

# BIO-AIR CONDITIONING BY EVAPORATIVE TECHNIQUES

INFORMATION GUIDE AND APPLICATION



Industries



Schools



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# INDEX / INFORMATION GUIDE AND APPLICATION SYSTEM

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" Sometimes nature puts at our disposal resources that make our life more comfortable and respectful with the environment "

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## A / INTRODUCTION TO THE COMFORT AND NEEDS OF TEMPERATURE REDUCTION

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**THE MOST IMPORTANT FACTORS INFLUENCING THE ENVIRONMENTAL COMFORT ARE TEMPERATURE, HUMIDITY AND AIR.** TO UNDERSTAND THE FUNCTIONING OF EVAPORATIVE TECHNIQUES IS NECESSARY TO KNOW ABOUT THESE KEY CONCEPTS, THEY ARE PRESENT IN ITS TECHNOLOGICAL DEVELOPMENT, ON THE UNDERSTANDING THAT THE TEMPERATURE IS DETERMINED IN THIS CASE BY HEAT LEVEL.

## A/I- KEY CONCEPTS OF THE ENVIRONMENTAL COMFORT

### HEAT

Heat is a declaration of the energy produced by the molecular movement that provokes the increase of the temperatures, the dilation of bodies, the smelting of solid and the liquids evaporation. It is the sensation that is experienced before an elevation of temperature. Heat is measured bearing in mind two magnitudes: the intensity and heat quantity.

**1- The intensity of heat** is related to the speed of the molecular motion and to measure it some comparative parameters are determined, that allow us to establish the degree of heat or temperature. A body with high molecular speed has more temperature or more level/degree of heat than another.

**2- The amount of heat** from a body is the sum of the thermal energies of all the molecules that compose it. While the intensity of heat or temperature indicates the degree of molecular motion or the level of heat from a body, this magnitude marks its total content of heat.

When we define the **heat unit**, the addition of such energy causes an increase of the temperature, that heat status, whose level variation can be determined using a thermometer, is called **sensitive heat**. However, when it is materializing a change of physical condition, the added energy doesn't cause any variation of temperature. That heat is called **latent heat**, and it is consumed in the action of physical transformation.

### HUMIDITY

The maintainance of a correct level of humidity is essential to enjoy a sense of environmental well-being.

Above and below this condition of comfort, an alteration in the humidity causes a change of thermal sensation, that is to say, the perception of the dry environment temperature changes without having produced any variation in it.

Therefore, the **Relative Humidity** influences our comfort because determines our thermal perception, as shown in the following table:

		EFFECTIVE TEMPERATURE																				
		RELATIVE HUMIDITY																				
T. Aire (°C)		0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
57		49	52																			
54		47	50	55																		
52		44	47	51	55	61																
49		42	44	47	51	54	59	64														
46		41	42	44	46	49	53	57	62	66												
43		37	39	41	42	44	47	51	54	58	62	66										
41		35	36	38	39	41	43	45	48	51	54	57	61	65								
38		33	34	35	36	37	38	40	42	43	46	49	52	56	59	62	66					
35		31	31	32	33	34	34	36	37	38	40	42	43	46	48	51	54	58	60	66		
32		28	29	29	30	31	31	32	33	34	35	36	37	38	39	41	43	45	47	50	52	55
29		26	26	27	27	28	28	29	29	30	31	31	32	32	33	34	35	36	37	39	41	43
27		23	23	24	24	25	25	26	26	26	27	27	27	28	28	29	29	30	31	31	32	32
24		21	21	21	22	22	22	23	23	23	23	24	24	24	24	25	25	26	26	26	26	27
21		18	18	18	18	19	19	19	19	19	20	20	21	21	21	21	21	22	22	22	22	22

## VENTILATION

Breathing clean and fresh air is one of the essential factors to create a comfortable atmosphere, especially in work areas in order to develop a proper performance of the professionals. Maintaining a good ventilation is possible thanks to the constant renewal of the air that we are breathing indoors, either a building, industrial plant or any other.

Cleaning is essential to ensure the safety of the air, also eliminate or reduce the concentrations of dust and particles in suspension, as well as check the correct level of humidity. Specifically in the industrial ventilation, it is necessary to neutralize the high temperature of the air (especially in summer) as well as the smoke, gases, condensation and odours that can be annoying and even harmful to the health of workers.

One of the factors that most contributes to improve the ventilation is the movement and filtering of the fresh air, just as the nature does with the sea breeze that also has a refreshing effect on people, as it increases the evaporation of humidity in the skin by sweating. In this regard, even though it does not vary the temperature, produces a feeling of well-being and freshness.

**When the humidity and the movement of air are controlled properly, the index of the “effective temperature” really measures the environmental comfort.**

THE TEMPERATURE FEEL WITH AIR TO 24°C	
Air (m/s)	Effective Temp. °C
0,10	23,25
0,50	22,50
1,00	22,00
1,50	21,50
2,00	21,00
2,50	20,50
3,60	19,75

*In residential and commercial applications the indoor air speed should be between 0.05m/sec and 0.25m/sec.*

*In industrial applications the air speed might be higher.*

It is precisely this reason that we use the fans and in general ventilation, as a method to solve the problems of heat, even when we do not reduce the temperature of the air.

## A/II- MAIN PROBLEMS GENERATED BY THE HEAT EXCESS AND LACK OF VENTILATION

The climatic conditions in work places constitute a factor that directly affects the welfare and the implementation of the tasks of the employees. The right temperature to develop a labor activity comfortably is between 22 °C and 24 °C, with a balanced humidity index, that does not generate feeling overwhelmed. But in many occasions, due both to the high summer temperatures such as those that are generated by the own professional activity (foundries, ovens,...) heat buildup can lead to serious problems such as thermal stress, low productivity labor and the increasing of the accidents.

The sick building syndrome and the abuse of air conditioning are other major problems that are caused by the heat and in the same way an inadequate use of air conditioning.

## A/II- MAIN PROBLEMS GENERATED BY THE HEAT EXCESS AND LACK OF VENTILATION



THE EVAPORATIVE  
BIO-AIR CONDITIONING,  
PROVIDES  
APPROPRIATE  
TEMPERATURES FOR  
THE WELFARE OF  
WORKERS

### INDUSTRIES

## THERMAL STRESS

Thermal stress is a problem that workers suffer when they develop their labor activity in a very hot environment, as a result of the combination of ambient heat (temperature and speed of the air, humidity, sun radiation or other sources of heat), generated by the own physical activity, and even because of work clothing that increases the temperature of the human body. As a consequence it may result in health disorders such as dehydration, cramps, dizziness and even fainting.

Human body has its own mechanisms to regulate its temperature, as the increasing of blood flow and sweating. However, is usually not enough to stop the rise of body temperature, which can rise to dangerous levels, increasing the risk of disorders. Therefore, this is a serious problem that many times by ignorance was not known how to solve.

**In this regard, conventional systems such as air conditioning are not viable, mainly due to its high economic cost both installation and energy consumption, because they usually cool large spaces.**

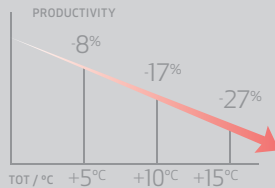
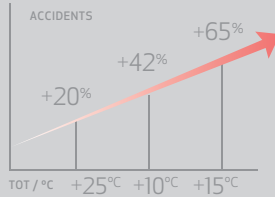
**The effective, economic and sustainable solution is the evaporative Bio-air conditioning (ECB), which provides a fresh atmosphere and comfort, achieving appropriate temperatures for the welfare of workers.**

## LOW PRODUCTIVITY AND OCCUPATIONAL ACCIDENTS

The ambient temperature has a great influence on both the level of productivity and the work-related accidents. Of course, it is not possible to obtain the same performance of a worker developing an activity continuously to 40 °C that performing the same action at 24 °C.

These parameters are scientifically analyzed in the NASA report (CR-1205-1), concluding that the decline in productivity and the risk of work accidents occurred go hand in hand with the increase -grade to grade- of temperature, when it is above the optimal working (TOT) that is established in 24 °C in summer.

## HEAT EFFECTS



TOT = Optimum Temperature of Work (+24°C)

A SYSTEM THAT ALLOWS  
TO KEEP DOORS AND  
WINDOWS OPEN, THE AIR IS  
CONSTANTLY RENEWED



## A/II- MAIN PROBLEMS GENERATED BY THE HEAT EXCESS AND LACK OF VENTILATION

In this regard, the current legislation on Prevention of Occupational Risks, it contemplates in its ANNEX III (\*), the limits of the environmental conditions in which work is to be performed depending on the activity.

To ensure that workers perform to the maximum, must develop their labor activity in a proper ambient temperature, which will also prevent accidents because professional health will benefit from working in a complex properly ventilated and fresh. The Bio-air conditioning is a way of cooling that maintains a balanced level of humidity and avoid sudden temperature changes, which directly benefits the health.

### OFFICES AND COMMERCE

## SICK BUILDING SYNDROME DUE TO LACK OF VENTILATION

The Sick Building Syndrome is defined by the World Health Organization (WHO) as the set of diseases caused by air pollution in enclosed spaces. It occurs as a result of several factors that were favoured to such stale air such as: poor ventilation, the concentration of particles in suspension, polluting gases, vapors, etc.

This situation causes discomfort and disease: migraines, dizziness, skin irritation and the appearance or aggravation of allergies, among others. This is a common syndrome in poorly ventilated industrial spaces and with a high stale air in the environment.

The ECB fixes this problem because it provides a fresh and clean air with the adequate hygienic conditions. A system that allows to keep doors and windows open, air is constantly renewed so is not recirculated, avoiding stale air. In addition, moves dust, smoke, odors and other pollutants to the outside, providing fresh air quality.



**A/II- MAIN PROBLEMS GENERATED BY THE HEAT EXCESS AND LACK OF VENTILATION**

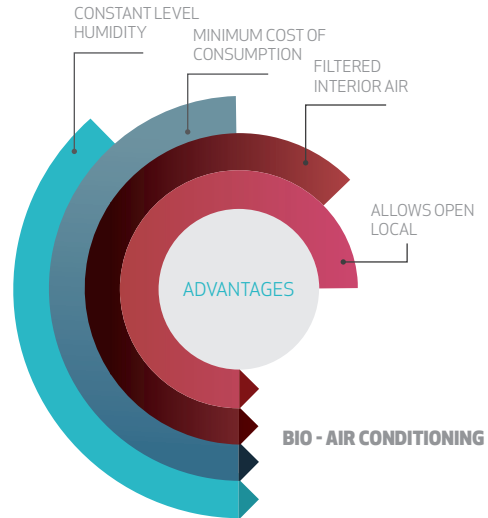
TRADE AND RESIDENCES

**THE MISUSE AND ABUSE OF THE AIR CONDITIONING**

Due to a bad air conditioning adjustment an environment too cold in contrast with the outside temperature is often generated. This gives rise to sudden changes in temperature, which can cause the appearance of colds, throat inflammation and even respiratory infections, also contractures, among other pathologies. Equally, the dryness in the atmosphere, generated by the air conditioning which absorbs the larger part of humidity, favors the appearance of infections such as rhinitis, bronchitis and even pneumonia. The adverse health effects caused by the improper use of air conditioning are preventable with the evaporative Bio-air conditioning.

In addition, it allows to maintain open doors and windows, which is very pleasant in summer creating soft breezes of fresh air. This is to avoid that feeling of isolation that produces the lack of access to open spaces, for example to the terraces.

THE EVAPORATIVE BIO-AIR CONDITIONING SYSTEMS OFFER THE LOWER PRESSING TEMPERATURE, THE MORE HEAT AND DRIER IS THE EXTERNAL ENVIRONMENT. THE IDEAL SOLUTION FOR EXTREME HOT DAYS





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## **B** / BIO-AIR CONDITIONING: COOLING BY EVAPORATIVE TECHNIQUES

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**THE EVAPORATIVE COOLING IS PRESENT IN NATURE**, IN PLACES CLOSE TO THE WATER AS THE WATERFALLS, LAKES, SEAS AND OCEANS AND EVEN ON THE HUMAN SKIN. THE PRIMITIVE MEN ALREADY APPLIED RUDIMENTARY COOLING TECHNIQUES ON THE BASIS OF THIS OBSERVATION.

**B/I- WHAT IS BASED THE EVAPORATIVE BIO-AIR CONDITIONING (ECB) ON?**

## B/I- WHAT IS BASED THE EVAPORATIVE BIO-AIR CONDITIONING (ECB) ON?

### BRIEF HISTORY: FROM THE PHARAOHS UNTIL TODAY

The ancient history already describes how the Egyptians used large earthen vessels filled with water ventilated with fans of ostrich feathers, they cooled the air in the hottest days. The porosity of the mud made it possible to keep the surface humidity, providing the process of evaporation of water.

Like other oldest civilizations they took advantage of the evaporative cooling of water in its most primary form, when wet white sheets were hung from the doors and windows to produce a natural cool breeze stopping the heat of the sun.

Some years later, the arabs also used the technique of evaporative Bio-air conditioning in houses and sumptuous palaces, as in the Alhambra of Granada, with numerous fountains and ponds built into its cloisters and gardens, such as those that are currently in the fresh Andalusian patios.

In the Modern Era has been in the U.S. where the ECB has had a greater development both in industrial applications - especially in the eastern area of the country - to vent, filter and clean the air; as in the installation of houses and even buildings - in the South West - mainly to cool temperature, as well as to vent in a healthy way.

In the Industrial Era and with the introduction of air conditioning, developments of the air conditioning were directed to systems by compressor, leaving aside the natural systems of much lower consumption, where require a specific temperature was more complicated and sometimes required further maintenance. In countries such as Australia, this system has been adopted with great success and obtained governmental support because of its low power consumption and great savings.

With successive developments, the evaporative Bio-air conditioning today is based on latest generation systems that allow better control of the parameters of air conditioning and support the domotic control systems, even through mobile applications.

IT IS TIME TO ASK OURSELVES WHETHER WE ACTUALLY KNOW AND APPRECIATE THIS SOLUTION AND THE BENEFITS THAT WE, OUR CUSTOMERS AND THE PLANET WOULD HAVE TO USE THIS TYPE OF NATURAL SOLUTION.

EVAPORATIVE  
COOLING IS  
PRESENT IN  
NATURE



## INTRODUCTION TO THE PHYSICAL PRINCIPLE AND SYSTEM OPERATION

The evaporative Bio-air conditioning is a technique of air conditioning based on a physical principle that we see daily in nature: the sea breeze. This is the air cooling when driving in contact on a mass of water, because it evaporates, reducing its temperature and increasing the humidity in the air, without variation in energy or enthalpy. It thus provides the transformation of sensitive heat (temperature) of the air, in latent heat (humidity). The evaporative Bio-air conditioning mimics the natural process by providing a breeze of fresh air.

**The functioning of the system is simple, the bio-air conditioning collects warm outside air and moistens when passing through a few filters soaked in water, cooling the air that drives to the inside of the place with up to 12° C of temperature less.**

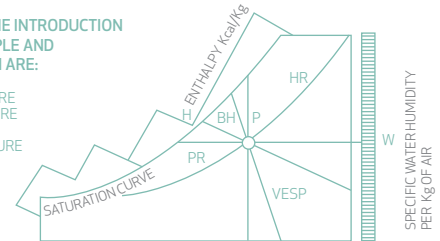
**Is achieved in this way to project a constant natural air flow, fresh and filtered, it enters clean in the complex, evacuating at the same time the odours, germs and dust in suspension to outdoors by the open access (doors and/or windows), which benefits the constant renewal of not recirculated air, but that is renewed, generating a healthy environment.**

## B/II- SCIENTIFIC CALCULATION IN AIR CONDITIONING

The **psychrometry** is a branch of the science that studies the thermodynamic properties of humid air and the effect of atmospheric humidity in the human comfort. Related to the temperature, the air has the property to retain a certain amount of water steam. At a lower temperature, the lower the amount of steam, and conversely: The higher the temperature, the greater the amount of steam if you hold it at a constant atmospheric pressure. It is also considered that is a method to control the thermal properties of humid air and is represented by a psychometric diagram.

DATA REPRESENTED IN THE INTRODUCTION TO THE PHYSICAL PRINCIPLE AND PSYCHOMETRIC DIAGRAM ARE:

BS= DRY BULB TEMPERATURE  
BH= WET BULB TEMPERATURE  
HR= RELATIVE HUMIDITY  
PR= DEW-POINT TEMPERATURE  
W= SPECIFIC HUMIDITY  
H= ENTHALPY  
VESP= SPECIFIC VOLUME



## PSYCHOMETRIC DIAGRAM AND APPLICATION

In the Psychrometric Diagram multiple parameters are related to a mixture of humid air, temperature, relative humidity, absolute humidity, dew point, specific enthalpy or total heat, sensitive heat, latent heat and specific volume of air. The values of the diagram are not constant, they vary according to the altitude above sea level.

Used in architecture and engineering in the teaching of the thermo mechanical facilities in buildings for dimensioning of the heating system and air conditioning. The processes of heating, cooling, humidification and dehumidification that occur in air-conditioning change the status of it from the represented by the point of initial state in the abacus until a different condition, represented by a second point on the graph.

In case of the evaporative air conditioning, we move in the psychrometric within the lines of constant enthalpy increasing the humidity, as shown in the (figure A).

We will also be able to calculate by using formulas, the load heat dissipated by a bioclimatizador knowing the flow, temperature of drive and the target temperature by using the following equation:

$$Q = 0.3 \cdot V \cdot \text{Dif } T$$

$$\text{Dif } T = T_{\text{design}} - T_{\text{pressing}}$$

$$V = \text{Flow of air blown}$$

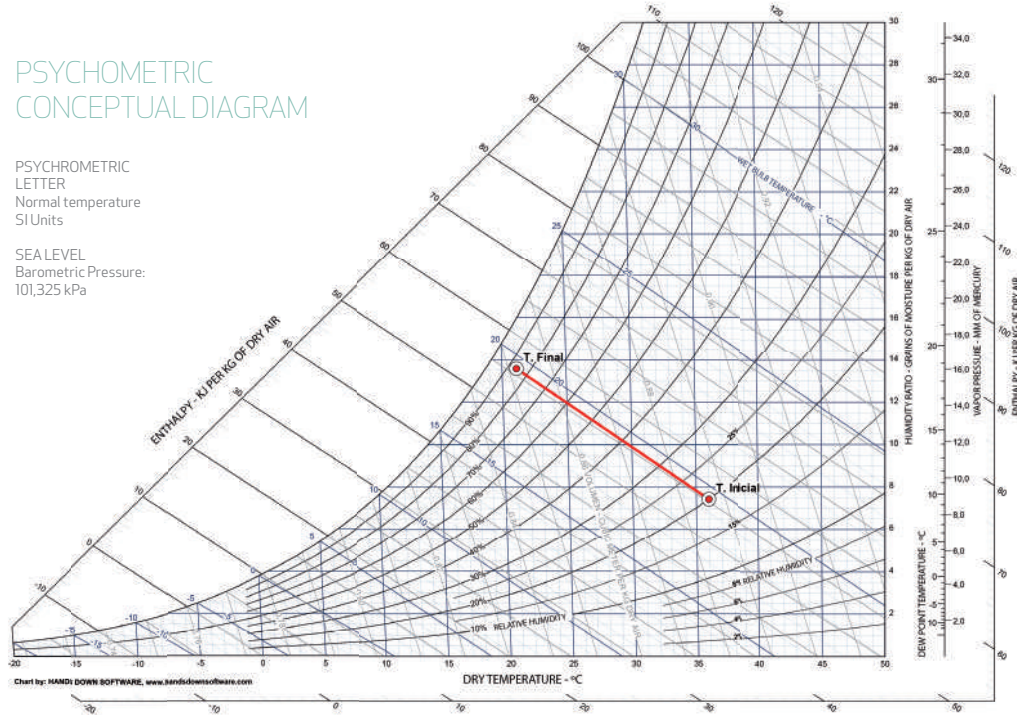
In this way, a bioclimatizador that impulse 14.000 m<sup>3</sup>/h at 22 °C for a design temperature of 26 °C, dispel a load of 16 kw approximately, with a consumption of 1.2 kw. That represents a COP of 13.4.

B/II- SCIENTIFIC CALCULATION IN AIR CONDITIONING

PSYCHROMETRIC  
CONCEPTUAL DIAGRAM

PSYCHROMETRIC  
LETTER  
Normal temperature  
SI Units

SEA LEVEL  
Barometric Pressure:  
101,325 kPa



(figure A)

1. INITIAL T. REPORT OF THE TIP AND STATE PROCESS / TIP STATE DATA	Dry temperature (°C)	Wet bulb temperature (°C)	Relative humidity (%)	Humidity proportion (g/kg)	Enthalpy (kJ/kg)	Dew point (°C)	Density (kg/cu.m)	Vaporize the pressure (mm Hg)	Absolute humidity (g/cu.m)
		36,000	19,484	20,00	7,42	55,231	9,5332	1,1277	8,9266
2. T. IMPULSION	21,130	19,484	86,00	13,59	55,752	18,7066	1,1731	16,1853	15,958
PROCESS / Evaporative Cooling	Start the name of the tip	Add the power (w)	Sensitive energy	Latent energy (w)	Refreshing effectiveness (%)	Rate-mass evaporation (kg/hr)	Rate-volume evaporation (L/hr)	Relation of sensitive heat transformation	
	T. initial	295	-8.684	8.979	90,00	12,6	12,6	-29,4	

Project infromation: Altitude: 0 (meters) / Barometric pressure: 760,001 (mm Hg) / Atmospheric pressure: 101,325 (kPa)

## B/III- COMFORT TEMPERATURES REACHED

The system of ECB allows to decrease the temperature between 4 °C and 12 °C respect to the outside, pushing air between 20 °C and 24 °C approximately, depending mainly on the conditions of the outside air (degree of humidity, temperature, etc.) and geographical area where it is located. The more heat and drier is the day, the more efficiency will display the machine.

WITH 85 PER CENT OF AVERAGE EFFICIENCY OF AN EVAPORATIVE SYSTEM IT OBTAINS AN AVERAGE REDUCTION OF 5.1 °C, OSCILLATING BETWEEN 2°C AND 11°C ACCORDING TO THE DAILY CONDITIONS. THIS REDUCTION OF TEMPERATURE IS VERY SIGNIFICANT AND JUSTIFIES THE INVESTMENT WHERE PROBLEMS OF HEAT ARE IMPORTANT.

However, in industry where the machinery generates smoke and heat inside a place that is already punished by the sun, the interior temperature can rise up to 4 degrees above the outside. In these cases, the contribution of cool outside air reduced by an average of 5 °C with regard to the outside, it can represent a real reduction of 9°C in relation to the conditions would withstand without this treatment, and with a minimum electrical consumption.

In addition, the constant air injection of the bioclimatizador within the place, obliges its continuous renewal, replacing the stale air with fresh air permanently.

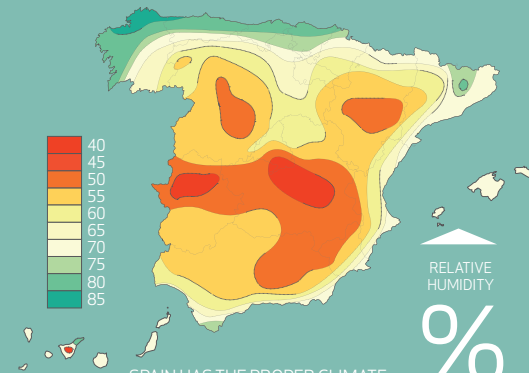
### PERFORMANCE OF THE ECB

#### TEMPERATURE REDUCTION

TEMPERATURE DRIVE IN DEGREES CELSIUS	PERCENTAGE OF RELATIVE HUMIDITY								
	10	20	30	40	50	60	70	80	90
10	4,0	4,5	5,5	6,0	7,0	7,5	8,0	9,0	9,5
15	7,5	8,5	9,5	10,5	11,0	12,0	13,0	13,5	14,0
20	11,0	12	13,0	14,5	15,5	16,5	17,5	18,5	19,0
25	14,5	16,0	17,0	18,5	20,0	21,0	22,0	23,0	24,0
30	17,5	19,5	21,0	22,5	24,0	25,0	26,5	28,0	29,0
35	20	23,0	25,0	26,5	28,5	30,0	31,5	32,5	34,0
40	23	26,5	29,0	31,0	32,5	34,5	N/A	N/A	N/A
45	26	29	32,5	35,0	N/A	N/A	N/A	N/A	N/A
50	29	32,5	36,5	N/A	N/A	N/A	N/A	N/A	N/A

OUTSIDE TEMPERATURE

#### AVERAGE RELATIVE HUMIDITY SUMMER



SPAIN HAS THE PROPER CLIMATE FOR THE USE OF THE ECB

### B/III - COMFORT TEMPERATURES REACHED

This action brings an important component in industries where they are generated gases and odors by the own production process. It is the case of the presses, plastics injection, welds, industrial laundry, kitchens, etc. In some of these examples the air changes are already legislated, so that the investment in systems of removal is mandatory.

Similarly, the evaporative conditioning increases the humidity of the place, which in many cases is lower than the outside by the influence of the machinery in use. It doesn't create an uncomfortable environment, on the contrary, provides that the local is sufficiently ventilated. In addition, there are production processes that are especially grateful to this humidity as the textile, footwear, printing... also eliminating the static electricity.

## EFFECTIVE EVEN IN COASTAL AREAS

While in principle the air conditioning units evaporativa have a higher performance in areas climatically more dry, in wetlands and coastal areas are also obtained comfortable conditions, taking into account that in the highest heat hours the relative humidity is reduced. The humidity is opposite to the measured temperatures throughout the day. That is to say, at midday temperatures are highest and lowest the relative humidity, and otherwise by night.

In coastal areas of the peninsula temperature reduction is enough for most of the specialized applications. To reply in detail to lower temperatures in a representative area, is reflected in the data table provided by the Institute of Valencia corresponding to the weather conditions measured at 13:00 hours from 1st June 2013 until 31th August of the same year.

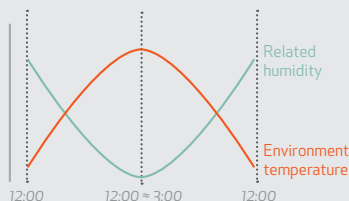
Thus, the evaporative system is viable to significantly reduce temperatures throughout the country and in some coastal applications or damp areas, reducing the temperature and removing odours and smoke, providing humidity and dissipating internal structural heat.

**On the other hand and in relation to industrial applications, even in very humid converge many factors make a bio-air conditioning the best choice for cool and ventilate larger and open spaces. As evidenced by the fact that facilities exist in some tropical areas.**

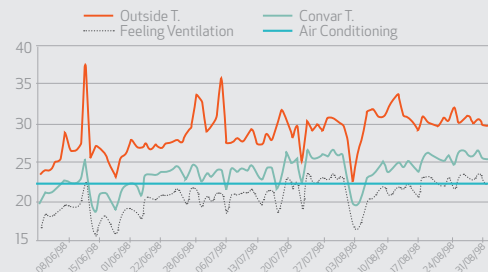
And while it is true that the evaporative air conditioning doesn't guarantee a fixed cooling temperature, as it depends on the external conditions, it can decrease up to 12 °C, providing a pleasant natural breeze that generates a cool environment very comfortable.

Typical Cycle of 24 h relative humidity in Valencia. Source: ASHRAE.

RELATIVE HUMIDITY VARIATION IN A PERIOD OF 24 HOURS



EVAPORATIVE CONDITIONING  
VALENCIA ANALYSIS JUNE-AUGUST 13.00 H.



## B/IV- SPECIAL APPLICATION CASES. SPOT COOLING IN INDUSTRY

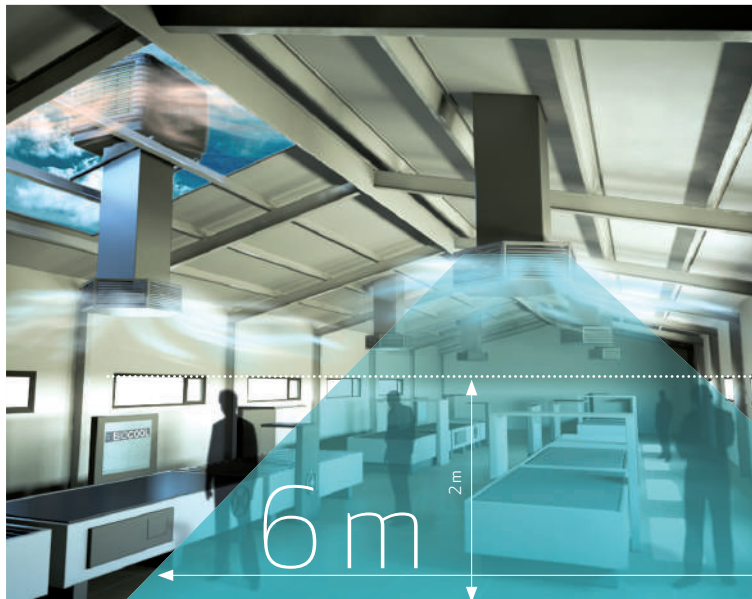
### HOT INTERNAL ZONES:

In commercial and industrial buildings, many times small specific spaces are created where the temperature is higher than the rest. The main reason is the generation of heat due to several causes:

- The generated by the own machines
- The originated by the production processes
- By the concentration of several people working in the same area
- By lack of air ventilation, which is not refreshed and goes increasing grade to grade

Commonly these spaces have a higher temperature than the outside air, so that by entering the latter in that particular area by means of mechanical ventilation will improve the environmental situation. However, the evaporative Bio-air conditioning offers a better solution by introducing fresh air at a lower temperature than the external air.

For example, a factory melting machines produce heat and the temperature of the air inside is 45 °C, but the external air is 38 °C. The ECB may provide the air conditioning from 38 °C to approximately 29 °C, which implies a colder work environment (16 °C temperature decrease in total), what it means to the owner a better productivity of their investments, both staff and their machines.



SPOT COOLING  
ALLOWS TO FOCUS  
INVESTMENT IN AREAS  
OF EXCESSIVE HEAT  
WITHOUT ENCLOSURES  
OR HEATED THE PLACE  
COMPLETELY



**B/IV - COMFORT TEMPERATURES REACHED**

Some wetter areas can benefit from this concept, as the supply of bio-air conditionings can produce a decrease in temperature of 5 °C as minimum. In these cases we do not make any calculation of heat loads, we simply design a system covering the entire "zone" with evaporative air conditioning, which continuously will replace the hot air. **It is not necessary to build new walls - the system will function without any additional wall.**

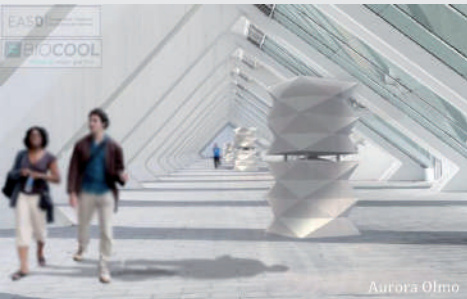
**HOT EXTERNAL ZONES:**

Another useful application of "zonal packaging" is for the external areas where people relax, eat or entertain, and where there is no wall by any side and possibly without roof. The Bio-air conditioning can supply cool air conditioning to these areas too, which it would be impossible to cool using a conventional air conditioning.

**DESIGN FOR THE PACKAGING OF HOT AREAS:**

We begin by obtaining the owner's information about what is happening in the area; where are the machines located, where are working their operators, the floor area they use, the limits of height for the location of the air diffusers, etc. We measure all of these areas and we make a plane of the area to be conditioned.

In this way, we can fix the hot areas in a timely manner without making a conditioning of the whole place, but of the area to be treated by excessive generation of heat.



PROJECTS DEVELOPED BY: AURORA OLMOS, MANUEL BELLVER AND IKER SOTO. EASD.



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## C / BENEFITS AND SOLUTIONS THAT BRINGS THE BIO-AIR CONDITIONING

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ONE OF THE MAIN FEATURES AND ADVANTAGES OF THE SYSTEM OF BIO-AIR CONDITIONING IS ITS GREAT ENERGY EFFICIENCY, **IT CONSUMES UP TO 80% LESS ENERGY THAN THE TRADITIONAL AIR CONDITIONING SYSTEMS.**

## C/I- MAXIMUM EFFICIENCY AND ENERGY SAVINGS

### BENEFITS AND SOLUTIONS

The Bio-air conditioning is highly competitive both in capital and acquisition costs, as in operating costs and maintenance, especially when it is compared with the equivalent installation of Air conditioning compressor. In this way, the operational costs of the ECB are similar to those of a fan.

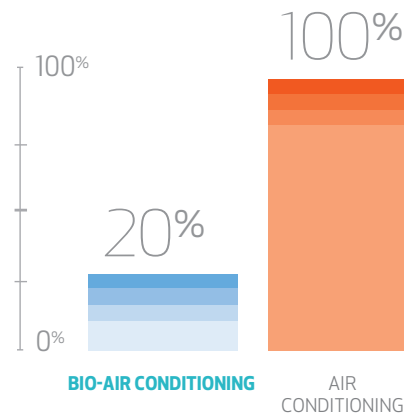
Its installation cost is low as only requires a socket of water and a power energy source without any complementary pipeline. Its maintenance is very economical and by incorporating few pieces of work will reduce the chances of faults. It also stressed the simplicity of the filters and the water manifolds maintenance.

**All the benefits of efficiency energy that characterized the systems of Bio-air conditioning result in an economic savings significant in the account of the results of the companies users of the system.**

Although there are no studies in Spain in relation to global energy savings that could produce the massive use of evaporative air conditioning, we can find data of its application in The United States, where it is massively used for more than 50 years and they so-called "Cooling": Only in the South zone in the United States have identified 4 million evaporatives installed in residential, that have resulted in an approximate 11.8 million barrels of oil annually and 3 trillion Kg of carbon dioxide emissions savings, by comparing it with the equivalent to air system by compression. Is necessary to add to these numbers the savings provided by the use of the evaporatives in industry, commerce, agriculture, and the livestock, that have not been evaluated in the report but which are even greater.

# 80%

LESS ENERGY  
 THAN THE AIR  
 CONDITIONING



THE BIO-AIR CONDITIONING  
 IS A NATURAL SOLUTION  
 AND SUSTAINABLE



## LAW 80/20: A VERY RELEVANT REFLECTION

The Law of Pareto implies an interesting reflection in relation to the decision to undertake the air conditioning of a industrial space or local, knowing the easy access to air conditioning and the considerable lack of knowledge that exists about the systems of evaporative Bio-air conditioning .

Many times, it imposes a design of an specific temperature that it is not always necessary. An example to expose this approach: Maintaining a local with a constant temperature of 25 °C it is not possible to get it always 100% with the ECB in some geographical areas, but can be possible in a 80-90%. However, multiply the cost of energy per 5 to cover that 10-20% of occasions where it can not reach the required temperature, probably unprofitable nor necessary.

## MAIN DIFFERENCES COMPARED TO THE AIR CONDITIONING

















The evaporative Bio-air conditioning is an example of effective technology not pollutant that has many advantages compared to the conditioning by air conditioning. **Its low energy consumption is similar to a fan, and it is estimated that can be up to 80% lower with respect to the air conditioning.** In addition, does not use coolant gases by what is ecological and can be used in open spaces, without need to close doors or windows. It will not dry out the environment but that maintains an optimal level of humidity.

As main disadvantage or limitation of the Bio-air conditioning we are not able to demand always a specific temperature, as always we depart from the conditions of the outside air and its constantly variations. However, in 90% of the cases we can obtain comfort conditions with minimum consumption.



## DIFFERENCES

ADVANTAGES AND LIMITATIONS OF THE EVAPORATIVE BIO-AIR CONDITIONING (ECB) OPPOSITE TO AIR CONDITIONING (A/C)

 <b>BIO-AIR CONDITIONING</b>	 <b>AIR CONDITIONING</b>
 Enter 100% air	 Recirculates the same air
 Windows and doors can be opened	 Windows and doors must be closed
 Maintains an adequate level of humidity	 Dries the air, may be harmful to health
 Ventilation: removes smoke, odors and stale air	 Recirculates air from the place, which contains odours, smoke, dust mites, etc.
 Improves the performance the more outside heat	 Reduces the ability of cooling when more outdoor heat
 Reduced cost of performance	 High cost performance
 Cooling as nature. Deletes the static electricity in industrial processes	 Uses refrigerant gas

## C/II- HEALTHY AND ECOLOGICAL

The Bio-air conditioning is a way of cooling, in addition is economic, healthy and ecological. This system allows the constant renewal of air, improving its quality as introduces clean and filtered air inside the space, evacuating bad odours, smoke and gases to the outside, allowing to maintain the open spaces.

In this way, fresh and renovated air is permanently breathed with a balanced humidity level very beneficial for health, without resection of the environment, and thus avoid problems such as the alteration of the mucous membranes to respiratory and skin dehydration, eccemas, rhinitis and conjunctivitis, among others. In this sense also highlights the fact that prevents abrupt changes in temperature, and with it all the pathologies that can lead: colds, pharyngitis, hoarseness, etc.

From an ecological point of view, the ECB does not use coolant gases CFC'S or similar, it is based on the use of natural water for its functioning, which also returns to the atmosphere in steam form.

PREVENTS THE USE OF THE CHLORINE FLUOROCARBONS (CFC) THAT DESTROY THE OZONE LAYER USED IN COMPRESSOR SYSTEMS AS A COOLANT. THEREFORE AND UNLIKE AIR CONDITIONING, THIS SYSTEM HELPS TO STOP GLOBAL WARMING.

## C/III- COMPLIANCE WITH CORPORATE SOCIAL RESPONSIBILITY (CSR): VISION OF FUTURE

The advantages for companies that adopt a social responsibility related to environmental management are many and framed in different areas. Global warming is a global problem that stirs consciences not only for governments but also in consumers and markets at the international level, thereby increasing the tendency of customers who prefer to choose products and services of companies committed to the environment.

The Green Paper of the EU or the United Nations Global Compact (principles 7, 8, and 9) are international documents of free membership for companies that want to voluntarily assume the commitment to implementing principles of environmental responsibility opting, among other measures, by the **energy efficiency**.

**Each time there are more multinationals and SMES that are actively involved in pursuing policies that contribute to stop climate change to grow economically in a sustainable manner with the decrease in the consumption of resources and pollutant emissions to reduce the impact on the environment.**

### MAIN ADVANTAGES OF CSR IN ENVIRONMENTAL MANAGEMENT

*Rising corporate profitability and competitiveness of the company*

*Savings in energy consumption, therefore improvement in the results*

*Good public image, identification of the company with positive values*

*Positioning against competitors, which supposes a differential advantage*

*Increased satisfaction of the professionals at corporate level*

*Contribution and promotion of a global benefit to the environment, Nature and the planet*

We must not forget that the water consumption of this system, is remarkably lower than required to generate a kw by another method, either by nuclear energy, hydraulic or other source.

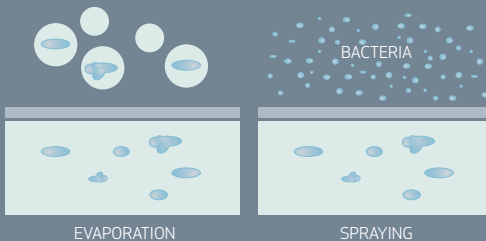


**GLOBAL WARMING IS  
A GLOBAL PROBLEM  
THAT STIRS  
CONSCIENCES**

### WHAT WE NEED TO KNOW **ABOUT THE LEGIONELLA**

The legionella is a bacteria that is widely extended in natural aquatic environments (rivers, lakes, thermal waters, etc.). For its concentration causing a risk to people must colonize, primarily through the water network, water systems built by man, such as cooling towers and water health network systems, where find conditions of suitable temperature for their multiplication (35-46 °C), physical protection and appropriate nutrients.

From these facilities the Legionella bacteria can infect people if the water is sprayed through aerosols, so that the bacteria can be transported through the air in droplets and inhaled by people. As a consequence, will be risk facilities all those that trying conditions of nesting suitable for this, essentially stagnant or retained water at a temperature of 25-45 °C and especially in presence of dirt, produce aerosols that can be inhaled by people.



### MINISTRY OF **HEALTH AND CONSUMERS AFFAIRS**

RD 865/2003, 4th of July, establishing the hygienic-sanitary criteria for the prevention and control of legionellosis.

#### WITHOUT RISK BY:

▶ Evaporated by contact without spray

▶ Works with cold water

▶ Timed drainage systems, cleaning by ozone.



NOTE: Systems bioclimatizadores evaporate water by contact at low speed without production of aerosols. Some incorporate modern systems of cleaning and purification by ozone, and maintain the temperature of the water to humid temperature of air (between 19 °C and 23 °C approximately).



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## D / APPLICATIONS BY SECTORS

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**THE EVAPORATIVE BIO-AIR CONDITIONING IS ESPECIALLY INDICATED FOR COOL LARGE SURFACES**, MAINLY DUE TO ITS MINIMUM ENERGY CONSUMPTION, BECAUSE USING TRADITIONAL SYSTEMS WOULD BE ALMOST UNSUSTAINABLE.



## D- APPLICATIONS BY SECTORS

The evaporative air conditioning is the only effective option to cool areas/open access - as industrial buildings or shopping centers - that constantly renews the air, sending it clean, fresh and filtered, as a soft breeze.

Its installation is particularly beneficial to large spaces that require the evacuation of polluted air, because it is able to expel smoke, odors, dust and other contaminants achieving a healthy environment for workers.

THE GREAT ADVANTAGE OF THE BIO-AIR CONDITIONING IS THAT YOU CAN INSTALL ON AN EXTENSIVE RANGE OF BUILDINGS, ACTIVITIES AND INDUSTRIES. REGARDLESS OF THE HEAT LOAD, CONSTRUCTION AND THE METHODS OF VENTILATION EXISTING.



IT IS POSSIBLE TO OFFER GLOBAL AIR CONDITIONING TO THE WHOLE BUILDING OR ONLY FOR SPECIFIC AREAS OF HIGH HEAT LEVEL .

## D/I- INDUSTRIAL SECTOR

### PROBLEM

Industrial sector is very wide and the problem of heat affects the vast majority of industrial buildings, each one of them with different productive activity characteristics, but with a common difficulty: the accumulation of heat.

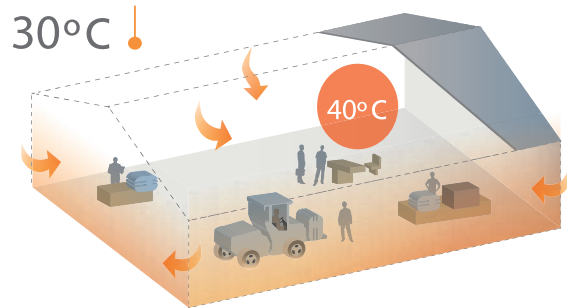
**To solve this problem is not optional, but a requirement of the rules of safety and hygiene at work to limit the temperature in the workplace.**

In addition, we must also take into account the concentration of odors, smoke and gas pollutants, which can be generated depending on the industrial sector. To solve this issue, there are two essential aspects to take into account: the economic and the common need in most cases to maintain the open space by requirements of transport, load and receipt of goods.

On the other hand, provide solutions for air conditioning to workers with the aim of improving their productivity and reduce absenteeism due to heat stress, has been considered until very recently excessively expensive. Given the large size of the spaces are impossible to install air conditioning, both for its high economic cost and by the excessive consumption of energy.

In their absence, the companies have traditionally chosen to reduce the heat simply by opening windows and creating air currents, or with simple fans. Another solution quite widespread has been remove the hot air of upland areas with the support of extractors, replacing it by air again but warm and without filter, so that the temperature in the interior does not drop. Therefore, all these measures don't solve the problem and are insufficient to achieve the appropriate degrees.

### PROBLEM



IN THIS CONTEXT, IT IS REQUIRED A VERY ECONOMICAL SOLUTION, WITH A CONSUMPTION OF SUSTAINABLE ENERGY, WHICH ALLOWS COOL INTELLIGENTLY, IMPROVING WORKING CONDITIONS OF WORKERS, INCREASING THEIR PRODUCTIVITY AND REDUCING OR ELIMINATING THE ACCIDENT RATE.

> HEAT ACCUMULATION

> SMELLS

> LOW PRODUCTIVITY

> INEFFICIENCY

## SOLUTION

The energy efficiency of the evaporative air conditioning is especially demonstrated in the cooling of large spaces, as industrial buildings. The energy consumption of this system is minimal, which is a big economic savings, and their installation is very easy.

With this solution it is mainly achieved:

*The evacuation to the outside of the smoke, dust, odors and pollutants*

*The elimination of the problem of thermal stress*

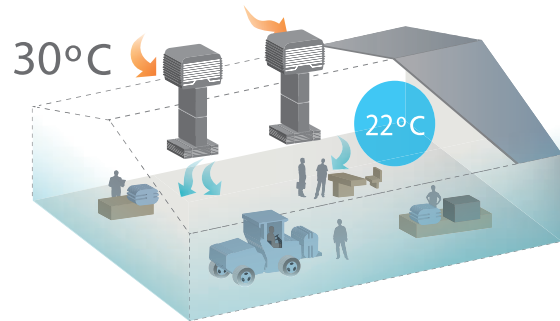
*The increase in labor productivity as well as the reduction/elimination of absenteeism and accident rates*

*The maintenance of the access open without loss of effectiveness in cooling*

*An adequate level of humidity, beneficial for the worker and for certain industrial processes*

*The compliance with the legislation in force*

## SOLUTION



On the other hand, the “zonal air conditioning” is possible with the BCE . It is usual to work only at a concrete part of the industrial space, therefore it is not necessary to treat all the volume. It is calculated that 20 % of the used area can go so far as to suppose 80 % of the cost of traditional refrigeration. A great waste, bearing in mind that the air conditioning of big spaces needs many investment and high electrical costs of functioning. Thanks to the bioair conditioning, it is possible to focus on the area to be cooled without loss of effectiveness not of energy, since it is possible to impel fresh air only where need, saving big part of the cost.

It also solves the problem of accumulation of dust, bad odours and smoke generated by different production processes, because the air is constantly renewed and is expelled to the outside through filtering, fresh and clean inside the space by keeping all access open.

> MINIMUM CONSUMPTION

>NON RECIRCULATED AIR

>ALLOWS LOCAL OPEN

>CONSTANT LEVEL HR%



THE STABILITY OF THE PRODUCT DEPENDS IN LARGE PART ON THE THERMAL CONDITIONS OF CONSERVATION.

## APPLICATIONS

### 1) FOOD INDUSTRY

**The conservation of food is more effective and prolonged if performed in areas well refrigerated and with an adequate level of humidity.**

Each product and specialty has some specific needs and characteristics. For example, in meat industry the rooms where they process, manipulate and packaged products, are specifically benefited of filtering and elimination of environmental pollutants that provides the ECB.

In case of flour treatment, the main issue is to maintain a proper level of humidity that facilitates the drag of the grain because it is done by air and if it is too dry may difficult the grinding. This factor also influences the packaging with the paper sacks, that can easily be broken by lack of humidity. Both disadvantages are resolved thanks to the evaporative air conditioning.

### 2) PHARMACEUTICAL WAREHOUSES

**The quality standards in the pharmaceutical industry are very demanding, including control of the storage of the product, which must be kept in proper conditions, avoiding the microbial contamination.** The quality of medicines should preserve their identity, purity, wealth, efficacy and safety.

The stability of the product depends in large part on the Thermal-conservation conditions, so it is especially important to achieve an appropriate temperature that does not reach to be extreme. The ECB gives a soft and fresh temperature avoiding thermal abrupt jumps, in addition to providing quality of air moving pollutants, dust and odors to the outside.

### 3) GRAPHIC ARTS/PRINTING

The properties of the paper may be decreased if their treatment is done in dry and hot areas, so that provide a cool and humid environment with evaporative air conditioning will translate into an ideal conservation of their properties. Will ensure that the paper is less brittle and not charged of static electricity, because it hinders their manipulation. With this, it also reduces the risk of

D/I- INDUSTRIAL SECTOR



making mistakes involving a waste in printing inks, which implies a remarkable economic savings.

#### 4) CERAMICS

In the ceramics industry some areas that are particularly vulnerable to heat, such as for example the place of the glazing machines, both by the heat generated as by the high level of humidity, or in areas close to the drying ovens, where it produces heat of radiation. **Thanks to evaporative Air conditioning installation is achieved to generate economic form a cool environment**, stressing that the contribution of moisture extra does not represent a handicap because it integrates air at lower temperature resulting beneficial.

#### 5) TECHNICAL ROOMS/ DATA CENTERS

The machines of the "Data Centers produce a lot of heat, which added to the generated by the high ambient temperatures, may cause a slowdown in its operation.

**The air conditioning is not a good option for the cooling, in this case as in addition to their high energy consumption, is insufficient because the performance of the device is lower in hottest days**, contrary to what happens with the evaporative Bio-air conditioning, so the installation is highly recommended.

#### 6) FOUNDRIES

The thermal level of foundries may exceed by far the limit allowed by the law, owing mainly to the own industrial activity. As a result of high temperatures creates a suffocating environment where it is difficult to develop the work, which favors the thermal stress.

**Thanks to the ECB it is produced a general improvement in working conditions, creating a fresh atmosphere, healthy and economically sustainable.**



### 7) LAUNDRIES

The industrial laundry due to its specific machinery generate much water steam and produce a high level of heat, which contributes to increase the temperature to impact negatively on the productivity of workers as well as in their own health. The evaporative air conditioning is especially indicated to reduce the temperature in this type of installations, because **it eliminates the iron water steam, facilitates the effect of drying and prevents static electricity, guaranteeing the correct thermal conditions throughout all the year.**

### 8) WOOD

**Wood is a material that is sensitive to dry environment, it can be cracked and resect if this does not resolve this issue.** Therefore, cooling the wood factories with the ECB assumes that will benefit from the contribution of humidity that will keep the product in optimal conditions. In addition, will increase the performance of the workers because they will do their work in a cool and healthy environment.



### 9) PAPER AND CARDBOARD

The own process of manufacture of paper and cardboard in its different phases leads to the generation of heat, in point areas becomes extreme, as for example in the pulp drying.

**Thanks to the air zonal conditioning is projected fresh air on certain labor spaces, which allows it to move down the temperature only where it is needed,** facilitating the productive development of the worker and reducing workplace accidents.

### 10) PAINTINGS

The flammable substances such as paint, have a risk in their manipulation and in storage. So, it is very important to keeping the right temperature. **The evaporative Bio-air conditioning provides a fresh atmosphere, in addition to eliminating static electricity and reduce/eliminate the entry of dust,** which benefits this product.



REDUCES STATIC ELECTRICITY, INCREASING PRODUCTION AND IMPROVING THE QUALITY OF THE THREAD OR TEXTURE PRODUCED.

### 11) PLASTICS

The own plastic material accumulates a lot of dust, so installing a cooling to erase it, in addition to evacuate outside odors and even the insects that could end up into the material, assumes a value added to take into account, in addition to energy efficiency that characterized the ECB.

### 12) VOLATILE PRODUCTS

The volatile products are related to activities in which they are used organic solvents such as in paints and varnishes, in the steel industry, wood, cosmetics and pharmaceuticals. Its deterioration could affect the environment and the health of the people, so it is necessary its correct storage.

**Thanks to the Bio-air conditioning the stored products are not evaporated, and also reduce the risk of fire, eliminating the gases and odors that may arise.**

### 13) TEXTILE

The Bio-air conditioning offers optimal conditions for the development of the textile fiber in each one of the manufacture processes.

**Thanks to the appropriate level of humidity, it increases the resistance to breakage of some fibers, contributing to be more elastic and flexible.** It also reduces or eliminates the formation of static electricity; which increases the speed of machines, increasing production and improving the quality of the thread or texture produced.

## D/II- SERVICE SECTOR

### PROBLEM

According to the World Health Organization (WHO) we consider an air conditioned healthy must be at a temperature of 20 °C to 23 °C degrees, and maintain a humidity of 40% to 60%. To do this during the hottest months it is necessary to use refrigeration systems that do not dry the air.

ONE OF THE MAIN PROBLEMS THAT ARISE IN AIR CONDITIONING RELATED WITH ACTIVITIES OF THE SERVICE SECTOR, IN ADDITION TO THE EXCESSIVE CONSUMPTION OF ENERGY, IS THE NEGATIVE FACTOR FOR HEALTH THAT MAY ARISE FROM THE IMPROPER USE OF AIR CONDITIONING.

Sudden changes of temperature are very frequent, that favors the emergence of colds and the worsening of certain allergies. Furthermore, the A/C downs the level of humidity in the atmosphere, which generates a series of alterations to health, from small annoyances (skin irritation, itching, eccemas...) to diseases such as pharyngitis, conjunctivitis, chronic rhinitis, etc.

### SOLUTION

To provide during the hottest months a cool environment but also healthy, the Bio-air conditioning is one of the best options, because is economic and sustainable, and mainly:

*Avoid sudden changes in temperature*

*Maintains an adequate level of humidity*

*Filters the air, cleansing of particulate pollutants*

*Allows to maintain open access renewing the air constantly*

*Does not contain polluting gases, so that it is ecological*

The evaporative air conditioning in services sector is often used in highly developed countries such as the United States or Australia, due to its healthy properties. In Europe its deployment is increasing in response to the need to provide a healthy environment, not only at working environment but also in leisure and family.

A HEALTHY AIR-  
CONDITIONED ROOM MUST  
BE AT A TEMPERATURE OF  
20 °C TO 23 °C





D/II- SERVICE SECTOR



## APPLICATIONS

### 1) SPORTS HALLS, GAME ROOMS AND LEISURE AREAS

In spaces dedicated to leisure and entertainment often strong odors are generated due to the high concentration of people. This problem is higher in summer, when the high temperatures increase sweating with the heat, creating an uncomfortable environment in leisure areas, bingo games or game rooms.

**The evaporative air conditioning solves this problem**, cooling the spaces allowing open doors displacing the smells outside, regenerating the air constantly that is renewed filtered and fresh, producing a pleasant feeling of well-being.

### 2) WINE CELLARS

**Maintain the correct degree of temperature and moisture in wine cellars is a vital factor to the protection of wines**, the excess heat and low humidity contribute to increase the fluid loss. The higher is its evaporation, the higher the frequency of refilling, which generates high costs of labor and high cost of the product.

The evaporative air conditioning favors not to interrupt the aging of wine, because it does not evaporate or make it rude, and not volatilise the ethers, so the wine cellar is fully oxygenated.

### 3) CENTERS AND COMMERCIAL BUILDINGS

**The evaporative air conditioning are greatly influenced by the choice of a shopping center**, because customers will shop in those where the temperature is pleasant, especially in the summer, and if they go with children or elder people it even acquires greater importance.

These large spaces have generally wide open access, and the evaporative air conditioning is 100% effective in this situation, saving the heat even at outdoor areas of the complex. In addition, the fresh breeze of the ECB rid of insects these spaces providing a pleasant feeling of comfort and costumers welfare.



THE EVAPORATIVE BIO-AIR CONDITIONING PROVIDES AN OPTIMAL HUMIDITY LEVEL, VERY BENEFICIAL FOR CHILDREN AND PEOPLE WITH ASTHMA.

#### 4) INDUSTRIAL KITCHENS

**Industrial Kitchens tend to have a heavy load of heat, due mainly to that emerges from the machinery: cookers, ovens, electrical devices...** as well as the own heat generated by workers, who concentrate their activity in certain hours of the day. In addition, due to the handling of the food, the accumulation of different odors are also characteristic of this type of facilities.

It is therefore very important to cool them in a correct way to achieve both the welfare of workers as an ambient temperature that favors the conservation of the own food.

The evaporative Bio-air conditioning is perfect, it generates fresh and clean air as a gentle breeze, and favors the elimination of smoke, odors and other contaminants allowing permanently open access.

#### 5) SCHOOLS

Children are often requires a high school performance and the temperature is a key factor in promoting a healthy environment that facilitate it, creating welfare and maximizing their productivity. Excessive heat can cause the increasing fatigue, dehydration and even heat strokes.

**Given the large size of the educational centers, the use of air conditioning has an unsustainable cost** and its continued use favors the dryness in the atmosphere causing skin and respiratory problems, among other alterations. Therefore, the evaporative Bio-air conditioning is a solution specially indicated, it provides an optimal humidity level very beneficial for children and people with asthma. Moves the dust and odors outside of the building, promoting a healthy environment with fresh and clean renovated air.

D/II- SERVICE SECTOR



In addition, avoiding sudden temperature changes, which are harmful to health because they cause colds and aggravate some types of allergy. Its use is effective in open spaces, without need to close doors or windows. And can be installed either in the classroom, as in kitchens and dining-rooms and also in gyms and other common areas of leisure.

## 6) CAR DEALERSHIP AND GARAGES

**The consumption of energy in car dealerships is very high, they are large spaces that have important installations of lighting and air conditioning.**

Normally they have three distinct areas: garage, exhibition hall and offices. It is necessary to choose an effective air conditioning system but also sustainable, adapted to the peculiarities of this activity.

The exhibition hall of automobiles is usually determined by a lar-

ge glazed surface overheated in summer. Also, the great lighting load also contributes to raising the temperature.

In the case of the garages, to maintain a good ventilation system that favors the elimination of harmful gases generated by petrol and the solvents in paints, is very relevant. For this reason, the renewal and air filtration is needed to generate clean air quality.

## 7) GREENHOUSES /“GARDEN CENTERS”

**To maintain the high humidity and avoid the excess of heat between plants allows to improve the length and quality of the product.**

Taking into account that they also require adequate ventilation, with the evaporative system they will achieve the desired conditions.



## 8) GERIATRICS

In the field of social-sanitary sector, the ECB is a solution designed to ensure and to maximize the comfort of the elderly people living in a residence or geriatric. The elders as children are more sensitive to the inconvenience and alterations air conditioning can lead to health .

**There are negative factors such as sudden changes in temperature and humidity, which alter the mucous respiratory and produce dryness in the skin. Also irritation pharyngeal, hoarseness, chronic rhinitis, pharyngitis and conjunctivitis. In addition, can aggravate respiratory allergies and transmit by air infectious diseases of the respiratory system.**

For all these reasons, the evaporative air conditioning implies creating a comfortable atmosphere thanks to a cool temperature without abrupt changes. It is ecological, economic, clean and healthy.

The ECB generates quality air because it is filtered and expelled outside the dust, smoke and toxic odors, keeping doors and windows open without loss of efficiency in air conditioning. At the same time, the more the temperature increases outside the greater the air conditioning indoors, an advantage key of the bioclimatization process.

## 9) PADDLE INDOOR

**Paddle players recover better if it reduces the ambient temperature in the tracks. A natural air conditioning , with a minimum installation cost and energy consumption, will mean an added value for the sportsmen/customers.**



Traditional systems of air conditioning become obsolete if we take into account the need to create a cool environment where the air is recirculated continuously and does not recirculate stale air. It is also important to maintain an adequate level of humidity and avoid a great deal of energy in spaces of large dimensions. All these aspects are answered satisfactorily with the evaporative air conditioning.

## 10) RESIDENTIALS, TOWNHOUSES

In independent houses and townhouses, during the summer months it is a common practice to use air conditioners that trigger the invoice of power because of its great energy consumption.

It is ironic that many people who have it installed do not use it because they feel uncomfortable with the dry environment that

is generated, as well as by sudden temperature changes that favor the appearance of colds.

On the other hand, in residences with spacious terraces it is important to be able to open windows and doors and even keep them without close to renew the air, something that is not possible with traditional cooling systems.

The evaporative air conditioning however, allows to enjoy a cool environment with open doors and windows, creating a gentle breeze that also contributes to the elimination of insects so annoying in summer.

Also, the cool temperature that is generated is healthy, especially for children, the elderly and people with asthma because it maintains an optimal humidity level with warm temperatures and clean air constantly renovated.



WHEN THE AIR  
EXCEEDS 24 °C CAUSES  
AN EFFECT OF LOW  
PRODUCTIVITY

## D/III- OTHER APPLICATIONS

### 1) ANIMAL FARMS

**The animals have a body temperature higher than humans, they don't sweat so they expel the heat that is generated by irradiation or convection. When the ambient temperature is close to the body temperature of the animals, they suffer significantly, and even to die when the exceed, being especially vulnerable pigs and poultry.**

When the air exceeds 24 °C causes an effect of low productivity in young hens, this implies a reduction in their production of eggs, and the same thing happens with turkeys, ducks, geese, quails...

In addition, the environmental comfort is necessary at all stages of the manufacturing process, from the breeding area of the chickens until the laying of eggs, or where they are stored to be slaughtered, etc. It is necessary to maintain well ventilated spaces to eliminate possible concentrations of CO<sub>2</sub> and NH<sub>3</sub>.

Therefore, the ECB is the best choice for these cases, sustainable, ecological and profitable.

With it you can cover the needs at all industrial stages in an economic way and healthy, renewing the air constantly, providing adequate ventilation and achieving a significant reduction in the ambient temperature, all with a minimum consumption of energy and without sudden changes in temperature.

### 2) ARMY

**During the hot days of campaign, encourage the rest of the army in a cool and healthy environment is a necessity.**

The evaporative air conditioning of low energy consumption is suitable for the energy of the generators, this is an ideal solution. Also, the mobile units of Bio-air conditioning offer autonomy for its functioning during several hours, without need to be connected to the network, thanks to the incorporation of a deposit at its base.

#### D/III- OTHER APPLICATIONS



In addition to these advantages, it is also an ecological and healthy alternative, thanks to the filters that incorporates the system to clean the air and eliminate or reduce the dust particles, tobacco smoke and odors, which promotes health and physical recovery of the military, maintaining an adequate level of humidity.

This technology can also be applied in playgrounds and outdoors areas, as usual on the premises of fast-food, thus allowing the children enjoy pleasantly the environment and generating an added value to the complex.

### 3) OUTDOOR ENVIRONMENTS

Through the evaporative Bio-air conditioning it is also possible to create fresh outdoors spaces in areas and places where the atmosphere is warm. This solution has application in pedestrian streets, social and sporting events, hostelry, etc.

As a practical example: applied with an excellent result in Expo Zaragoza where 30 bioclimatic towers were installed that helped to create a fresh environment for rest areas providing an oasis of freshness in the hottest days.

THE COOL BREEZE THAT  
GENERATES THE ECB IS  
ORGANIC AND HEALTHY

## FAQS EVAPORATIVE BIO-AIR CONDITIONING

### I- IS THE ELECTRICAL CONSUMPTION AS HIGH AS THE AIR CONDITIONING?

No. It is a sustainable system of very low energy consumption and spends up to 80% less than an A/C. For example, in a surface of 200 m<sup>2</sup> consumption is approximately 960 W at maximum speed. Consumes less energy than a hair dryer and the eighth part that an air conditioning.

### IV- DOES THIS SYSTEM KEEPS ITS EFFICIENCY WITH DOORS AND WINDOWS OPEN?

Unlike air conditioning, this system requires an open space, because the boost air inside requires the existence of an output. Therefore, it operates with maximum efficiency in open spaces, generating the movement of a nice breeze of fresh air.

### II- DOES INCREASE THE HUMIDITY LEVEL WITH THIS SYSTEM?

In a minor form, but will not be obvious because they must be to keep open the access to the place, which will enjoy the movement of a soft cool breeze very nice without feeling of humidity.

### V- WHAT MAINTENANCE NEED THE BIO-AIR CONDITIONING MACHINES?

Its maintenance is minimal, due to the automatism that equipment incorporate, such as a electrolytic water quality detector, automatic drain and programmable or automatic closure of ducts. Only it is advisable to perform at least one review and annual cleaning.

### III- SHALL ENTER HOT AIR AND DUST FROM THE OUTSIDE WITH OPEN ACCESS?

No, because it generates an overpressure that causes the fresh air introduced exit as breeze through the doors and windows open, not allowing the air inlet or dust from the outside.

### VI- IS THE CONSUMPTION OF WATER FOR ITS OPERATION HIGH?

No. The average consumption of water is located in the 30 liters per hour, being the economic minimum cost. However, it depends on the temperature and humidity in the air outside. The drier is the air outside the greater the consumption of water and the greater the cooling. The water is not wasted, it brings into the air to cool.



### VII- HOW YOU CAN REDUCE THE TEMPERATURE?

Between 4°C and 12°C lower than that of the outside air. Will depend on daily climatic conditions, mainly from the exterior air temperature and humidity. The more hot and dry is the day, the more will cool the evaporative coolers. For example, if the temperature is 35°C and the humidity of 40%, the ECB will boost the same air inside to 26.5 °C. In extreme conditions can be cut up to 12 °C.

### IX- DO I NEED TO WORRY ABOUT THE LEGIONELLA WITH THIS SYSTEM?

No, because the cooling is done by contact. The problem of the Legionella affects the cooling towers and those equipment of evaporative cooling that generate aerosols. Specifically the Biocool evaporatives cool the air by contact and not through the generation of aerosols, by this reason cannot generate Legionella and are not subject to what the law provides for another type of equipment.

### VIII- IS THIS COOLING SYSTEM BENEFICIAL FOR THE HEALTH?

Yes. It provides a proper humidity level, it does not dry the air which translates into beneficial hydration to humans (especially for people with asthma and children), animals, plants and certain products such as paper and textiles. It also generates clean, fresh and filtered air as a constantly soft breeze. Does not emit gases, so that doesn't damage the ozone layer. Moves the dust, smoke, odors and other pollutants to outdoors. Does not generate static electricity.

## BIOCOOL SYSTEM

Biocool is the sponsor of the Guide of the evaporative Bio-air conditioning in its objective to promote energy efficiency and air conditioning techniques respectful with the environment, that contribute to stop climate change by promoting a global benefit for the environment, Nature and the planet.

**Biocool has received in December 2014 the award in category of air conditioning of the magazine Nan Architecture and Construction, for being an example of effective technology non-polluting by its low energy consumption and by the absence in its operation of gas emissions refrigerants, which turns it into an advanced ecological model to heat in a responsible and efficient manner.**

In addition, the company has promoted parallel developments as a calculator for energy savings, an Ipad App for for users and technicals they understand the benefits this technology brings in each climatic zone, in addition to measure the number of equipment required for each application.

Equally, Biocool offers compatibility with Smart City Cooler, capable of offering the maximum performance and minimum maintenance of the equipment, this is a notable aspect taking into account that these are located outdoors and in heights.

**BIOCOOL BETS FOR THE MORE SUSTAINABLE SOLUTION: THE EVAPORATIVE BIO-AIR CONDITIONING.**





[www.biocool.info](http://www.biocool.info)

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