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Introduction of the most advanced air conditioning system which focuses on humidifying

Realizing of latent and sensible heat separating air conditioning by *MOIST PROCESSOR*®

DYNA-AIR Inc.



We have been developing in market many kinds of air conditioning solution with latent/sensible heat separating air conditioning method which can be realized by combining *MOIST PROCESSOR*® which processes outside air and adjusts humidity ( latent heat) with air conditioner with high energy efficiency.

Conventional air conditioners are not good at creating the most appropriate air environment for air conditioning targets because it is difficult to remove interaction between temperature and humidity, and they have limitation to improve energy efficiency.

On the other hand, the combination of this outside air conditioning devise, “Moist Processer” and temperature adjusting devise which specializes in adjusting indoor temperature can respond to every demand for any air conditioning. That’s because it is able to adjust temperature and humidity separately at the same time of cleaning ventilation.

Our main product *MOIST PROCESSOR*® is the devise which can convert various energy into latent heat in large scale and with high efficiency. And it can develop many kinds of businesses and solutions.

DYNA-AIR Inc.

# Contents

- I** Air conditioning and *MOIST PROCESSOR*®
- II** About *MOIST PROCESSOR*®
- III** Air conditioning and feeling temperature
- IV** Latent / sensible heat separating air conditioning  
by *MOIST PROCESSOR*®

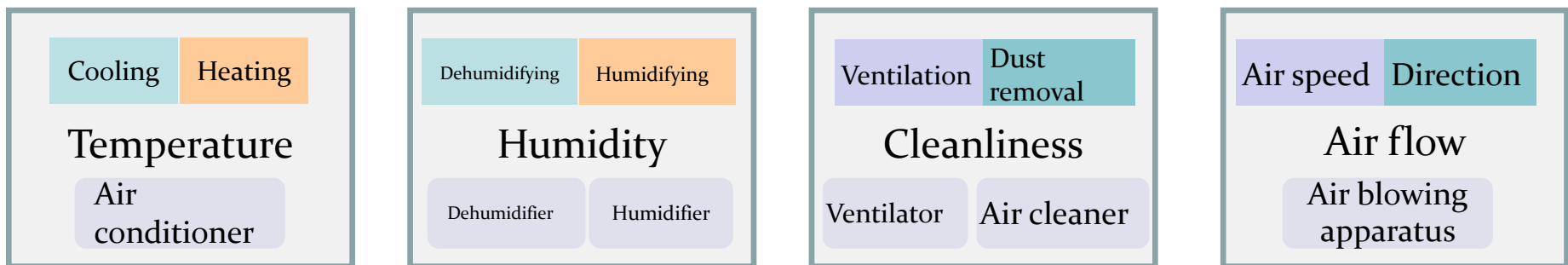
## 1 Air conditioning and indoor environment

Air conditioning is process which realizes at the same time four required levels in air space for air temperature, humidity, cleanliness and air flow ( four elements of air conditioning).

Indoor environment is result realized by air conditioning and there are many ways to realize it. But requirements for air conditioning (=combination of process and result) depend on targets of air conditioning (human beings, animals, plants, or industrial products and process of manufacture).

For example, in order to realize same indoor temperature there are two ways ; one is to supply relatively small amount of air which temperature difference is big and the other is to supply relatively big amount air which temperature difference is small. Sometimes the former case cannot be applied for targets in which bottom limit of temperature is strict and the latter cannot be applied for targets in which wind speed is limited.

Therefore usually to fulfill requirements for each target, various air conditioning systems are combined and air conditioning systems are constructed.



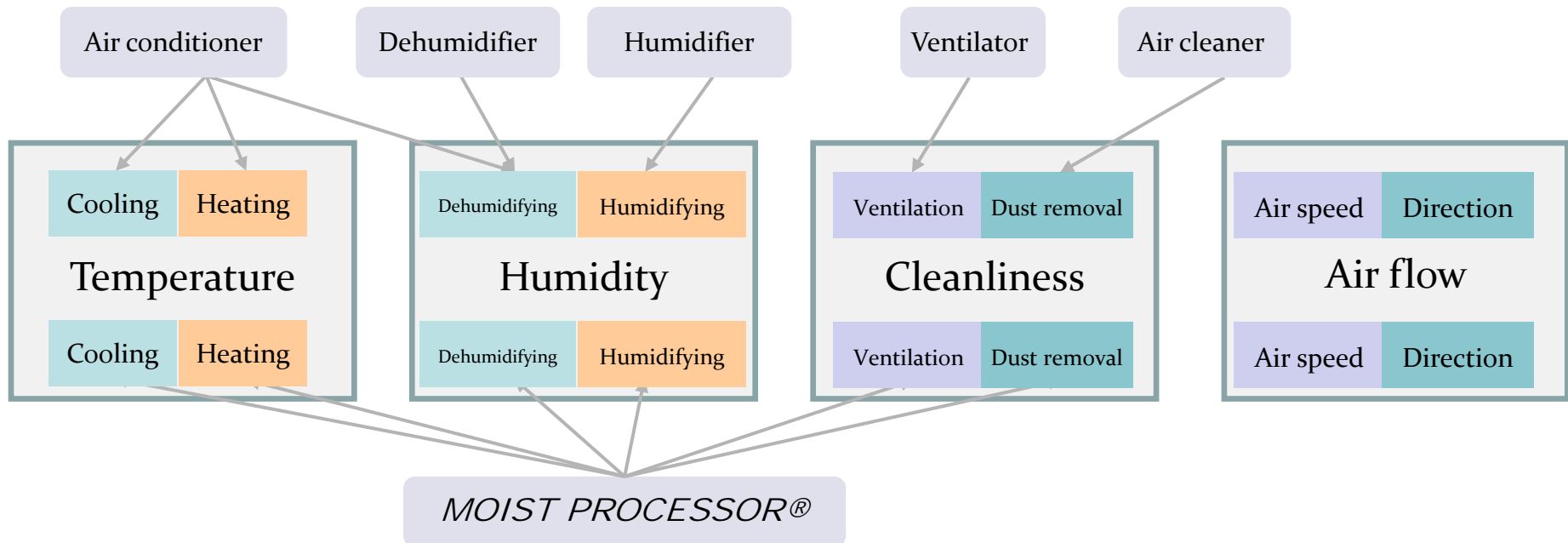
# I Air conditioning and *MOIST PROCESSOR*®

## 2 Functions of *MOIST PROCESSOR*®

Moist processor is device which satisfies four elements of air conditioning with just this one unit.

It processes outside air with very powerful humidifying function and it is outside air conditioning device which, in process of cleaning ventilation, supply air of which “humidity difference” is big and “temperature difference is small”.

Moist processor can change only humidity with “ventilating” and “maintaining almost same temperature”, so it can satisfy needs of many kinds of targets by combination of air conditioner and temperature adjustment apparatus as radiation panel.



# I Air conditioning and *MOIST PROCESSOR*®

## 3 What *MOIST PROCESSOR*® can do





Keeping indoor temperature

Ventilating

Maintaining targeted humidity

**Efficient and flexible air conditioning system which finds appropriate humidity for the whole accommodation**

For example,

	Outside air processing	Indoor air processing
Adjusting temperature	<i>MOIST PROCESSOR</i> ® 	Air conditioner 
Adjusting humidity	<i>MOIST PROCESSOR</i> ® 	<i>MOIST PROCESSOR</i> ® 

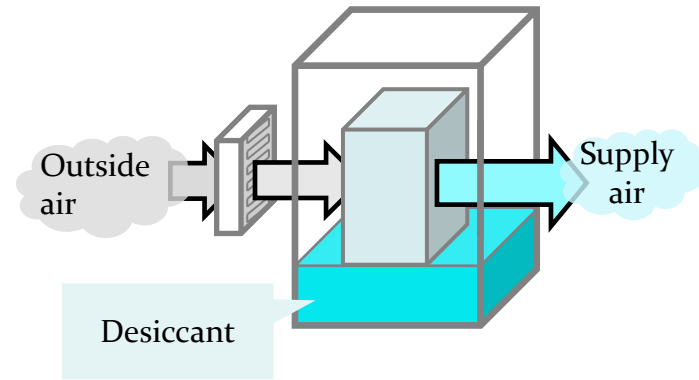
## II About *MOIST PROCESSOR*®

### 1 Operation of *MOIST PROCESSOR*®

We briefly explain about Operation of *MOIST PROCESSOR*®

#### <Mechanism of adjusting humidity >

*MOIST PROCESSOR*® is humidity adjusting device of liquid desiccant method and adjusts humidity and temperature and cleans air at same time. Desiccant has two characteristics; it “dehumidifies” under low temperature and high density and “humidifies” under high temperature and low density. It controls dehumidification and humidification by using these characteristics. When it processes outside air, it removes not only dust, but also removes dust, pollen, and fungi at same time of dehumidification and humidification by making air contact with desiccant.

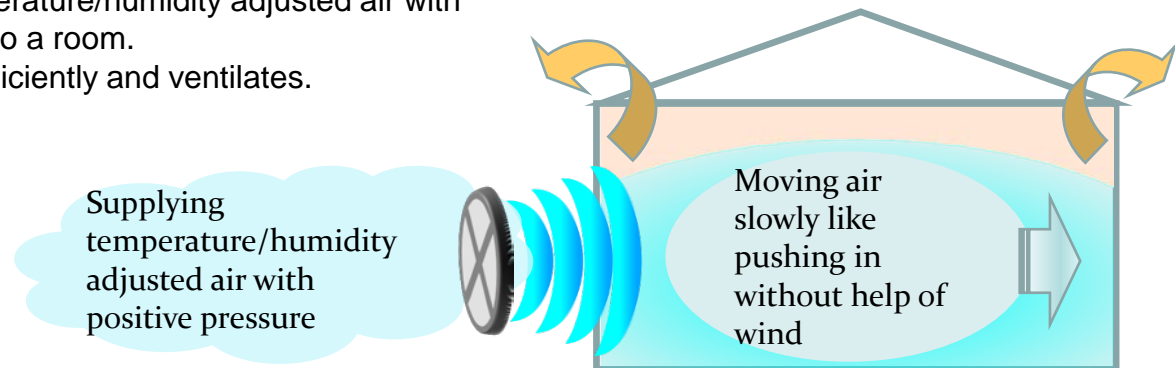


#### <Supplying air and ventilation >

It maintains indoor cleanliness by efficient ventilation process with force-fed supply air.

It doesn't send wind making indoor air hit to temperature adjusting coil like common air conditioner. It supplies temperature/humidity adjusted air with positive pressure and pushes it slowly into a room.

Because of that, it exhausts indoor air efficiently and ventilates.



## II About *MOIST PROCESSOR*®

### 2 Comparison of *MOIST PROCESSOR*® to air handling unit

*MOIST PROCESSOR*® is designed as “outside air conditioning devise” which processes outside air adjusting to indoor temperature and humidity setting and supplies it. It plays same role as all fresh type air handling unit. But its ability of adjusting humidity and cleaning air is much more powerful than ordinal air handling unit and makes flexible control possible.

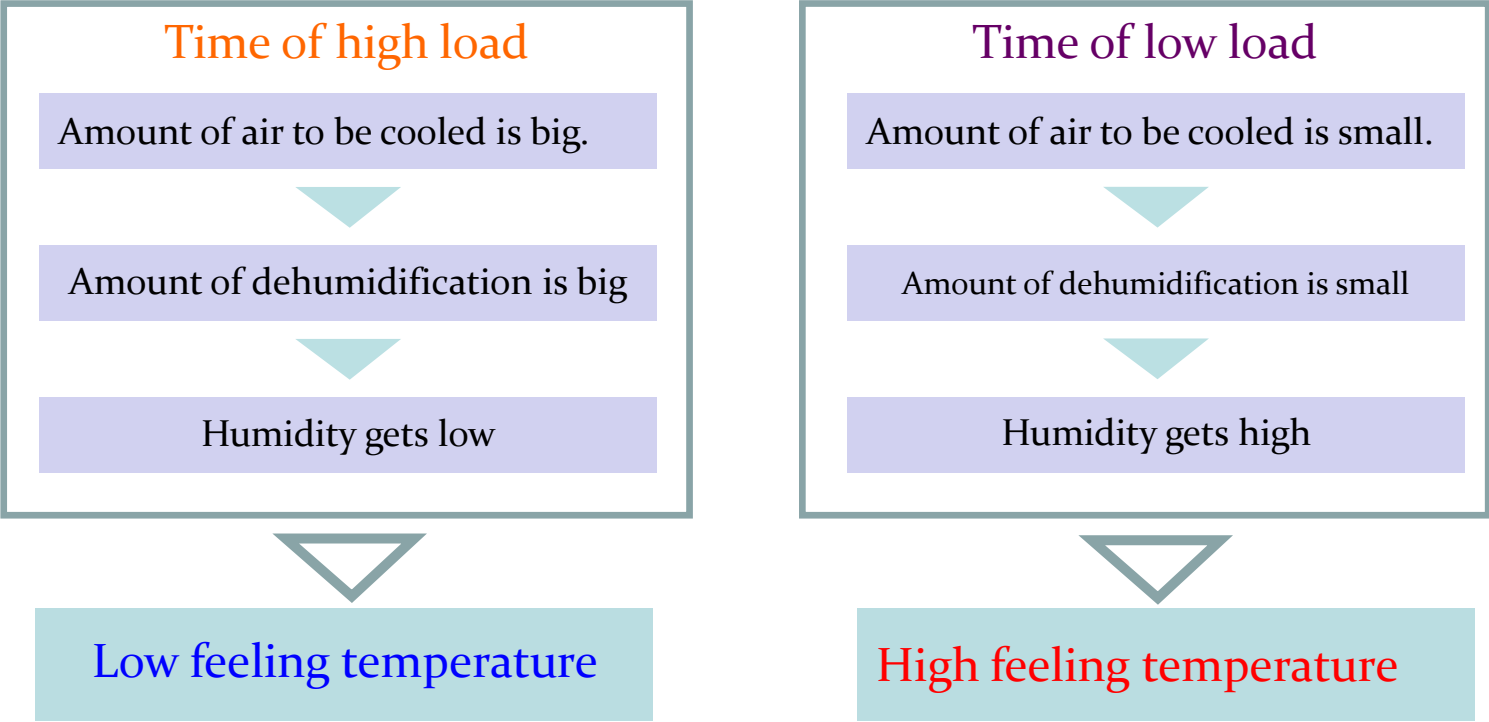
Structure		Elements of air conditioning			Remarks
Introduce of outside air	Indoor	Temperature	Humidity	Cleanliness	
Ventilating fan	Air conditioner	△	×	×	Because outside air burden is processed by indoor air conditioner, temperature and humidity tend to be unstable. Invasion of dust from outside cannot be prevented, so cleanliness is low.
Air handling unit	Air conditioner	○	△	○	It doesn't have enough humidifying ability and its dehumidification runs its course, so humidity gets unstable. Also it cannot get enough cleanliness with nonwoven fabric only.
<i>MOIST PROCESSOR</i> ®	Air conditioner	○	◎	◎	<b>Powerful abilities to adjust humidity and to clean air which do not depend on temperature controlling process can be obtained by liquid desiccant humidity controlling devise.</b>



## II About *MOIST PROCESSOR*®

### 3 Comparison of *MOIST PROCESSOR*® to air conditioner

*MOIST PROCESSOR*® processes outside air and maintains accurately targeted humidity. In contrast, air conditioners dehumidify in process that they circulate indoor air and cool it at time of cooling. Dehumidifying process is done responding to amount of air to be cooled (load size), so they will run their courses.



If they have enough processing ability, they can maintain appropriate temperature, but as a result of maintaining appropriate temperature, humidity goes up and down, so feeling temperature gets unstable.



## II About *MOIST PROCESSOR*®

### 4 Ventilation method by *MOIST PROCESSOR*®

There are roughly three following methods for ventilating by devices.

#### ① Class 1 ventilation

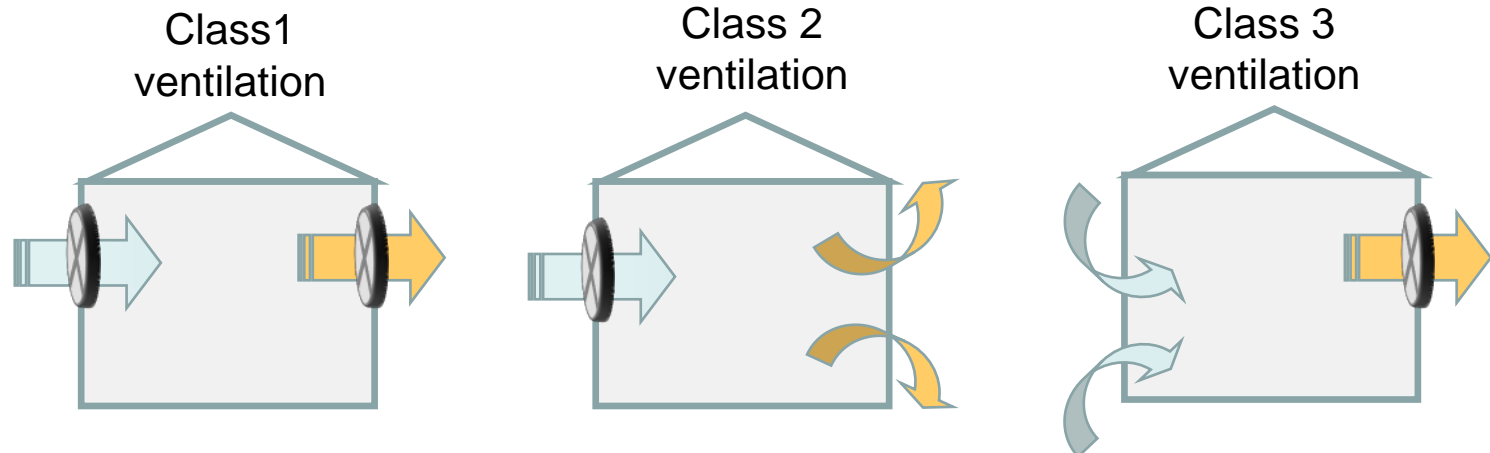
It is method that both supplying and exhausting air is done by fan. It can make indoor space either positive pressure or negative pressure by setting ability of each fan for supplying air and exhausting air.

#### ② Class 2 ventilation

It is ventilation system that fan is installed at side of supply air and indoor air is naturally exhausted by pushed air. Positive pressure is maintained inside and flow of outside air gets minimum.

#### ③ Class 3 ventilation

It is ventilation system that fan is installed at side of exhaust air, negative pressure gets dominant inside because of exhausting air and air is supplied naturally. Negative pressure is maintained indoor space, outside air flows in continuously and it cannot control its pathway.



*MOIST PROCESSOR*® is usually operated with class 2 ventilation method.

※ It can utilize return for purpose of using exhausted heat.

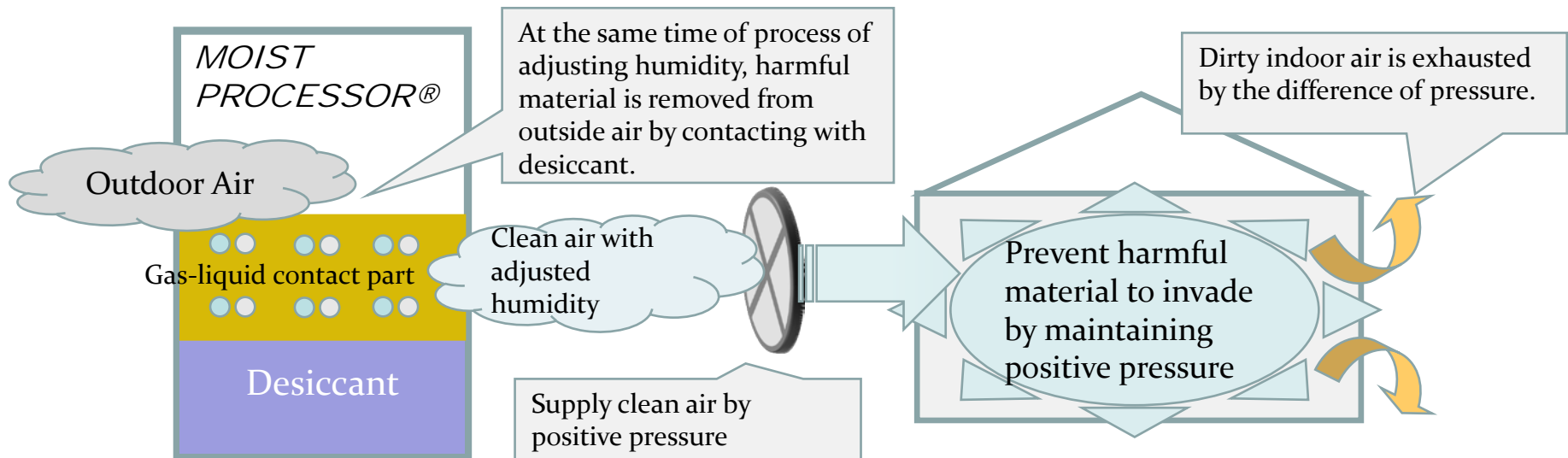
## II About *MOIST PROCESSOR*®

### 5 Mechanism of ventilation by *MOIST PROCESSOR*®

In ventilation it is required not only to secure oxygen amount but also “to realize clean indoor air environment”. To do that, it is necessary to

- ① Ventilate enough amount of air to remove harmful material which occurs indoor.
- ② Provide clean air into indoor.
- ③ Prevent harmful material to invade into indoor

Those mentioned above are required. But the Class 3 ventilation is not able to control entry pathway of outside air and not able to clean it with filter, therefore it cannot achieve both of ventilation and maintaining comfortable humidity and temperature at the same time. At the end, “realizing environment of clean indoor air” means supplying clean air in large amount with positive pressure. *MOIST PROCESSOR*® can easily realize that by the ventilation system which is explained below.



## II About *MOIST PROCESSOR*®

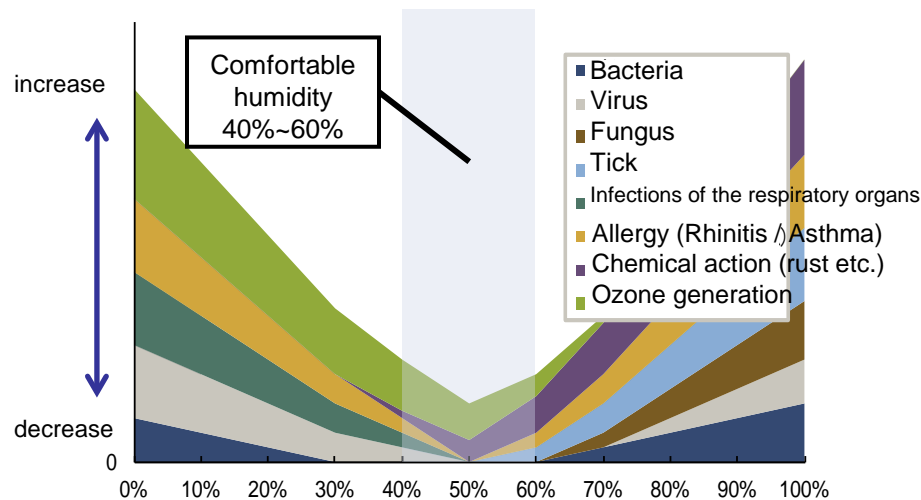
### 6 Indoor environment *MOIST PROCESSOR*® creates

*MOIST PROCESSOR*® can dehumidify and humidify while it is cleaning air, therefore it can continuously keep comfortable humidity ranges (relative humidity 40%~60%).

At time of cooling, it suppresses occurrence of mold and bacteria by dehumidifying and at time of heating, by humidifying, it can reduce unpleasant feeling which accompanies burden to skin or to the respiratory organs, risk of infections like Flu and indoor harmful materials.

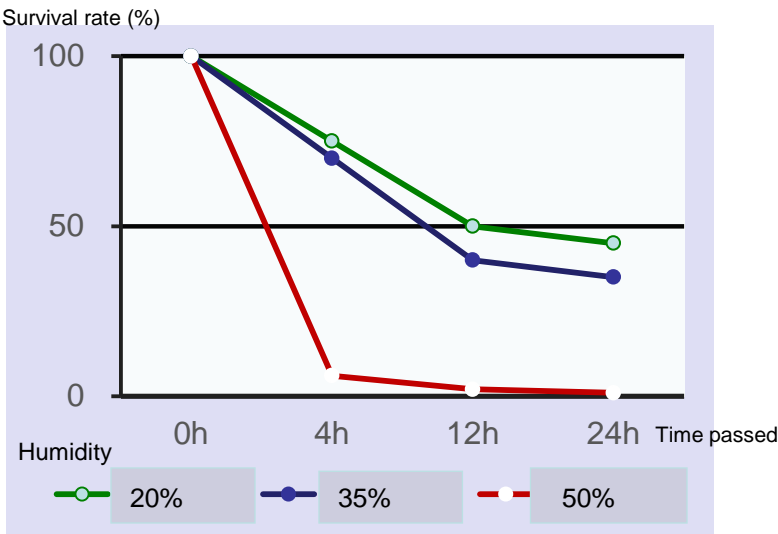
Especially in environment where the degree of people concentration is high, it is important to reduce indoor harmful materials.

It is expected to prevent allergy response or reduce risk of infections by virus by maintaining most suitable humidity ranges (40%~60%) in a room.



Relation of relative humidity to indoor harmful material

Survival rate of flu virus existing in air decreases remarkably in the environment where temperature is from 20 to 24 °C and relative humidity is about 50%.



Relation of relative humidity to survival rate and time of flu virus

### 7 Energy-saving effect by *MOIST PROCESSOR*®

By controlling humidity, it can improve feeling temperature under same temperature, therefore it can give same feeling temperature even if you set temperature high at time of cooling, or low at time of heating.

Processing humidity appropriately increases energy-saving effect and the effect has been proved at many facilities where Moist processor has been already introduced.

**If you raise setting temperature 1°C up at time of cooling, energy-saving effect goes up 10%.**

**By reducing temperature difference from outside air, it can reduce air conditioning load by heat flowing in from outside.**

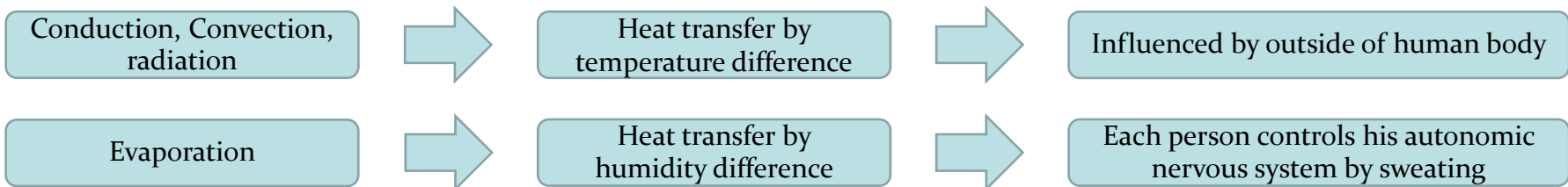
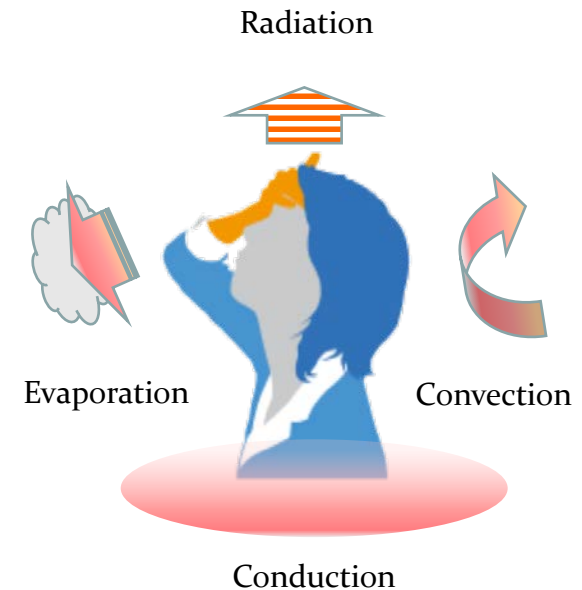
This air controlling device with excellent ability of adjusting humidity carries process of latent heat, which leads to big energy-saving, stabilizing indoor temperature and humidity at comfortable level.

# III Air conditioning and feeling temperature

## 1 Principle of controlling body temperature

Mankind controls body temperature by radiating heat (produced heat) which is produced by basic metabolism or exercise metabolism. Mechanism of heat transfer includes evaporation, radiation, convection and conduction.

Phenomenon	content	case example
Conduction	Phenomenon when subjects in the different temperatures contract. Heat moves from high temperature side to low temperature side at the time of contacting	Sitting on warm floor
Convection	Transfer caused by inhomogeneity of inside temperature of fluid or surface tension	Exposing to warm wind
Radiation	Phenomenon that heat is transferred as electromagnetic wave	Exposing to bonfire
Evaporation	Phenomenon that heat moves by evaporation heat when water vaporizes.	Drying sweat

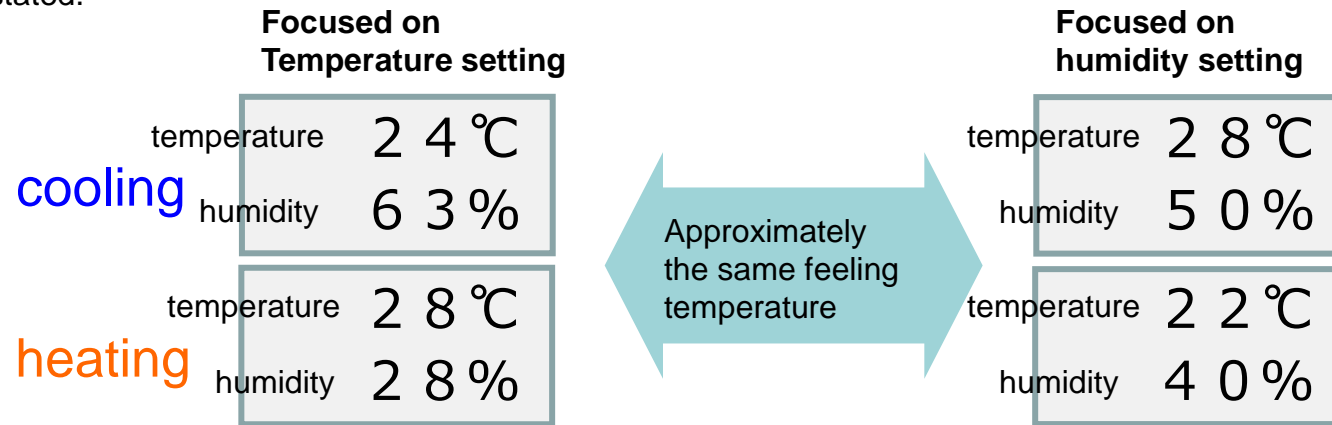


Temperature difference means strictly phase transition. For example it means phenomenon that water vaporizes but heat amount which is taken away is usually calculated to 600cal.

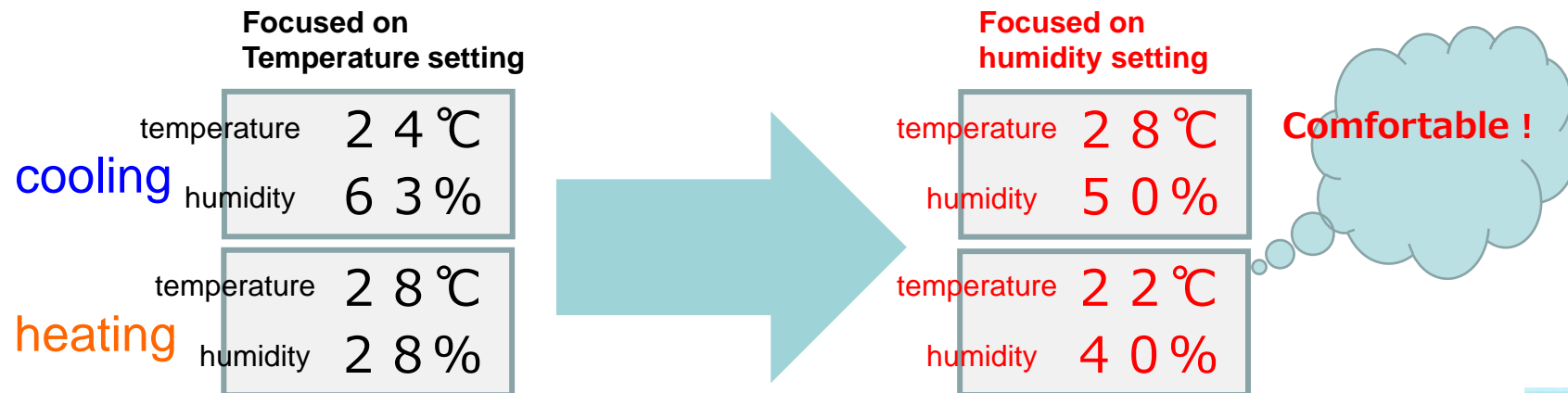
# III Air conditioning and feeling temperature

## 2. Feeling temperature and comfortability

The feeling temperature people feel is determined by the combination of temperature, humidity, air current, and even under the same temperature the higher the humidity the warmer people feel, and the lower the humidity the cooler. This is because when the humidity is lower there is more heat dissipation through “evaporation”. Generally the following relation can be stated.



“Approximately the same feeling temperature” here means “feeling warm, feeling cold” to the same extent, and does not necessarily mean “feeling comfortable to the same extent”. Generally under the same feeling temperature, lower humidity when cooling, and higher humidity when heating people feel more comfortable.



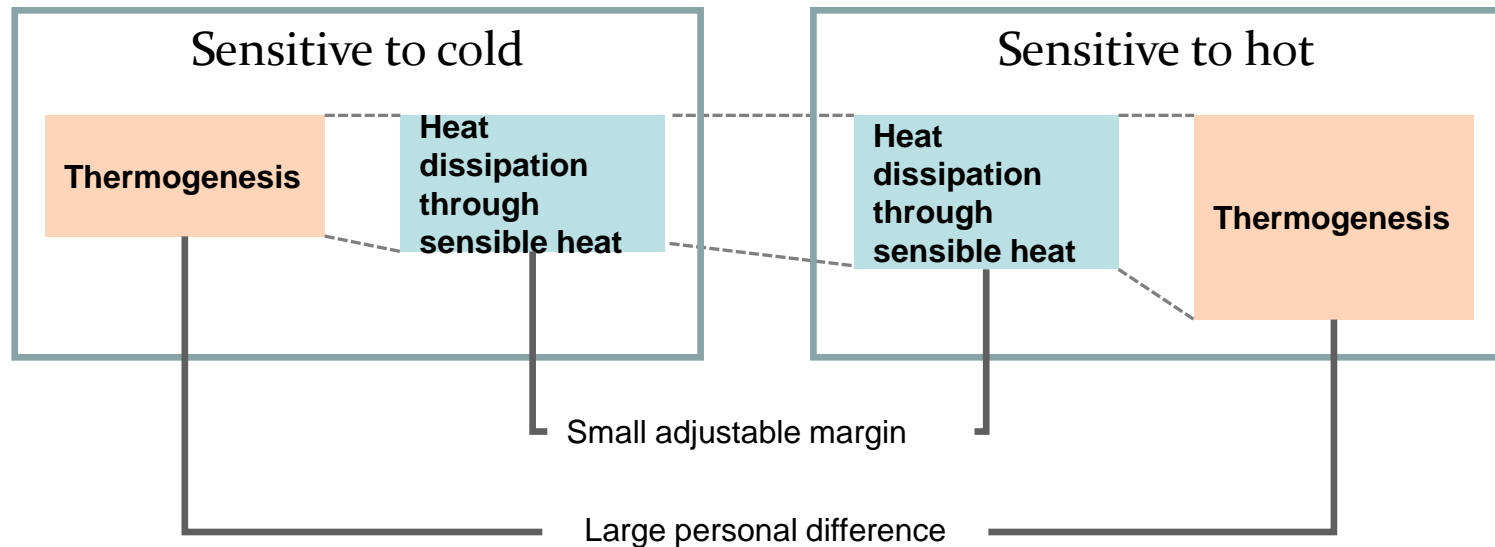
### III Air conditioning and feeling temperature

### 3. Cooling temperature that is comfortable for everyone

Like the terms “sensitive to heat”, “sensitive to cold”, there are personal differences in warmth comfortability. This is because there are differences in metabolism, bodily composition and body temperature management abilities, heat sensitivity.

Heat dissipation of the human body is largely divided into those caused by sensible heat (conduction, convection, radiation) and those caused by latent heat (evaporation).

Heat dissipation amount by sensible heat basically can only be adjusted by body surface temperature, and because this adjustment only has a small margin, when focusing on temperature, it is impossible to satisfy both people sensitive to heat and people sensitive to cold.





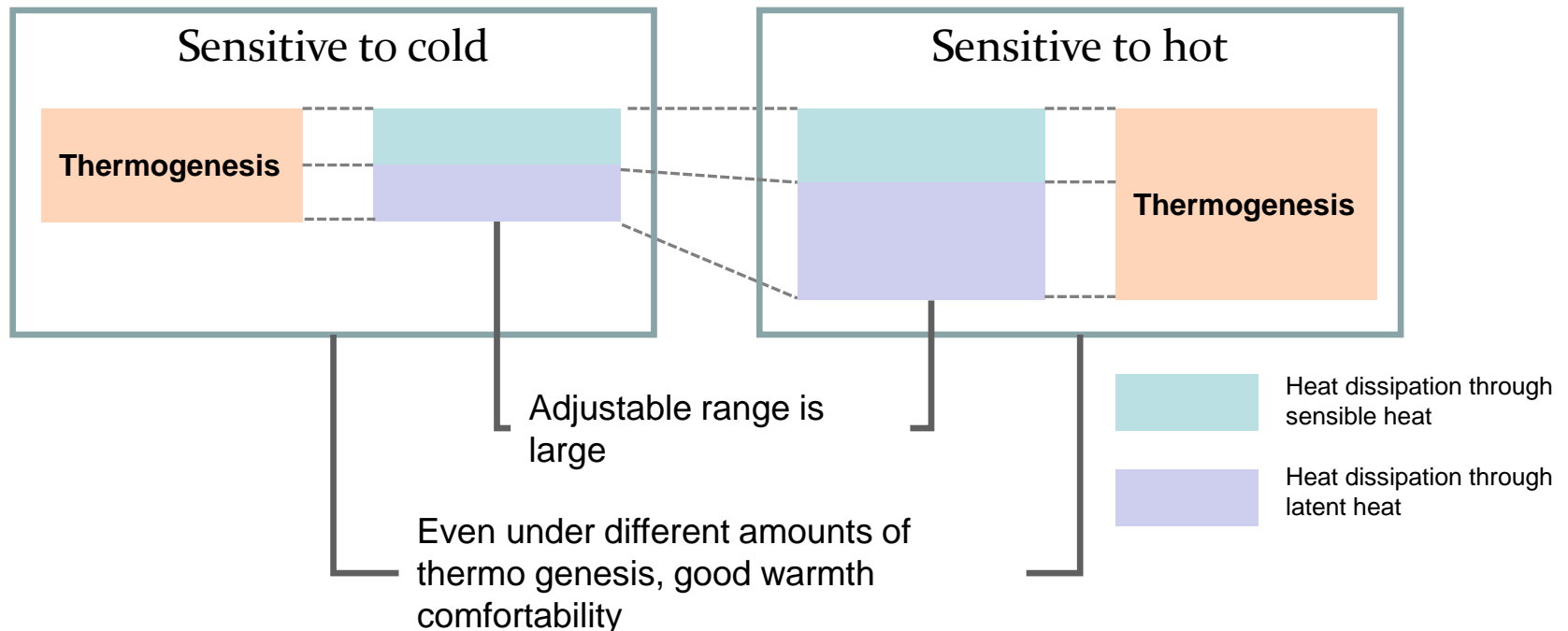
### III Air conditioning and feeling temperature

#### 4. Margin of feeling temperature adjustment through heat dissipation by latent heat is large

The adjustable range through sensible heat is not big. However, the adjustable range of heat dissipation by latent heat is large, and it fluctuates between 10% to over 90% of the total amount of heat dissipation according to air temperature and thermogenesis.

Heat dissipation through latent heat is mostly done by sweating, but even in situations in which sweating is not noticeable heat dissipation through latent heat is being performed.

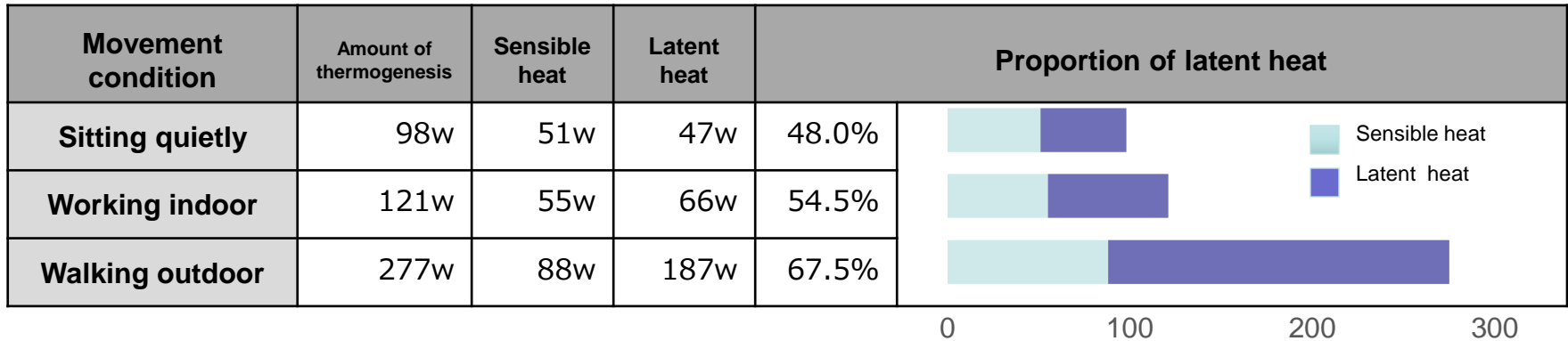
Because the amount of released heat by sweating also varies largely according to conditions, “people sensitive to heat” can gain better warmth comfortability, even in relatively high temperatures, through stimulating heat release by maintaining adequate humidity.



### III Air conditioning and feeling temperature

#### 5. Cutting-edge air conditioning centered on humidity adjustment

Heat dissipation of the human body is largely divided into sensible heat(conduction, convection, radiation) and latent heat(evaporation). As shown in the following table, as intensity of movement increases, proportion of heat dissipation through latent heat increases.



In the end, comfortable feeling temperature is the state in which the body's thermogenesis and heat dissipation can be in balance without any burden.

By dehumidifying during cooling, heat dissipation through latent heat can be stimulated, and even though differences in thermogenesis(metabolism) caused by personal differences and differences in activeness exist, necessary and sufficient heat dissipation is possible, therefore very comfortable cooling is possible.

Also, by humidifying during heating, heat dissipation through latent heat can be suppressed, and can heat very comfortably without drying of the skin.

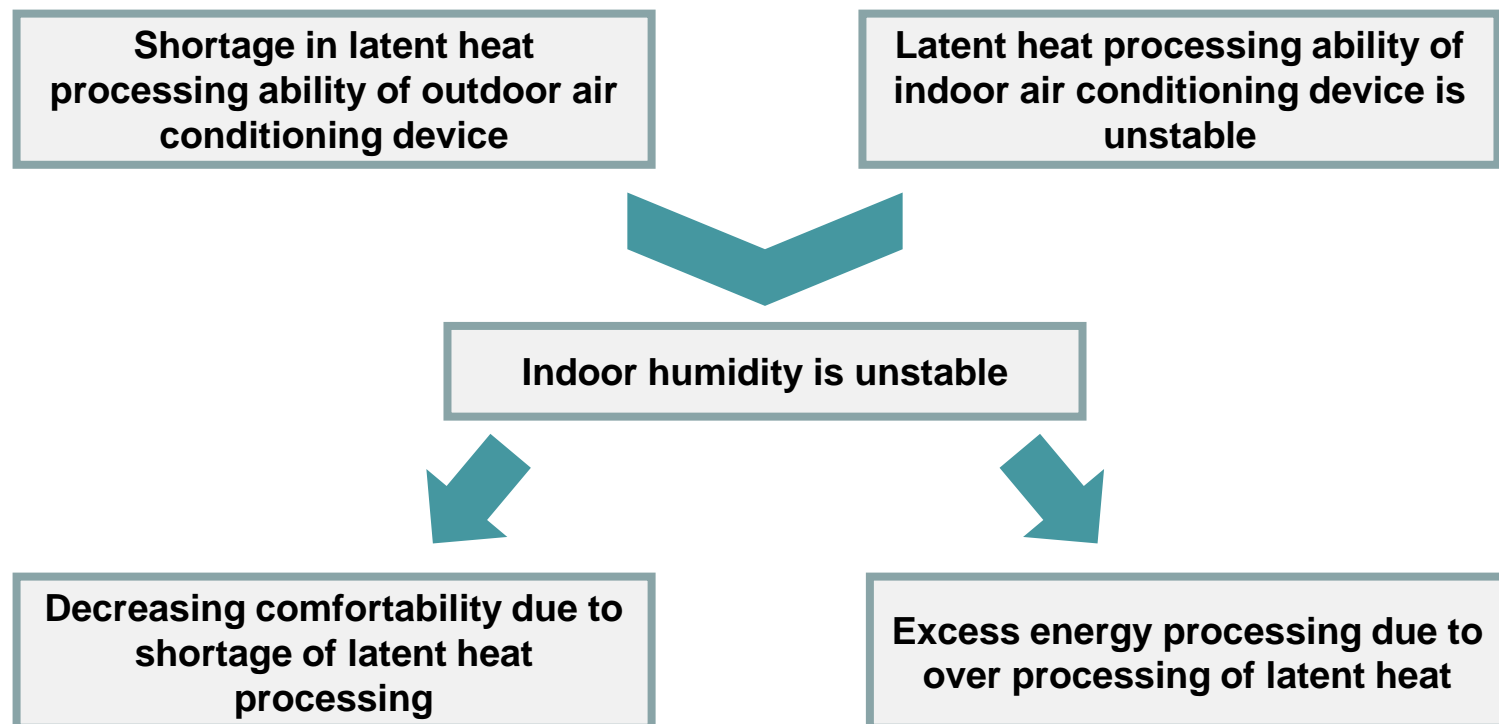
Cutting-edge air conditioning centered on humidity management is an air conditioning system in which the balance between temperature and humidity is managed based on the needs of the target to be air conditioned, and by using our *MOIST PROCESSOR®*, the individual management of temperature and humidity can be achieved.

### 1. Problems of existing air conditioning systems

General outside air conditioning devices and dry desiccant method humidity management devices have difficulties in processing the burden of latent heat of outside air completely depending on the amount of burden.

Also, when processing heat produced indoors with conventional air conditioners, latent heat processing( dehumidifying process) results during cooling depend on the sensible heat burden, and become “wait and see” situations.

In addition, there is no humidifying ability during heating, so it is almost impossible to stabilize indoor temperature at a desired level.



## IV Latent / sensible heat separating air conditioning by *MOIST PROCESSOR*®

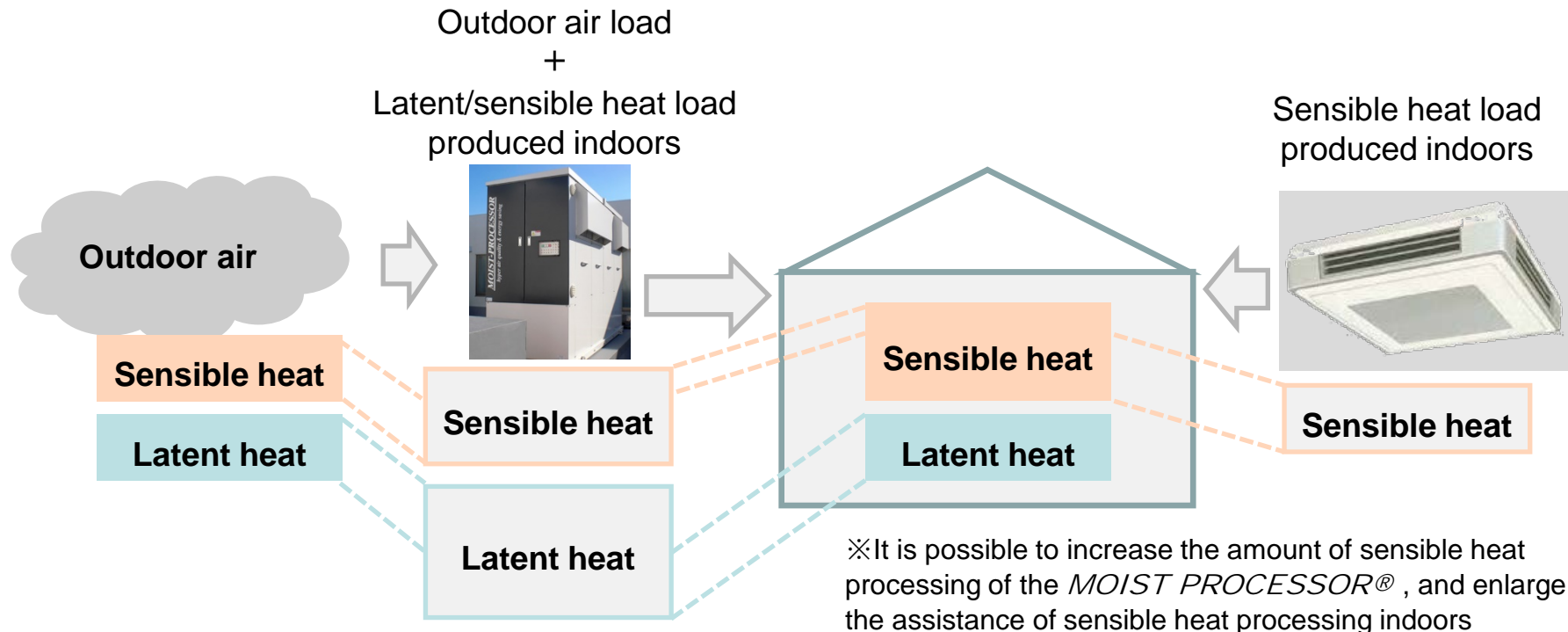
### 2. Latent sensible heat separating air conditioning by application of *MOIST PROCESSOR*®

*MOIST PROCESSOR*® which has a great humidity managing ability, not only processes latent heat of outside air, but also can provide air with humidity that is taken into account the latent heat produced indoors.

Therefore

- *MOIST PROCESSOR*® : **outdoor air load + latent heat load produced indoors**  
**+ sensible heat load produced indoors**
- **Air conditioner** : **sensible heat burden produced indoors**

As above, a definite assignment of latent heat processing/sensible heat processing the device undertakes becomes possible, and temperature/humidity at a desired level can be realized stably/very energy efficiently.



### 3. Advantages provided by separate air conditioning of sensible and latent heat

Problems that could not be solved by conventional air conditioning can be solved with the realization of separate air conditioning of sensible and latent heat.

Main points	Explanation
Resolution of personal difference in sensitivity to hot/cold	By maintaining adequate humidity, heat dissipation through latent heat is stimulated, and even if there are differences in metabolism and sensitivity to heat, a space with a temperature and humidity in which many people obtain a comfortable effective temperature can be achieved.
Stability of feeling temperature	Because changes in humidity caused by the air conditioner's burden level occur, even under the same temperature settings, differences in feeling temperature can be felt such as "yesterday was comfortable, but today is hot", but with separate air conditioning of sensible and latent heat in which humidity is individually processed, the "same feeling temperature" under the "same temperature setting" can be stably maintained.
Stable humidification during heating seasons	By not humidifying with an individual device, but with an outdoor air conditioning device, a sufficient humidity and its uniform distribution can be stably maintained while performing the necessary and sufficient clean ventilation.
Energy saving due to maintenance of adequate temperature	By maintaining sufficient humidity while heating or cooling, the temperature difference between outside air can be reduced, therefore decreasing the burden of temperature management. Also, air-conditioning equipment such as air conditioners can be operated at energy efficient temperature settings.

### 4. Indoor environment provided by *MOIST PROCESSOR*®

In commercial facilities and medical care facilities, service providers (people with high activity) and service receivers (people with low activity) coexist, but applying the *MOIST PROCESSOR*®.

**Healthy air conditioning that utilizes the body temperature management functions of individuals is possible**

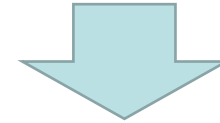
**Clean air with removed pollen and hazardous substances will fill the indoors**

therefore,

**Indoor environments in which both service providers and service receivers are comfortable can be created**



**Leads to improved working environments**



**Leads to improved customer service**

**END**