COTES ADSORPTION DEHUMIDIFIERS

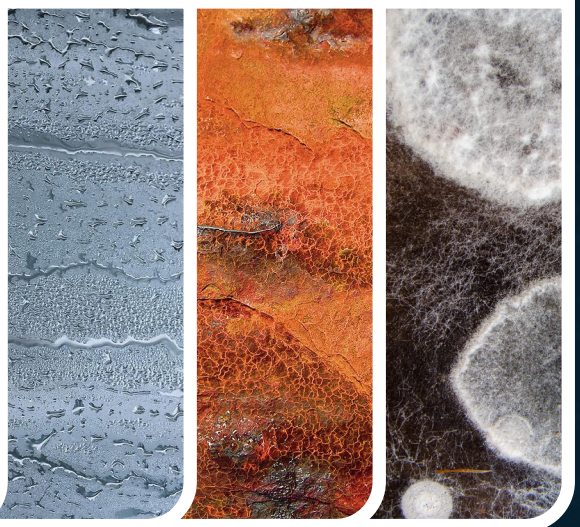
# THE RIGHT WAY TO DRY YOUR WIND TURBINE

## ONSHORE, NEARSHORE AND OFFSHORE


COTES
THE RIGHT WAY TO DRY

# CONDENSATION CORROSION AND MOULD

- lead to issues



HUMIDITY MANAGEMENT

## WHAT IS HUMIDITY AND WHAT CAN YOU DO ABOUT IT?

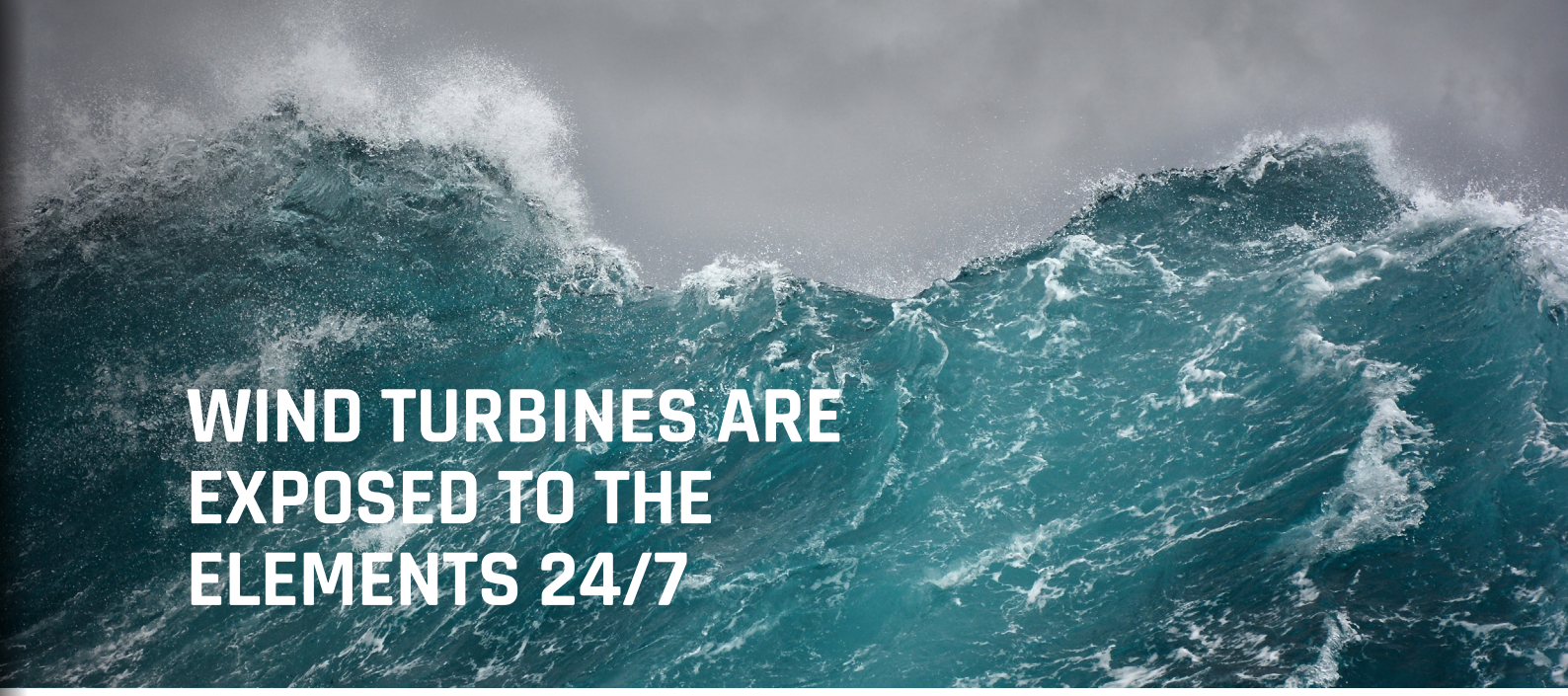
Humidity is the amount of moisture in the air – if you have too much for too long, it will cause issues inside your wind turbine, which is why you need more control.

**Absolute Humidity**
Absolute humidity is the amount of moisture present in a particular volume of air and is typically measured in g/kg.

**Relative Humidity**
Relative humidity is the relationship between the actual amount of moisture present and the maximum amount that the air could contain. Relative humidity is always measured in percentages.

**The Issue**
Inappropriate levels of relative humidity can result in a wide range of problems inside wind turbines - mould, corrosion, and electrical failures.

**The Solution**
Cotes dry-air solutions help you establish full control over the humidity conditions (and salinity) inside your wind turbine throughout its entire life cycle.



# WIND TURBINES ARE EXPOSED TO THE ELEMENTS 24/7

COTES DRY-AIR SOLUTIONS

## HOW DO YOU BENEFIT?

Protect your wind turbines and assets against mould, corrosion and electrical faults – offshore, onshore and nearshore.

Your wind turbines are exposed to the elements from the moment they leave the production floor. Whether your wind turbine is onshore, nearshore or offshore, you need a dry-air strategy to avoid mould, corrosion and electrical faults in your turbines.

The good news is that we can help you. With over 20 years of experience in the wind industry and working with some of the biggest names around, we have helped our clients protect their assets and maximise the operational uptime of their turbines.

Better humidity control ensures that you benefit from:

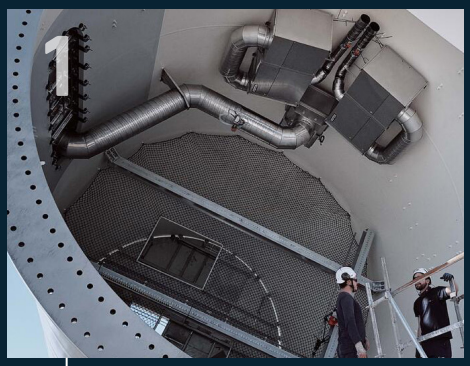
- Lower cost for materials, coating and components
- Fast, glitch-free turbine commissioning
- Fewer mechanical and electrical faults
- Greater uptime and better productivity
- Safer working environment

WHAT IS YOUR DRY-AIR STRATEGY?

# WIND TURBINE LIFE CYCLE

Your wind turbines are exposed to the elements from the moment they leave the production floor.

Airborne moisture is one of the major sources of operational disruptions, damage to equipment and structures, and costly practical problems inside the nacelles and towers of wind turbines – especially offshore. To our knowledge, as much as 20–25% of all breakdowns in offshore wind turbines are caused – directly or indirectly – by moisture and/or corrosion.




## Integrated Design

Having a dry-air strategy for your wind turbine starts at the design process. Onshore and offshore turbines are designed with different locations and weather conditions in mind, yet they face similar challenges with mould, corrosion and electrical faults.

Having effective, reliable control of corrosion means wind turbine manufacturers are able to work with lower ISO 9223 classification requirements and lower IP classes – this results in lower costs for wind turbine materials, coatings and components. With Cotes' technology and know-how you can roll back key manufacturing costs by as much as 10–30% because standard-spec coatings, parts and fittings are sufficient.


## Transportation

The nacelles, hubs and towers of wind turbines – and all the sensitive equipment and electronics inside them – are exposed to tough conditions from the moment they leave the factory until they reach the site. Some turbines are in transit for months on end before becoming operational.

Cotes dehumidifiers keep nacelles and towers – and the expensive fixtures inside them – in ready-for-service condition while en route to the site. This provides big savings on commissioning as well as rolling back maintenance and service costs – and keeps up the in-service revenue stream.


## Storage

En route to the wind farm site, towers and nacelles are often stored out in the open on trucks, rail cars, ship decks, storage areas and quaysides, exposed to fluctuating temperatures and weather conditions for extended periods of time. Cotes dehumidifiers can help you protect these assists even before they become operational.

# SECURE YOUR WIND TURBINE


## Substations

A good dry-air strategy does not stop at the wind turbine. The substations that collect the power from the wind farm and connect it to the grid are also vulnerable to the elements. These substations are full of sensitive electrical equipment that need to be protected from corrosion and mould. If they shut down due to electrical faults, the whole wind farm becomes inoperational. Some substations are required to be operational without servicing or maintenance for up to 12 months at a time, which makes having an effective dry-air strategy crucial.


## Operation and Maintenance (Retrofit)

Conditions don't get easier once the nacelles and towers are erected on-site and become operational. Nearshore and offshore wind turbines (offshore in particular) are exposed to harsh weather conditions and the corrosive combinations of airborne humidity and salt 365 days a year, for the entire duration of their service lives. This can have a detrimental impact on the turbines' profitability if there isn't an effective dry-air strategy in place.


## Offshore Foundation

In the case of offshore wind turbine installations, the foundations can be installed many months or even years before the turbine arrives on site. This leaves the foundations and the installed electrical equipment exposed to moist and salt-laden air without any protection.

COTES ADSORPTION DEHUMIDIFIERS

# DRY-AIR SOLUTIONS SUITED FOR YOUR WIND TURBINES

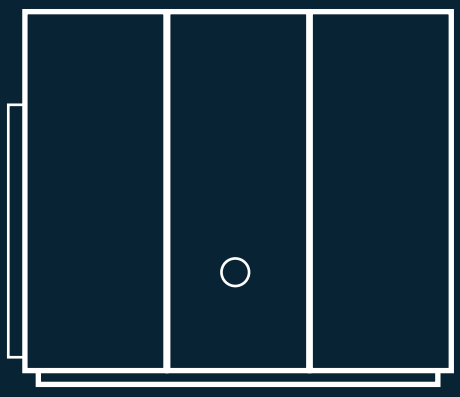
## MOBILE

A selection of compact, lightweight dehumidifiers built for mobility, with a handle for easy lifting and transportation.

## CWO

The patented range of CWO (Cotes Wind Overpressure) solutions consists of combined dehumidifier and desalter, specifically designed for wind turbines. These adsorption dehumidifiers can either be retrofited or included as part of the original wind turbine design.

## ULTRADRY



Wind energy is more than just wind turbines. Substations are crucial components of wind energy infrastructure, filled with expensive and sensitive electrical equipment.
If the substation fails, the whole wind farm is off-line.

When installed in topside substations, Cotes Ultradry dehumidifiers protect substations from the harmful effects of humidity that causes mould, corrosion and electrical faults.

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## INTEGRATED DESIGNS

For larger orders and projects, Cotes can create customised solutions with very specific design specifications and requirements.

For more information contact the team at sales@cotes.com

# MOBILE SOLUTIONS


### CR80B-FC/FCS, CR240BW and CR400BW

These dehumidifiers are recommended for protecting wind turbine towers and nacelles during the transportation and storage from the production site to the wind farm either onshore or offshore. They are also a popular and highly effective choice for retrofitting operational wind turbines that don't yet have a dry-air solution installed.

### CR100

This dehumidifiers is recommended for OEM design implementation in nacelles for localized dry-air only when overpressure is not a requirement.

### CR80B-FC/FSC

| | |
|---|---|
| Moisture removal capacity: | 0.44 kg/h |
| Connected load: | 0.83 kW |

### CR240B

| | |
|---|---|
| Moisture removal capacity: | 0.8 kg/h |
| Connected load: | 1.05 kW |

### CR400BW

| | |
|---|---|
| Moisture removal capacity: | 1.4 kg/h |
| Connected load: | 1.97 kW |

### CR100

| | |
|---|---|
| Moisture removal capacity: | 0.6 kg/h |
| Connected load: | 0.95 kW |

# CWO SOLUTIONS

The patented CWO (Cotes Wind Overpressure) range consists of combined dehumidifier and desalter solutions, specifically designed for wind turbines.

These adsorption dehumidifiers can either be retrofited or included as part of the original wind turbine design.

CWO dry-air solutions are compatible with all wind turbine designs, extending the lifetime, reducing maintenance costs, avoiding electrical failures, minimising downtime and maximising uptime.

The CWO unit is often installed in the bottom of the wind turbine tower, and it is a combined desalter and dehumidifier. Depending on the size of the wind turbine and the volume of air, there are three sizes to choose from. These Cotes dehumidifiers create positive pressure (overpressure) inside the structure with dry salt-free air.

Positive pressure moves the air upwards protecting the entire tower from humidity issues. This means that almost no ducting is required (as an option, a small independent duct can be installed in the bottom of the tower to ensure circulation if the transition piece needs to be conditioned).

As an added benefit, excess dry air from the tower can be directed into the nacelle to help protect the electrical and mechanical equipment.


### CW026
Equipped with a simple digital signal forwarding the hygrostat status for an in-person inspection.

### CW035 and CW065
Equipped with a digital interface for start/stop/reset and a digital signal forwarding the basic unit status for an in-person inspection.

Both CW035 and CW065 are equipped for remote communication interface with full control and detailed unit status for SCADA system integration (Modbus or Profinet protocol). ESCADA systems integration enables remote monitoring and control of conditions inside your wind turbine.

### Benefits:

- A C2/C3 corrosion class environment throughout the tower due to desalting and dehumidification
- Easy installation
- Short ducting
- Possible protection of nacelle too
- Best possible ventilation of unwanted gasses

### CW026

| | |
|---|---|
| Treated air: | 80 $m^3/h$ |
| Connected load: | 1.2 kW |

### CW035

| | |
|---|---|
| Treated air: | 300 $m^3/h$ |
| Connected load: | 5.3 kW |

### CW065

| | |
|---|---|
| Treated air: | 1000 $m^3/h$ |
| Connected load: | 15.7 kW |

# ULTRADRY SOLUTIONS FOR SUBSTATIONS

Wind energy is about more than just wind turbines. Substations are crucial components of wind energy infrastructure, filled with expensive and sensitive electrical equipment. If the substation fails, the whole wind farm will go off-line.

When installed in topside substations, Cotes Ultradry dehumidifiers protect substations from the harmful effects of humidity that causes mould, corrosion and electrical faults.

In some cases, a CWO is also a good option for substations depending on the structure and volume of air that needs to be dried and desalted.


# DRY-AIR STRATEGY

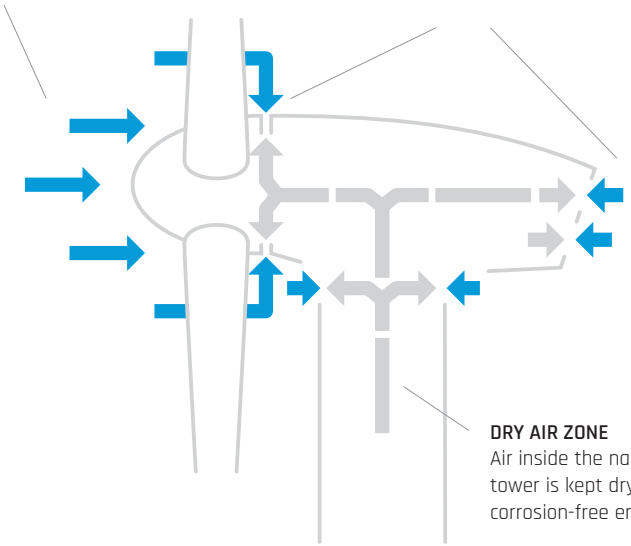
The right way to dry your wind turbine depends on your specific dry-air strategy and how much consideration has been given to the issue of unwanted humidity. We provide different dry-air solutions from collaborating on design through to retrofitting.

The right dry-air strategy and Cotes dehumidifier will extend the wind turbine lifetime, reduce maintenance costs, avoid electrical or mechanical failures and any subsequent downtime – maximising uptime of your turbine.

**SEALING THE WIND TURBINE USING AN OVERPRESSURE SYSTEM**

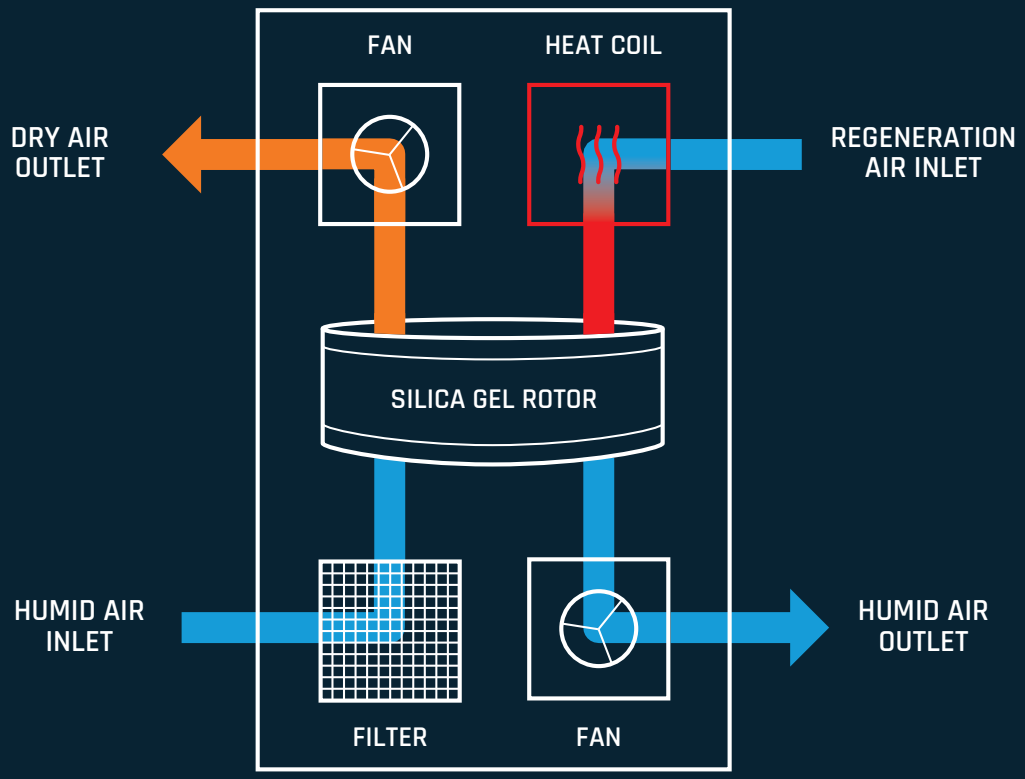
**WIND PRESSURE**
Air containing moisture and salt particles.

**OVERPRESSURE**
Creating a higher pressure prevents both moisture and salt from entering the nacelle and tower.



**DRY AIR ZONE**
Air inside the nacelle and tower is kept dry creating a corrosion-free envirnment.

# HOW IT WORKS




**ADSORPTION DEHUMIDIFICATION**

The effect of Cotes adsorption dehumidifiers is created by the action of two flows of air. The process is self-sustaining and requires little maintenance.

The silica rotor removes moisture from the intake airflow and the second airflow removes moisture from the silica rotor. The moisture is then transported out of the building or structure.

The regeneration inlet and fan setup will look different depending on your choice of rotor configuration.

COTES

THE RIGHT WAY TO DRY