence of people, monitored through the deployment of movement detectors, mainly in the basement and garbage room.

• Stairway lighting status controlled by dedicated light sensors (switches).

The low energy demand lighting system is more suitable for commercial buildings, offices, hotels as well as tertiary public buildings. In term of costs, the initial investments are still higher than the ones in conventional solutions. However, the LED price is getting down quite fast. When considering the whole building life cycle, low energy lighting system is providing better return of investment than conventional solutions.

The low energy demand lighting system is compatible with almost all building energy efficient measures. However a comprehensive control strategy needs to be implemented in the BMS, and this, by collecting data through an effective monitoring network and by continuously measuring the building behaviour.

- **Coupling high efficiency artificial and natural lighting by optimising the daylight compensation and avoiding switching on the artificial light if the area is not occupied and if it is not necessary (enough daylight).**

- **Low energy demand lighting system procurement for developers and real estates, to define optimal solution within specific context.**

- Technical completion: less than 1 year
- Can be used in new constructions
- Can be used in renovation retro-fitting
- Compatible with existing solutions

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BUILDSMART
Energy efficient solutions ready for market

BUILDING HEAT RECOVERY FROM VENTILATION

Self-regulating ventilation system

Self-regulating ventilation system enables changes to be easily made locally, without demand for rebalancing of dampers in the ducting system. It is also easy to install since smaller duct dimension is used than in a traditionally designed ducting system.

Self-regulating ventilation system is based on having the pressure drop in the ducting system concentrated to the end of the ducting system. The pressure drop is located to the supply air diffusers or cooling beams as supply air diffusers. Energy efficiency is increased when using self-regulating ventilation due to the lower power demand caused by the lower total pressure drop over the ventilation ducting system (120 Pa compared to traditional 240 Pa).

The air handling units are equipped with high efficiency heat recovery devices providing sensible heat recovery efficiencies above 72 % (FTX-system). The air handling units have also two extra pre-heating units for the outdoor air. The first step is a coil to restore the groundwater temperature to its normal level (during the cold season), the second coil is to pre-cool the return water in the cooling beam system (when possible). This means that there are two extra steps of heat recovery beside the normal heat recovery unit.

The FTX ventilation system reuses warm air coming from all the apartments through a heat exchanger. The new air inlet and exhaust air outlet are located in the outside the building and take place through large scale ventilation ducts. This system provides a key contribution to the energy efficiency of the building, thanks to the availability of heat recovery of the exhaust air, and the preheating and free cooling functionalities obtained taking advantage of the steady temperature of the ground (15 ºC) all over the year.

The main markets for the self-regulating ventilation system are the new commercial, mid and high rise residential buildings.

- **Advanced ventilation system with heat recovery system**
- **Significant heat recovery efficiencies above 72%**

- Technical completion: between 1 and 2 years
- Can be used in new constructions
- Compatible with existing solutions

Project: BUILDSMART, Energy efficient solutions ready for market.
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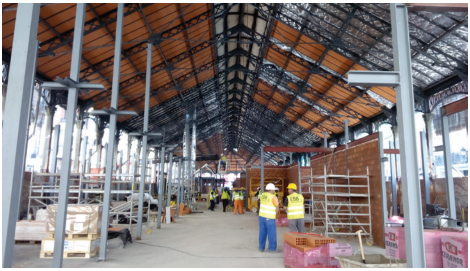
BUILDSMART
Energy efficient solutions ready for market

COMMONENERGY

CO2-Gas user for refrigeration systems



Today, the trend for buildings in the EU is getting closer to nZEB (nearly Zero Energy Buildings). This means that refrigeration is becoming, year after year, one of the most important and one of the last thermal loads in food retail shops. Refrigeration systems are usually standalone systems that sometimes have secondary connections to other systems. These connections consist, in most cases, of passive heat recovery based on heat exchangers. CommONEnergy's new technology is an energy pack consisting of an all-in-one R744 trans-critical device for supermarket application actively producing on demand thermal power for heating, cooling and refrigeration. The R744 trans-critical system is able to independently modify three pressure levels in order to satisfy the whole thermal demand of the store.

The main goal is a system that would primarily provide refrigeration to a convenience format store and at the same time use the heat from the refrigeration effect to provide heating to the store. The system would satisfy the store's space heating requirements without the need for additional boost heat from other sources such as space heaters or VRV units. The additional cost required to install CO2 refrigerants proves to be beneficial because of its ability to remove of reduce the need for a heating plant, reducing plant footprint and cost. A trial has proved that with the use of CO2 refrigerant and the benefits this allows for heat recovery, as well as the multi temperature heat recovery circuits, it has indeed been possible to meet the aims of the project. The technology was tested on a store that was chosen for trial, which was far from typical and had a higher than anticipated heat load, therefore a supplementary form of heating was installed. It has been found during the tests that this additional heating was not required with all heating demand having been satisfied by the refrigeration plant.

- Optimized heating system for improved thermal comfort
- Improved efficiency plant with CO2 ejector
- All-in-one R744 trans-critical device

- Technical completion: between 1 and 2 years
- Can be used in new constructions
- Can be used in renovation/retrofitting
- Compatible with existing solutions

Project: CommONEnergy
www.commonenergyproject.eu

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CommONEnergy

IMPROVEMENT OF HEAT EXCHANGERS VIA NANOTECHNOLOGICAL COATINGS AND NEW MODELING TOOLS

Significantly reduces energy consumption of HVAC systems

EnE-HVAC's new nanotechnological solutions will significantly reduce the energy consumption of heating, cooling and ventilation systems. While the majority of energy consumed in Europe is spent on heating and cooling, large sums can be saved by enhancing the energy efficiency of HVAC systems. Of the total energy consumed in housing and commercial buildings, 35% comes directly from HVAC systems.

This novel innovation is based on two different nanotechnological solutions for heat exchangers. The first solution is suitable for the refrigerant side of condensers and evaporators in heat pumps and refrigeration systems. A nanostructured surface improves the heat transfer of the refrigerants in heat exchangers by inducing early bubble boiling and efficient condensation. An improvement of the heat transfer coefficient by 15% could be demonstrated.

The second solution provides anti-freezing properties to the airside of heat exchangers and limits ice accretion. This property is profitable in heat recovery ventilation, heat pumps and refrigeration systems. The novel nanotechnology coating doubles the up-time between defrosting cycles for heat exchangers that require periodical defrosting. At present, 10-18% of the total energy consumption of heat pumps or refrigeration units is consumed by defrosting. It is estimated that the nanotechnology coating can divide this energy consumption in half.

The actual performance analysis and system optimization is possible to carry out with the supporting software. By using the advanced CFD and multi-physics solution, it is possible to model the physics of heat exchangers. For nanotechnology coatings application, a special tool has been developed. This model makes it possible to analyze and model specific parts of HVAC components, including condensation drainage systems, evaporation systems and heat transfer systems.

- **Significant improvement of heat exchanger efficiency**
- **Anti-freezing properties limit over icing**
- **Doubles the up-time between defrosting cycles**
- **Reduces energy consumption of HVAC and refrigeration systems**

- Technical completion: between 1 and 2 years
- Can be used in new constructions
- Can be used in renovation/retrofitting
- Compatible with existing solutions

Project: EnE-HVAC, Energy efficient heat exchangers for HVAC applications
www.ene-hvac.eu

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EnE-HVAC
Energy efficient heat exchangers for HVAC applications

This technology brochure highlights the highly promising innovations from selected co-funded European projects under the 7th Framework Program (FP7).

The Energy-Efficient Buildings (EeB) Public Private Partnership (PPP) is a joint initiative of the European Commission (EC) and the Energy Efficient Buildings Committee of the European Construction Technology Platform (ECTP).

This initiative aims at promoting research on new methods and technologies to reduce the energy footprint and CO2 emissions related to new and retrofitted buildings across Europe.

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ECTP
INNOVATIVE BUILT ENVIRONMENT

European Commission