



# SOLAR COOLING



Energy, experience and technologies of solar cooling



[www.kloben.it](http://www.kloben.it)

**Kloben**  
Solar Evolution<sup>®</sup>



SKY

## THE ENERGY INDEPENDENCE THAT COMES FROM THE SUN

**The sun has always been an inexhaustible energy supply, respectful of the environment, available to everyone and, most of all, totally free.**

**Kloben has, for the past fifteen years, been pursuing and developing the aim of integrating the heating of buildings and the production of hot water using high energy performance solar systems that use solar radiation.**

### SOLAR ENERGY

Solar energy is heat. This is what, starting from the second half of the last century, the most industrialised countries have discovered after decades where the total energy requirement suffered consumption drops such to develop greater ecological conscience in everyone and the need to identify other eco-sustainable energy sources. Therefore, with great success in Europe and with a forecast of ever greater feedback in Italy also, companies have been established, Kloben being the first, in the thermal solar sector, promoting and supporting the development, research and installation of renewable, eco-compatible, energy plants, within everyone's' reach.

### THE CHOICE: SOLAR SYSTEMS WITH TUBE COLLECTORS

The solar systems are the plants proposed by Kloben.

The continuous development of high performance solar collectors, able to capture the abundant energy supplied by the sun throughout the whole Italian territory, makes every structure on which the solar plant is applied, energetically more efficient.

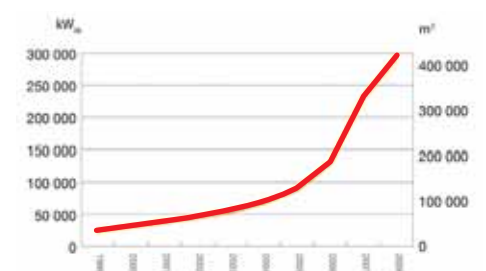
IN THE LAST FEW YEARS, THE EUROPEAN MARKET (SOURCE: ESTIF) HAS HIGHLIGHTED A HUGE INCREASE OF THE INSTALLED SURFACE. THE ITALIAN MARKET IS ALSO CONSOLIDATED, THANKS TO THE INTRODUCTION OF LAWS FACILITATING THE INSTALLATION ON THE EXISTING ASSET, THE EVER GREATER NEED OF PROFESSIONALS TO IDENTIFY ENERGY SOURCES WITH ZERO EMISSIONS, THE GOODNESS OF THE CERTIFIED PRODUCTS WITHIN EVERYONE'S' REACH, THE CONTINUED INCREASE OF ENERGY COSTS DERIVING FROM TRADITIONAL SOURCES AND, ABOVE ALL, THE EVER MORE ROOTED NEED TO GUARANTEE AN ENERGY INDEPENDENT FUTURE WITH ZERO EMISSIONS TO THE GROWING GENERATIONS (LAYOUT SOURCE: ESTIF - EUROPEAN SOLAR THERMAL INDUSTRY FEDERATION - TRENDS AND MARKET STATISTICS 2008 - MAY 2009).



The solar market in Europe



The solar market in Italy





What makes Kloben the leader in Italy in the realisation of thermal solar plants is the awareness that the sun is an every day of the year energy source for every plant requirement.



### THE SAME QUALITY EVERY DAY OF THE YEAR

The search for efficiency and quality was born from the belief of using a thermal solar plant every day of the year. Kloben has developed vacuum tubes solar collectors able to capture and confine energy within nozzles insulated from the outside through the vacuum. Like in an energy flask, the vacuum guarantees the ideal insulation for the heat which is forced to move into the internal circuit and, therefore, into the plant.

Only by searching the thermal yield of the solar collectors every day of the year, during the cold season also, a solar efficient plant is realised, with higher performance, more economical for its wide use, more respectful of the environment as it can also be used in winter heating in low temperature radiant plants.





## SOLAR COOLING

### GENERATING COLD FROM THE SUN

**Solar Cooling technology is a plant engineering technique which uses hot water of solar collectors to produce chilled water or air conditioning. The cold in this way produced is used in buildings as a mean for cooling the ambients or in industries as preservation or thermal stabilisation instrument.**

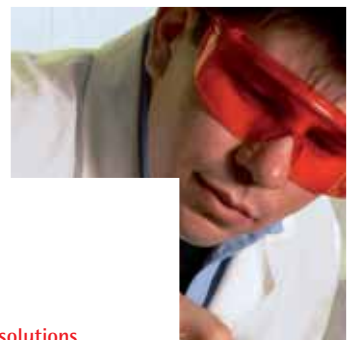
#### **THE AIM: THE BEST COMFORT WITH LOWER CONSUMPTION**

The Winter comfort of the occupants of the building or the need to have an energy supply under the form of hot water is not the only source of consumption. Energy consumed now-a-days is no longer during the Winter but during the Summer for air conditioning. The installing of water coolers consuming high electricity amounts cannot be the solution for energy saving. The real solution has been known for a few decades in the world and, commercially, only for a few years in Italy. The solution to decrease consumption is solar cooling.

#### **THE SOLUTION: SOLAR COOLING**

Solar Cooling is a simple conception plant using little other energy to work. You can obtain some megawatt of power of cooling using only electric energy for the circulation of plant fluids. The real energy is supplied by the sun, in a continuous and quantitative manner, as every one of these plants envisions one or more thermal storages of hot water heated by the vacuum tubes solar collectors.

The machines used to cool the air or the water are the result of more than a decade of technical research and perfecting: the machines use the natural hygroscopic feature lithium bromide or lithium chloride, similar to the normal kitchen salt, to generate a cooling cycle, continuously retreated by the sun. Once low temperature air or water is produced, it is distributed inside the building or in the manufacturing process through channels or piping.



#### **The Kloben solutions**

DESICCANT EVAPORATIVE  
COOLING AIR CONDITIONING FROM THE SUN

ABSORPTION CHILLERS CHILLED  
WATER FROM THE SUN

#### **PLANTS ARE OPTIMISED WITH INTEGRATION**

What must not be forgotten is that with Solar Cooling, integrated plants are realised offering yearly comfort to the building or to the manufacturing process in which they are inserted: the solar collectors produce Summer air conditioning but also Winter heating in low temperature plants and DHW or process hot water.

The Solar Cooling plants are silent, reliable, requiring low maintenance as they have only a few moving parts, use a small amount of electric energy and can be installed outdoors in case of no technical space inside the buildings.





Follow the constant increase of Kloben Solar Cooling plants installed in the world on HYPERLINK "<http://www.kloben.it>" [www.kloben.it](http://www.kloben.it)!

## QUALITY IS MEASURED IN SAVING AND ADVANTAGES

Reduction in the electric energy consumption using thermal solar energy



The sun powers the plants all year round



Healthy air in every situation



Choosing Kloben means entrusting in a pool of operators of the sector with full knowledge of the energy possibilities offered by solar radiation.



High savings on the electricity bill and of the fossil fuel



Energy saving through the crossed re-use of the air flows in the DEC technique



Reduction in consumption in the cold seasons also



Quicker depreciation with national tax deductions, regional or local bids, European financings

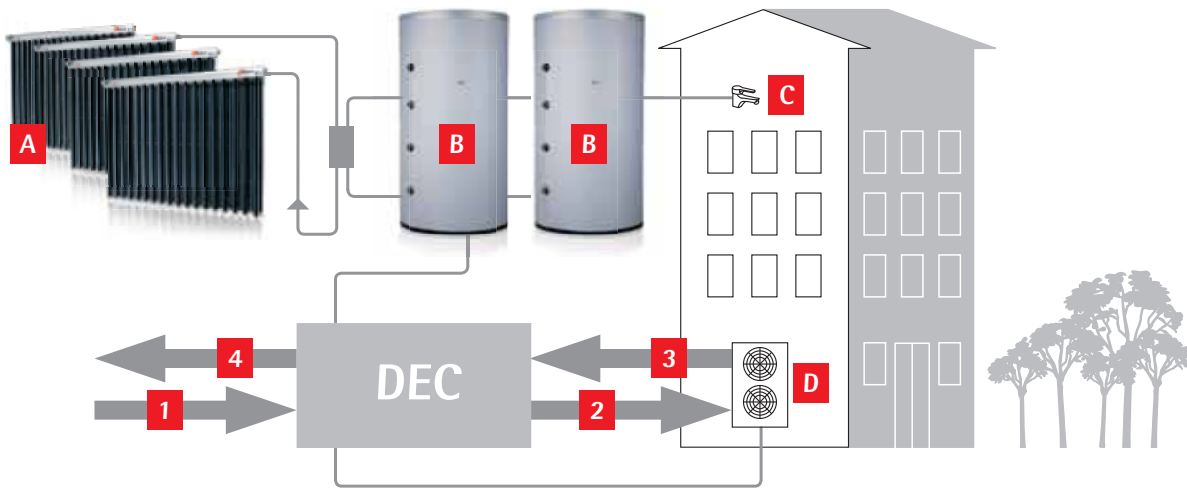


Always high amounts of cold water and DHW



Excellent yield if integrated with low temperature radiant plants





- A EXTERNAL SOLAR FIELD (COLLECTORS)
- B HOT WATER STORAGES
- C DHW IN THE BUILDING
- D AIR CONDITIONING OF THE BUILDING
- 1 INCOMING AIR TO BE CHILLED
- 2 CHILLED AIR
- 3 RECOVERY AIR
- 4 EXHAUSTED AIR

## DESICCANT EVAPORATIVE COOLING

SOLAR PLANTS FOR THE PRODUCTION OF AIR CONDITIONING WITH HYGROSCOPIC SALTS DESICCANT MACHINES

The DEC technology, Desiccant Evaporative Cooling, is used for air conditioning.

Machines with different constructive peculiarities can be found on the market, but the functioning principle for all is based on the absorbing capacity that certain salts, like lithium chloride or silica gel, have towards the humidity of the air.

### TREAT AIR TO BREATHE COMFORTABLY

A DEC plant is an air-handling unit, able to process large volumes of air, even tenths of thousands of cubic metres per hour, chilling humidity and temperature of the air. This is thanks to the ability of the absorbing salt when liquid, to take the humidity and temperature from the air that is conveyed on to the same. The DEC systems also have the possibility to perform post dehumidification to obtain the total comfort for air conditioning.

And the sun? Through the entire process, the sun is used to continuously regenerate the absorbing salts removing their humidity, previously removed from the air during dehumidification. Therefore, solar energy is the free energetic restorer of the plant.

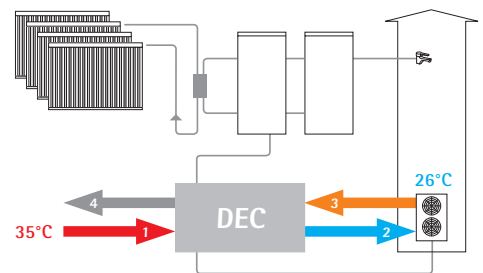
### BASIC PLANTS AND INTEGRATIONS

A Solar Cooling DEC plant is made by solar collectors field, of a volume of hot water stored in thermal tanks and by the air-handling unit. The plant is completed with an air conditioning distribution system and, naturally, by the supply of DHW.

This type of plant is optimised coupled with low temperature radiant systems like floor or ceiling, which can use thermal energy during the Winter guaranteed by the vacuum solar collectors as heating system.

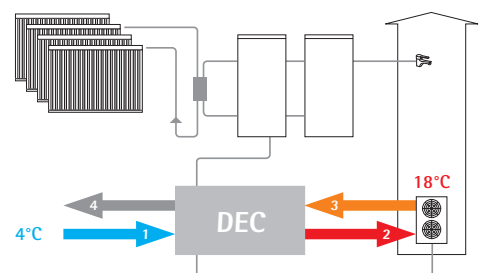


#### The plant in the Summer



- 1 INCOMING AIR TO BE CHILLED
- 2 CHILLED AIR CONDITIONER
- 3 RECOVERY AIR
- 4 EXHAUSTED AIR

#### The plant in the Winter



- 1 INCOMING AIR TO BE HEATED
- 2 HEATED AIR
- 3 RECOVERY AIR
- 4 EXHAUSTED AIR



- offices
- shopping centres
- service/administrative centres



plant combined with ceiling radiant system

## KLOBEN BOVOLONE, VERONA

### AIR TREATMENT PLANT FOR OFFICES

The corporate and technical pride is the Solar Cooling plant installed in the Kloben offices in the province of Verona.

It is one of the few examples in Europe of the DEC systems working with solar energy and combined with hot/cold energy distribution, both with air and with radiant surface.

During the cold season, the solar collectors heat the thermal storages from where it takes the hot water for the floor and ceiling low temperature radiant plants in the offices.

The peak loads are satisfied by the energy integration given by a geothermal plant. The air-handling unit with lithium chloride salts sees to the air change with crossed heat recovery.

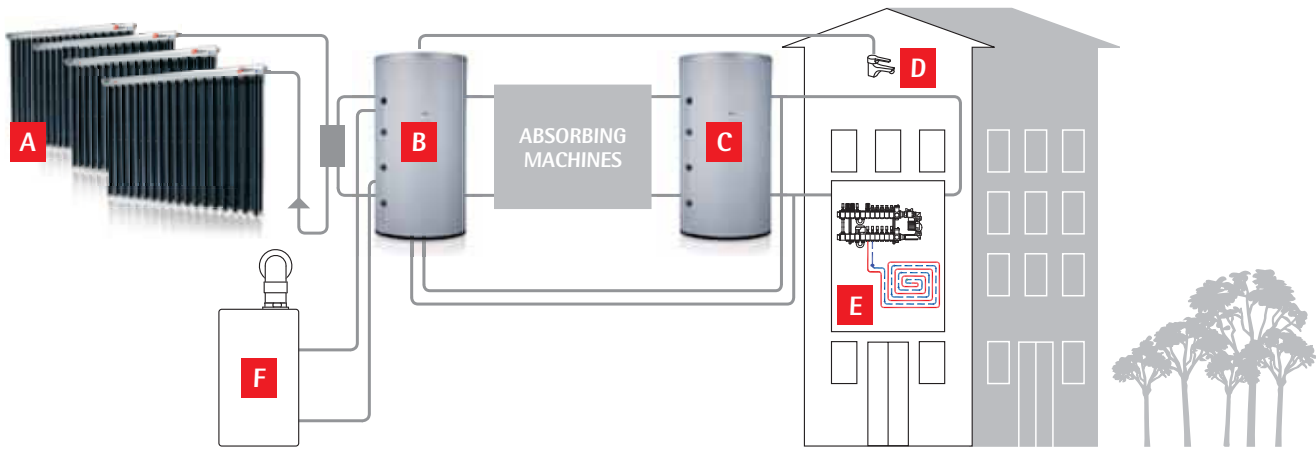
During the hot season, the solar collectors offer the free energy supply necessary for regenerating the absorbing salts able to chill large volumes of air, lowering its temperature and humidity. Geothermal technology sees to the floor and ceiling radiant chilling.



- Solar field  
72 Kloben SKY 12 Solar Collectors  
CPC 58, gross surface 156 sq. m
- Hot water thermal storages  
2x4000 litres
- DEC Machine  
89 kWf, 12000 m<sup>3</sup>/h
- Heat pump  
39 kWf
- Vertical geothermal probes  
14
- Insulated cold storage  
1500 litres
- Energy distribution  
air channelling +  
radiant ceilings







- A EXTERNAL SOLAR FIELD (COLLECTORS)
- B HOT WATER STORAGE
- C COLD WATER STORAGE
- D DHW IN THE BUILDING
- E HEATING AND CHILLING OF THE BUILDING
- F BOILER

## ABSORPTION CHILLING

SOLAR PLANTS FOR THE PRODUCTION OF CHILLED WATER USING ABSORPTION CHILLERS WITH SALT SOLUTION

**The more frequent installed Solar Cooling plants in Italy are realised by means of absorption chillers with liquid, which is a solution of lithium bromide. These machines generate chilled water from heat sources which temperature is just under 100° centigrade, according to energetic performances of vacuum solar collectors.**

### COLD WATER FROM THE SUN FOR AIR CONDITIONING

The absorbers available and reliable on the market go from 15 kW to more than one megawatt of cooling capacity. For this reason these plants are mainly designed for high cubage buildings or for industrial processes.

The absorbers with water-lithium bromide mix are freeze cycles which evaporation mean is the hot water, from 70° to 95° centigrade, produced by the solar collectors and stored in hot tanks. The evaporation and condensation processes of the salts solution provide cold water at a temperature of 7° centigrade, which will be temporarily stocked in a cool storage to supply the radiant floor/ceiling systems or fan-coil type cooling systems.

To obtain chilled water, absorbers need to dissipate the energy that can be used for the production of hot water, for the heating of a swimming pool or it can be given up to the air through a drainage system.

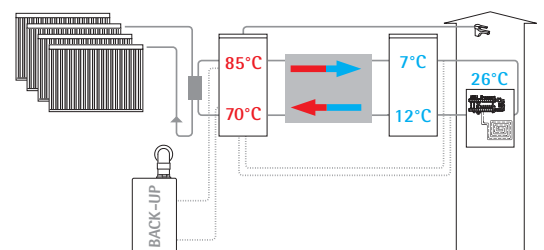
This type of plant, coupled with the existing electric chillers, completes the main part of the energetic needs of cooling the building or of the process in which it is integrated.

The particular feature of these machines is their low-electricity-consumption.

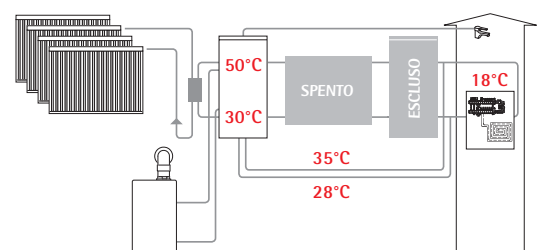
However, the best way to think at Solar Cooling is as a global plant that also satisfies the Winter heating requests and the production of industrial or DHW.



The plant in the Summer



The plant in the Winter







- offices
- restaurants and canteens
- existing hotels

## CURIA DI VALLO DELLA LUCANIA SALERNO

### COMBINED SOLAR COOLING PLANT

A combined plant was installed five years ago in the Curia di Vallo della Lucania for solar energy cooling of the restaurant and part of the sleeping area.

The plant was adjusted by simply producing water heated by the sun and storing it in the insulated tanks placed upstream of the pre-existing boilers. In this way, the solar is used during the cold season to integrate most of the fan-coil heating.

During the Summer, the water is stored in tanks and is used to produce chilled water that is sent to the pre-existing cold storage of the electric chiller.

It must be noted that the premises were not subject to building work as it is a non-invasive plant engineering technique applied to the present distribution.



- Solar field  
Kloben SP 21 Solar Collectors  
CPC 47, gross surface 165 sq. m
- Hot water thermal storages  
4x3000 litres
- Absorbing machine with LiBr  
35 kWf
- Insulated cold storage  
1000 litres
- Energy distribution  
hot/cold fan-coil








  
 ■ large structures
   
 ■ large industries




  
 ■ offices
   
 ■ tertiary

## EMERGENCY HOSPITAL KHARTOUM, SUDAN

## POLISTUDIO A.E.S. RICCIONE, RIMINI

### COMBINED SOLAR COOLING PLANT

An important application for the Solar Cooling is represented by all applications requiring large amounts of energy for air conditioning.

A concrete example is the plant installed in 2006 in the childrens cardiac surgery hospital in Soba, near Khartoum in Sudan, where Emergency has been working for a few years in the difficult African region.

The installed plant works in cooling for the whole year. The Kloben vacuum solar collectors solar plant of the SP series maintains at nearly 100°C approx. fifty cubic metres of water that powers two absorbing machines installed in parallel.

The energy distribution is at half a loop of cold water in over 4500 sq. m of hospital space. The plant has solved electric energy problems in that it is an area with non continuous supply.



- Solar field  
288 Kloben SP 21 Solar Collectors  
CPC 47, gross surface 1.083 sq. m
- Hot water thermal storages  
3x17000 litres
- Absorbing machine with LiBr  
2x615 kWf
- Insulated cold storage  
3000 litres
- Energy distribution  
cold fan-coil

### COMBINED SOLAR COOLING PLANT

An application example of solar plant with integration of the Winter heating and Summer cooling energy requirement is installed in an office building in Riccione.

(RN) where Polistudio A.E.S. works, project developer.

It is an integrated design example with heating system at the service of the utility completely hidden underground. The vacuum tubes solar collectors supply energy as well as technology and professionalism. Solar Cooling is also an able corporate marketing instrument for those believing in eco-sustainability and in the concrete use of renewable energy.

The plant is equipped with an energy and remote management supervisory system.


It is important to note that Solar Cooling is a silent technology used for the close installation in premises occupied by persons.



- Solar field  
Kloben SP 21 Solar Collectors  
CPC 47, gross surface 124 sq. m
- Hot water thermal storages  
2x2000 litres
- Absorbing machine with LiBr  
35 kWf
- Insulated cold storage  
1500 litres
- Energy distribution  
hot/cold fan-coil





  
 ■ offices
   
 ■ tertiary


  
 ENEA has chosen
   
 Kloben




  
 ■ hospitals
   
 ■ nursing homes


  
 plant for large
   
 D.H.W. utilities

## ENEA RESEARCH CENTRE CASACCIA, ROMA

## NURSING HOME S. MARGHERITA PAVIA



### COMBINED SOLAR COOLING PLANT

The corporate pride is the Solar Cooling plant installed in the F51 building in the Casaccia Research Centre, the largest ENEA Research Centre a few kilometres from Rome.

ENEA, the national agency for new technologies, energy and sustainable economical development, has chosen the knowledge on Solar Cooling gained by Kloben for the design, supply and realisation of a solar heating and cooling plant servicing their offices.

The plant, called "Experimental plant of Solar Cooling", is working in the F51 building intended for offices and research laboratories. The solar collectors heat two thermal storages connected to an absorbing machine, also installed outside, being interventions of requalification, with the impossibility of being positioned in the heating system.



- Solar field  
30 Kloben SKY 21 Solar Collectors CPC 58, gross surface 112 sq. m
- Hot water thermal storages  
2x1500 litres
- Absorbing machine with LiBr  
70 kWf
- Cooling storage  
2000 litres
- Energy distribution  
hot/cold fan-coil

### COMBINED SOLAR COOLING PLANT

A combined plant for heating and cooling with solar energy is installed in the Institute of Rehabilitation and Care Santa Margherita in Pavia.

It also produces DHW at the service of the over two hundred sleeping places.

In this case, the realisation was made easy thanks to the possibility of installing the whole heating system on the roof of the building, all in the open.

This can only be done by using perfectly insulated storages. The energy distribution is guaranteed by the pre-existing fan-coils.

The plant is obviously energy integrated and, therefore, the pre-existing machinery for the production of heat from fossil source and for the electric production of cold are still present and offer the energy supply for the hot or cold requirement when the need is greater than the solar energy supply.



- Solar field  
69 Kloben SKY 21 Solar Collectors CPC 58, gross surface 259 sq. m
- Hot water thermal storages (outside)  
4x2000 litres
- Absorbing machine with LiBr  
70 kWf
- Insulated cold storages  
2x1500 litres
- DHW storages  
2x1500 litres
- Energy distribution  
hot/cold fan-coil





- indoor stadium
- covered swimming pools
- sport centres



- restaurants
- accommodation facilities

## PALAZZETTO DELLO SPORT (indoor arena) DONGO, COMO

## VATICAN CANTEEN VATICAN CITY

### COMBINED SOLAR COOLING PLANT

There is a Solar Cooling plant equipped with thirty-two solar collectors producing energy for heating, cooling and DHW for showers in Dongo, in the province of Como.

The Solar Cooling technology applied to the sport structures is what best combines the use of the plant for the whole year. This is because cooling is obtained during the Summer, heating during the Winter and large amounts of DHW for showers all year round.

Furthermore, the disposal of heat necessary for cooling the absorbing machine is made easier by the possible presence of swimming pools, as energy outlet.

The plant is equipped with SSP type thermal storages with internal stainless steel exchanger for the production of DHW.



- Solar field  
32 Kloben SKY 18 Solar Collectors CPC 58, gross surface 104 sq. m
- Hot water thermal storages  
2x3000 litres
- Absorbing machine with LiBr  
35 kWf
- Energy distribution  
hot/cold fan-coil

### COMBINED SOLAR COOLING PLANT

The solar plant that Kloben has supplied to service the canteen of the Vatican City, in the centre of Rome, is positioned on three roofs: that of the canteen, that of the residential building adjacent to the canteen and that of the heating system. The hot storages are multiple given the large energy supply of the Kloben solar field.

The solar field is equipped with solar collectors with 21 tubes, 12 tubes and 8 tubes given the multiple arrangements on more existing roofs. The total area of the collectors is distributed on a roof surface equal to 1.700 square metres.

Pecularity of the plant is the arrangement on different roofs with an attentive design and care of the hydraulic uprights to service the various surfaces. This, once again, shows the technical care that Kloben can offer its solar plants.



- Solar field  
110 Kloben SKY Solar Collectors CPC 58, gross surface 350 sq. m
- Hot water thermal storages  
4x3000 litres
- Absorbing machine with LiBr  
105 kWf
- Insulated cold storage  
3000 litres
- Energy distribution  
hot/cold fan-coil





# SOLAR COOLING

THE RIGHT CHOICE TO DECREASE CONSUMPTIONS OF THE LARGE UTILITIES



Hospitals  
Nursing homes



Agroindustrial industries  
Manufacturing industry

Kloben is n. 1 in Italy in Solar Cooling sized and optimised according to the Client requirements.



Accommodation facilities  
Hotels  
Restaurants



Shopping centres



Offices  
Administrative centres



Indoor stadium  
Covered swimming pools  
Gyms and sport centres



Wellness centres



Solar systems  
Forced circulation  
DHW production

- LIVING SERIES
- GRAND SOLEIL SERIES



Solar systems  
Natural circulation  
DHW production

- EVO CPC SERIES



Solar systems  
Forced circulation  
DHW production and  
radiant plants integration

- TOTALENERGY NRG PRO SERIES



Solar systems  
Forced circulation  
DHW production and  
radiant plants integration

- K-FRESH SERIES

## KLOBEN® SOLAR EVOLUTION

**Kloben is an Italian company proposing itself on the world-wide energy market as forerunner in the use of solar energy in thermohydraulic plants, decreasing consumption of traditional energy sources in the respect and protection of the environment.**

### VISION

Our vision is energy independence, integrating solar energy with the Winter heating and Summer cooling requirement of buildings offering full and integrated solar plants, able to guarantee comfort and saving.

### RESEARCH & DEVELOPMENT

In the offices of Bovolone, Verona, is where the continuous technical development concentrates and where the knowledge of solar energy and its applications mature daily. There is also the commercial office, the logistic and the manufacturing of thermal storages, studied for use with solar energy.

### PRODUCTION

The production offices of Ogliastro Cilento, Salerno, is the manufacturing pole of Kloben - first in Italy - of the vacuum solar collectors. As proven by the ISO 14001, EN 12975 and Solar Keymark certifications, the control of the materials and use of modern constructive technologies, assure the realisation in compliance with the solar collectors ambient.

### SAFE INVESTMENTS

Kloben guarantees your investment and assures you the highest convenience, from the designing to the optimisation of the systems according to the specific requirements, through feasibility studies with specific calculation software, able to size residential and industrial systems requiring thermal energy.



### Consultancy and assistance

CHOOSING KLOBEN MEANS ENTRUSTING IN A POOL OF OPERATORS OF THE SECTOR WITH FULL KNOWLEDGE OF THE ENERGY POSSIBILITIES OFFERED BY SOLAR RADIATION. KLOBEN IS:

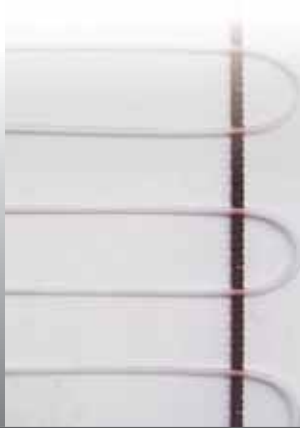
- DESIGN CONSULTANCY
- ON SITE SUPPORT DURING LAYING
- MARKET VISIBILITY
- PRE AND AFTER-SALES SERVICE
- GUARANTEED RELIABILITY AND ENERGY AND ECONOMICAL SATISFACTION

### Italian quality, international certifications

THE EXCELLENCE OF THE KLOBEN PRODUCTS IS TESTIFIED NOT ONLY BY THE HUNDREDS OF SATISFIED ORDERS, BY THE LOYALTY OF NUMEROUS PLANNERS AND INSTALLERS, BUT ALSO BY THE CERTIFICATIONS ACHIEVED WITH THE MAJOR EUROPEAN INSTITUTES ACCORDING TO THE MOST SEVERE STANDARDS IN FORCE.







#### Floor radiant systems

- HI-PERFORMANCE LINE
- HI-COMPETITION LIFE
- INDUSTRIAL LINE
- SEKKO LINE

#### Wall and wall/ceiling radiant systems

- PARETE LINE
- VERTICAL TOP LINE

## SOLAR SYSTEMS

Kloben, first Italian manufacturer of vacuum solar collectors, offers solutions dedicated to the production of DHW (through forced and natural circulation), and complete supplement systems for low temperature heating.

The development of high efficiency vacuum solar collectors, recognised world-wide as the only type able to assure functioning even in modest Winter radiation conditions, has always been the corporate pride.

## RADIANT SYSTEMS

Kloben is leader in the realisation of the most advanced solar technology combined with the most satisfying components for low temperature radiant plants: the combined plants marry the highest comfort with economical saving.

## MAYBE YOU DID NOT KNOW THAT...

- Kloben is leader in solar systems and low temperature radiant systems in Italy with tenths of thousands of square metres installed every year.
- Kloben is the first Italian manufacturing company with Solar Keymark certified products.
- Kloben solar collectors are "Made in Italy" and all realised with vacuum tubes.
- The plants proposed are all sized depending on the final requirement.
- The solar plants work with anti-freeze type thermal exchange fluid for Winter protection and longer lasting.
- An after-sales assistance centre is present in every city in Italy.



The experience and knowledge gained during the years, the ability to design, build and supply the plant components, the numerous realisations in Italy and in the world, the environmental benefits and the large reduction in the final energy consumptions and, therefore, the growing respect for the environment, have enabled Kloben and its Solar Cooling plants to achieve prestige.



Regione Lombardia

## Premio all'Innovazione Amica dell'Ambiente

Year 2009 | Category GREEN TECHNOLOGIES

Il premio di Legambiente è un riconoscimento alle tecnologie, ai processi, ai prodotti, ai servizi e ai sistemi gestionali innovativi che producono significativi miglioramenti ambientali. Il Premio è attribuito a realizzazioni che si distinguono per la loro originalità e per le loro potenzialità future, di cui sono già stati verificati i primi risultati in termini di miglioramento ambientale.

Direct line **045 923 7300**

The Kloben Direct Line answers from 8.00 until 17.30, from Monday to Friday.



Per maggiori informazioni contattate senza impegno il rivenditore autorizzato della vostra zona.  
For more information please contact the authorized dealer of your area.

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