Working gases, technology and tax – the future of coolth…

Presented by

Michael McCann

Thinkwell Australia

Seminar supported by Enterprise Connect

An Australian Government Initiative

ENTERPRISE CONNECT

Shaping Business, Transforming Industry

Contents

- **A little bit about who we are**
- **A lot of stuff about taxes and refrigerant gases**
- **A lot of stuff about leak prevention in refrigeration systems**
- **Stuff about energy savings for refrigeration systems**
- **Something about low GWP Refrigerants and their applications and issues**
- **Forum and discussion**

Introduction

AIRAH is the national industry body for refrigeration and airconditioning professionals.

AIRAH has taken a leading role in working with government to manage change in the industry

Michael McCann from Thinkwell Australia is contracted with AIRAH for this seminar series.

- Worked in close collaboration with network of industry experts in this field over the past 6 years (www.expertgroup.com.au)

HVAC&R Communique

- In the lead up to July 1 AIRAH convened an industry summit to discuss preparation for post July 1 world.
- Very diverse industry came together from across the long and complex supply chain to discuss the issues and risks – lots of problems identified and some solutions
- Communique sent to government can be downloaded from www.airah.org.au

Refrigeration – not an option

- Here to talk about levy on refrigerant gas and cost pressures on refrigeration
- But refrigeration itself is not an option, refrigeration is all about food
- Cold food chain is a piece of national infrastructure delivering food from farm to household fridge every day
- $40 billion fresh food production 2010-11
- Tens of thousands of people employed every day, millions of tonnes of food moved a year

Primary Producers → Mobile Refrig. → Food Processors → Mobile Refrig. → Cold Storage → Mobile Refrig. → Food Retail → Consumer

Applications Dairy farmers Fruit growers Vegetable farmers Livestock producers Poultry farmers Fisheries Aquaculture	Trucks Vans Trains Marine Air	Dairy industry Beverages Frozen foods Abattoirs & meat processors Confectionary	Trucks Vans Trains Marine Air	Large cold storage facilities 11 million m^3 Medium temp ≥ 0°C Freezers < 0°C	Trucks Vans Trains Marine Air	Supermarkets Food retail (green grocers, butchers, poultry, seafood, liquor) Convenience stores Service stations Takeaway foods Vending machines	Household Catering & hospitality: - Restaurants - Hotels, motels - Pubs, clubs - Sports venues - Hospitals - Nursing homes
Equipment Walk-in coolrooms Industrial refrigeration Milk Vat Liquid chillers Ice makers	Mobile refrig. units Reefers	Walk-in coolrooms Industrial refrigeration Liquid chillers Ice makers	Mobile refrig. units Reefers	Walk-in coolrooms Industrial refrigeration	Mobile refrig. units Reefers	Walk-in coolrooms Supermarket systems Retail display cases Vending machines Ice makers Water coolers Ice making equipment	Domestic refrigerators & freezers Catering & hospitality: - Walk-in coolrooms - Commercial refrig & freezers - Merchandising equipment - Beverage cooling (beer & post mix) - Ice makers
Common refrigerant types:							
Ammonia, HFC-404A, HFC-134a, HCFC-22	**R404A, R134a**	**Ammonia, HFC-404A, HFC-134a, HCFC-22, CO_2**	**R404A, R134a**	**Ammonia, HFC-404A, R134a, HCFC-22**	**R404A, R134a**	**HFC-404A, HFC-134a HCFC-22, CO_2**	**HFC-404A, HFC-134a HCFC-22, HC-600a, HC-290**

Source: Private client work Expert Group and Thinkwell

The Carbon Tax and SGGs

- It ain’t the carbon tax!
  - SGGs are subject to a ‘carbon equivalent levy’ at point of import.
  - For those of you who care the levy is legislated under - The Ozone Protection and Synthetic Greenhouse Gas Management Act 1989

WHY is the HFC Levy being imposed?

- New levy increases costs and in theory creates a strong market incentive for reducing emissions of refrigerants by stimulating:
  - Improved maintenance and refrigerant management/handling standards
  - Improved system design and installation standards to reduce refrigerant leaks.
  - Encouraging a move to systems that use a smaller charge of refrigerant.
  - Encouraging a move to the use of lower GWP refrigerants and refrigeration systems.

GWP and SGGs

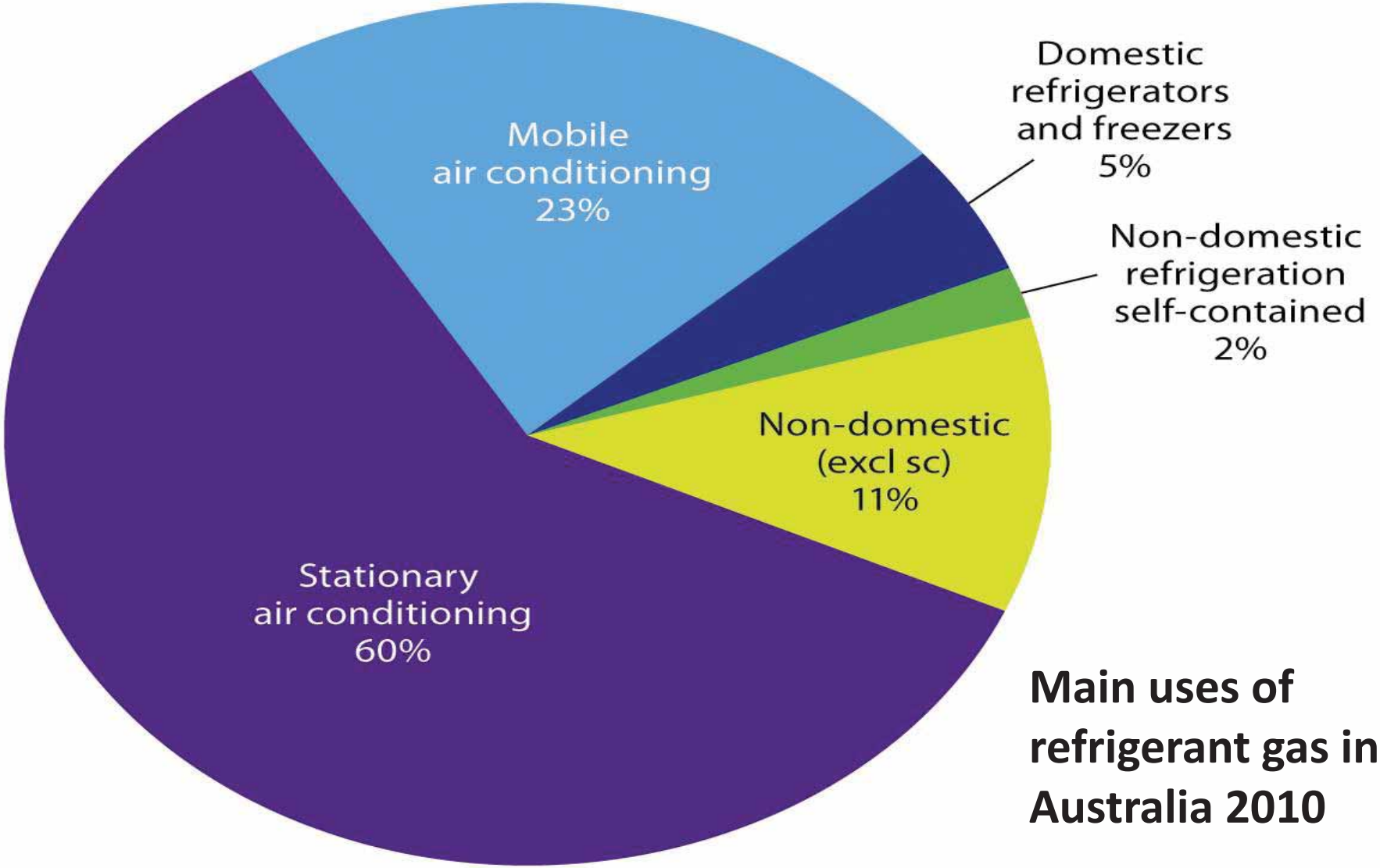
- Refrigerants are listed under the Kyoto Protocol as industrial gases

  100 year Global Warming Potential of covered HFCs (Second Assessment Report 1995)

Gas Species	GWP (AR2)
HFC-23	11700
HFC-32	650
HFC-41	150
HFC-43	1300
HFC-125	2800
HFC-134	1000
HFC-134a	1300
HFC-143	300
HFC-143a	3800
HFC-227a	2900
HFC-236fa	6300
HFC-245ca	560

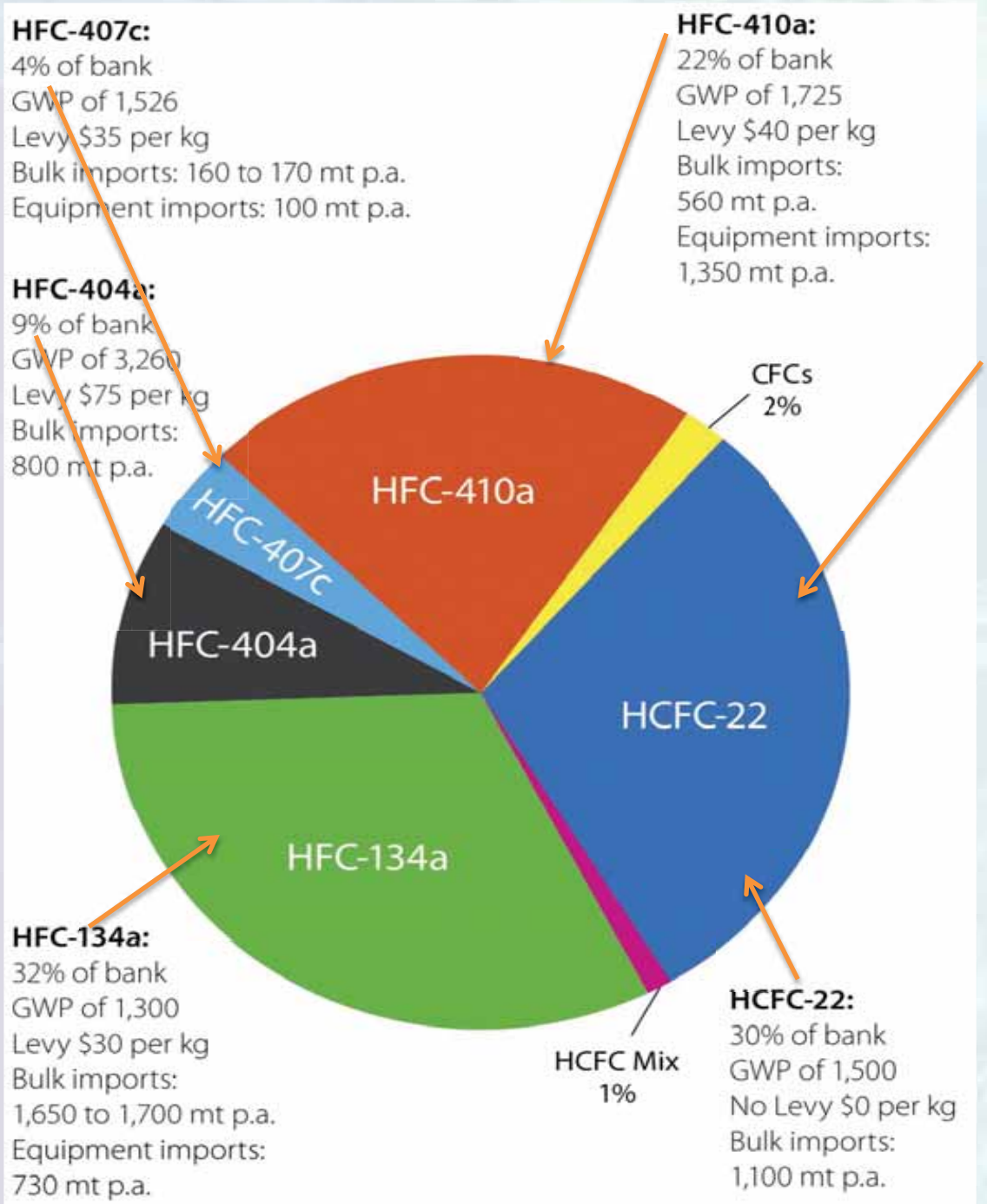
GWP values used by Kyoto Protocol were devised in 1995. Australian legislation is based on Kyoto values even though science has since revised most of these GWP values higher

40,100 metric tonnes contained in 37 million devices spread across the economy



Main uses of refrigerant gas in Australia 2010

Service consumption = 9% of bank p.a.

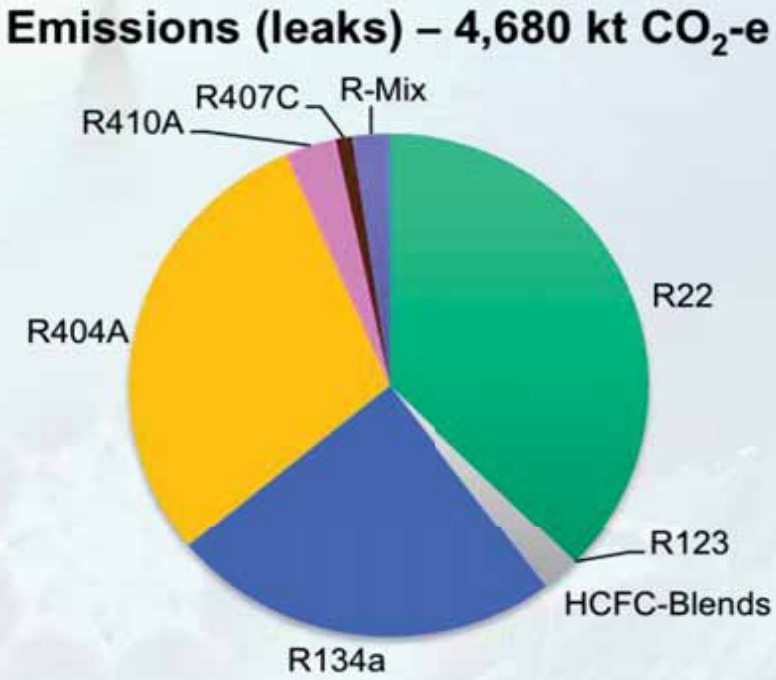


Note: All data and analysis based on 2010 imports.

AIRAH

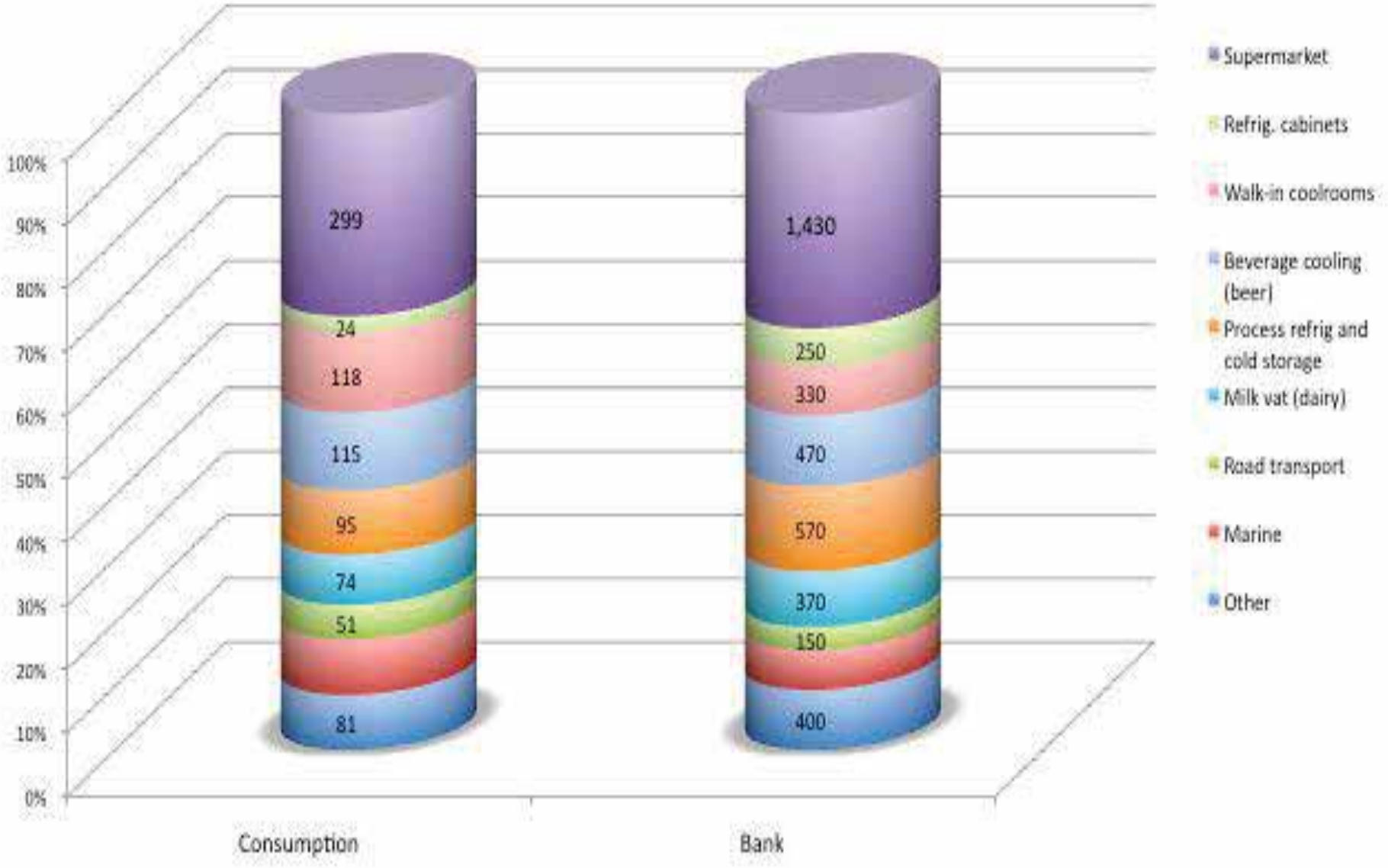
HCFC-22 is an ozone depleting substance and imports are scheduled for rapid decline under international agreement. Imports have already declined from more than 2500 mt in 2002 to a cap of approximately 725 mt in 2012. The cap is scheduled to decrease rapidly to a service 'tail' of only 45 mt pa from 2016 to 2030 when imports will cease completely. It is inevitable that some of the existing bank of more than 12,000 mt is reclaimed and reused.

Annual Losses



	R22	R123	HCFC Blends	R134a	R404A	R410A	R407C
Emissions (**kt CO_2-e**)	1,751	0.4	112	1,133	1,381	148	48
Emissions metric tonnes (approx)	1,030	na	101	872	424	86	32

Total imports in 2010 of between 4500 – 4600 mt.
Annual losses consume *at least* > 55% of annual imports equal 2500 mt



Non-Domestic Refrigeration Annual Consumption and installed Bank of gas in metric tonnes

Source: 'A study into HFC consumption in Australia, Expert Group, October 2011

Import levy cost on gases

Gas	GWP	Levy/kg 2012-2013 @ $23/tonne CO_{2e}	Levy/kg 2013-2014 @ $24.15/tonne CO_{2e}	Levy/kg 2014-2015 @ $25.40/tonne CO_{2e}
HFC-134a	1300	$29.90	$31.40	$33.02
HFC-404A	3260	$74.98	$78.73	$82.80
HFC-407C	1526	$35.10	$36.85	$38.76
HFC-410A	1725	$39.68	$41.66	$43.82
HFCF-22	1700	$0	$0	$0

Gas Price Rises

Source: Heatcraft List Prices Increase Schedule released June 6, 2012

Type	List Price - 13 June, 2012, $/kg	List Price - 9 July, 2012, $/kg	$/kg rise	Direct levy cost $/kg	Additional cost increases
R134a	65.72	181.82	116.10	29.90	$86.20
R404A	92.88	377.71	284.83	74.98	$209.85
R407C	97.87	213.10	115.23	35.10	$80.13
R410A	90.58	227.91	137.33	39.68	$97.65
R22	108.36	170.83	62.47	0	$62.47

Contractors and major end users pay a lot less (list price less 40% or more), small enterprises and consumers can pay list price or even more.

Multipliers

- GST – you cannot charge GST on a levy, but after the point of payment the levy becomes just the cost of goods and GST is applied to the total
- Insurance, security, cost of money, administration, business preparation, stockpiling and market stresses prior to levy introduction
- Supply and Demand – it's a global commodity made by multi-purpose plant that respond to demand for other products and reduce HFC production to do so
- Supply and Demand – the same drivers that have seen iron ore and copper reach record highs – China, India, etc
- Raw materials – shortage of feedstock mineral fluorospar
- And all of that is just the forces driving importer prices

Import
Export

Bulk storage, decanting & distribution
Equipment manufactures-suppliers

Wholesalers
Leasing Coys.

Contractors
Owner-end user

End
of life

Bulk refrigerant imports
≈ 70 mt p.a. HFC-134a/404A

ISO Containers 10 to 18 mt

PCE Imports
≈ 50 to 60 mt p.a

40 gm in a bottle water cooler to up to 3 kg in a RDC

PCE Export < 1 mt p.a

Australian border
Import-export licence required
Customs calculates & collects levies

Bulk storage

30 to 70 mt

Decanting & distribution

1 mt to 10 kg

Refrigerant wholesaler

Stock 10, 16 & 50 kg cylinders

Contractor

Prepare equipment for end use & install

Repair, re-charge & commission during & after warranty

Destruction

Recovered refrigerant is sent to RRA for destruction

Equipment manufacturer

- Self contained cabinets
- Bottle water coolers
- Post mix equipment
- Packaged coolroom systems
- Small liquid chillers

1 mt & 400 kg portable tanks

Refrigerated display case (RDC)

Equipment importer-supplier

- RDCs
- Bottle water coolers
- Refrigerated vending machines
- Ice cream makers
- Post mix equipment
- Packaged coolroom systems
- Small liquid chillers
- Ice making machines

Distribution of finished product

Leasing company

Mostly for vending machines, glass door merchandisers, ice cream makers & cabinets

Equipment Owner

Mostly SMEs across a wide range of applications†

Bank
≈ 860 mt

Leak rate
≈ 3% p.a.

Recovery

Equipment disposal, some refrigerant recovered & sent for destruction

Loss to atmosphere
Leaks ≈
30 mt p.a.

† Food retail (take-away, convenience stores, supermarkets), catering & hospitality (restaurants, hotels, pubs, hospitals), processors (meat, poultry, wine, etc.) & industrial application

End Result

- Business uncertainty around operational costs and no time yet for price discovery, stockpiles distorting market, cash committed to owning stockpiles and storage costing money, locking up cylinders
- Other factors driving prices as well
- Anecdotal reports of price rises to end users
  - of 570% for 410a ($65/kg rising to $372/kg)
  - small supermarket being told that routine service that was once $1300 was going to cost $9500 etc
  - Thefts of large numbers of gas in cylinders already reported
- From the end user point of view very unsatisfactory - all happening at the same time that electricity prices have also been rising strongly - new risks, new costs

Risks for Owners

Risk	Issues
Financial - existing systems	System failure costs. Refrigerant leakage replacement cost, total charge loss, insurance and security costs will all reflect new HFC refrigerant values and higher costs.
Financial - new/modified systems	Costs of higher design and installation standards, new operating and maintenance skills, costs of recovering and disposing of regulated refrigerants.
Security - Theft of refrigerant	Security arrangements for high value refrigerants either in storage or within systems.
Refrigerant quality and supply	Counterfeit refrigerant, contaminated refrigerant, unauthorised refrigerant replacement.
Energy efficiency	Reducing refrigerant charge severely impacts system energy efficiency, as electricity prices rise the energy efficiency of existing plant must be addressed.
Compliance with regulations	Leak management, refrigerant handling, using only licensed contractors, DSEWPaC monitoring compliance , ACCC monitoring prices, penalties apply for breaches
Perverse outcomes	Poor and ill informed design choices leading to an increase rather than decrease in direct and or indirect emissions

Risks for Contractors

Risk	Issues
Financial – New and existing systems	Push-back from end users regarding higher refrigerant costs/price rises, managing systems with unknown refrigerant/poor documentation and dealing with unauthorised retrofits/drop-in replacements. Rising insurance costs, compliance costs, security costs.
Skill and technical capacity	Compliance with higher design and installation standards, natural and new low GWP refrigerants, new operating and maintenance regimes, costs of training/CPD for staff.
Theft of refrigerant	Review and upgrade of security arrangements for refrigerants in storage.
Refrigerant quality and supply	Counterfeit or contaminated refrigerant, additional supply related price increases.
Inherent risks in low GWP alternatives	Flammability and toxicity risks, lack of appropriate skills and knowledge, licences and registrations, varying rules in varying jurisdictions.
Compliance with regulations	Leak management, refrigerant handling, maintaining appropriate licenses and registrations, justifiable price rises, penalties apply for breaches.

R22 Phase out risk

- HCFC-22 has no levy but is being phased out
- Temptation to stay with or go back to R22 systems to avoid levy is not a solution given the accelerating timetable for phase out which will see extremely small ‘service’ quantities imported from 2016 so shortages in supply are certain although reclamation and reuse is also certain.
- Reuse of oily or below spec gas presents risks
- Because some R22 equipment is no longer supported parts for some types of equipment are becoming virtually impossible to find

Economic Tragedy/Opportunity

Type	Estimate 2010 emissions mt	List Price - 9 July, 2012, $/kg	Value of losses to air at list price
R134a	872	181.82	$ 158,547,040.00
R404A	424	377.71	$ 160,149,040.00
R407C	32	213.1	$ 6,819,200.00
R410A	86	227.91	$ 19,600,260.00
R22	1030	170.83	$ 175,954,900.00
TOTAL VALUE OF LOSSES TO AIR AT 2012 LIST PRICES			$ 521,070,440.00

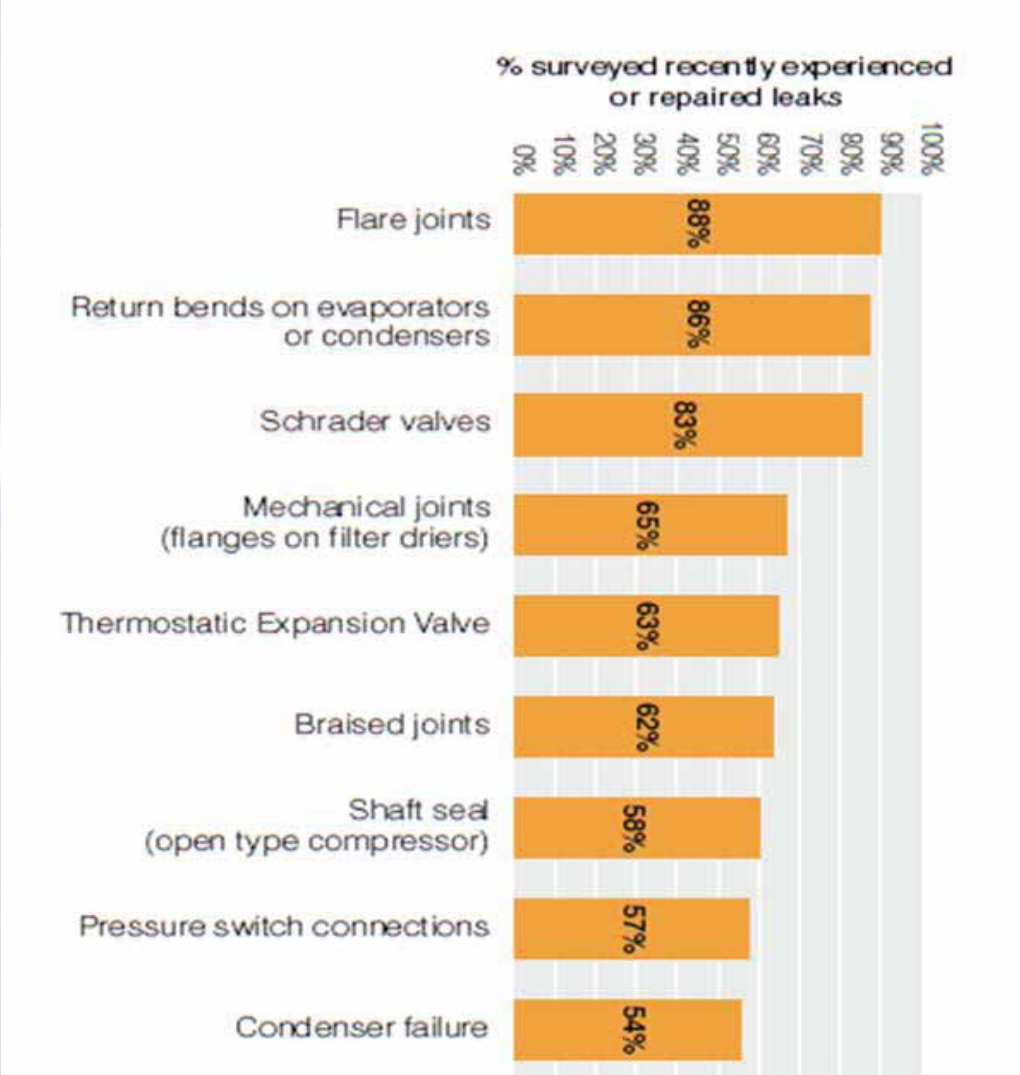
$16B? $Hey Big Spender!!

- No doubt that HVAC&R industry is a noticeable fraction of the GDP (at least 1 %+??)
What value do you place on the services?
HOW MUCH IS IT REALLY WORTH?

Price Pressure and Opportunity

- Sudden price increases inevitably lead to changes in business practices to avoid costs – so get out front and lead the change
- Prevent refrigerant losses
  - Maintenance boom? Leak detection services, remote monitoring
- Energy efficiency gains
  - Audit, monitor, maintenance boom?
- Refit equipment
  - Refit programs built into upgraded maintenance programs, seals, night blinds, new fans
- Turnover old equipment
  - Capture gas and energy cost savings to fund new capital expenditure
- Lead the field in risk mitigation
  - Tie improved (better paid) maintenance schedules to accepting some risk of gas losses from avoidable causes other than accidents and then get insured for it
- Use the system luke! – Government programs and support

Burning Money - Leaks

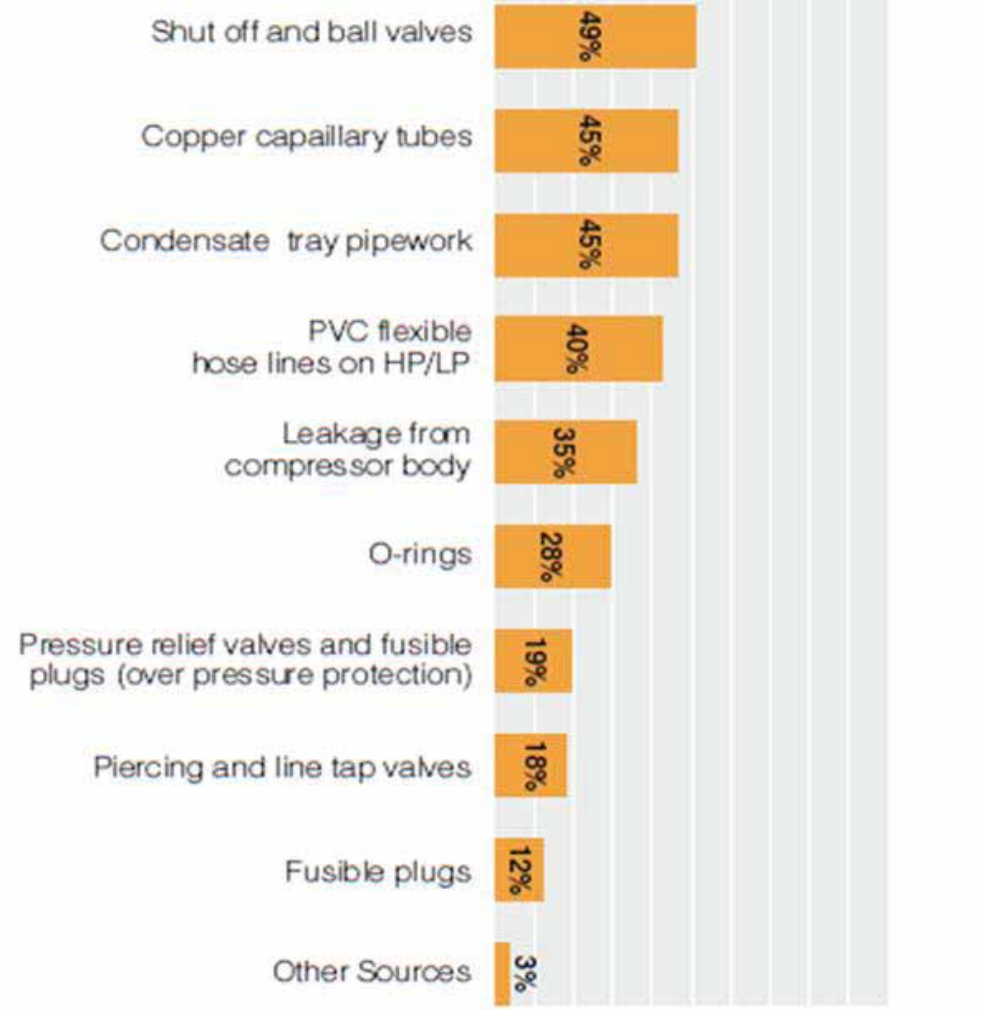


Sources of Leaks – where was it leaking from

Survey of 156 members of Refrigeration and Air Conditioning Contractors Associations - technicians and contractors involved in servicing refrigeration equipment daily

Source: Expert Group, Peter Brodribb and Michael McCann 'Refrigerant Emissions in Australia, Sources, Causes and Remedies, 2010

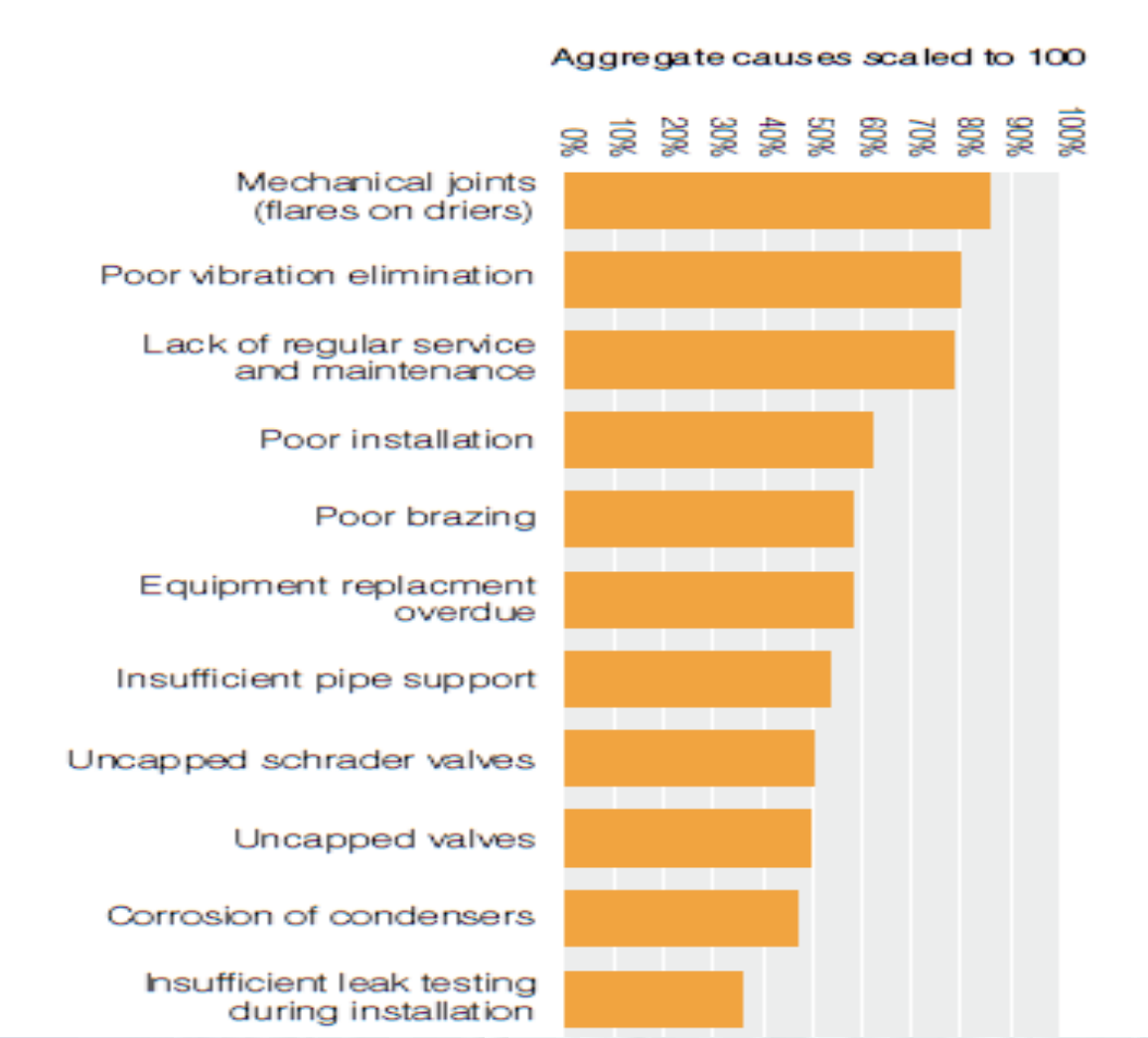
Burning Money – Leaks 2



Sources of Leaks

Survey responses in Australia were almost identical to survey responses from similar survey of larger population conducted in the UK affirming these common component and equipment failures

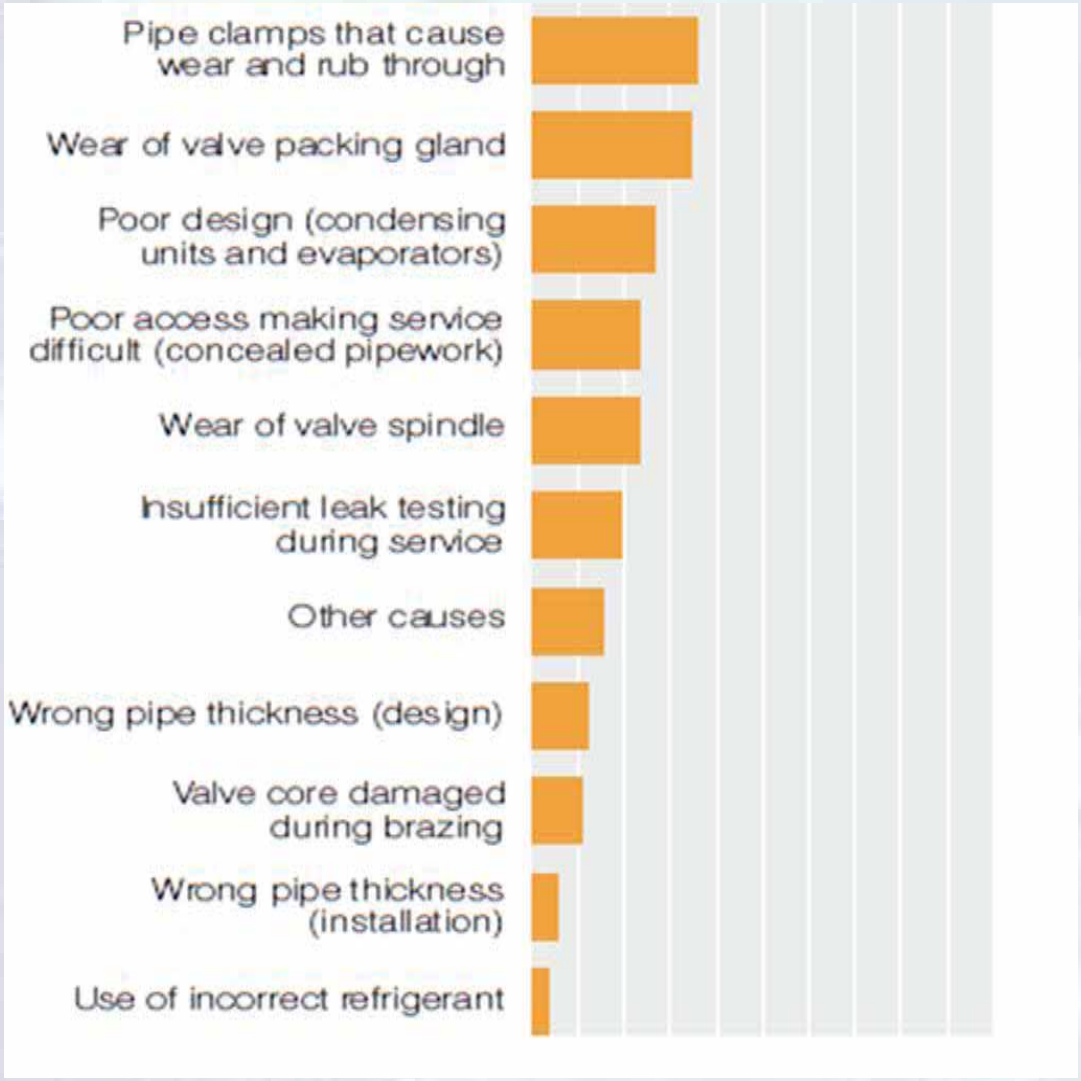
Burning Money – Leaks 3



Causes of Leaks – why was it leaking

Almost all leaks can ultimately be traced to cheap components, poor design, poor installation, and a lack of service and maintenance.

Burning Money – Leaks 4

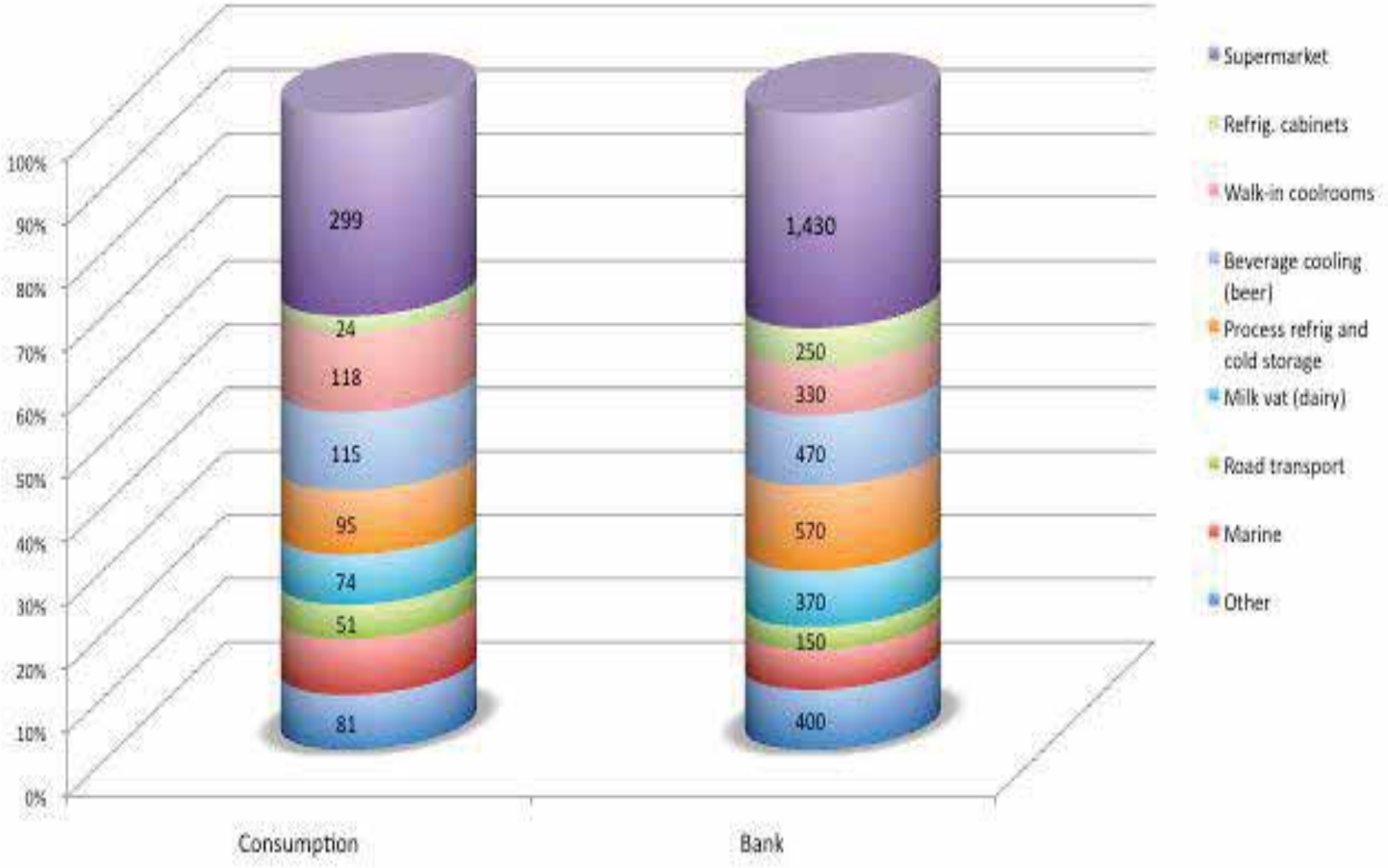


Causes of Leaks – why was it leaking

Annual losses by equipment

Table 1: Typical refrigerant emissions by RAC sector [Source: DEFRA, 2010]

Type of Equipment	Typical Range in Charge Capacity (kg)	Installation Emission Factor (% of initial charge)	Operating Emissions (% of initial charge/ year)	Refrigerant remaining at disposal (% of initial charge)	Refrigerant recovered (% of remaining charge)
Domestic Refrigeration	0.05 - 0.5	1.0%	0.3%	80%	99.0%
Stand-alone Commercial Applications	0.2 - 6	1.5%	2.0%	80%	94.5%
Medium & Large Commercial Applications	50 - 2,000	2.0%	11.0%	100%	95.0%
Transport Refrigeration	3 - 8	1.0%	8.0%	50%	94.0%
Industrial Refrigeration (inc. food processing and cold storage)	10 - 10,000	1.0%	8.0%	100%	95.0%
Chillers	10 - 2,000	1.0%	3.0%	100%	95.0%
Residential and Commercial A/C including Heat Pumps	0.5 - 100	1.0%	8.5%	80%	95.0%
Mobile Air Conditioning	0.5 - 1.5	1.0%	7.5%	50%	88.0%



Non-Domestic Refrigeration Annual Consumption and installed Bank of gas in metric tonnes

Source: A study into HFC consumption in Australia, Expert Group, October 2011

The Dirty Dozen

- Flared connections commonly on components such as filter driers, TX valves, solenoid valves, sight glasses, check valves and pressure regulator controls (crankcase and evaporators)
- Lack of regular service, insufficient maintenance and insufficient leak testing
- Failure of condenser and evaporators, particularly on return bends
- Poor installation techniques such as insufficient vibration elimination and lack of pipe support
- Schrader valves (very commonly used and often left uncapped)
- Poor brazing techniques

The Dirty Dozen

- Old equipment overdue for replacement particularly open drive equipment with leaky shaft seals
- Service valves (ie being left uncapped, using plastic caps, wear of glands, wear of spindle, overheating during installation)
- Pressure switch connections (ie PVC flexible lines and capillary lines)
- Corrosion, particularly on condensate tray pipe work, evaporators and outdoor condensors
- Mechanical joints and flanges
- Inferior quality cheap equipment

Eliminating Leaks?

- Probably not possible, but massive and sustained reductions are achievable with simple measures
- 2010 DSEWPaC report '*Refrigerant Emissions in Australia – Sources, Causes, Remedies*' (Section 4.1) list a dozen straightforward technical remedies for the dirty dozen
- http://www.expertgroup.com.au – report authors always if you want some advice

Information sheets summarising findings from this report available from AIRAH

- Excellent resources also available from http://www.realskillseurope.eu/home

Eliminating Leaks

- Designers and Installers
  - Make leak minimisation and detection a priority – minimise joins and maximise effective service access to piping and critical components
  - Design and install pipework to minimise risks of mechanical damage and accidental impacts
  - Specify and install leak detection systems appropriate for the refrigerant charge
  - Label the system clearly including refrigerant type and optimal charge
  - Thoroughly leak test during commissioning

Eliminating Leaks

- Maintenance Contractors
  - Make leak minimisation and detection a priority
  - Create a refrigerant log book and routinely check charge and record
  - Ensure all technicians know how to check charge, and leak test effectively and ensure technicians keep good records
  - Update all service contracts to include refrigerant management and leak detection costs
  - Ensure appropriate insurance cover is in place for accidental loss

Eliminating Leaks

- Owners - Know your kit
  - Audit all refrigeration equipment and record for your own purposes
    - Make
    - Model
    - Year
    - Refrigerant gas type
    - Refrigerant gas charge size
    - Maintenance reports including refrigerant charge replacement volumes and costs
  - Ensure condensers and evaporators are clean, clear of physical obstructions and getting good air flow
  - Have a plan for leak detection, equipment upgrades to eliminate leaks and improve energy efficiency

Eliminating Leaks

- Visual inspection – large leaks can sometimes be seen by inspecting for traces of oil at joints
- Ultrasonic leak detection
- Electronic leak detection – a number of effective options
- Fluorescent leak detection – handle with care, potential warranty issues
- **Audit, monitor, test, repair, make it routine**

Electricity

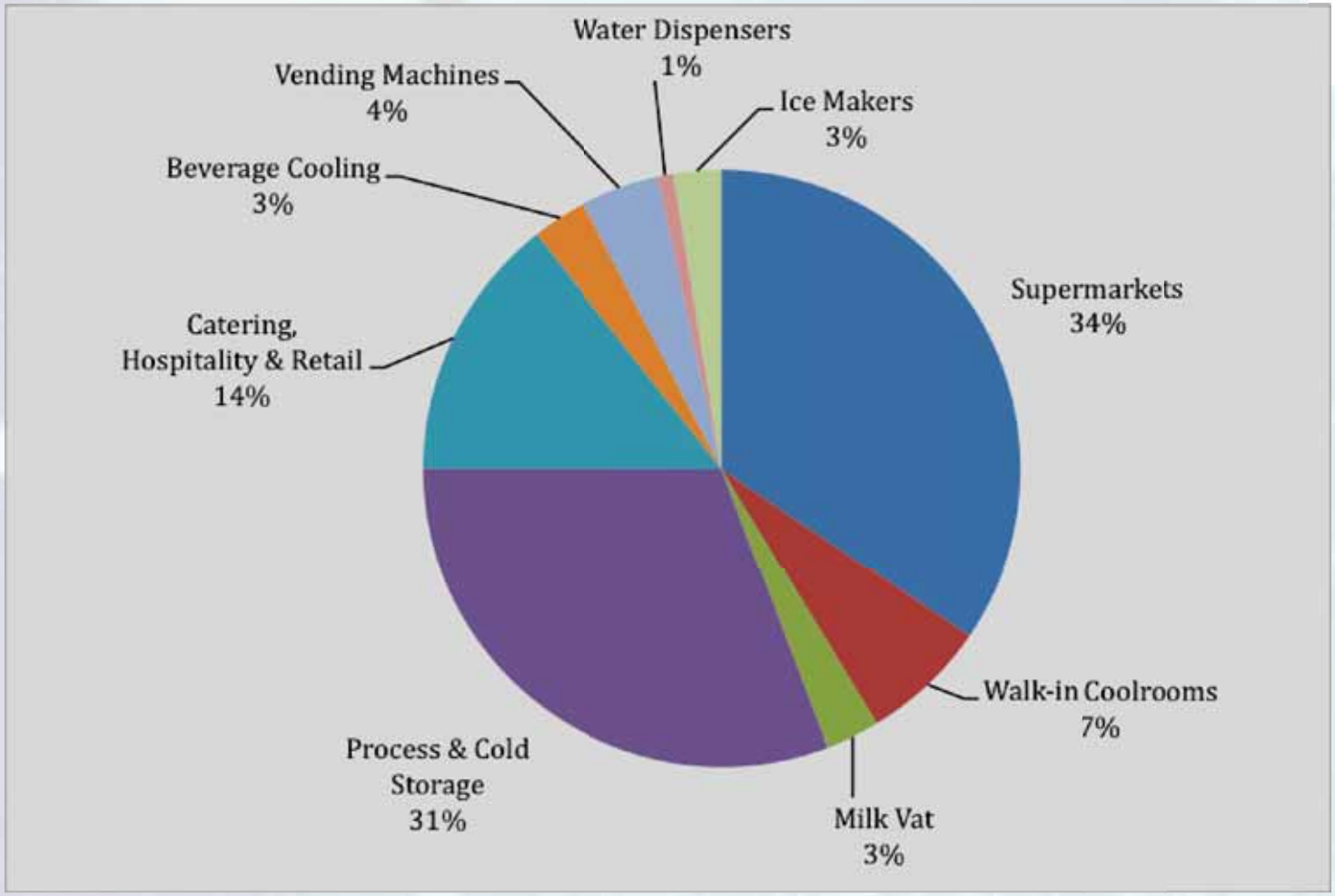
- Refrigeration is the single largest energy using technology in food retail
- Cool rooms, freezers, display refrigeration use more electricity than all other in-store systems combined
- Throw in air-conditioning and in summer months the electricity for cooling things will account for 70% to 80% of energy use in the majority of stores

In from the Cold – it is a big contribution

- In from the Cold Identifies the priority refrigeration technologies and market sectors to be targeted to make a significant improvement to energy performance throughout the non-domestic refrigeration sector.
- Fully implemented, these measures are expected to reduce electricity consumption from non-domestic refrigeration by 3,300 GWh in 2020, and by 8,000 GWh in 2030.
- The estimated savings between 2010 and 2030 total nearly 50 Mt CO_{2e}, and reaching 5 Mt CO_{2e} pa in 2030
- This is just energy related emissions
- If you include reductions in direct emissions of refrigerants the CO_{2e} reductions from this sector by 2030 could be closer to 7Mt per annum or more than 1.25% of the annual national emissions

(Source: In from the Cold', Mark Ellis & Ass and Expert Group, Oct 2009)

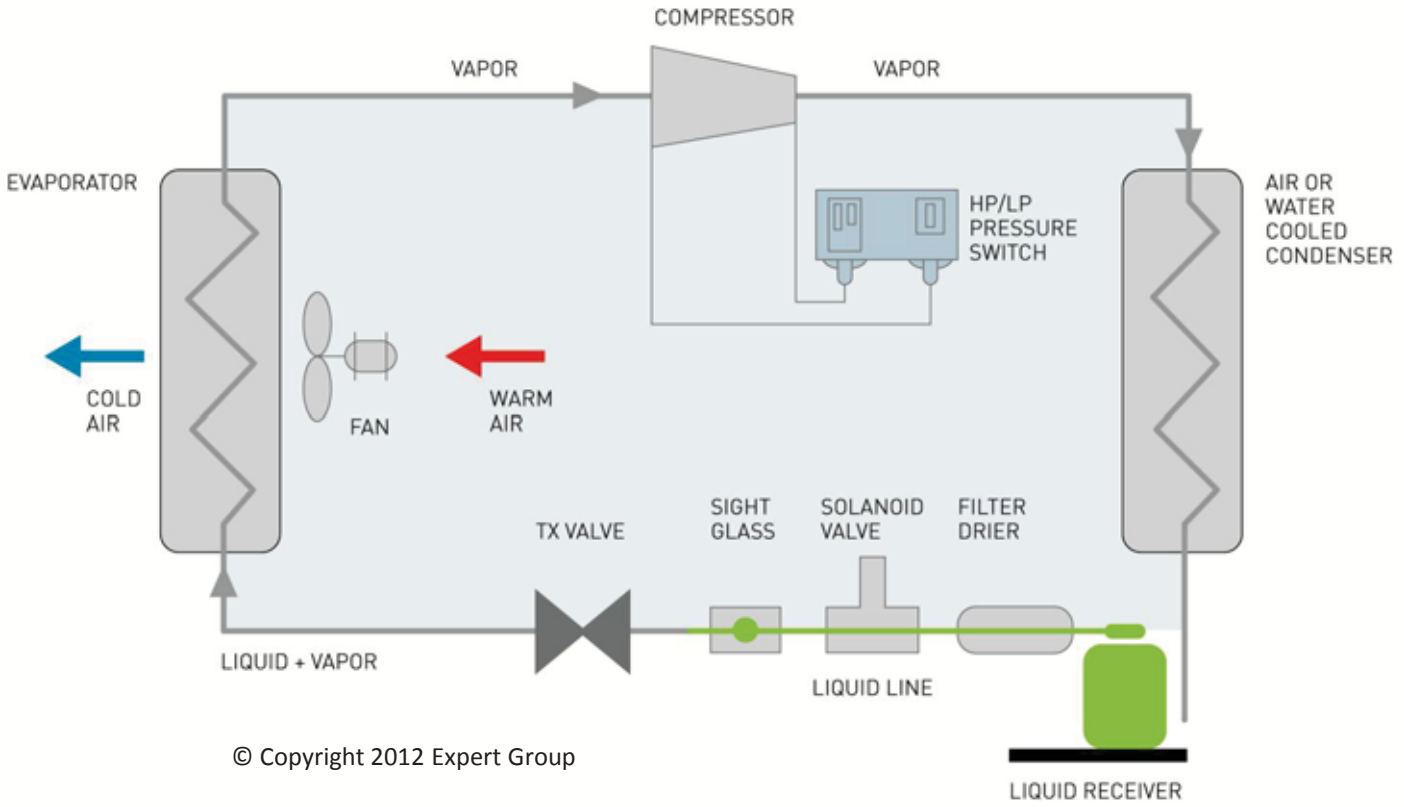
Market segments



Electricity consumption in non-domestic refrigeration, Australia, 2008 (Source: 'In from the Cold', Mark Ellis & Assoc and Expert Group, Oct 2009)

Power Use

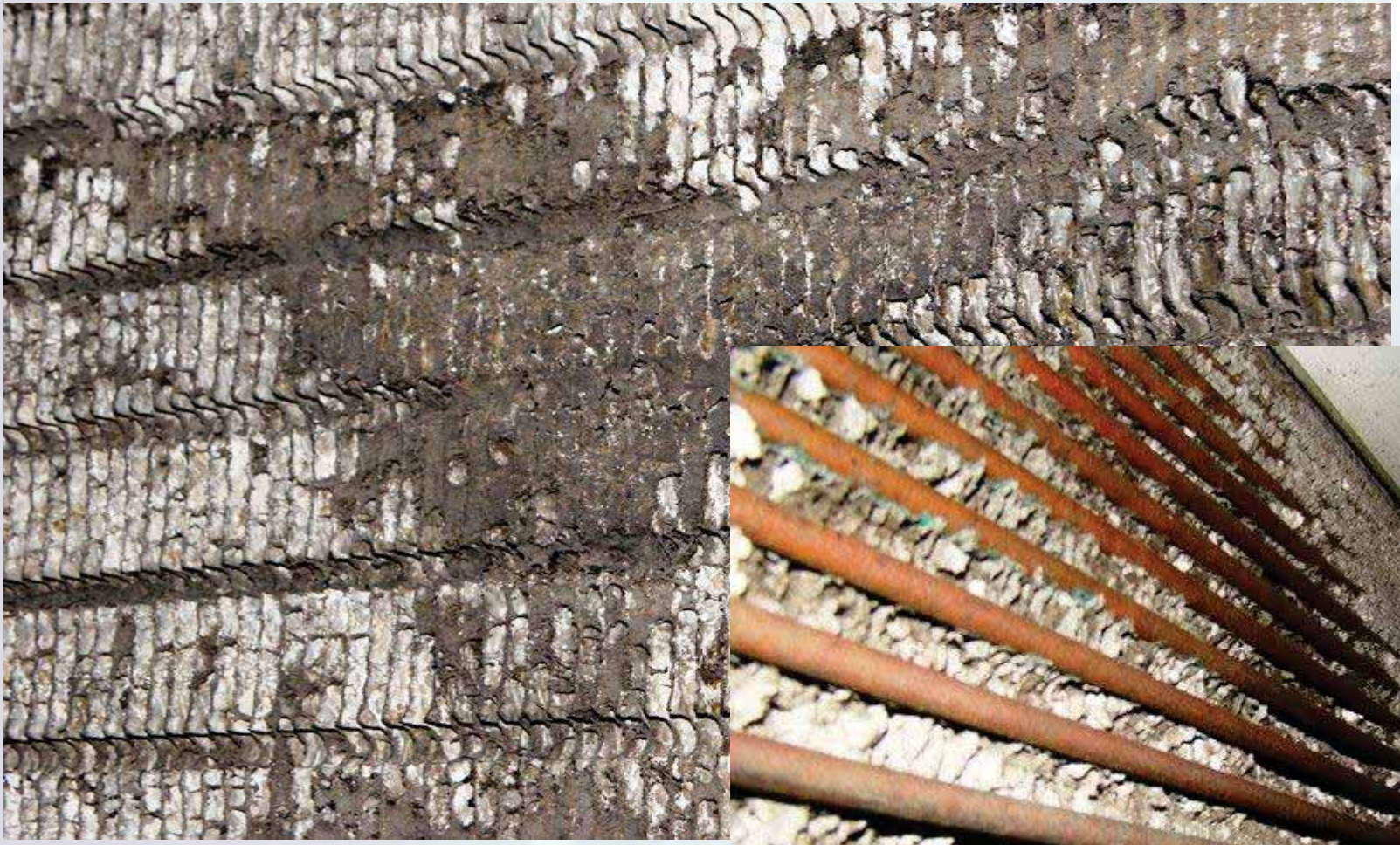
- Compressor 40% – 60%
- Condenser Fans 10% – 25%
- Evaporator Fans 10% - 20%
- Defrost Heaters 5% - 20%



Energy Inefficiency

- Open refrigerator display cabinets!
- Lights left on all day and night in cool rooms
- Condensers and coils choked by dust, mould and muck
- Pipework not insulated at all
- Perished seals on fridge doors
- Air cooled condensers sitting inside hot back rooms, basement carparks or packed into metre wide back alleys
- Shops filled with open refrigeration displays and with shop doors open all the time
- All these types of conditions make refrigeration components and system work harder

Burning money – with muck



Muck is costing a lot of money

Defrost! – recycle waste heat

Burning money – losing cold

Smoke curtain demonstrates cold air spilling from supermarket open display case

Cut electricity costs and consumption

- Two types of electricity charges you can cut
  - Electricity consumption charges – number of kWh and cost per kWh
  - Peak electricity demand charge – highest period of consumption – always look to lop peaks – timing of use
- Two broad types of behaviour changes to reduce refrigeration energy use and costs
  - Interventions to reduce the *heat load* on the systems, and
  - Interventions to improve the *operating efficiency* of the systems.
  - Both of these opportunities *and* load shifting or load shedding can reduce Peak Demand charges

Look at your electricity bill

- Made up of costs via various names in different states of
  - Actual electricity use charges at
    - Peak, shoulder, off-peak
  - Poles and wires (network charges) at
    - Peak, shoulder, off-peak
  - Metering charges
  - NEMMCO charges
  - Service charges
  - Renewable and energy efficiency scheme fees (RECs, NGAC, VEET, etc)

Cut electricity costs and consumption – Easy Wins

- Ring up your supplier and tell them you are shopping around – get a better deal – or change supplier and get a better deal
- Clean all coils, condensers and fans on all refrigeration and airconditioning regularly (can dramatically improve efficiency immediately if this has not been done often)
- Ensure good air flow – eg don't stack crates in front of the evaporator
- Motion sensors on lights in toilets, service areas, office areas, storage areas, loading dock etc (pay back about three hours after you install them)

Cut electricity costs and consumption – Easy Wins

- Cost lighting upgrades to most efficient possible lighting (often pays back in less than one year – do it in stages to spread out costs – start with high usage areas)
- Use heat recovery where practical (defrost)
- Manage set points without compromising food quality
- Automatic shop door that stays open once entries and exits is greater than x per minute.
- Choose high efficiency equipment and components
- Optimise system performance - ensure your equipment is clean, fully charged and fighting fit!!!
- Make wise energy efficiency investment decisions sooner rather than later that prepare your businesses for rising energy prices (i.e. rates of return on kWh reductions today will deliver increasing rates of annual cost savings over future years as electricity costs continue to rise)

Reducing Heat Load

- Insulation – more of it
- Ventilation- possibly less of it and do it efficiently!
- Infiltration – doors, lids, automatic closers, door alarms, air locks, night blinds
- Reduce air infiltration to coolroom or freezer (automatic doors)
- Lighting in cool rooms and freezers – LEDs, movement sensors
- VSDs save energy and reduce heat load on evaporators in cold storage (Heat dissipated is proportional to speed^3)
- Energy management systems (set point turn up, self learning features, etc.)
- Defrost – fine tune or replace electric defrost

Reducing Heat Load

Doors on fridges do not stop people buying! In fact research shows that customers will spend longer in a refrigerated good section in areas fitted with doors as temperatures are not uncomfortable. Doors can save 30% to 70% of electricity use, savings equal to 20%+ return on capital not including depreciation

Night Blinds – a cheaper cost solution compared to doors and still deliver excellent energy savings particularly in hot climates and seasons

Improving Efficiency

- Electronically Commutated Fans – EC Fans
  - Just more efficient and variable speed
  - Can save as much as 80% of power as compared to old style fans
  - Easy to retrofit on evaporators – www.fansretrofit.com.au

- Variable speed drives – VSDs - on compressors and big fan motors
- Shorter pipe runs with larger diameter pipe
- Replace thermostatic expansion valves with electronic expansion valves

Efficiency = + Cashflow

- Sell clients savings – make them pay for maintenance – (AIRAH Maintenance Guide)
- Maybe the first hour(s) will be free
- Reinvest savings - efficiency compounds savings rapidly, savings aggregate very fast over a few years
- Medium and long term clients start now
- The best time to plant a tree was 20 years ago
- The second best time is now

Low GWP Refrigerants

- Area to tread carefully
- Not all designers, installers and service contractors will have good experience in these areas
- New refrigerants on horizon but not here yet
- Be wary of snake oil and magic solutions

Applications and Issues

Refrigerant	Typical Applications	GWP	Issues for consideration
Ammonia R717	**Food preservation, industrial processes,** some air conditioning	0	**Toxicity and flammability** requires high construction and handling standards
CO_2 R744	**Supermarket, cold storage, process applications**	1	**High pressures**/high construction standards
Hydrocarbons R290, R600a, R436	**Small sealed low charge systems**, some air conditioning, some industrial	≈3	**Flammability**, charge limits and handling standards, licensing issues and associated risks
Low GWP synthetics HFO-1234yf	Air conditioning, mobile air conditioning, medium temp refrigeration	< 10	Refrigerants, equipment designs and practices **still under development**
Reduced GWP synthetics DR-4, DR-5, XP10 L-41, L-20	Air conditioning and refrigeration Mimic R22, R410A, R404A	< 650	Refrigerant blends **still under development**
Reduced GWP synthetics R32	Air conditioning	650	**Mildly flammable** classification Equipment redesign and installation practices

If you are going to replace old equipment, for instance R22 equipment at end of life, in some cases you may be able to specify equipment with low GWP refrigerants.

Recommendations

- **Increase tightness** of existing systems
- **Train staff** to work with highly and mildly flammable refrigerants
- **Keep informed** about environmental issues & refrigerant options & performance
- Use AIRAH, Best Practice Guidelines:
- Use a life cycle costing approach so long term focus - Methods of calculating Total Equivalent Warming Impact to understand best low emission option – free download
- Shift to lower GWP refrigerants when significant system changes are needed
- Carefully plan and schedule replacement of existing large R22 systems
- Try to use NRs if safety issues can be addressed and/or capital replacement opportunities warrant investment

Codes

- Ammonia Code of Practice for Industrial Refrigeration - This is currently a Victorian COP that will be amended to become a national code and submitted to SWA (Safe Work Australia). That means that all the regulators will look to this code for compliance etc. as well as the regulations.
- Hydrocarbon Code of Practice for stationery equipment. This code is currently being developed and will go through the same process once completed.
- CO2 Code of Practice for Industrial Refrigeration - This code will be commenced after the hydrocarbon code is completed.
- All of these codes being completed are dependant on the release of the replacement for AS1677 which will be called AS5149. It is being adopted from the European standard. There is a hold up on this due to the European standard still not released for public comment. Timeframe for everything above is dependant on when this standard is released. Hoping for drafts by October.

Low GWP Refrigerants

- Very fast moving area with lots of potential (presently much smaller than 5% of fleet)
- For supermarkets bigger CO_2 systems (majors and independents) and Hydrocarbon self contained units (in use in Aldi stores for several years)
- http://www.r744.com/ - just one site to watch developments

Use the System Luke!

- Government energy efficiency programs
- State governments all have programs that can pay for audits, subsidise investments, provide good case studies that can be used in marketing or for enrolling management
  - NSW Energy Saver Program
  - Queensland Ecobiz and Energy Innovation Fund
  - Victoria Energy Efficiency Target
  - South Australia BSA Energy Efficiency Program
  - All State Government Programs listed at the Energy Efficiency Exchange – www.eex.gov.au/business-support/programs/

Provided By Airconstruct
http://www.Airconstruct.com.au

Conclusion

- Refrig gas and power costs are rising
- The opportunities on their own are significant
- Together these are business turbo charging events
- The obstacles are largely time, skills and priorities for capital expenditure
- Show your clients how wise energy efficiency and refrigerant management decisions prepare their businesses for rising prices
- Implemented sooner rather than later to deliver early and continuing returns
- Quantify and invest savings in further efficiencies to achieve a virtuous cycle of compound savings

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