

# THE HIDDEN SECRET IN MODERN INDUSTRY

COTES DEHUMIDIFYING SOLUTIONS

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COTES DEHUMIDIFYING SOLUTIONS

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The ability to control levels of humidity is one of the most significant overlooked issues in modern industrial activity.

Effective humidity management can play a surprisingly important role in tackling many big practical headaches, as well as avoiding a wide range of costly remedial steps and cutting back on unnecessary energy consumption.

Adsorption dehumidification technology provides management with an important additional tool for boosting efficiency in virtually all kinds of industry by acquiring better control of what is going on in key environments, structures and processes – both up front and behind the scenes.

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## 1/ HUMIDITY IS A MANAGEMENT ISSUE

# WATER, WATER EVERYWHERE

Water is virtually an omnipresent feature – and requirement – of human life and civilisation, as well as of the weather and climate on our small planet. The presence of water molecules in the air goes under the seemingly innocuous, catch-all name of humidity.

But humidity isn't "sexy", and certainly doesn't make headline news – it's just there, in differing degrees. You can't see it, and only rarely can you feel it.

Most people don't notice humidity to anywhere near the same degree that they are aware of other equally basic phenomena, such as heat, cold and draughts. Those of us who live, work and play in temperate climes are rarely directly confronted with the practical ramifications of humidity in our day-to-day lives. Or so we think.

The widely overlooked fact is that the presence of water in the air can have significant detrimental effects on a vast number of industrial structures, equipment and processes.

Humidity can have a profound influence on materials, on production costs, on service and maintenance expenditure and on asset durability, as well as energy consumption and the resultant environmental impact. This applies to virtually all sectors of both manufacturing and service industry.

## AFFECTS EVERYTHING AROUND US



It is important to establish a clear understanding of exactly what humidity is, how it manifests itself in practice and how many different ways it affects the structures, processes and products around us.

The majority of materials, substances and ingredients used throughout industry feature some degree of hygroscopy – they have a natural tendency to absorb moisture from the surrounding air.

This increase in moisture levels has important effects on many of their key properties. For example, higher moisture contents can result in:

- > increases in weight
- > increases in volume
- > changes in electrical conductivity
- > heat being given off from a process or material
- > inconsistencies in product quality as well as process efficiency

- > changes in a wide range of material properties, including tensile strength and pliability
- > alterations in the conditions for bacteria and other biological growths.

Despite the effects that humidity can have on virtually all the materials, processes and structures used in industry, it is a widely overlooked and under-prioritised aspect – with a substantial impact on the planning, budgeting and quality control processes involved.

It also plays an under-appreciated role in determining energy consumption and environmental impacts.

## THE PREVENTIVE DIVIDEND



Most buildings, industrial installations and other forms of infrastructure contain a wide range of components, features and equipment at different temperatures. The combination of air laden with water vapour, on the one hand, and a large range of wooden and metallic surfaces on the other often results in the formation of condensation.

Such condensation almost inevitably has a detrimental effect on the structures and installations involved. Moisture can cause wooden structures to rot, electronic systems to short-circuit, metal structures to rust and corrode, and powders to become lumpy.

Dehumidification technology is therefore the most cost-effective and environmentally responsible way to tackle widespread problems that include:

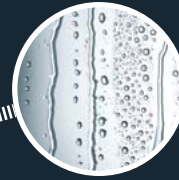
- > rust and corrosion
- > mould and rot
- > condensation
- > electrical faults
- > powders and granulates clumping.

Effective management of humidity levels often represents an astoundingly cost-effective way to tackle such issues in modern business, because of the substantial knock-on benefits from a relatively limited outlay, as well as only relatively limited energy consumption.

And humidity management is also a particularly responsible way to achieve such results with only very limited environmental impacts. It normally only requires limited energy inputs, and can make use of waste heat from other processes.

It is also vastly more energy-efficient than traditional stop-gap heating solutions, which involve a relatively high emissions impact while having only a very limited effect on humidity.

# UNCONTROLLED HUMIDITY MAKES NASTY THINGS HAPPEN



## CONDENSATION

Condensation is the result of the fact that the air, which inevitably contains a certain level of moisture, has a different temperature from the surfaces with which it comes into contact.



## CORROSION AND RUST

The combination of humidity and oxygen makes metals corrode, significantly affecting both strength and durability. Iron and steel rust and lose structural integrity, copper is plagued by *verdigris*, affecting electronics and electrical equipment.



## MOULD AND ROT

Wood, building materials and other hygroscopic materials absorb humidity. This can give rise to many kinds of mould and rot, affecting both structural integrity and material value.



## ELECTRICAL FAULTS AND ELECTRONICS PROBLEMS

Humidity can create corrosion in components and brazings, giving rise to dangerous short-circuits and flashovers, as well as impacting uptime and service costs.



## CLUMPING AND BLOCKAGES

Powders and granulate absorb humidity particularly easily. They then clump together, affecting quality and causing blockages in processing equipment, as well as providing a fertile breeding ground for bacteria.



## INCONSISTENT PRODUCTION CONDITIONS

Seasonal fluctuations in humidity result in inconsistent production conditions that can affect product quality, energy consumption and profit margins.



## INEFFICIENT USE OF ENERGY

Traditional ways of dealing with humidity (such as heating and making humidity condense so it can be removed) use much more energy than adsorption dehumidification. This makes adsorption dehumidification systems a much more energy-efficient solution.



## LACK OF CONTROL

Not having full control over humidity impacts:

- > return on investment in major installations, plants and structures
- > reliability of electronics and electrical systems
- > operating uptime
- > product quality and consistency
- > energy bills
- > service, maintenance and repair costs.

## MANAGING HUMIDITY PREVENTS LOADS OF PROBLEMS

By controlling the levels of humidity in the air, adsorption dehumidifiers do away with a whole spectrum of different practical problems, and make sure condensation does not form on any of the surfaces.



# THE INDIRECT MULTIPLIER

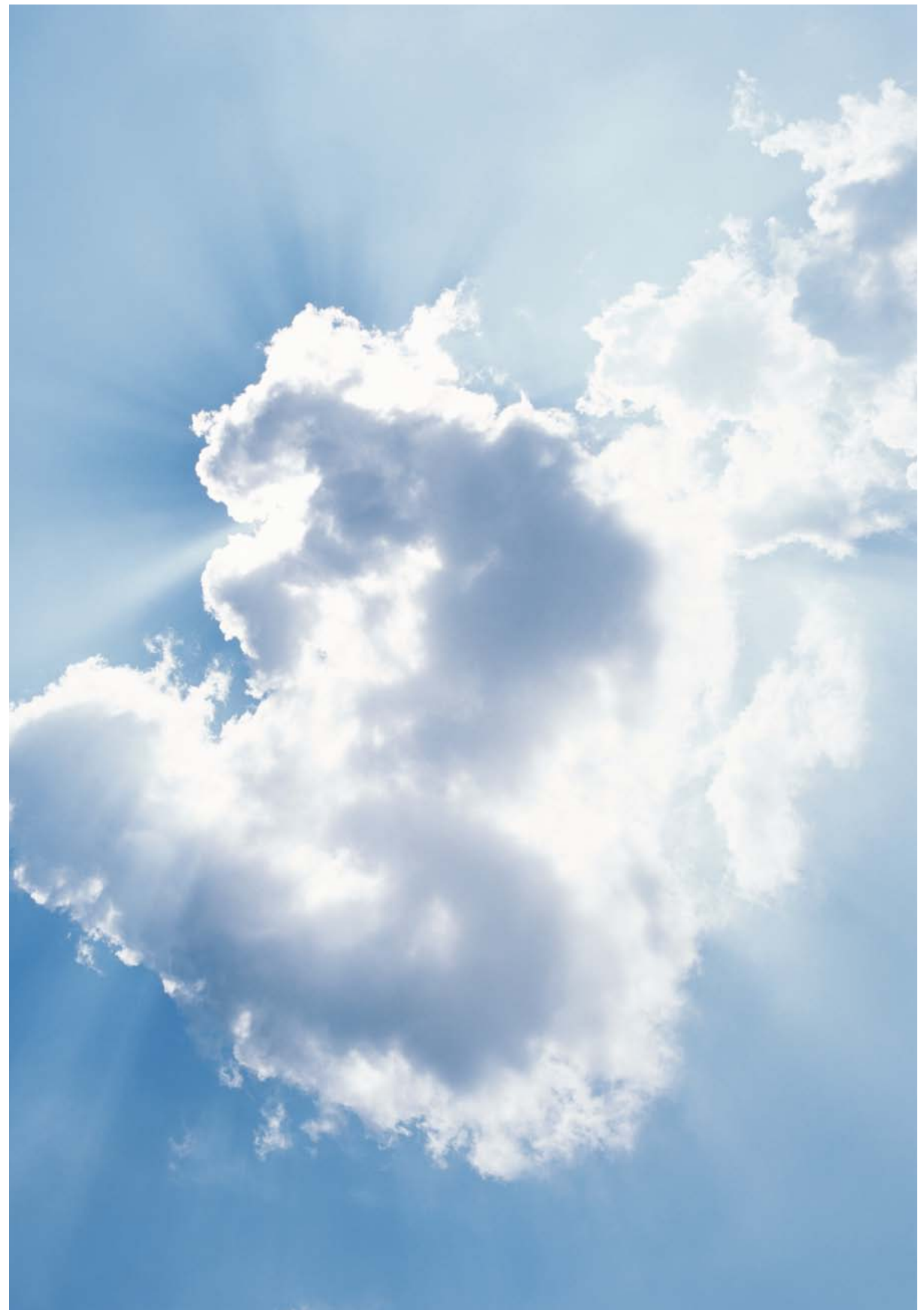
As explained previously, humidity can have multiple effects, including everything from causing metals to rust to making wood swell in volume to making powders go lumpy. This means many of the major benefits of effective humidity management are actually indirect – and therefore often overlooked.

The indirectness of such cause/effect linkages often means they are not immediately associated with the basic idea of controlling humidity. As a result, the indirect benefits of humidity management are often under-estimated and over-looked.

This makes humidity management a field with tremendous commercial potential in many different ways – including prevention, streamlining and better control.

The intelligent application of humidity control technology can pave the way to significant efficiency benefits and savings that stem from:

- > greater output
- > effective control and preventive action rather than remedial measures
- > lower maintenance and repair costs
- > more consistent production processes
- > higher, more consistent product quality
- > longer service life of key assets
- > lower energy costs
- > reduced CO<sub>2</sub> emissions.







## THE FURNITURE CHALLENGE

If wooden furniture or furniture components are manufactured and stored under one set of humidity conditions, it can give rise to big problems when they are assembled and installed elsewhere, where the climate and/or relative humidity is different.

Such changes mean that components are more difficult and time-consuming to assemble, or no longer fit together. This in turn influences the perceived quality of the furniture, as well as customer satisfaction with both the furniture and the post-purchase experience, as well as the seller's costs for dealing with complaints and product returns.

If the furniture is being used in the construction of homes, offices or other commercial premises, the extra time spent on installation due to the wooden components having either shrunk or expanded can increase manpower costs, disrupt completion schedules and affect the profitability of contracts.

## 2/ WHY IT'S GOOD BUSINESS

# MANAGING HUMIDITY

Water present in the air can have nasty effects on structures, equipment and processes in virtually all sectors of manufacturing and service industry.

Humidity can have a profound influence on materials, on production costs, on service and maintenance expenditure and on the service life of expensive assets – as well as on energy consumption and the resultant environmental impact.

Which is why it pays to get it under control. Better control is good business.

## LATERAL THINKING



One of the key characteristics of the highly specialised – and little-appreciated – field of humidity management is that the linkages between the “problem” and the solution are not always immediately obvious.

And a major benefit of intelligently managed dehumidification is that it not only solves the immediate problem. Experience shows that professionally applied dehumidification technology also provides customers with many unforeseen knock-on benefits in terms of production efficiency, energy savings, infrastructure durability and pro-active asset maintenance.

This is why it is important to get the assistance of experienced professionals who are used to considering issues as an integrated whole, and applying the basic laws of physics to balancing the effects of temperature, pressure and water vapour content.

Effective humidity management requires vastly more complex engineering know-how than is normally available from any local heating and ventilation supplier whose focus is simply on selling out-of-the-box hardware.

## A QUESTION OF CONTROL



Humidity can have a wide spectrum of effects on countless aspects of commercial and industrial activity.

Using humidity control technology and know-how is therefore ultimately a question of a company, facility or organisation establishing – and maintaining – control over key parameters that can have substantial direct and indirect effects on efficiency, profitability and the organisation’s interaction with working partners, suppliers and customers.

Monitoring and controlling levels of humidity make it possible to balance out the effects of seasonal variations, and in the long term even to compensate for the production implications of climate change.

Humidity management enables a company to improve and fine-tune many different processes in order to ensure the best possible control of performance, quality and costs.

Such control lies right at the heart of good management and responsible decision making.



## CONDENSATION



A good indoor climate is not just a question of personal comfort and good public health. Condensed water that runs down walls and drips from ceilings and pipes is a major cause of corrosion, rust, mould and rot within buildings and other structures.

Condensation occurs when moist air is cooled by any surface that is colder than the dew point of the air – such as a cold iron pipe. The moisture in the air then forms and gathers on the cold object. This is why problems with condensation are often encountered in buildings such as ice rinks and waterworks, where surfaces are usually colder than the surrounding air.

Cotes recommends adsorption dehumidification as the only effective way to protect against condensation on cold surfaces.

It is rarely possible to increase the temperature of the cold surface (in places like ice rinks, the pipes in waterworks, etc.). The solution, therefore, is to lower the dew point to below the temperature of the cold surface.

The dehumidifier is controlled by the dew point – in the air if the cold surface has a constant temperature – or directly using a moisture sensor placed on the appropriate cold surface to register fluctuating temperatures.

## RUST AND CORROSION



Iron is a strong material, but it loses its strength when it starts to rust. A particularly cost-effective way to protect iron against rust caused by the combined presence of combination of moisture and oxygen is to manage and/or remove any moisture present.

There are several factors at work when trying to ensure constant moisture levels. The more moisture there is, the faster iron will rust. Hardly any corrosion takes place in clean air with a relative humidity of 45% or lower. If the humidity level increases to 60%, corrosion increases. As humidity increases past this point, the rate of corrosion increases exponentially.

Cotes recommends a relative humidity level of 50–55% to ensure the best possible protection of iron against rust and corrosion, ensuring that this key material retains its integrity and strength much longer.

## MOULD AND ROT



Wood, building materials and a large number of other materials are hygroscopic, and therefore absorb humidity from the surrounding air. If relative humidity exceeds 70%, there is a significant risk of mould and mildew growth.

If not properly monitored or controlled, such biological growths can give rise to extensive, costly problems with damage to building structures as just one example. This can be extremely costly as well as resulting in significant health risks.

Humidity often arises when warm air (such as air from a heated room) is cooled, perhaps against a cold wall.

This results in the formation of condensation, which in turn creates ideal conditions for the proliferation of rot and mould, particularly on or near:

- > cold walls
- > outer walls
- > thermal bridges.

Effective protection against mould and rot therefore requires in-depth knowledge of the relationship between the cold surface temperature and air temperature and humidity.

Cotes recommends maintaining a relative humidity not exceeding 70% at the cold surface temperature. For example, in a room where the air temperature is 20 °C, and there is a cold wall with a surface temperature of 12 °C, the air close to the wall surface will be cooled down to 12 °C. To maintain 70% relative humidity at 12 °C, the air has to have a relative humidity of 42% at 20 °C.

## ELECTRICAL FAULTS



Electrical installations and electronics are often vulnerable to the effects of moisture and humidity. This is critical for complex, expensive equipment such as wind turbines, ships, aircraft, offshore installations and many other facilities.

The problems in set-ups featuring electrical and electronic equipment often stem from:

- > corrosion in components and soldered connections
- > electrical short-circuits caused by condensation
- > flashover and current leakage.

Cotes recommends keeping the surroundings dry in order to prevent faults in operations-critical electrical systems, avoiding expensive work stoppages and production downtime and significantly reducing maintenance costs.

And the best way to do that is with modern adsorption dehumidification solutions.



## DEALING WITH THE EFFECTS OF HYGROSCOPY

Many of the materials used throughout industry are hygroscopic – they absorb moisture from the surrounding air. This means their water content changes depending on the relative humidity of the air around them. Common examples of such materials include wood, paper, pharmaceutical ingredients, salt and sugar.

Because of their relatively high surface area, many of the vast numbers of powders and granulates used throughout industry are particularly hygroscopic. This means that if humidity is too high, they tend to clump together. This can:

- > affect the quality, durability and other characteristics of the material
- > result in conditions that encourage bacterial growth
- > render powders unsuitable for pneumatic transportation
- > result in uneven distribution of the active substances in powders
- > result in uneven surfaces when the powder is used for coating.

All hygroscopic materials have their own specific “sorption isotherm”, which indicates the relationship between the water absorbed by the product and the relative humidity of the air. These materials will therefore vary in terms of the point at which the humidity in the air reaches a level that can give rise to problems.

Cotes recommends the implementation of effective humidity management using the sorption isotherm of the particular powder or granulate as the focus point for dehumidification. This makes it possible to avoid the powder clumping together and to ensure greater reliability and productivity.

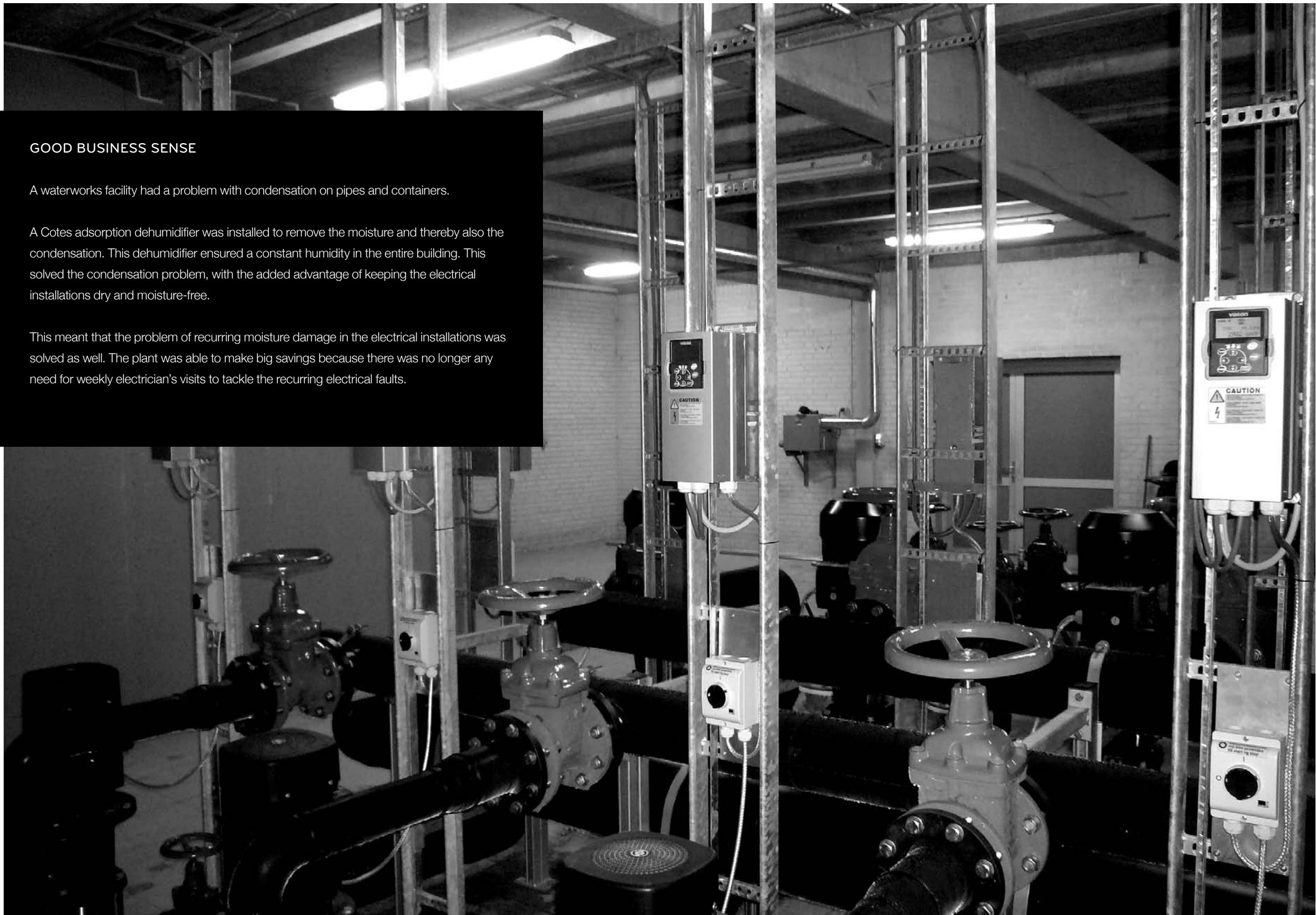


## GOOD BUSINESS SENSE

A waterworks facility had a problem with condensation on pipes and containers.

A Cotes adsorption dehumidifier was installed to remove the moisture and thereby also the condensation. This dehumidifier ensured a constant humidity in the entire building. This solved the condensation problem, with the added advantage of keeping the electrical installations dry and moisture-free.

This meant that the problem of recurring moisture damage in the electrical installations was solved as well. The plant was able to make big savings because there was no longer any need for weekly electrician's visits to tackle the recurring electrical faults.





### 3/ BIG PERSPECTIVES

# THE CHALLENGES OF RELATIVISM

Temperature and pressure are conventionally considered absolutes that are relatively easy to understand. Humidity, however, represents more of a difficult-to-envisage balancing act between temperature and the vapour content of the air.

The interaction of these parameters is by no means straightforward. It is complicated still further by the fact that different dehumidification solutions and equipment configurations are required in different geographical locations and different climates, and in conjunction with different materials.

In many contexts, temperature isn't actually as important as air humidity, because of the dew point.

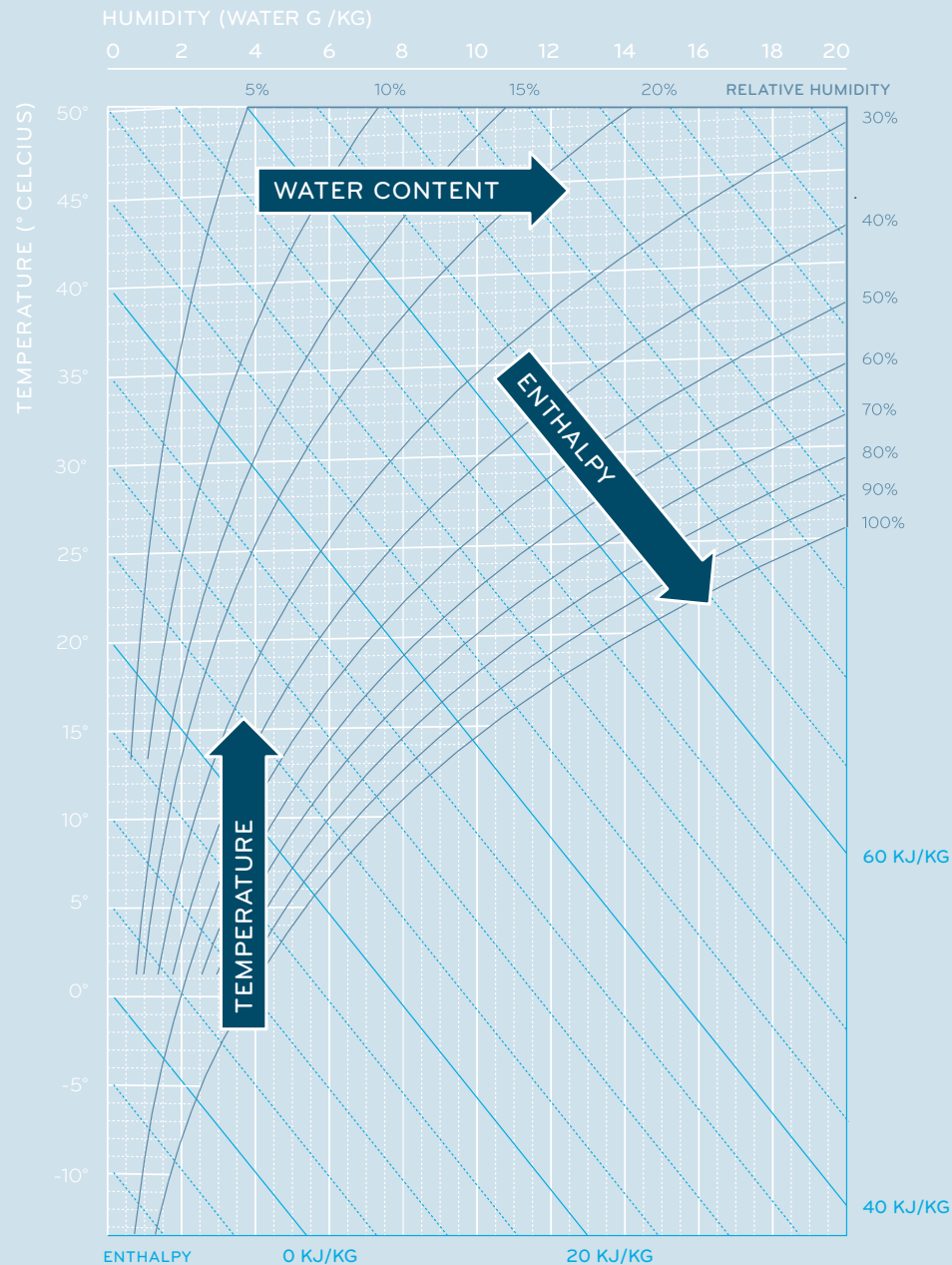
One of the key tasks of dehumidification equipment is to ensure that condensation does not form on cold surfaces, such as products, pipes, pumps and containers.

It does this by maintaining a constant dew point in the air, matching the temperature of the cold surfaces.

If levels of humidity exceed approximately 60%, it is not condensation that will be the main problem, but the effects of hygroscopy.



# MOLLIER DIAGRAM



## APPLYING THE LAWS OF PHYSICS

The most widely used basis for virtually all decisions, calculations and specifications relating to humidity is the so-called Mollier diagram (also known as an  $h-x$  diagram) for air and water vapour mixtures, first published in 1923 by Richard Mollier of Dresden.

This diagram lays out the relationship between the heat content (also known as enthalpy) and the water vapour content of air. This done by mapping the relationship between temperature and relative humidity on the one hand and water vapour content on the other.

Temperature and relative humidity are normally considered easy to measure, making the Mollier diagram a supremely useful tool for deciphering the practical results of some basic laws of physics.

## DIFFERENT HORSES FOR DIFFERENT COURSES

Several distinct technologies are normally used for removing unwanted humidity from the air. Each has its own particular advantages.

Traditional condensation dehumidifiers can be used within a relatively narrow temperature band of 10-32 °C, and work best at 30 °C and when there are high levels of water vapour in the air.

In short, they are only really effective at high temperatures and high levels of relative humidity.

Adsorption dehumidification technology, on the other hand, can be used over the entire range of temperatures from -30 °C to +30 °C, and is most efficient in the temperature range from -30 °C to +20 °C.

In short, adsorption dehumidifiers are effective over an extremely wide range of temperature conditions and at any level of relative humidity, and are the only viable solution at temperatures below about 10° C.

For the discerning customer, this makes adsorption dehumidification the technology of choice due to its versatility and ability to operate over a substantial range of temperature conditions.





## HEATING IS NOT THE ANSWER



The layman's idea about dealing with humidity and condensation problems is simply to turn up the heating. Due to a lack of general awareness that often results in trying to deal with symptoms rather than causes, this is often the so-called "common sense" approach used in industry as well.

However, turning up the heating has only very limited effects on humidity, as can be seen from the Mollier diagram. Heating does not alter the absolute level of humidity present in the air – it only increases the overall temperature.

The relationship between the heat content and the water vapour content of air is relatively complicated and non-linear, and temperature isn't as important as air humidity, because of the dew point.

This usually results in excessive energy costs to very little effect, because it takes much more energy to heat moisture-laden air than to heat dry air. And it does not provide a year-round solution.

In virtually all cases, removing moisture from the air using adsorption dehumidification technology is significantly more effective, and makes it possible to work with consistent levels of effectiveness regardless of season or weather.

## THE MOST ECONOMICAL SOLUTION



Effective management of humidity levels using adsorption technology is often by far the most economical approach, not least because the heat energy naturally present in the air is used to reduce the moisture content – it is not necessary to draw on or create additional heat energy outside the dehumidification system itself.

Removing any particular amount of moisture from the air releases energy corresponding to the energy used to change the water from liquid form to vapour. This also reduces the dew point.

#### 4/ BETTER CONTROL, LOWER COSTS

# THE PAYOFFS OF HUMIDITY MANAGEMENT

Effective humidity management gives you:

- > better control of parameters that affect your raw materials, production processes, manufacturing installations and fixed assets
- > lower costs for service, maintenance and refurbishment
- > lower energy costs and reduced environmental impact
- > longer service life for buildings and equipment
- > a way to actively prevent detrimental processes such as rust and corrosion, mould and rot, condensation, electrical faults, and spoilt materials and products.

Cotes adsorption dehumidification technology enables you to take full control of conditions in the air surrounding your industrial processes.

And better control is good business.

## BIG MONEY

Effective control of humidity can result in major savings in operating costs within virtually all branches of industry, and most kinds of structures.

Choosing the most appropriate humidity management technology can also slice here-and-now acquisition costs, as well as energy consumption throughout the service life of the dehumidification equipment.

### Example 1

A Danish cheese manufacturer saved about 60% on equipment and installation costs, and was able to make annual savings on energy costs amounting to more than €17,000 (as well as eliminating 98,500 kg of CO<sub>2</sub> emissions) by fitting a Cotes adsorption dehumidifier.

### Example 2

Installing Cotes adsorption dehumidifier systems on vessels, to keep a constant level of humidity inside the transformer space normally recoups the initial outlay in an average of just 14 days. This is achieved by savings on the costs for fuel oil used for heating.

### Example 3

Two Cotes adsorption dehumidifiers at a Danish ice rink were able to use thermal energy from the heating and cooling plant – which previously mostly went to waste – for air regeneration, paving the way to direct savings on the arena's energy costs amounting to more than €80,000 a year.

### Example 4

A gelatine production facility in Poland was able to double its output as the result of installing Cotes adsorption dehumidifier technology – with no significant increases in its energy bills.



## IN TUNE WITH THE ZEITGEIST

One of the prime under-the-radar benefits of effective humidity management lies in the substantial indirect environmental benefits. These stem from the overall reductions in energy consumption that dehumidification makes possible, and the reduced CO<sub>2</sub> emissions that result from this.

The environmental benefits of humidity management can be both direct and indirect. Cotes dehumidification systems make it possible to use less energy – and thus have less of an environmental impact – than other technologies used to achieve the same effect.

There are also important indirect benefits – for example, the energy required to heat dry air is significantly less than that needed to heat air with a high level of humidity.

Further energy savings are possible because effective humidity management enables users to cut back on the energy inputs otherwise needed for remedial action once a problem has arisen due to poorly controlled humidity and the effects of condensation.





## 5/ HOW ADSORPTION DEHUMIDIFICATION WORKS

# MAGIC IN A BOX

Modern adsorption dehumidifiers are relatively small units that remove water vapour from any volume of air that passes through them.

Despite their modest size, these dehumidifiers can work wonders on their surroundings by determining what happens to all the moisture present in the air, and making sure it ends up where it does least possible harm.

Managing the conditions of the air can work serious magic on all sorts of other conditions in any building, structure or industrial process.

# HOW AN ADSORPTION DEHUMIDIFIER WORKS

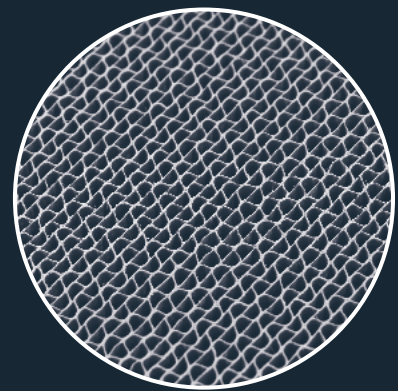
Dehumidifiers are designed to remove water vapour from any volume of air that passes through them.

The heart of this process is a slowly turning rotor coated with silica gel, which absorbs the water molecules present in the air passing through it. In a designated regeneration zone, the saturated rotor is then dried with a separate flow of heated air. The warm, humid regeneration air is then led away, and the rotor is once again ready to absorb water.

The entire process is cyclic, making the system largely self-reliant, with no need for manual intervention and very little need for maintenance.

## WHAT DOES A COTES ADSORPTION DEHUMIDIFIER CONSIST OF?

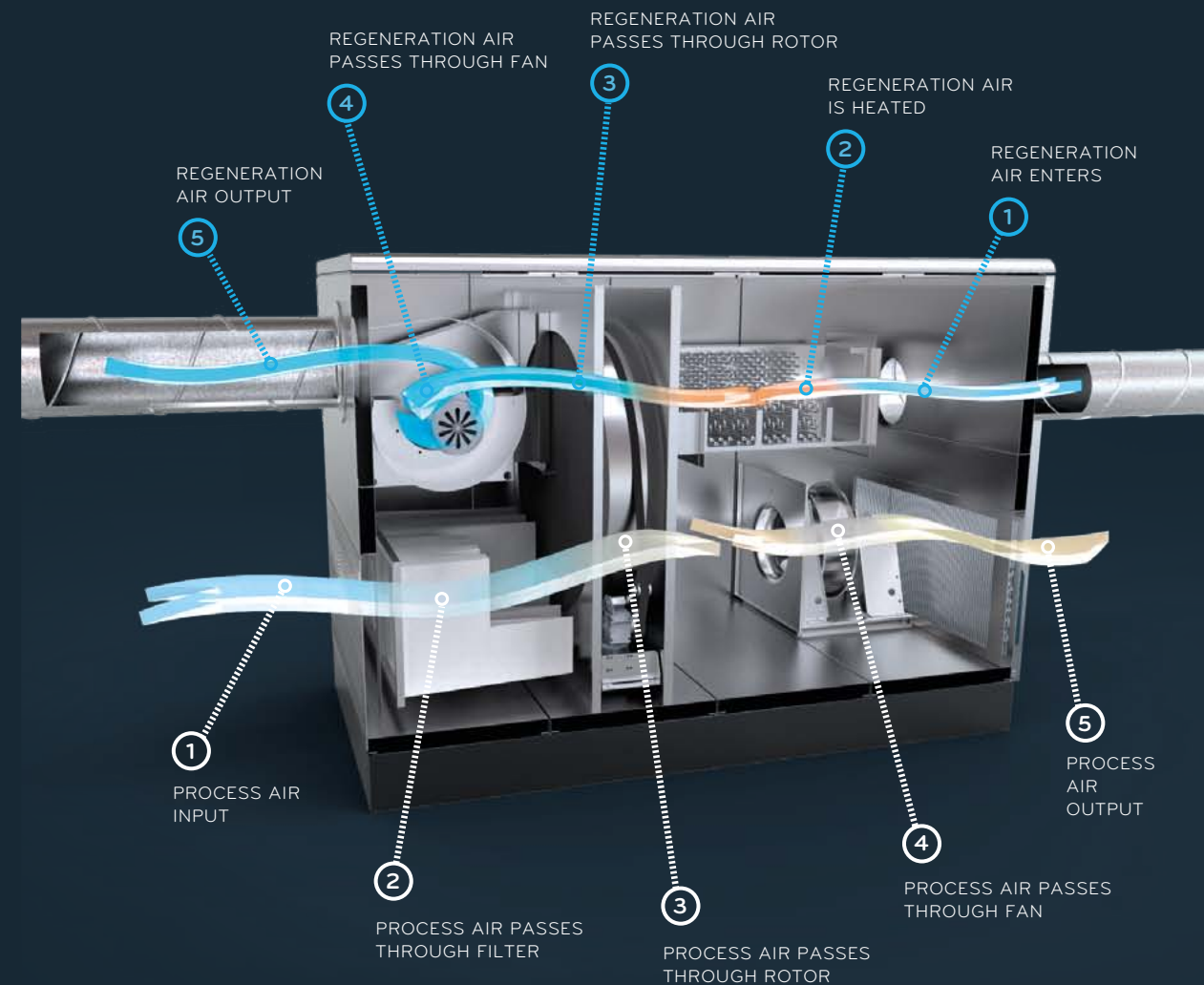
A Cotes adsorption dehumidifier is a complete unit that includes a rotor, geared motor, fans, heater, air filters and an integrated electrical system featuring all the components necessary for safe operation.



### ROTOR AND SILICA GEL

- > Fibreglass rotor coated with silica gel
- > 1g of silica gel has a hygroscopic surface area of approx. 800 square metres
- > 9g of silica gel has a hygroscopic surface area corresponding to 1 football pitch

- ① - ⑤ PROCESS AIR FLOW
- ① - ⑤ REGENERATING AIR FLOW



## WHERE ARE ADSORPTION DEHUMIDIFIERS NORMALLY USED?

Adsorption dehumidifiers are particularly suited for use wherever lower temperatures, low humidity levels or low dew points are required.

There are some examples of where such dehumidifiers are used.

- > Filtration and purification facilities
- > Warehouses (dry storage, climate-controlled cold storage, unheated warehouses, etc.)
- > Waterworks and pumping stations
- > Hydroelectric plants
- > Waste water treatment plants
- > Double-hulled ships, ships' holds and storage tanks
- > Ice rinks
- > Storage silos
- > Bridge structures
- > Wind turbines
- > Breweries
- > Pharmaceutical production facilities
- > Refrigerated and deep-freeze storage facilities
- > Slaughterhouses

- > Military vehicles and equipment
- > Turbines and boilers in power plants
- > Offshore oil/gas drilling and production platforms
- > Crawl spaces and basements in buildings
- > Museums, libraries and other high-value storage facilities
- > Spray drying systems
- > Low dew point facilities.

## WHAT ARE ADSORPTION DEHUMIDIFIERS NORMALLY USED FOR?

Adsorption dehumidifier technology normally plays a key role in production and processes that require dry conditions.

Examples

- > Manufacture of optical panes, laminated glass and double glazing
- > Manufacture and storage of pharmaceuticals
- > Air used in pneumatic transportation systems
- > Dry air for coating processes used in the production of chewing gum and pharmaceuticals
- > Manufacture of wine gum and other hygroscopic food products
- > Manufacture of lithium-ion batteries
- > Keeping wind turbine installations dry and in good condition
- > Drying out newly constructed buildings, or structures damaged by flooding or downpour
- > Preventing the formation of condensation on cold surfaces in all kinds of structures and storage facilities
- > Dry air for use in spray drying systems

- > Drying out wet clothes and equipment in a wide range of different contexts
- > Dry air used in sandblasting and industrial coating processes
- > Point dehumidification in aircraft, vehicles and boats
- > Preventing ice formation in cold stores and freezing tunnels/facilities.

# INSTALLATIONS THAT BENEFIT



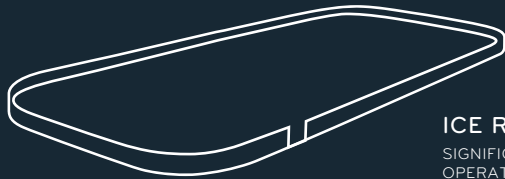
## LITHIUM-ION BATTERY PRODUCTION

PRODUCTION NOT POSSIBLE WITHOUT  
LOW DEW POINT



## SPRAY DRYING INSTALLATIONS

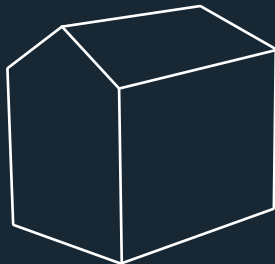
**35%**  
INCREASED DRYING CAPACITY  
**15%**  
REDUCTION IN ENERGY COSTS



## ICE RINKS

SIGNIFICANTLY REDUCED  
OPERATING COSTS

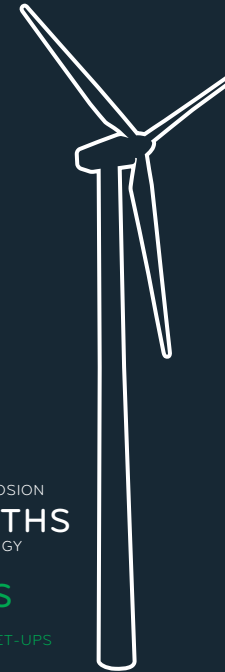
**70-80%**  
LOWER ENERGY CONSUMPTION  
FOR THE DEHUMIDIFICATION SET-UP



## DRYING OUT BUILDINGS

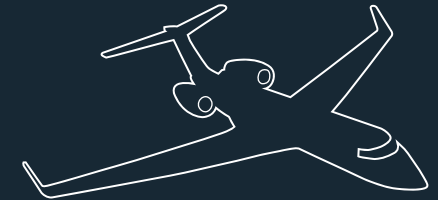
SPEEDING UP BUILDING/RENOVATION WORK,  
SAVING ON MANPOWER

**15%**  
ENERGY REDUCTION



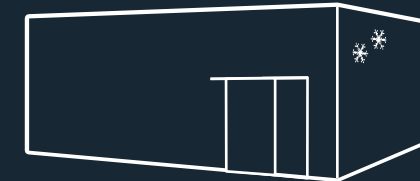
## WIND TURBINES

**72%**  
REDUCED SPEED OF CORROSION  
**ROI 12 MONTHS**  
OR LESS - BASED ON ENERGY  
SAVINGS ALONE  
**10-20 TIMES**  
MORE ENERGY-EFFICIENT  
THAN ANY ALTERNATIVE SET-UPS



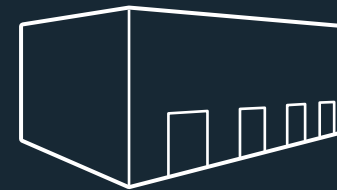
## AVIATION

REDUCED MAINTENANCE COSTS  
IN JET ENGINES  
EFFECTIVE CORROSION PROTECTION



## COLD STORES

**50%**  
GREATER EFFICIENCY  
FOR FREEZER TUNNELS  
**10%**  
REDUCTION IN OVERALL  
ENERGY CONSUMPTION



## WAREHOUSES

AVOID COSTLY, DISRUPTIVE DAMAGE  
TO GOODS WHILE IN STORAGE

**60%**  
ENERGY REDUCTION  
COMPARED TO OTHER SYSTEMS

## WATER WORKS

SIGNIFICANTLY REDUCED  
MAINTENANCE AND  
REPAIR COSTS

REDUCTION IN OVERALL  
ENERGY CONSUMPTION



## SLICING ICE RINK OPERATING COSTS

Ice rinks normally have a constant struggle with the effects of moisture from the air condensing on the many cold surfaces and parts of the building structure, as well as the technical installations.

A major ice hockey arena in Denmark adopted a new approach to the arena's condensation problems – and the energy bills being run up to tackle them – by installing two Cotes adsorption dehumidifiers.

Using sensors to measure the actual dew point in different parts of the building, and using thermal energy from the heating and cooling plant – which previously mostly went to waste – for air regeneration resulted in savings on energy costs amounting to more than €80,000 a year.

Constant condensation on windows and other structures was also eliminated, cutting back on maintenance and repair expenditure, and enabling the owners to improve the facilities and the quality of the user experience throughout the venue.



6/ TALK TO US ABOUT WHAT'S POSSIBLE

# DEHUMIDIFICATION IS A DECISION-MAKING PROCESS

Humidity has had a hitherto relatively anonymous role in industry. However, recognition of its substantial effect on production, service and maintenance costs, on environmental impacts and on the service life of key assets can change this.

Getting the best results from dehumidification technology means a new approach: quick-fix retrofits may enable you to solve the problem, but they're unlikely to be a long-term solution because they don't tackle the cause.

An appreciation of the effects that humidity plays in a wide spectrum of industrial applications makes it important to include consideration of humidity management issues at an early stage in the process of designing and configuring virtually any structure, production set-up or process.

Effective humidity management should be included in any managerial toolbox for exerting control over the conditions in which business operations take place.

It can result in key increases in efficiency compared with competitors using similar industrial processes, and adsorption dehumidifier technology in particular provides an exceptional return on investment.



## WORLD LEADER IN HUMIDITY MANAGEMENT

Cotes A/S is a specialist company that is among the world leaders in the relatively under-the-radar field of humidity management.

Located in Denmark, the company develops, designs and manufactures the most advanced and most reliable adsorption dehumidification solutions on the market today.

Cotes works exclusively with adsorption dehumidification, providing equipment that can be powered by virtually any energy source, including electricity, gas, steam, solar power and waste heat. This makes it possible to use the cheapest, most environmentally friendly form of energy available in any given context.

In-depth expert familiarity with the many complex issues and big opportunities available from humidity control play a major role in leveraging the payback from any dehumidification solution.

As a result, Cotes is a prime mover in helping and advising customers with the entire process of humidity management, applying our exceptional engineering know-how about this technology, and the laws of physics on which it is based.



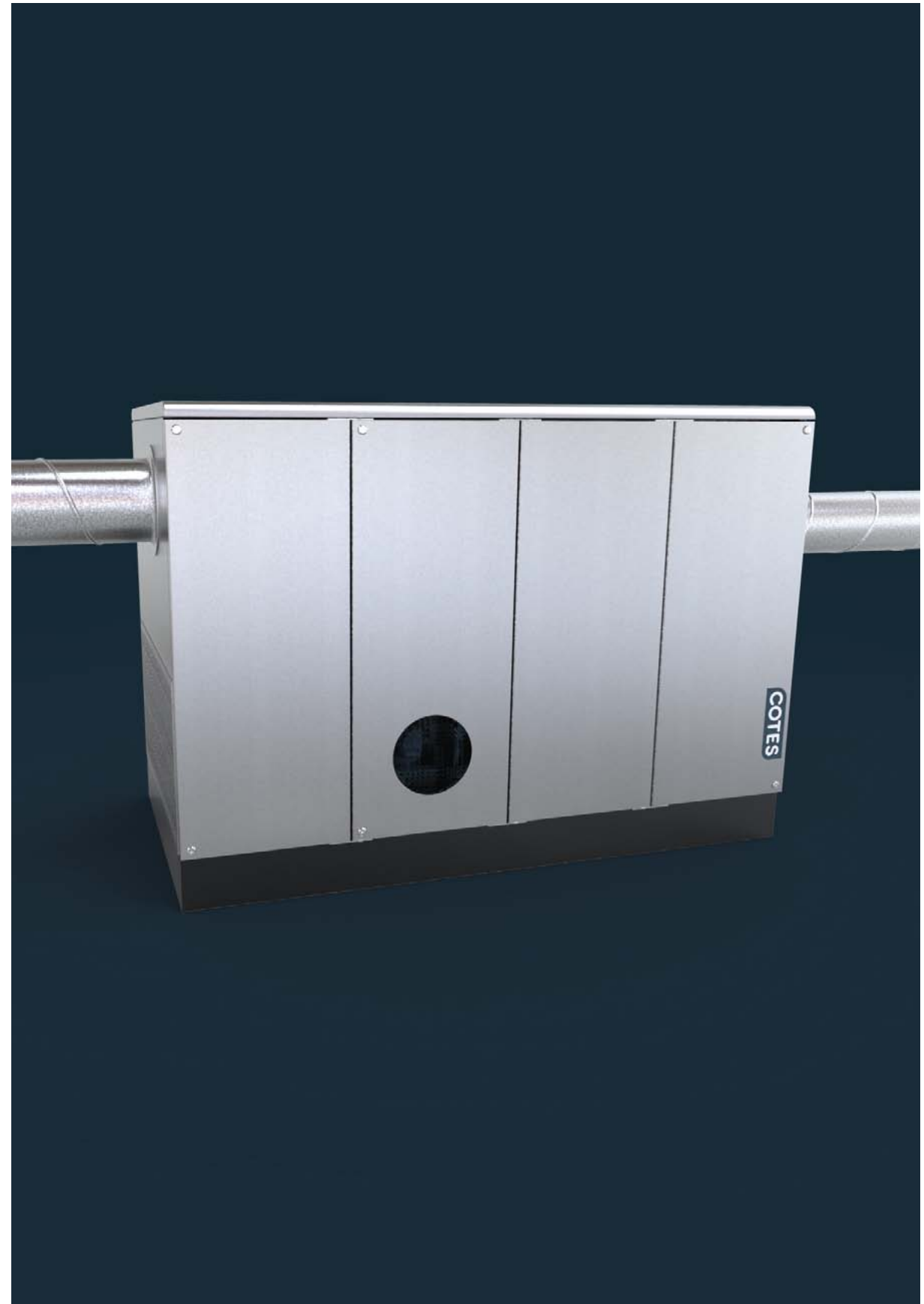


## ASKING THE RIGHT QUESTIONS AND GOING THE EXTRA MILE

Managing humidity is a highly specialised field in which many of the parameters and solutions seem almost counter-intuitive for the layman – and sometimes even for dehumidification customers.

In many cases, it's not so much a question of finding the right answer as of being sure to ask the right questions. And sometimes it's a question of seeing through what customers actually ask for to see what they really need to get the job done.

There are also many practical things to consider when installing a dehumidifier, such as geographic location, buildings and materials. That is why it can be a good idea to involve us early on in the decision-making process, so you can benefit in full from unparalleled Cotes experience and expertise.



# RESUMÉ OF BENEFITS

CONSISTENT  
CONDITIONS  
YEAR ROUND

BETTER  
CONTROL  
OF OUTPUT

BETTER  
PRODUCT  
QUALITY

INCREASED  
CAPACITY  
AND OUTPUT

ELIMINATE  
CORROSION,  
MOULD AND  
OTHER  
HUMIDITY  
RELATED  
PROBLEMS

ELIMINATE  
DAMAGE TO  
MACHINERY,  
PRODUCTS  
AND GOODS  
IN STORAGE

GREATER  
RELIABILITY  
AND REDUCED  
DOWNTIME

BETTER  
EXPLOITATION  
OF COSTLY  
ENERGY

REDUCED  
CO<sub>2</sub>  
EMISSIONS

BETTER  
CONTROL OF  
OPERATING  
COSTS

SIGNIFICANTLY  
REDUCED  
MAINTENANCE  
AND REPAIR  
COSTS

SIGNIFICANT  
REDUCTIONS  
IN ENERGY  
COSTS

RAPID  
RETURN ON  
INVESTMENT

Controlling humidity is ultimately a question of establishing – and keeping – control over parameters that can have big effects on efficiency, reliability and profitability.

Controlling what's happening with your company's operations is a management priority.

## Taking control

Humidity affects countless aspects of commercial and industrial activity – and virtually all the materials, processes and structures used.

The decision to take full control of this lesser-known physical parameter can pave the way to substantial business improvements – some unforeseen.

Cotes humidity management technology enables you to deal with the consequences of some of the basic laws of physics.

## Boosting results

The use of modern humidity management technology can also enable your company to achieve significant efficiency benefits, energy savings and substantial indirect environmental benefits.

This is in addition to the savings you can make from avoiding a wide range of costly remedial steps.

## Preventive action

Prevention is almost always better than cure. The effective use of adsorption dehumidification can help you prevent lots of practical difficulties and glitches with expensive processes, structures and installations.

Dehumidification technology is the most cost-effective and environmentally responsible way to tackle many problems widespread throughout industry. It's an easy, inexpensive way to implement pro-active measures that help make sure you can maintain the value of key structures and other high-value assets.

TEXT WORD DESIGN  
DESIGN MARLENE HALD

TALK TO US ABOUT WHAT'S POSSIBLE

COTES A/S

DENMARK

+45 5819 6322

[INFO@COTES.COM](mailto:INFO@COTES.COM)

[COTES.COM](https://COTES.COM)