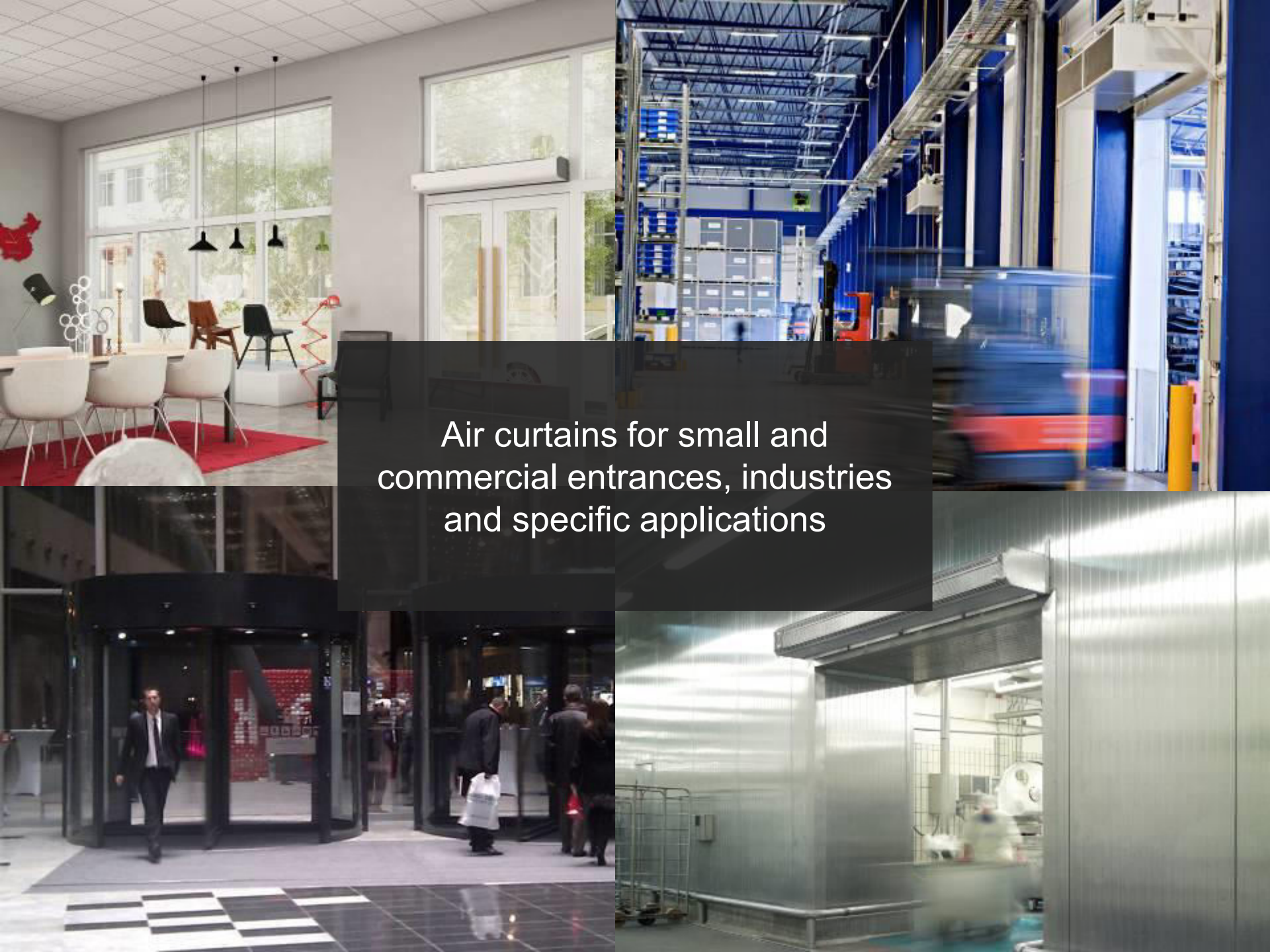
Introducing Frico

For a comfortable indoor climate



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

Benefits of air curtains in cold storage applications

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

Benefits of air curtains in cold storage applications

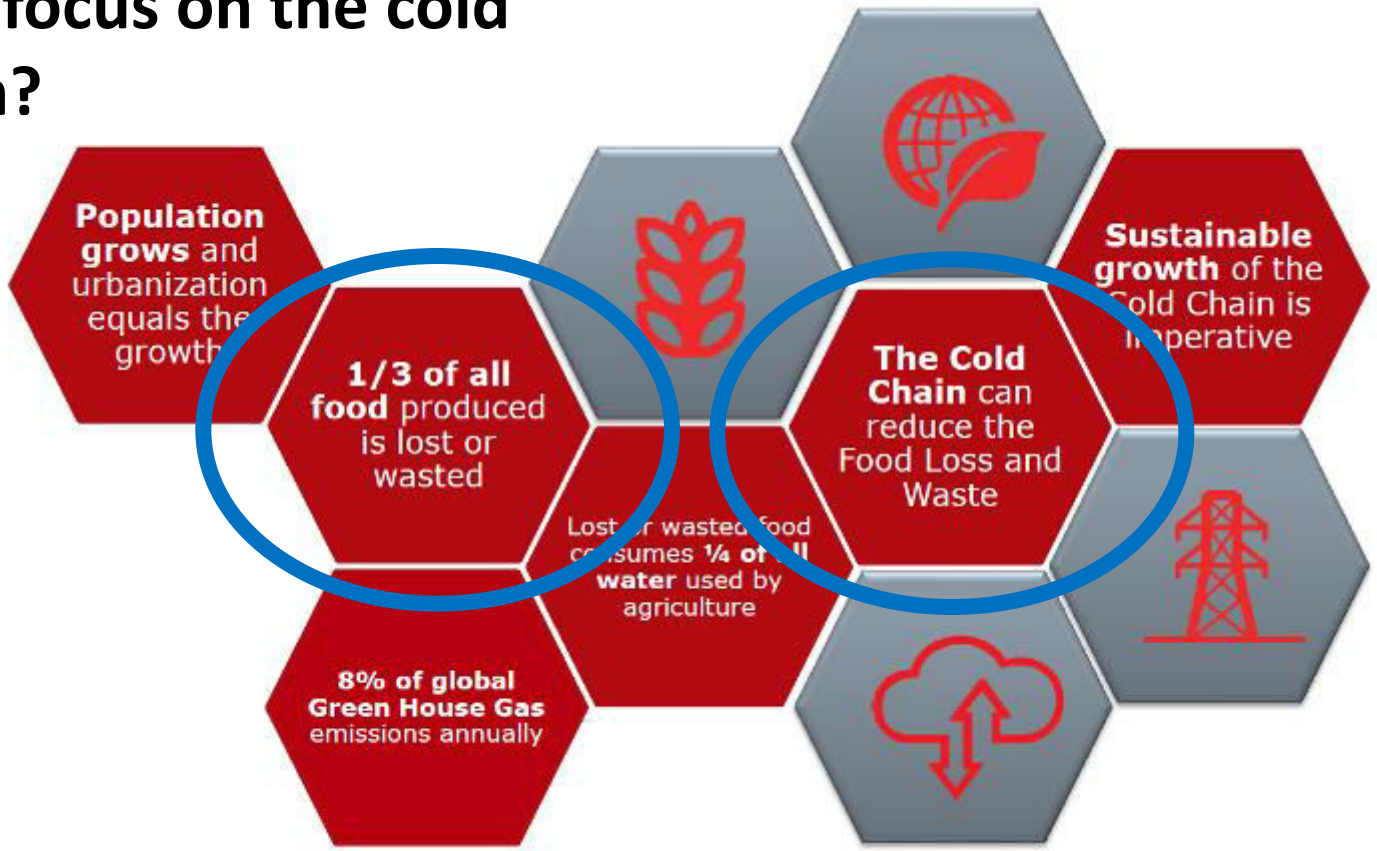
The advantages of applying state-of-the-art air curtain technologies in cold rooms

Case studies plastic strips vs air curtains

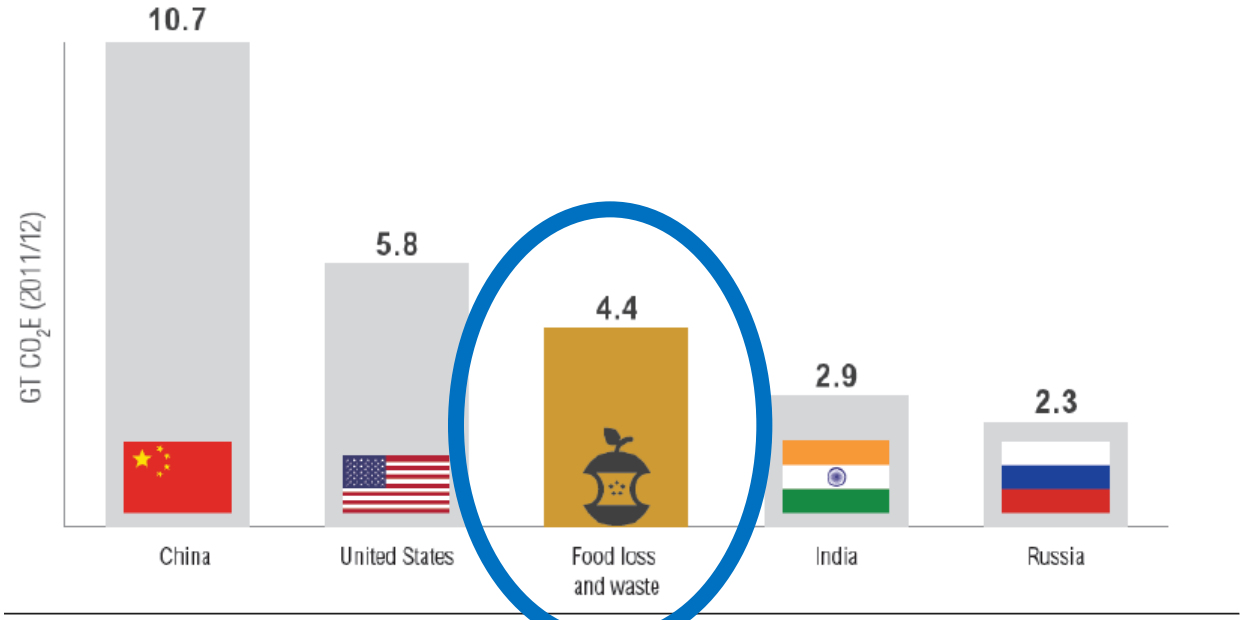
The benefits of using EC fans in air curtains


Up to
75%
energy savings
with air curtains
More hygienic
Safer environment
Less maintenance

Why focus on the cold chain?

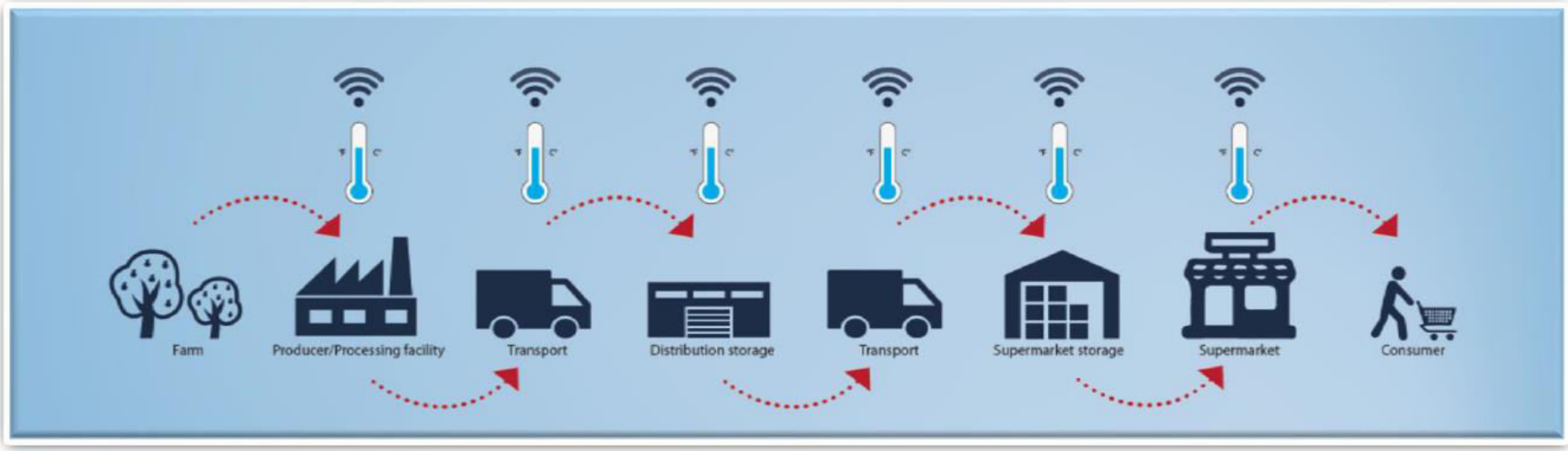


Why focus on the cold chain?

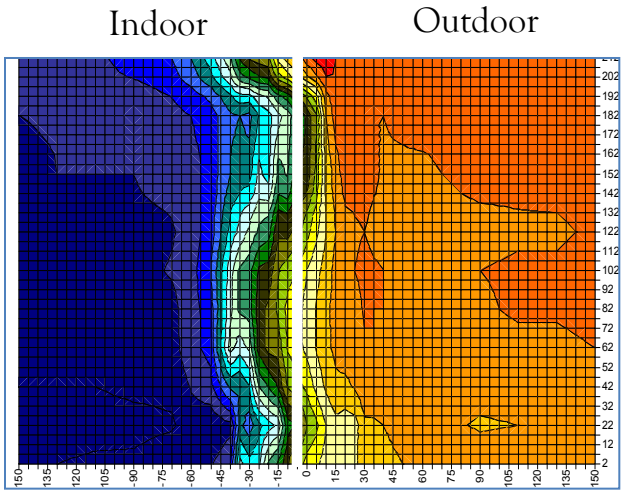


Source: WRI, SDG Target 12.3 on food loss and waste: 2016 progress report

Protect the cold chain



Benefits of air curtains in cold storage applications

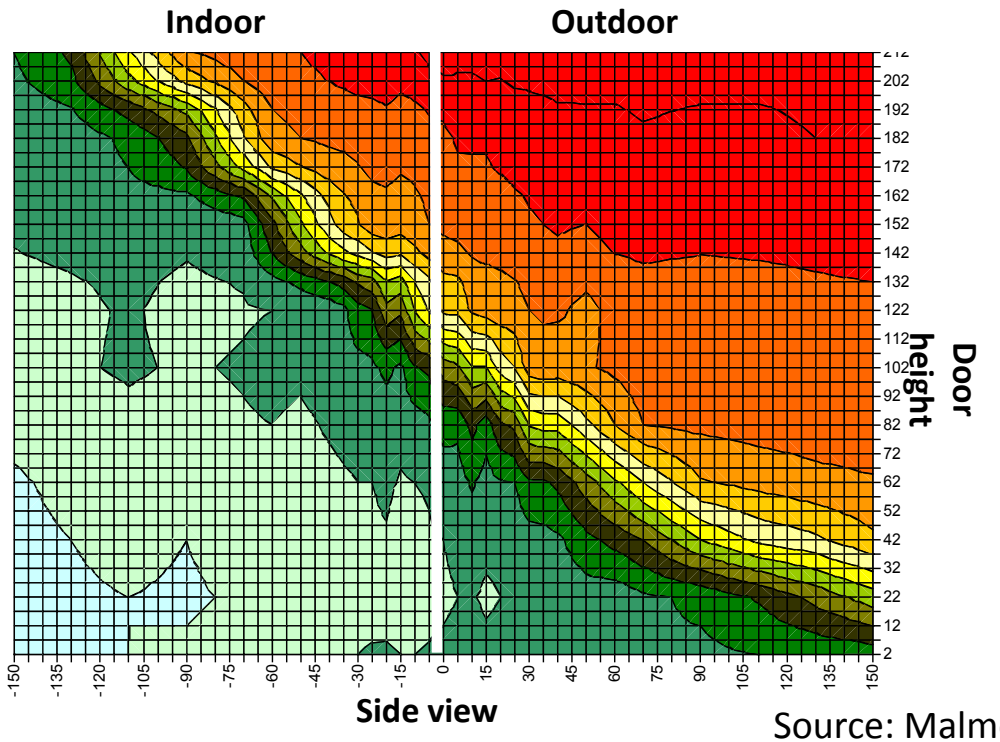


Side view

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



Source: Malmö Högskola

Saving Energy with Air Curtains

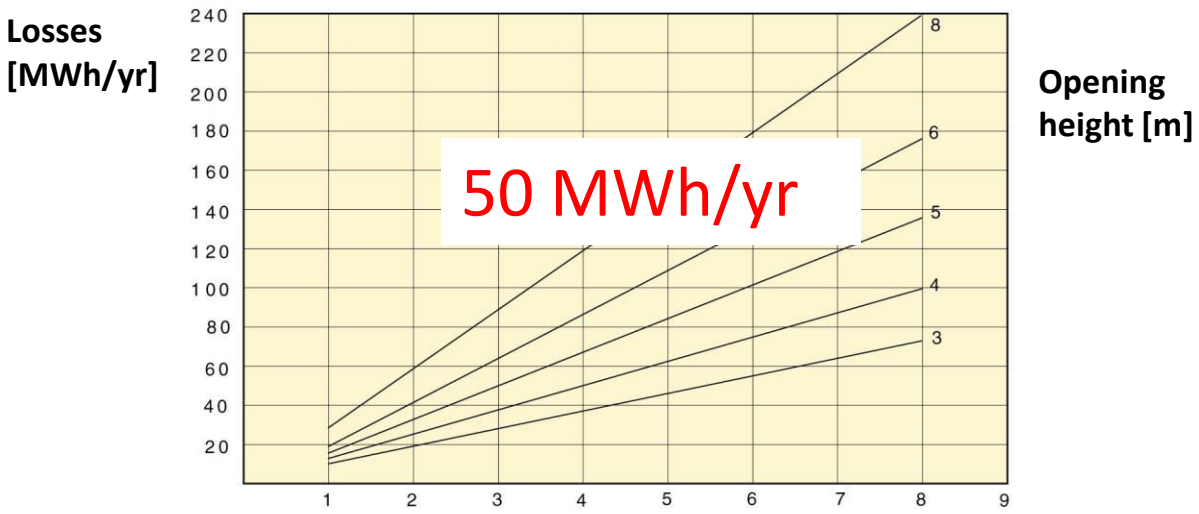
The solution

- 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

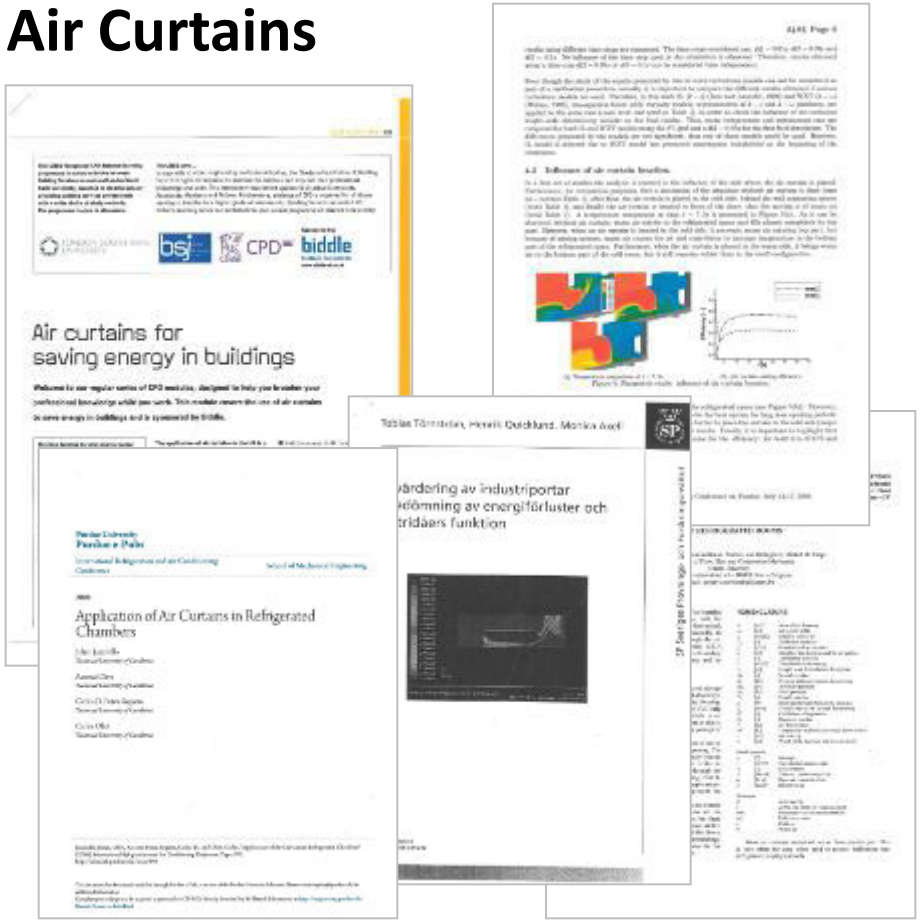


Industrial building/warehouse
Temperature difference: 15 °C
Year mean wind speed: 4 m/s
Door open 1h/day

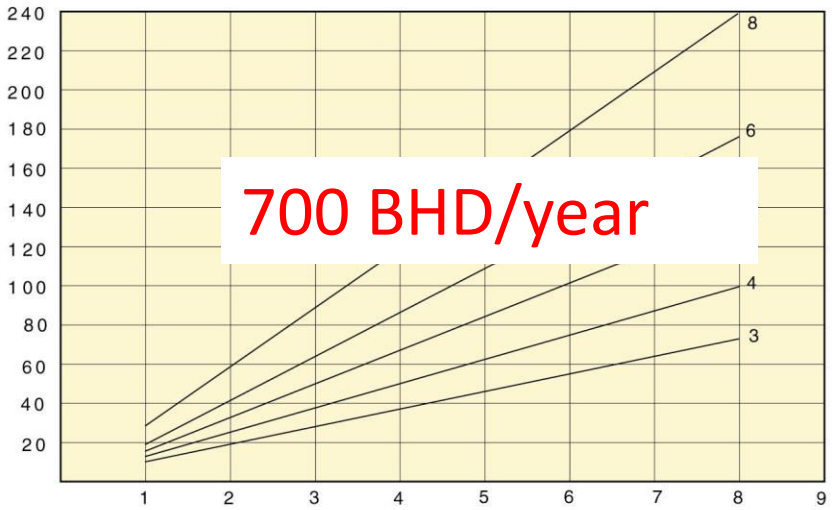
Efficiency of Air Curtains

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

Cold storage – Case study Portugal

Cold storage temp: -23°C
Heated area temp: +26 °C
Door dimensions: 2.4 x 2.1 m
Door opened 100 times a day

Cold storage – Case study

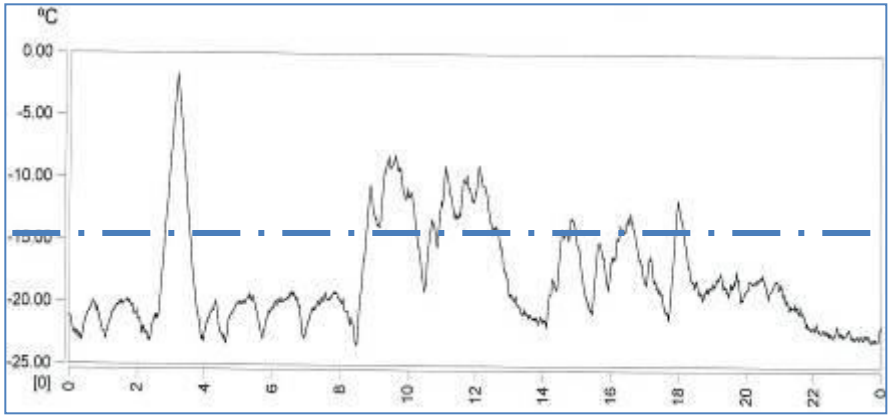
- Huge energy losses
- Temperature rise in the cold sections
- Ice on the refrigeration units
- Ice on the floor

Cold storage – Case study

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

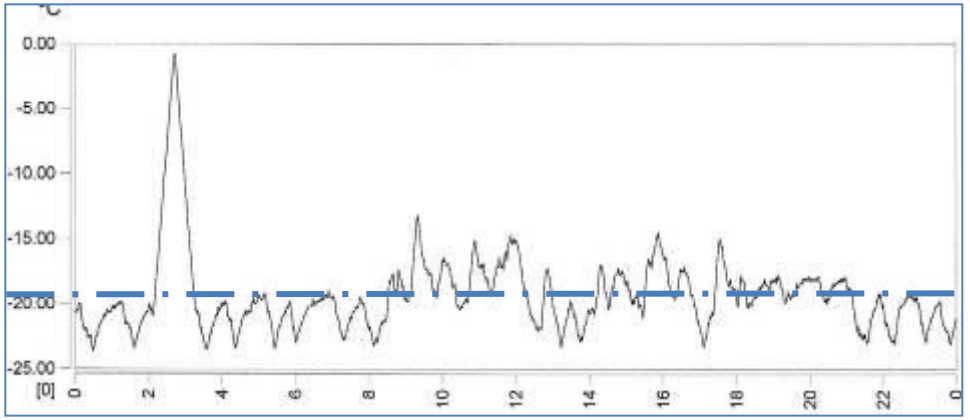
Cold storage – Case study

With Plastic Strips

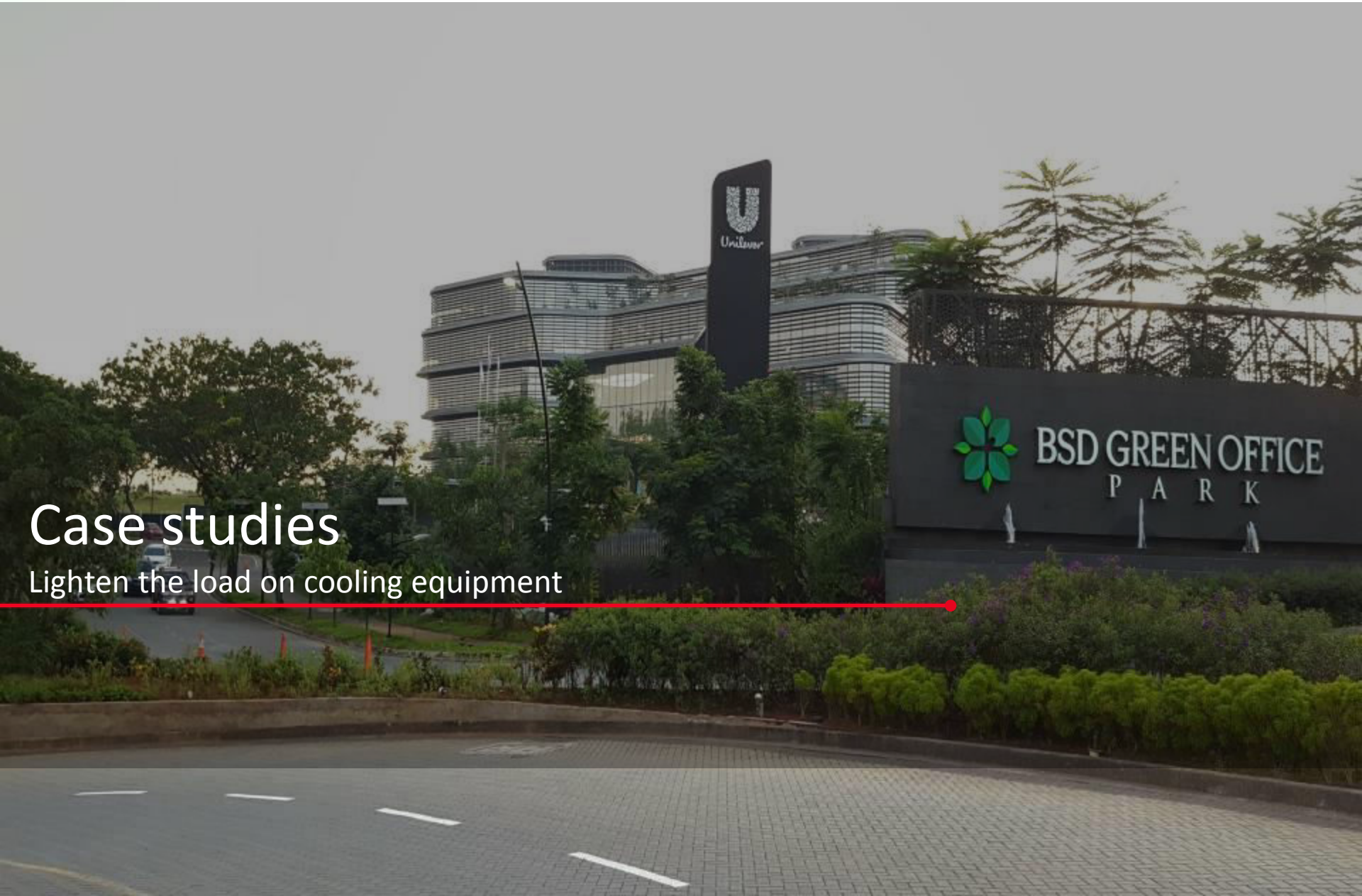


Average cold room temperature: -14°C

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

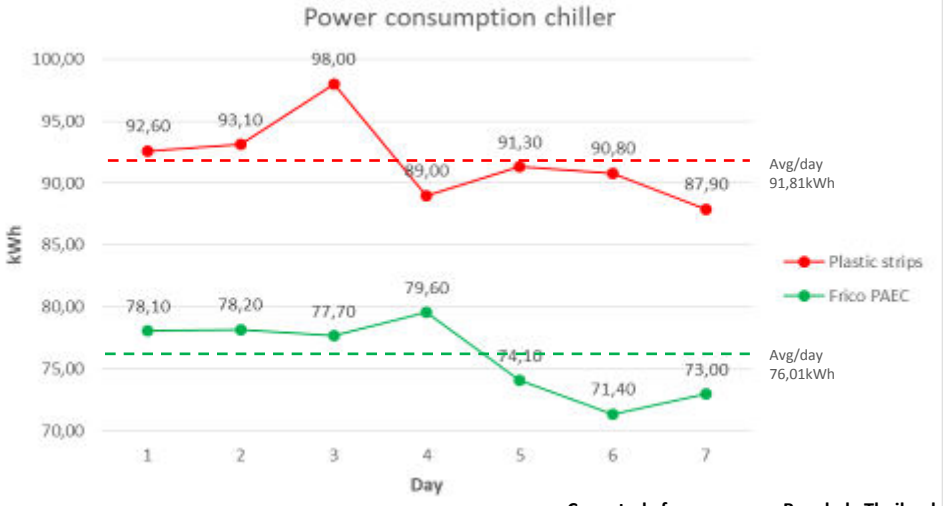
~2754kWh

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

2280kWh

~27% or 474kWh

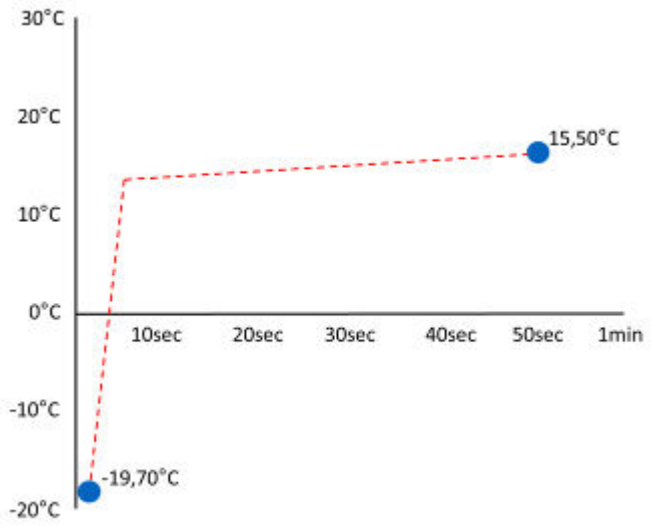
Less energy waste per month

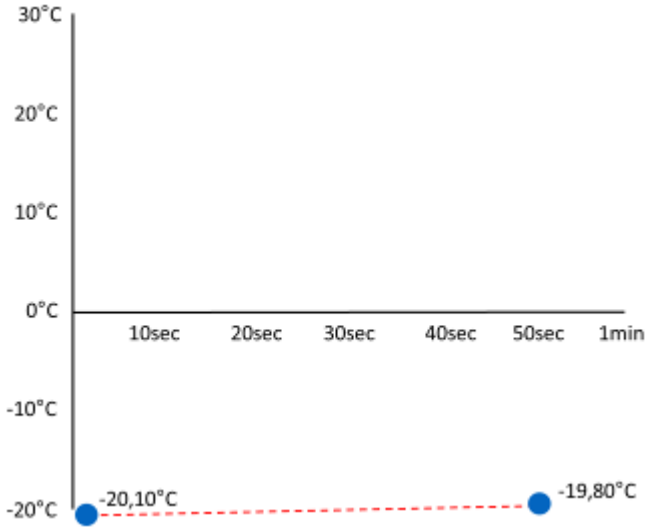


Case study freezer room– Bangkok, Thailand

Temperature rises

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





After installing a Frico 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 freezer room –Bangkok, Thailand

Case study – Cold storage

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

Total consumption for cooling per month
with plastic strips

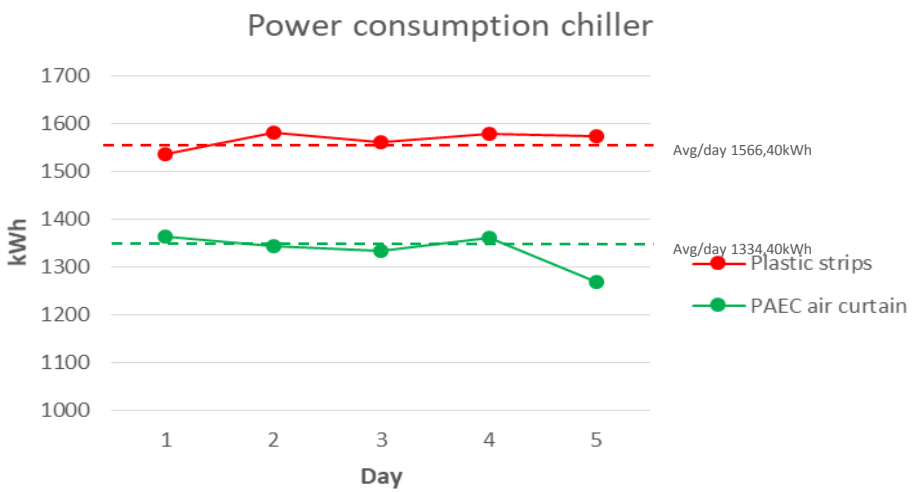
~46992kWh

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

40032kWh

~15% or 6960kWh

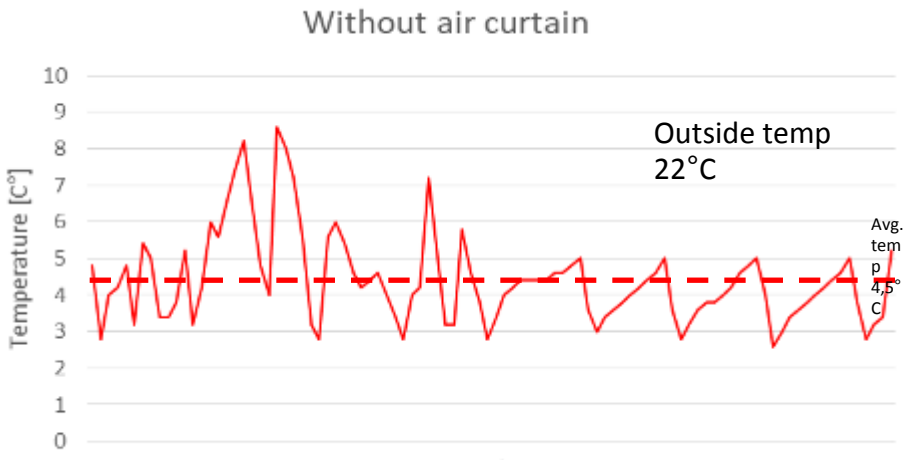
Less energy waste per month



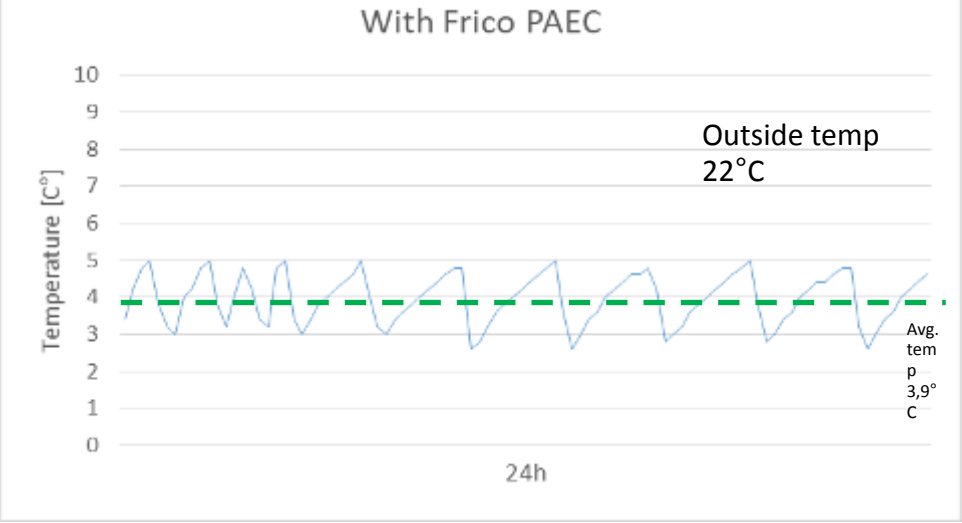
Case study cold storage– Bangkok, Thailand

Temperature fluctuation

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

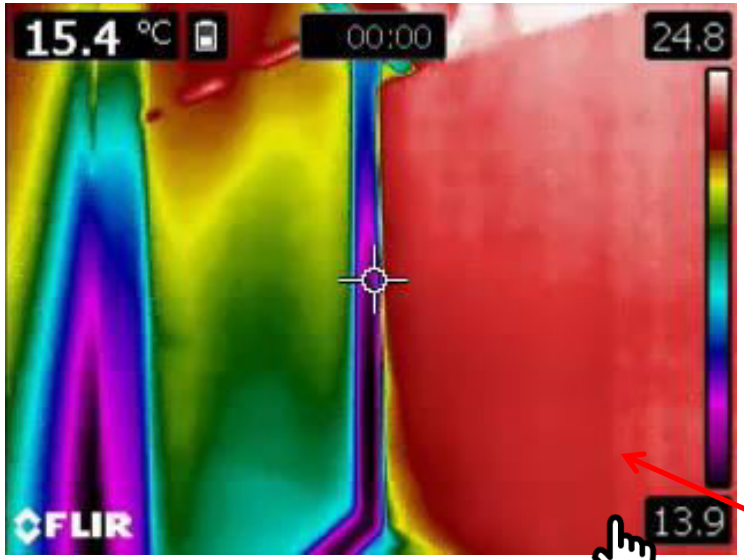


Case study Cederleufs bakery – Sävedalen, Sweden
Measured with the chiller rooms system for temperature



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

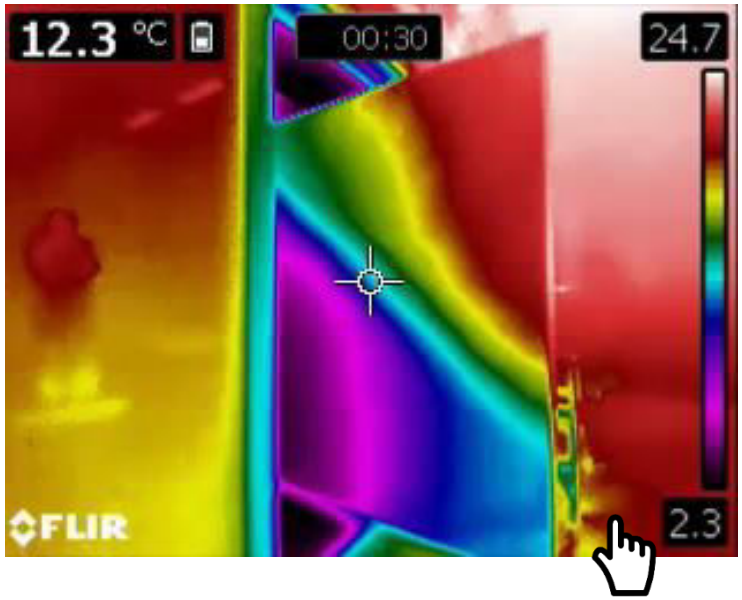
Cold Storage Solutions – Importance of correct velocity



Entrance without air curtain

Press to play

Shield placed in middle of doorway once door opens up



Press to play

Air curtain with correct air speed

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**

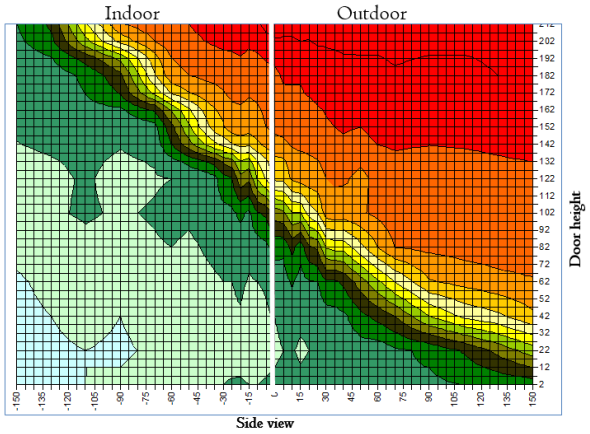
Air curtain with too low speed

Press to play

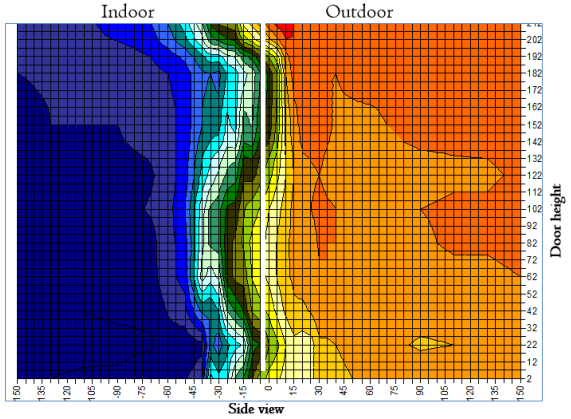
Air curtain with too low speed

- Air barrier cannot resist stress load

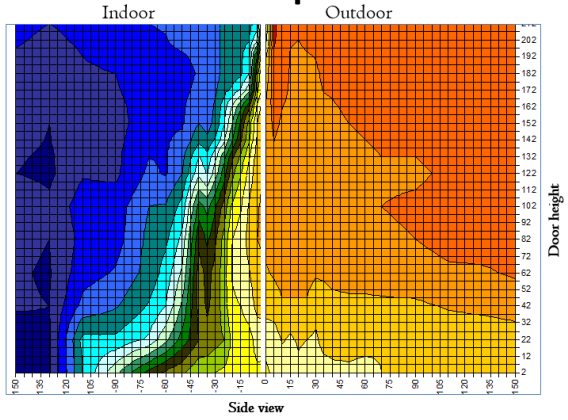
Without air curtain



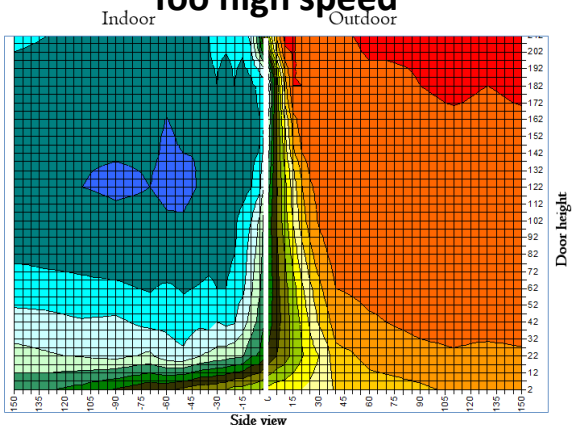
Optimal installation



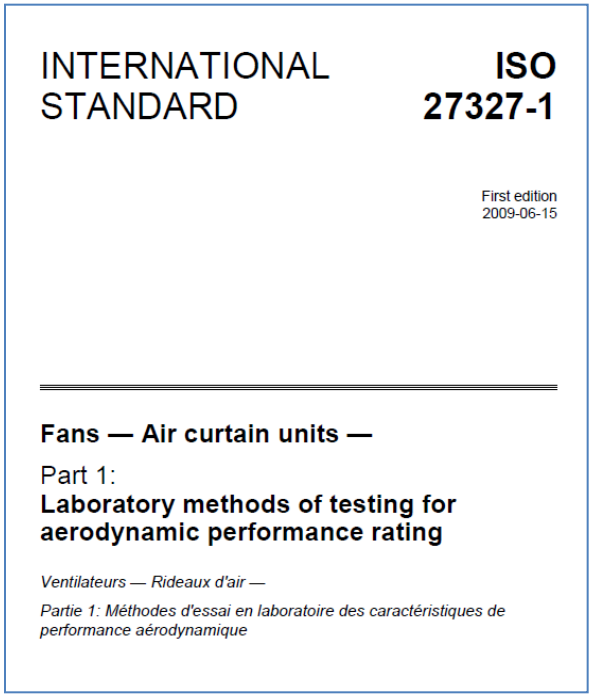
Too low speed



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 —

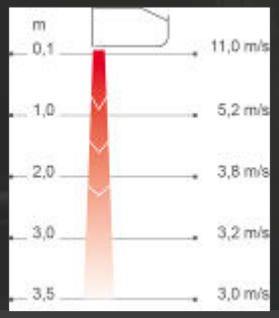
Partie 1: Méthodes d'essai en laboratoire des caractéristiques de performance aérodynamique

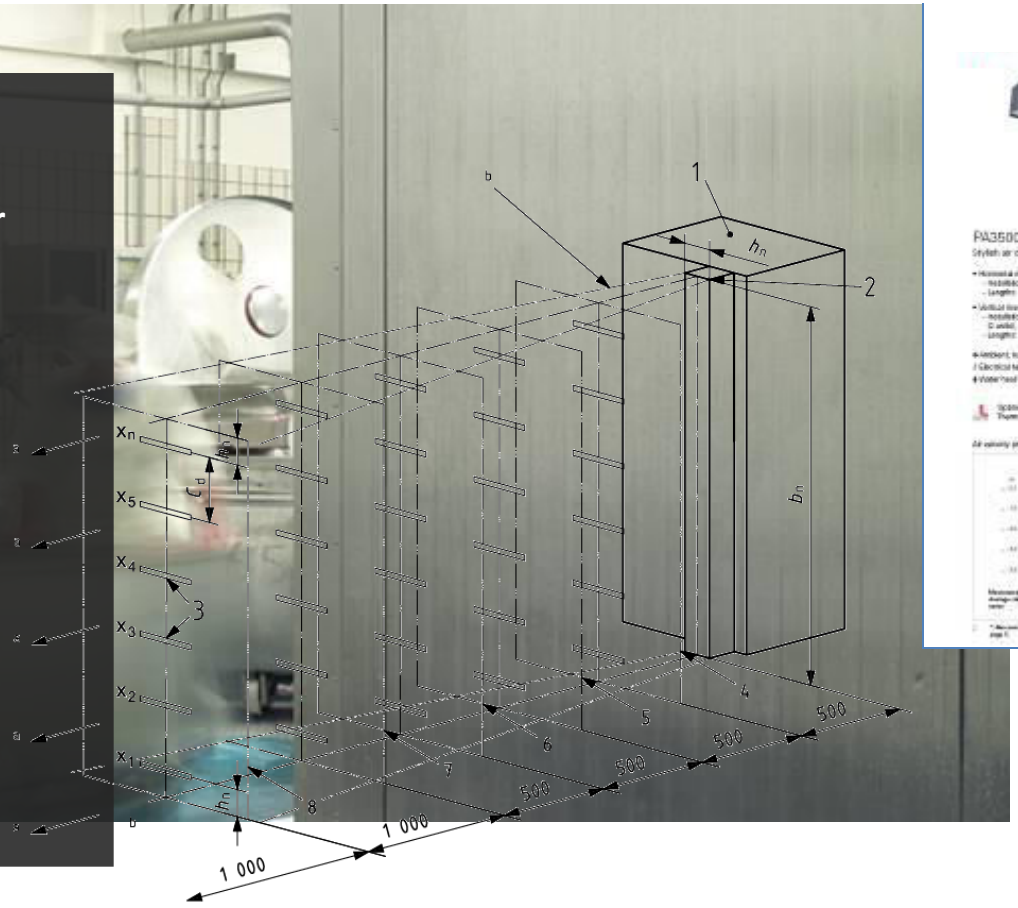
This part of ISO 27327 establishes uniform methods for laboratory testing of air curtain units to determine aerodynamic performance in terms of airflow rate, outlet air velocity uniformity, power consumption and air velocity projection, for rating or guarantee purposes.

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

Optimized air curtains for cold storages.

Velocity according to the ISO 27327-1 standard.

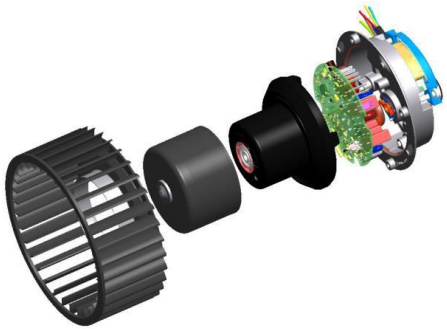




The perfect air curtain for cold storage…….?

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

Combining EC-motors with tangential impeller



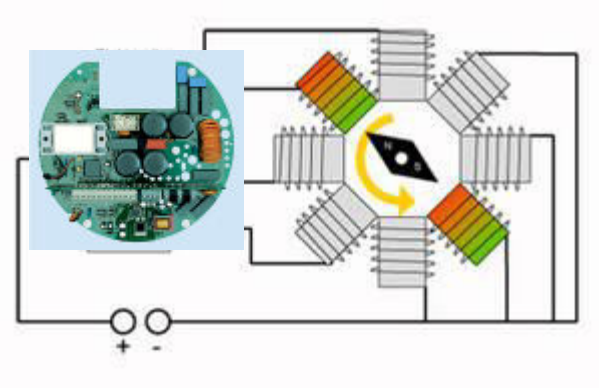
Driven by EC

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%

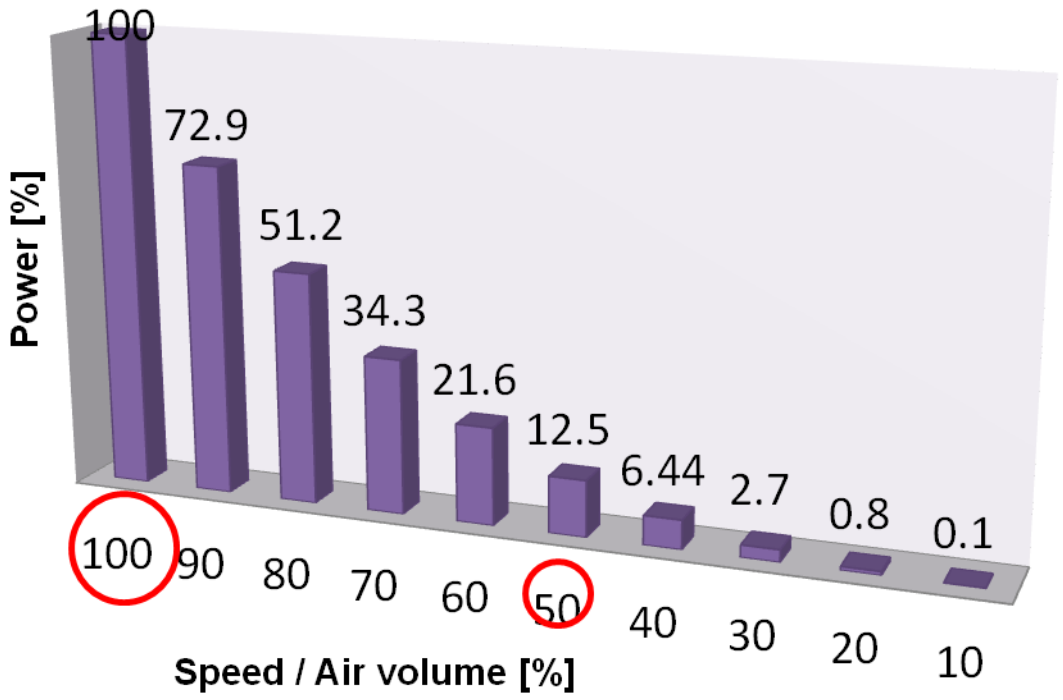
Fan laws

$V1/V2 = n1/n2$

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

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

Energy savings using EC-fans



Fan laws

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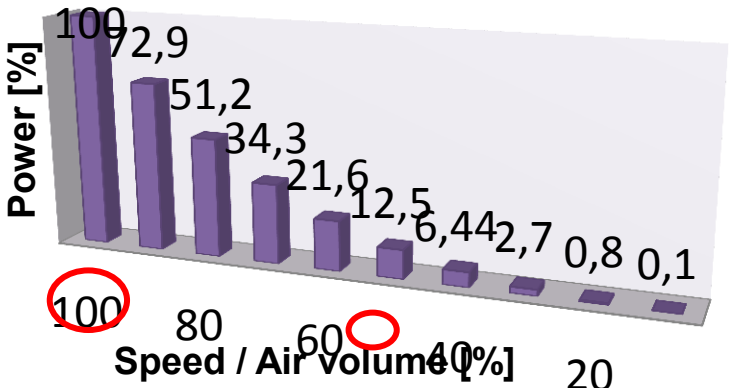
The perfect air curtain for cold storage…….?

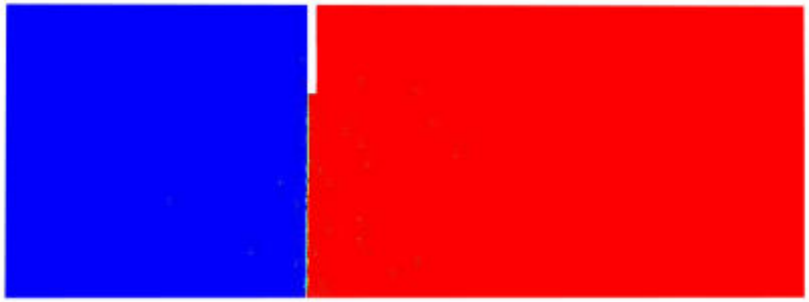
- **Easy and accurate control of the speed – stepless**

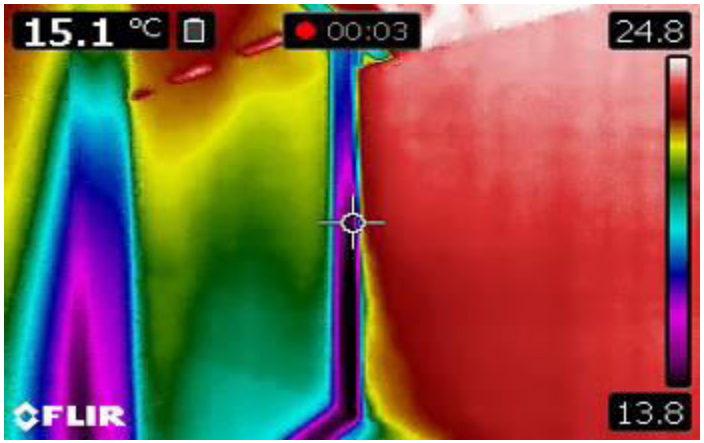
- **As low power consumption as possible**



- **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 hinder 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

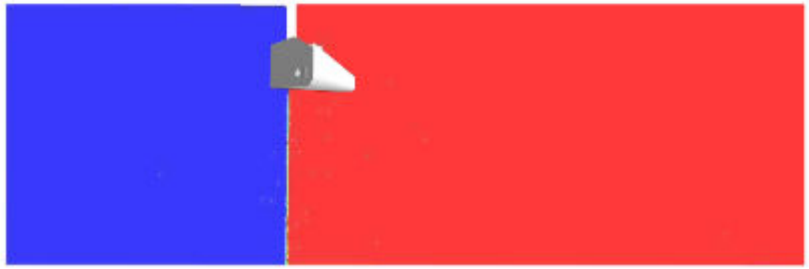
By replacing the plastic strips with air curtains you get an uninterrupted view.

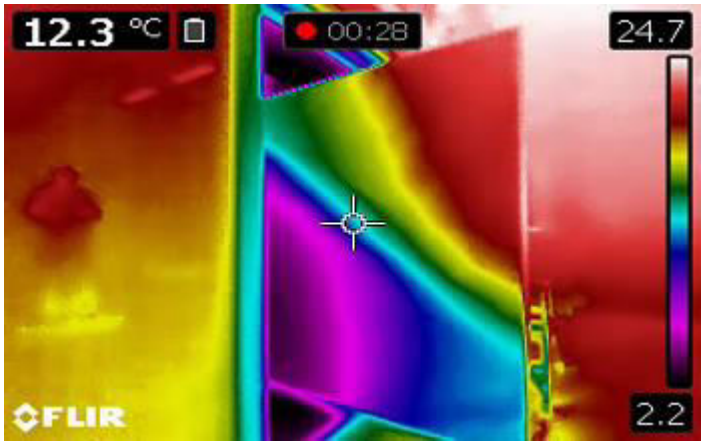
Ice building

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.

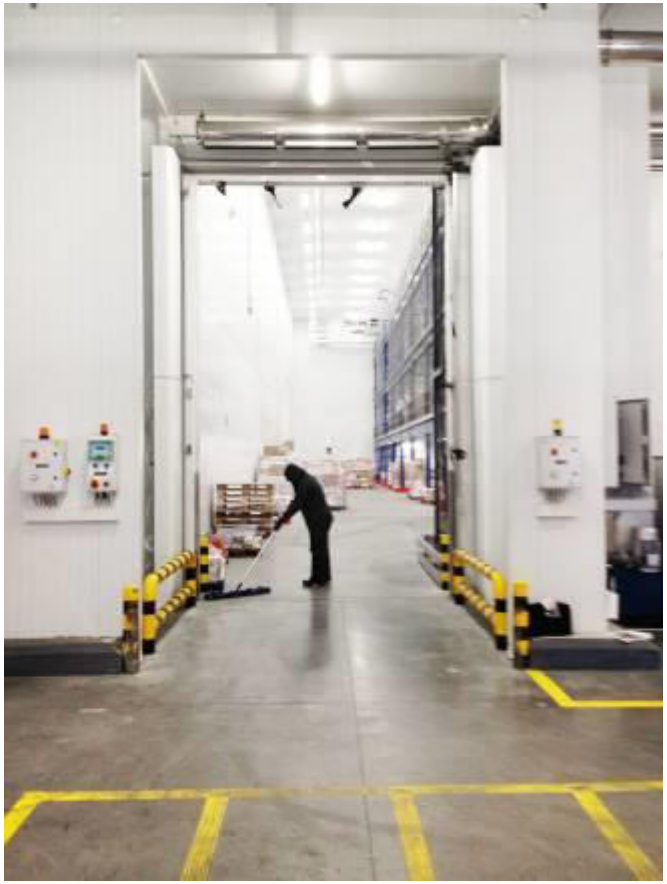




Air barrier
Reduced infiltration of particles and insects.

Case study laboratory– Sävedalen, Sweden

Installation examples



PAECS

Freezer room, Portugal

-18°C

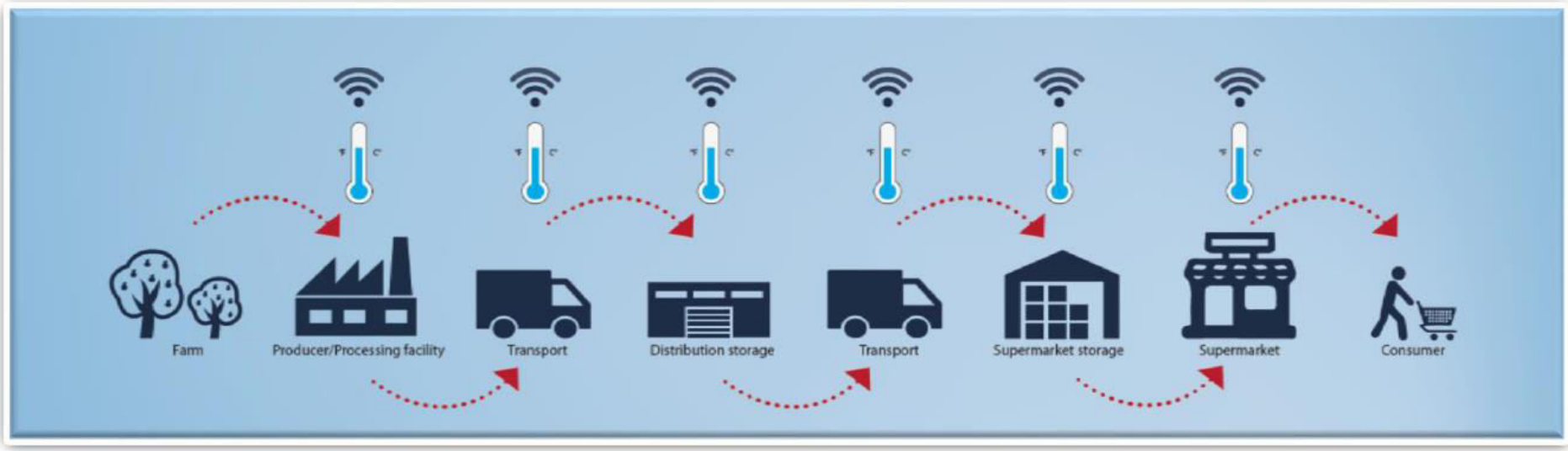
PAECS - Cold storage, Thailand

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

PAEC2515A
Cold Room,
Portugal
-18°C


FRICO

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

Thank you for your attention!

Questions*?*

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