MultiSystem

Air conditioning system for cinemas and theatres

CLIVET®

Every time has its value. Ours is enriched by innovative projects. It is the bringer of new stimuli, and especially of the search for total well-being, also in leisure activities that we choose to feel free and in control of the quality of our time.

Editorial
Clivet: quality in free time

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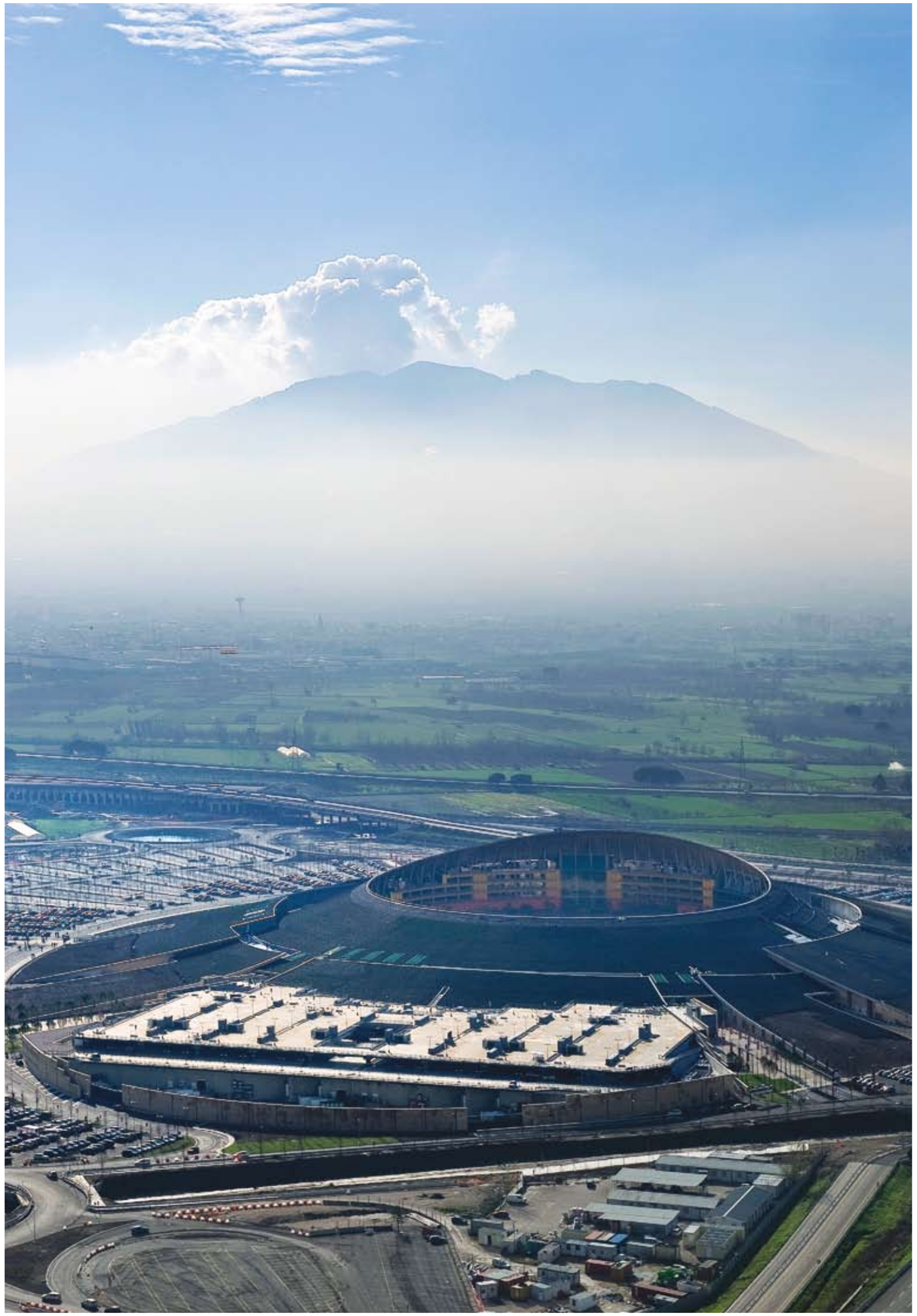
In modern living, there prevails the exploitation of leisure time and places for cultural activity or entertainment. Nowadays, furniture, lights, armchairs, and audio/video systems are the only factors of success or indexes of evaluation of the quality of a cinema or theatre.

The audience demands modern ambient standards: perfect comfort control, the right temperature, optimum relative humidity and calibrated air re-circulation. All of these aspects are ensured by the choice of a systems solution that optimizes the use of energy.

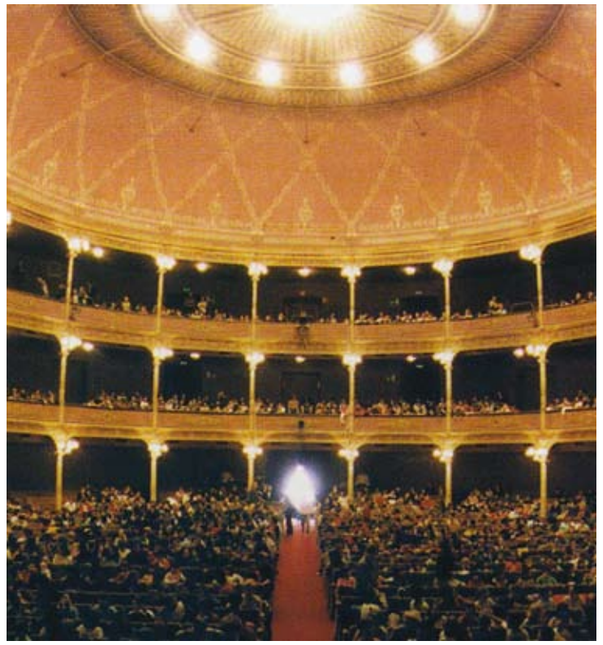
Clivet focuses its research on public well-being. Satisfying this need is the basis of its company philosophy, and designing in respect of the environment, through ethical and thoughtful use of energy.

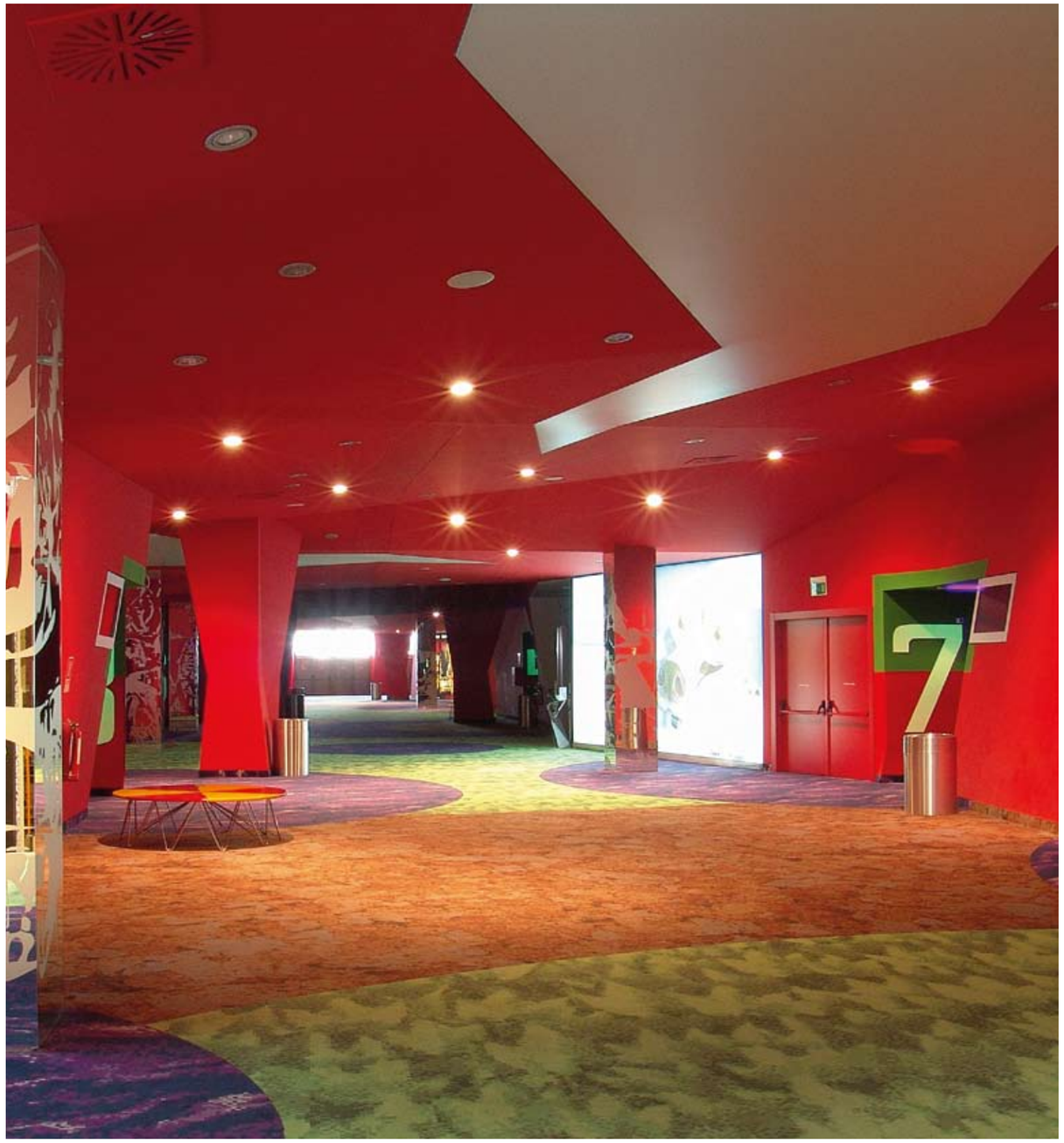
Calculated savings not only in operating costs but also on the total life cycle cost of the system, is an attainable objective. For this reason, we develop every unit and solution with the assurance of the best use of energy and the least possible environmental impact.



The services sector and the enhancement of free time

Worldwide growth of construction for the services sector continues incessantly. This sector always concentrates excellent ideas and technical solutions. Whether they are new projects, renovations of pre-existing buildings, or projects for the redevelopment of industrial areas, the common denominator is always the search for places to meet and gather that are as welcoming and comfortable as possible.





World-famous architects are generally the driving force behind these modern temples of culture and entertainment.
Modern and pleasant buildings marked by architectural innovation and technological solutions that are on the cutting edge. Original, brand-new, daring constructions, designed by people who are aware of their own time, re-interpret the setting and integrate with the local architecture.

The aim is to attract an increasing number of visitors and to host them for an extended time in the structure. An essential criteria is no longer the amount of the time the visitor spends there, but rather the quality of that time.

For complete satisfaction of the public, a pretty wrapper is not enough: comfort has to be total.

In this scenario, air conditioning plays a vital role.
Factors such as optimal temperature, controlled humidity, air purification and correct ventilation are essential for ensuring a prolonged and pleasant stay in these areas.

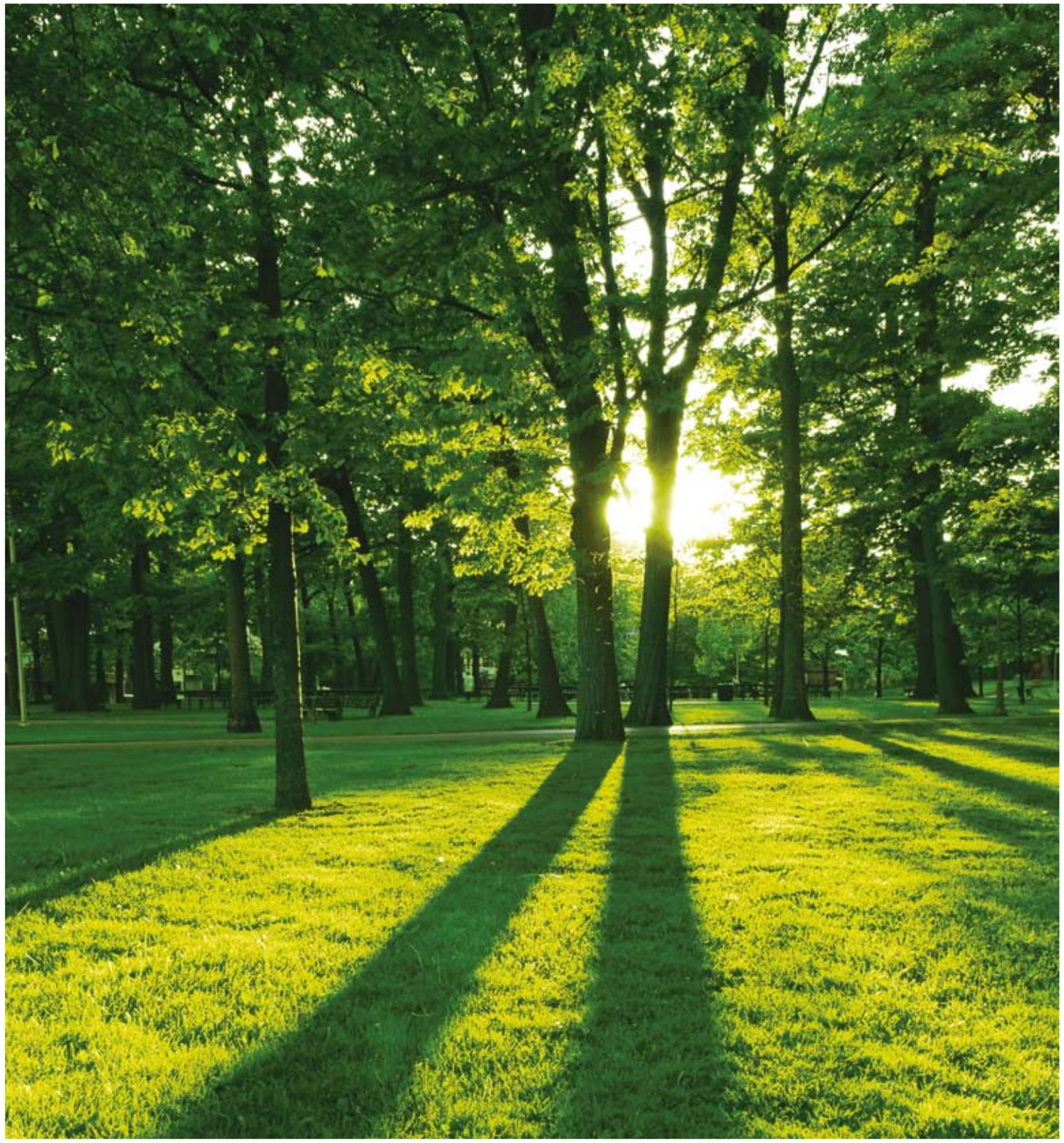
The New York Times

June 3, 2003
The Markets: Commodities
Crude Oil exceeds $30 a barrel on concerns about supply levels
The price of crude oil in New York rose above $30 a barrel for the first time since April on concerns that low inventories of gasoline and other refined fuels would spur oil demand by refineries.

July 21, 2006
As Oil Rises, Will Economy Finally Fall?
… When oil almost hit $40 a barrel in 2003, there was talk that the rising cost of gasoline would slow the American economy. The talk returned when oil topped $50 in 2004 and $60 last year. But the economy kept on growing at a good clip.
Now, with oil above $70, some seem to think the logic was simply wrong, and that the new American economy is impervious to oil.

January 4, 2008
Dealing with the dragon
… On both Wednesday and Thursday, the price of oil briefly hit $100 a barrel. The new record made headlines, as well it should have. But what does it mean, aside from the obvious point that the economy is under extra pressure?…

July 3, 2008
Price of Oil Rises Again, Rattling the Markets
... Crude oil climbed above $144 a barrel before settling at $143,57, up $2.60 for the day. The Energy Department reported an unexpected decline in inventories, sending oil prices to a record. And now oil slowly is closing in on $150 a barrel, the next psychological milestone to be crossed.



The increasing use of air conditioning brings with it a growing demand and consumption of energy.
Today, choices must be made taking into account limited resources and expensive energy. The following information should be cause for alarm for everyone: the cost of a barrel of crude oil has more than tripled in the last 5 years, from $40 a barrel in 2003 to nearly $140 in 2008.

Where can we find energy resources at a reasonable price? We need for designers to face these issues in a informed manner.

In this specific sector, the use of alternative sources such as solar heat and solar panels will most likely never be used, given the enormous amount of energy that is required to run the systems properly.

The first source of energy is the savings of energy itself, i.e. **rational use of the available resources.**
The second source is to take advantage of the transfer of energy between the planet and the served location, whether it comes from the outdoor air, from the ground, from the water (groundwater, river, or lake), or from expelled ambient air.
In other words, the solution is in the use of **heat pumps.**

"Lights down!". And the adventure of the cinema begins.

On December 28th, 1895, an audience in Paris was the first to see a film projected by the brothers Auguste and Louis Lumière, who considered it "an invention with no future".
The Lumière brothers wanted the spectator to feel that what he was seeing was real, and with the moving images they made their dream come true. In the beginning, cinema was merely a visual art form, with no sound.
In the first cinemas, which were mostly theatres converted to the needs of film projection, the owners of the premises hires musicians, mainly pianists, to accompany the film.
The musical score, performed live, underlined the highlights of the film and affected the emotional tension of the viewers. Spectators were more caught up in the film and the fiction came closer to reality. And cinema has been providing excitement to millions of spectators ever since.

The first multiplex cinema was built in the United States in 1962. The aim was to offer a wide variety of shows at the same time.
Often, the multiplex is created as a system that is part of a larger complex such as a shopping centre, or it may be independent. In other cases, it is created by dividing up large pre-existing buildings, or newly constructed structures.
The theatre has always represented in the collective memory the privileged location of cultural entertainment. Theatrical plays never go out of style; rather, they continue to flourish.
In the urban setting, they are always acknowledged as prized buildings of architectonic value. As a result, they are subject to rigid standards of protection as they are truly pieces of the civil and cultural heritage.

The evolution of the show

A stage to each type of art

Theatres
buildings open to the public where drama, concerts, musical events, opera, poetry readings and dance performances are displayed.

Town cinemas
buildings fitted with screens open to the public and located in town centres, often inside historic buildings.

Multiplex
buildings divided into at least three screens open to the public, complete with accessory services and often located near large shopping centres

Make yourselves comfortable: well-being in the cinema

A vital part of the show is the well-being of the people in the seats. The audience expects to watch a film or play in optimal conditions, to fully enjoy the emotion of this collective ritual.

Today, technology has substantially improved the clarity of sound and the visibility of the screen. However, the quality of a show doesn't depend solely on crystalline highs and rumbling lows. It is an integral well-being that comes from a comfortable setting where the rights temperature, the correct degree of humidity, and calibrated filtering and recirculation of air make the spectator completely comfortable.

The concept of health has constantly evolved over time, so that today it has assumed the widest of definitions. The primary condition of a lack of systems is now joined by an ever-increasing sense of the person's overall well-being.
The first ambitious initiative aimed at implementing a global strategy of well being for all, undertaken by the World Health Organization (WHO) dates back to 1978, with the Declaration of Alma Ata Declaration, which led to the "Ottawa Charter", the result of the first International Conference for the Promotion of Health in 1986.
In 1998, the WHO adopted the World Declaration of Health, under which the member states agreed to create a wide-ranging programme for the implementation of a universal health strategy for the 21st century.
Twenty-one key points of the programme "Health for All" (HFA) aim at ensuring individuals have a safe and healthy physical environment, thanks to the control of the presence of harmful pollutants.
The objective of the standard is to create places that are conducive to health, in order to offer everyone, anywhere in everyday life - at home, at school, in the workplace or free time - greater opportunities to make use of a healthy social and physical environment". In 2003, consideration was given for the first time to environmental conditions that interfere with an individual's powers of decision -making. Therefore, favourable conditions must be created so that each individual assumes personal liability for making healthy choices. This is why it was deemed necessary, among many other pressing needs, to provide the cinema or theatre spectator with perfect comfort in which to spend his leisure time in the best way possible, and creating the desire to relive the experience.

During a show that lasts two or more hours, the spectator must not feel too warm nor too cold. There must be no air currents, and unpleasant odours must be reduced to the extent possible. Noise from adjacent rooms or from outdoors must be reduced to a minimum.
Generally, the aim is to create the most comfortable setting possible around the spectator. This objective is achieved only through a global concept of quality in the building that host shows. The centrepiece of it all is the well-being of the audience that makes use of the spaces.

The rules of common well-being

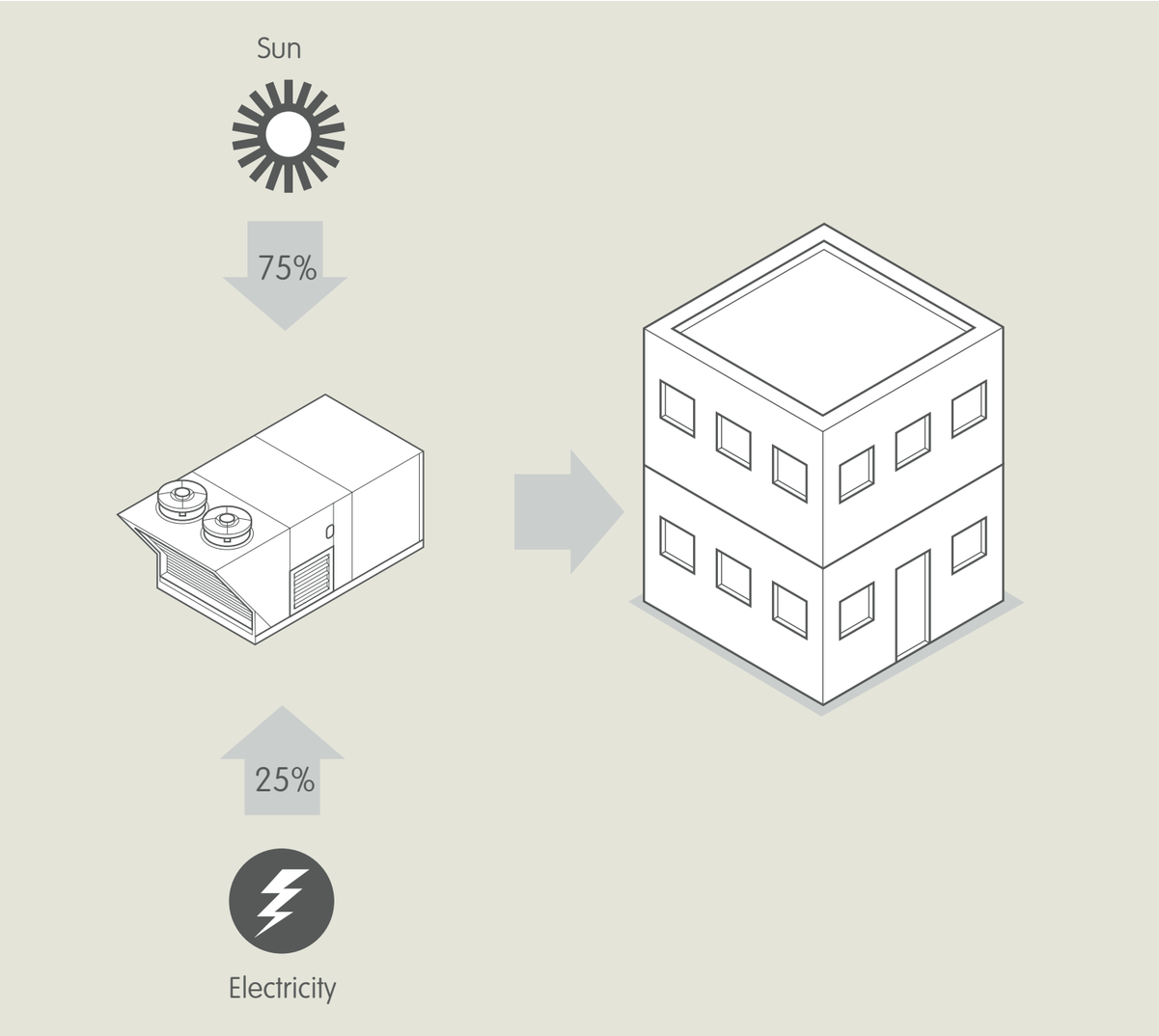
In public places, standards are focused on respect for the environment and protection of public health.

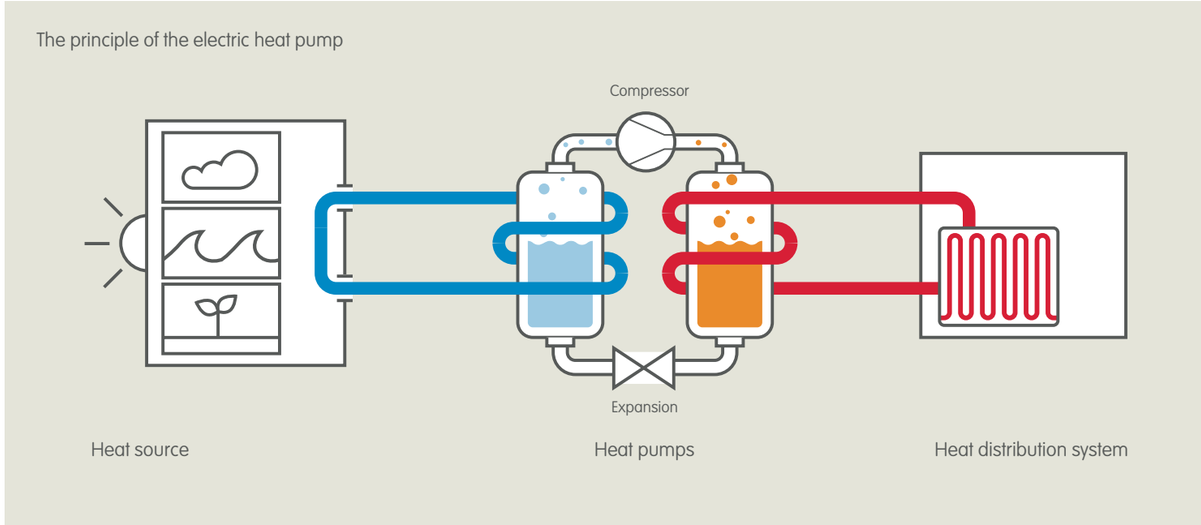
When constructing or renovating cinemas or theatres, compliance with limitations established by the authorities responsible for protecting architecture and issues of environmental impact are decisive matters in performing the work.
In historical centres, invasive work needs to be kept to a minimum, also due to the presence of adjacent buildings. Just as important are the new standards on noise emissions and combustion by-products.

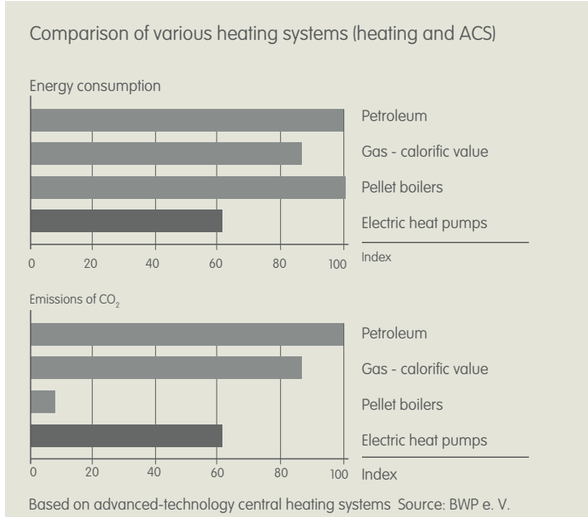
During work, proper application of the standards may lead to increased times for both renovation and new construction. However, the operator or investor can shorten the times required for compliance by choosing packaged air conditioning units, pre-tested and ready for use. The simplicity and reliability of the system ensure reliable operation of the system even by non-specialist persons. In this way, the reduced operating costs help to offset the expenses for the purchase and installation of the system.
Further constraints are encountered as early as the design stage.

A serious problem always arises, perhaps more in building to be renovated than in new construction, concerning the availability of space for equipment rooms to house heating and cooling plants, pumping systems, plumbing and electrical systems, and air ducts. The only place designers normally provide space for the air conditioning units is on the roofs. For this issues, the compact outdoor units offer a perfect ready-made solution.

Also in the design phase, the latest directives concerning energy savings require optimization, depending on the climatic area, air re-circulation, and operating hours of the system, the forced recovery of the flow of air expelled from the system.
Another important feature is the correct use of devices that adjust the flow of fresh air into the rooms based on how crowded the rooms actually are.







The electric heat pump

Better performance and higher savings

Electric heat pumps represent an efficient and advantageous choice for the air conditioning of environments. These devices allow the exchange of energy between the external environment, called the "source", and the served environment, via the specific cooling circuit with which they are equipped.

This transfer only requires the use of electricity and is highly efficient and therefore low consumption.
The energy freely derivable from the atmosphere supplies about 75% of the energy required by a heat pump. With the integration of only 25% of electricity, 100% of the heating system's demand is reached.

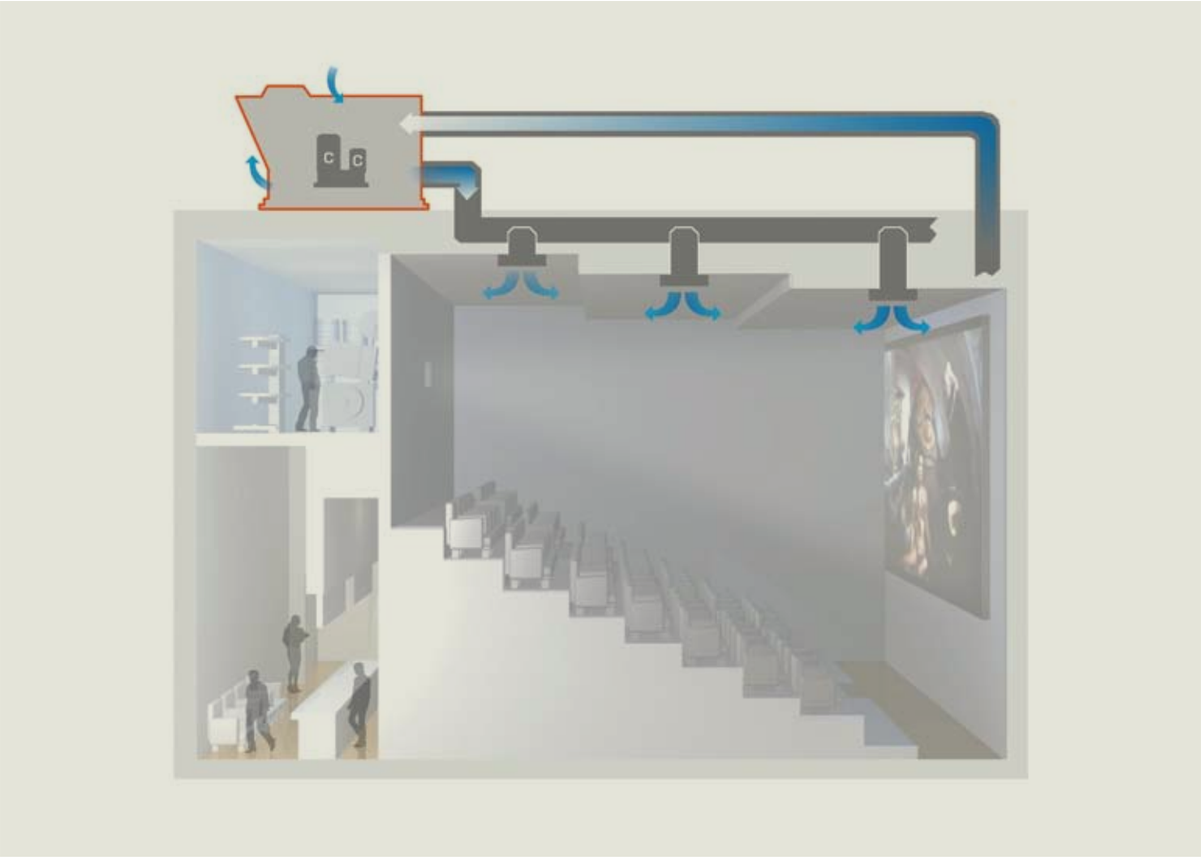
The most frequently used source is **air** as it is available everywhere. Nonetheless, of particular interest in specific cases is the use of **water** as a source in that it is a natural resource able to further increase the efficiency of the system and therefore reduce consumption. This is found to be the ideal solution when there are accessible sources such as wells, groundwater, lakes, rivers or the sea.

The **ground** can also be a useful source of exchange, by means of opportune underground circuits (geothermal probes) arranged horizontally in the presence of adequate surfaces or vertically when the space allows it.

Thanks to their energy efficiency, heat pumps guarantee the desired comfort with reduced management costs and with a low environmental impact. For this reason the initiatives aimed at favouring realisation through economic or tax incentives are numerous.

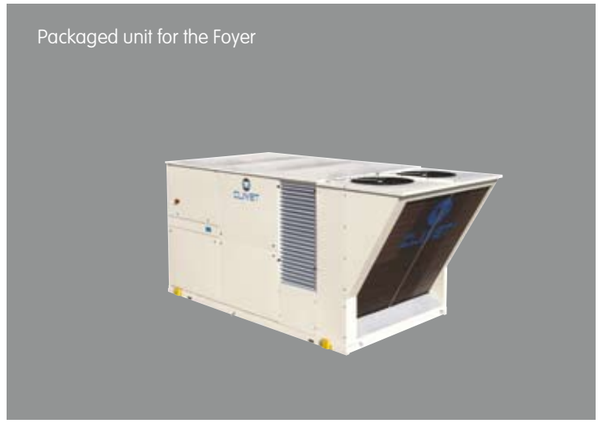
MultiSystem
The art of air conditioning

MultiSystem by Clivet offers efficient and reliable solutions for the air conditioning of multiplex cinemas and theatres. Thanks to an innovative line of products developed for specific areas, the flexibility of the system ensures quality performance and excellent control of ambient comfort in complete compliance with current standards.




Packaged unit for auditoriums


Packaged unit for projection corridors


Packaged unit for the Foyer


Management and supervision system

MultiSystem
Synergy of design and functionality

Multiplex cinemas represent the most characteristic development made in the entertainment industry in the last decade. Normally built near the main communication centres, multiplex structures are based on a typical repeated design, subdivided into three specific functional areas:
· the auditoriums
· projection corridor
· the foyer

The auditorium certainly poses the most building constraints, for obvious acoustic reasons, flexibility of use and especially for the need to maintain comfort conditions for the audience that are precise and stabile over time regardless of the external atmospheric conditions or the time of day.
Accessory areas such as the projection corridor and the foyer are absolutely necessary for the correct performance of the shows. Also for these the degree of comfort represents an essential condition.

Finally the entire structure requires competitive management costs, able to ensure the shortest return on investments time and the achievement of the objectives set by the management once in full operation.

MultiSystem by Clivet maintains the comfort required for every environment simply and effectively:

· precise control of temperature and humidity, air quality and silence in the auditoriums

· re-integration of the flow of air extracted by the projector extractors in the projection corridors, with the aide of the recirculation flow

· adaptation to the variable conditions of use inside the foyer

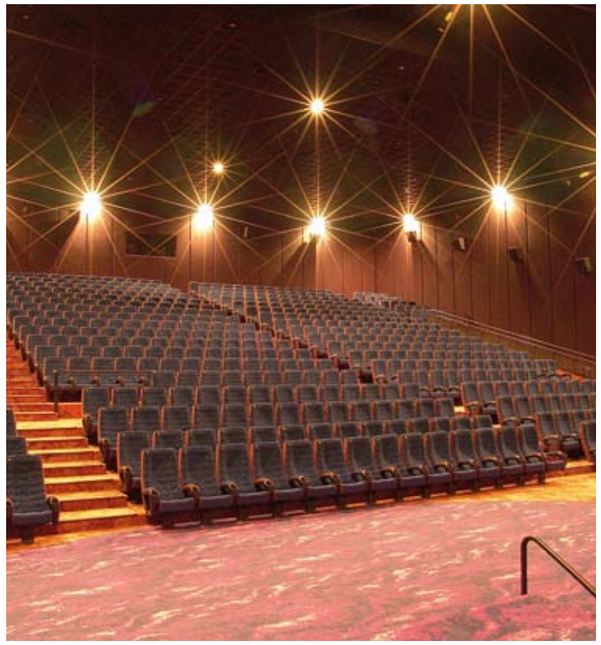
· rapid and efficient elimination of odours in the refreshment area

Featuring units that can be configured for each specific application, MultiSystem is the result of experience gained over the years as the host of references in the sector testify.

The extreme compactness of the units allows the simplification of positioning, thus enabling work to be completed more quickly.

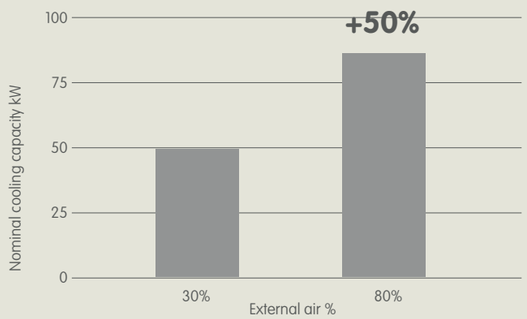
All the units are ready for use and already tested individually at the end of the production process. At the worksite, all that is required are the air ducts, the electrical connections and the plumbing connections.

The high degree of industrialization and mass production ensure the utmost system reliability.



Auditoriums are **highly crowded** environments where the need for comfort and hygiene for the audience and compliance with current standards require a high air exchange, therefore taking **large quantities of external air** into the environment.

The re-circulation with high quantities of external air requires **dedicated units** with a higher power to those used normally for environments with average crowd levels, such as for example large commercial areas.



Typical values referring to a unit supplying 10,000 m³/h

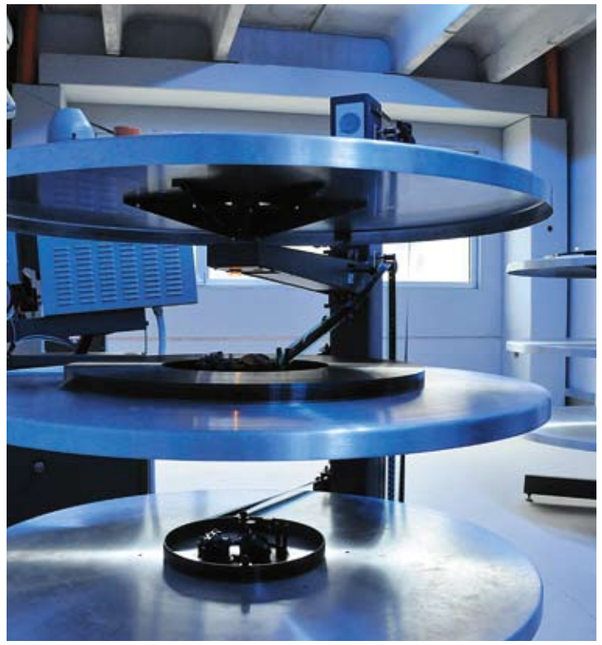
The specialised units for auditoriums are able to provide:
· up to 80% of external air re-circulation
· automatic variation of the re-circulation depending on the crowd levels of the room
· energy recovery on the air expelled of a thermodynamic type
· free cooling in the free-cooling mode
· high air filtering capacity

Auditoriums

Independent and reversible rooftop heat pump

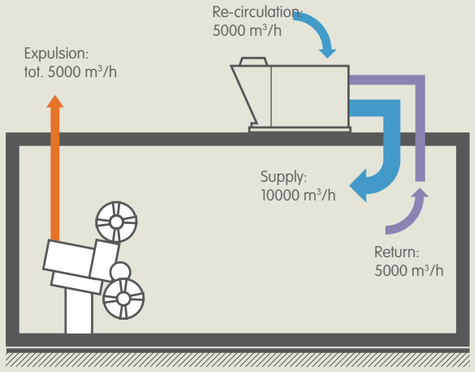
In each auditorium MultiSystem guarantees high **independence** and **adaptability** in varying the external (climate) and internal (crowd levels) conditions, with the maximum **energy saving**.

In addition to environmental comfort, the system also works on the **acoustic comfort**, thanks to low sound levels that can be further reduced due to the availability of integrated silencers made of purposefully designed sound absorbent materials.



The projection corridors are the technical premises where the **projectors** work. When working, each of these expels a significant quantity of air through the **extractor** it is fitted with, and at the same time contributes to the **heating** of the environment where it is placed.

The incoming air in the projection corridors must:
· introduce fresh air to replace the extracted air and expel it outside
· guarantee the correct climate conditions for apparatus and operators



Example of a typical corridor with 5 projectors

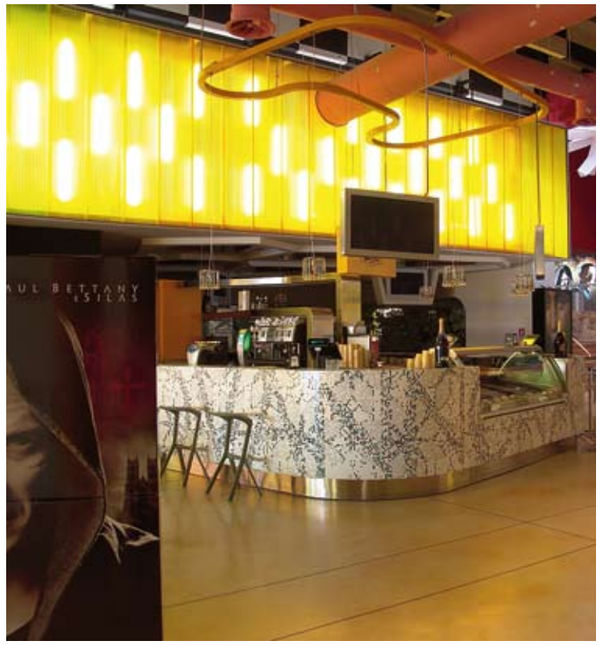
The units configured for the projection corridors are fitted with:
· automatic external air emission
· energy recovery on the air expelled of a thermodynamic type
· free cooling in the free-cooling mode
· high air filtering capacity

Projection corridors

Independent and reversible rooftop heat pump

In the projection corridor MultiSystem maintains the necessary temperature and humidity conditions, while guaranteeing optimal operation of the equipment and the best comfort for the operators.

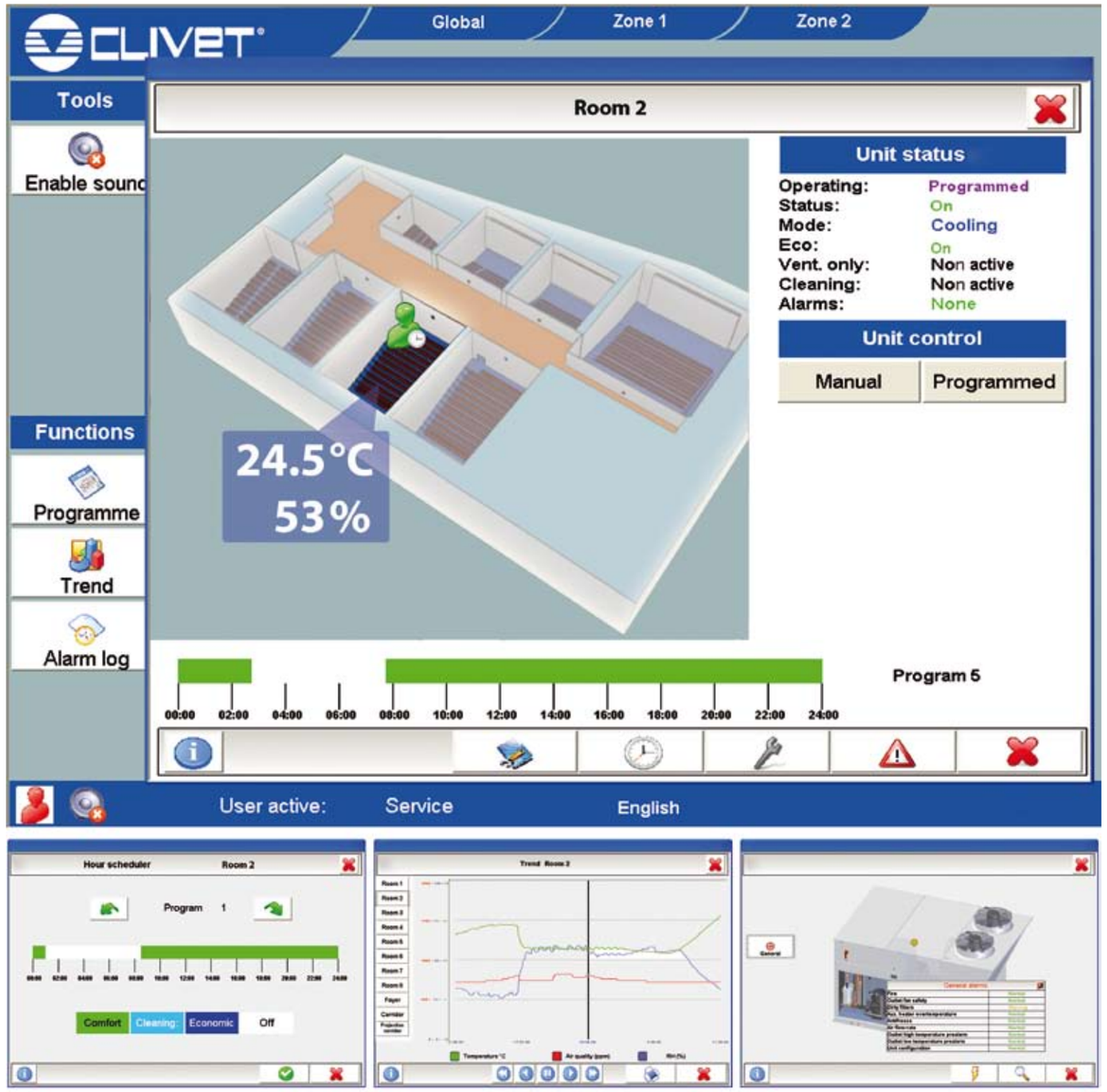
The controlled emission of external air automatically compensates the air flow extracted from each projector and necessary for its cooling.



Foyers and refreshment areas are environments that feature a clear variability in crowd levels, very high between one film and another and nearly empty during screenings, heat and smells from the refreshment areas and often souvenir shops.

· Automatic adjustment
· Active thermodynamic energy recovery
· Energy saving with free-cooling

All the MultiSystem units use ecological R-410A **refrigerant** fluid, which improves the energy efficiency compared to other ecological refrigerants such as R-407C, and makes the same units more compact.



Foyers and refreshment area

Independent and reversible rooftop heat pump

In the Foyer and in the refreshment areas the MultiSystem quickly and efficiently meets the variations of ambient load that occur. Typically the number of people tends to vary, and there is a high heat load due to the preparation of snacks and drinks at the bar, lights, monitors, and ticket counter staff.
Furthermore the system ensures the optimal change of air in a way to also eliminate the smells coming from the refreshment area. A typical configuration includes double ventilating sections (supply and return/expulsion), with automatic air exchange and energy recovery on the air expelled.

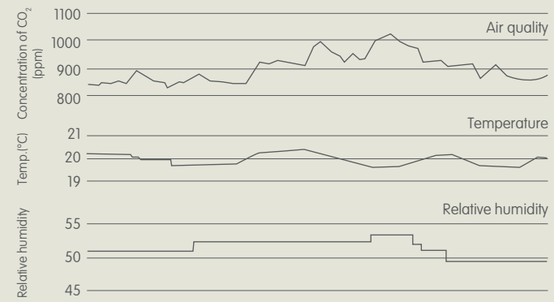
System management

Centralized management and supervision system

All of the MultiSystem units are set up for connection to the centralized control system of the air conditioning for the entire facility. For each zone, you can easily and functionally set the desired parameters for temperature, humidity, and air quality. A troubleshooting system along with rapid repair times makes it possible to optimize service and ensure constant reliability.

The management system is provided in a range of languages and, upon request, supervision may take place through 3D display, purposefully developed and customised. Users can browse, using a workstation, through the graphic pages that three dimensionally represent the systems and have a general overview of the situation of the multiplex.

The strenght of MultiSystem is in
its high overall efficiency.
This has been achieved through research and development of innovative technologies guaranteed by the Clivet brand.



Efficient control of air quality

Designed to ensure strict control of the temperature, humidity and air quality, the units offer the possibility to change the **amount of fresh air** depending on the crowd levels of the room.

The higher the number of people in the room, the higher the amount of carbon dioxide (CO_2). Thanks to the automatic detection of the on-board probes, only the quantity of external air necessary is treated and emitted.

Independently from the number of spectators, the **comfort** inside the room is always maintained at a high level, while management can take advantage from optimised **energy consumption** based on the effective need.

Savings on consumption of primary energy

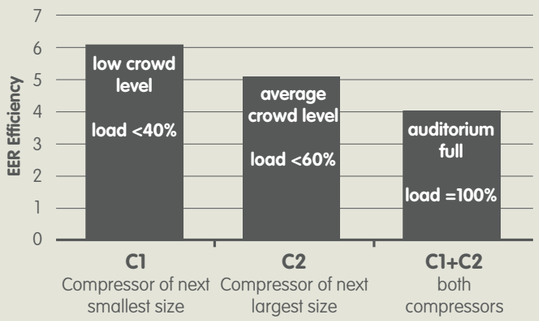
-30%

Energy recovery efficiency

As a standard, the units provide the recovery of **thermodynamic** heat**:** the energy contained in the expelled air flow is used to improve the operating conditions on the external treatment battery, and thus generate, cooling or thermal energy on the main circuits **highly efficiently**.

The absence of a traditional static recoverer (crossover or rotary flows) cuts load losses on the air duct systems and so a **great reduction in seasonal energy expense** for the fan.

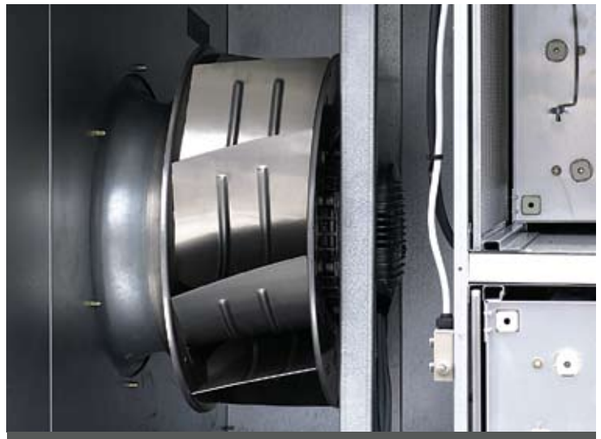
Seasonal energy analyses **have shown average savings of 30% on primary energy consumption**, compared to crossover flows.



Efficiency of the unit at reduced load

During the life cycle of the system, its operation at full load occurs for a very small amount of time.
Based on the external environmental conditions and crowd levels in the auditorium, the units operate at reduced load for the majority of the time.
The trend of the loads is perfectly supported by the system thanks to the asymmetrical configuration of the individual refrigeration circuits: the two Scroll low absorption compressors are of different sizes, providing three step levels and **high efficiency** when only one compressor is working.

Furthermore, in the evening, in spring, autumn and winter it is often possible to exploit the **freecooling**. With only the cost of the energy that would be in any case absorbed by the fans, the unit cools the room, and leaves the compressors in standby mode, with **substantial energy savings.**



Plug fans
Decrease in electricity consumption

-40%

Efficiency of the ventilation system

In various types of systems, electrical energy represents a **major part of operating costs**, at times as much as 50% of the total.
The Clivet ventilation system for the treatment of the air increases the general efficiency thanks to the use of the plug-fans with reversed rotor blades, driven by DC brushless motors with electronic switching.

The immediate advantages are:
· elimination of losses due to friction in transmission
· greater reliability and reduced maintenance
· the possibility to maintain a constant supply of air flow treated by the unit in automatic mode, even after the filters are progressively soiled
· the significant reduction of electricity

On equal terms to the flow rate and useful static pressure, the special fans adopted provide a **reduction of the electricity consumption equal to more than 40%.**

Second filtering stage	Pockets	Electronic
Purchase cost of filtering system		
Affect of filters on price of basic unit	+ 2.6%	+ 13.7%
Affect of cost of energy		
Annual energy consumption of fans	3.5%	2.6% -26%
Affect of cost of maintenance		
Frequency of filter maintenance	4 times a year	
Price of spare parts (for each action) (Filters+Detergent)	3.1% (F7 filters)	0.1%
Labour time for filter maintenance	60 min	120 min
Labour cost for filter maintenance	25 EUR/h	
Yearly cost for filter maintenance	12,4%	1,3%
Yearly operating cost		
Energy + maintenance, affect on purchase	16.4%	9.3%
Pay-Back		11 months

An example related to a unit dedicated to an auditorium with 120 seats, with a air load of 5,400 m^3/h

Efficiency of the filtering system

The **correct removal of impurities** present in the air is fundamental to maintain the desired comfort of the audience and to comply with current standards. For this reason a second high efficient filtering stage, usually a pocket filter, is often employed on the air to be introduced into the environment.

The innovative **electronic air filters** are based on the electrostatic principle. They offer extremely high filtering classes (until H10), are effective also on bacteria and viruses, but especially provide great economic running.
Compared with traditional high efficiency pocket filters (class F7), the electronic filters actually drastically reduce the electrical absorption for the treatment fan, thanks to the **almost zero load losses.**
The electronic filters are **renewable.** By simply washing them, they regain their filtering effectiveness without having to be replaced. Their duration is therefore the same as that of the machine itself.

If the initial purchase price of the electronic filters is slightly higher, **the "pay-back" is about a year:** so fast to make its use essential.
It also benefits the environment, with a cut of more than 1/4 of the **emissions of CO_2**

Global efficiency

The system's features automatically guarantee the **maximum comfort** in the various environments served, complying with current standards concerning safety and reducing realization times and costs.
Thanks to the high global efficiency, **energy consumption is practically halved** compared to a traditional system. The functionality of the system and its industrialisation also mean greater **reliability** and **lower maintenance costs**.
That is why MultiSystem will always be the preferred solution for people passionate about the entertainment business.

Application example

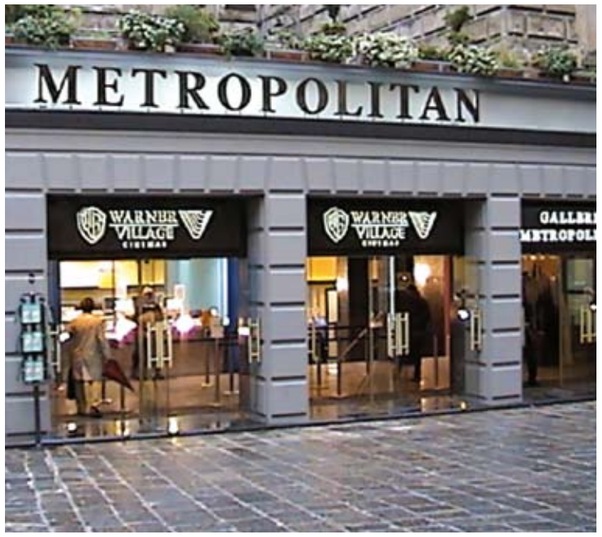
Warner Village "Valecenter"
Marcon, Venice - Italy

Year 2000 · 7 screens

The multiplex which was built in 2000 in Marcon, just inland from Venice, marks a turning point for this major American cinema group in the choice of the type of air conditioning. This facility saw the change over **from centralized hydronic systems to the innovative proposal from Clivet**, composed of packaged units with direct expansion, fully independent. Warner made this choice based on the possibility to limit operating costs by using this system, with substantial savings for the entire life cycle of this system.

The scientific community has also shown considerable interest in this aspect. The Department of Technical Physics of the University of Padua monitored the performance of the air conditioning system in one of the auditoriums for one year in order to scientifically evaluate the operation of the machine in serving that room.

The study confirmed the excellent behaviour of the unit for uses in places with varying degrees of persons present over time. The result of the research documented that the use of an electric heat pump allows maximum exploitation of the multi-hour rates.



Application example

Warner Village Metropolitan
Naples - Italy

Year 2003 · 7 screens

The unique system conditions of this multiplex made the design study even more challenging, and its completion was all the more satisfying.

Various types of constraints that were encountered included:
· tight, hard-to-reach technological areas
· Very strict and limiting fire codes for the construction of the heating plant
· requirement for systems to be housed in the existing volume
· limitation of outdoor emission of combustion by-products
· restrictions on external noise levels
· Space available on outside only for fresh air intake and expulsion

The structure housed a number of stores which actually made it a shopping centre. The existence of an old well ensured supply of a substantial amount of water. This discovery guided planning in the direction of **WSHP (Water Source Heat Pump) decentralized system.** Therefore, packaged water-cooled units in heat pump version were used between the source (well water) and the user (air conditioning unit supplied with water of the loop).
The WSHP solution provided the simplest and most efficient air conditioning for the 7 auditoriums, the foyer with refreshment area, the projection corridors and the shopping centre. The choice of this solution rather than the traditional hydronic system made it possible to:
· Optimize construction times as a result of greatly simplified plumbing networks and air conditioning units that were already tested and ready for installation
· ensure high level of machine efficiency resulting in energy savings
· use groundwater as a renewable, free energy source.

Application example

Politeama Rossetti
Trieste - Italy

Year 2004

As stated previously, theatres are the permanent emblem of the cultural and social prestige of a city.
For Clivet, it was a fulfilling challenge to provide air conditioning for a building such as the Politeama Rossetti in Trieste, for the unquestionable architectural and cultural value of this historical theatre.

The building was constructed in the style of the late 1800's. IT required the use of equipment rooms, while its location in the heart of the city made the issue of environmental impact important. This required units that are compact, technologically advanced, high-performance and quiet.

It was also essential to ensure ambient and acoustic comfort for the audience, while minimizing energy consumption.

The solution implemented by Clivet ensured the use of a sturdy, self-adapting, high-efficiency unit gives **the best trade-off between maximum performance and minimum "Total Life Cycle Cost".**

An added value of this solution was the dramatic reduction in overall noise level of the system.

Application example

UCI Cinemas
Milano Bicocca, Milan - Italy

Year 2005 · 18 screens

Europlex, located in the Bicocca Village, is the most innovative entertainment centre in Italy and this multiplex is part of the UCI Cinemas. Clivet technology provides air conditioning for 18 auditoriums, with the objective of providing the audience with the best conditions of temperature, humidity and air quality, in line with the high performance of the sound system. The entire system of units is managed by a control and supervision system. It measures the operating status of the machines and, based on the of the rooms, programmes their use according to available resources. The strong points of this installation are **the reduced operating costs** and significant savings of the air conditioning systems themselves, with a substantial reduction of their environmental impact.

Application example

Cineworld
Iglesias, Cagliari - Italy

Year 2005 · 8 screens

In the splendid setting of Sardinia, one of the multiplex complexes of Cineworld was created.
It is on the cutting edge in the quality of projection. One of the auditoriums is equipped with Digital Cinema advanced technology, which allows films to be stored on a server instead of using the traditional reels. It also includes the Dolby Digital EX-dts 6.1 system. Cineworld then completed the excellent services it offers its audiences with a Clivet air conditioning system.

The **dedicated autonomous units are pre-tested in the factory and are easy to install**, This resulted in considerable reductions in working times. In turn, this led to limited economic costs. The designed compactness of the units allows then to be placed on the roof of the projection booth.

The units fit in perfectly with the complex to deal with the special climatic conditions of the area. They allow excellent control of the most important parameters such as temperature, relative humidity and air quality.

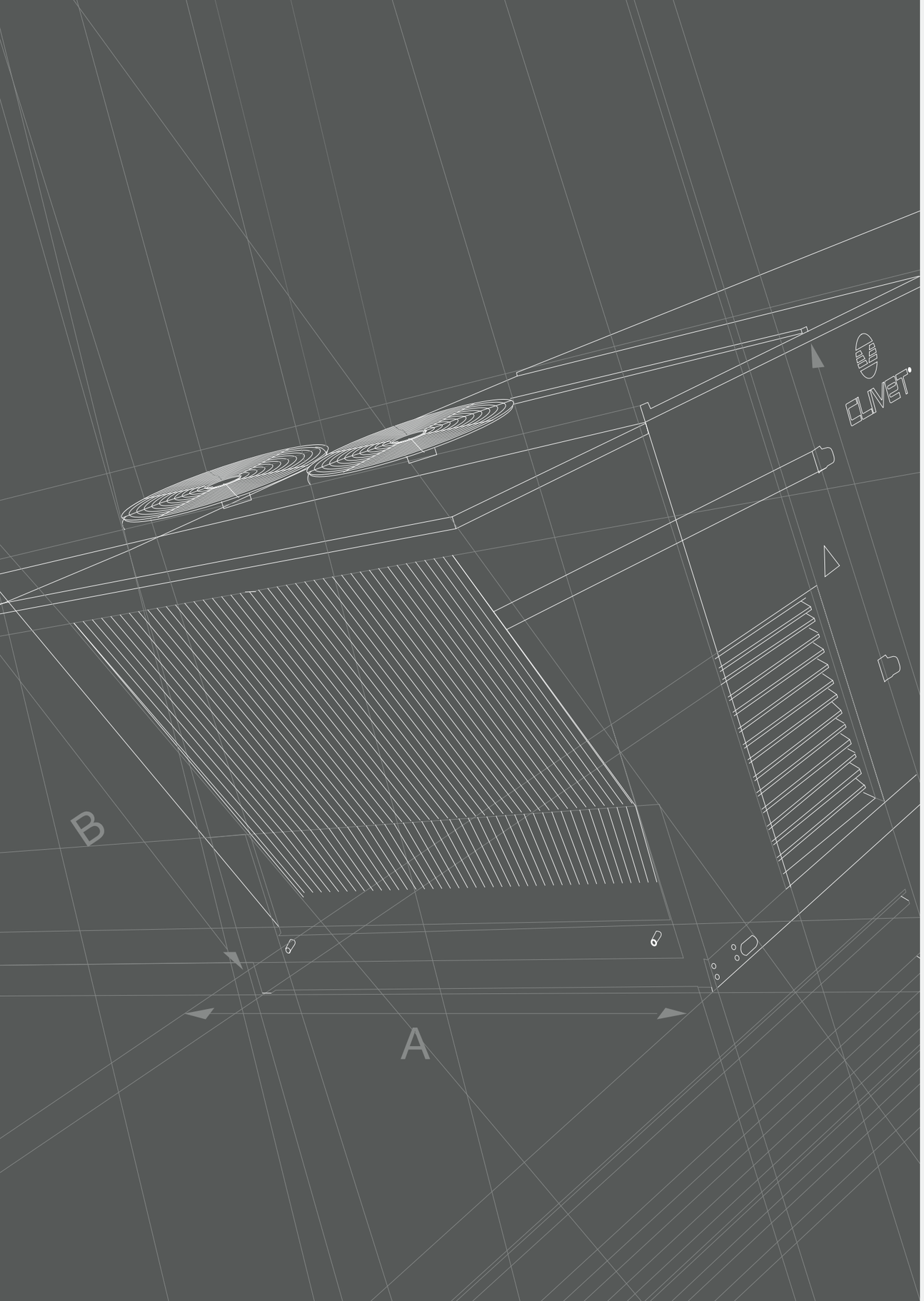
Application example

Cinecity
Limena, Padua - Italy

Year 2005 · 14 screens

The largest-capacity multiplex in northeast Italy is also the most advanced in terms of technological and qualitative services. The projection and sound systems are the most advanced in the world. The screens are equipped with Cinemeccanica mechanical projectors and the latest Barco-Cinemeccanica digital projectors. The sound system ensures perfectly clean surround-sound from anywhere in the auditorium. Cinecity is today the most digital multiplex in the world.

The system provided by Clivet has allowed the following:
· Centralized, automated management of all systems
· Constant temperature in the auditoriums
· Correct fresh air flow based on the attendance in the auditoriums
· Limitation of system operating costs.



Technical information
Synoptic of products

Auditoriums

CSNX-XHE
MultiSystem · air source

kW | 30 | 60 | 90 | 120 | 135 | kW

AIR · R-410A · FC · CC · ECO BREEZE · EEV

CSNX-XHE H
MultiSystem · water source

kW | 40 | 60 | 90 | 135 | 120 | kW

H_2O · R-410A · FC · CC · EEV

Projection corridor · Foyer

CSRN-XHE
MultiSystem · air source

kW | 40 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | kW

AIR · R-410A · FC · ECO BREEZE · EEV

CRH-XHE
MultiSystem · water source

kW | 40 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | kW

H_2O · R-410A · FC · EEV – CC

Glossary

ACS domestic hot water.

A foyer of a cinema or a theatre is where the audience may linger before, during and after a show. It usually includes an: entrance, ticket counters, wardrobe, bar, retail outlets.

Absorbed energy is the electrical energy consumed by air conditioners for the operation of their components (i.e. compressors, fans, auxiliary components).

Active thermodynamic energy recovery device for reduction of consumption, used in the most modern air treatment systems. It recovers energy contained in flow of air expelled from the served environment, using a dedicated direct expansion refrigeration circuit, reversible in air-air heat pump mode. The energy thus recovered is used as the first high-efficiency step in the production of heating and cooling energy of the entire system.

Air Conditioning refers to all the processes used to obtain the conditions of temperature, relative humidity, quality and air movement requested for people's well-being.

Air re-circulation with this process, part of the room air is expelled for hygienic reasons and replaced with fresh air.

Auditorium where the audience watches films and documentaries, projected onto a screen placed at the end of the room. Given the number and the general specialisation of cinemas, the current trend is to unite more than one auditorium of varied capacity in one single purposely built structure: multiplex cinemas.

Chiller see chiller unit.

Chiller unit unit providing chilled water (can also be referred to as water cooler).

CO_2 is the chemical symbol of carbon dioxide. It is produced by combustion and when human beings breathe.

Coil is a heat exchanger, normally between a fluid and air, where the fluid (refrigerating gas or water) flows inside copper pipes and air passes externally. In the construction the copper pipes are inserted in perforated superimposed aluminium sheets (the fins) and expanded in a way to create a mechanical contact between copper and aluminium.

Comfort is the special condition of well-being created by temperature, humidity, air quality, noise level and light in an environment, based on individual perceptions.

Compressor a device activated by an electric motor that raises the fluid pressure from the evaporation value to the condensation value.

Condenser an exchanger in which the coolant condensates (i.e. passes from the gaseous state to the liquid state) and, while cooling down, transfers heat to another fluid (air or water) by warming it up.

Cooling Cycle set of changes in state of a fluid by means of which the heat can be "moved" from one section to another. There are 4 phases in the cooling cycle: evaporation, compression, condensation and expansion (or lamination).

COP (Coefficient Of Performance). A COP equal to 3 means that, for 1 kWH of electric power consumed, the machine makes 3 kWH of thermal power available to heat the environment.
Crossover flow energy recovery performs a heat exchange between two air flows, passing them alternatively over a series of coupled plates that are usually made of aluminium. The two air flows are perpendicular to one another, and are supported by special ventilating sections with high static pressure.

Cycle inversion an operation through which, with a 4-way valve, the evaporator and the condenser exchange functions in a way to be able to heat or cool an environment.

Cycle inversion valve 4-way valve that enables the inversion of the operating mode of the cooling cycle.

Defrosting indicates the process for the removal of frost or ice that may form on the external coil of a heat pump with air as source, in heating mode with low external air temperatures. The most commonly used defrosting method switches the operating mode, automatically reversing the cooling cycle. The external coil switches to operation as a condenser, thus heating and melting the frost or ice. A defrosting cycle causes a reduction, albeit slight, in overall system efficiency.

Dehumidification atmospheric air is, at any temperature, a mixture with water. Dehumidification is the thermodynamic process with which a certain quantity of water is removed from air.

Direct expansion this term indicates that the evaporation of the refrigerant liquid occurs in direct contact with the air to be cooled.

EER (Energy Efficiency Ratio) this ratio refers to units in cooling mode. An EER equal to 3 means that, for 1 kWH of electric power consumed, the machine makes 3 kWH of cooling power available to cool the environment.

Greenhouse Effect indicates the effect caused by the release of greenhouse gases to the atmosphere. The gases let sunrays pass, whose energy turns into heat, the same gasses do not allow the reflection of thermal radiations towards space, thereby causing an increase in temperature. It is thanks to the greenhouse effect that we can live on earth: however, for some years now, the excess of gas CO_2) has been undermining this effect, causing the global temperature to increase.

Electric heat pump a machine capable of transferring heat from a source at a lower temperature to a user at a higher temperature, thus heating it, through the use of electricity. If it is reversible, it allows the cycle to be reversed so that it operates in cooling mode.

Energy Class is a product classification based on energy efficiency. Class A is the most efficient, class G the least efficient. The reference to determine the efficiency is the punctual COP.

Energy recovery (or heat recovery device) device that recovers heat dissipated by a machine to generate a useful effect. For an air treatment unit, the energy is recovered from the expelled air flow. For a liquid chiller the heat is recovered, which would otherwise be disposed of by the condenser.

Energy source is a natural resource that allows a thermal exchange. The earth or water (underground, ground, river, lake, sea water) are energy sources.

Environment terminal unit is the peripheral device of an air conditioning system placed in the room to be serviced.

ESEER (European Seasonal Energy Efficiency Ratio) extends the meaning of EER to the entire yearly operation cycle. It is calculated as an opportune combination of various seasonal operating modes defined by Eurovent/CEN, especially those at partial load.

Eurovent is an independent organisation that certifies refrigerating and air conditioning products. It is the main reference point for operators in the sector and users, who can thus count on the correctness of the data declared by the manufacturers.

Evaporator an exchanger in which the coolant evaporates (i.e. passes from the liquid state to the gaseous state) and, while heating up, absorbs heat from another fluid (air or water) by cooling it down.

Expansion valve an essential and indispensable component of the cooling circuit that triggers the expansion of the coolant, allowing it to evaporate inside the exchanger with the consequent heat absorption.

Fan coil unit a type of environment terminal unit. It consists of a water-air heat exchanger that heats or cools an air flow by exchanging heat with water, a fan to move the air flow, a filter and a series of adjustable fins for air distribution.

Fossil fuel a natural substance that, when suitably refined, produces today's fuels such as natural gas, oil (and its derivates) and coal.

Free cooling indicates the cooling of a fluid via the effect induced by low external temperatures, without the activation of the chiller compressors and therefore with energy savings. In the treatment units, the fresh air is placed directly in the environment, while in chillers it cools special heat exchangers where the fluid to be cooled flows.

Geothermal means the ability to take advantage of the energy in the ground using special devices (geothermal probes) which are buried horizontally or vertically.

Geothermal probes a thermal exchange element used in geothermics.

Head is the delivery pressure of a fan or pump to counteract the pressure drops of the system. It is measured in Pa or kPa.

Heat exchanger a device used to transfer heat between two fluids without these mixing with each other.

Humidification atmospheric air at any temperature is mixed with water. Humidification is the thermodynamic process with which the desired quantity of water is added to air.

Ice protection system special measure in the refrigeration circuit which prevents the formation of ice at the base of the heat exchanger during operation in heat pump mode.

Inverter is an electronically controlled device used to change the rotation speed of a motor.

Lamination/expansion device a device that lowers the pressure of the coolant from the condensation value to the evaporation value.

Latent Heat is the heat released or absorbed when a fluid passes from the gas state to the liquid state or from the liquid state to the solid state and vice versa, without temperature variation. For example, when water is heated, it increases in temperature up to 100°C (it is absorbing sensible heat) while beyond 100°C, if we continue to provide heat (at ambient pressure), water evaporates, changes its state without increasing its temperature; it is absorbing latent heat.

Liquid cooler a machine used to lower the temperature of liquids used in industrial processes (such as water, glycol mixtures, oil) or of the liquid that acts as a source for water-water or water-air units. Its main components are finned packaged heat exchangers and fans.

Major indicates the multinational companies that hold the majority share in the cinema industry worldwide (also used by the music recording industry).

Noise data indicating the noise of the machine in the environment.

Packaged indicates an air conditioning unit with a single section (and therefore extremely compact), as compared to the "split" unit.

Plug-fan a highly efficient fan with reversed-blade rotors, driven by a directly coupled motor, and hence without belt-pulley transmission.

Pressure drop indicates the reduction in the pressure of a fluid (e.g. water, air or coolant) caused by mechanical friction, changes in the section, curves and obstacles that may form inside pipes or ducts.

Projection corridor a multiplex area where the projectors of the various screens are positioned.

Radiant panel a terminal thermal exchange system that enables the heating and cooling of wide surfaces such as ceilings and floors.

Refrigerant/coolant liquid is contained in the circuits of air conditioning units and chillers, and through it heat transfer is achieved.

Roof top see Roof top unit.

Glossary

Roof top unit a packaged air conditioning unit, often installed on a roof top, which sends the filtered and treated air (heated or cooled) directly into the serviced environment, making the system simple and quick to install.

Routine/scheduled maintenance verification, cleaning and calibration, performed periodically according to a predefined programme.

Scroll Compressor a device that consists of two scrolls, a fixed scroll and a rotating scroll, inserted one inside the other; from outside the gas is pushed to the centre of the scrolls. During this route, the volume of the chamber diminishes and the gas pressure increases. Featuring very few moving parts, it is highly reliable, produces no vibrations and is relatively quiet.

Sensible Heat is the heat released or absorbed by a fluid with temperature decrease or increase. Together with the latent heat, it determines the total heat.

Set-point is the value of temperature, humidity or another characteristic parameter relating to environmental well-being that, when adjusting an air conditioner, is fixed to reach such comfort.

Hydronic system indicates an air conditioning system that uses water as an intermediate medium. A chiller cools the water that, through a pump, is made to circulate in pipes and sent to the internal units installed in the rooms to be air conditioned.

Special maintenance operations of an exceptional nature, either for overhaul or for improvement, carried out on-site with special equipment or at authorized service centres.

Split is an air conditioner divided into two sections: the external section is called "motor condensing", while the external one is called "evaporating". In portable units, the external sections is only represented by the condenser, connected to the air conditioner by means of hoses.

Stepping is the reduction of the thermal or cooling yield of an air conditioner to adjust it to the requirements based on the load of the system at a certain time.

TEWI (Total Equivalent Warming Index). This parameter assesses the impact of a system (air conditioner) on the greenhouse effect. It considers the direct impact of the refrigerating fluid and the CO2 produced by the air conditioner: the more efficient the system, the lower the TEWI and the lower the environmental impact.

Thermodynamic energy recovery device for reduction of consumption, used in the most modern packaged air treatment systems. It recovers the energy contained in the air flow expelled from the conditioned environment, by controlling its delivery on the external finned coil. This energy is used to boost the heating and cooling energy production efficiency of the whole unit.

UTA Unità di Trattamento Aria. In English AHU (Air Handling Unit).

Wind energy is a form of clean and renewable energy that uses special systems to transform the energy of wind into electricity.

WLHP (Water Loop Heat Pump) a decentralised air conditioning system based on water-air or water-water high-efficiency heat pumps, connected by a water circuit that enables energy to be transferred from one unit to the other. The system is able to provide heating or cooling at the same time in different parts of the building.

Workstation refers to a set consisting of a PC, a monitor and a printer, used to manage and supervise a system (such as an air conditioning, fire-fighting or intrusion detection system).

WSHP (Water Source Heat Pump) a decentralised air conditioning system based on heat pumps and thus similar to the WLHP system, in which the energy source is naturally available disposable water, such as water from wells, groundwater and water from rivers, lakes and the sea.

Services

Clivet services make the most of air conditioning systems, with specific responses to modern needs for major project in the field of entertainment.

Transport
On request, Clivet organizes transport of the units from its plants to the place of use.

Commissioning
Also on request, the units can be commissioned, to include correct installation, connection, and power supply. The local service centre will test the plumbing and air duct connections, check for proper electrical connections and ensure that the unit is running within the pressure and temperature limits for that machine.

Air flow rate tests
Once proper operation of the units has been ensured, on request we can also test the air flow rate, to make sure that the correct amount of air flow through the system based on design specifications.

Clivet Assistance
With a complete programme of assistance and maintenance, Clivet offers a wide range of services designed to ensure perfect operation of your air conditioning units, constant over time and with prompt response times.
The network of service centres is distributed nationwide. Their staff is constantly selected, trained and updated by Clivet. We ensure skill, reliability and efficiency in any work that is performed. With the agreement of Clivet Assistance, costs for routine maintenance established when the contract is stipulated make it possible to plan its operating costs.

For further technical information and to find out about tax benefits, consult the website www.clivet.com.

Credits:
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