Supermarket Refrigeration Trends in the Asia Pacific Region

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View of the world from our place ….

Asia Pacific

- 4 Billion people (60% of the world's population
- 30% of the world's land area
- Extreme variances in Climate / Languages / Peoples / Religions / Wealth / Education / & Customs
- Large distances (e.g. Auckland to Shanghai is 6,000 miles or 12 hours flying time)
- Retail markets varying from the latest large full service supermarkets to outdoor 'wet markets'
- In short a region of extremes

Asia Pacific Region – early adopters

- Currently in the region Australia is the clear leader and often the first adopter of new technology and identifying / setting new trends in Supermarketing.
- New Zealand now lags Australia but is a ready adopter of proven new technologies that show valid energy payback and / or sales / margin growth.
- Thailand is also a ready adopter.
- China is the waking Tiger – as refrigeration industry knowledge grows expect to see new technologies increasingly accepted and wanted.
- Most of the other countries / regions are slow adopters with of course some localised exceptions.

Asia Pacific Region – Government Regulations

- Australia & New Zealand are the most regulated countries in the region in regards to refrigeration, including: -
  - All Retail Display Cabinets must be Government registered that they meet MEPS (Minimum Energy Performance Standards)
  - Refrigerant type & release is regulated
  - Imminent Carbon Tax / Emissions Trading Scheme (ETS), including refrigerants based on GWP:-
    - NZ has a soft phase-in which commenced July 2010 and is fully applicable by 1st January 2013
    - Australia commences July 2012

Key Drivers in Refrigeration Trends

- Merchandising / Product Presentation
- Capital Cost
- Energy Efficiency / Energy Cost
- Refrigerant & System Choice / Carbon Footprint
- Expected future Government Regulations
- Reliability and Serviceability
- Retail Display Innovation
- Temperature integrity
- Store Shopper Comfort

Merchandising / Product Presentation + Energy

- Sliding Glass Lids on Island Freezer Cabinets

- refrigeration load reduction of 40 to 50%
- evaporating temperature raised by approx. 10°F
- Payback approx. 3 to 5 years

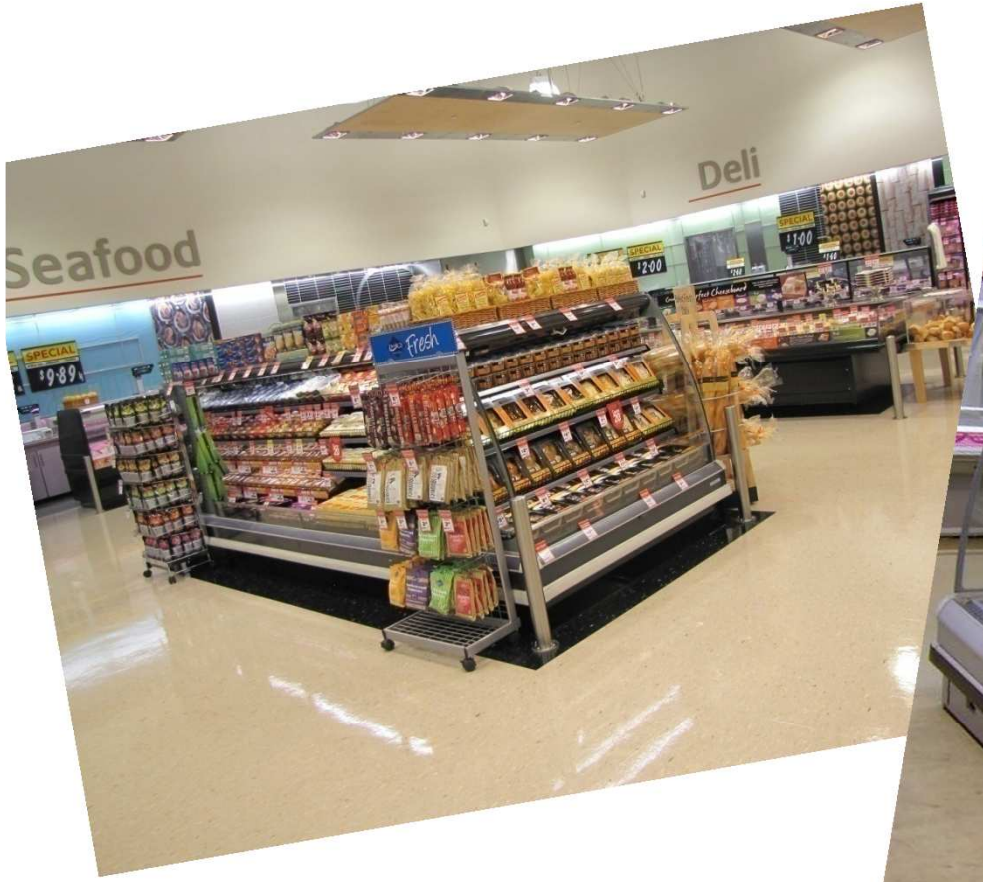
Merchandising / Product Presentation + Energy

- Front Display Glass

- refrigeration load reduction of 5% to 10%
- Reduced cold air spill = warmer shopping aisles
- Payback approx. 1 to 2 years

Merchandising / Product Presentation

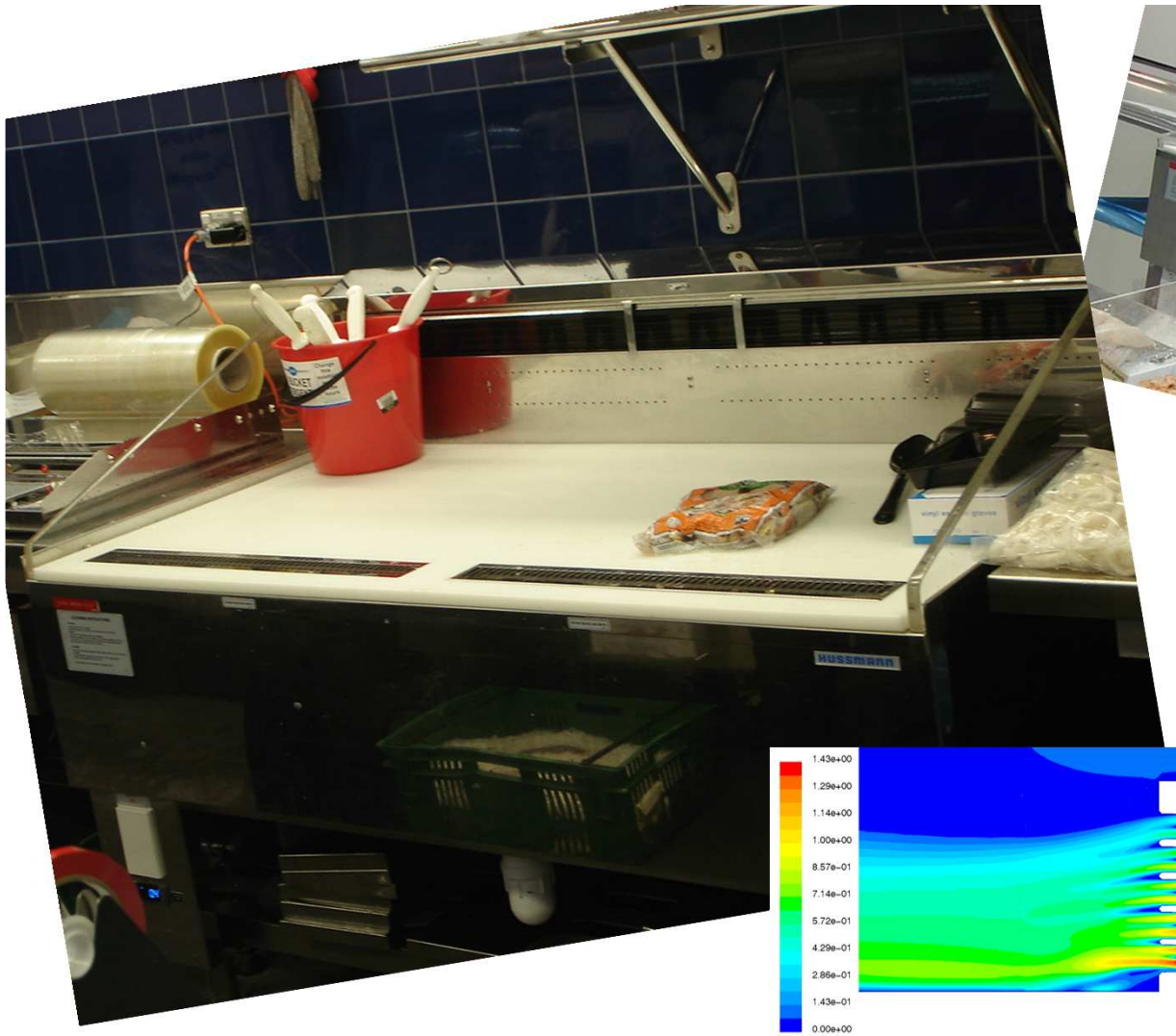
- Semi Vertical Shop-Around Cabinets



- lower height semi-vertical cabinets replacing some Multi-Decks

Product + Energy Solution

- Chilled Cutting Benches



- localised cooling solution
- eliminates total prep area cooling
- Payback approx. 1 to 2 years

Merchandising / Product Presentation

- Under-Lit Pedestal Cabinets

Temperature integrity

- Again AU & NZ lead, requiring Cold Chain temperatures meet: -
  - For Chilled between +30.2degF and +41.0degF
    - Some even specify maximum allowable temperature deviation between refrigeration cycle and post defrost peak
  - For Frozen below -0degF at all times except immediately post defrost when product temperatures may temporarily rise to +5.4degF
  - For Hot Foods always above +149degF
- Some retailers now fitting x1 Product Simulator into each display cabinet, logging and alarming if excursion outside above temperatures

Reliability and Serviceability

- Whilst energy efficiency is a key metric, there is a requirement that reliability is not compromised in the quest for the last 1 or 2 percentage points in energy reduction
  - Likewise temperature integrity is a must
- Newer technologies (i.e. CO2 etc …) do require investment in training of key staff to ensure competency and prompt service repairs
  - Including cognisance of possible loss of CO2 sub-critical charge during extended power outages and methodologies to reduce possible down-side exposure

Refrigerant & System Choice / Carbon Footprint

- With a looming ETS (Carbon Tax) this is one of the main 'drivers' for recent trends (i.e. energy, & refrigerant & even merchandising considerations)
- With the ETS start point of US$24.00 per ton of GWP, the costs to a supermarket will be significant for both electricity energy consumed and refrigerant (initial purchase and thence leakage) …. See attached refrigerant ETS implications :-

Refrigerant ETS costs per pound

Refrigerant	GWP per kilogram	ETS cost per lb @ US$24 per ton GWP	ETS cost per lb @ US$30 per ton GWP	ETS cost per lb @ US$40 per ton GWP	ETS cost per lb @ US$50 per ton GWP
R404a	**3,260**	**$ 35.50**	**$ 44.30**	**$ 59.00**	**$ 74.00**
R134a	**1,300**	**$ 14.10**	**$ 17.70**	**$ 23.60**	**$ 29.50**
M410A	**1,730**	**$ 18.80**	**$ 23.50**	**$ 31.40**	**$ 39.20**
MO99	**1,890**	**$ 20.50**	**$ 25.70**	**$ 34.30**	**$ 42.80**
R22 (Exempt)	1,500	$ 0.00	$ 0.00	$ 0.00	$ 0.00
R744 (CO2)	1	$ 0.00	$ 0.00	$ 0.00	$ 0.00
R717 (NH3)	0	$ 0.00	$ 0.00	$ 0.00	$ 0.00
R600a (Iso-Butane)	3	$ 0.00	$ 0.00	$ 0.00	$ 0.00

Refrigerant timeline (Australia & NZ)

- Pre 1989 …. LT = R502, MT = R12
- 1989 to 1995 …. LT & MT = R22
- 1995 to 2008 …. LT & MT = R404a
  - Note:-
    - from 1999 to 2003 some isolated secondary brine systems (essentially trial stores only)
    - first sub-critical CO2 systems emerge from late 2005 onwards
- 2007 onwards …. dramatic increase in use of CO2 and low GWP refrigerants (in preparation for anticipated Government Regulations and Carbon Tax). Most commonly new stores LT = CO2 DX, MT = R134a DX (or pumped liquid CO2), sub-critical CO2 systems predominantly using R134a as the high side of the cascade

CO2 Plant

LT DX CO2 plus MT pumped liquid CO2 Rack

LT DX CO2 Rack

(MT DX R134a – Rack not shown in photo)

Australia & NZ large format full service supermarkets

	Approx. Qty Total Large Stores	Qty with Brine Secondary Refrig Systems	Qty with CO2 Refrig Systems
Australia	1,575	3	51
New Zealand	342	3	21
Total	**1,917**	**6**	**72**

NOTE:-

- Secondary Systems all pre 2005
- CO2 Systems all post 2005
- 1x CO2 Store in Thailand to date
- 1x CO2 store in China to date

Other Refrigerants

- Whilst CO2 and R134a are the predominant refrigerants used in Australia and NZ today, certainly there is interest in further evolutions that may reduce Global Warming and increase efficiency. A few being considered include: -
  - R407F …. an alternate to R404a with approx. half the GWP and a C.O.P. approx. 8% to 13% better (dependent on application)
  - XP10 (an HFO with a GWP of approx. 500 and rated as an A1 refrigerant) …. an alternate to R134a
  - Transcritical CO2 …. a fully natural refrigerant system, however currently energy penalises in hot ambients (possibly a climate specific alternate)
  - At present both Propane and Ammonia discounted for Supermarkets due to charge sizes and resultant safety concerns

Expected future Government Regulations

- **"In From the Cold"**
  - An Australian and NZ Government bilateral initiative
  - Non-domestic refrigeration equipment and systems consume approx. 7% of the total energy use of each country. Energy use is predicted to grow with an increased demand for ready-to-eat food
  - Making non-domestic equipment and systems more energy efficient, will assist in enabling that our energy supply can keep up with demand, and also reduce greenhouse gas emissions to meet international commitments
  - "In from the Cold" is a strategy about how to achieve this for industrial and commercial refrigeration equipment used in the food sector. The strategy was prepared for the E3 Equipment Energy Efficiency program which runs in both New Zealand and Australia
  - The strategy outlines reasons why the sector is not as energy efficient as it could be (barriers) - and poses a variety of initiatives to improve the situation in the next 10 years
  - These initiatives are a mix of voluntary and regulatory tools, and the ideas are being refined with industry input since a draft was first released in late 2009. Initiatives include MEPS, best practice guides, industry training and online energy-use tools and targets

Other Energy Initiatives

#1. TRAINING

Ensure your staff understand the energy implications of leaving cold room doors open and over-loading display cabinets. Immediate returns for low effort and low cost.

#2. CLEANING & MAINTENANCE

Clean and well maintained cabinets are more efficient energy-wise and reduce reactive service costs.

#3. EC FAN MOTORS

A standard AC cabinet fan motor consumes approx. 40 Watts whereas an EC motor consumes approx. 15 Watts or less, payback in the region of 1 to 2 years.

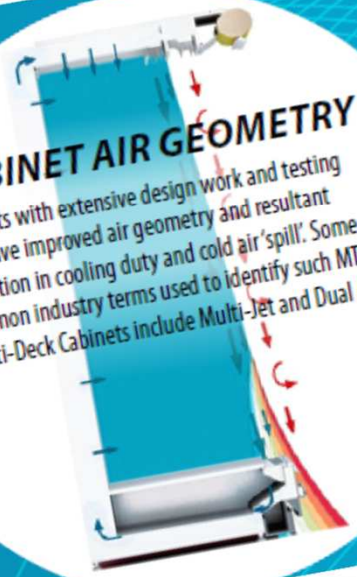
#4. NIGHT BLINDS

When blinds are down, cooling duty reduction in the region of 25% to 35% are achievable. For stores closed 8 hours each day a payback in the region of 1.5 to 2 years can be realised.

Manual - Motorised - Strip Curtain

#6. CABINET AIR GEOMETRY

Cabinets with extensive design work and testing will have improved air geometry and resultant reduction in cooling duty and cold air 'spill'. Some common industry terms used to identify such MT Multi-Deck Cabinets include Multi-Jet and Dual Air.



#8. GLASS DOORS ON MT MULTI-DECKS

Will reduce cooling duty by 50% plus, high capital cost, payback in the region of 2.5 to 3.5 years.

Other Energy Initiatives

#9. LED LIGHTS

4ft Flouro tube consumes approximately 30 Watts, same light output LED consumes approximately 15 Watts, payback in the region of 2.5 to 4 years.

#10. RE-COMMISSIONING

Over time refrigeration settings may be altered (often referred to as drift-back), checking optimum settings are in place on a bi-annual basis is prudent and pro-active.

#11. STORE TEMPERATURE & HUMIDITY

Have a major influence on the energy consumption of display cabinets (reducing humidity from 60% to 50% can reduce refrigeration energy consumption by up to 10%).

#12. ANTI-SWEAT HEATER DEW POINT CONTROL

For some cabinets anti-sweat heaters are only required in extreme store ambient conditions. Dew Point Controllers power anti-sweat heaters on an as required basis, rather than 24/7. Payback period is cabinet and store ambient dependent.

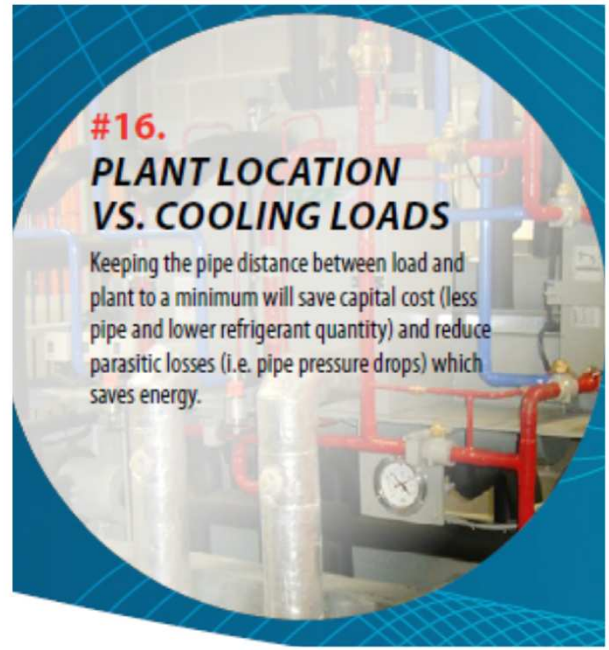
#13. FLOATING HEAD PRESSURES COUPLED WITH FLOATING SUCTION PRESSURES

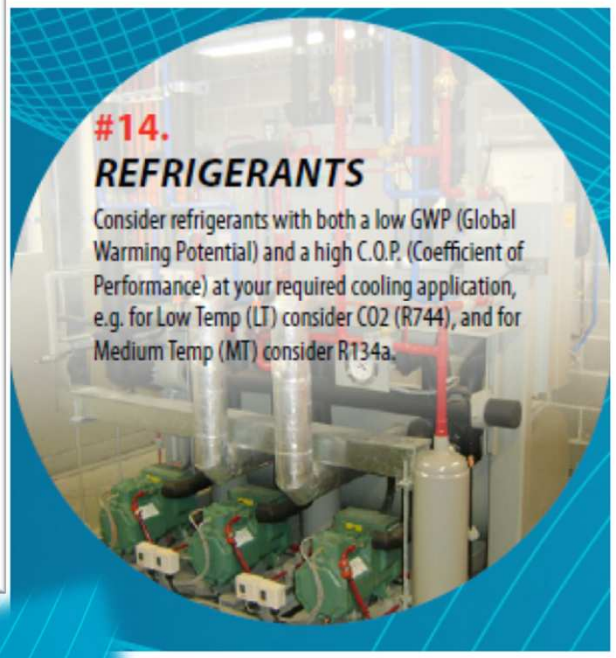
A simple control setpoint change from fixed to floating head pressures when ambient conditions plus raising suction pressures when coldest loads achieve temperature will save energy from improved compressor compression ratios, payback often in less than 6 months.

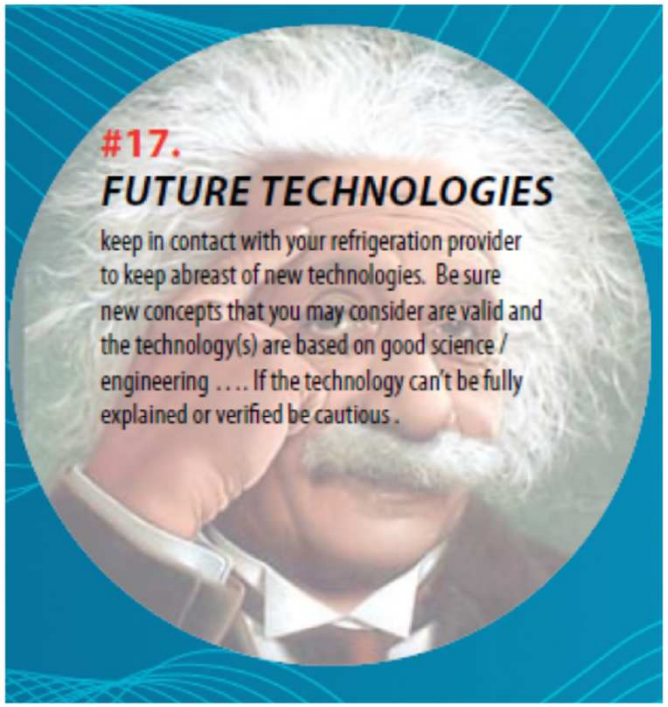
#15. VARIABLE SPEED DRIVES (VSD'S)

Refrigeration system cooling loads are constantly changing, adaptation to this through the use of variable speed components, provides variable cooling capacity to match the change in cooling load. This thereby reduces energy consumption seen with 'over-cooling'.

Other Energy Initiatives







In Summary

- Supermarket Refrigeration Trends in the Asia Pacific Region:-
  - Widely varying regional maturity and trends
  - Strongly influenced by both Europe & USA
  - The mature regions are increasingly Government regulated (which is a harbinger for developing regions)
    - This then drives Refrigerant & System Choice with a high focus on Energy Efficiency & Carbon Footprint reduction
  - Increasing customer understanding of cost vs. benefit for valid new technologies


Thank you for your attention –
Questions ?
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