



Cold Hard Facts 2nd Edition

The Refrigeration and Air Conditioning Industry in Australia

Presentation by The Expert Group
CCN Live - August 8 2013

Cold Hard Facts 2 - What is it?



Published in July
50,000 words
134 pages
45 Tables
26 Charts
3 typos

App due for release in 2014

Get it from –

<http://www.environment.gov.au/atmosphere/ozone/publications/cold-hard-facts-2.html>

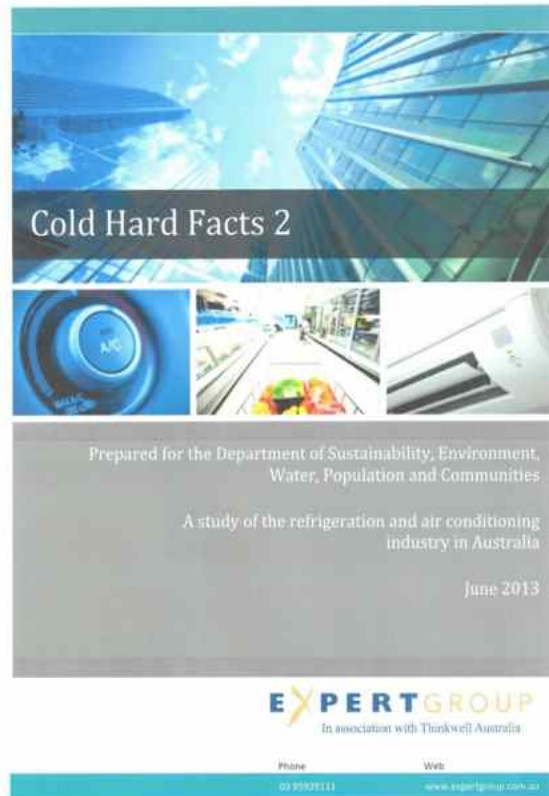
CHF2 – What is it?

- A benchmark of an industry moving through a period of dramatic growth, diversification and change
 - How big is it?
 - How much gas and machinery is out there?
 - How much energy does it all use?
 - What emissions does it produce?
 - What is the economic value of all this, employment, spending?
 - And where is it heading?
 - CHF2 includes validation of data and methodology as it is in part a reference work on which others can build



How can those questions be answered at all?

- Authors of the original Cold Hard Facts study in 2006-07
- Between us and working together have completed more than 20 major pieces of research and analysis into almost every aspect of the RAC industry, the technology and the supply chains over the last 10 years

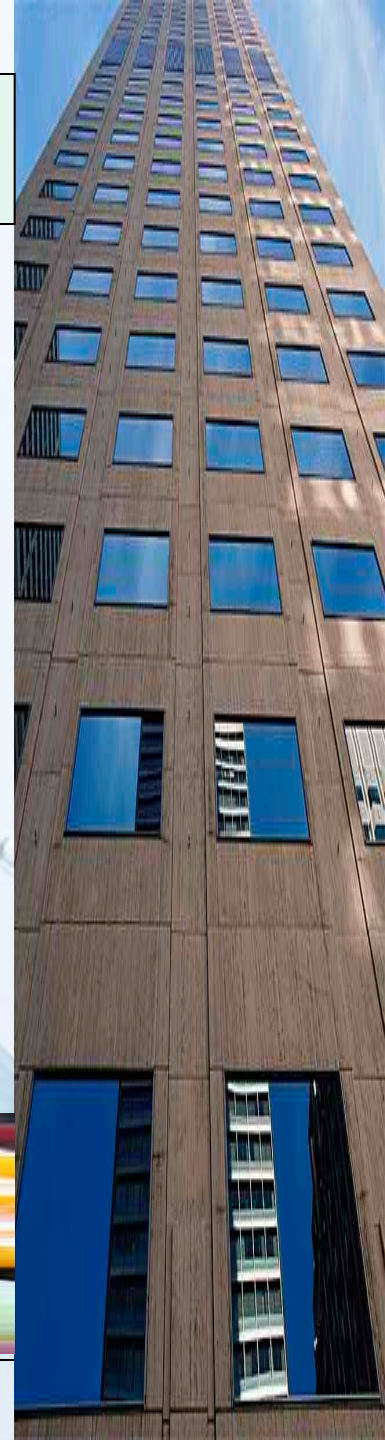


Big deal, so what? Who cares?

- RAC services are essential services, mostly not optional
- Essential for 'LIFE AS WE KNOW IT'
 - High rise buildings completely reliant on HVAC
 - Telecommunications and data network infrastructure
 - The essential functioning of our cities depends to a large degree on the continuing provision of efficient, effective RAC services
- **Cold Food Chain particularly should be regarded as national infrastructure**
- But hard for economists to come to grips with because RCFC is a massively distributed set of privately owned assets though delivering one complex yet coherent set of logistical services.

• RAC IS BIG –

REALLY BIG



RAC – The Invisible Industry

But if all of that is so – then why is this industry effectively invisible on the stage of national industry policy and economic planning?

Hidden in a sea of acronyms perhaps?

Claimed by its customers??

Agriculture, commercial buildings, housing, automotive, health, retail, process industries, mining, telecoms, etc

Suffering from a lack of a defining characteristic, a unifying singular feature perhaps??

R. A. C !

This action, this energy service, cooling things down, is one of the largest single energy services in the economy



- This service is a cornerstone of the energy economy
- A very significant portion of national emissions (carbon economy)
- A reasonable fraction of the financial economy



Taxonomy of a Technology – A Tool for Analysis from the Bottom Up

- Over the years we have sourced a mass of data from across the industry but often aggregated into sets with various differing boundaries
- For CHF 2 we developed a Taxonomy of RAC equipment. EG will always seek to incorporate data into the categories established in the taxonomy – we are going to ask the industry to start reporting data using this same structure whenever possible

RAC Taxonomy

Four broad classes – 18 coded segments and 50 coded products

Stationary AC

Mobile AC

Refrigerated Cold Food Chain

Domestic Refrigeration

Taxonomy of a Technology – Stationary Air Conditioning

Major class	Segments (application/product)		Product categories		
STATIONARY AIRCONDITIONING					
AC	Stationary airconditioning	AC1	Single split: non-ducted	AC1-1	Single split: non-ducted: 1-phase
				AC1-2	Single split: non-ducted: 3-phase
		AC2	Single split: ducted	AC2-1	Single split: ducted: 1-phase
				AC2-2	Single split: ducted: 3-phase
		AC3	Window/Wall	AC3	Non-Ducted: Unitary 0-10 kW _r
		AC4	Portable AC	AC4	Portable AC 0-10 kW _r
		AC5	Chillers	AC5-1	<500 kW _r
				AC5-2	>500 & <1000 kW _r
				AC5-3	>1000 kW _r
		AC6	Light commercial	AC6-1	RT Packaged systems
				AC6-2	Multi split/VRF
				AC6-3	Close control
				AC6-4	HW heat pump: commercial
				AC6-5	Pool heat pump
		AC7	HW Heatpumps	AC7	HW heat pump: domestic

Taxonomy of a Technology – Refrigerated Cold Food Chain

REFRIGERATED COLD FOOD CHAIN					
RCFC	Refrigerated cold food chain	RCFC1	Unitary equipment	RCFC1-1	Refrig. cabinets
				RCFC1-2	Refrig. beverage vending machines
				RCFC1-3	Ice makers
				RCFC1-4	Walk-in coolrooms: small
				RCFC1-5	Walk-in coolrooms: medium
				RCFC1-6	Walk-in coolrooms: large
				RCFC1-7	Beverage cooling (post mix)
				RCFC1-8	Beverage cooling (beer)
				RCFC1-9	Water dispensers (incl. bottle)
				RCFC1-10	Packaged liquid chillers
				RCFC1-11	Milk vat refriger.
				RCFC1-12	Portable refrigerators (commercial)
		RCFC2	Transport refrigeration	RCFC2-1	Mobile refriger.: road: trailer - inter-modal
				RCFC2-2	Mobile refriger.: road: diesel drive
				RCFC2-3	Mobile refriger.: road: off engine
				RCFC2-4	Mobile refriger.: marine
		RCFC3	Supermarkets	RCFC3-1	Supermarket refriger.: small
				RCFC3-2	Supermarket refriger.: medium
				RCFC3-3	Supermarket refriger.: large
		RCFC4	Hospital refrigeration	RCFC4	Process and large kitchens
		RCFC5	Industrial refrigeration	RCFC5-1	Cold storage and distribution
				RCFC5-2	Process chilling

Stock of Equipment CHF1 vs CHF2

STOCK OF EQUIPMENT	2006	2012
Domestic refrigerators and freezers	13,000,000	17,149,000
Domestic and light commercial air conditioning	5,638,669	11,526,000
Chillers	22,450	28,440
Volume of cold storage	9,460,000 m ³	13,050,000 m ³
Supermarket chain stores	3,675	3,336
Small independent stores	-	840
Convenience stores	-	5,817
Walk-in coolrooms (also included below for purpose of comparison with 2006)	22,853	98,100
Walk-in coolrooms and self-contained non-domestic refrigeration equipment	821,500	1,055,000
Refrigerated Vehicles	16,418	28,900
Passenger vehicles with air conditioning	10,293,770	12,079,000

R. A. C. – How Big Is It?

Metric 2012	Size and Proportion of Total	
Employment	173,000	(1.5%)
Businesses	21,350	
Direct Spending	\$26.2 Bn	(1.7%)
Electricity Use	59,100 GWh	(>22%)
Greenhouse Emissions (direct and indirect)	64.5 Mt CO ₂ e	(11.7%)
Stock of Equipment	45 million pieces	



Spending

Expenditure by major sector (\$ Million)	Equipment spend (installed)	Direct wages costs	Refrigerant cost (end-user)	Total
Stationary AC	\$3,350	\$5,744	\$535	\$12,175
Domestic refrigeration	\$1,201			
Refrigerated cold food chain: stationary	\$728			
Refrigerated cold food chain: mobile	\$54			
Mobile AC	\$562			
Other Employment	-			
Total estimated direct spending	\$5,896	\$5,744	\$535	\$12,175

Energy Expenditure by major sector (\$ Million)	Energy spend (end-user)	Total Energy
Stationary AC	\$7,456	\$14,061
Domestic refrigeration	\$2,058	
Refrigerated cold food chain: stationary	\$2,811	
Refrigerated cold food chain: mobile	\$99	
Mobile AC	\$1,637	
Total spending including Energy	\$26,236	

Employment

Business activity by major sector	Direct employment
Stationary AC: commercial	47,194
Stationary AC: residential	16,747
Domestic refrigeration	1068
Refrigerated cold food chain: stationary	20,975
Refrigerated cold food chain: mobile	58,171
Mobile AC	24,315
Other	2,055
Total estimated direct employment	170,524
ABS derived employment	173,940

Business Types	
Suppliers	2,200
Manufacturers	450
Contractors	18,700
Other	1,500
Total	21,350

Scale of the Industry CHF1 vs CHF2

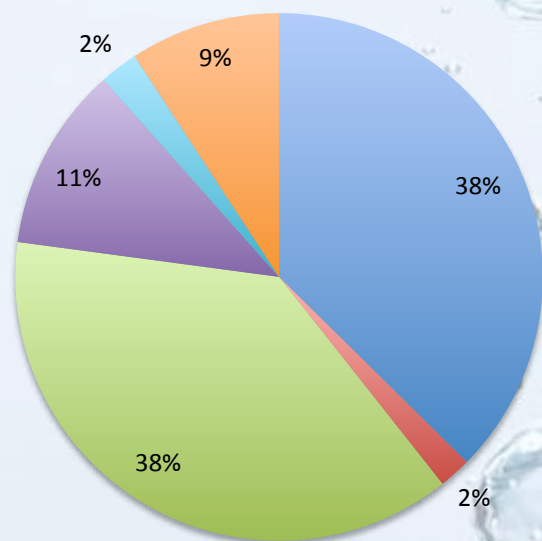
Main measures	2006	2012
Direct spending	\$15.96 Bn	\$26.235 Bn
Total employment	163,000	173,940
Electricity consumed	45,000 GWh	59,100 GWh
Proportion of total electricity generation	21.9%	22.3%
Indirect emissions	40 Mt CO ₂ -e	57.1 Mt CO ₂ -e
Indirect emissions as proportion of NGGI	-	10.4%
Bank of high GWP Gases	30,150 tonnes	43,500 tonnes
Bank of low GWP Gases	-	4,800 tonnes
Direct emissions (ODS)	—	1.3 Mt CO ₂ -e
Direct emissions (SGG)	-	4.1 Mt CO ₂ -e
EOL emissions (ODS and SGG)		1.9 Mt CO ₂ -e
All RAC emissions as proportion of NGGI	-	11.7%

Bank of high GWP HCFCs and HFCs in Australia 2006 - 2012

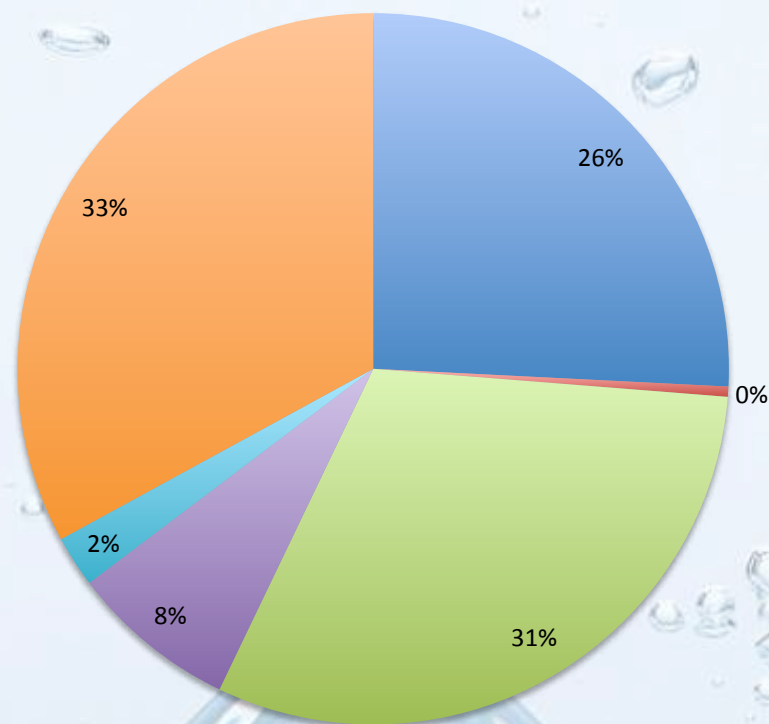
2006 30,150 tonnes

~ 44% increase

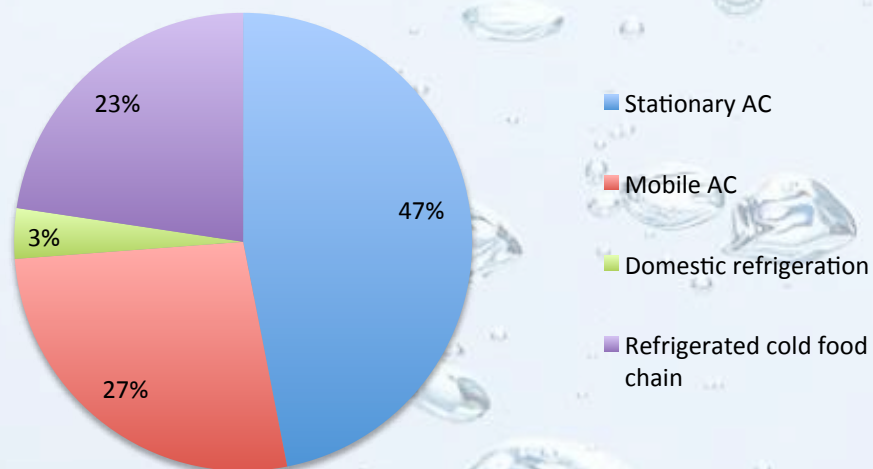
2012 43,500 tonnes



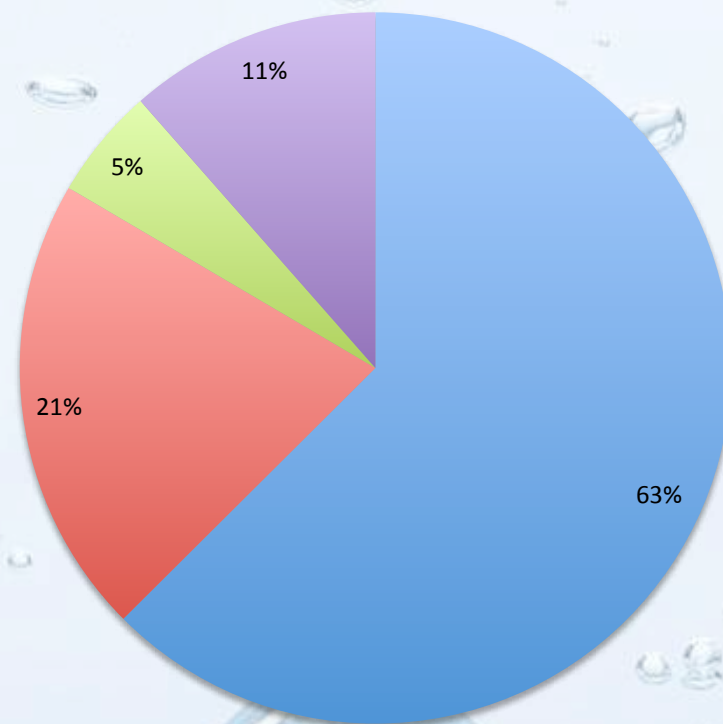
- HCFC-22
- HCFC Mix
- HFC-134a
- HFC-404A
- HFC-407C
- HFC-410A
- HFC-Mix



Bank of Refrigerant by Major Class of Equipment

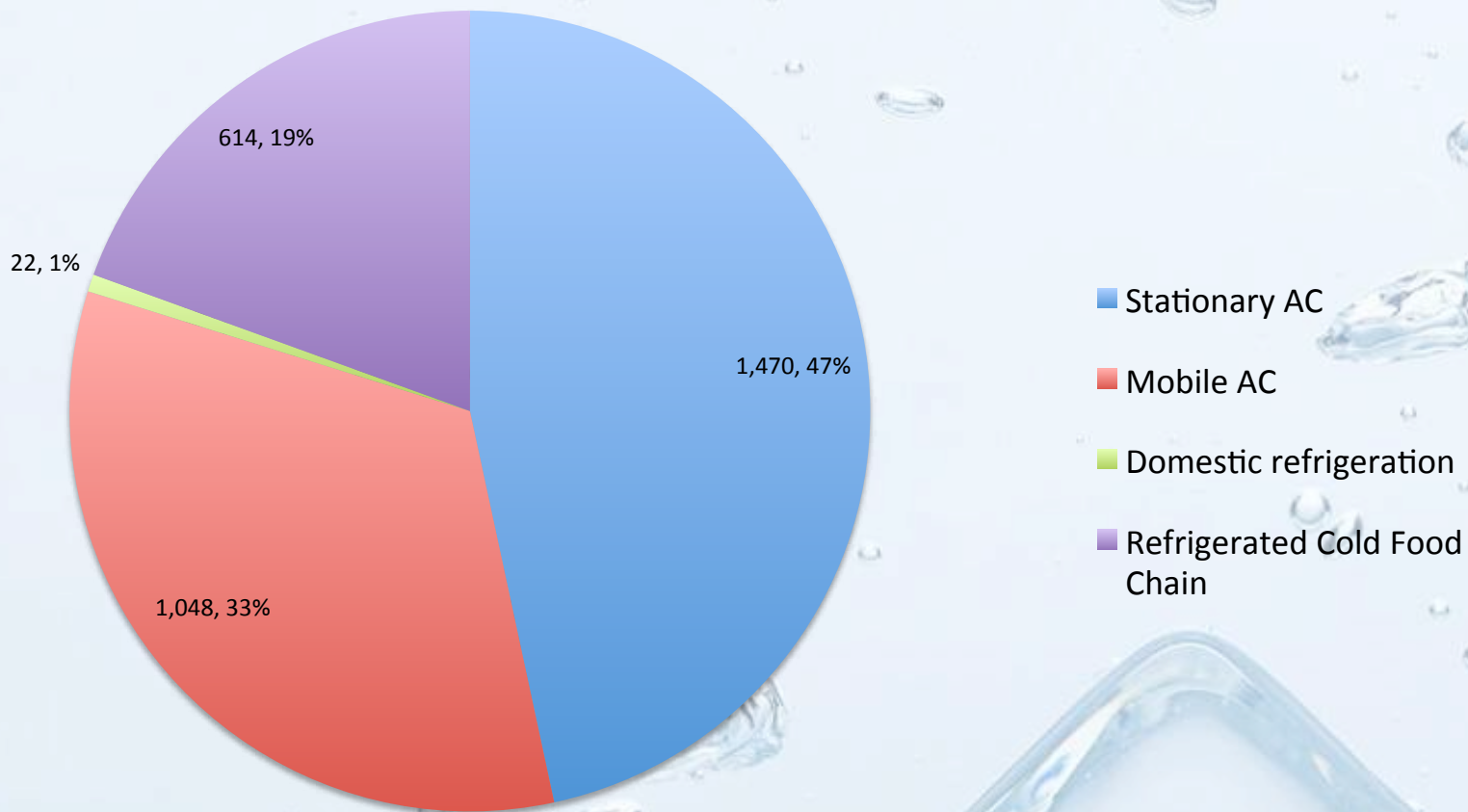


2006

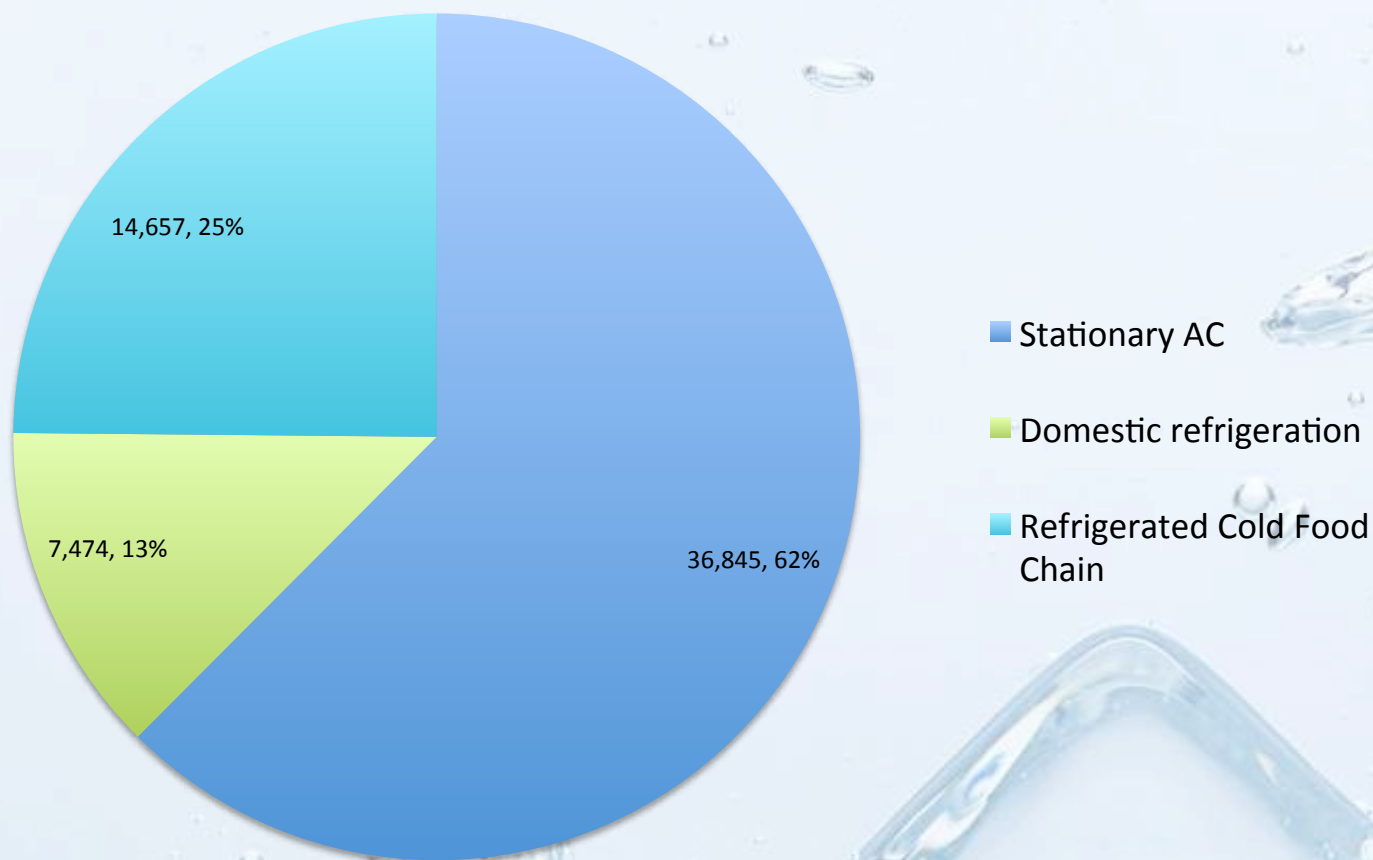


2012

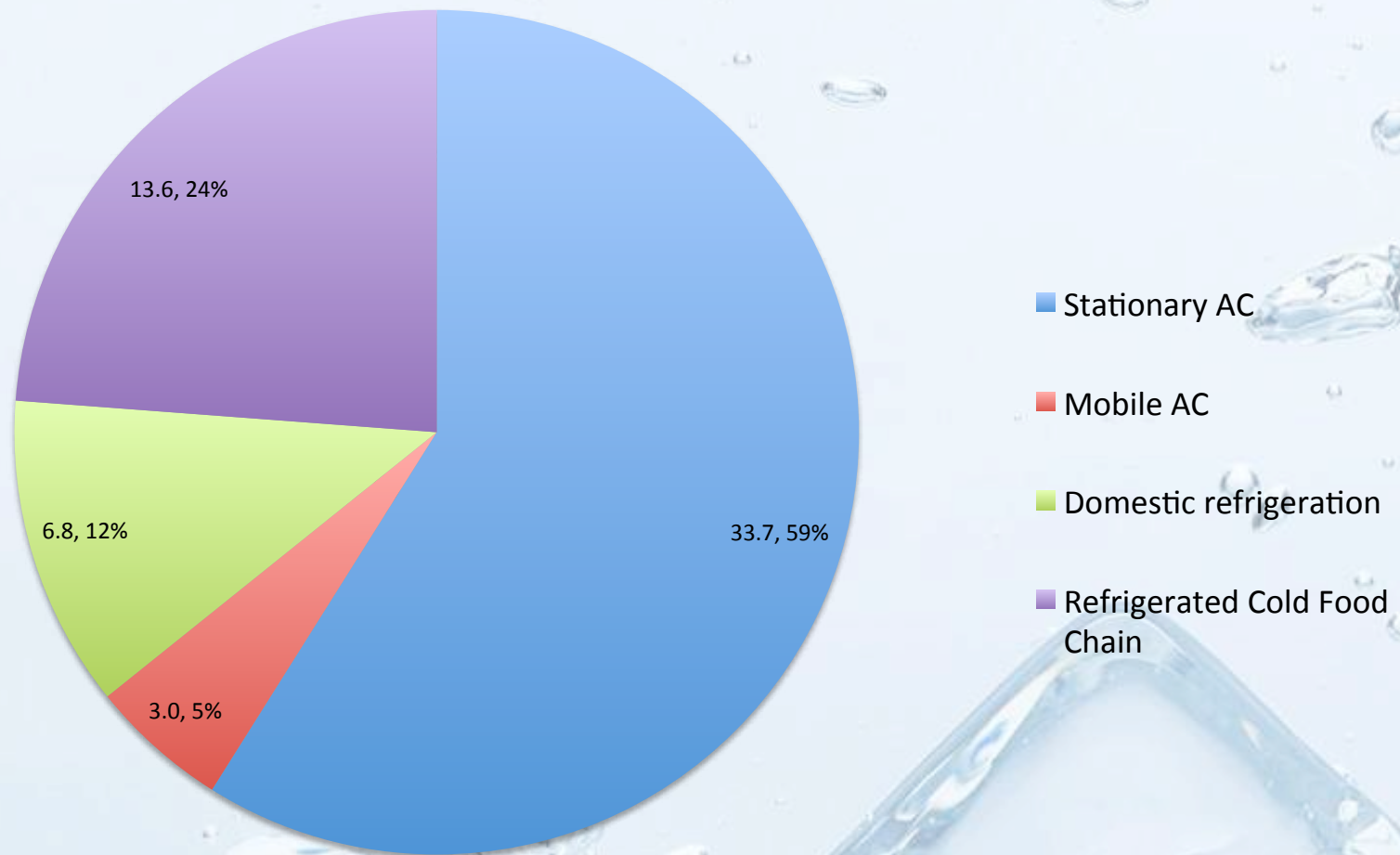
2012 SGG Consumption by Class of Equipment, tonnes and %



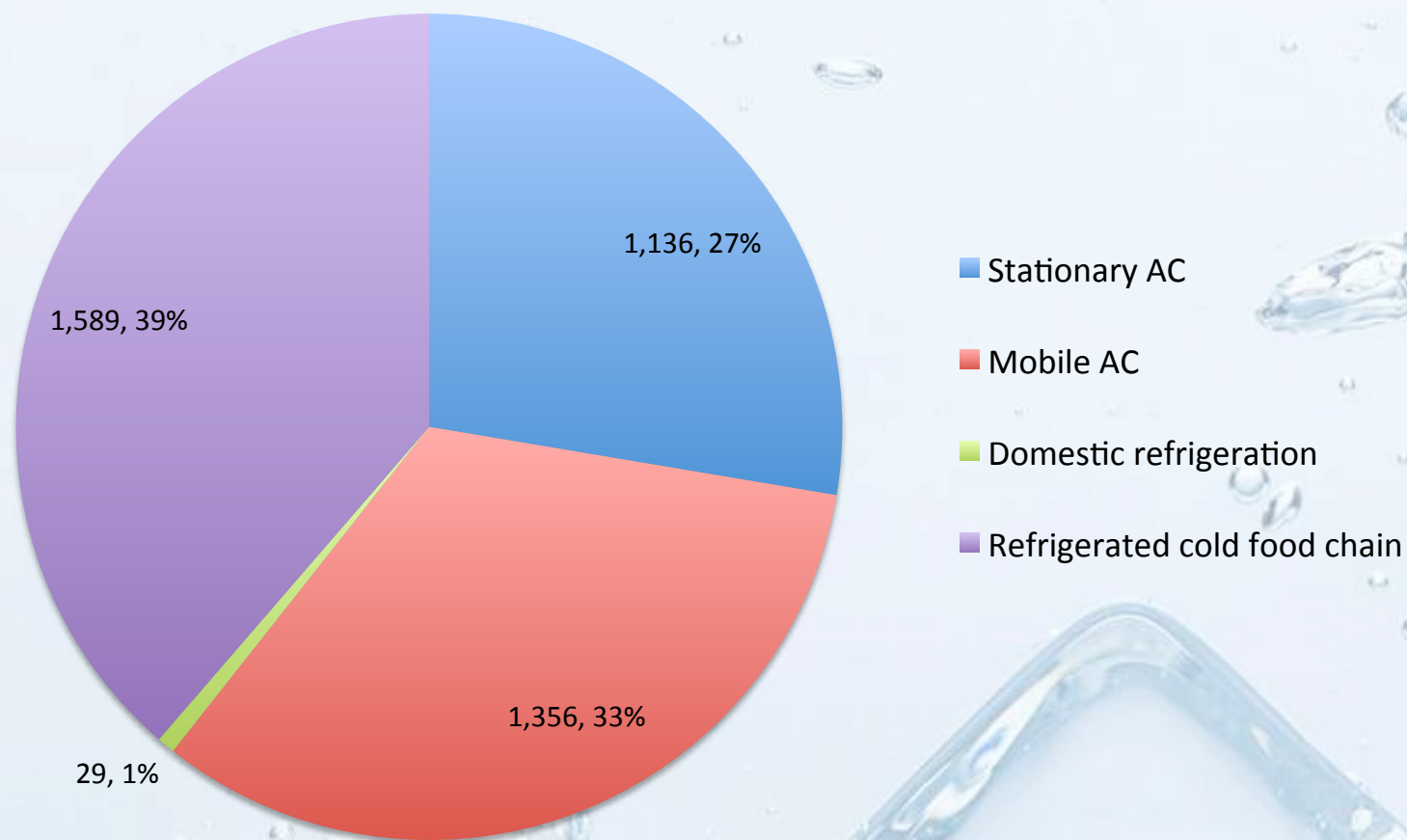
Electricity Consumption by Class in GWh and % Total



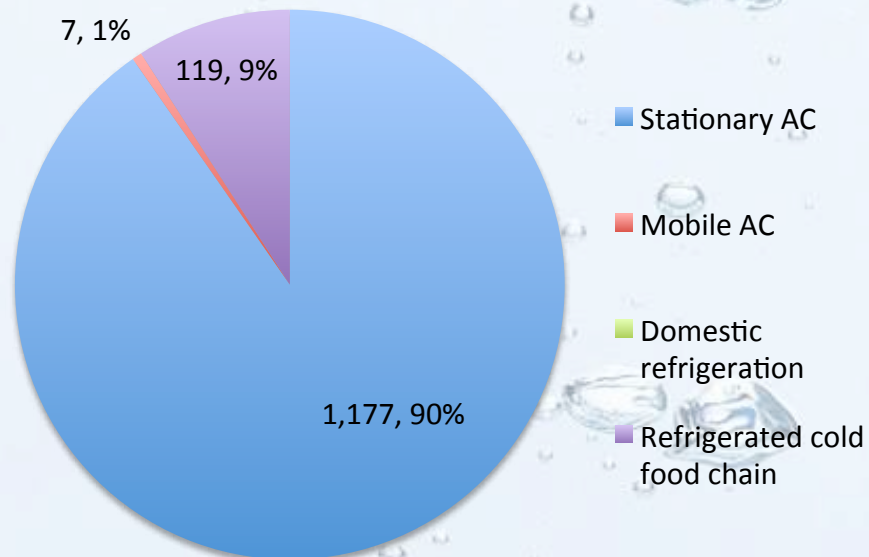
Indirect Emissions by Class in Mt CO₂e and % Total



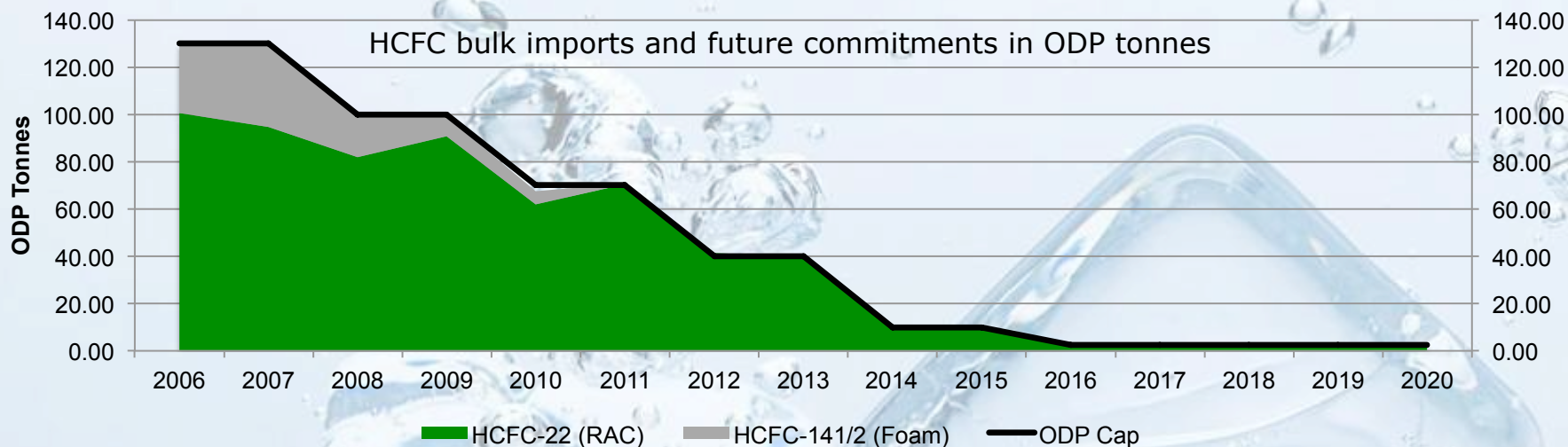
Direct emissions SGGs by class of equipment Mt CO₂e and %



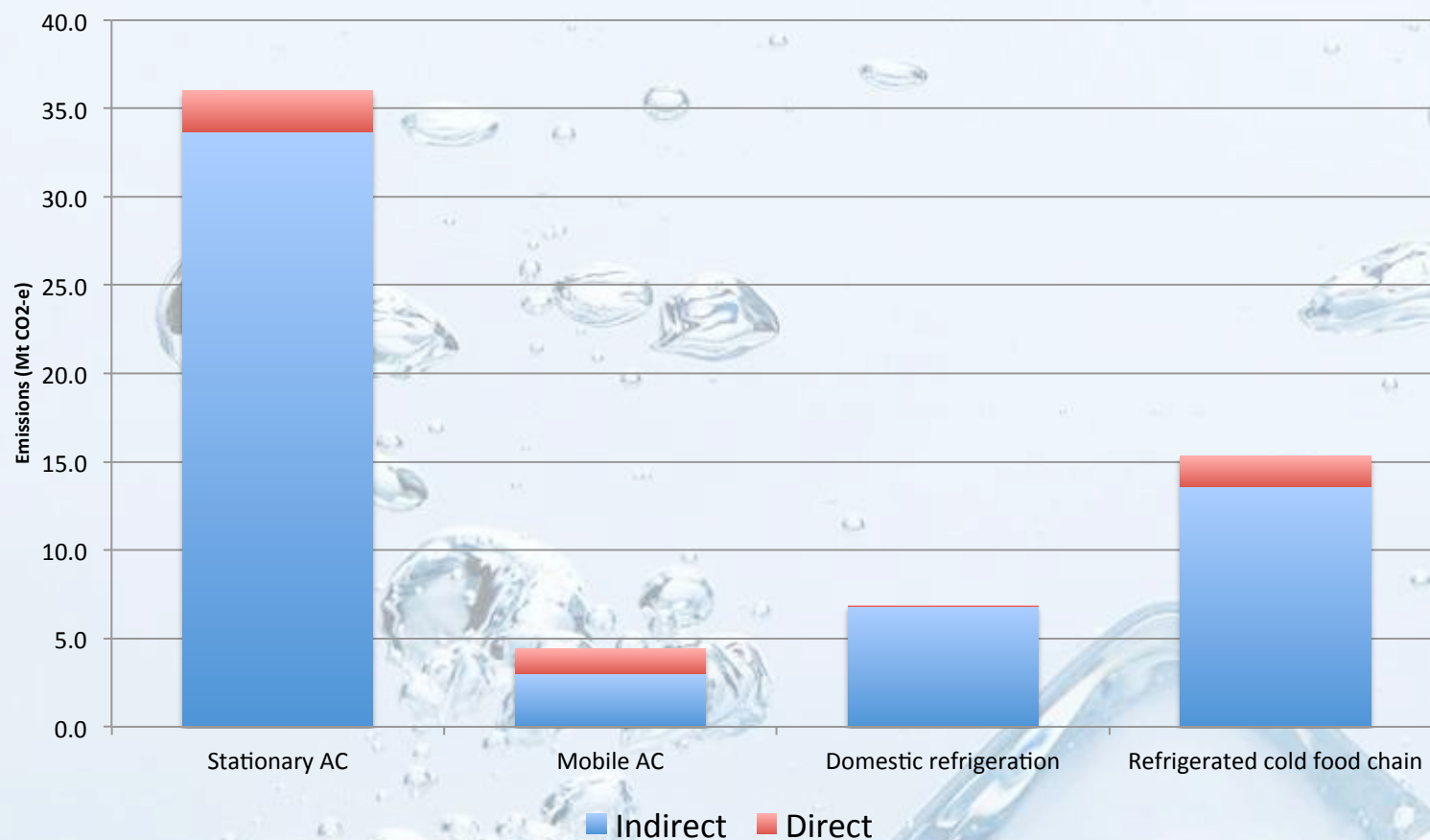
Direct emissions ODS by class of equipment Mt CO₂e and %



R22 GWP (AR2-100) = 1500
1,177 Mt CO₂e \approx 785 tonnes R22
ODP multiplier for R22 = 0.055
785 tonnes R22 = 43.2 ODP tonnes
Next cap step is 10 ODP tonnes



Indirect And Direct Emissions, ODS and SGGs by Class of Equipment Mt CO₂e and %



Natural Refrigerants

Species	Supply (t)	Bank (t)
CO ₂	70	80
Ammonia (R717)	545	4,400
Hydrocarbons	80	320
Total	695	4,800

Natural refrigerant technology and expertise is rapidly emerging in a wide range of applications including large food processors, truck and automotive ac, refrigerated vending machines, hot water heat pumps, and REEFERS.

Relative to total cooling economy it is starting from a small base with total natural refrigerant services equivalent to around 10% of the market in 2012.

Transition to low GWP bank will take time!

Refrigerated cold food chain

- CO₂
- R717
- HC (small charges)
- HFO-1234yf

Domestic refrigeration

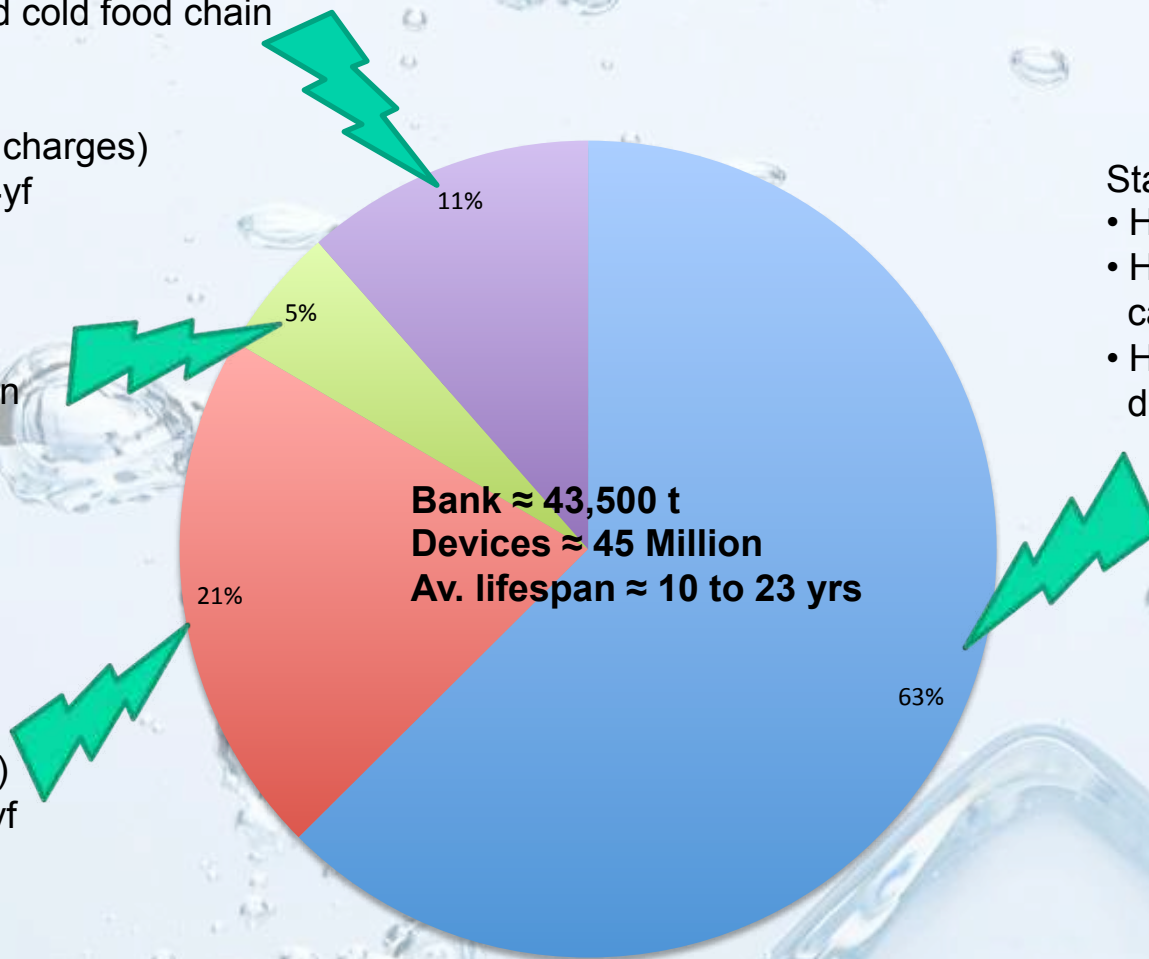
- HC (new)

Mobile AC

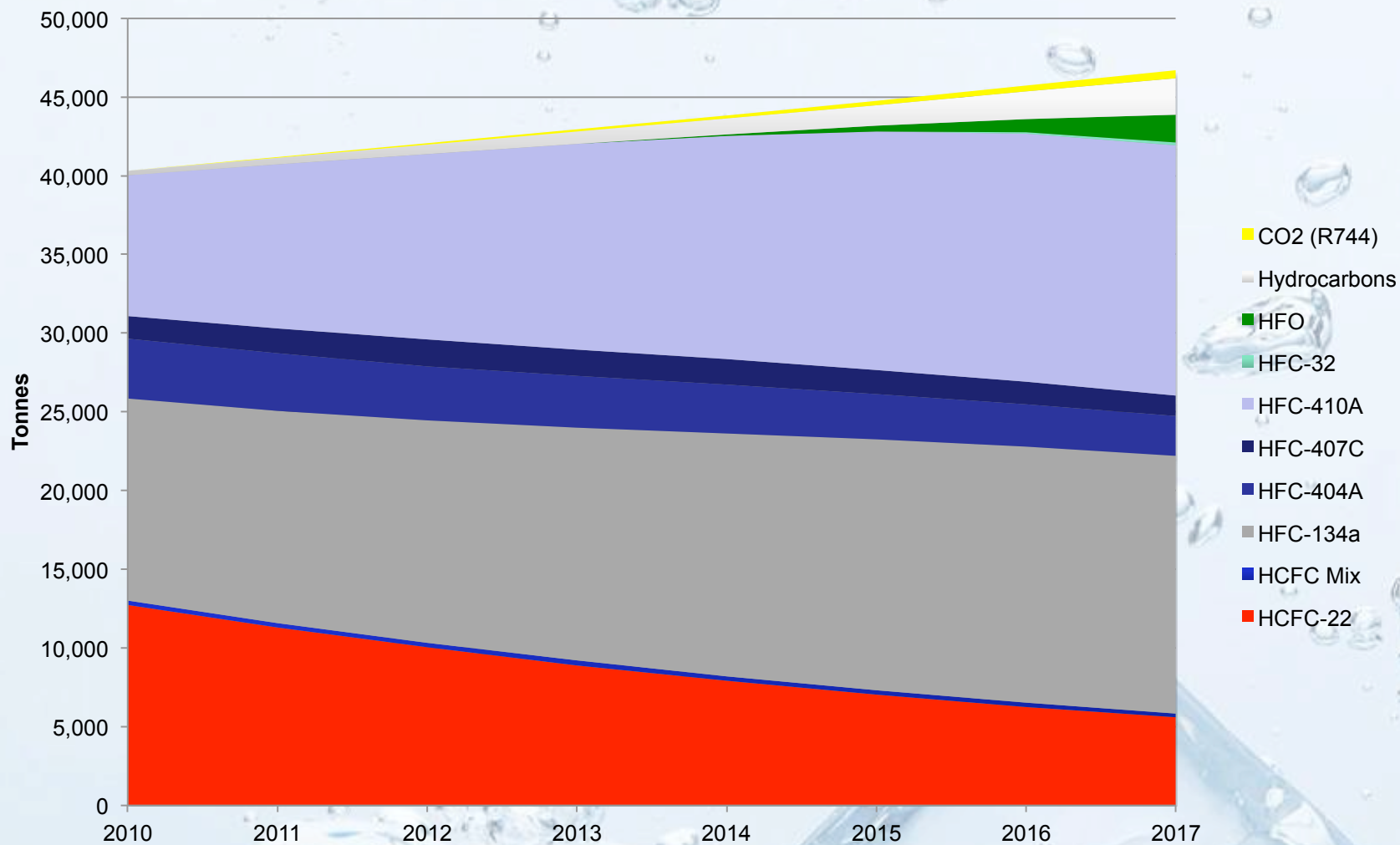
- HC (retrofit)
- HFO-1234yf
- CO₂ (new)

Stationary AC

- HFC-32
- HC (smaller charge/ capacity)
- HFO blends under development



Projected refrigerant bank trend by species from 2010 to 2017



Note Ammonia not displayed

And so looking down the road.....

Diversification – driven by the transformation of the bank

Efficiency – driven by economic reality and climate reality

Communication – driven by the internet of everything, responsive to power supply and demand

Recognition – the value and role of the industry in the economy will drive collaboration of the industry participants

None of these trends are independent

Direct Spending and Perishable Foods

Expenditure categories	Economic spend (\$ Billion)
New hardware costs installed	\$5.896
Annual refrigerant gas cost	\$0.535
Energy cost	\$14.061
Discounted wages cost	\$5.743
Total spend	\$26.235

Product	Production volumes	Farm gate value	Number of farms	Employment	Value of export
Dairy products	9.1 million litres	\$3.9Bn	8,594	27,500	\$2.4Bn
Meat Products	3 million tonnes	\$13.6Bn	55,090	137,726	\$5.6Bn
Poultry and eggs	866,000 tonnes	\$2.27Bn	968	8,250	n.a. ⁽¹⁾
Wine grapes	1.53 million tonnes	\$1.1Bn	4,880	31,309	n.a. ⁽²⁾
Fruit, Berries and Vegetables	3.34 million tonnes	\$7.4Bn	10,860	31,309	\$1.715 Bn
Fisheries 2010	241,000 tonnes	\$2.0 Bn		8,500	\$1.2Bn
Total	20.11 million tonnes	\$25.63Bn	80,392	244,593	\$10.9Bn

The Food Imperative

- The business of so called soft commodities are booming around the world.
- That is a financial markets description of the essential business of delivering high quality, nutritious, fresh food – its going to get much much bigger
- Two seminal reports in 2012
 - The National Food Plan
 - “Greener Pastures: The Global Soft Commodities Opportunity ANZ and Port Jackson Partners
- \$35.6 billion total value expected for farm exports 2013/14
- 77% increase in agricultural output between now and 2050
- 20% - 30% rise in average real prices for agricultural commodities in next decade
- Additional \$1.7 trillion in export earnings for Australia in next 35 years



- **Estimated investment of an additional \$600 billion needed in Australian agriculture in the next four decades to ensure we capture the value that the global market offers.**
- **How is it then that in both of these documents, across several hundred pages of detailed research, refrigeration is only mentioned once!! And the only time it was mentioned was in one instance in the Food Plan where it was noted that some services were not readily accessible to some remote area of production.....**
- **Being 99.99% effective and reliable is tremendous, and being 100% invisible does not serve this industry.**