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HVACR Leadership Workshops

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Welcome to:
Retrofits for Supermarkets

HVACR Leadership Workshop by Eurovent Middle East

Moderated by

Markus Lattner
Managing Director
Eurovent Middle East

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Eurovent Middle East

Association of the **H**eating, **V**entilation, **A**ir-**C**onditioning and **R**efrigeration Industry in the Middle East

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Service Providers
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KEY PERSPECTIVES ON THE REGION'S HVACR INDUSTRY

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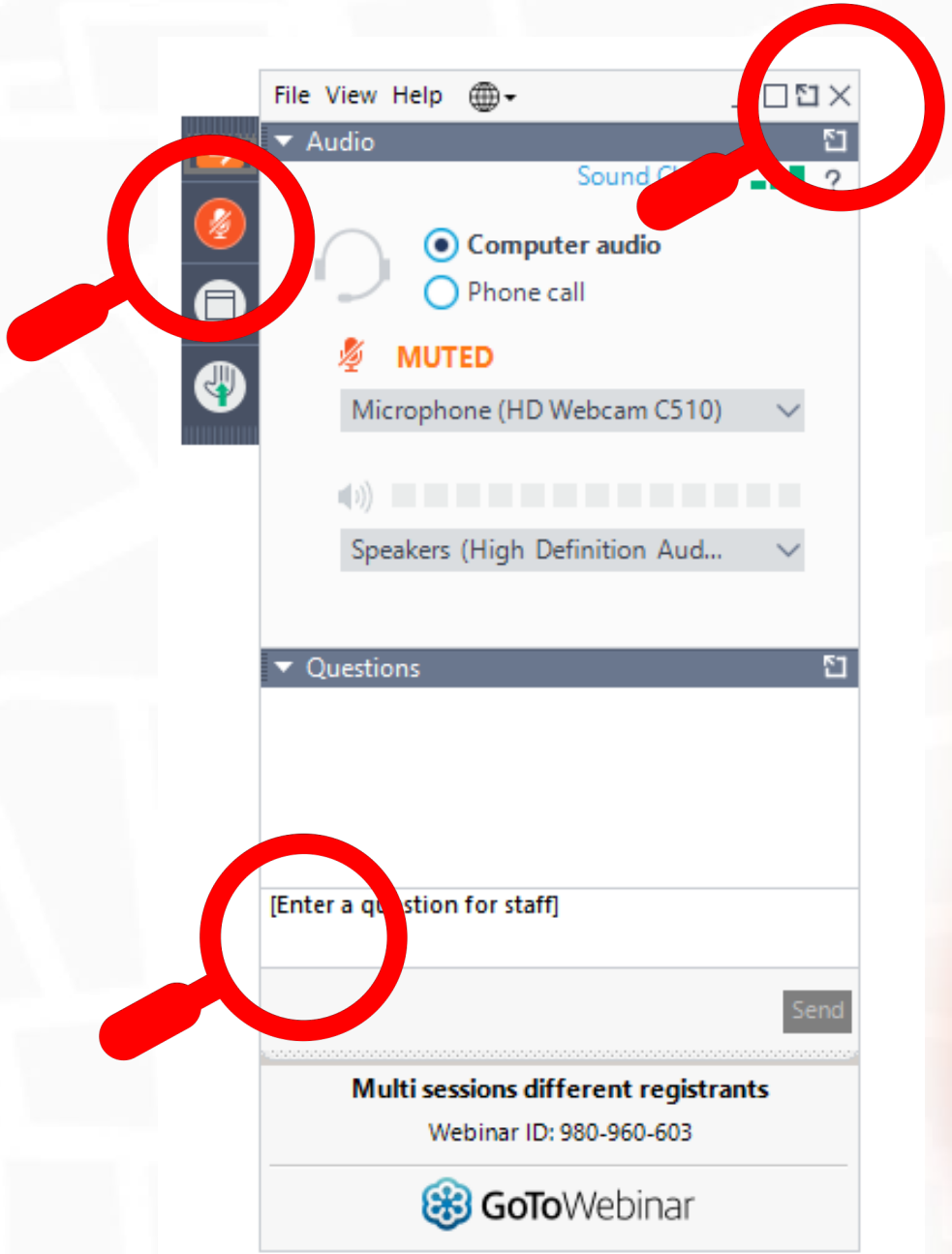

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Agenda

1. Energy efficiency in supermarkets: An overview of retrofit options
2. Efficiency and reliability for supermarket retrofits using DC technology
3. Optimising energy efficiency by adding variable speed to compressor racks
4. Energy efficiency of air curtains in supermarkets and cold rooms
5. Savings from the air: Retrofitting fans in supermarkets
6. Doing more with less: Smart stores for energy efficiency
7. Panel Discussion, Q&A

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Energy Efficiency in Supermarkets:
An Overview of Retrofit Options

Mr Andrea Cavalet
Contracting & After Sales Director
EPTA Middle East

Epta

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Agenda

- Key Demands of Refrigeration
- Energy Consumption
- Techniques to Improve Energy Efficiency during Retrofit
- Design and Sustainable Approach to New Project
- HFC Phase-down and solutions
- Summary

Key Demands of Refrigeration

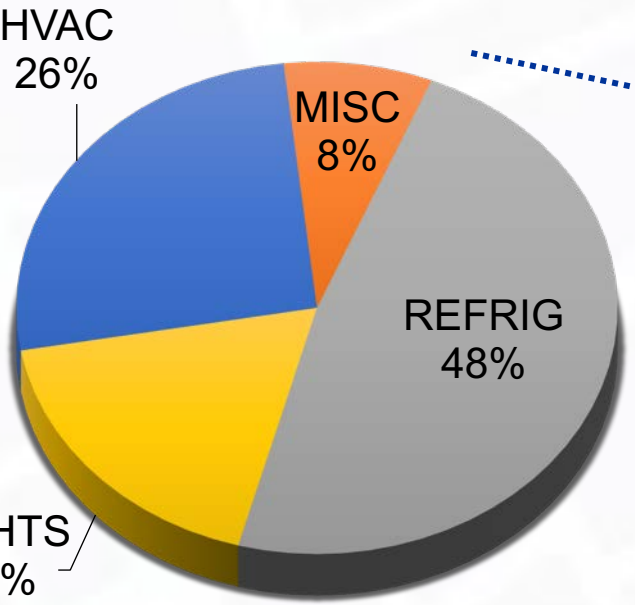
- Safety and food preservation with top quality
- Reliability
- Lowest operating cost
- Sustainability

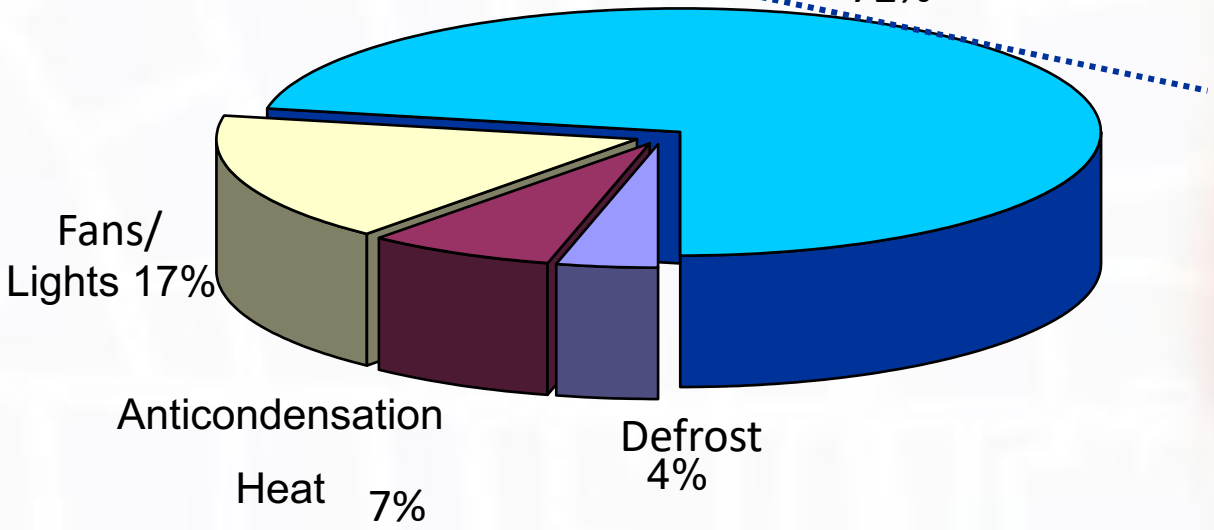
Energy Consumption

90%

10%

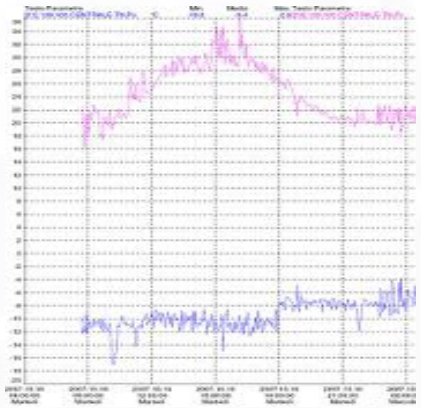
Compressor & Condenser 72%

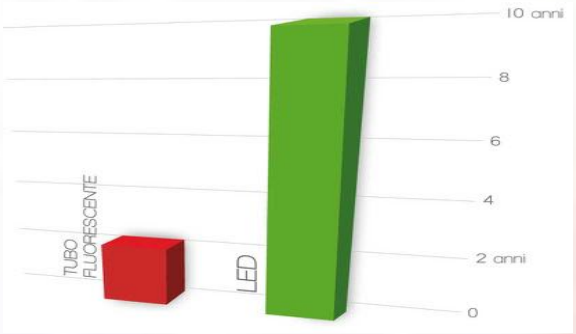




Techniques to Improve Energy Efficiency

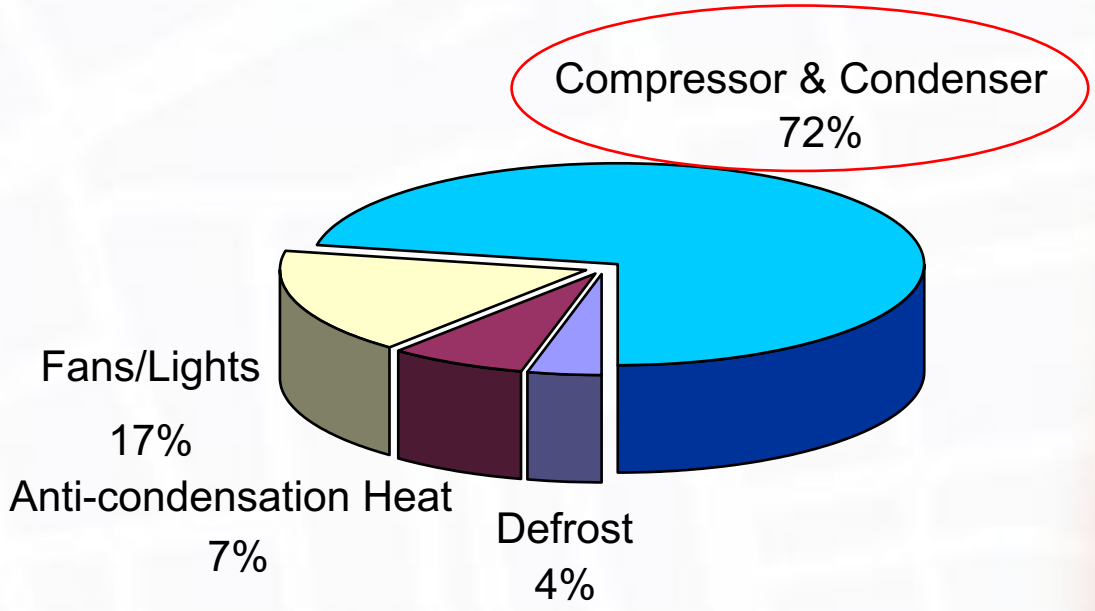
- Door/Covers
- Variable Frequency Drives
- LED Lights
- EC Fans
- Remote Monitoring System
- Refrigerant Retrofit





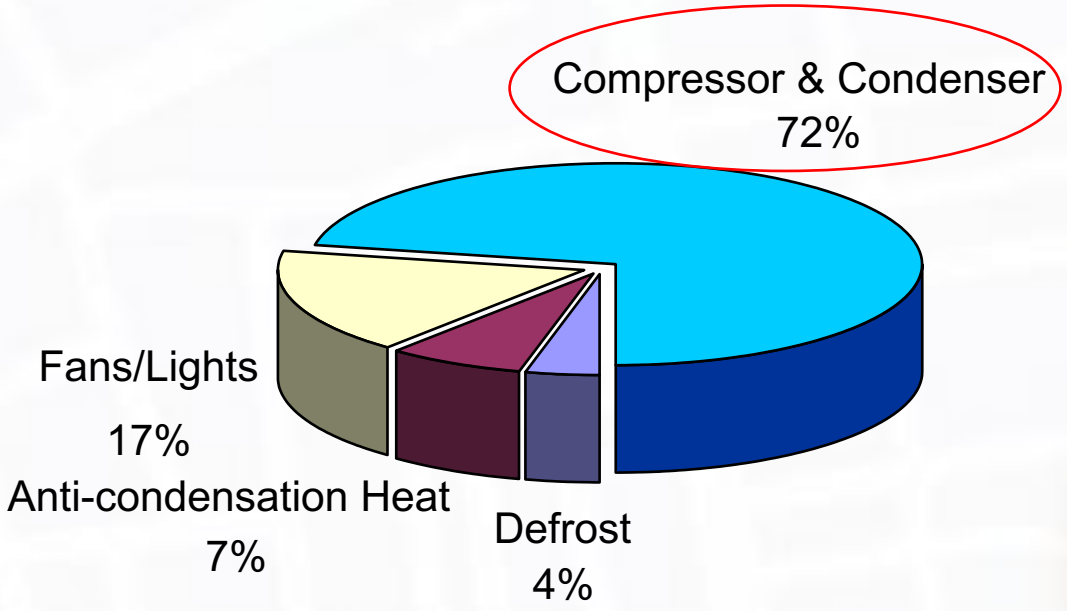
Doors on Chiller Displays
Covers on Freezer Displays

- Up to 40% of decrease on refrigeration load
- Optimal food preservation
- Increases shelf-life
- No unpleasant ‘cold corridor’



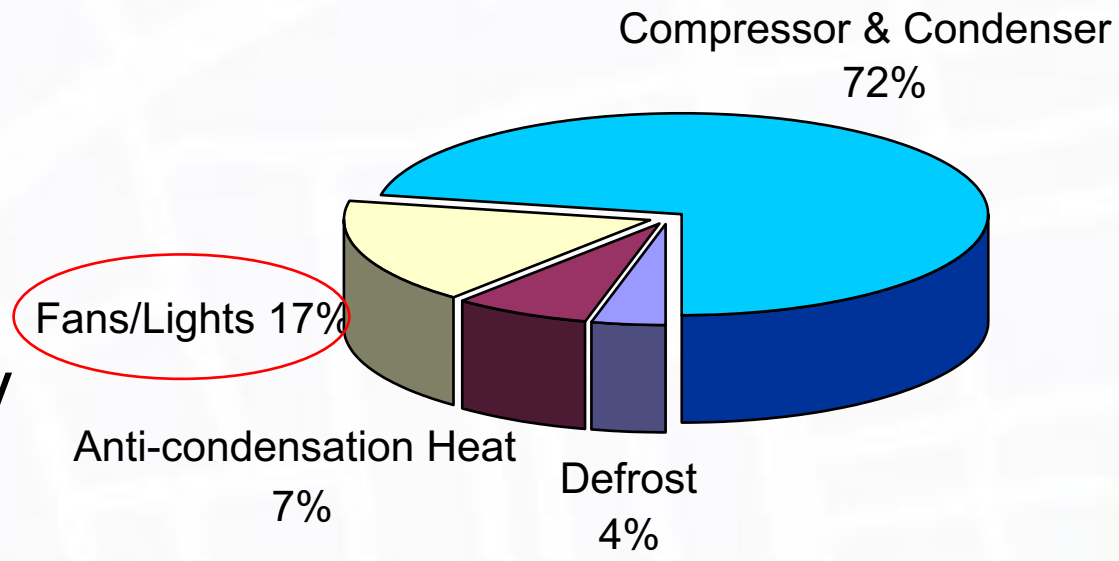
Variable Frequency Drives

- 10-15% in energy savings
- Reduces compressor cycling



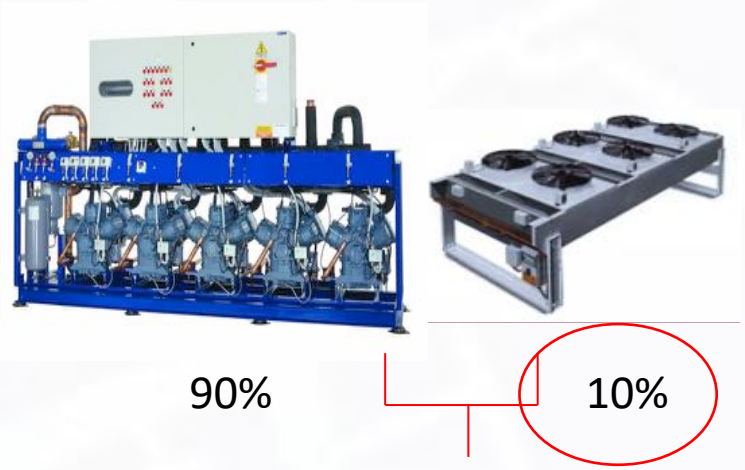
Retrofit of LED Lamps

- 50% energy savings
- Increased lifespan
- Low heat dissipation
- Improves product visibility



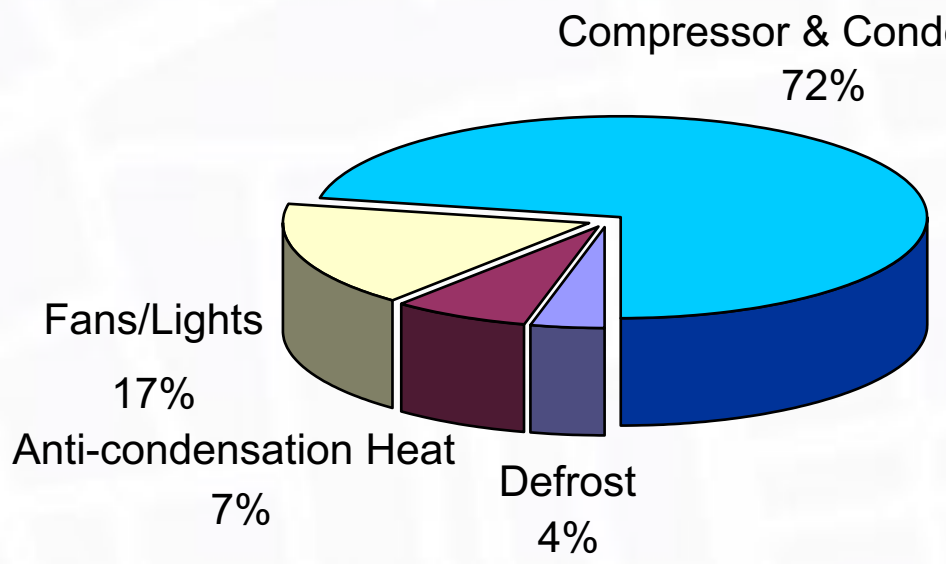
EC Fans

- 70% increase in energy savings
- Reduces maintenance requirements
- Reduced noise



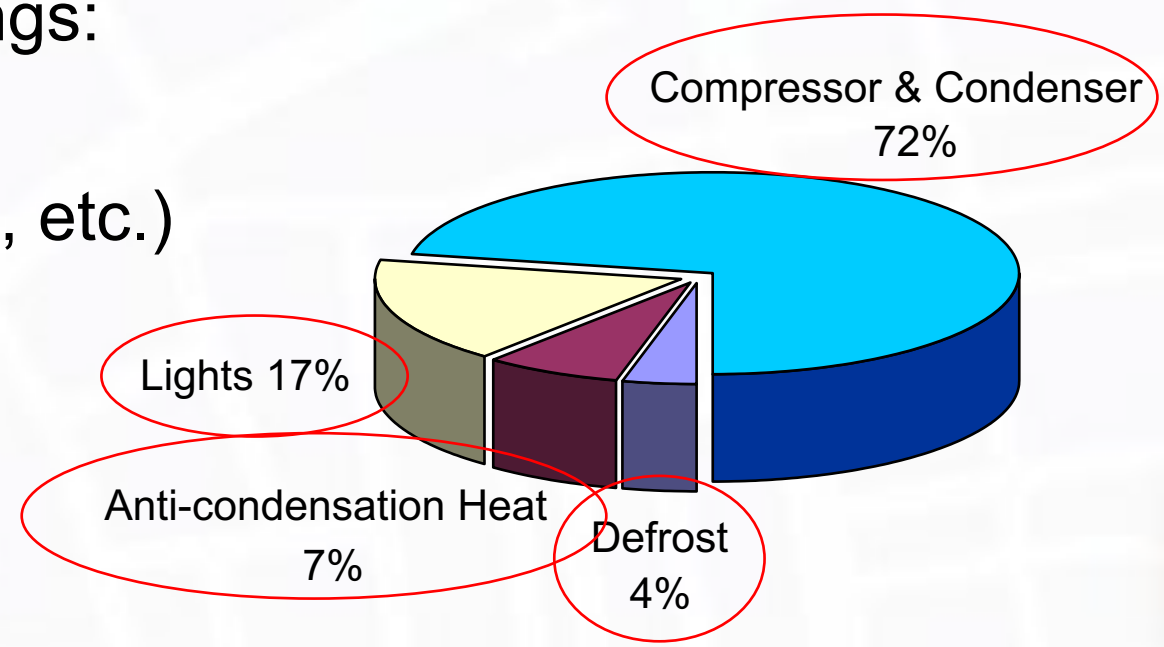
90%

10%



Remote Monitoring Systems

- Up to 10% in energy savings: Optimisation
- Alarm management (temp, etc.)
- Light/door opening control
- Preventive action



Refrigerant Retrofit with HFO blend

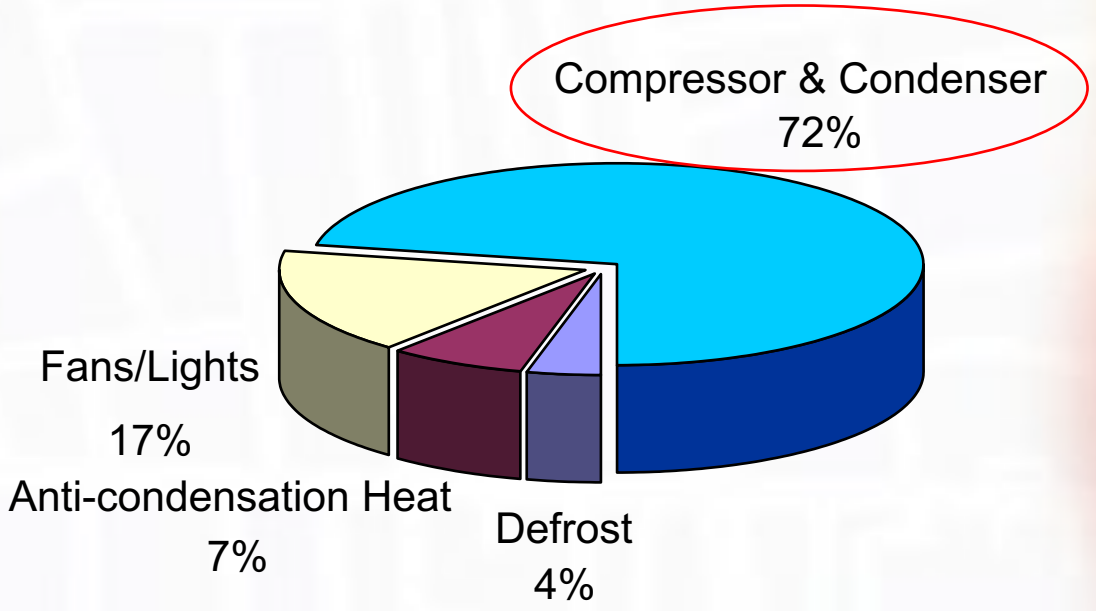
PROS

- Improved energy efficiency
- Safe and non-flammable (ASHRAE A1)
- Extensively field tested with no equipment/lubricant changes (in case of R404 retrofit)
- Miscible with POE lubricants

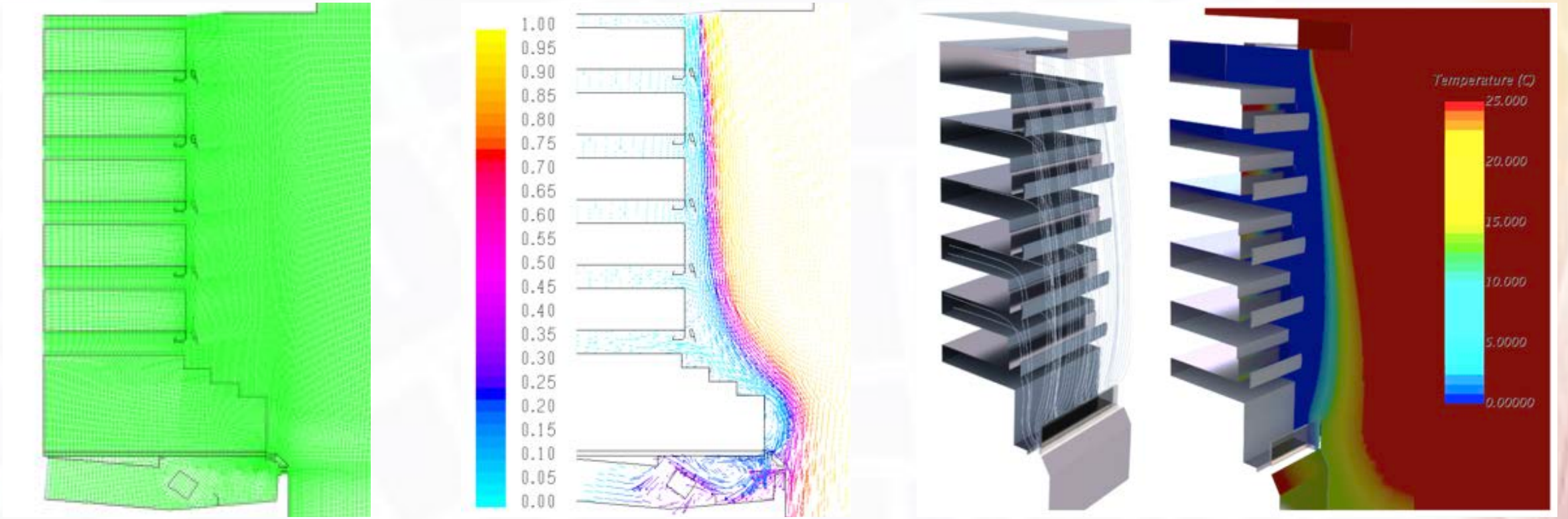
CONS

- Solution to be studied case by case (LT!?)
- High cost of refrigerant
- Higher pressure, close to rack limit (ME)
- Higher disharge temp – need complication on the rack

Product	Capacity	Efficiency	GWP AR5
R404A	100%	100%	3943
Solstice® N40 (R448A)	100-105%	110-115%	1273



Project - Design phase



Sustainability

- Sustainability is a complex concept

"Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs."
- UN World Commission on Environment and Development definition

Environmental sustainability is the rates of renewable resource harvest, pollution creation, and non-renewable resource depletion that can be continued **indefinitely**.

Economic sustainability refers to practices that support long-term economic growth **without negatively impacting social, environmental, and cultural aspects of the community.**

Economic indicators are **capital costs** and **operating costs**.
Capital costs represent expenses incurred when setting up the process.

Operating costs give information about daily/monthly/yearly consumption.

The economic pillar of sustainability is where most businesses feel they are on firm ground. To be sustainable, a business must be profitable. That said, profit cannot trump the other two pillars. In fact, profit at any cost is not at all what the economic pillar is about.

Sustainable profitability for a business means that an organization provides a service or product that is both profitable and environmentally friendly.

Frozen – Insulation and Glass Door Technology efficiency in UAE Market

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Glass door chiller saves 50-60% compared with open displays

in UAE Market

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HFC Phase-Out The Kigali Amendment

UAE experts laud Kigali climate deal

Dubai: Top climate experts in the UAE have lauded a new climate deal reached in Kigali, Rwanda last week — an agreement that will gradually phase out hydrofluorocarbons (HFCs) to reduce global warming thanks in part to a major commitment by hundreds of scientists gathered in Dubai in November 2015.

Called the Dubai Pathway on HFCs, last year's five-day assembly in Dubai of 50 government ministers and 500 scientists and delegates from 197 countries set the stage for Saturday's historic HFC agreement in Rwanda when all delegates agreed to work towards a 2016 amendment to the Montreal Protocol.

Caps will be phased in the beginning of 2019 although some countries such as Pakistan and Gulf states agreed to a 2028 deadline for economic reasons.

The deal is expected to remove up to 85 per cent of HFCs from the atmosphere by the year 2047.

Editorials Op-Eds Letters Columnists

Dubai Pathway successful in planning end of HFCs

Montreal Protocol is one of the few bright spots in the human race's battle to save the planet

Published: October 16, 2016 16:57
Gulf News

The terrible way that the human race has abused its planet is abundantly clear. Global warming, endemic pollution and a destructive reliance on unsustainable energy are only a few indications of a much wider danger that casual abuse can continue to the long term destruction of the planet's biosphere. Therefore it is heartening when we find examples of the global community taking action to stop the crisis.

	Non-A5 (developed countries)	A5 (developing countries) Group 1	A5 (developing countries) Group 2
Baseline HFC component	2011-2013 (average consumption)	2020-2022 (average consumption)	2024-2026 (average consumption)
Baseline HCFC component	15% of baseline	65% of baseline	65% of baseline
Freeze	-	2024	2028
1st step	2019 - 10%	2029 - 10%	2032 - 10%
2nd step	2024 - 40%	2035 - 30%	2037 - 20%
3rd step	2029 - 70%	2040 - 50%	2042 - 30%
4th step	2034 - 80%	-	-
Plateau	2036 - 85%	2045 - 80%	2047 - 85%
Notes	Belarus, Russian Federation, Kazakhstan, Tajikistan, Uzbekistan, 25% HCFC component and 1st two steps are later: 5% in 2020, 35% in 2025	Article 5 countries not part of Group 2	GCC (Saudi Arabia, Kuwait, United Arab Emirates, Qatar, Bahrain, Oman), India, Iran, Iraq, Pakistan

Greenhouse Warming Refrigerants

- **R404A=3,922**
- R410A=2,088
- R407A=2,107
- R407F=1,825
- R134A=1,430
- HFO1234yf=5
- R1270=2
- **R290=3**
- **R744 (CO_2)=1**

Global Warming Potential (GWP)

R404A has a GWP of 3922 CO_2 equivalent →

The release of 1 kg has the same effect of release of nearly 4 Tonnes CO_2

Vehicles: 120.4 grams of CO_2 per km average

1 kg of R404 = 3922*1/0.1204= 38'000 km

Hyper Market first charge of Refrigerant→ 1000 kg = 38'000'000 km

38'000'000/80'000 = 500 Vehicles lifetime

1 Hyper Lifetime with R404A, considering leakages →

1000/1500 vehicles lifetime

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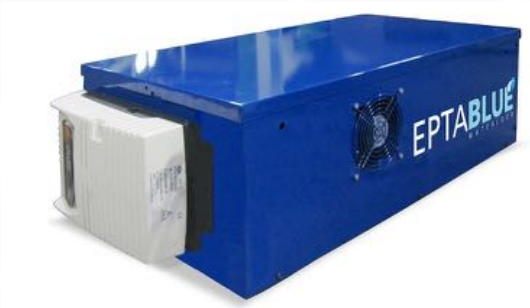
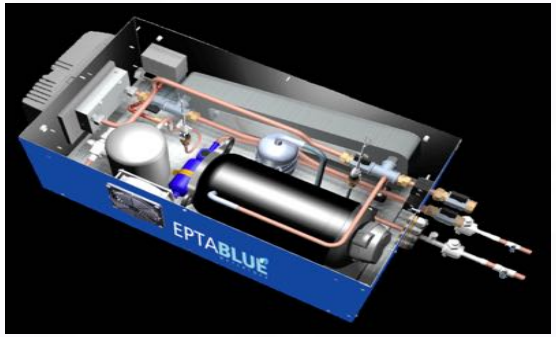
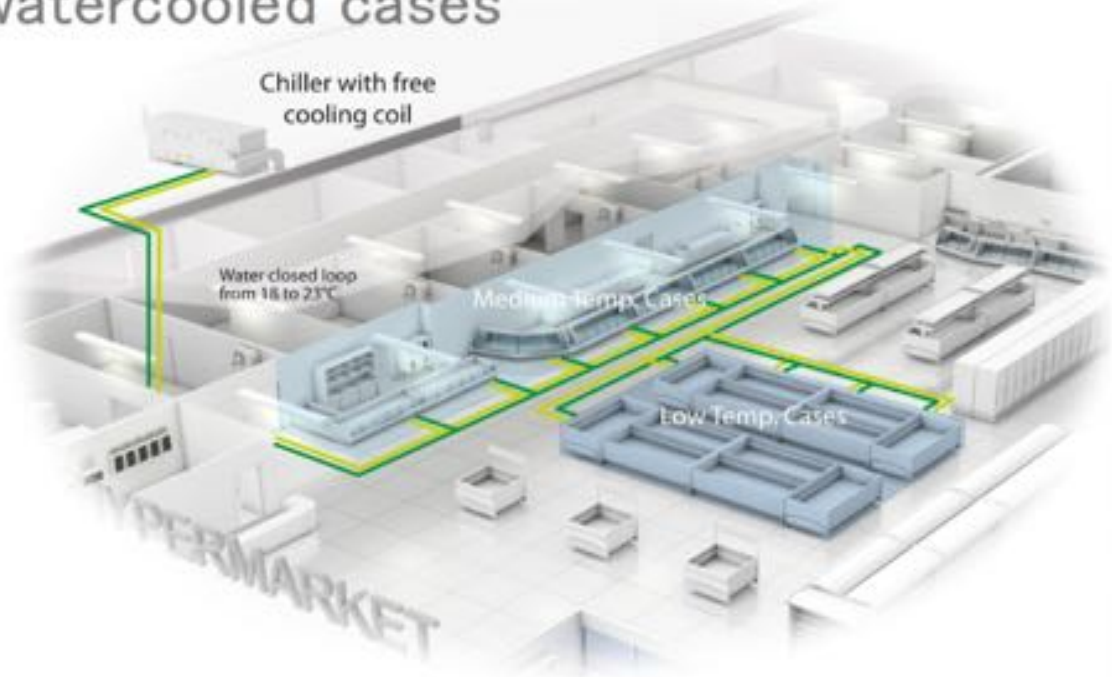
Water cooling Reliable Operation: Minimum Leakage



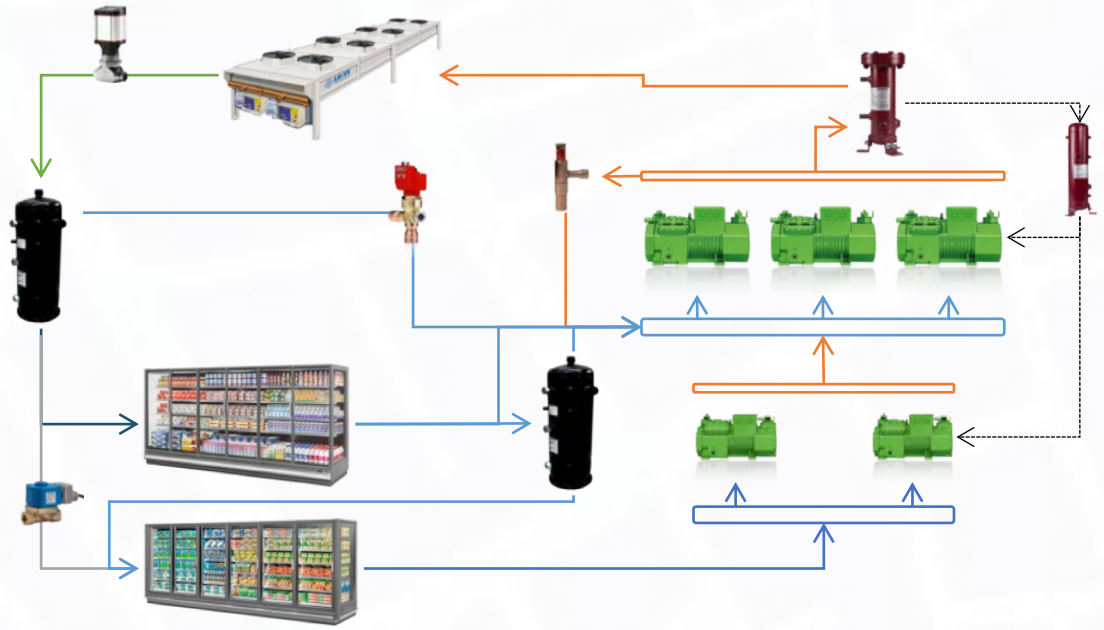


- Full size supermarket cabinets
- Low refrigerant charge, in self-contained units, factory tested
- Natural refrigerant
- Installation without machinery room
- Water chiller can be combined into A/C
- Heat is not added into sales area
- Each unit is optimised for efficiency

Supermarket with plug–in watercooled cases



Energy Efficient CO2 Cooling



- A simple mechanical solution therefore **reliable.**
- Reduced oil temperature combined and endorsed by
- Improved efficiency during **all climatic conditions.**

CO2 Measured Electrical Consumption

Al Ain store

22 % smaller in refrigeration capacity than Masdar

Al Ain Store - UAE

R404a

Total 128 kW refrigeration load

n. Cabinets 42

n. Coldrooms 13

Masdar City Centre – Abu Dhabi

CO2 with FTE EPTA technology

Total 166 kW refrigeration load

n. Cabinets 51

n. Coldrooms 20

	TOTAL MASDAR	TOTAL AL AIN	TOTAL MASDAR ADJUSTED	% difference
	[kWh/month]	*[kWh/month]*	*[kWh/month]*	*[kWh/month]*
May	74261	115594	57986	50%
June	80856	117338	63136	46%
July	85248	119293	66565	44%

CO2 with EPTA technology is 45 % - 50 % more efficient than R404a

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Summary

- Several retrofit options are available → good opportunity to “fix” the past
- The most **energy efficient** refrigeration system starts with a focus on **technology during the design-project phase**
- Middle East countries are now preparing for **HFC phase-out** legislation → this is achievable whilst improving efficiency
- **CO_2 systems** are energy efficient and reliable in hot climates and are now well proven
- **Sustainable Profitability** should be the driver

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Efficiency and reliability for supermarkets retrofit

Mr Michele Mohorovicich

Marketing Manager Refrigeration - EMEA

CAREL

Efficiency and reliability for supermarkets retrofit

Mr Michele Mohorovicich

Marketing Manager Refrigeration - EMEA

CAREL

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Agenda

- Decision Drivers
- Solution trends for Supermarket Retrofit
- Benefit of DC inverter technology and EXV in Food Retail applications
- Energy Savings for Food Retail
- Food Preservation
- OPEX Optimisation (operational cost)
- Key Takeaways

Decision Drivers for Retrofit Projects

High energy efficiency	System reliability	Temperature control as mission critical	Usability and OPEX
Focus on energy savings in the HVACR market **is constantly increasing;** it represents a **critical driver in the decision to retrofit any existing project.**	Benefits come in the **form of safety;** of the **product preservation** and **lower operational costs**.	Maintaining a **stable temperature** is the first step for system reliability and food preservation with **longer "shelf-life"**.	How people use a system results in how we can **evaluate the system performances**, how we can optimise the operational costs and system profitability thanks to **data analytics**.

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Solution trends for supermarkets retrofit

High Efficiency Condensing Units

'A condensing unit is a product integrating ***at least one electrically driven compressor and one condenser****, capable of cooling down and continuously maintaining low or medium temperature inside a refrigerated appliance or system,* ***using a vapour compression cycle*** *once connected to an evaporator and an expansion device.'* (Ecodesign Directive, 2009).

- **Cold Rooms**
- **Petrol stations**
- **C-Stores**

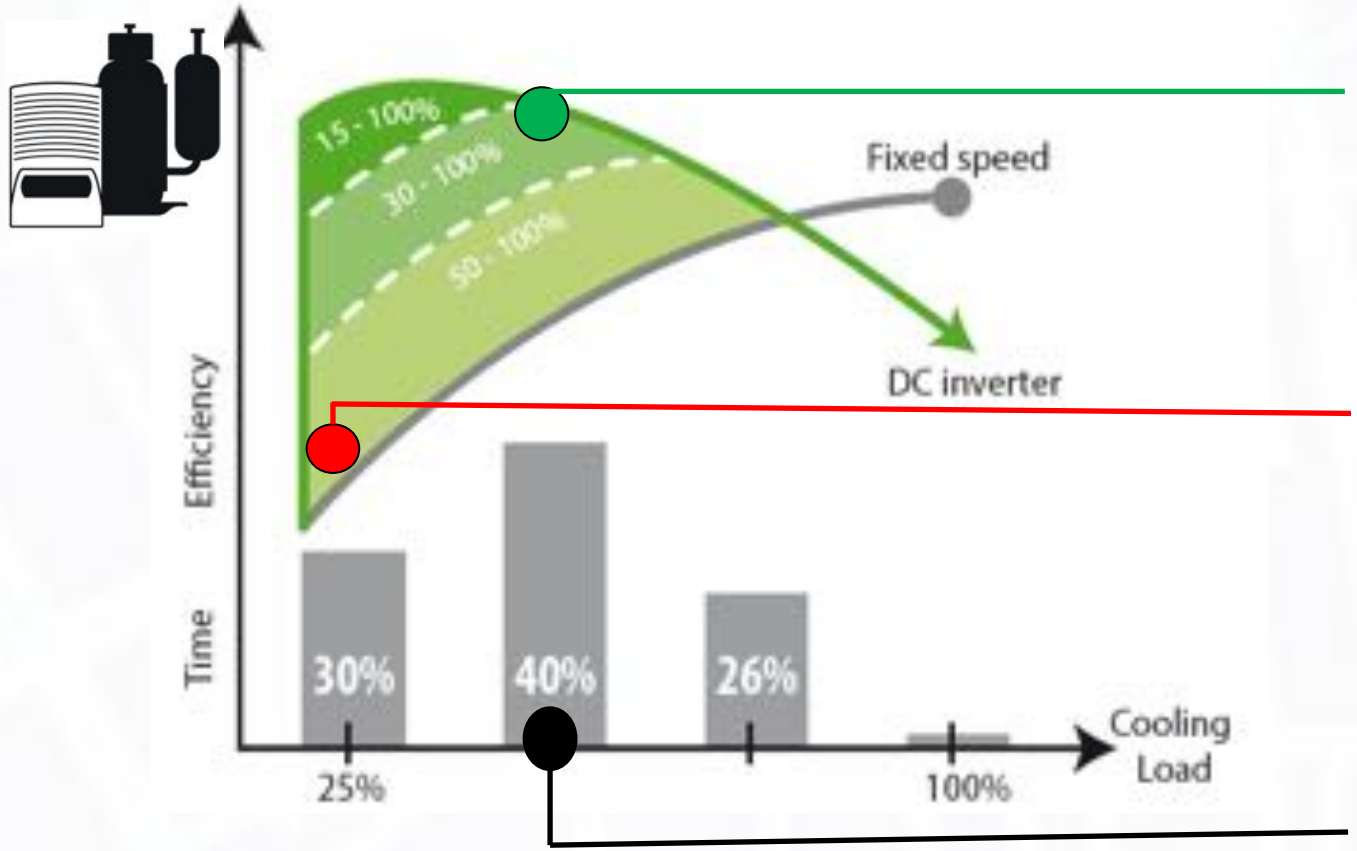
DC Technology

- DC Technology provides a refrigeration system with the possibility to modulate the cooling capacity according to the real load request.

Compressors	**Inverter**	**Electronic Controller**
Brush Less Direct Current motor, (BLDC or DC)	to modulate the speed of the compressor.	to manage the Inverter and guarantee the maximum safety to the system (full compressor envelope control).

DC Technology

Permanent magnets variable speed compressors driven by intelligent DC drives allows high efficiency in **all load** conditions.



This area represents the **increase of efficiency at part load.**

ON-OFF cycling is not efficient as the refrigeration circuit needs time to reach the nominal efficiency.

An HVACR application is working **for the largest part of the time at partial load.**

Multiplex Cabinets

Complete management of a multiplex cabinet.

Synchronised actions among homogeneous groups of showcases.

High level of security, guaranteed by configurable user profiling with password protection.

Full management of electronic expansion valves.

Advanced control algorithms to stabilise the control temperature, for optimal food preservation and reduced energy consumption.

coldroom
cabinet LT
cabinet MT

Diversified management of parameter configurations on mobile devices and/or in the cloud.

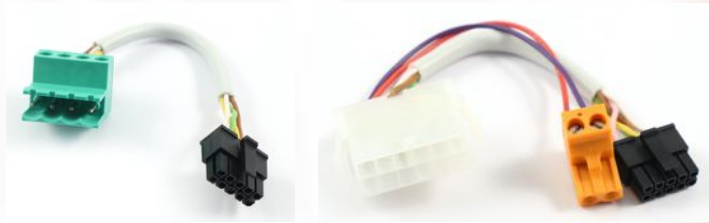
System Modernisation

- Retrofits on multiplex cabinets fitted with a generic panel mounting controller and limited space available in the electrical panel. Four simple steps:

Removal of existing electronic controller and replacement of the mechanical thermostatic valve with an EEV.

Installation of the VALVE driver (IP65/IP67) directly in the evaporator compartment.

Connection between VALVE driver and SMART CONTROLLER via RS485 serial cable.



Adapter kits developed to simplify replacement for retrofitting SIMPLE controllers.

System Modernisation

Smart control system with **Electronic Expansion Valve** which guarantees stable regulation temperature, dynamic adjustment according to the cooling request, NO vibration over the pipe.

Electronic Expansion Valve **Driver** specifically developed to operate in extreme conditions (IP65/IP67) thanks to the special resin coating.

Complete serial communication between the cabinet controller and the valve driver (just one device connected to the supervisor).

Quick commissioning, using special tools developed for mobile devices.

Advanced functions for optimal cabinet control, adapting at all times to evaporator operating conditions (smooth lines).

Benefits of DC Inverter Technology

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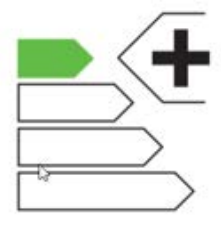
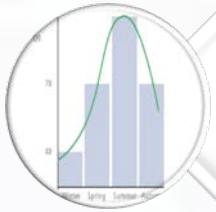
Benefits of DC Inverter Technology

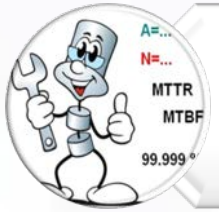




High Efficiency of the entire system,

due to operation at partial-load this technology grant great ENERGY SAVING

Stability and precision in temperature control: increased reliability of the equipment cooled, FOOD PRESERVATION



System reliability increased,

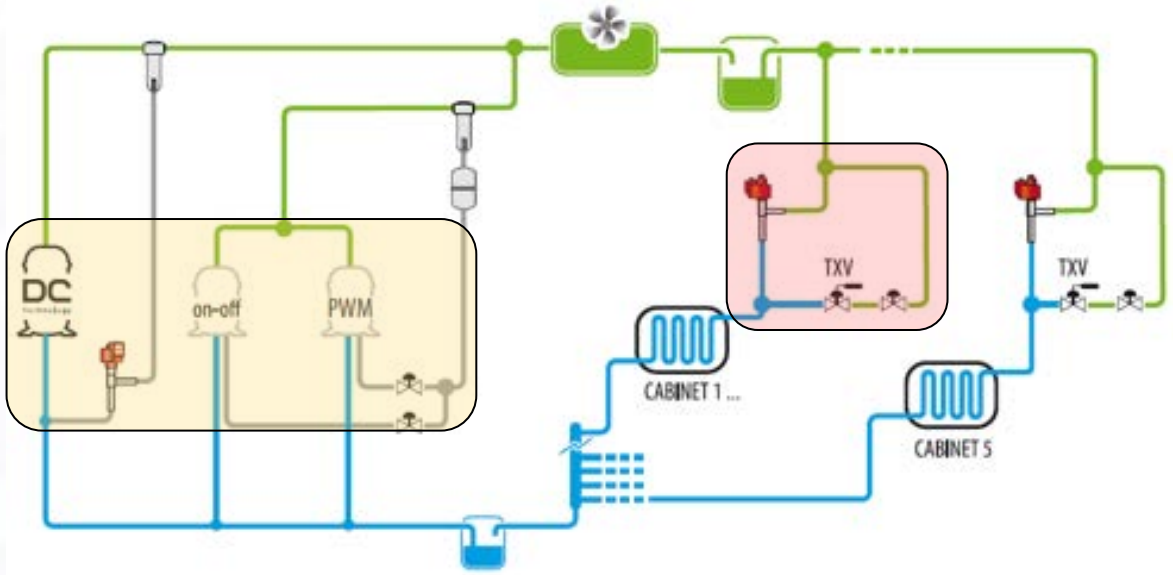
thanks to the reduction in compressor inrush current, with a reduction of mechanical and electrical stress.

Lower noise level:

under part-load conditions, units will have lower sound levels than traditional on-off compressor systems in both running and start-up periods

Energy Savings for Food Retail

DC compressors and electronic expansion valves, helps to **reduce the energy consumption** of condensing units.



Real store monitoring by a 3rd party scientific institute: Fraunhofer ISE

3 compressor technologies: DC inverter, PWM, on-off

5 medium temperature refrigerated units

The data were collected for one year and analysed in accordance with EN13771-24.

Four configurations were rotated for one year:
(24 hour cycles)

- Compressor with **DC inverter** and **electronic valve**
- Compressor with **DC inverter** and **thermostatic valve**
- Compressor with **PWM modulation** and **thermostatic valve**
- **ON/OFF** compressor and **thermostatic valve**

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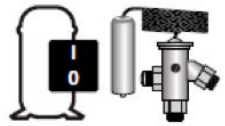
Energy Savings for Food Retail

Cdu technology	Annual SPF	Power consumption over the year (kWh)	Average monthly energy expense*	Total annual energy expense*
BLDC + EEV	2,92	14800	185 €	2220 €
BLDC + TEV	2,60	16640	208 €	2496 €
PWM + TEV	2,21	19520	244 €	2928 €
ON/OFF + TEV	2,53	17120	214 €	2568 €

*Electricity cost hypothesis = 0.15 euros/kWh

-708 €/year compared with PWM compressors with TEV



-340 €/year compared with ON/OFF compressors with TEV

Fraunhofer ISE monitoring and evaluation in a real store:

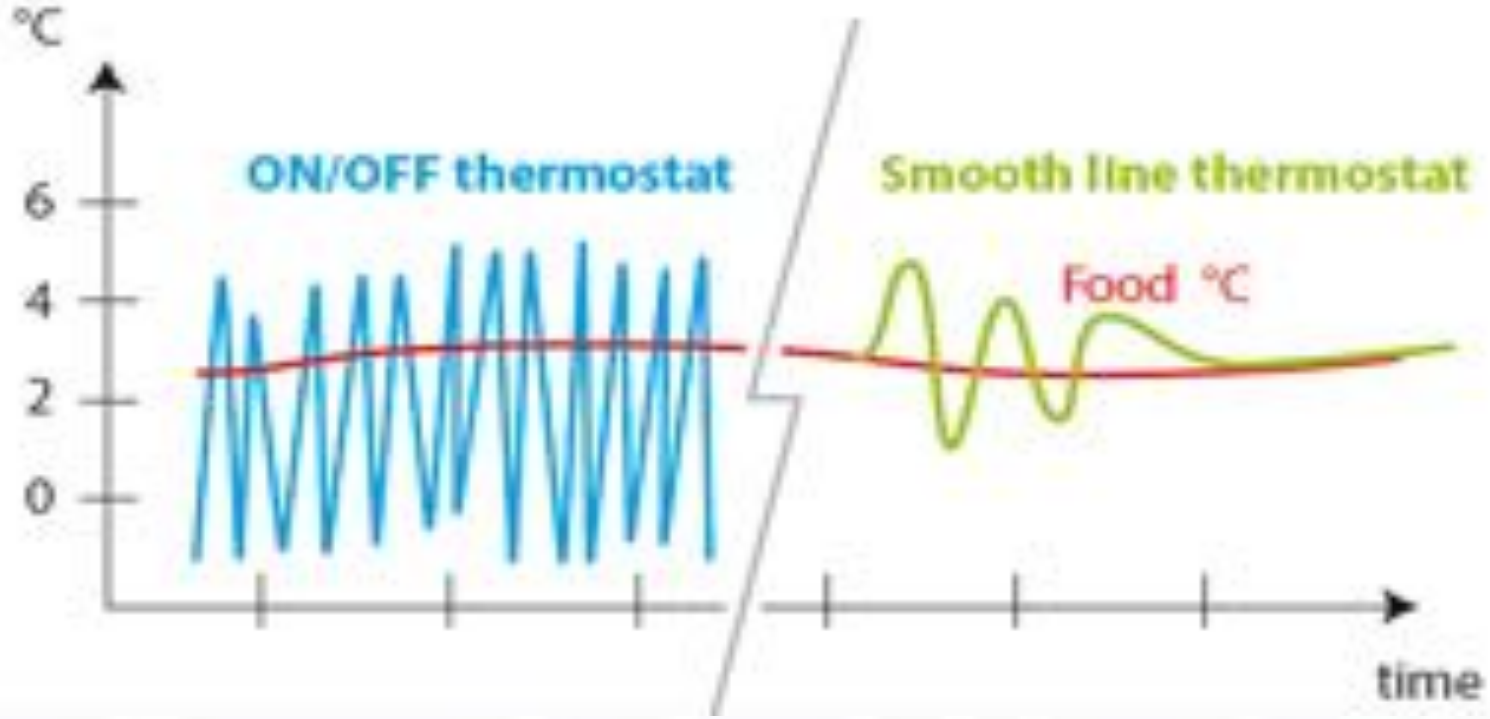
+24.2%

Efficiency increase with DC Inverter compared with other technologies.

Food Preservation

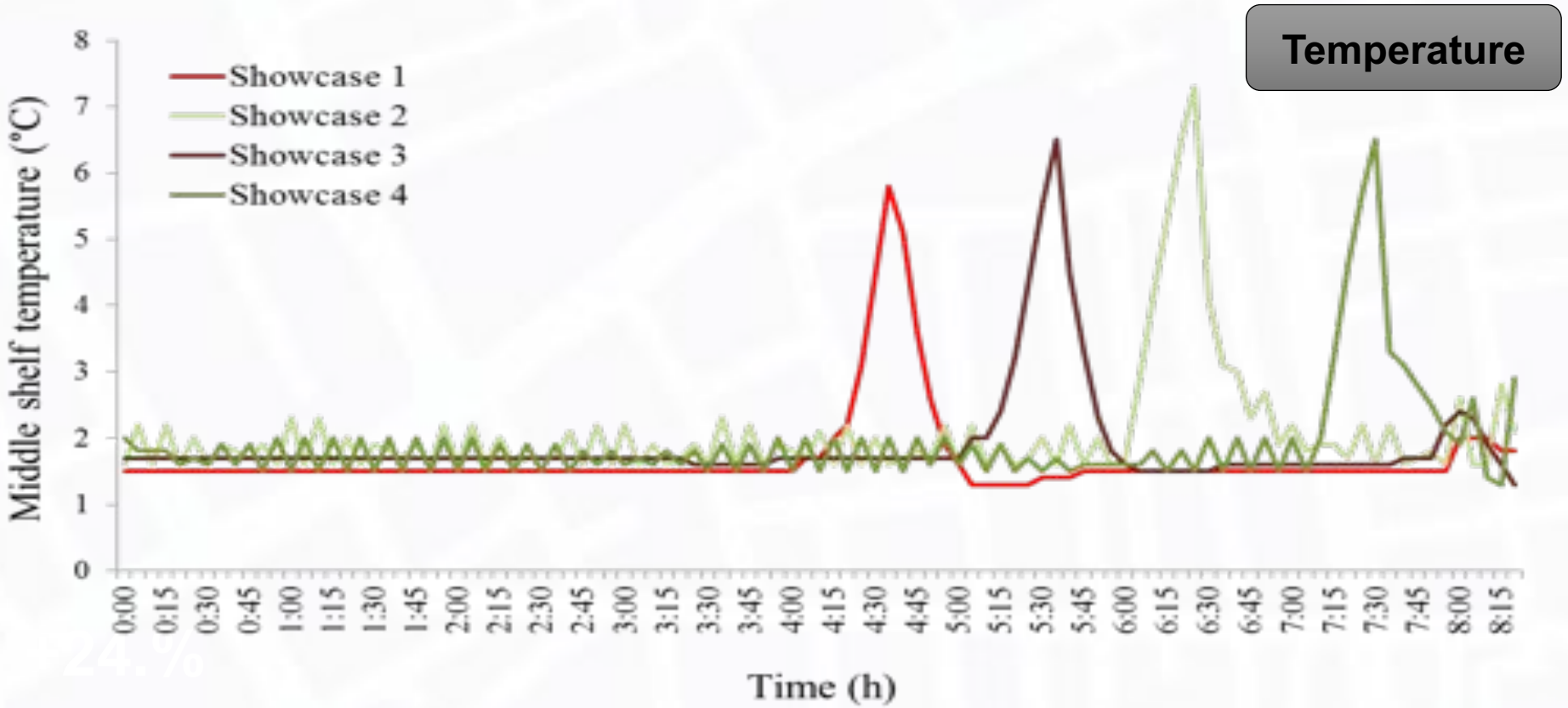
Food Preservation

- The combination of DC Technology (variable speed compressor) together with the electronic expansion valve managed by advanced algorithms inside the e-board provide stable regulation and optimum food preservation.



Optimal Food Preservation

Effect of the use of DC Technology on semi plug-in condensate by water.

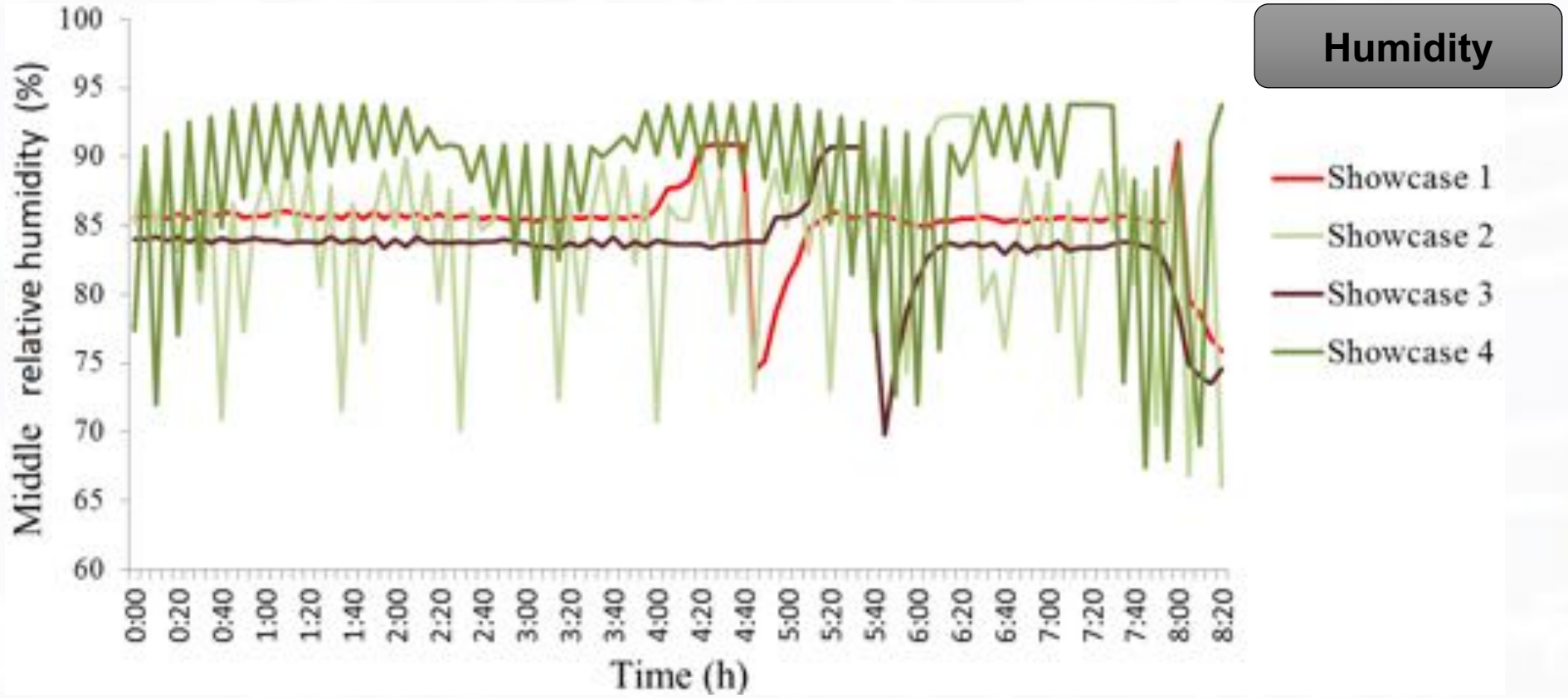


The variations in temperature can deteriorate the quality of the food, making its shelf life shorter.

(Soo Dong, S. et al., 2013)

Optimal Food Preservation

Effect of the use of DC Technology on semi plug-in condensate by water.



The effect of humidity on food is very relevant, in some cases even more than the effect of temperature (Forney, C.F., 2008 ; Lineberry, K.R., 2011)

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OPEX Reduction

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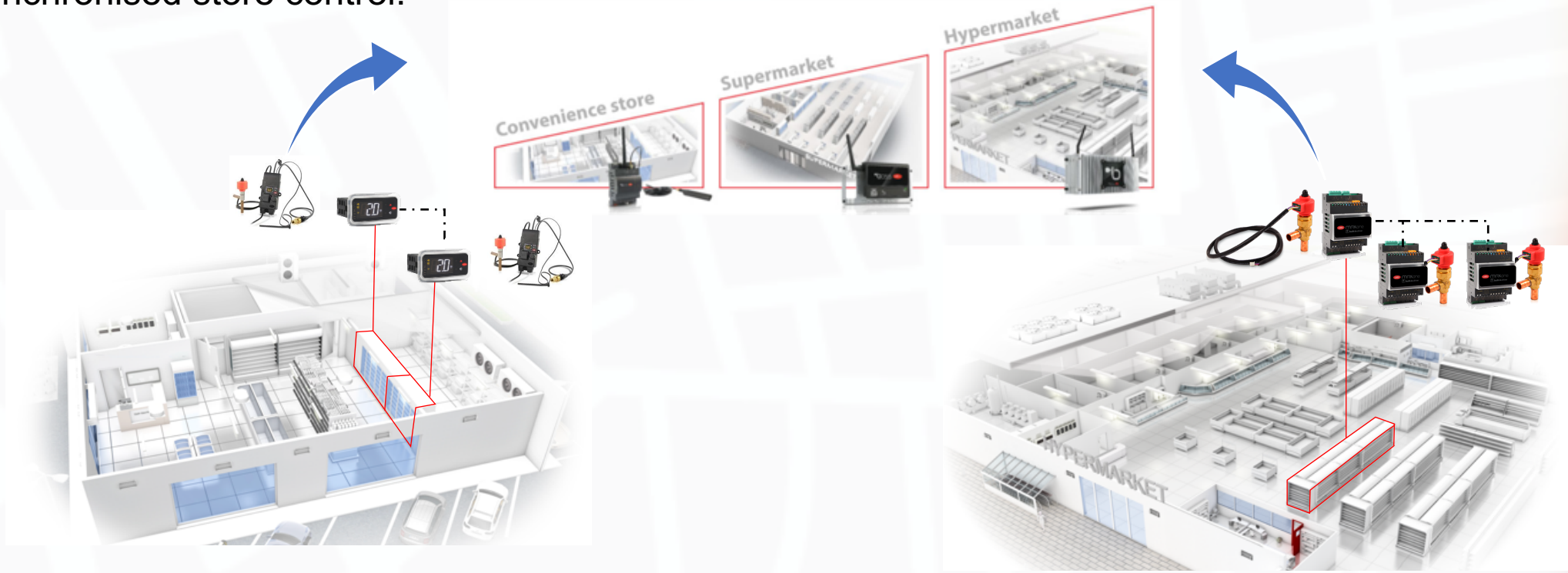
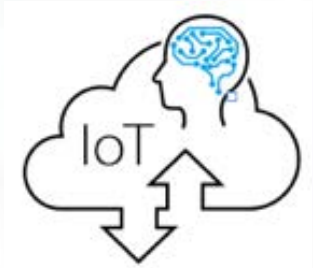
Store Data Management

Advance electronic controllers for the complete management of multiplexed refrigerated cabinets as well as high efficiency condensing units are capable of generating a significant amount of data. These data can be collected (logged) through a supervisory system which permits full and synchronised store control.



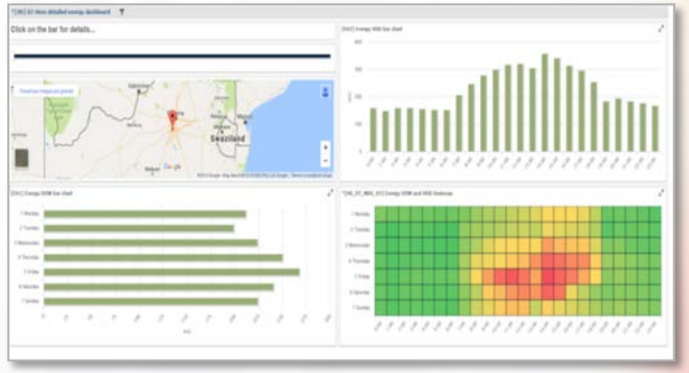
Analytics: Data is King



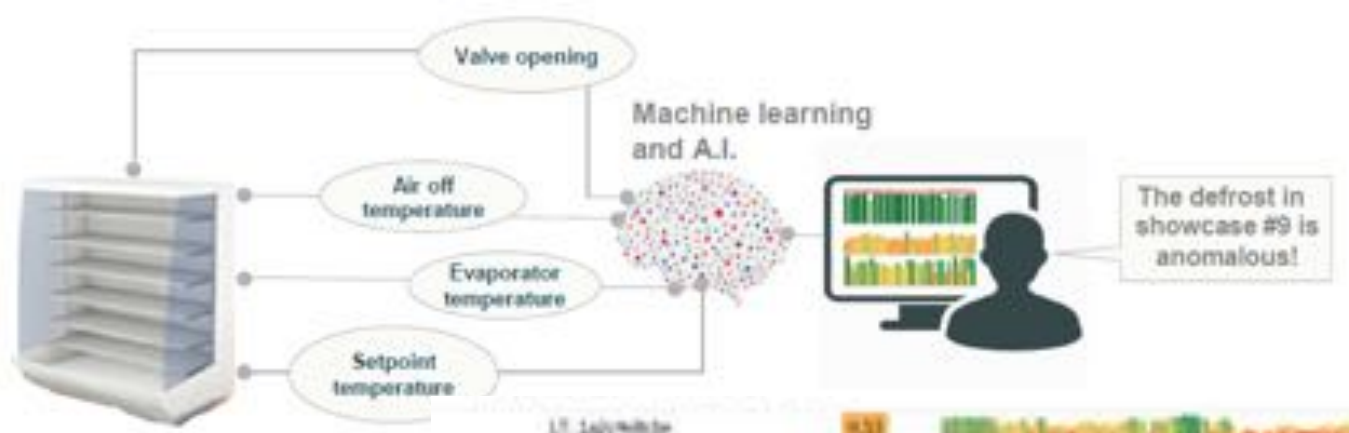
The significant amount of data generated daily in more than one connected store can be processed in a cloud system.

There are opportunities for process optimisation by collecting the data and translating it into **Analytics:** KPI/Benchmark/Reports

Making the refrigeration system **sustainable** and preserve/increase **profitability** of the stores.



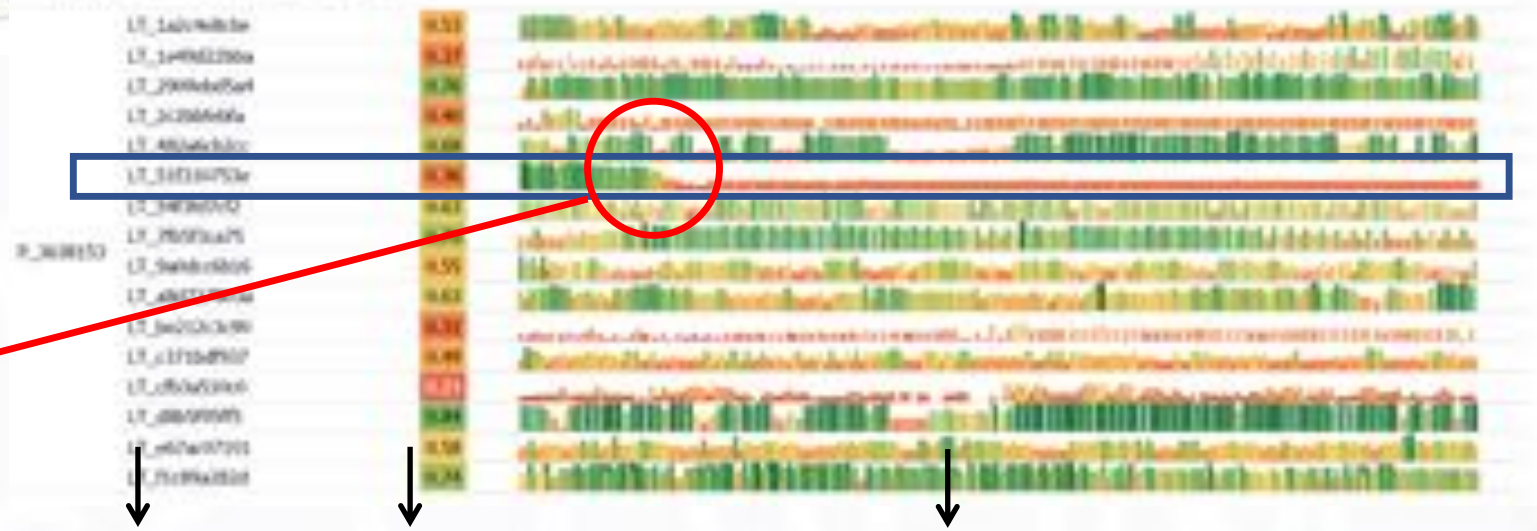
Analytics



Show and improve the **defrost status** of supermarket multiplex cabinet by means of machine learning and A.I. in one single dashboard.

LOW SCORE

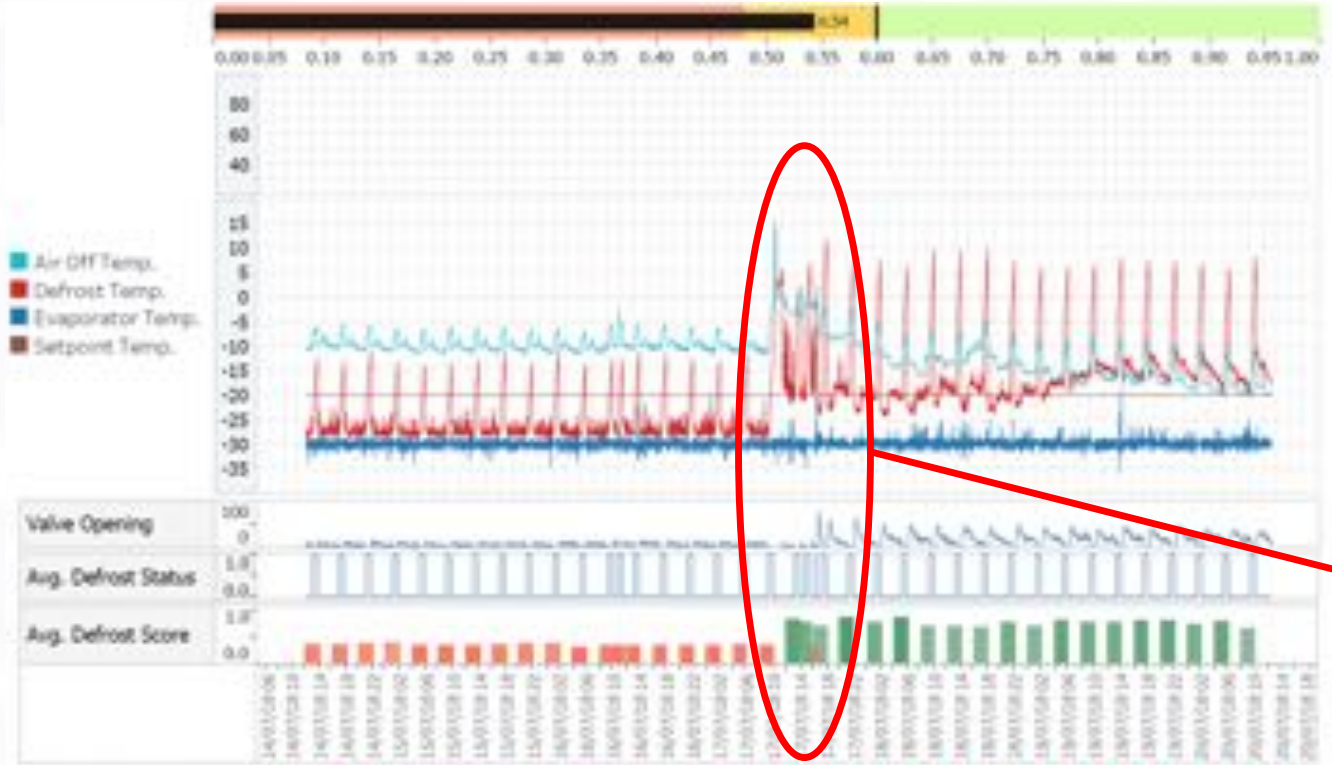
Triggered by an event



Cabinets Score Visible defrost quality by colors

Analytics

- Detailed analysis of the main parameters monitored for the LOW SCORE cabinet.



- The defrost score indicated that there was an anomaly in the system.
- After a maintenance operation, the score became green therefore no extra maintenance requirements.

- Improve evaporator efficiency
- Optimise food regulation temperature
- **Decreases the risk of food waste.**

Key Takeaways

- Retrofitting the existing supermarket with new technologies is simple thanks to a wide range of solutions ready for system modernisation.
- Considerable energy saving results can be achieved thanks to DC technology usage.
- Further energy saving with better food preservation can be achieved by combining an Electronic Expansion Valve (EEV) and advanced control algorithms.
- Precise temperature/humidity regulation for mission critical and shelf-life food extension.
- High data availability eliminates food waste and increase the overall system reliability (less operational costs).

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Optimising energy efficiency by adding variable speed to compressor racks

Mr Frank Taaning Grundholm
VP, Global HVACR Sales
ABB Motion

ABB

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Benefits of Air Curtains in Supermarkets

Mr Jan Svallingson

Director of Business Development

Systemair-Frico

Benefits of Air Curtains in Supermarkets

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Director of Business Development

Systemair-Frico

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Agenda

- Introduction
- Challenges
- Solutions and Functions
- Case Studies
- Benefits of Air Curtains
- Summary

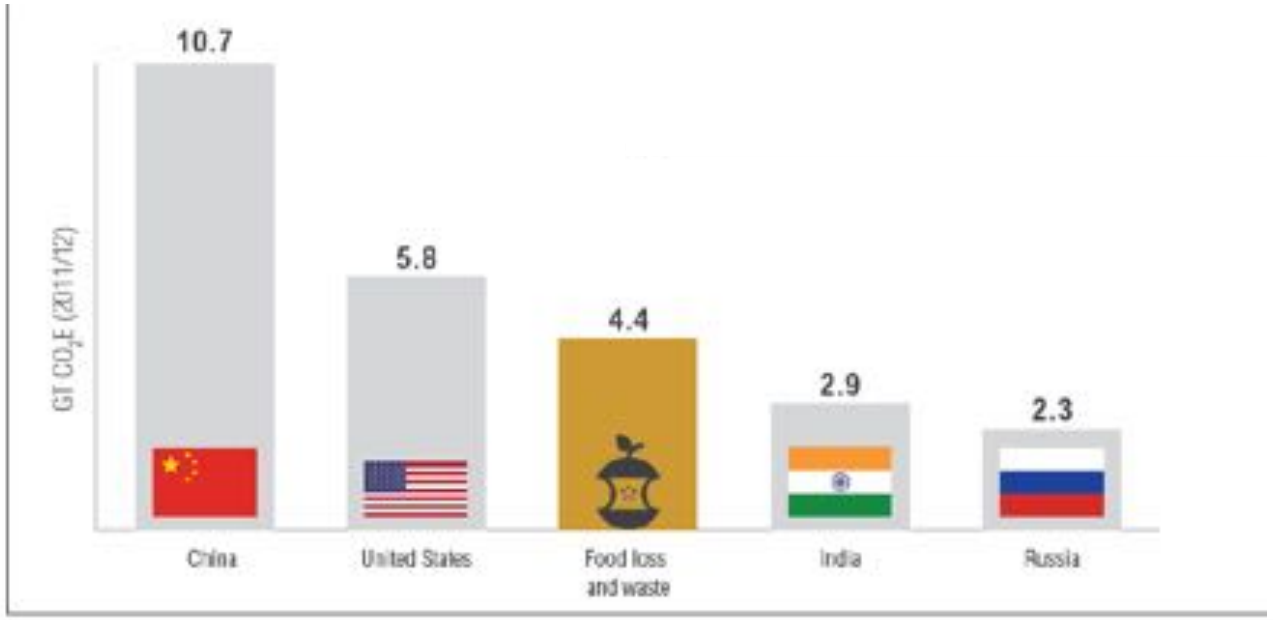
Air Curtains

- Used to separate two different temperature zones

Energy Saving Opportunities
Maintain the Cold Chain

Why focus on the Cold Chain?

- 1/3 of the world's food is wasted!



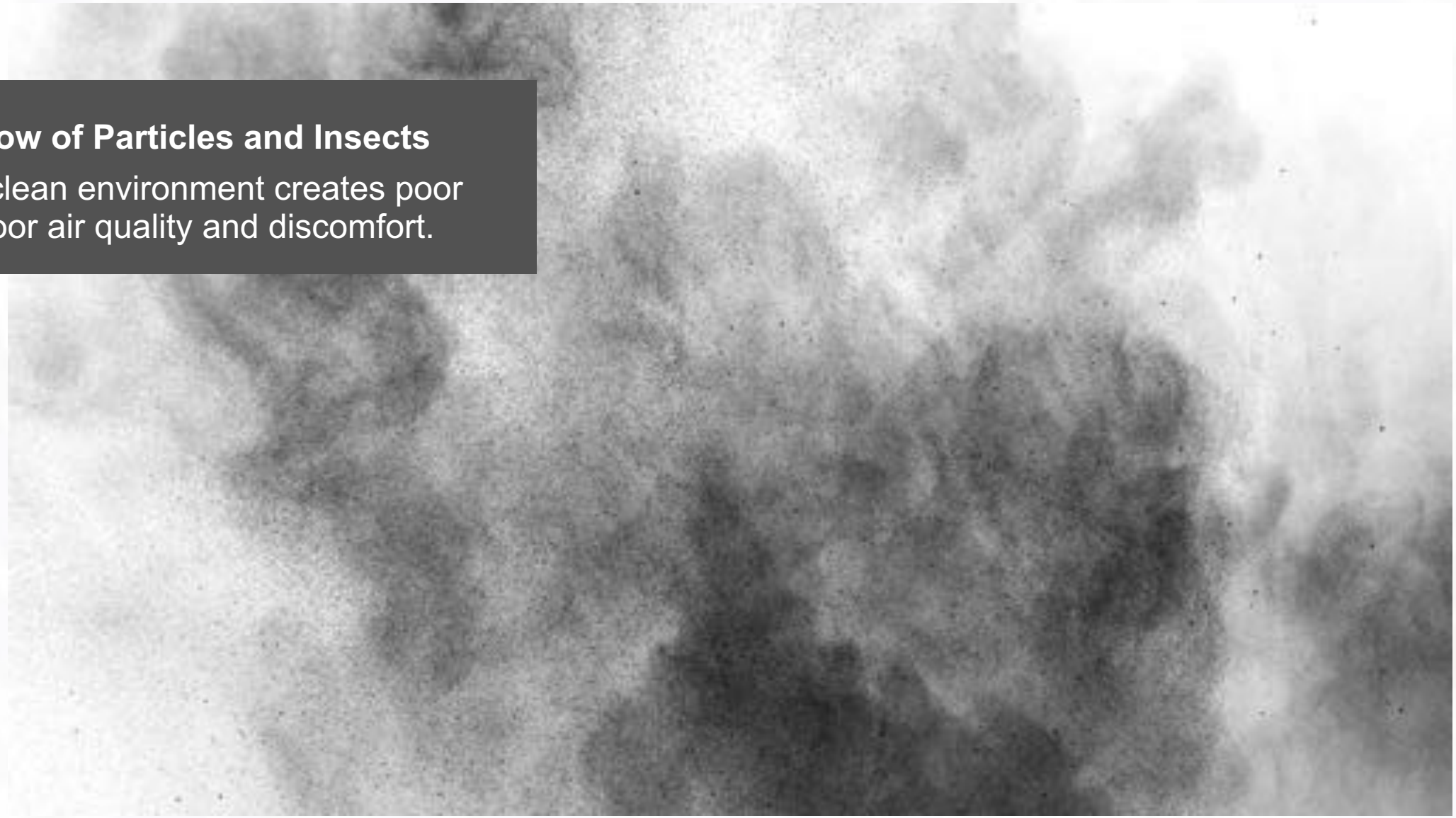
Source: WRI, SDG Target 12.3 on food loss and waste: 2016 progress report

Unwanted Flow of Air

Warm, moist air enter climate-controlled area and conditioned air escape the area.

Inflow of Particles and Insects

Unclean environment creates poor indoor air quality and discomfort.



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Ice Building

Inflow of condensation builds up ice which generates frequent defrost and service along with safety hazards.

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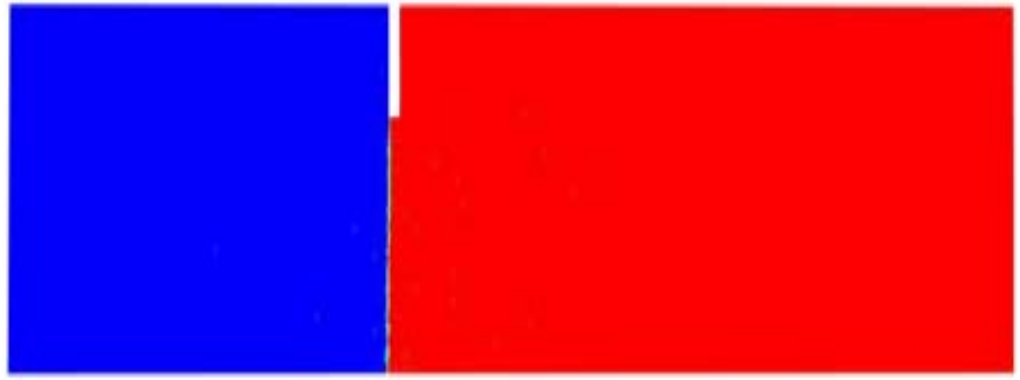
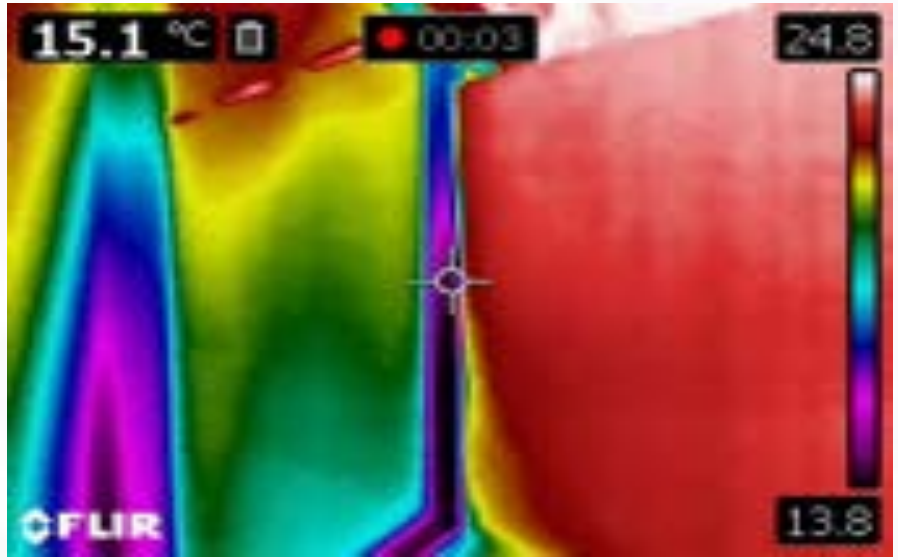
Poor Visibility

Plastic strips are a safety hazard due to the low visibility and the bacterial impact on the goods passing by. They quickly get unclean and break easily.

Open door

When a door opens it leads to an exchange of air - warm, moist air enters top third of the opening and cold air escapes bottom third.





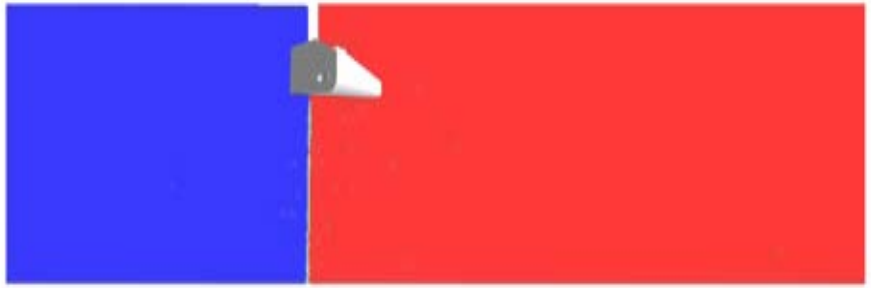
No barrier

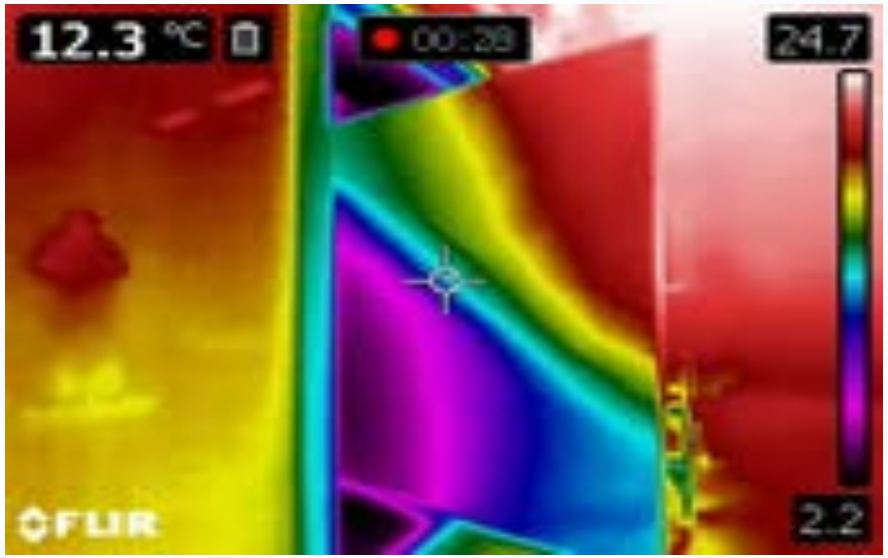
Nothing to hinder particles and insects from entering.

Solutions to challenges

Open Door + Air Curtain

Air curtains reduce the opening and prevents 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

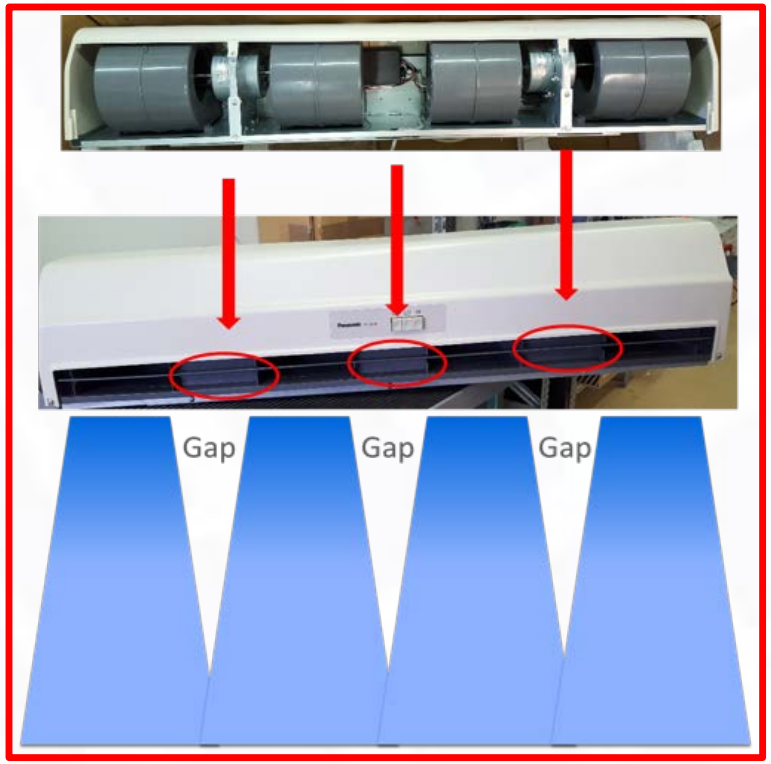
Reduced infiltration of particles and insects.

Solution

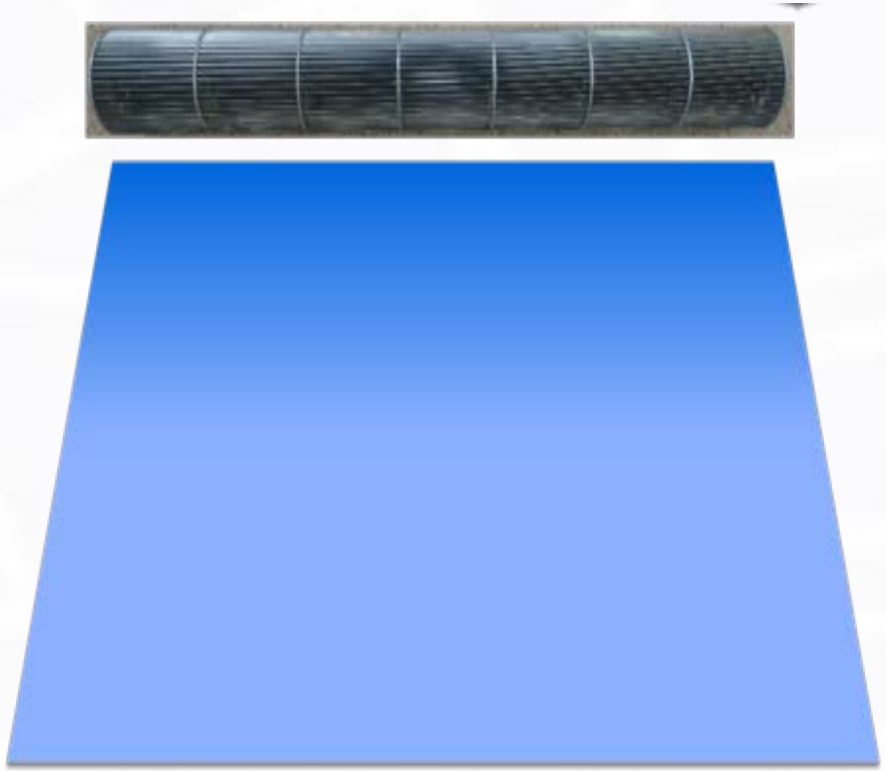
Install a proper air curtain that covers the complete opening

Cross Flow Fan

A powerful, laminar and uniformed air beam without gaps



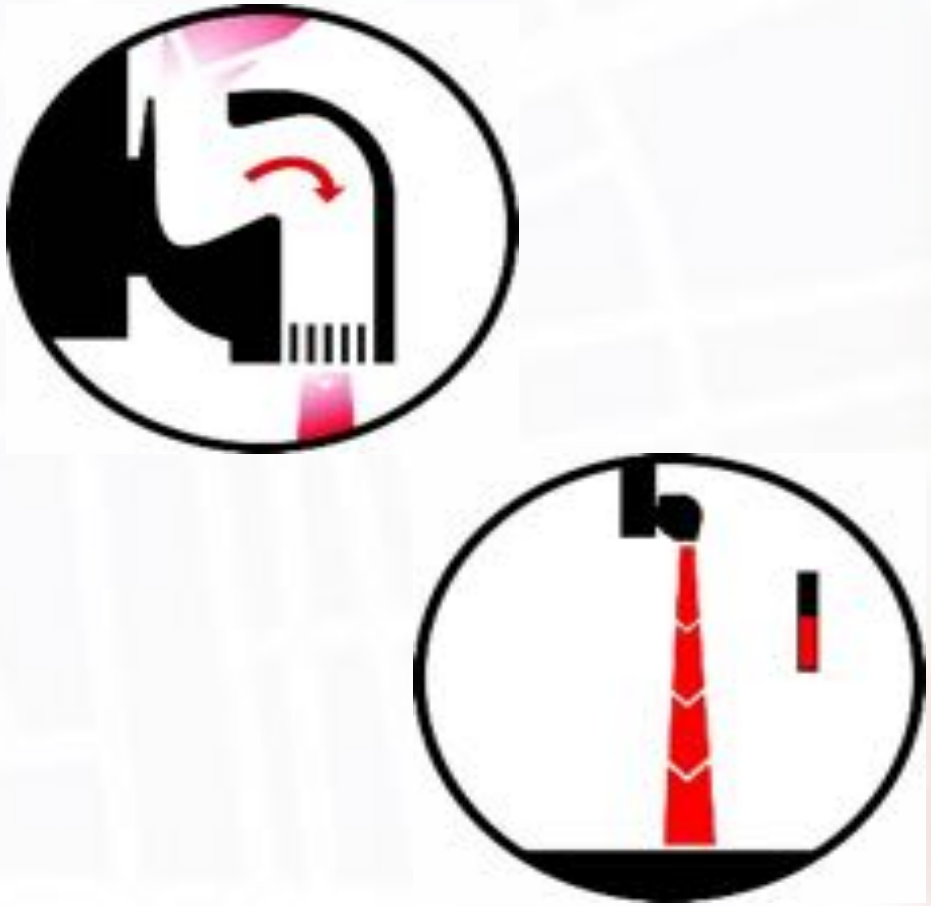
Radial Fan



Cross Flow Fan

Impulse

The combination of correct air velocity and air volume gives an optimised impulse



Outlet Grille Design

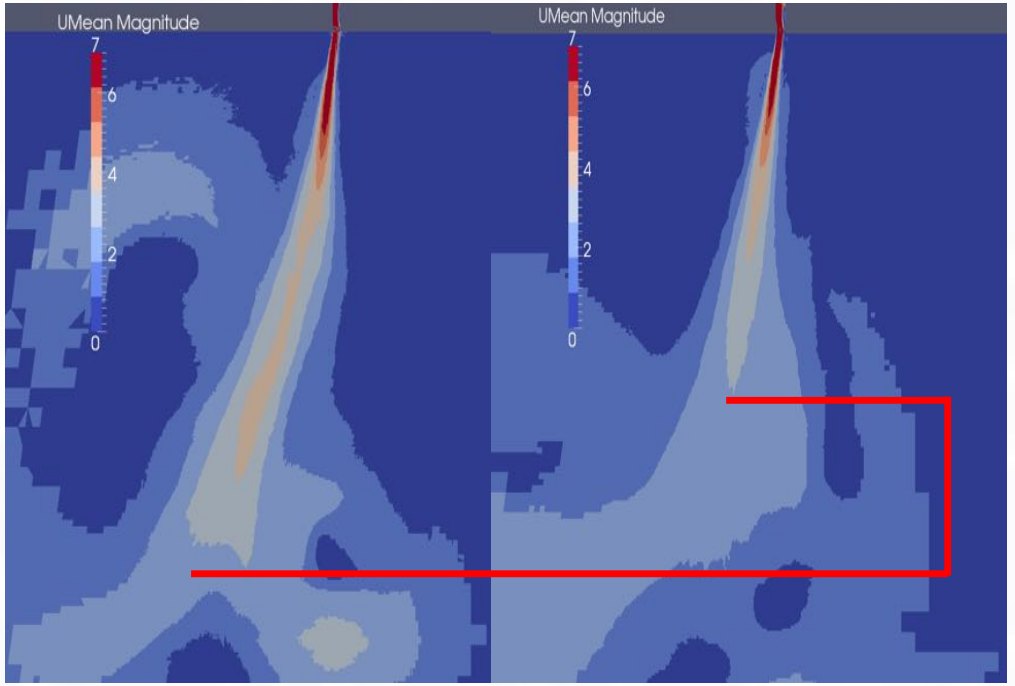
A powerful, laminar and uniformed air beam with low turbulence and strong throw length

Grille Design A

Grille Design B

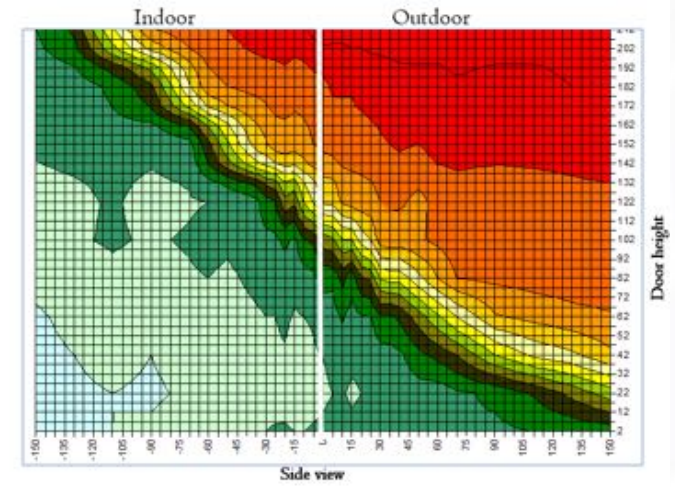
Grille Design A

Grille Design B

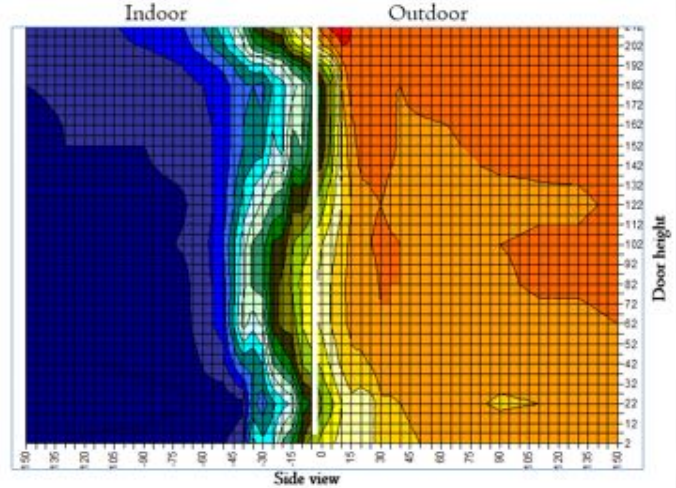


CFD Analysis showing comparison between two air curtains with the same air volume but different air beam characteristics.

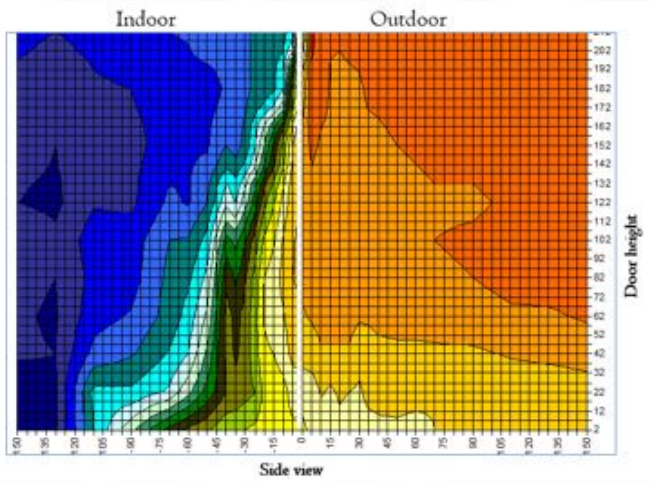
Without air curtain



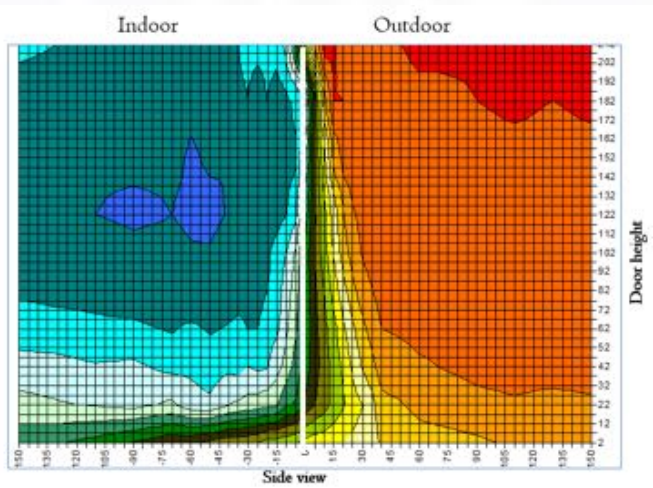
Optimal installation



Too low speed



Too high speed



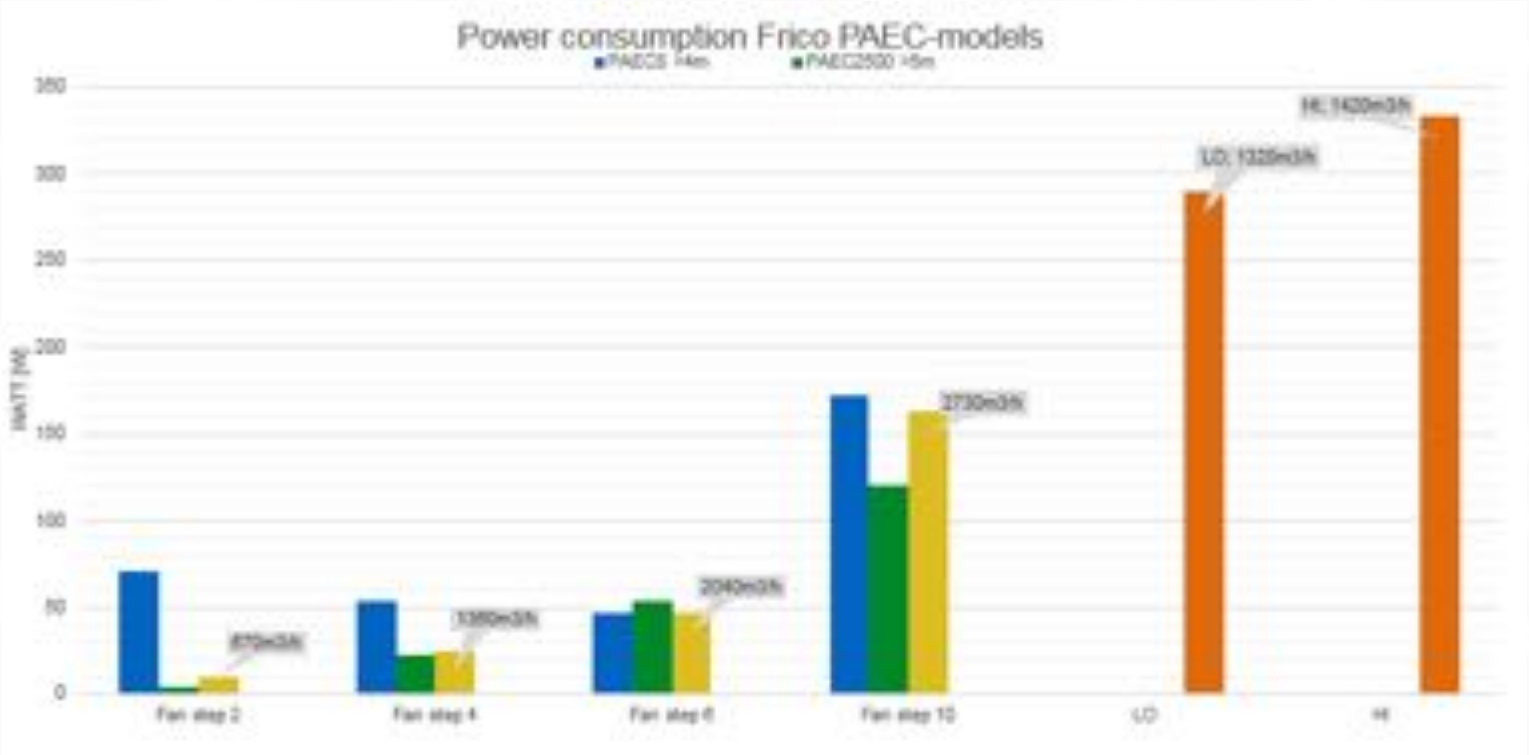
EC Air Curtains

The EC-motor allows for step-less control of the fan speed, giving the possibility to achieve optimised fan-speed and energy savings in every installation.

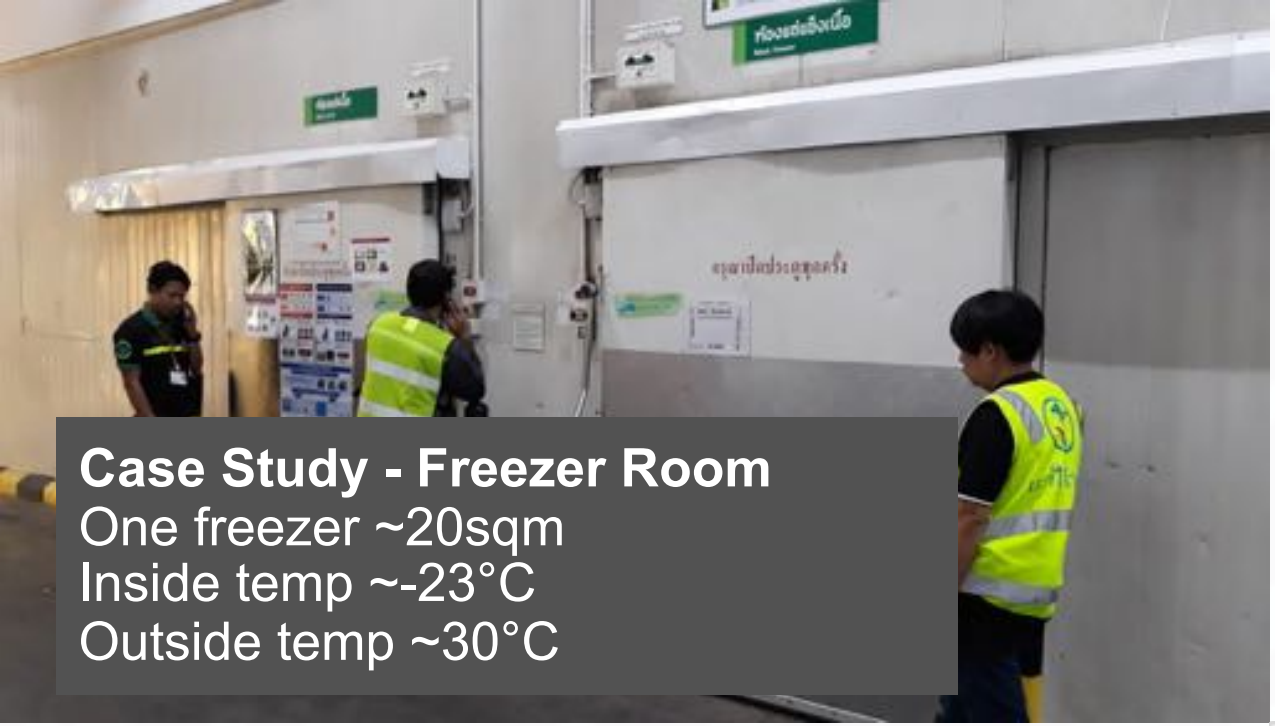
+

EC Air Curtains

The energy saving is not only at maximum power, but also especially in lower power operation dependent on demand. For example, there is 0-10 step-less control of the fan, in the diagram only four (4) fan settings is presented.



Case Studies



Case Study - Freezer Room
One freezer ~20sqm
Inside temp ~-23°C
Outside temp ~30°C

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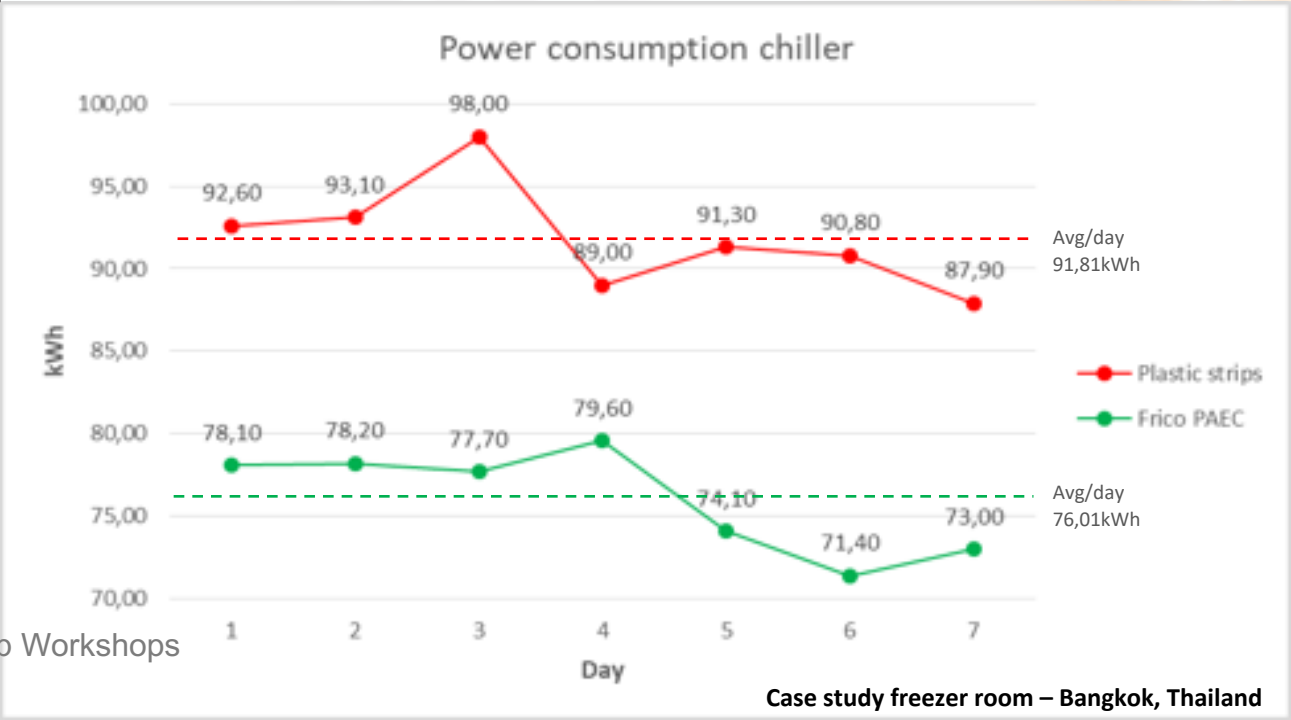
Total consumption for cooling per month with plastic strips

~2754kWh

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

2280kWh

~27% or 474kWh Less energy waste per month



Case study freezer room – Bangkok, Thailand

Case Study – Convenience Store
200sqm - ~1000 visitors per day
Inside set temp 24°C
Outside temp ~35°C

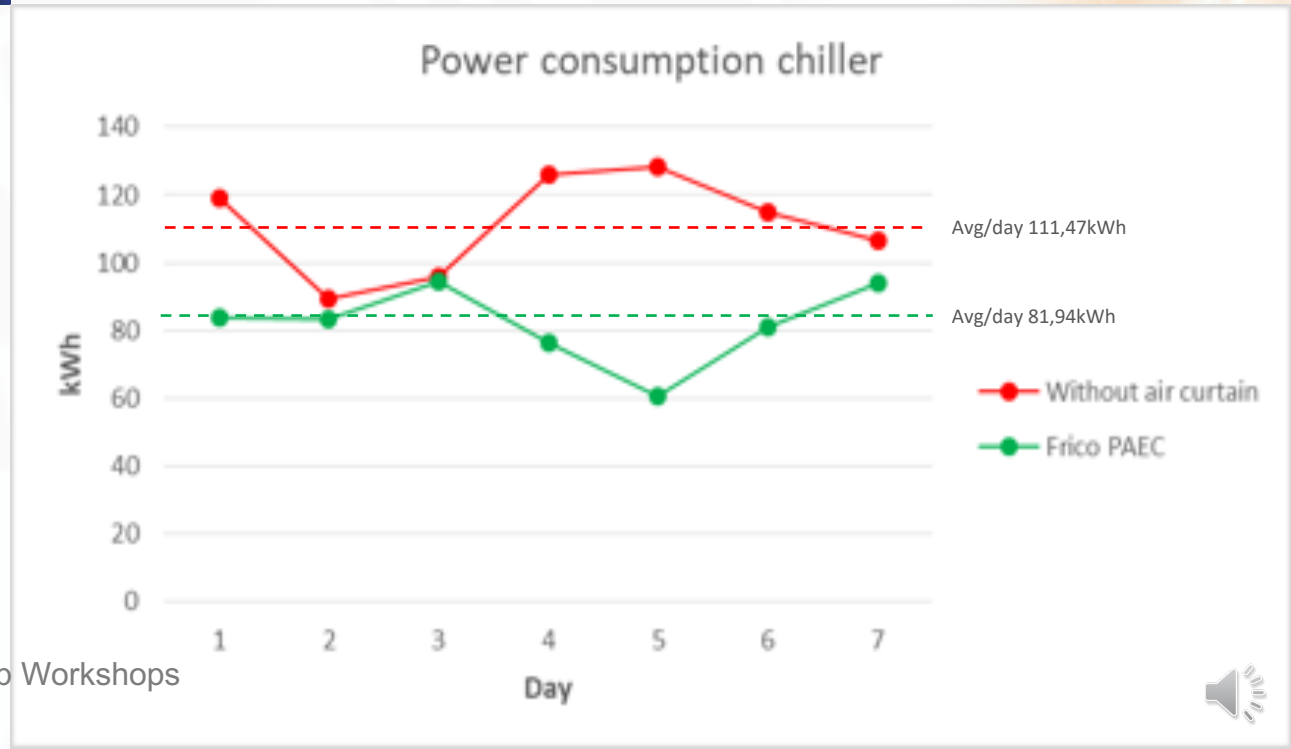
Total consumption for cooling per month without any protection

~3344kWh

with air curtain

2458kWh

~26% or 886kWh less energy waste per month



Benefits of Air Curtains

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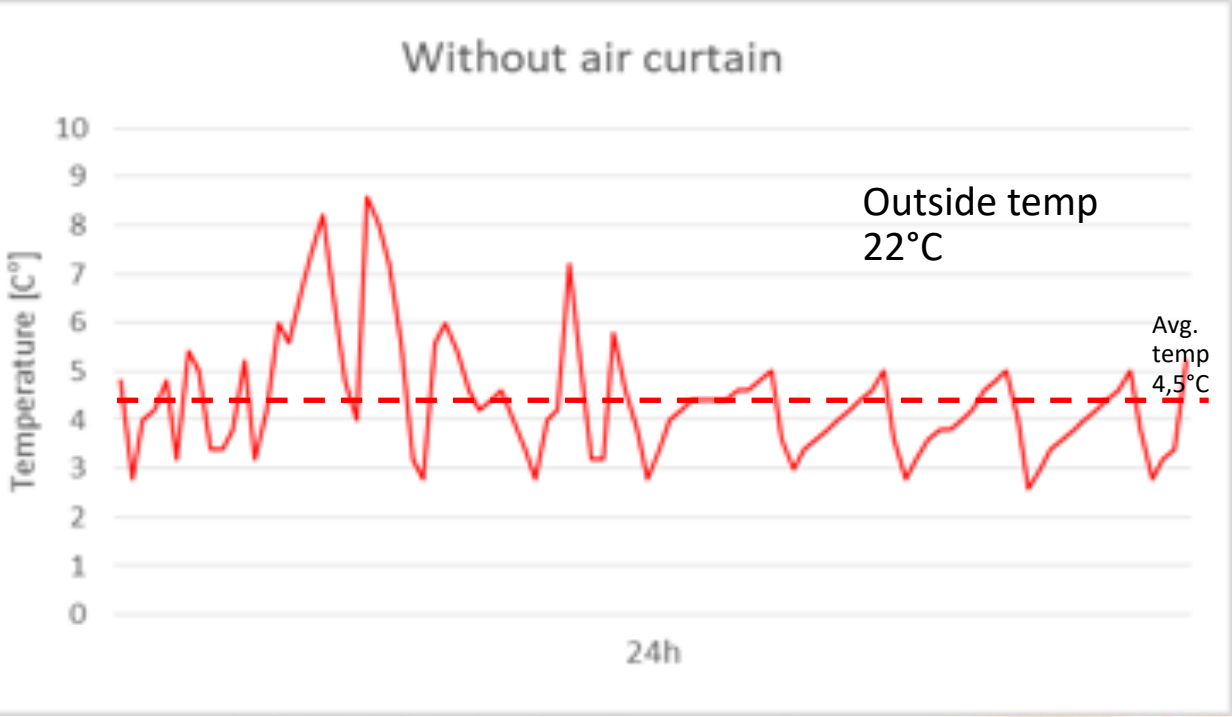
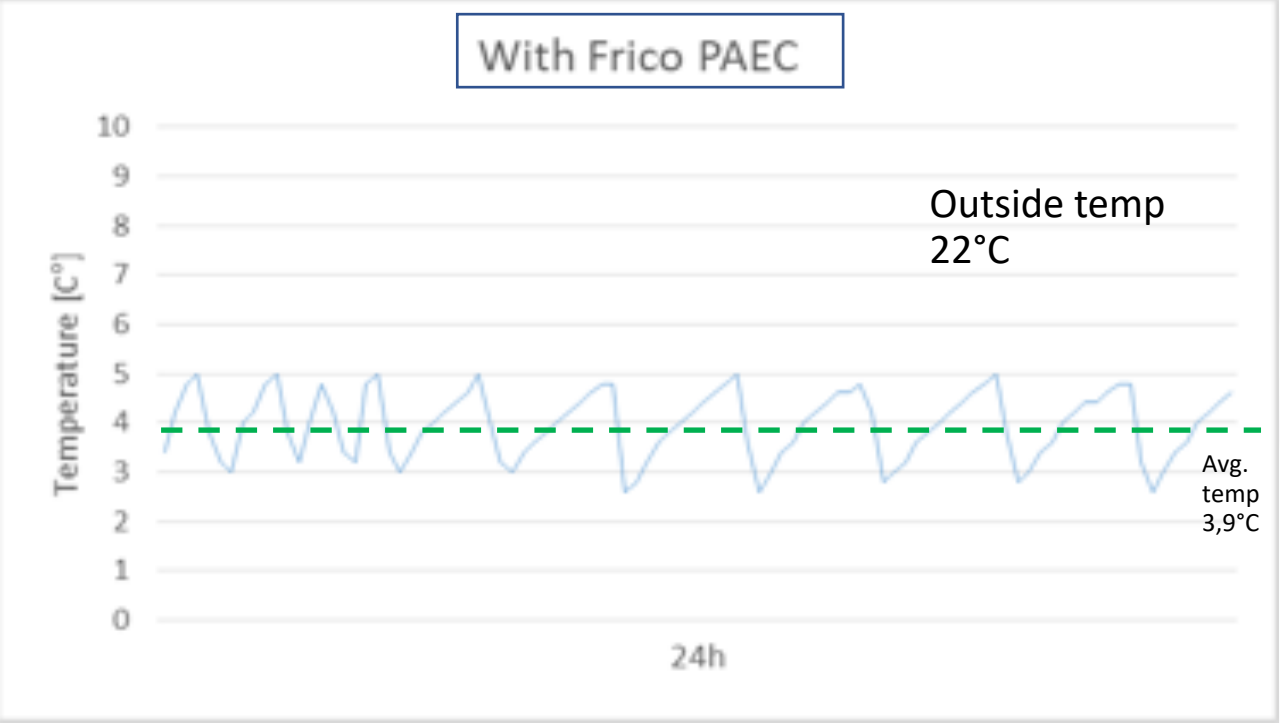
Temperature Fluctuation

Without an air curtain, the fluctuation in temperature generates high loads on the cooling equipment.





With an air curtain with optimised fan speed, the temperature is more even, and the high temperature rises are avoided.

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

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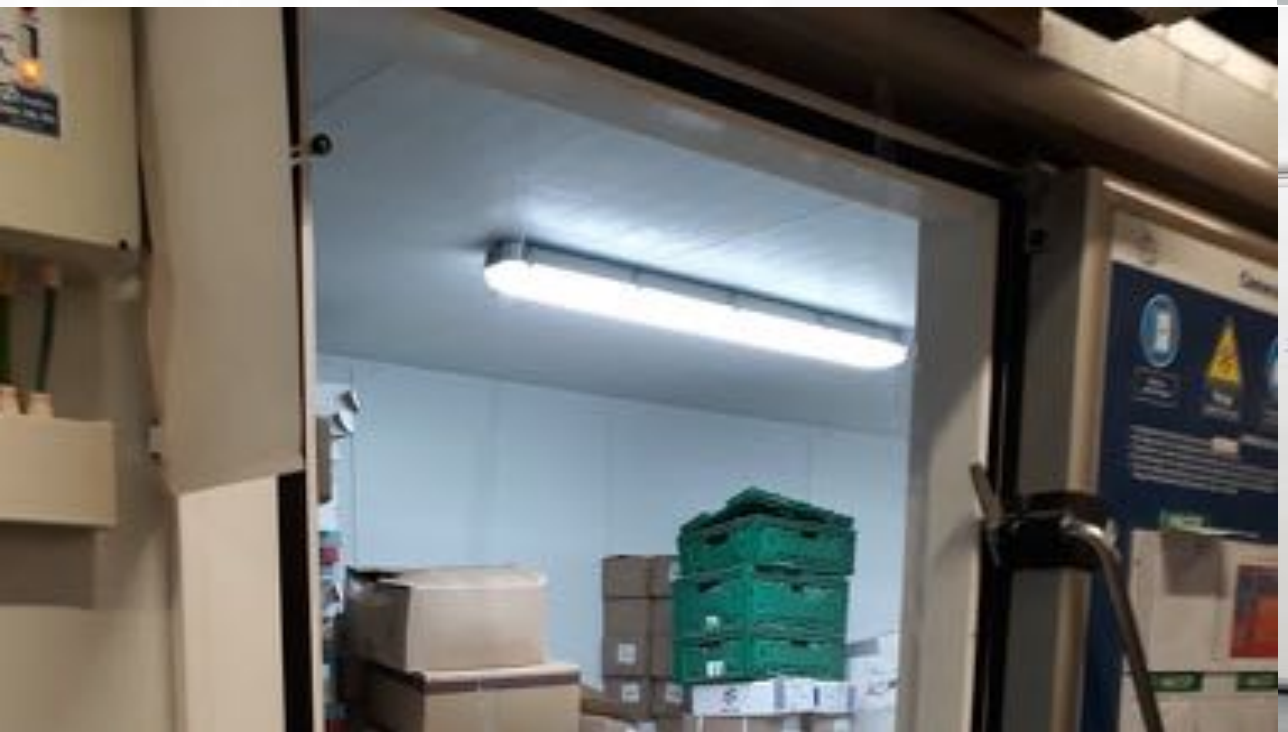
Improved Visibility

By replacing the plastic strips with air curtains you get a clear view.



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Reduce the Ice Build-up

Reduced ice and frost building by preventing inflow of condensation and warm air.

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Air Curtain Turned Off

Air Curtain Turned On


TESCO
Lotus


เทสโก้ โลตัส ช่วยคุณประหยัดทุกวัน
TESCO
Lotus


ขอขอบคุณที่ใช้บริการเทสโก้ โลตัส

The Optimal Solution

High speed sliding doors

Freezer door + air curtain

Case study convenient store – Bangkok, Thailand

Summary

- HYGIENIC
- LESS MAINTENANCE
- SAFER WORKPLACE

- ENERGY SAVINGS
- BETTER ECONOMY ENVIRONMENT

- PROTECTS THE COLD CHAIN
- LESS WASTE

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Savings from the air: **Retrofitting fans in supermarkets**

Mr Tony Wright

Divisional Director (Upgrade) Market

ebm-papst UK

ebmpapst

the engineer's choice

Savings from the air:
Retrofitting fans in supermarkets

Mr Tony Wright

Divisional Director (Upgrade) Market

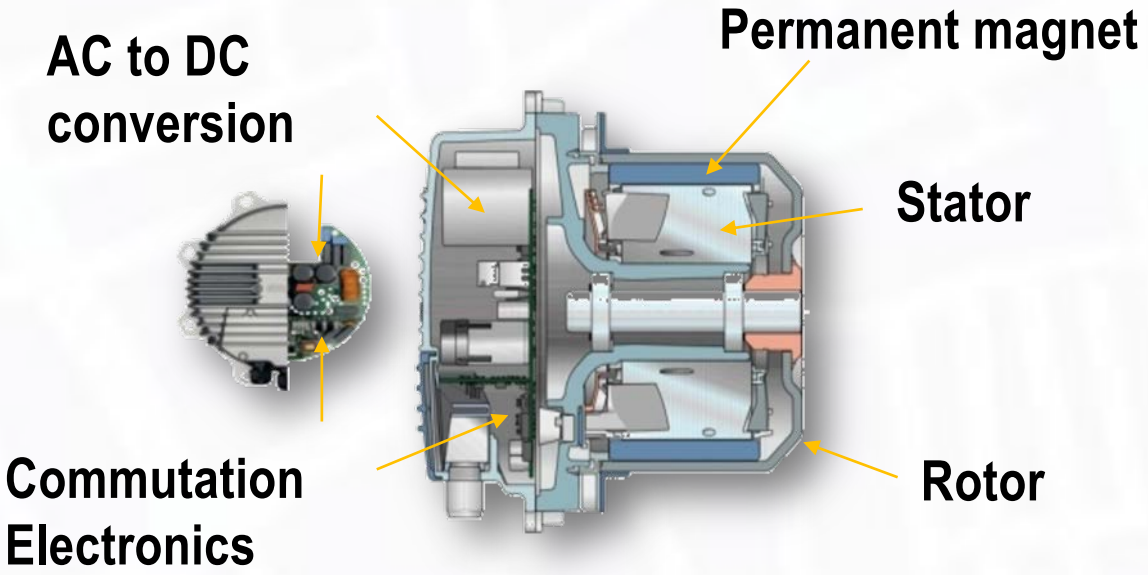
ebm-papst UK Ltd

Agenda

- What is EC Technology?
- Applications for retrofitting fans in supermarkets
- Case Studies
- Conclusions

What is EC Fan Technology?

What is EC Technology?



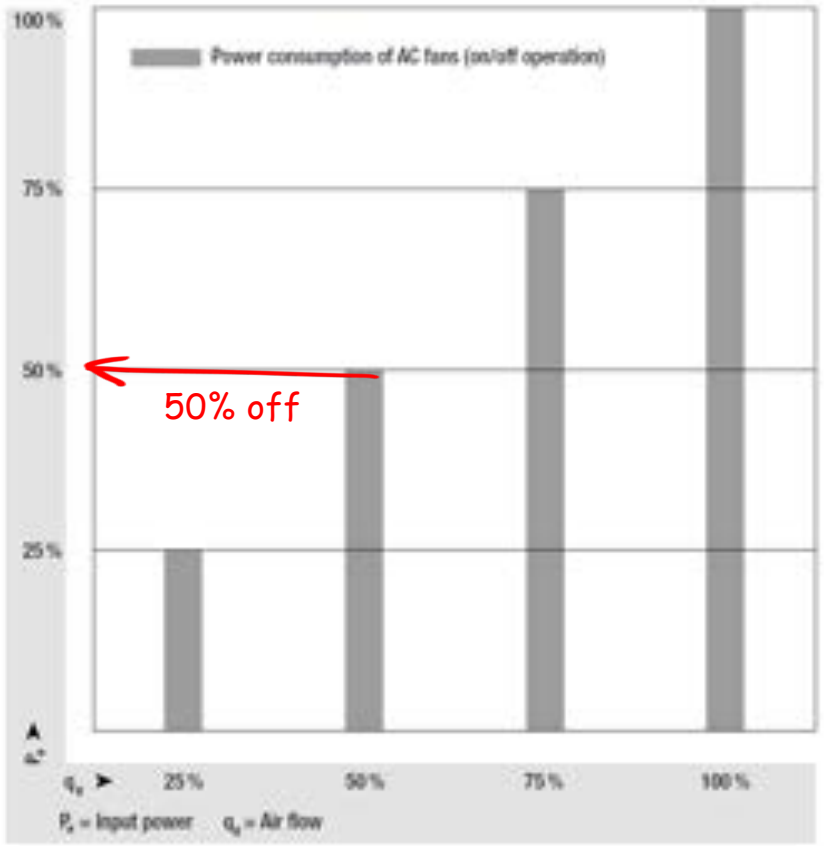
- Permanent magnet on rotor
- AC mains Input – converted to DC onboard
- Integrated variable speed control (0 – 10v or PWM)
- High efficiency (>IE4 as standard)

EC Fan Technology
Speed control

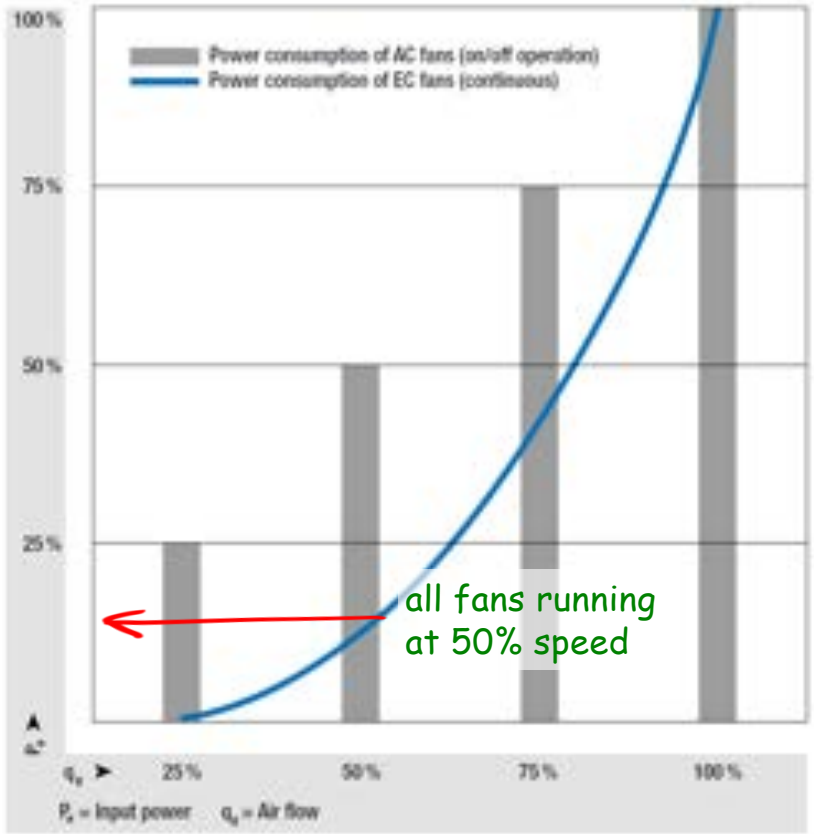
Scenario:
Condenser with 8 fans in parallel.

Question:
What are the possible variants for reducing the overall air power to 50%?

Variable speed for variable air power



Variable speed for variable air power



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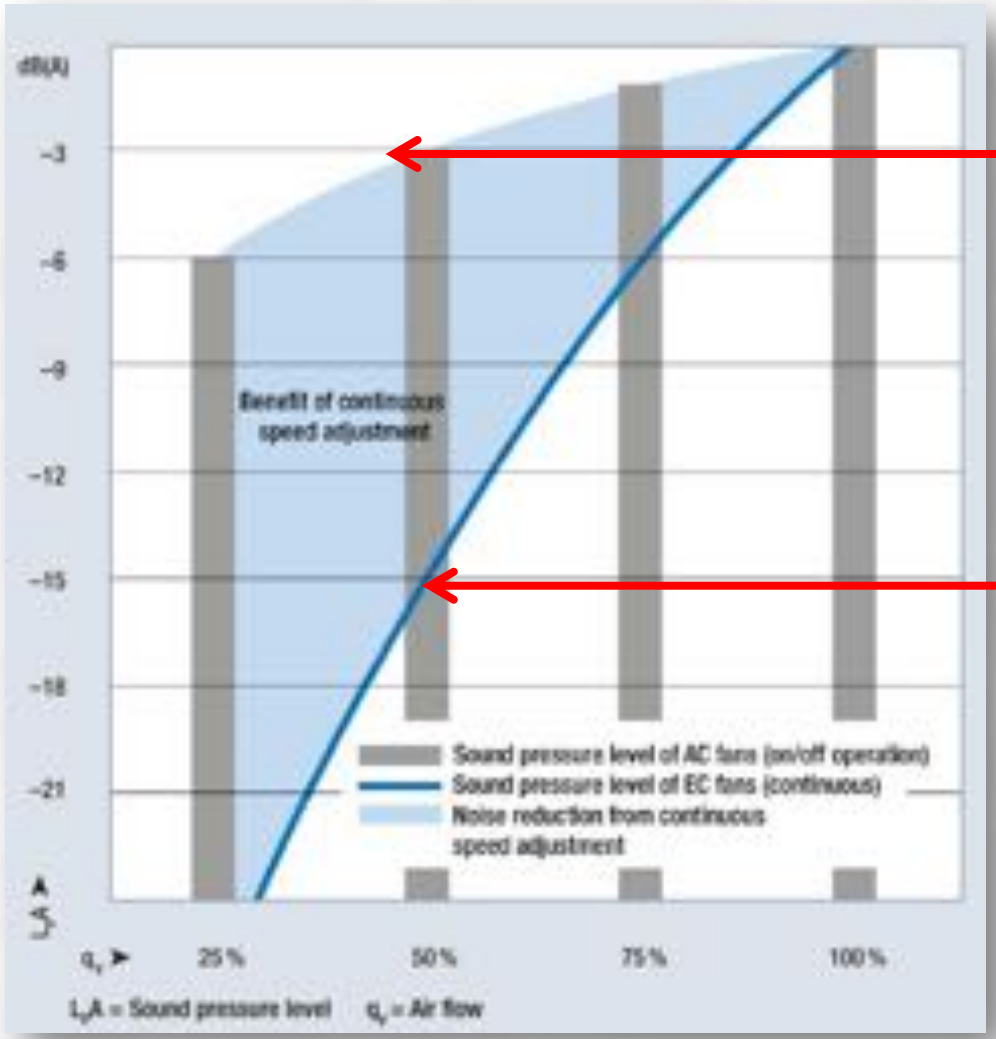
Noise Reduction

Integrated Speed Control allows for fan speed to be modulated



Stage Control

Ie. For a 4 fan system. - Switching off 2 fans

- 50% reduction in airflow
- 3dBA noise reduction

Modulation

Noise reduction by speed controlling all fans.

Ie. For a 4 fan system. - all fans @ ½ speed

- 50% reduction in airflow
- 15dBA noise reduction

Applications for retrofitting fans in supermarkets

Supermarket retrofit applications

70%

savings in
food refrigeration

50%

savings through fans
in air handling units

30%

savings in
condensers

30%

savings in
evpaorators

EC Fan Retrofit Case Studies

Case Study
Henderson Group – Northern Ireland

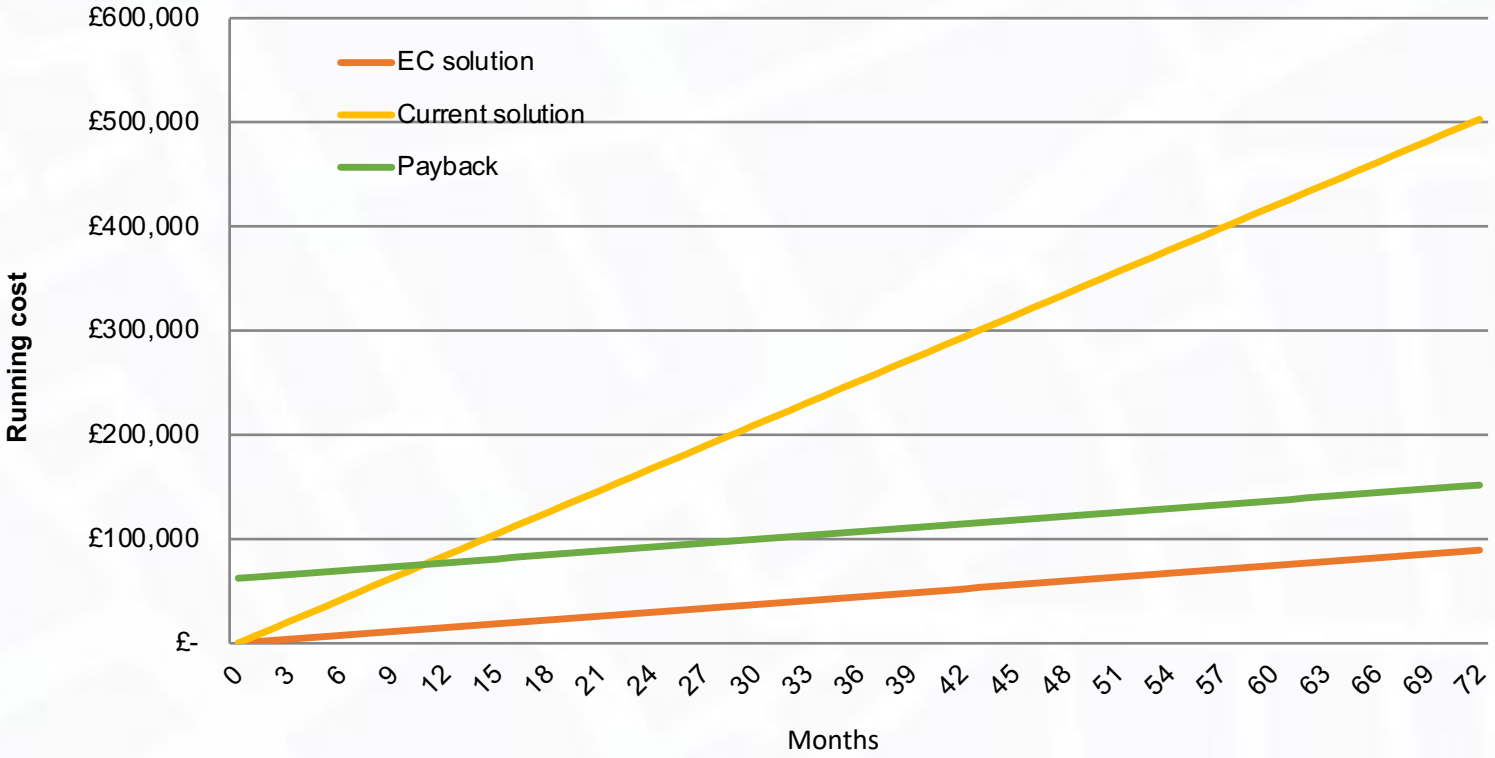
- Cross Refrigeration installed over 2000 fans

- Replacing their existing stock of 38W AC fridge fans with the ECM 8W fans

- 80% reduction in energy consumption, reduced energy consumption and reduced heat load in the fridge cabinets

- Annual savings are in excess of £60,000 per annum

Case Study
Henderson Group – Northern Ireland



Marks & Spencer
Condenser fan retrofit project

- Part of M&S Plan A
- Trial completed in UK
- 152 stores retrofitted
- 1400 Axial EC fans and AxiTops
- 258 condensers
- 153 new controllers
- Challenging 4 month installation schedule

Case Study
M&S condenser fan retrofit

- 910mm EC axial fans, AxiTop diffusers, adaptor plates & electrical cables with Isolators
- Annual energy reduction 3265.3 kWh
- Less than 5 years ROI
- Annual estimated energy cost saving per fan £375.51
- Total Annual estimated saving in excess of £500,000

Conclusions

Retrofitting EC fans into legacy refrigeration equipment:

- Saves energy
- Reduces noise levels
- Allows for greater controllability
- Improves equipment life expectancy
- Reduces maintenance

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Doing More with Less: **Smart Stores and Energy Efficiency**

Mr Alexander Abrass

Sales Director of Cooling, MENA

Danfoss Turkey, Middle East & Africa

Danfoss

Doing More with Less: **Smart Stores and Energy Efficiency**

Mr Alexander Abrass
Sr. Sales Director, Cooling Division
Danfoss Turkey, Middle East & Africa

Agenda

- Challenges in the Food Retail Industry
- Turning Challenges into Opportunities
- Cold Stores and Unrealised Potential
- A Holistic Approach - Energy Efficiency & Smart Stores
- Summary

Turning Challenges into Opportunities

The food retail industry is more challenging than ever:

- **New consumer demands**
- **New technologies**
- **Low profit margins**
- **Regulatory uncertainties**

Despite challenges in the industry, multiple opportunities exist to:

- **Optimize Food Safety**
- **Think ahead with Big Data**
- **Combat Climate Change**
- **Maximize Energy Efficiency**

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Your stores hold unrealised potential for efficiency gains

WHAT IF YOUR SUPERMARKETS COULD:

- Reduce your carbon footprint and grow your bottom line
- Redistribute and sell more energy than you use to local energy grids
- And ensure that all this can be monitored and managed in real-time from one location

Up to **50%** more energy savings

Up to **60%** reduction in CO^2 emissions

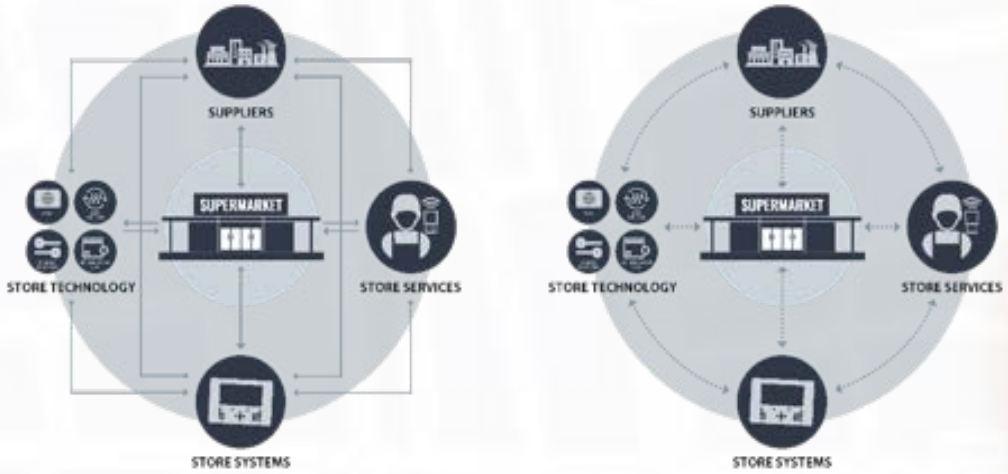
24/7 monitoring for improved food safety

A Holistic Approach

Integrates all enablers of energy efficiency into one solution

- Interconnected digital technologies
- Multiple cross-store applications
- Refrigeration, HVAC and lighting
- Automatic and remote monitoring
- Enterprise-level data collection
- Smart-grid integration
- Staff training

Disparate Store technology vs **Integrated Store technology**



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An end-to-end solution to store efficiency

Maximising store efficiency

- STORE DIAGNOSTICS
- OPTIMISATION POTENTIAL
- JOINT ACTIVITY PLAN
- IMPLEMENTATION
- SMART DATA MONITORING
- COMMISSIONING AND OPERATION
- CONTINOUS STORE PERFORMANCE

Smart Store Solutions

Levels of improvement through the use of Smart Stores

Smart Store Solutions
Levels of Improvement

LEVEL 1
MONITORING AND MANAGMENT

- Alarms and deviations
- Optimisation of existing equipment
- Cooperation with local contractors

LEVEL 2.
CASE CONTROL

- Decentral adaptive superheat control
- PO optimisation
- In connection with a store refurbishment

LEVEL 3.
NATURAL REFRIGERATION

- From HFC to CO_2
- Training technical staff
- In connection with a store refurbishment

LEVEL 4.
HVAC/R INTEGRATION

- Integration of refrigeration and air conditioning
- Heat recovery system installation

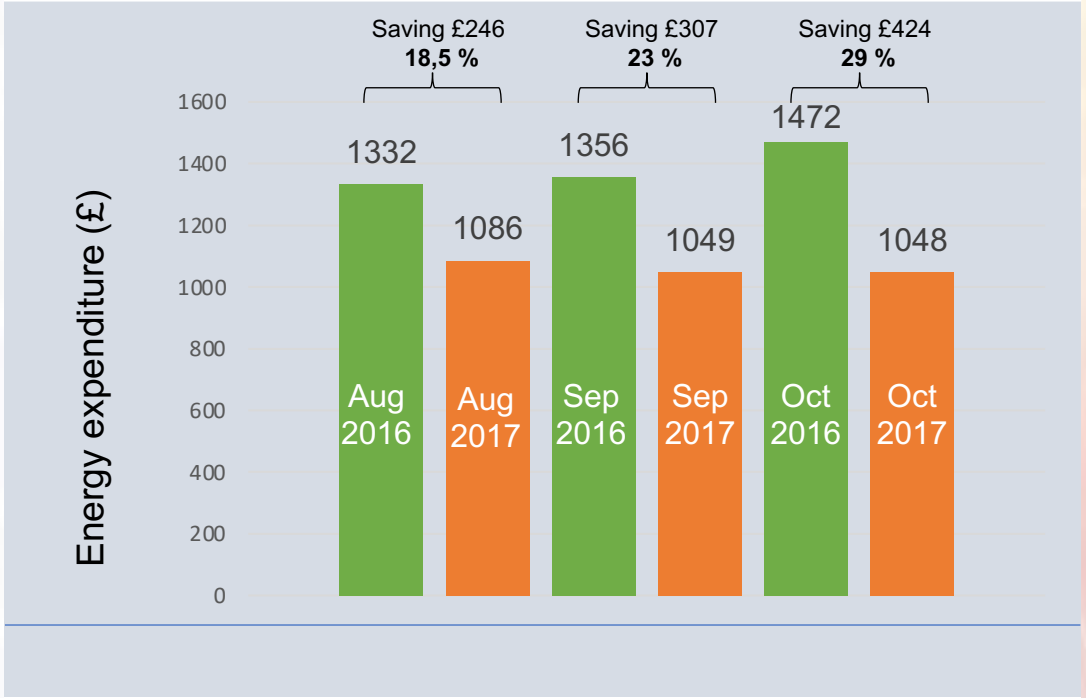
LEVEL 5.
SMART ENERGY

- Demand Response/Smart Grid
- Photovoltaic
- Battery & cold storage
- E-mobility

Level 1 - Monitoring and Management

ACTIVITIES	✓ Monitoring of stores (HVAC, Ilumination, Others) ✓ Adressing alarms (managed services) ✓ Fine-tuning of stores
ENERGY SAVINGS	5-10% of total store energy
EVIDENCE	➢ Cases from small to large store pilots ➢ Minor investments in equipment. ➢ Activities in cooperation with local contractors

CONVENIENCE STORE PILOTS SHOW A SIGNIFICANT INCREASE IN MONTHLY SAVINGS

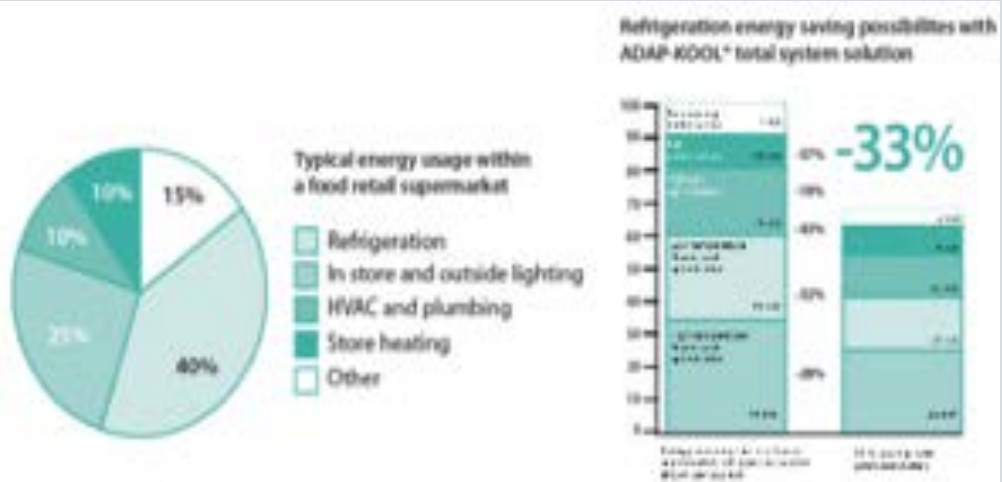


20-29% SAVINGS

Level 2 – Case Control

ACTIVITIES	✓ Move from TXV or Centralised control to decentral adaptive superheat control
ENERGY SAVINGS	11-20% on Refrigeration
EVIDENCE	➢ Cases from small to large store pilots ➢ More accurate) with PO Optimisation
COMMENTS	▪ Standard in most Supermarkets and Hypermarkets in Europe ▪ Typically done in connection with a major store refurbishment

ENERGY SAVINGS IN SUPERMARKET REFRIGERATION



33% SAVINGS

Level 3 – Natural Refrigeration

ACTIVITIES	✓ Move from HFC to CO_2 solution ✓ Guide retailer in selecting the right solution ✓ Training of technical staff and contractor
ENERGY SAVINGS	10%+ on Refrigeration
EVIDENCE	➢ Cases and calculations for medium to large stores
COMMENTS	▪ Focus has been CO_2 solutions for medium to large stores ▪ Typically done in connection with a major store refurbishment

POTENTIAL SAVINGS WITH EJECTOR AND PARALELL COMPRESSION

System	Energy Saving vs. R404a	Compressor Saving vs. Booster
Booster	- 11%	0%
Parallel compression	7 %	15 %
Gas ejector	10 %	18 %
Liquid & gas ejector	22 %	27 %

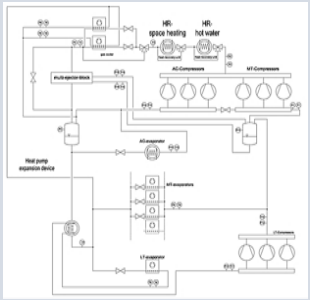
22% SAVINGS

Level 4 – HVACR Integration

ACTIVITIES	✓ Integrate the Refrigeration and Air Conditioning rack into one system ✓ Install heat recovery system.
ENERGY SAVINGS	25%+ on HVAC
EVIDENCE	Cases and calculations primarily from CO_2 installations in Europe – both hot and cold climates
COMMENTS	CO_2 and heat recovery is a perfect combination, due to very high tempertures in CO_2 system

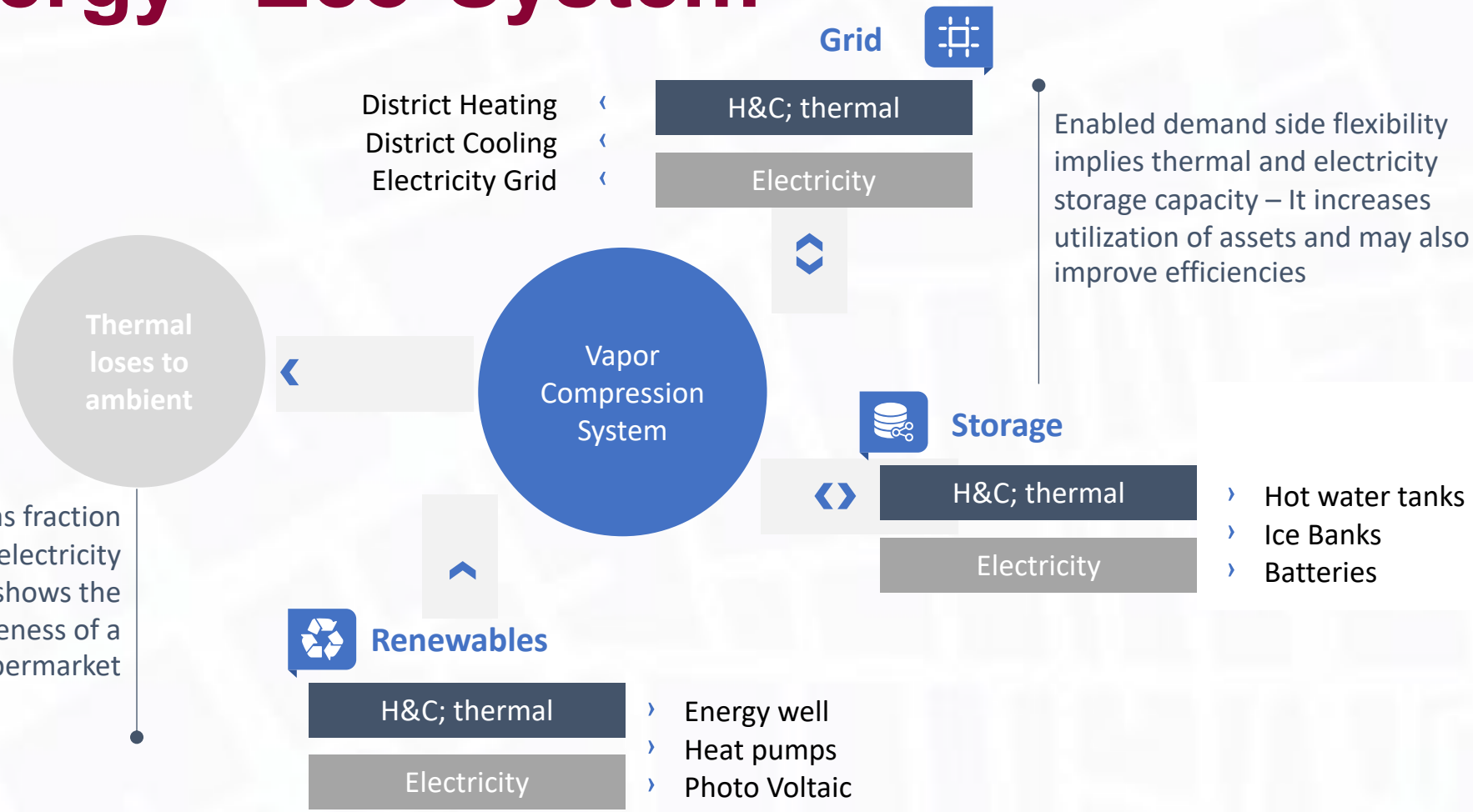
ALL NATURAL HVACR INTEGRATION

For every investigated operation conditions, the refrigeration system with the running vapour ejectors reduced the total energy power consumption mainly between 15 and 30% depending on the ambient temperatures and corresponding AC requirements.



15-30% SAVINGS

The Supermarket is a key factor in the Energy “Eco-System”



Summary

- The retail industry is faced with multiple challenges which can be turned into opportunities
- Cold stores show unrealised potential for energy savings
- Smart Stores provides a platform for integrated energy management through a holistic approach

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Final Remarks

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KEY PERSPECTIVES ON THE REGION'S HVACR INDUSTRY


Thank You!