

## **Cold Hard Facts 2**

### **A study of the Refrigeration and Air Conditioning Industry in Australia**

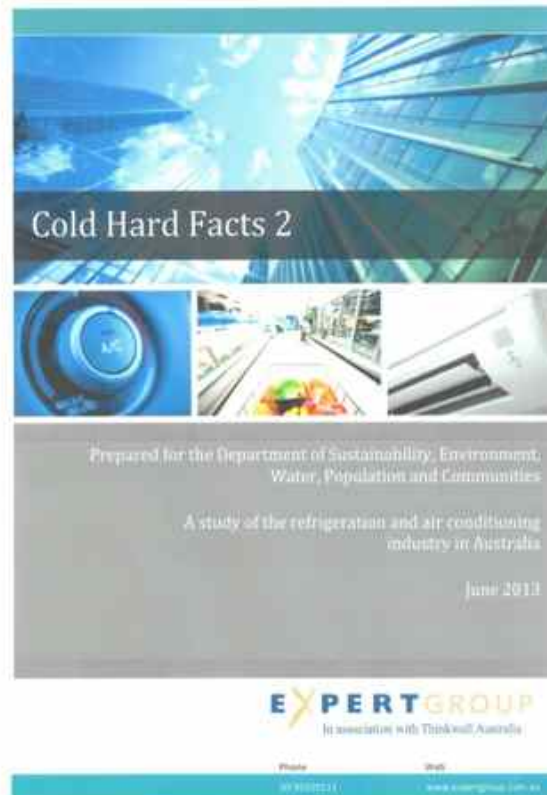
Presentation by the Peter Brodribb  
[www.expertgroup.com.au](http://www.expertgroup.com.au)

AIRAH – August 2013

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

## Expert Group - How have we got here.....

- Authors of the original Cold Hard Facts study in 2006-07
- Nearly 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



## 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 we are always interested in improved containment and potential efficiency gains?
    - And where is it heading?





**Its all about the cooling economy**

# 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 – Getting industry data in good order**

- One of the big obstacles is the mass of data - often aggregated into sets with various boundaries
- In CHF2 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

### **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 <sub>r</sub>
		AC4	Portable AC	AC4	Portable AC: 0-10 kW <sub>r</sub>
		AC5	Chillers	AC5-1	<500 kW <sub>r</sub>
				AC5-2	>500 & <1000 kW <sub>r</sub>
				AC5-3	>1000 kW <sub>r</sub>
		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

# R. A. C. – How Big Is It?

Metric 2012	Size and Proportion of Total	
Employment	173,000	(1.5%)
Businesses	21,350	
Direct spending (i.e. energy \$14.2 Bn)	\$26.2 Bn	(1.7%)
Electricity use	59,100 GWh	(>22%)
Greenhouse emissions (direct and indirect)	64.5 Mt CO <sub>2</sub> e	(11.7%)
Stock of equipment	45 million pieces	



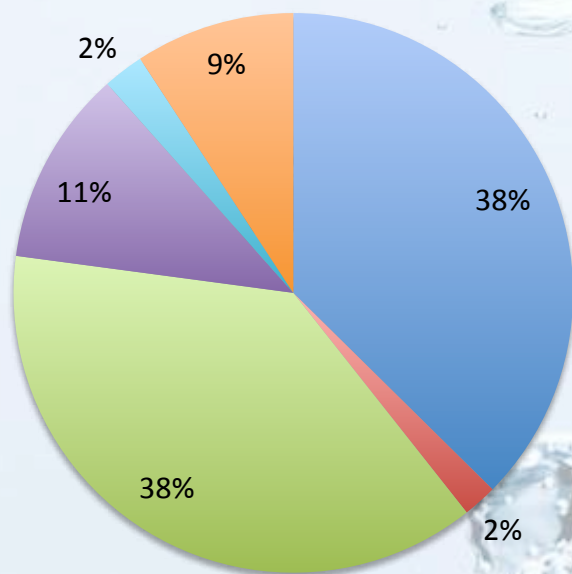


## Bank of high GWP HCFCs and HFCs in Australia 2006 - 2012

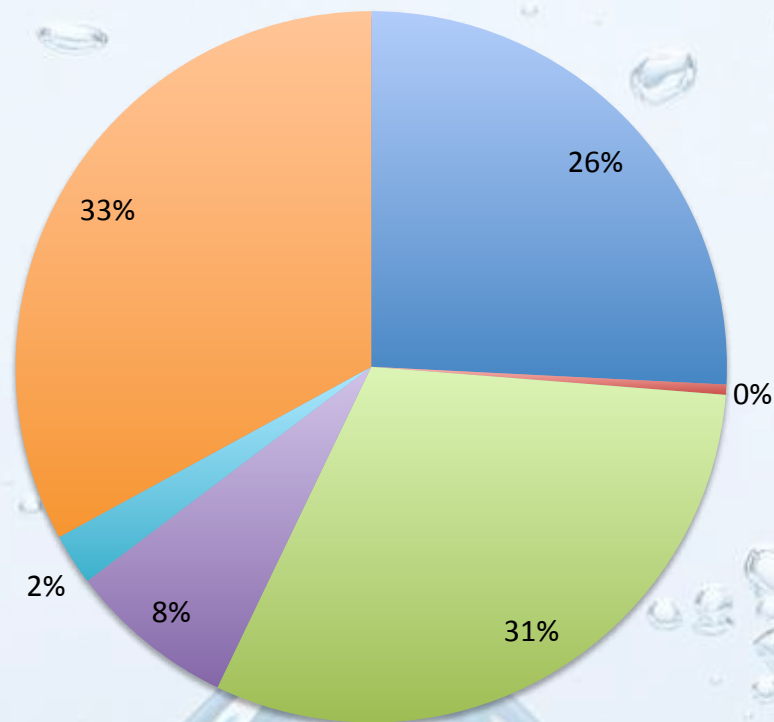
2006 30,150 tonnes

~ 44% increase

2012 43,500 tonnes

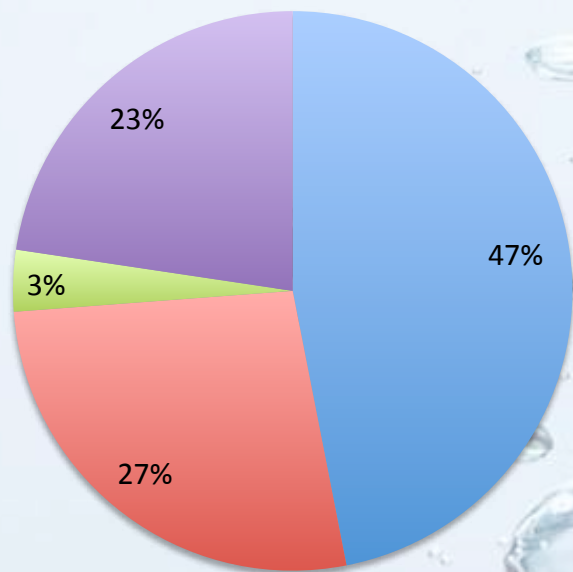


■ HCFC-22  
■ HCFC Mix  
■ HFC-134a  
■ HFC-404A  
■ HFC-407C  
■ HFC-410A  
■ HFC-Mix



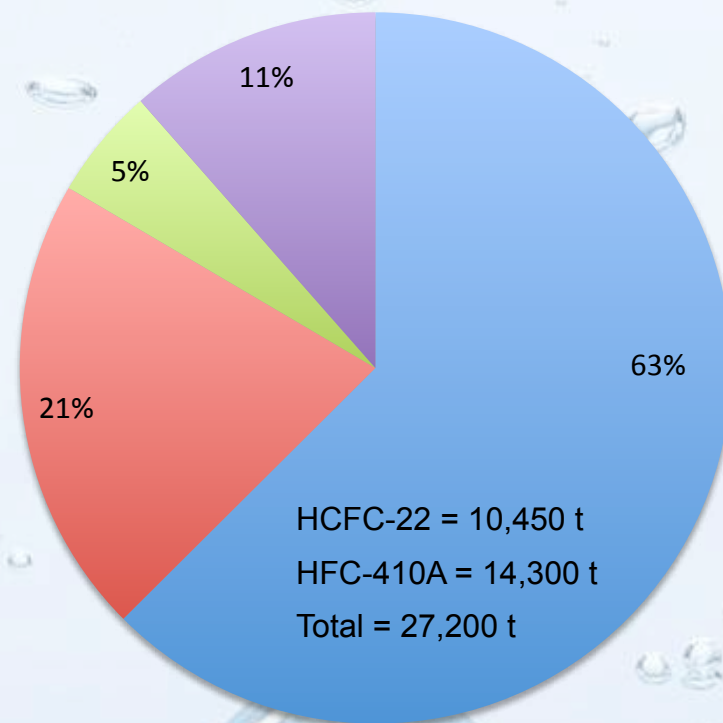


## Bank of refrigerant by major class of equipment



2006

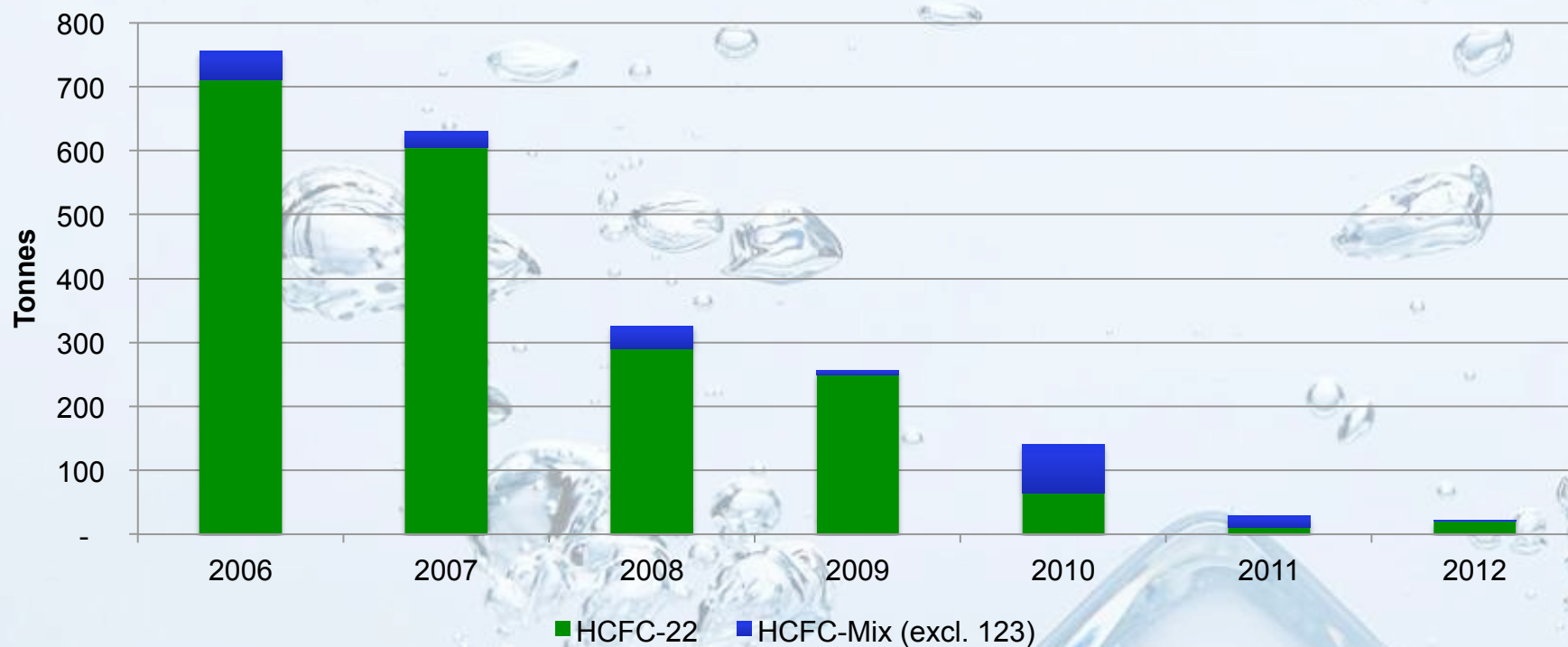
- Stationary AC
- Mobile AC
- Domestic refrigeration
- Refrigerated cold food chain



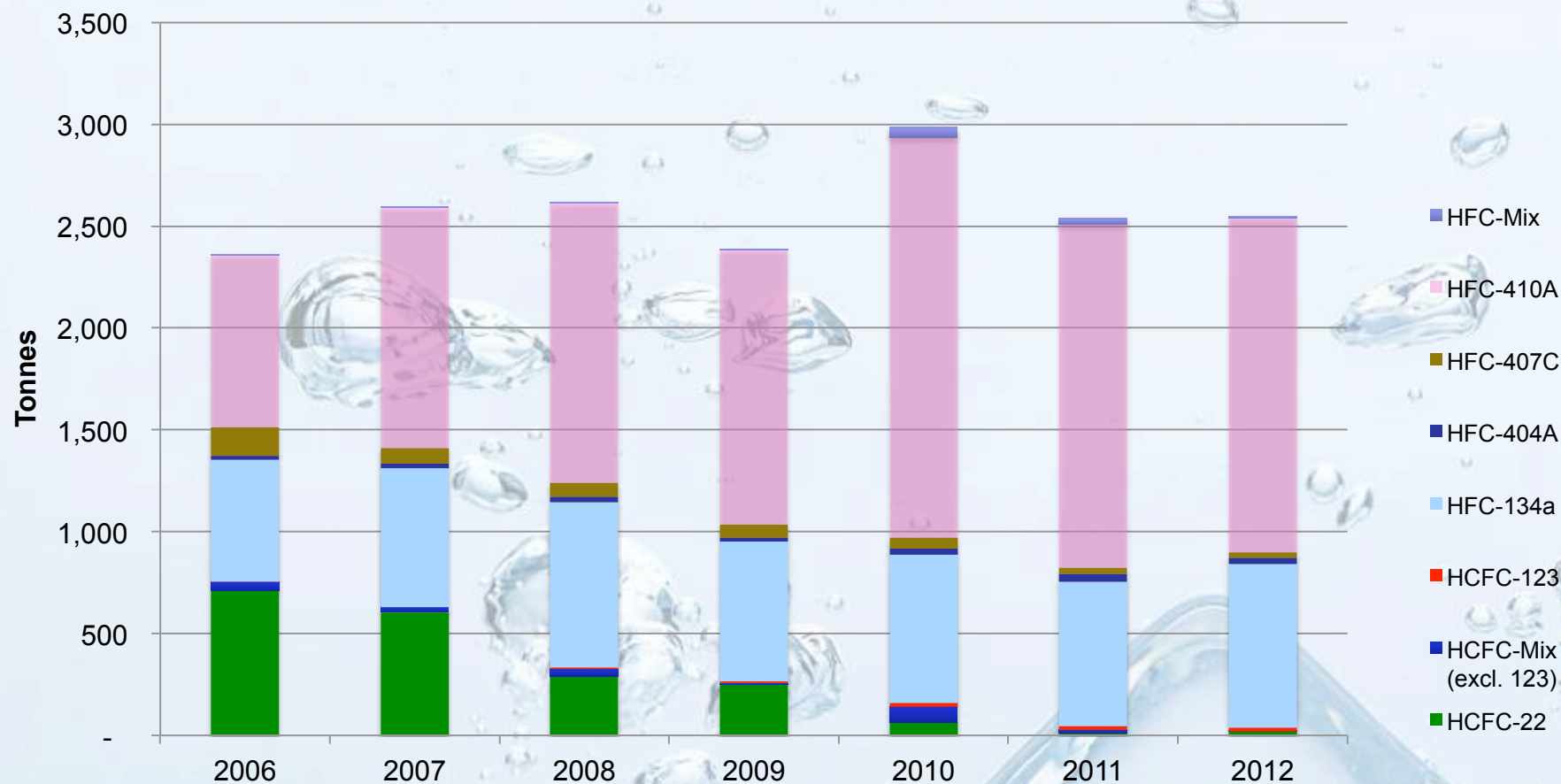
2012

HCFC-22 = 10,450 t  
HFC-410A = 14,300 t  
Total = 27,200 t

## HCFC Pre-charged equipment import trend 2006 to 2012 in tonnes



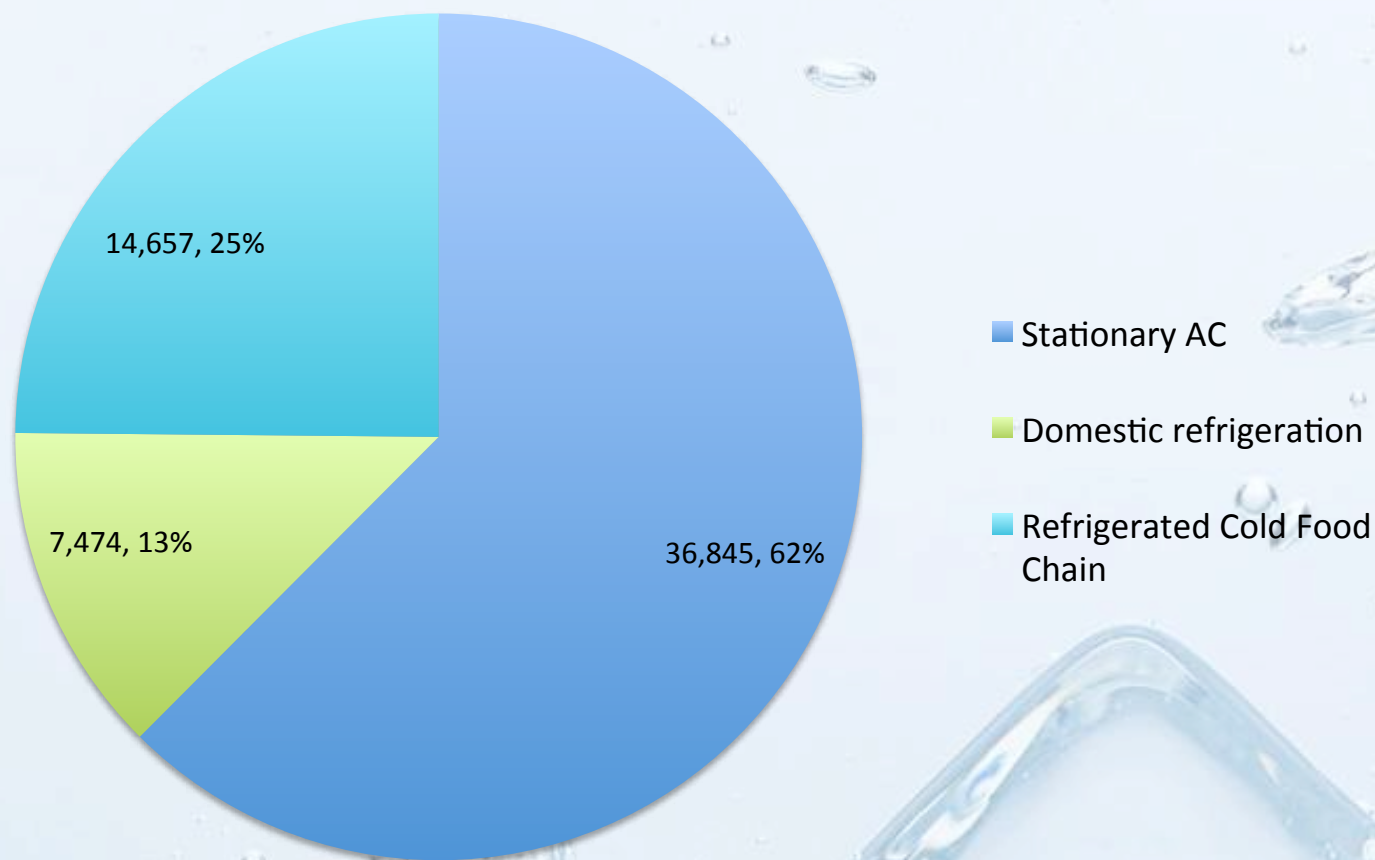
## HCFC and HFC Pre-charged equipment import trend 2006 to 2012 in tonnes



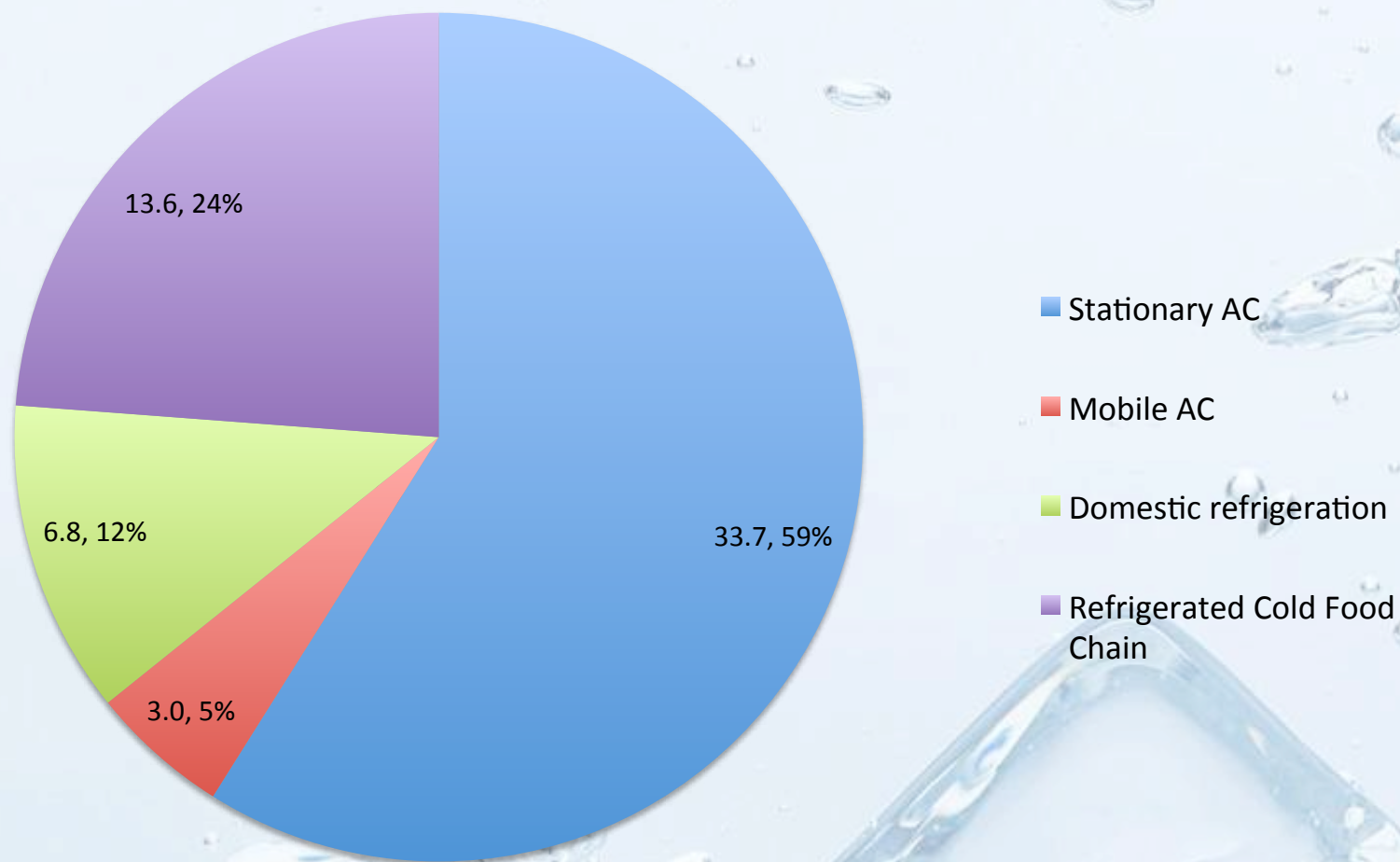
**Stationary AC PCE grown to more than 1,630 tonnes of HFC-410A in 2012**



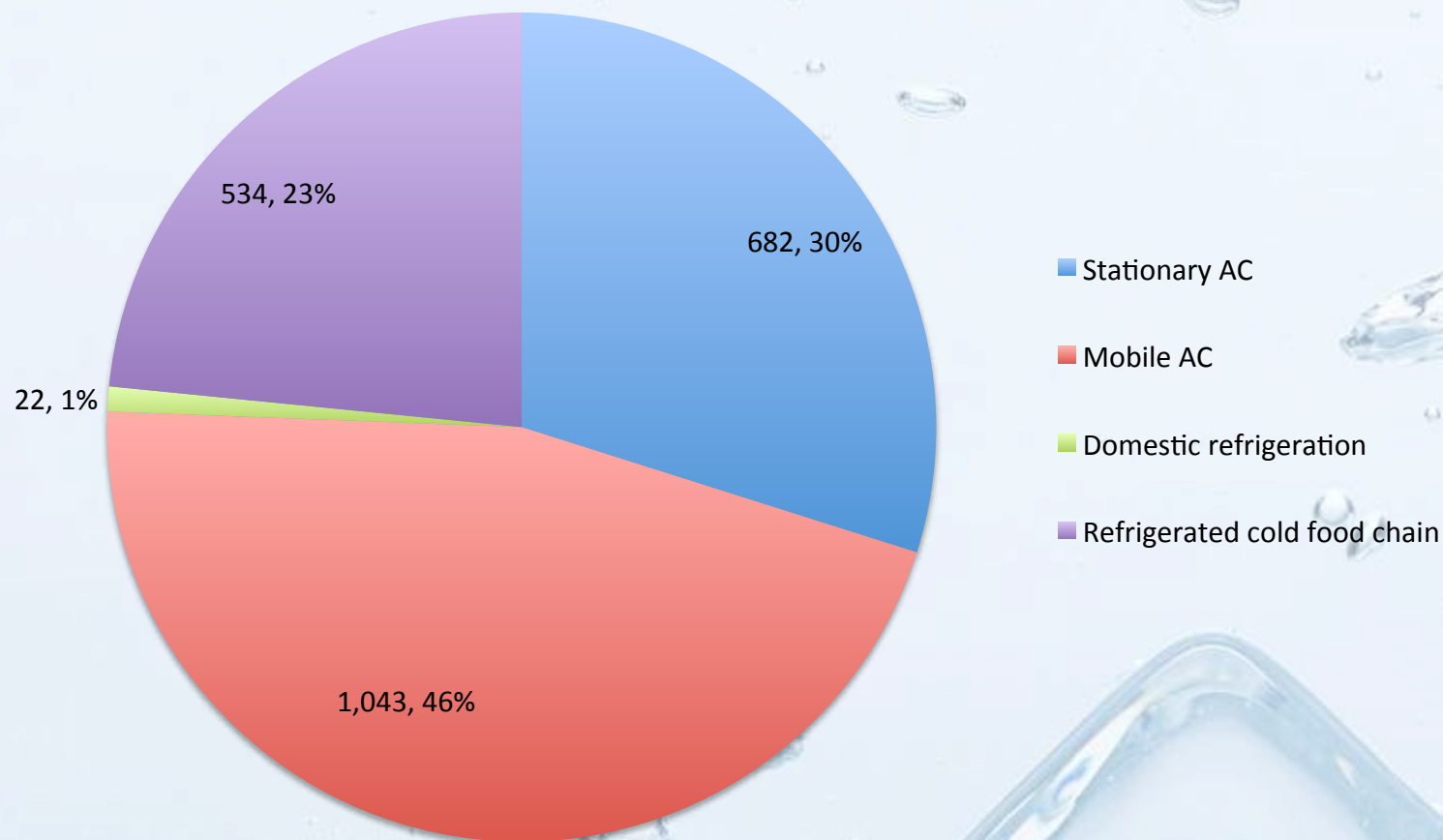
## Electricity consumption by class in GWh and % total



## Indirect emissions by class in Mt CO<sub>2</sub>e and % total

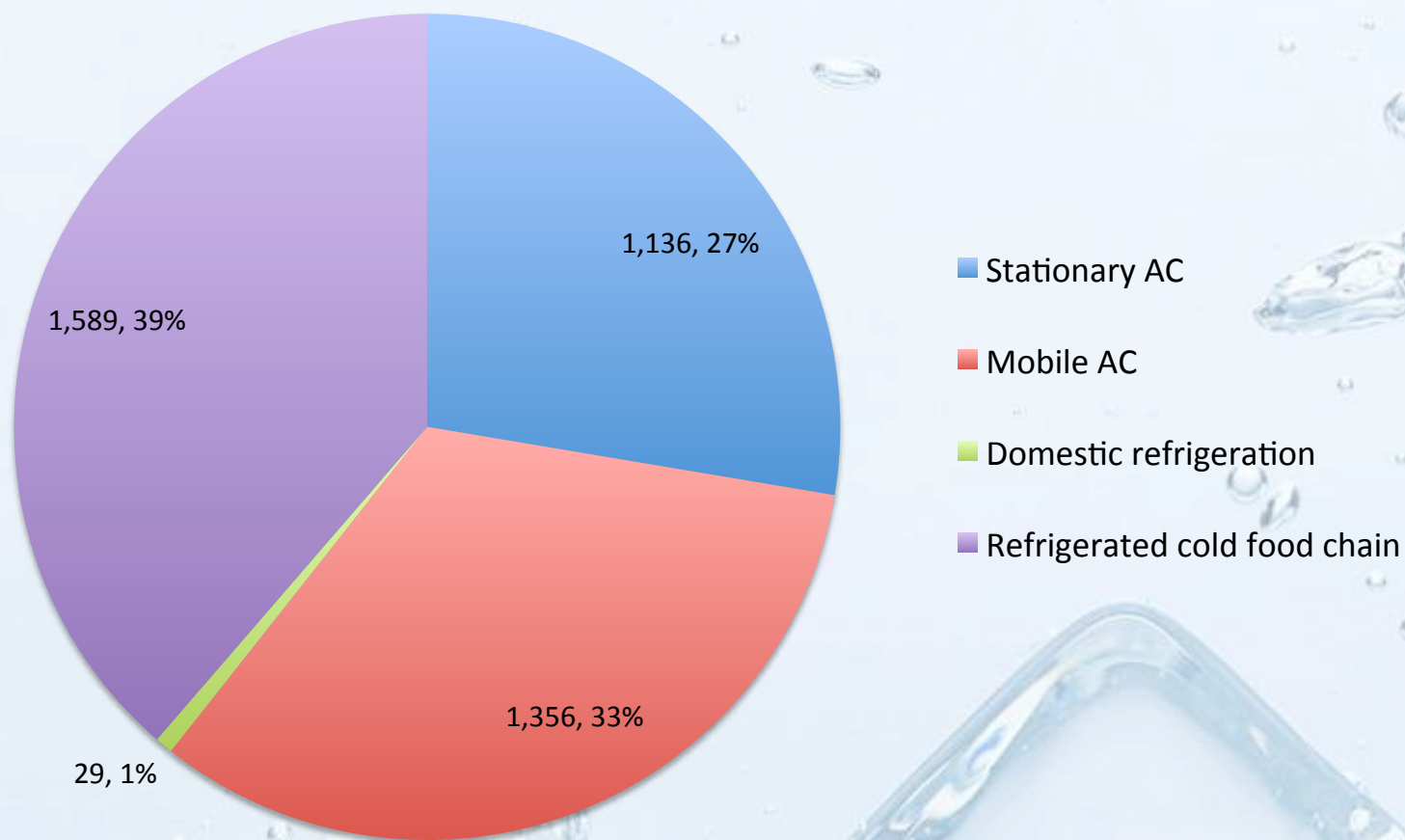


## SGG Consumption by class of equipment in tonnes and %

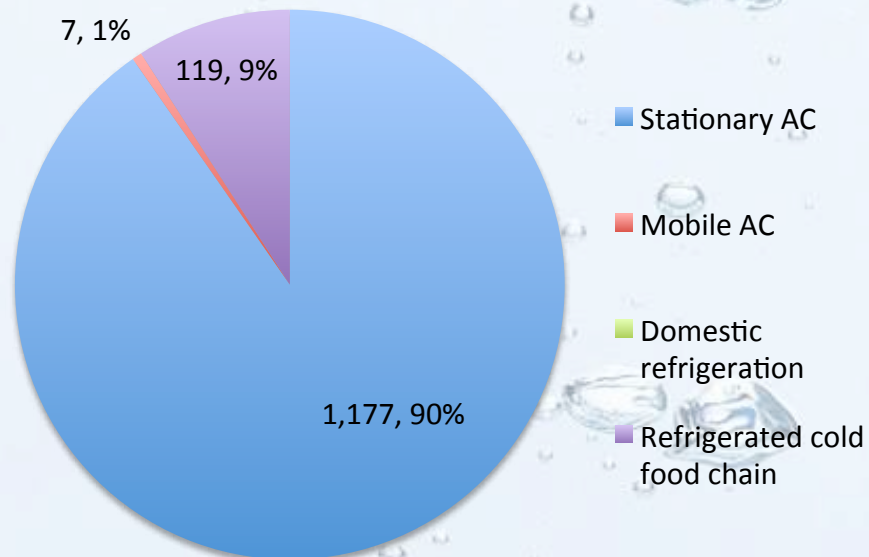




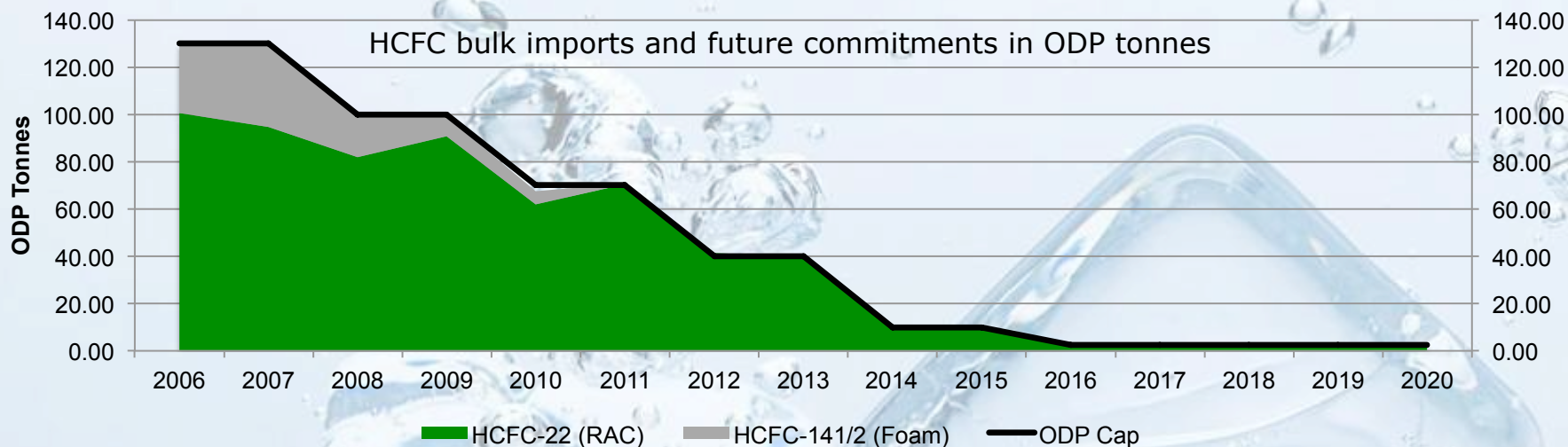
## Direct emissions SGGs by class of equipment Mt CO<sub>2</sub>e and %



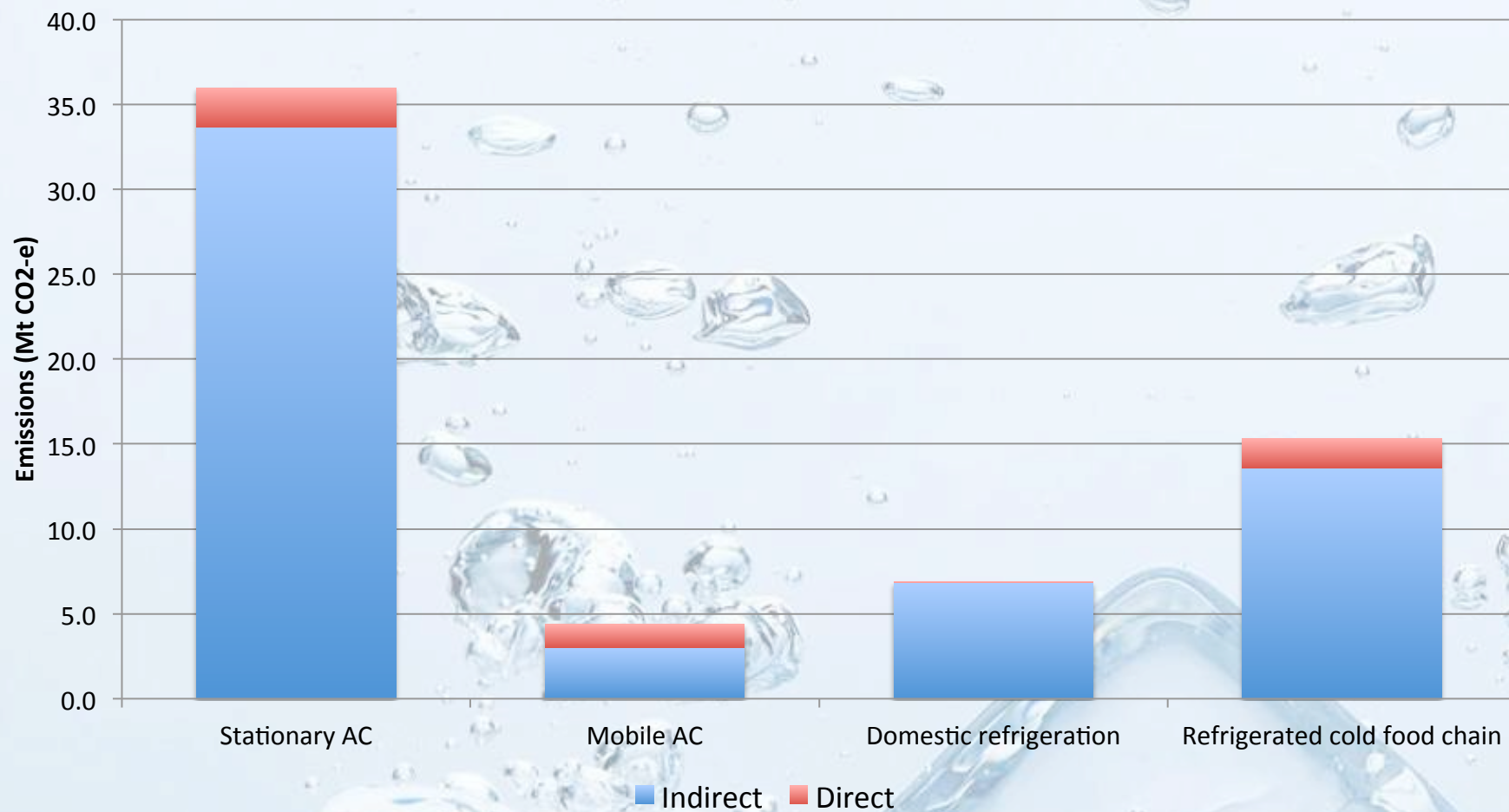
## Direct emissions ODS by class of equipment Mt CO<sub>2</sub>e and %



R22 GWP (AR2-100) = 1500  
 1,177 Mt CO<sub>2</sub>e  $\approx$  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 CO<sub>2</sub>e





## Scale of the industry CHF1 vs CHF2

Main measures	2006	2012
<b>HVAC&amp;R INDUSTRY</b>		
Total 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 <sub>2</sub> -e	57.1 Mt CO <sub>2</sub> -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 <sub>2</sub> -e
Direct emissions (SGG)	-	4.1 Mt CO <sub>2</sub> -e
Net EOL emissions (ODS and SGG)	-	1.9 Mt CO <sub>2</sub> -e
RAC emissions as proportion of NGGI	-	11.7%

## 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 <sup>3</sup>	13,050,000 m <sup>3</sup>
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

## Stock of stationary AC equipment

Category	Product category	Av. Lifespan (yrs)	Estimated stock (units)
AC1	Single split: non-ducted: 1 & 3 phase	12	7,145,000
AC2	Single split: ducted: 1 & 3 phase	12	1,304,000
AC3	Window/wall: non-ducted: Unitary: 0-10 kW	10	1,915,000
AC4	Portable AC: 0-10 kW	7	606,000
AC5-1	Chillers: <500 kW	15	20,200
AC5-2	Chillers: >500 & <1000 kW	20	7,200
AC5-3	Chillers: >1000 kW	25	1,100
AC6-1	RT Packaged systems	15	70,000
AC6-2	Multi split/VRF	15	276,000
AC6-3	Close control	15	11,500
AC6-4	HW heat pump: commercial	20	1,000
AC6-5	Pool heat pump	15	28,000
AC7	HW heat pump: domestic	10	170,000
	Total		11,555,000



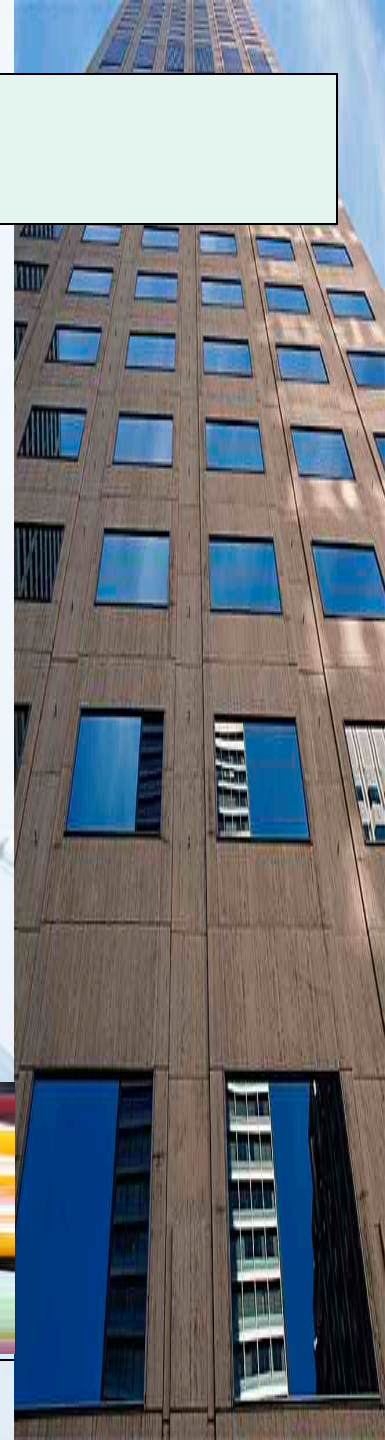
## Natural Refrigerants

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

- Total natural refrigerant services is equivalent to around 10% of the bank/market in 2012.
- 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, portable AC and REEFERS.
- Relatively speaking – non-existent in stationary AC.
- More applications are emerging (e.g. HC in small capacity/charge AC and ammonia AC systems where the plant room can be modified or the charge can be isolated from the general public).

## RAC – What's so Cool about RAC

- RAC services are essential services, we cannot do without them.
- Essential for 'LIFE AS WE KNOW IT'!!!
  - High rise buildings
  - 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
  - **RCFC particularly should be regarded as a piece of national infrastructure!!!**
- 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.
- This service is a cornerstone of the energy economy (22% electricity).
- A reasonable fraction of the financial economy.
- A very noticeable portion of the emissions economy (~11%).





## And so looking down the road.....at the future of HVAC

- Has the stationary AC market saturated?
- What portion of the market is a replacement market by class?
- Is the industry ready for the bubble of R22 equipment due for retirement?
- Which refrigerants will emerge, substitute and dominate the future bank as R22 and R410A have done in the past? (On the horizon.....HFC-32, HFO blends and naturals)

Is your company ready for:

- Diversification – driven by the transformation of the bank (Low GWP alternatives, phase out of R22, reduced charge, improved containment, skills, etc.)
- 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.

