



Ryan-Jayberg

Manufacturing

*Optimising Display Cases
and the Knock-on Effect*

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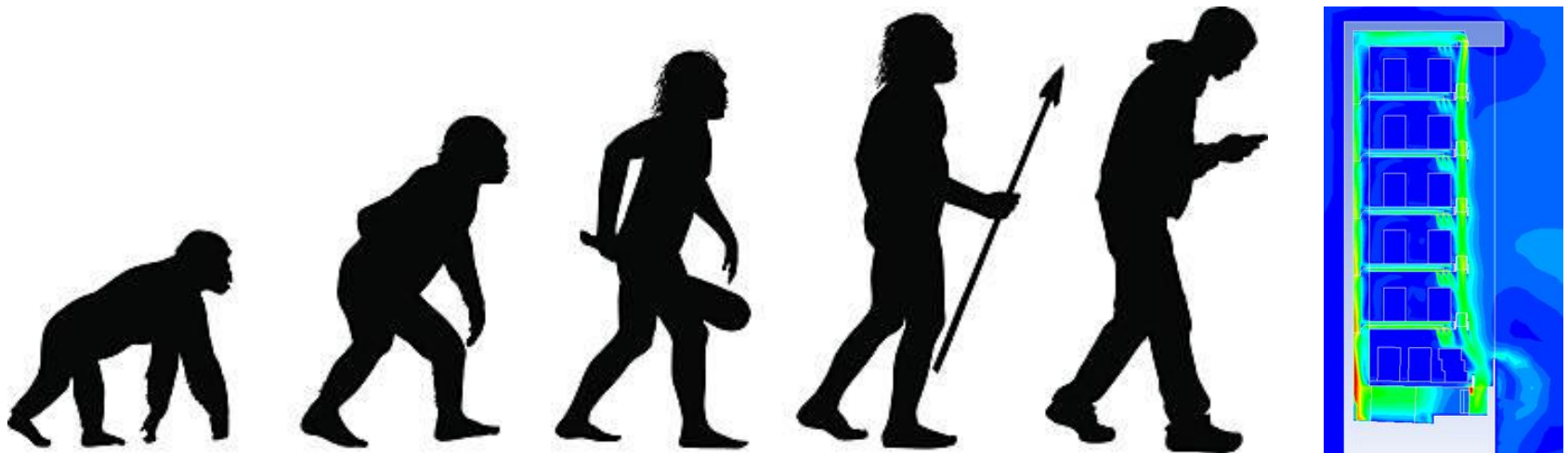
Presented by Colin Green MinstR

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Display cabinet optimisation?

To start my presentation, I'd like to take you back a few years to see how refrigerated display cabinets have evolved.....



Welcome to the 1970's

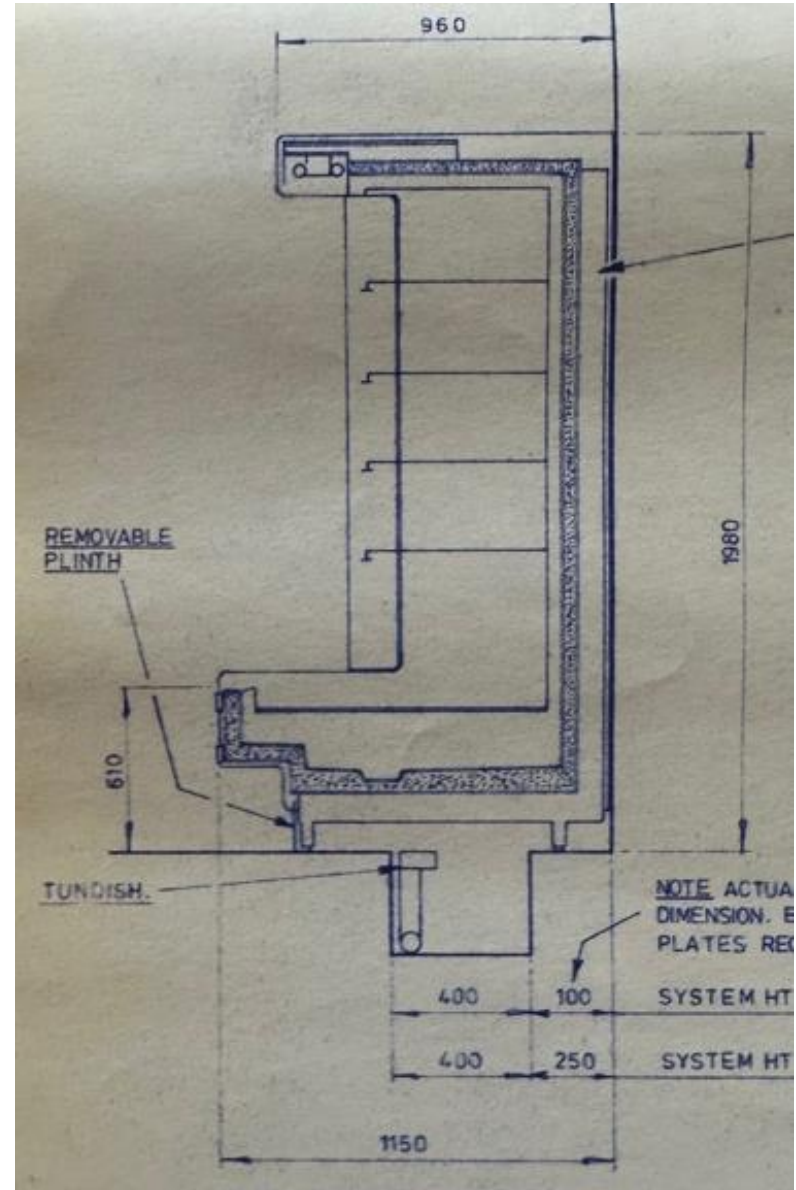
Not many of us here today can remember supermarkets looking like this, but fundamentally the basic design of display cabinets has evolved over time rather than radically changed over the last 50 years



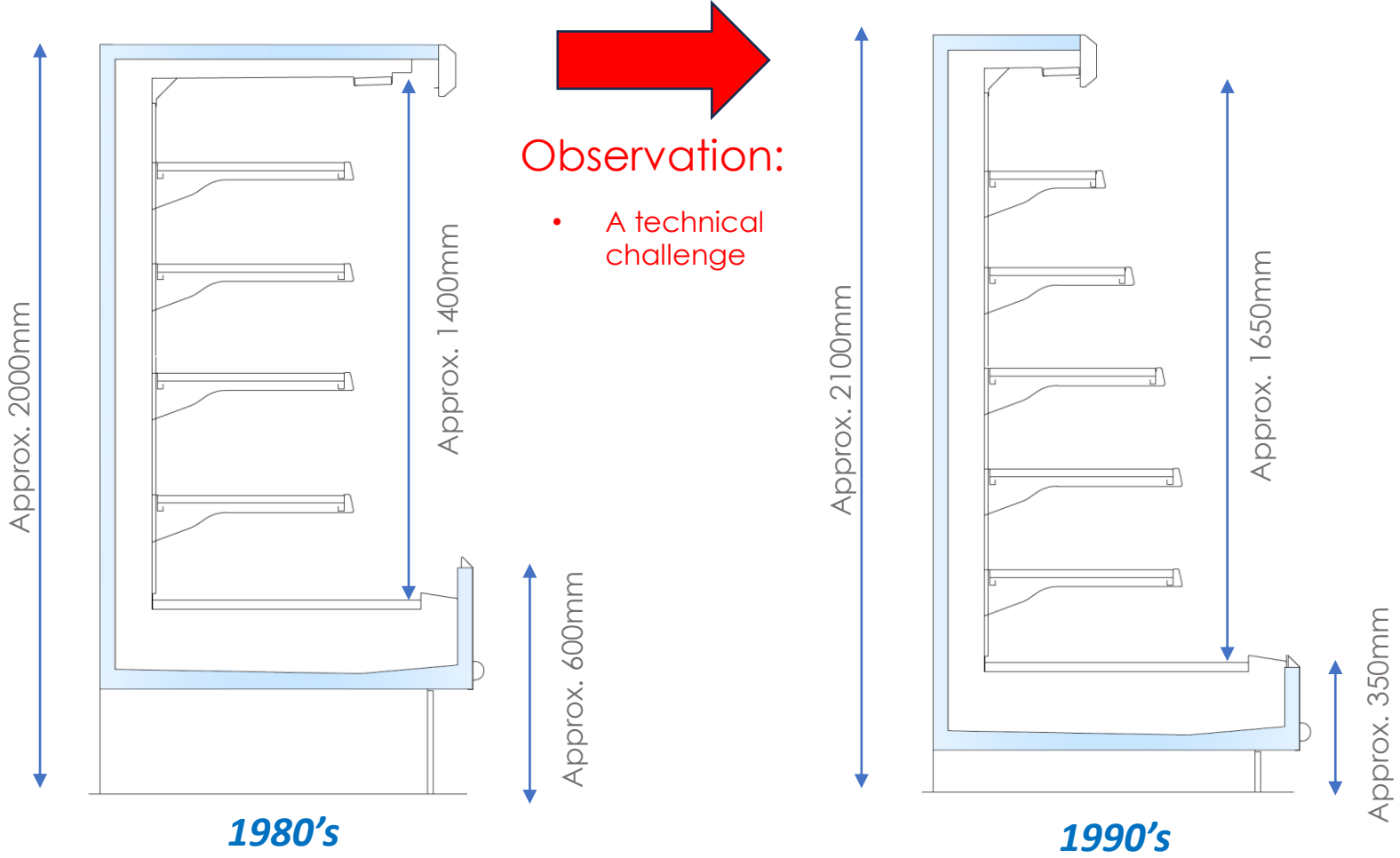
Back in 1982, at the start of my refrigeration journey, remote multideck display cases typically looked like this:

Observations:

- No food temperature legislation, cabinet data referenced air off temperature range, Dairy cabinet data typically published at +4/+6° C, Meat 0/-2° C.
- Product core temperatures possibly +10 /+12° C.
- Simple mechanical thermostat control.
- Meat cabinets typically Gas Defrost
- Small Total Display Area as a result of high front & nominal 1400mm 'throat' (internal height between base panel & ceiling).
- Ample space below cabinet for electrical panel & drainage pipework.
- Energy consumption not considered a priority
 - Evaporating Temperatures typically -10 ° C
 - Twin tube fluorescent canopy & shelf lighting
 - Low efficiency fans.
 - Trim heaters to prevent condensation

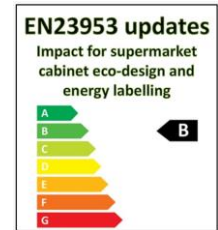


Supermarket competition produced a demand in the 1990's - 2000's for continuous development of display cabinets with increased capacity & display options.



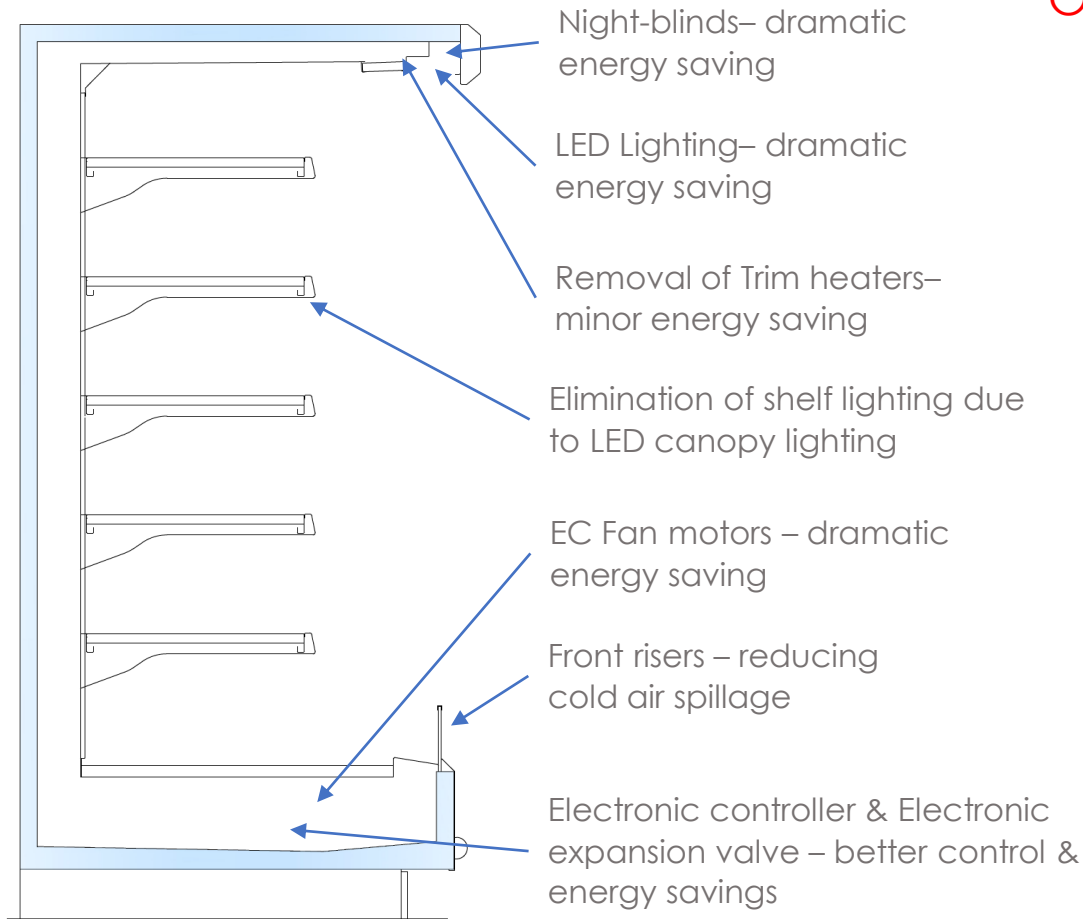
As display cabinet designers, we kept pace with the demands of the merchandisers for lower fronts, no canopies, taller cabinets etc. If you throw lots of energy at it, you will be surprised at what can be achieved!

However, things were starting to change!



Date	Initiative	Impact
1989	The Montreal Protocol, an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.	No more CFC & HCFC Refrigerants - Move to HFC's
1994	EN 441 standard introduced specifying marking and performance requirements, methods of classification, methods of determining dimensions and methods of test for commercial refrigerated cabinets for the sale and display of food products.	Standardization of test methods & adoption of product temperature as measure of performance
1995	The Food Safety (Temperature Control) Regulations 1995 ("Regulations") require potentially dangerous foods to be held at or below 8°C	New performance criteria demanded by 'End Users' Review of 'cold chain'
1997	The Kyoto Protocol, an international treaty which commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that global warming is occurring and that human-made CO2 emissions are driving it.	Phaseout of HFC Refrigerants - Move to lower GWP blends & natural refrigerants
2001	The Enhanced Capital Allowance (ECA) scheme, introduced by UK Government to encourage businesses to invest in low carbon, energy-saving equipment.	Manufacturers challenged to focus on more energy efficient designs
2005	EN 23953 standard introduced replacing EN 441, specifying requirements for the construction, characteristics and performance of refrigerated display cabinets used in the sale and display of foodstuffs.	Further standardization of test methods incorporating updated technology
2021	Introduction of Energy labels for refrigerating appliances with a direct sales function use, a scale from A (most efficient) to G (least efficient) under Regulation (EU) 2019/2018. The labels provide information on the product's energy efficiency class / energy consumption / volume or display areas of the compartments / temperature of the compartments	Further drive on energy efficiency, low efficiency models now banned from sale

As energy & performance became increasingly in the focus of supermarkets in the 2000's new thinking & technology was required to deliver display cabinets that met the new criteria.

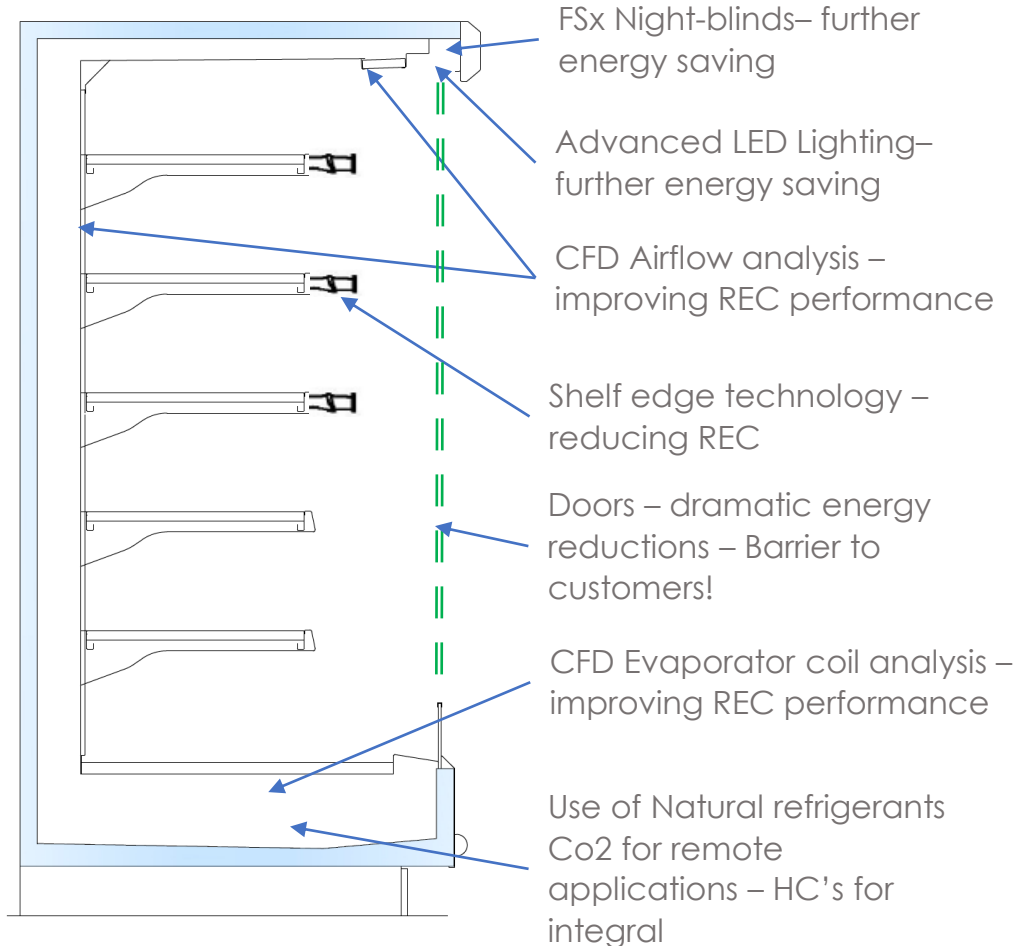


Observations:

- **Energy saving solutions mainly focus on reducing DEC (direct energy consumption)**
- **Air curtain associated with 'Open Front' design still represents the major contributor to the cooling requirements REC (refrigeration energy consumption) of the cabinet.**
- **Advancements in control & coil design increase evaporating temperatures typically to -7°C**

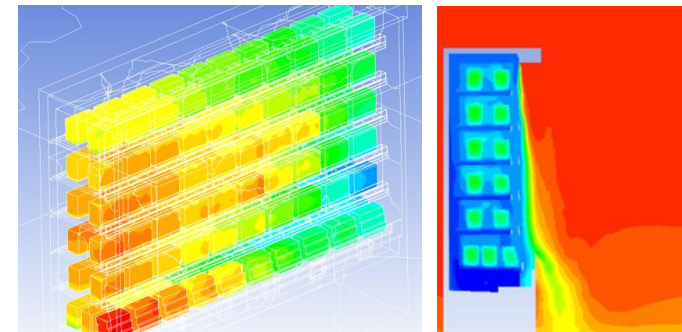


As we move onward to the 2010's, global warming & energy prices had become the drivers for further change.



Observations:

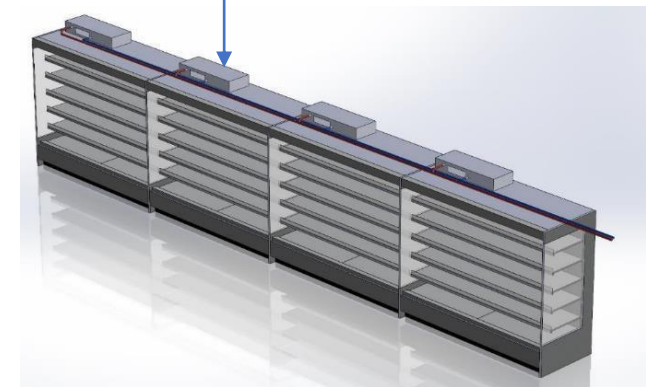
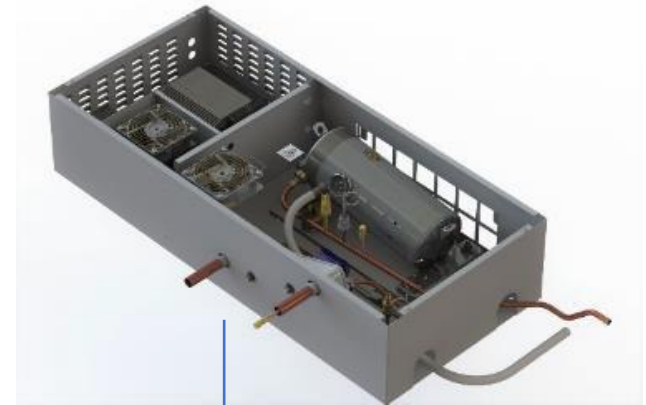
- **Focus on reducing TEC (Total energy consumption) = REC + DEC**
- **New technologies for analysing & improving the air flow characteristics of open & closed cabinets.**
- **Advancements in air flow / coil design & alternative refrigerants increase evaporating temperatures typically to -4 ° C**
- **Doors represent 'obvious' energy savings but not liked by all retailers.**



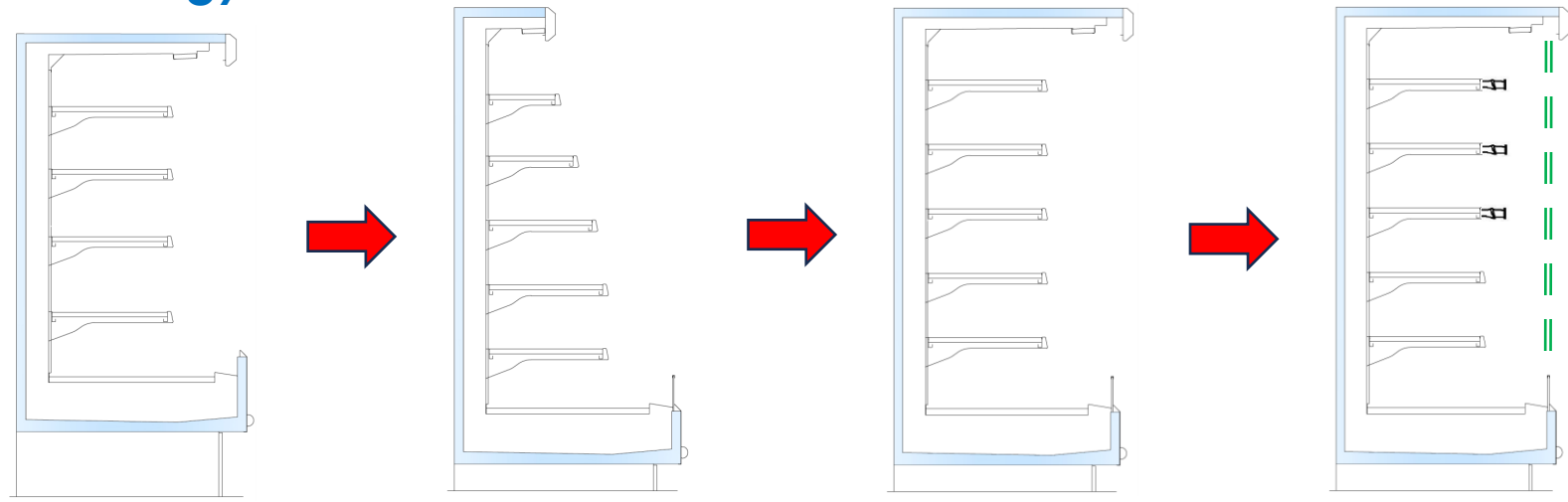
Natural refrigerants

The introduction of natural refrigerants has given rise to differing refrigeration 'plant' solutions available to retailers.

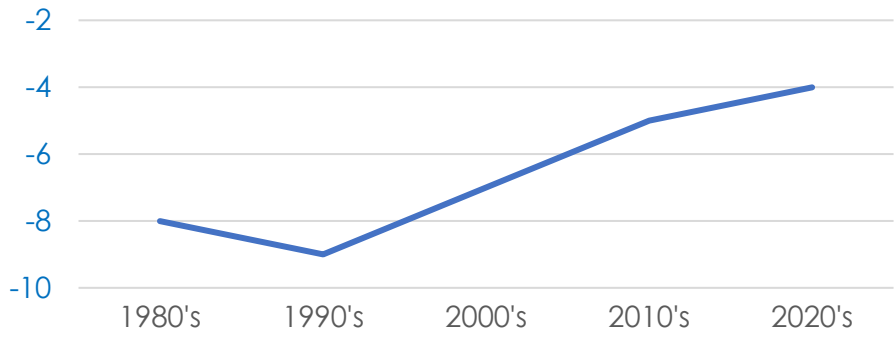
- **Co2 primarily used as DX solution for remote cabinets.**
 - Properties of Co2 lend themselves to effective heat reclaim solutions & gas defrost potential for low temperature cabinets in preference to electric defrost heaters.
 - Cabinet evaporator design & line component selection has changed to accommodate the properties of R744, in particular higher pressures.
- **HC commonly used for Integral cabinets**
 - Though restricted in charge size due to high flammability & subject to stringent safety regulations, HC's have become commonplace within integral cabinets in UK.
 - Unlike the majority of Europe, the UK have adopted a different approach to applying the standards & have led the development path of large remote style cabinets being fitted with water cooled HC condensing units utilising horizontal scroll compressors. This solution enables the use of multiple integral cabinets without adding excessive heat load to the store.
 - The use of variable speed compressors has further increased energy efficiency of HC integrals



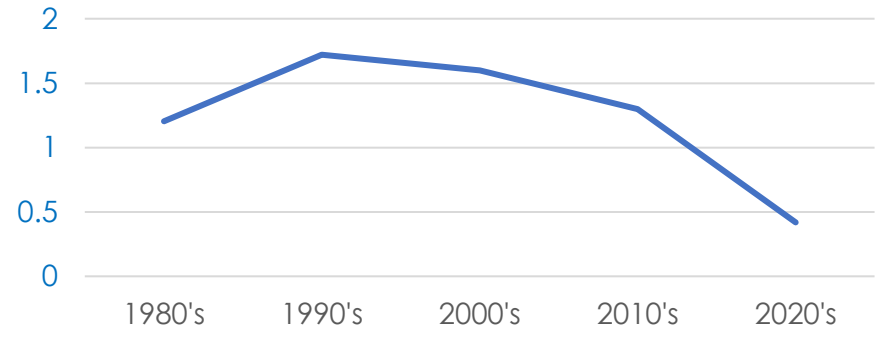
So, we arrive at the 2020's. We are producing cabinets that are offer 15/20% more product capacity & display area than in the 1980's, but use approx. 70% less energy



Dairy Cabinet Evap °C temp Optimisation over time



Dairy Cabinet Duty Kw/m Optimisation over time



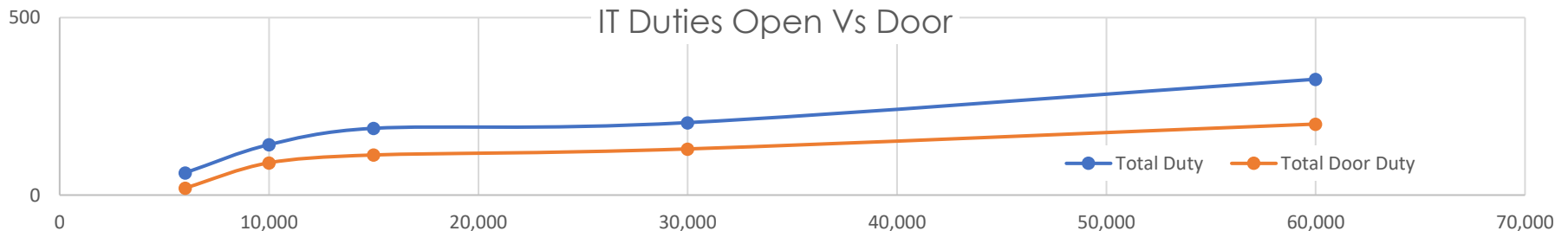
Having optimised the cabinets – What are the knock-on effects?

The influence of display cabinets on the overall energy balance within a supermarket cannot be underestimated.

It has historically been understood that **Remote cabinets** create a substantial cooling load within the store that requires balancing with an effective heating system required all year round. Conversely **air-cooled integral cabinets** produce excessive heat within the store that requires the introduction of adequate cooling from air conditioning which is often not sufficient in the summer months.

With many cabinet optimisation solutions now available, the increased efficiency of display cabinets will significantly change the cooling / heating load balance within the store.

The **cooling effect** of **Remote cabinets** will be reduced & the **heat produced** by **air cooled integral cabinets** will also reduce.



This fundamental change in the energy balance within the store must be calculated at the design stage by refrigeration & HVAC specialists to develop a solution that will meet the environmental conditions required within the building.

Energy Balance

Open fronted multi-deck stores often require heating to cold aisles or include cold aisle retrieval systems to aid customer comfort. These systems need to be reviewed when doors are installed.

Heat Gains

Lights

Solar

Fabric

Occupants

Small Power

Doors- Air Ingress/Vent



Doored Cabinets with reduced cold aisle



Climate Change



Reduced winter heating loads

Increased Cooling- AC?

De-humidification Systems?



What next for cabinet development?

The engineers at RJM are already looking at the next generation of display cabinet innovation.



We provide our clients with a **'one stop'** shop for all things cabinet related.

- Concept Designs
- Prototypes
- Complete product development
- Product supply & aftercare
- On site evaluation and testing
- Laboratory testing
- Product tests
- Performance enhancements
- Solution recommendations

