

Introducing Frico

For a comfortable indoor climate





Air curtains for small and commercial entrances, industries and specific applications



Benefits of air curtains in cold storage applications



A decorative red dotted line that starts as a horizontal line, then turns 90 degrees down to a vertical line, ending in a small red circle.

Benefits of air curtains in cold storage applications

Founded 1932 in Sweden

World market leader for air curtains

Active in more than 70 countries

Part of Systemair Group


A decorative red dotted line that starts at the top left, extends horizontally to the right, and then turns vertically down to end at a red circle.

Benefits of air curtains in cold storage applications

The advantages of applying state-of-the-art air curtain technologies in cold rooms

Case studies plastic strips vs air curtains

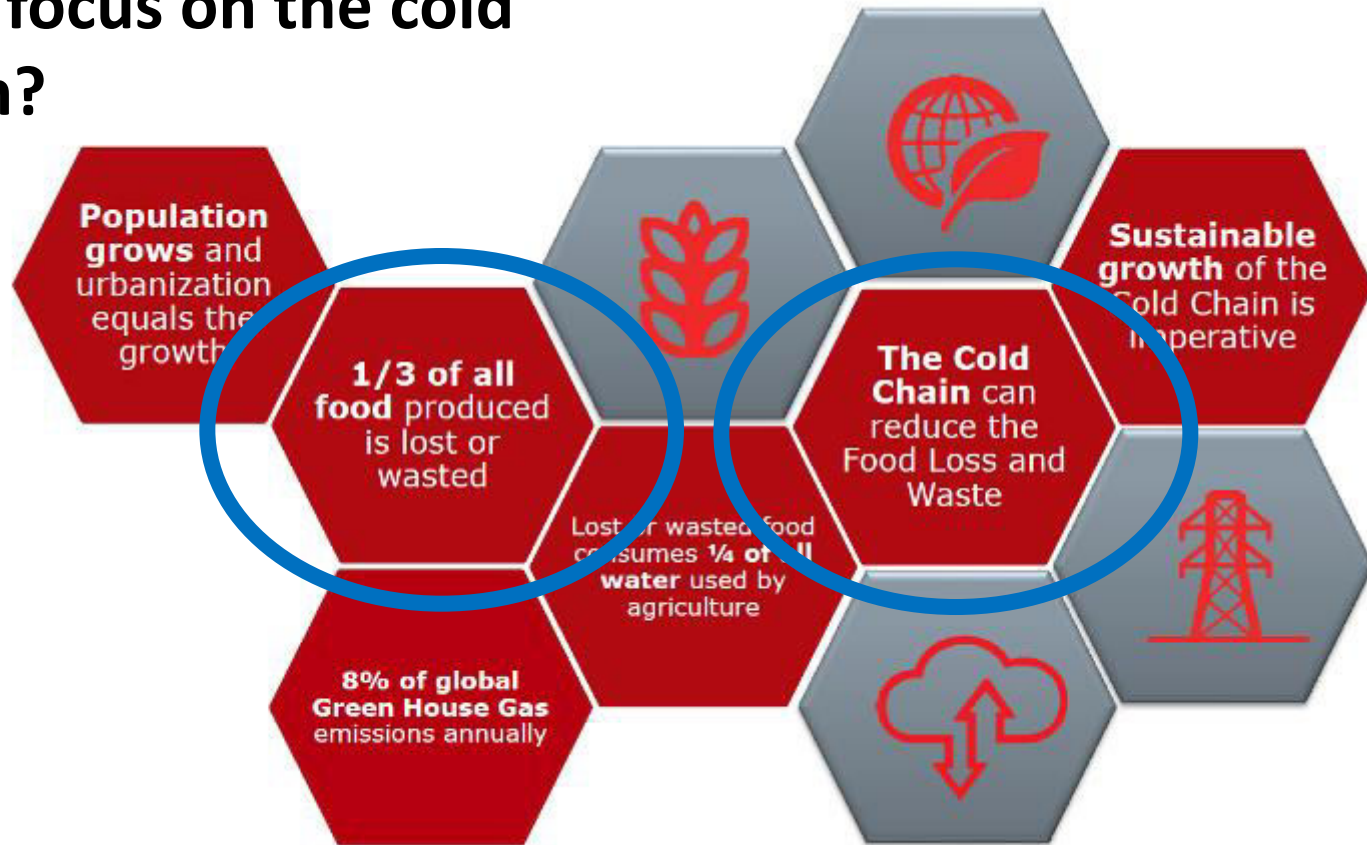
The benefits of using EC fans in air curtains

The background image shows a large industrial facility, likely a food processing plant, with stainless steel walls and ceiling. A large air curtain is installed over a doorway. Inside the facility, a worker in a white protective suit is visible, and a large piece of machinery is in the background. The floor is blue, and there are metal railings in the foreground.

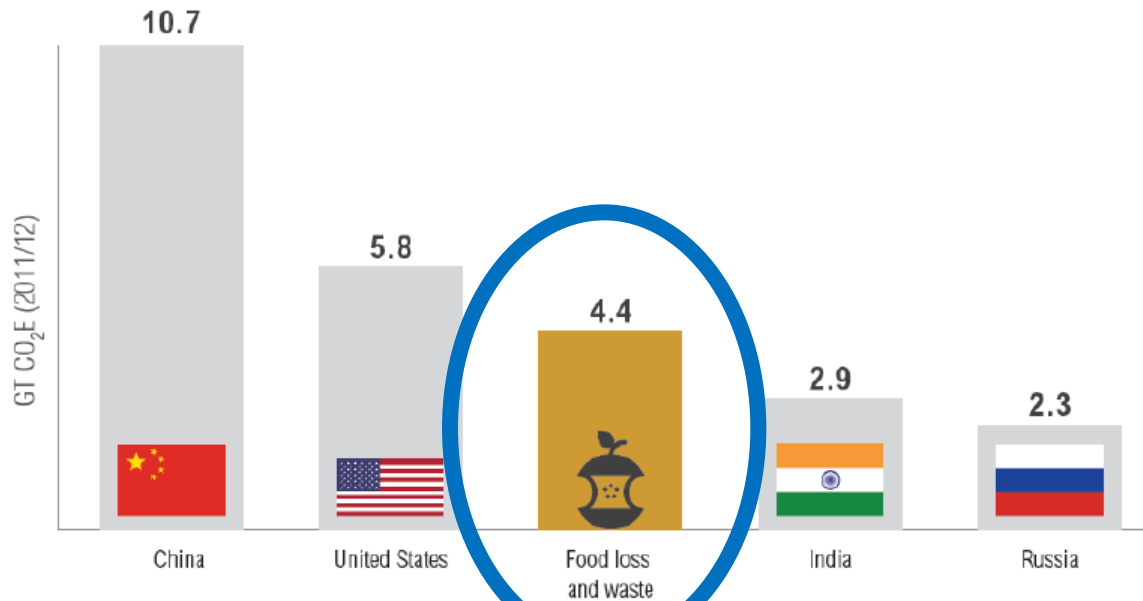
More hygienic
Safer environment
Less maintenance

Up to
75%
energy savings
with air curtains

Why focus on the cold chain?

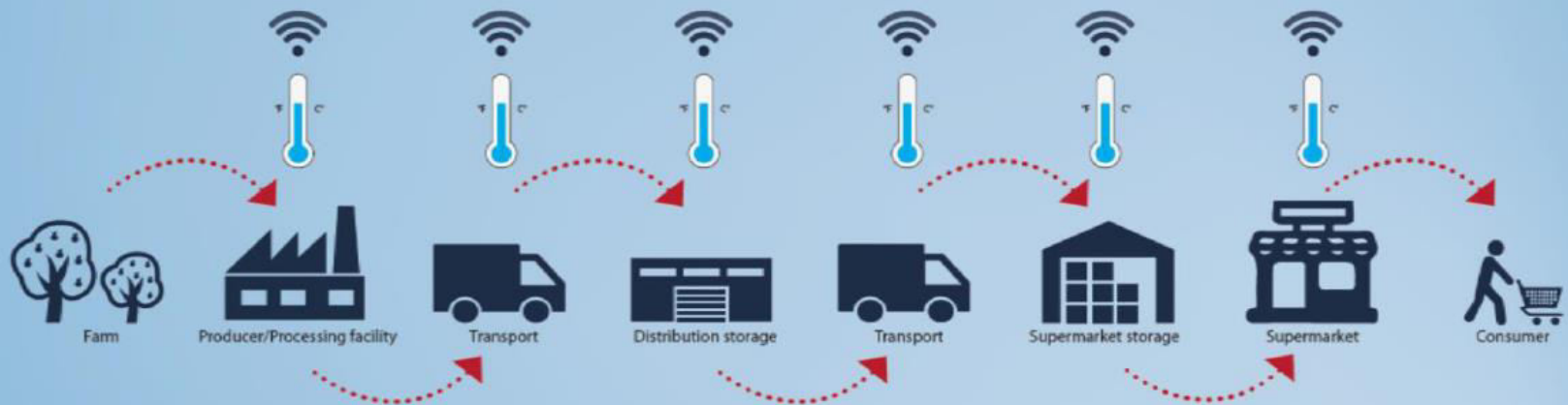


Why focus on the cold chain?

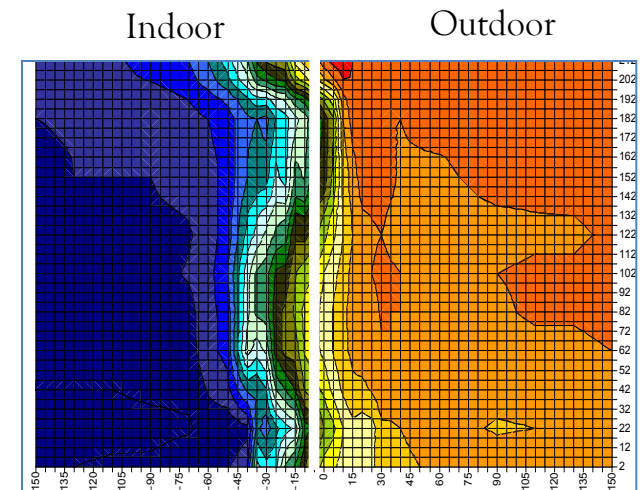


Source: WRI, SDG Target 12.3 on food loss and waste: 2016 progress report

Protect the cold chain



Benefits of air curtains in cold storage applications



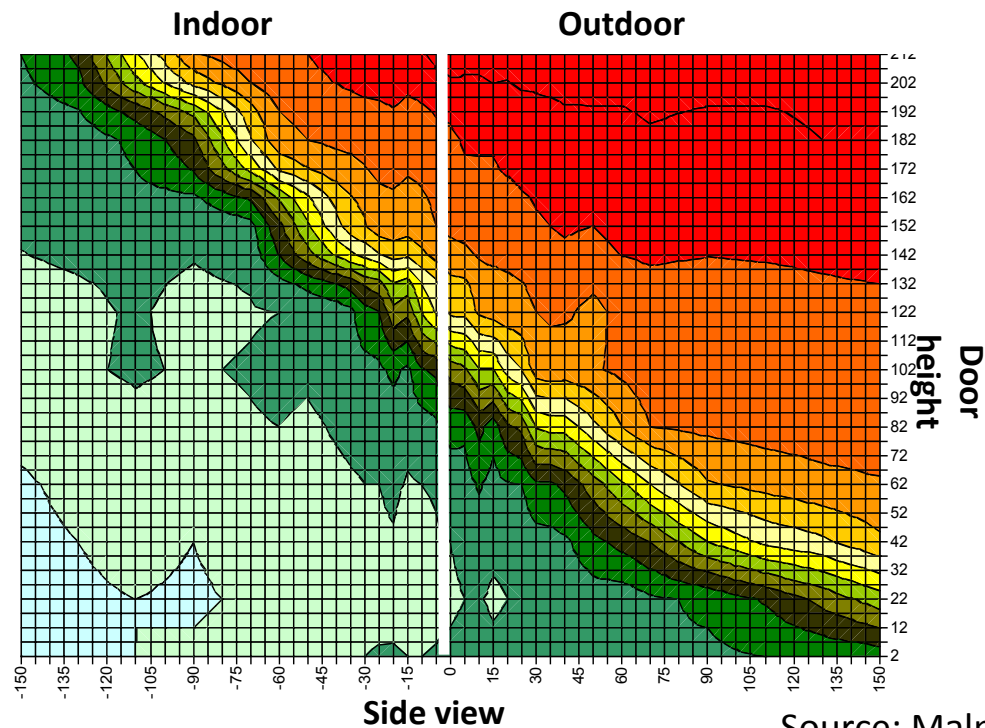
Side view



Dubai Green Building Regulations, 501.04

”For all new air conditioned buildings, other than villas, all regularly used air conditioned entrance lobbies must be protected by a door design which acts as a barrier to the loss of conditioned air”

Open door – Huge energy losses



A decorative red dotted line that starts at the top left, extends horizontally to the right, and then turns 90 degrees downward to end at a red circle.

Saving Energy with Air Curtains

The solution

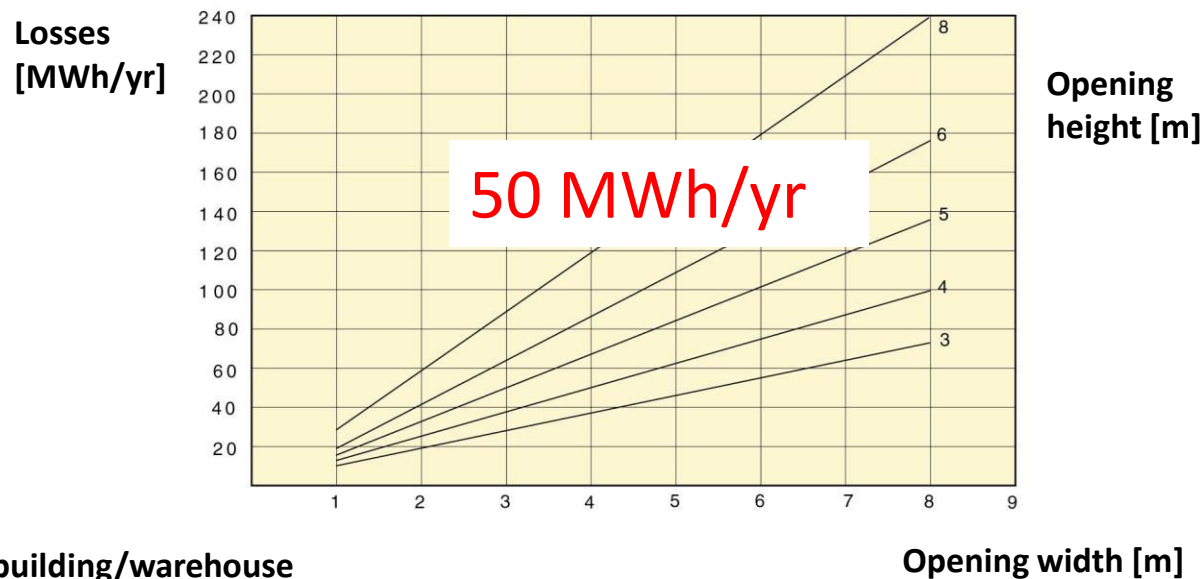


- An air curtain with optimized air stream effectively protecting the entrance from the outdoor climate

The result

- Saving energy providing comfort
- Improving the indoor air quality
- Less problems with insects, fumes etc.

Losses in MWh per year through open doors



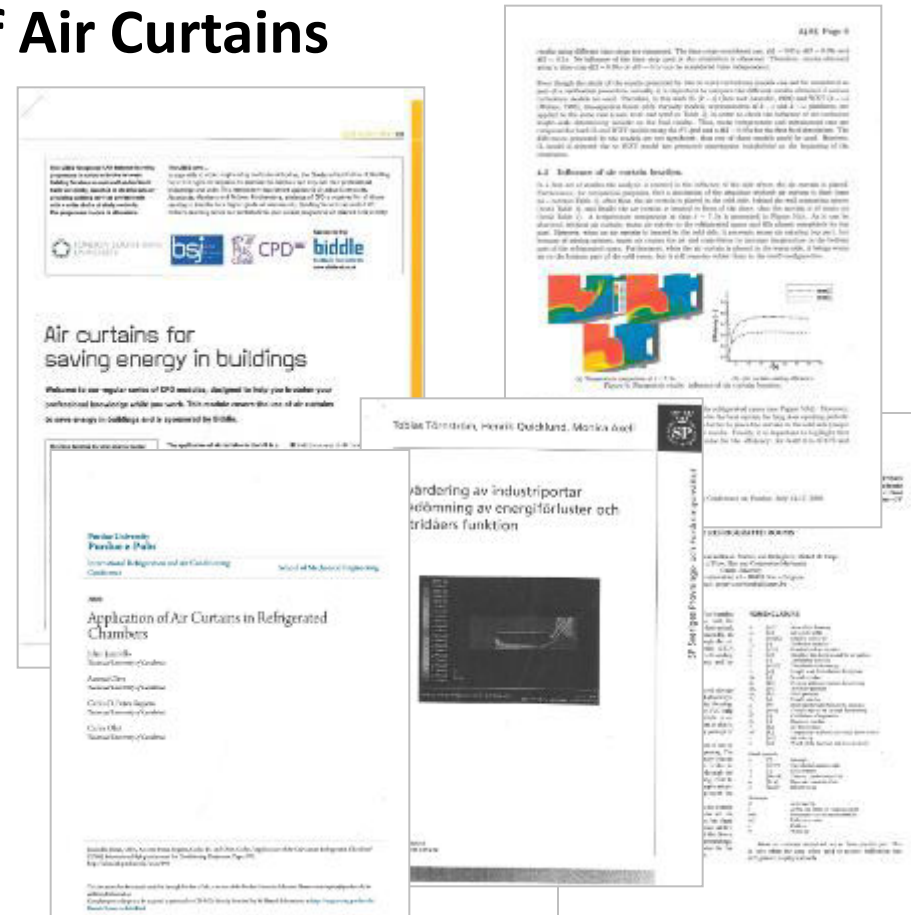
Industrial building/warehouse
Temperature difference: 15 °C
Year mean wind speed: 4 m/s
Door open 1h/day

Opening width [m]

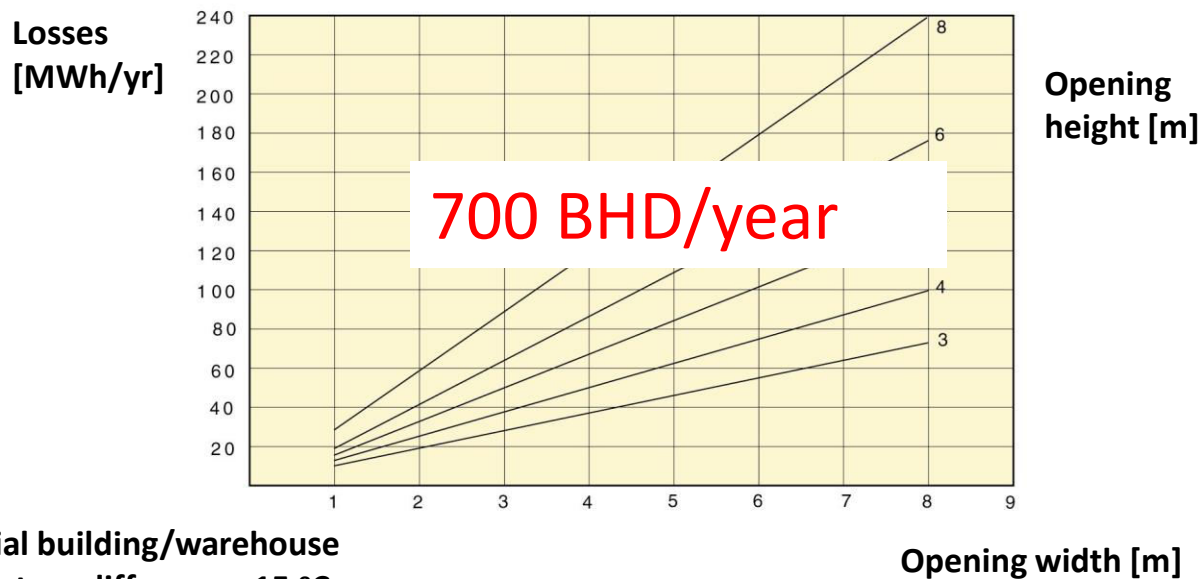
Efficiency of Air Curtains

Tests are showing that a correct installed air curtain significantly can reduce the energy losses in an open door

- Ghent University **80%**
- Purdue University **75%**
- SP Swedish National Testing and Research Institute **85%**
- London South Bank University **70%**



Possible yearly saving with 70% efficiency



Industrial building/warehouse
Temperature difference: 15 °C
Year mean wind speed: 4 m/s
Door open 1h/day

Opening width [m]

Cold storage – Case study Portugal

Cold storage temp: -23°C
Heated area temp: $+26^{\circ}\text{C}$
Door dimensions: 2.4 x 2.1 m
Door opened 100 times a day



Cold storage – Case study



- Huge energy losses
- Temperature rise in the cold sections
- Ice on the refrigeration units
- Ice on the floor



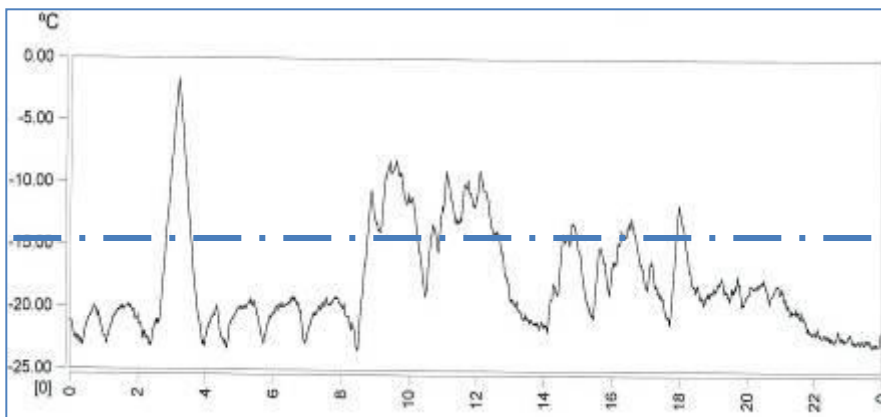
Cold storage – Case study



- Lower cold losses
- Less frost and de-frosting intervalls
- Easier to pass through the door without the plastic strips

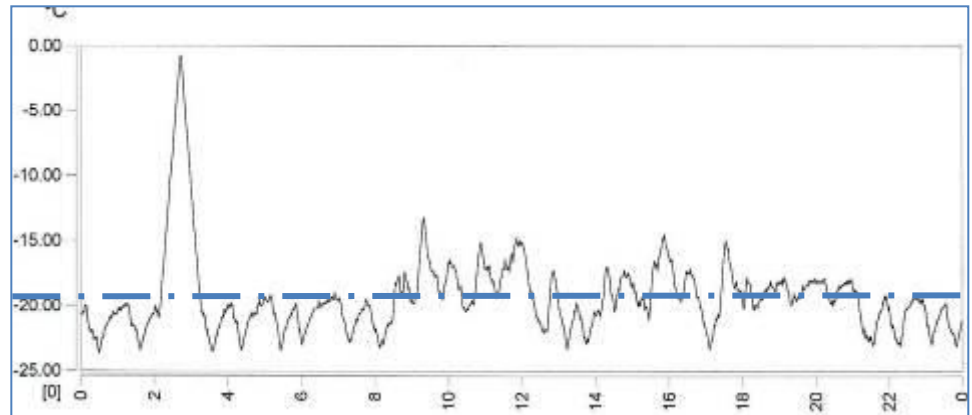
Cold storage – Case study

With Plastic Strips



Average cold room
temperature: -14°C

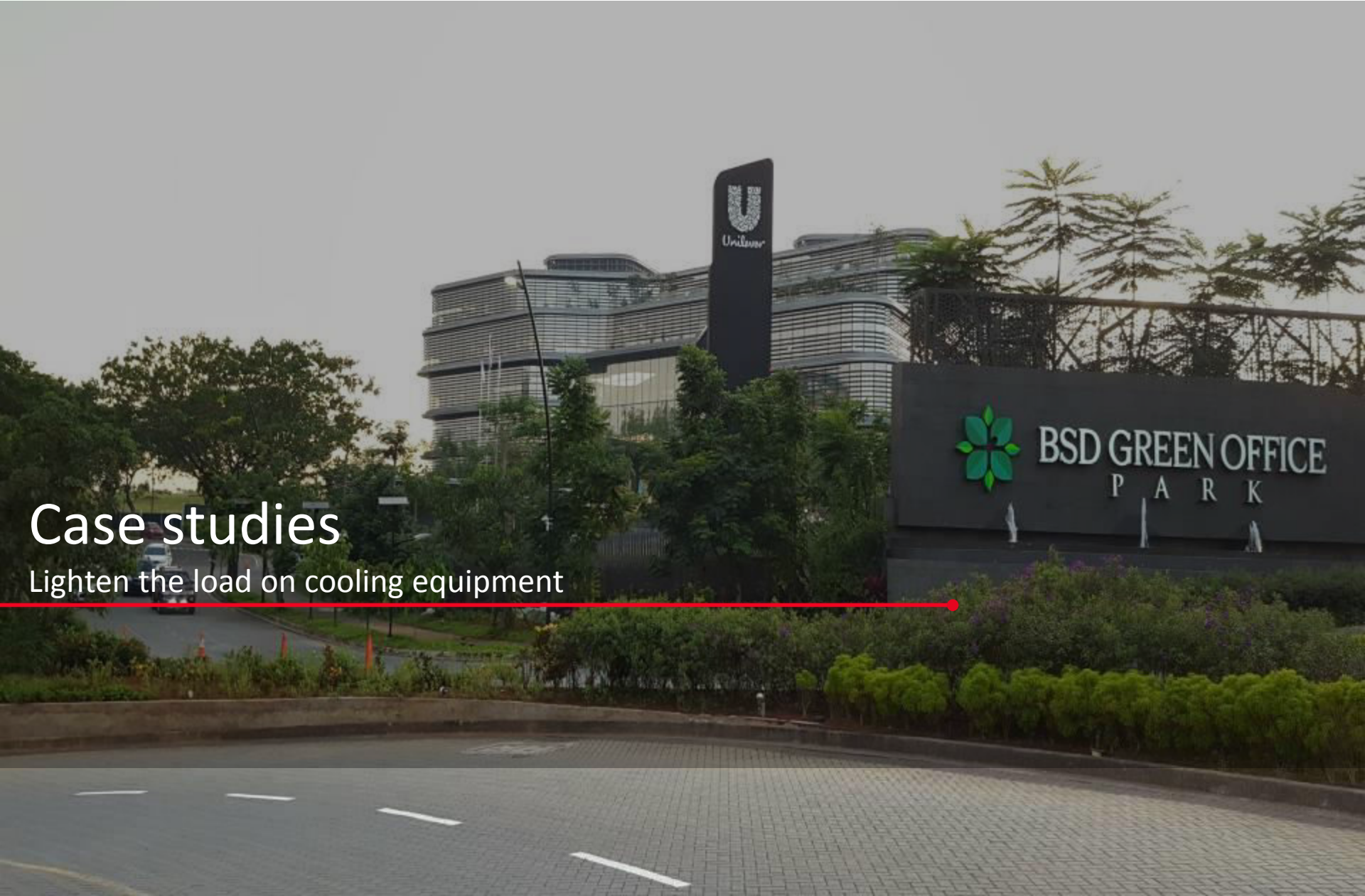
With Air Curtain



Average cold room
temperature: -19°C

Case studies

Lighten the load on cooling equipment





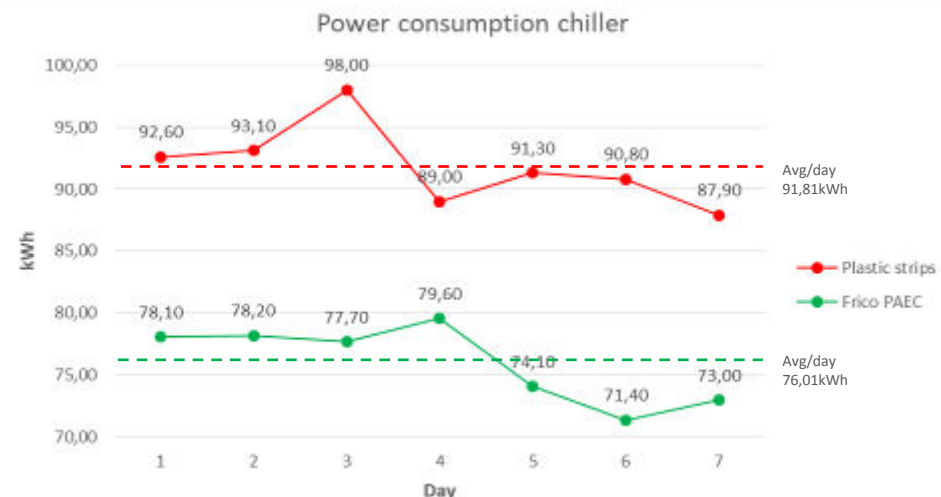
Case study- Freezer room
 One freezer ~20sqm
 Inside temp ~-23°C
 Outside temp ~30°C

Total consumption for cooling per month with plastic strips
~2754kWh

Total consumption for cooling per month after removal of plastic strips and installing Frico PAEC air curtain

2280kWh
 ~27% or 474kWh

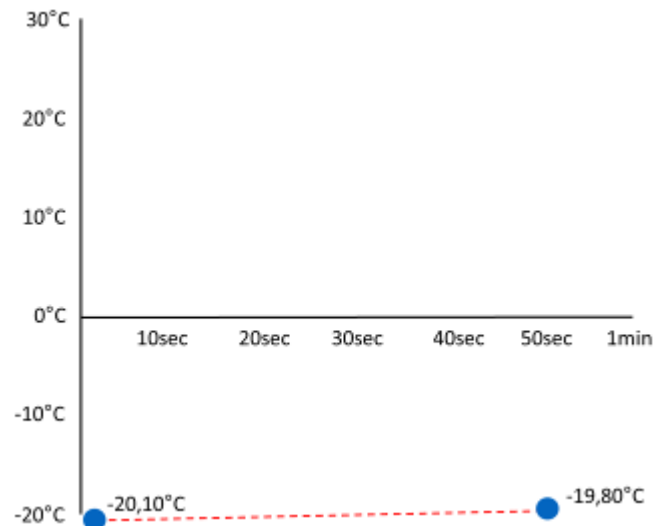
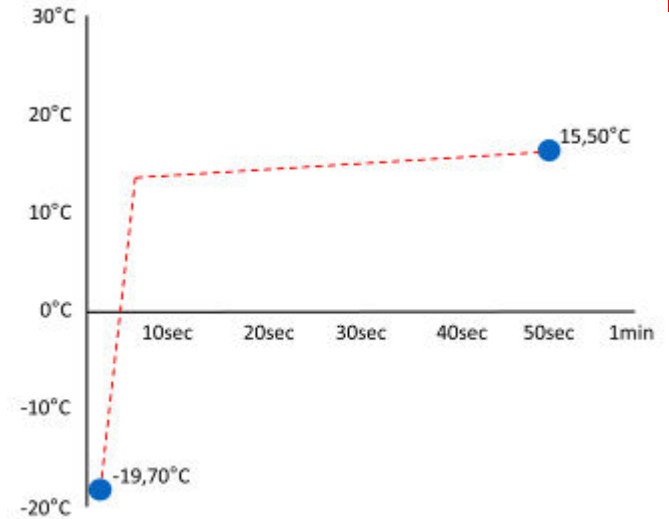
Less energy waste per month



Case study freezer room– Bangkok, Thailand

Temperature rises

Huge temperature rises inside the freezer room without any protection when the door is open – outside temp ~34°.



After installing a Frigo PAEC the inflow of warm, moist air is restrained and the cool retained in the area it is meant for – outside temp ~34°.



Case study – Cold storage

Six cold rooms 15-30sqm
Inside temp ~0°C
Outside temp ~30°C

Total consumption for cooling per month after removal of plastic strips and installing Frico PAEC air curtain

40032kWh

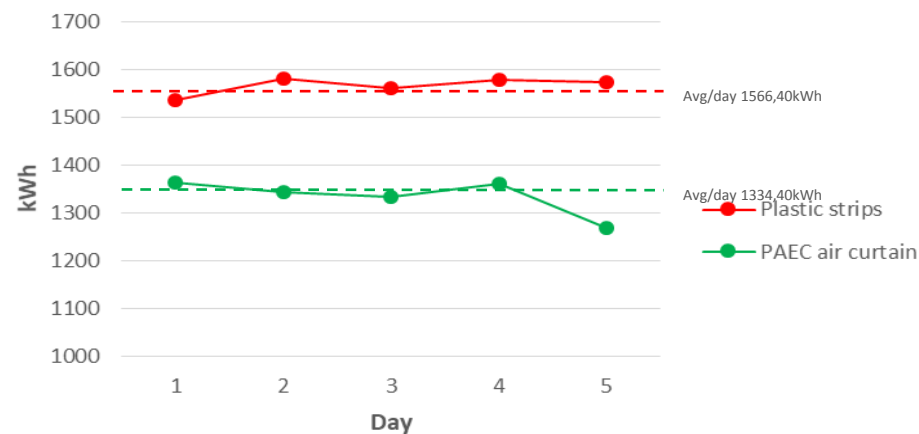
~15% or 6960kWh

Less energy waste per month

Total consumption for cooling per month with plastic strips

~46992kWh

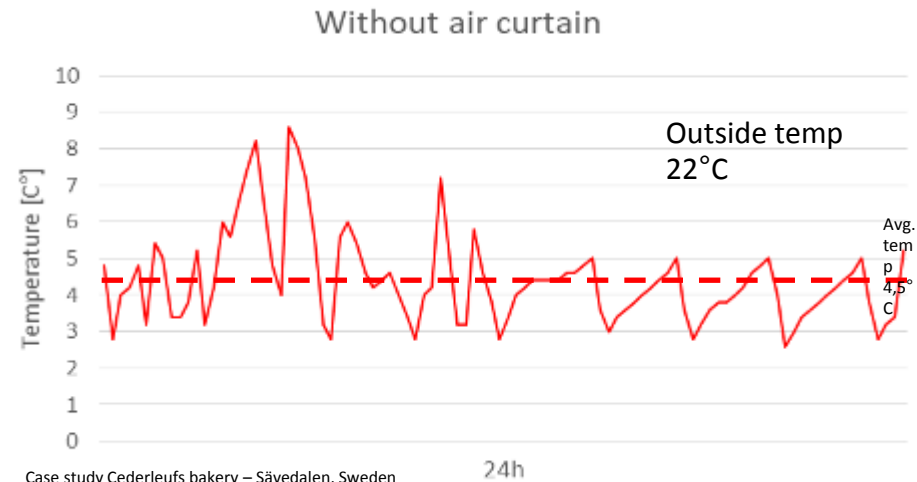
Power consumption chiller



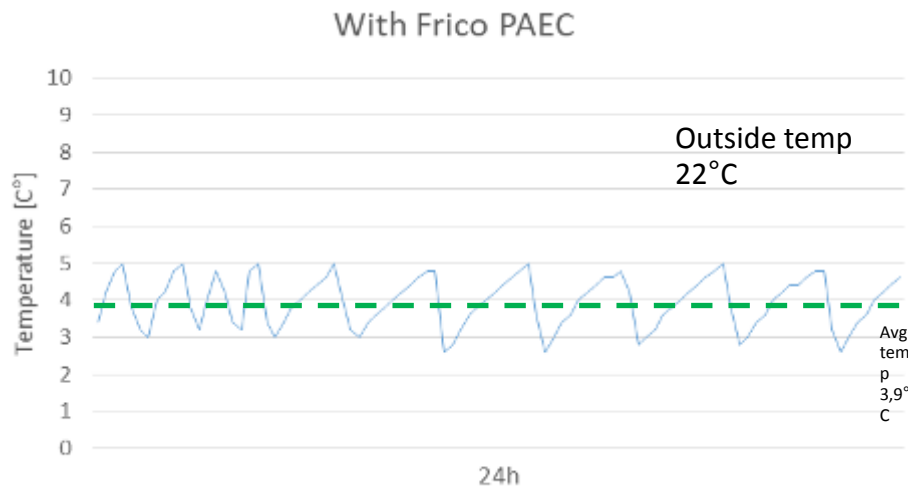
Case study cold storage— Bangkok, Thailand

Temperature fluctuation

Without air curtain the fluctuation in temperature in the climate controlled area generate high loads on cooling equipment.



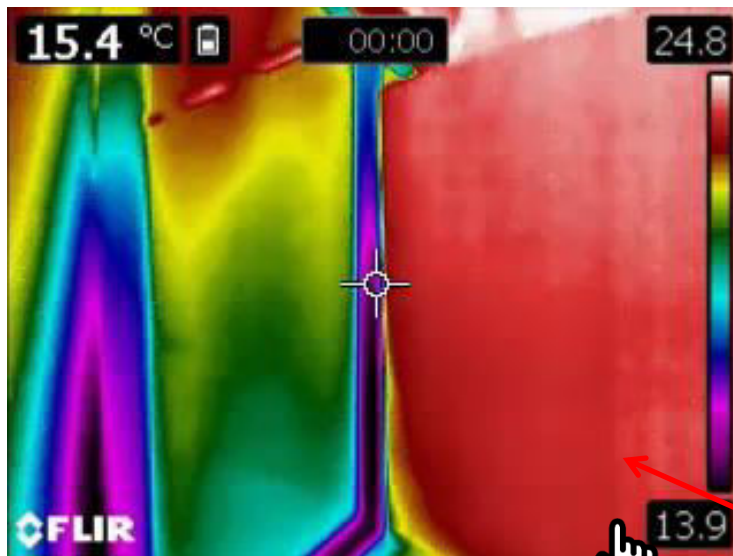
Case study Cederleufs bakery – Sävedalen, Sweden
Measured with the chiller rooms system for temperature



With an air curtain, optimized fan speed the temperature is more even and the high temperature rises are restrained.

Cold Storage Solutions – Importance of correct velocity



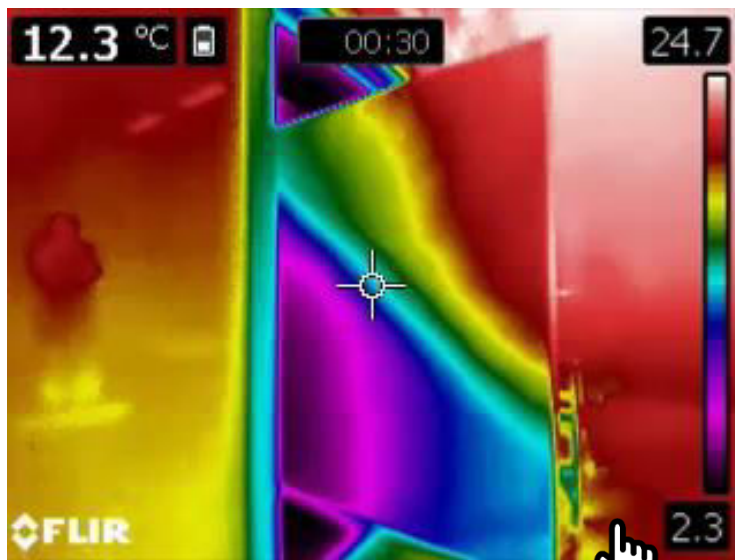


Entrance without air curtain

Press to play



Shield placed in middle of doorway once door opens up



Air curtain with correct air speed *Press to play*



Air curtain with correct air speed

- Distinct air-barrier at the floor



Air curtain with too high speed *Press to play*

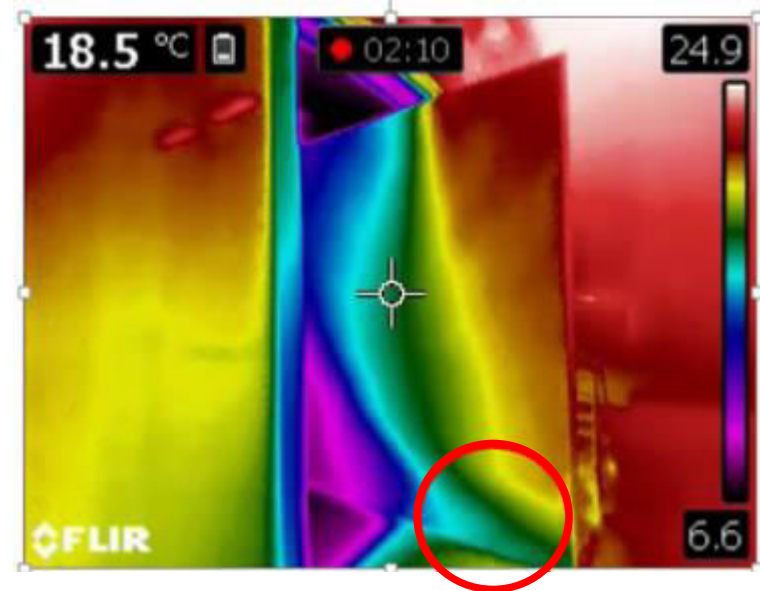


Air curtain with too high speed
• Turbulence at floor level, causing losses



Air curtain with too low speed

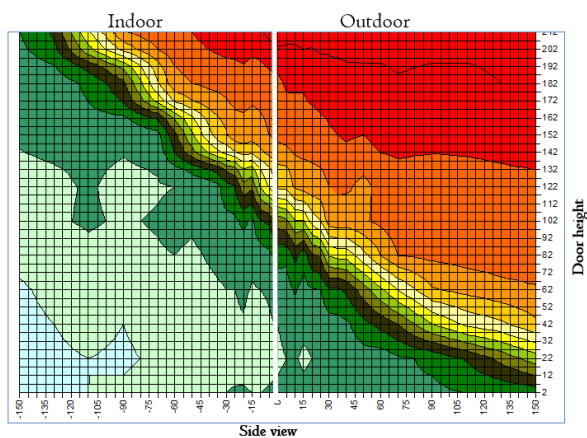
Press to play



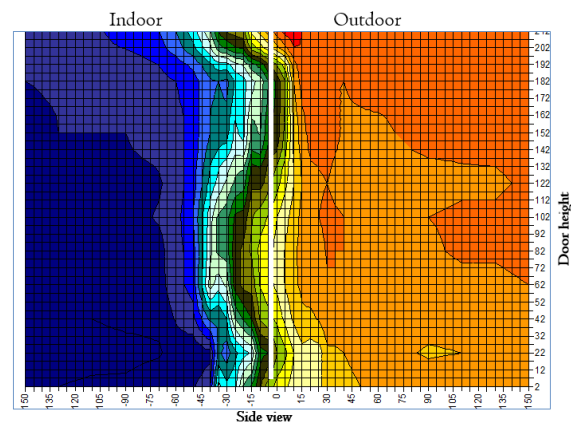
Air curtain with too low speed

- Air barrier cannot resist stress load

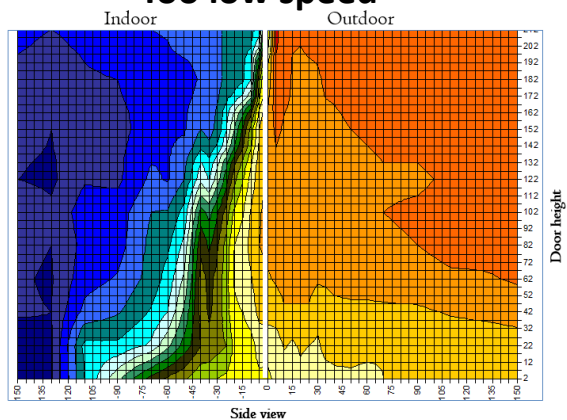
Without air curtain



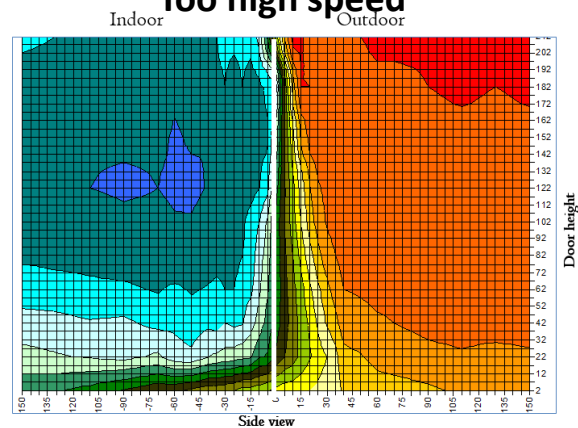
Optimal installation



Too low speed



Too high speed



Correct Air Velocity - Air Curtain Standards

INTERNATIONAL
STANDARD

ISO
27327-1

First edition
2009-06-15

Fans — Air curtain units —

Part 1:

**Laboratory methods of testing for
aerodynamic performance rating**

Ventilateurs — Rideaux d'air —

*Partie 1: Méthodes d'essai en laboratoire des caractéristiques de
performance aérodynamique*

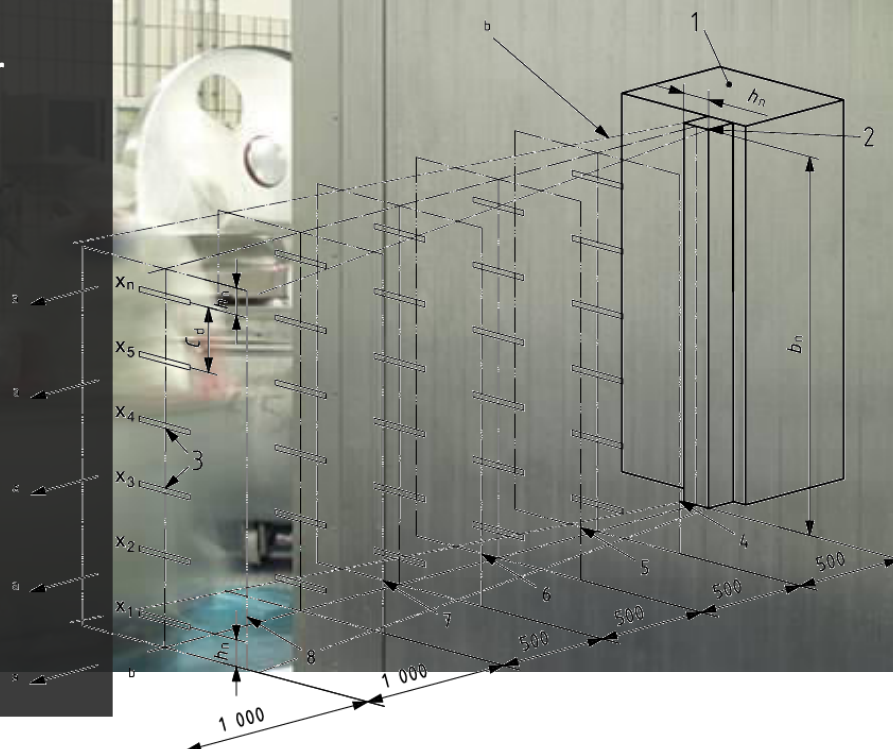
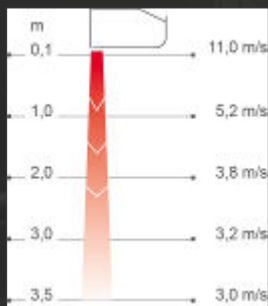
This part of ISO 27327 establishes uniform methods for laboratory testing of air curtain units to determine aerodynamic performance in terms of airflow rate, outlet air velocity uniformity, power consumption and air velocity projection, for rating or guarantee purposes.



**AMCA 210-07, 220-
05 and 300-08**

Optimized air curtains for cold storages.

Velocity according to the ISO 27327-1 standard.



FA3500
Stylish air curtains for commercial premises, with intelligent control

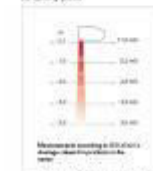
- Horizontal mounting
- installation height up to 3,5 metres*
- lengths: 1, 1,5, 2 and 2,5 metres
- Vertical mounting
- installation height up to 11 metres*
- 2 models: one on each side
- lengths: 1,5, 2 and 2,5 metres

Applications
Air curtain FA3500 gives you the possibility to design your building, production, the store product. These air curtains ensure easy access to your FA3500 is particularly suitable for entrances to stores and shopping centres for example.
The air curtain has energy intelligence and energy saving features which provide fully automatic protection for the entrance, adapted to the needs of use.

Advantages, features
1) Electrical heat up to 2000W
2) Improved PVH, IHL, IHL

Optimized diffuser with
Thermosonic technology

Air velocity profile



Product specifications

- Proprietary FA3500 control system with programming enabled directly on the unit and remote control is also available and can be used to control the FA3500 system.
- FA3500 is a complete unit suitable for very low ambient temperatures.
- The FA3500 is designed to be used in the same position, which includes installation and after care maintenance.
- The FA3500 is equipped with a remote control for the FA3500 system.
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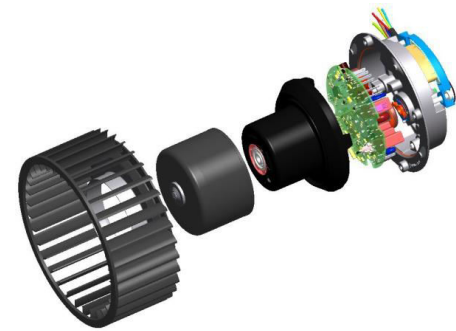
* According to the ISO 27327-1 standard and with reference to the air velocity profile, the FA3500 is designed to be used in the same position, which includes installation and after care maintenance.

A decorative graphic element consisting of a red dotted line that starts at the top left, extends horizontally to the right, and then turns vertically down to a red circle at the bottom left.

The perfect air curtain for cold storage.....?

- **Easy and accurate control of the speed – stepless**
- **As low power consumption as possible**
- **Homogeneous air beam**

Combining EC-motors with tangential impeller





Driven by  EC

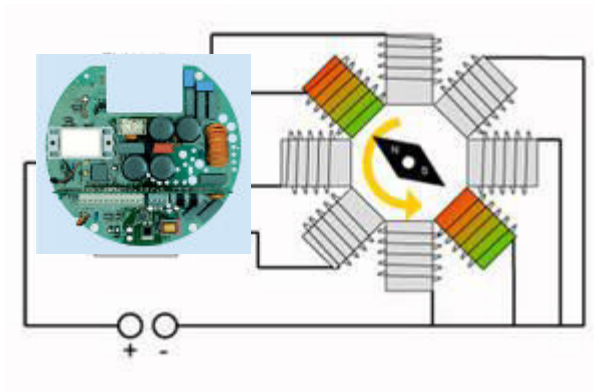
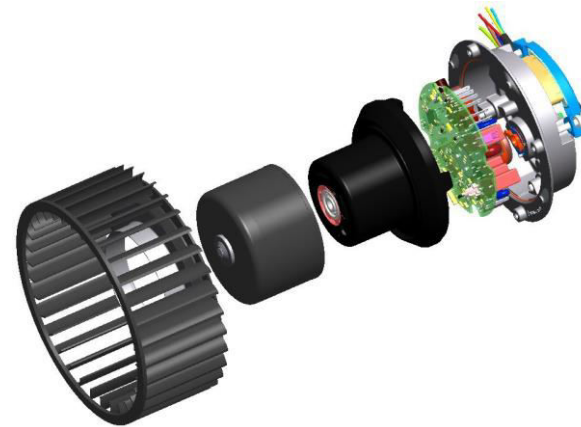
EC-motor

= electronically commutated motor

Definition: **Commutation** in power electronics describes the process through which a current passes and flows from one branch to another.

EC-Motor

EC-motors with integrated electronics can be controlled steplessly at the required air volume and have a high efficiency.



The power saving is not only at maximum power, but also especially in lower power operation dependant on demand.

Example: Duct Fan

Speed [1/min]	Airvol. [m³/h]	Pressure [Pa]	Power [W]	Savings
2289	1000	250	220,00	(100%)
2060	900	203	160,38	-27%
1831	800	160	112,64	-49%
1602	700	123	75,46	-66%
1373	600	90	47,52	-78%
1145	500	63	27,50	-88%
916	400	40	14,08	-94%

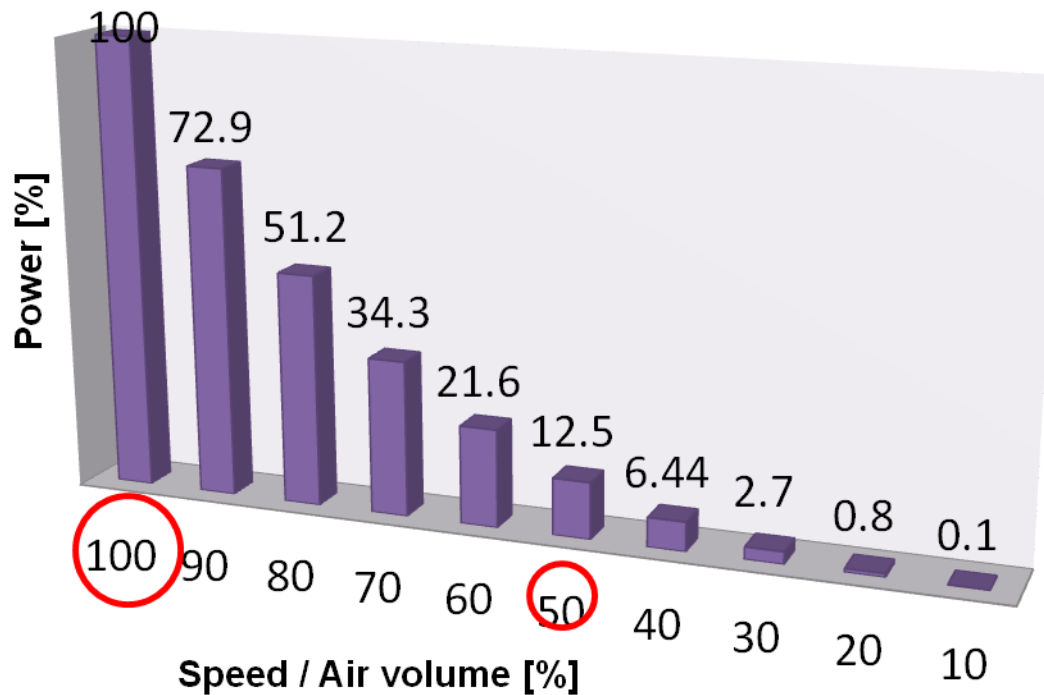
Fan laws

$$V1/V2 = n1/n2$$

$$p1/p2 = (n1/n2)^2$$

$$Pw1/Pw2 = (n1/n2)^3$$

Energy savings using EC-fans

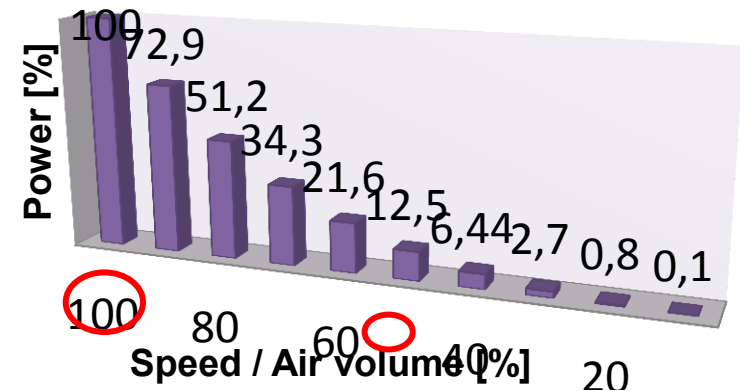


Fan laws

$$\begin{aligned} V1/V2 &= n1/n2 \\ p1/p2 &= (n1/n2)^2 \\ Pw1/Pw2 &= (n1/n2)^3 \end{aligned}$$

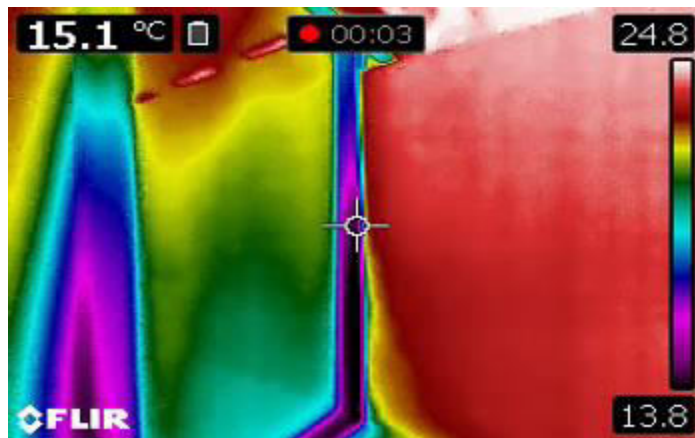
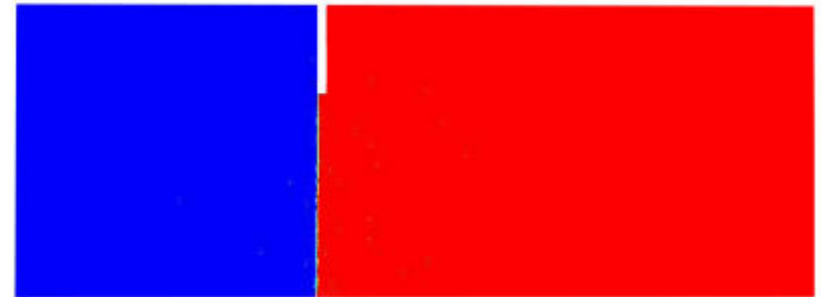
The perfect air curtain for cold storage.....?

- Easy and accurate control of the speed – stepless
- As low power consumption as possible
- Homogeneous air beam



Open doors

When a door opens the pressure and density difference between the inside and outside air leads to an exchange of air - warm, moist air enter top third of the opening and cold air escape bottom third.



No barrier

Nothing that hinders particles and insects from entering.

Case study laboratory – Sävedalen, Sweden

Alternatives

Plastic strips is a safety hazard due to the low visibility and the bacterial impact. They quickly get dirty and break easily.



Improve the visibility

By replacing the plastic strips with air curtains you get an uninterrupted view.



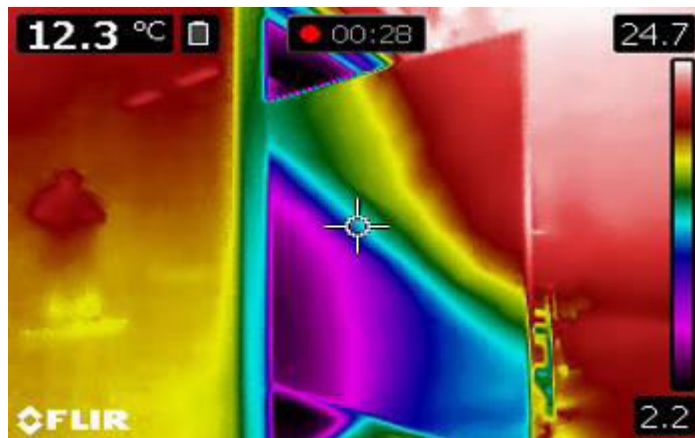
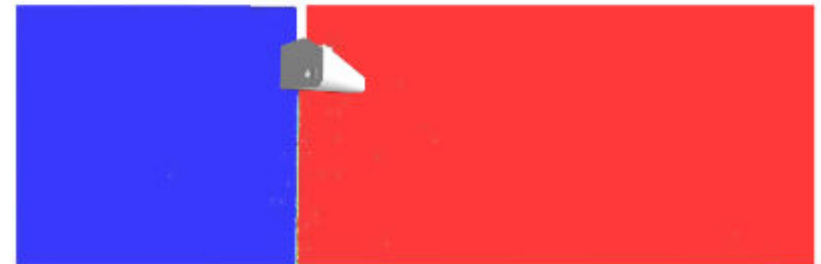
Ice building

Inflow of warm, moist air lead to ice and frost building which generate frequent defrost and service along with safety hazards.



Reduced ice and frost building by restraining inflow of warm, moist air with air curtains.

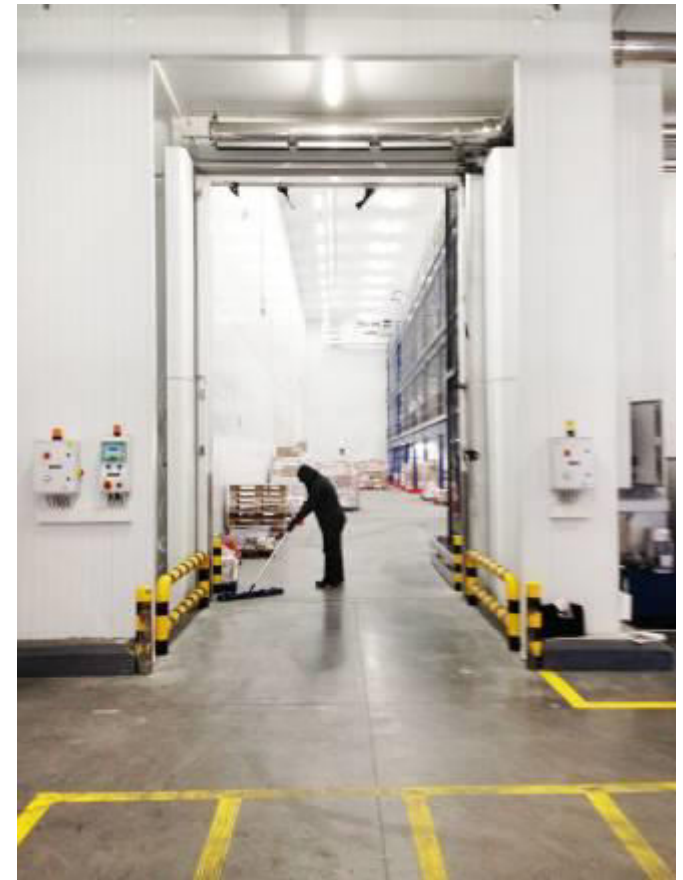
Air curtains restrain the warm, moist air from entering controlled climate areas, at the same time conditioned air is retained in the area it was intended for.



Air barrier
Reduced infiltration
of particles and
insects.

Case study laboratory – Sävedalen, Sweden

Installation examples





PAECS

Freezer room, Portugal

-18°C





PAECS - Cold storage, Thailand

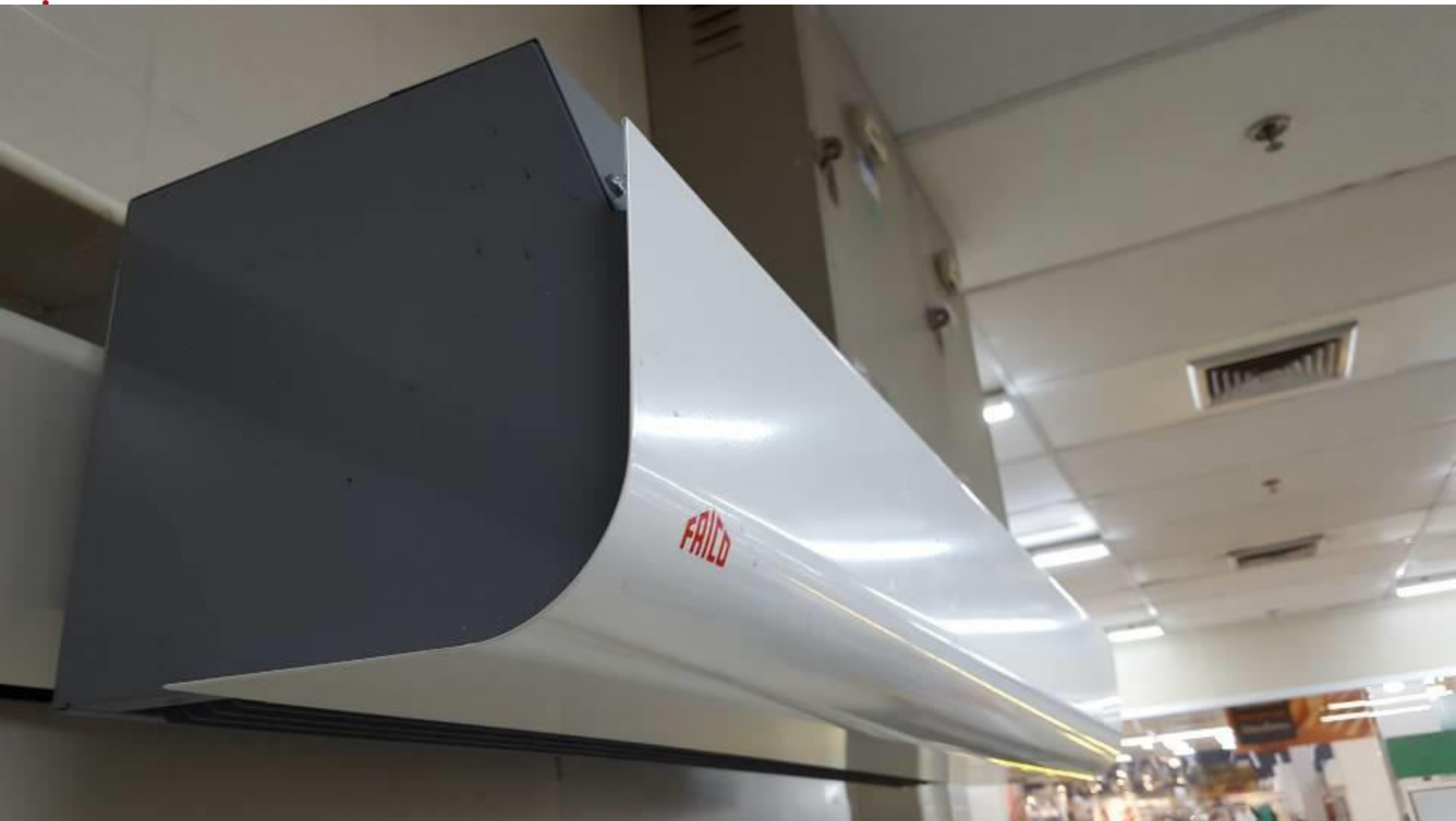




PA3515A
2 units per door
Logistic center,
Portugal
+7°C

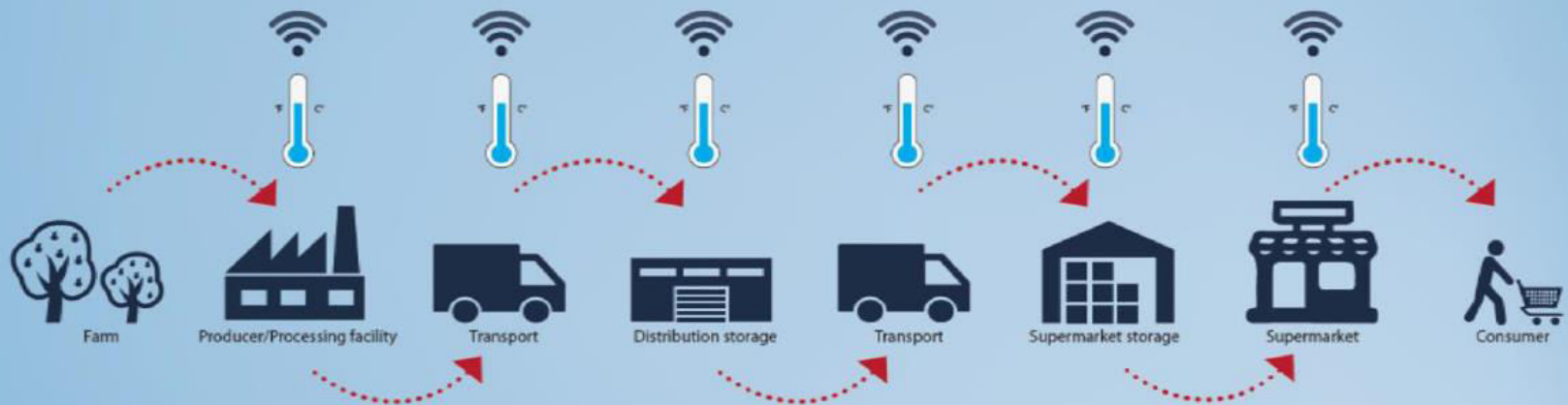


PAEC2515A
Cold Room,
Portugal
-18°C





Keep the cold chain



Cold Storage Solutions – Key Take Aways

- **Saving energy**
- **Reducing need for defrost**
- **Reducing maintenance**
- **Safer and more hygienic environment**
- **Applying EC-technology**



A decorative dotted line in red starts from the top left, goes horizontally to the right, and then turns vertically down to end at a small red circle.

Thank you for your attention!

Questions?

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www.frico.se/en