Dairy Manufacturers Sustainability Council

Energy efficiency & carbon levy

What are the options?

Prepared by:

Peter Brodribb
B. Eng (Mech), MBA
pbrodribb@bigpond.com

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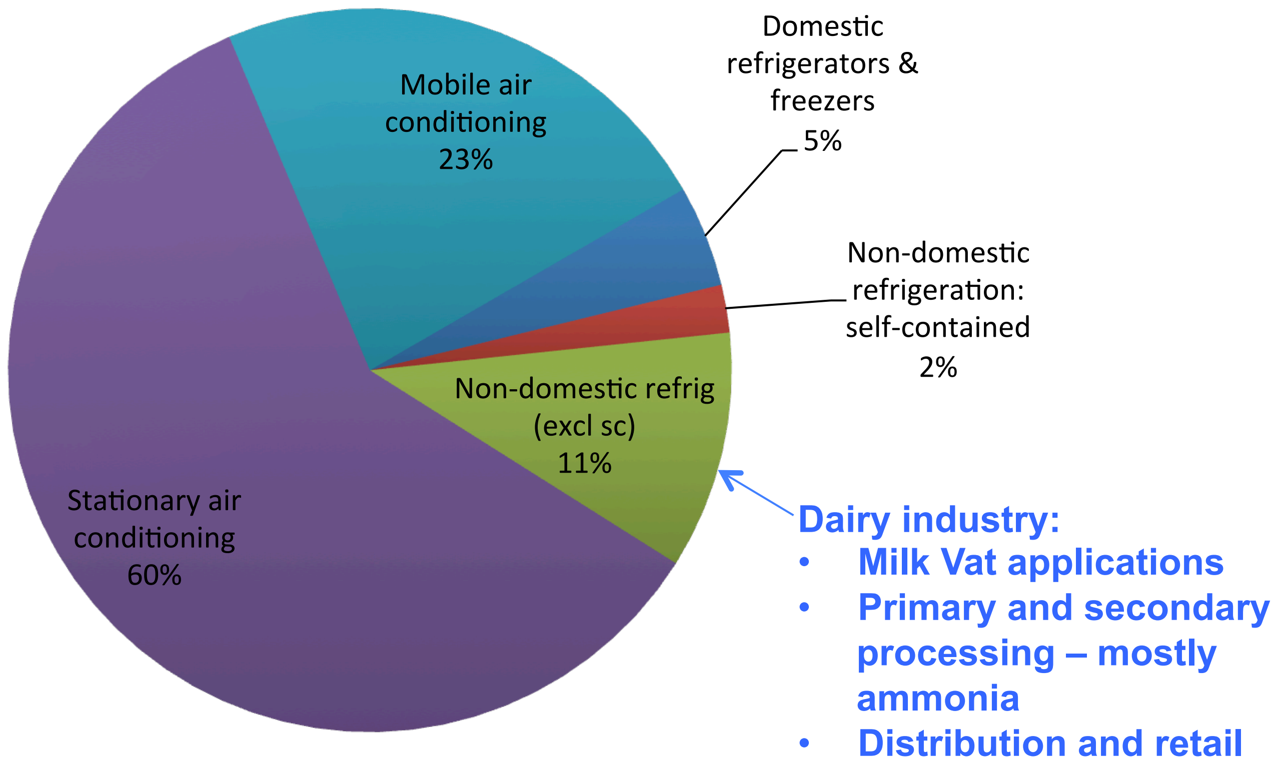
Expert Group

- Independent consulting firm
- Extensive experience working with government and private enterprise, in the development of climate change, energy efficiency and renewable energy policies and programs
- Professional engineers that deliver innovative, practical and cost-effective solutions that help businesses to thrive in a highly competitive, carbon-constrained world
- Clients: State and Federal policy makers, industry associations and international inter-governmental agencies, and private enterprise (food industry, equipment manufacturers, etc.)

The 'Working Bank'

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

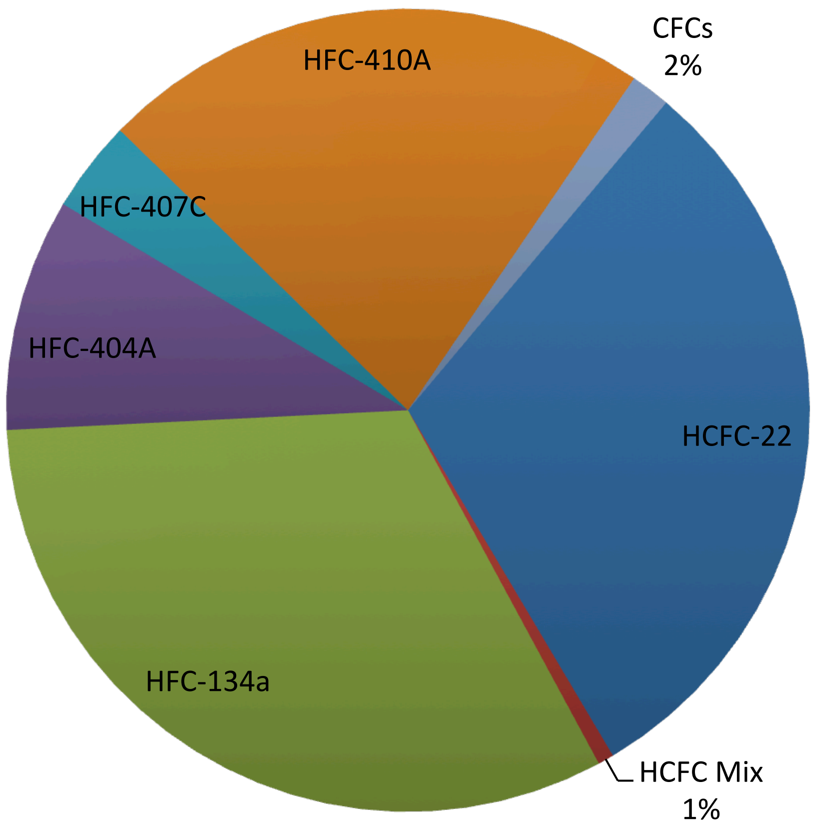


Service consumption ≈ 9% of bank p.a.

The 'Working Bank'

HFC-407C: 4% of bank
GWP of 1,526
Levy $35 per kg
Bulk imports: 160 to 170 mt p.a.
Equipment imports: 100 mt p.a.

HFC-404A: 9% of bank
GWP of 3,260
Levy $75 per kg
Bulk imports: 800 mt p.a.
Prices increased by ≈ 400%
Heatcraft list price $374 per kg
Contractor ≈ $190 to $224 per kg



HFC-410A: 22% of bank
GWP of 1,725
Levy $40 per kg
Bulk imports: 560 mt p.a.
Equipment imports: 1,350 mt p.a.

HCFC-22: 30% of bank
GWP of 1,500
No Levy $0 per kg
Bulk imports: 1,100 mt p.a.

HFC-134a: 32% of bank
GWP of 1,300
Levy $30 per kg
Bulk imports: 1,650 to 1,700 mt p.a.
Equipment imports: 730 mt p.a.

Note: All data & analysis based on 2010 imports

Refrigerant levy - What can be done?

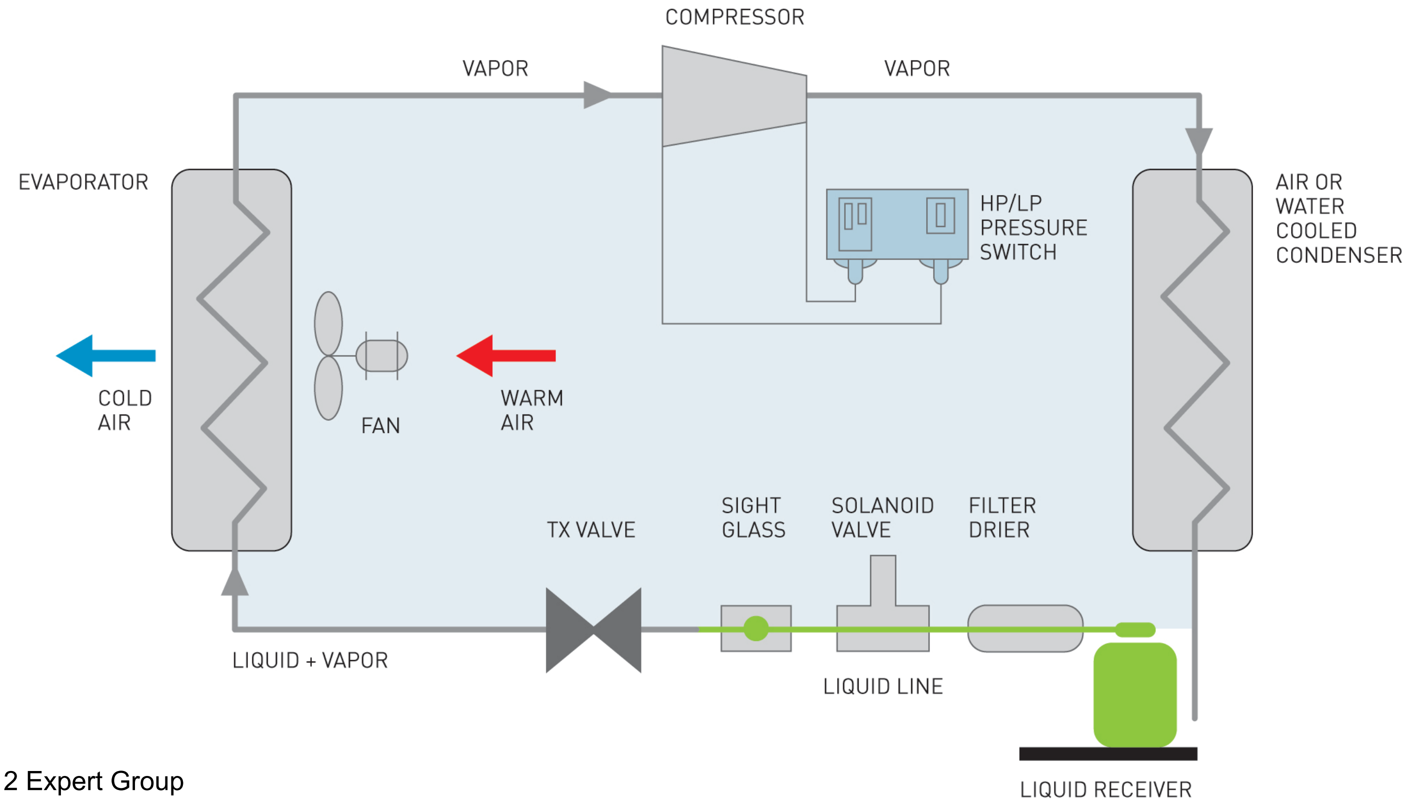
1. Improve refrigerant containment

2. Transition to available low and reduced GWP alternatives

3. Wait for emerging technology

The risk of leaks depends on:

Size and complexity of the refrigeration system	Equipment design and quality
Types of connections (i.e. flare, solder or screw)	Vintage of the equipment
Operating conditions (i.e. pressures, ambient temperatures, vibration)	Quality of maintenance and many other factors



The 'dirty dozen'

1	Flared connections commonly used on components such as filter driers, TX valves, solenoid valves, sight glasses, check valves and pressure regulator controls (crankcase and evaporator)
2	Lack of regular service, maintenance and leak testing
3	Failure of condenser and evaporators, particularly on return bends
4	Poor installation (i.e. vibration elimination and pipe support)
5	Schrader valves (i.e. uncapped and overused by industry)
6	Poor installation (i.e. brazing)
7	Old equipment overdue for replacement, particularly open drive equipment with leaky shaft seals
8	Service valves (i.e. uncapped, plastic caps and wear of glad/spindle/overheated during installation)
9	Pressure switch connections (i.e. PVC flexible lines and capillary lines)
10	Corrosion, particularly on condensate tray pipe work, evaporators and outdoor condensers
11	Mechanical joints and flanges
12	Inferior quality equipment, particularly cheap imports

2. Transition to low and reduced GWP alternatives

- Natural refrigerants (CO_2, ammonia & hydrocarbons) - no carbon levy and can be very energy efficient
- Reduced GWP refrigerants (HFC-32, GWP of 650) – mostly AC
- Minimise GWP risk (charge size and HFC-134a, GWP of 1300)
- Drop in replacements: HFC-407A (GWPs of 2,107) and HFC-407F (GWPs of 1,824), approx. half of HFC-404A
- Beware of magic potions, if it sounds to good to be true, it probably is!

3. Wait for technology to emerge

- Transition to non-HFC or low GWP substances is inevitable
- Australia is a 'technology taker' in many application segments
- Uptake of non-HFC or low GWP gases - constrained by limited market demand, labor force limitations and commercial barriers
- Maintain existing systems, solution will emerge in the next five years
- Emerging natural refrigerant technologies (i.e. ammonia packaged systems)
- DuPont and Honeywell have developed three classes of new candidate low or reduced GWP refrigerants
    - HFO-1234yf (GWP of around 4)
    - Azeotropes, which are blends of refrigerant gases for which the composition of the liquid and the vapor phase are the same, such as Opteon XP10 (GWP of about 600)
    - Developmental refrigerants are made up of mixtures of HFO-1234yf and other stable refrigerants, including HFCs
    - Replicate characteristics of common refrigerants (HFC-410A and HCFC-22 with GWPs < around 400)

Energy Efficiency – Cold Food Chain – What can be done?

Findings from *10 Year Non-Domestic Refrigeration Strategy: In From the Cold*, prepared for the DCCEE:

- Primary and secondary processing applications
- Inherently energy-intensive, careful application of engineering principles in design and operation can lead to significant improvements in energy efficiency
- Energy reduction opportunities are in the hands of engineers and their ability to identify, implement and maintain best practice technologies
- This equipment class has strong commercial drivers for energy efficiency with less market barriers than other segments
- Increasing energy prices will drive these facilities to seek their own solutions without Govt. intervention

Energy Efficiency – Cold Food Chain – What can be done?

Refrigeration systems:

- **Manage set points** - British Frozen Food Federation (BFFF 2009) highlighted a significant opportunity for the food service industry to reduce energy consumption by up to 15% by managing Cold Chain temperatures more effectively without reducing food quality

- **Improved thermal specification** – insulation panels (100mm PIR versus EPS), and insulation on refrigeration pipework, etc.

- **Minimise or reduce parasitic loads** – heat sources (lights, forklifts, equipment) in cold storage areas, ingress of ambient air, defrost cycles, heated floors, etc.

Energy Efficiency – Facility – What can be done?

Implement energy saving techniques across various levels of the production facility:

- **At the process or system level**, process control, optimization (proper loading), and integration can ensure maximum efficiency. In addition, implementation of new or alternate process systems can improve efficiency and reduce operating costs.
- **On the facilities level**, efficient lighting, heating, and cooling can reduce energy loads, and implementation of combined heat and power or process integration systems can improve efficiency.
- **Equipment level** - energy efficient choices for new equipment, and the replacement of older components and equipment with higher efficiency models when feasible
- **Component level** – energy efficient fan motors, compressors, pumps (use of VSDs)
- **Preventative maintenance** – ensure equipment is operating at optimal performance (critical refrigerant charges, leak containment, oil return, clean refrigeration coils and plate heat exchangers, etc.)
- **Supervisory level** - measurement, monitoring, target setting and KPIs
- **Finally, on the organizational level** - strong company commitment to energy management with employee involvement and continuous improvement

Dairy Processors & Cold Storage

Industrial refrigeration technology options	Saving potential (%) Partially optimized plant	Saving potential (%) Energy inefficient plants
1. Variable plant pressure control	3%	12%
2. Automated compressor staging and capacity control	5%	15%
3. Remote optimization of refrigeration plant	5%	8%
4. Heat recovery (reduces consumption of other energy sources)	0%	2%
5. Defrost management (Cold Storage only)	2%	3%
6. Variable room temperatures (Cold Storage only)	0%	2%
7. Variable evaporator fan speeds	0%	2%
8. Condensate sub-cooling	2%	4%
9. Plant design review	2%	10%
10. Plant condition maintenance Optimised oil supply, water and air removal (Cold Storage only)	0%	2%
Total potential % energy savings	17%	45%

Source: NSW OEH: Technology Report: Industrial refrigeration and chilled glycol and water applications

Complementary technology - What can be done?

Look for complementary or innovative technology solutions to improve payback periods, for example:

- Co-generation (30 to 40% efficient) for base load
- Heat recovery (use in process)
- Efficient energy use of electricity generated such as ammonia absorption chiller (tri-generation)
- CO_2 system (with heat recovery)

What should be done?

Revisit existing projects – refrigerants levy may change the priorities

Site audits and identification of energy efficiency and carbon reduction opportunities - feasibility studies for priority projects

When evaluating refrigerating systems consider *Best Practice Guideline: Methods of calculating Total Equivalent Warming Impact (TEWI) 2012* if synthetic refrigerants are being considered.

Maximise opportunities with incentives and financing while they exist:

- Clean Technology Food and Foundries Investment Program ($200M)
- Low Carbon Australia – finance only, limited benefits with projects < $500k
- VEET – limited to lighting and retrofit fan motors (coming soon)
- NSW Energy Saver Scheme (free audits, carbon abatement credits, 30 hours project management – success with industrial refrigeration applications)
- Govt. funding can quickly dry up – the underlying issue (rising energy prices) will still exist!!!