

**green cooling association**



***Scientists are alarmed to see walruses on land in Alaska,  
new evidence of shrinking sea ice... can we act in time?***

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# Natural Refrigerants - an update from downunder

Brent Hoare, Executive Director,  
Green Cooling Association



# Overview - Green Cooling Solutions



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- Importance of training



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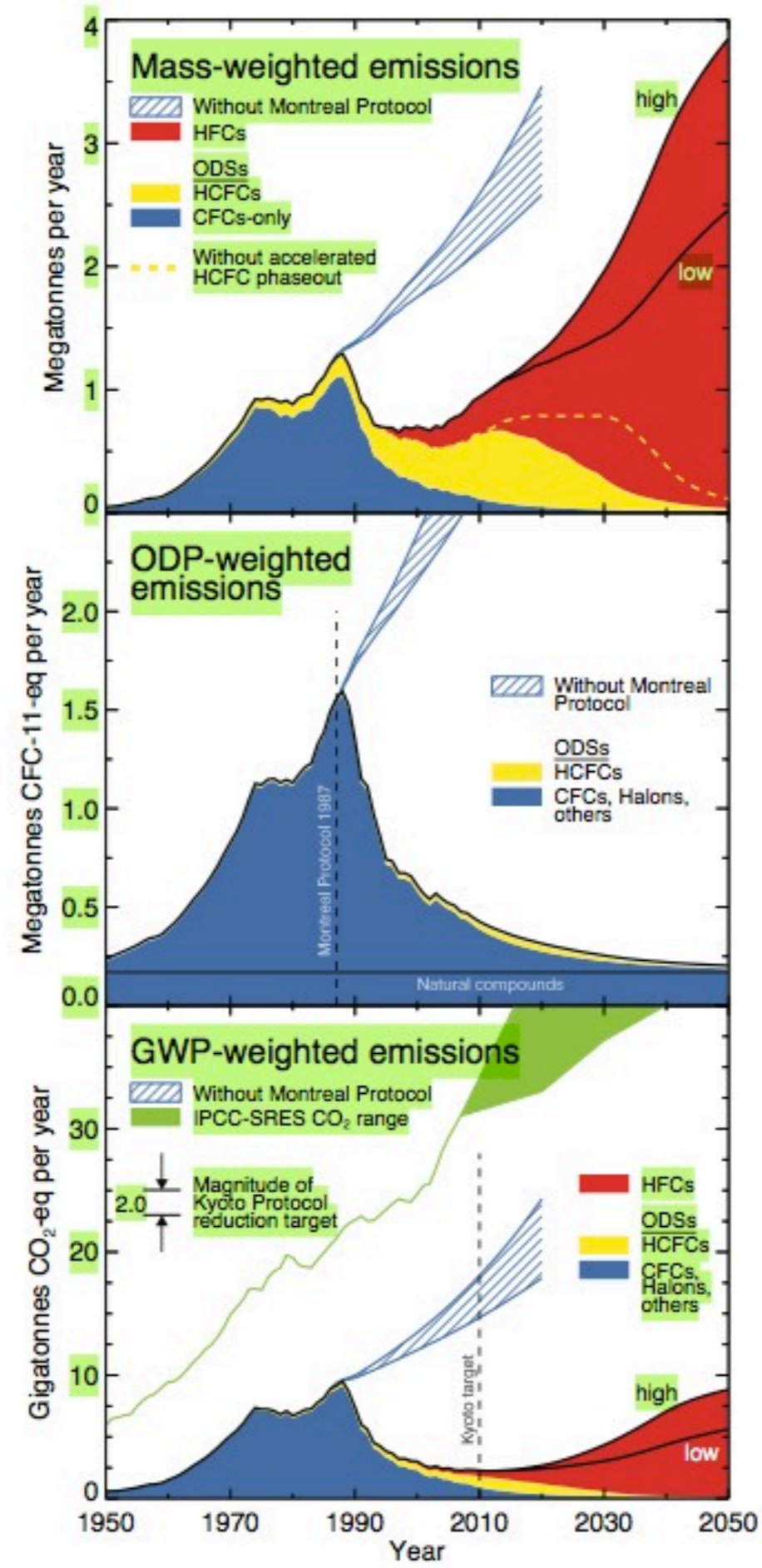


Scientific  
Assessment  
Panel, 2010  
Executive  
Summary,  
fig ES-1

- Montreal  
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# Scientific Assessment Panel, 2010 Executive Summary, fig ES-1

- Montreal Protocol climate benefits being eroded by HFCs



**Figure ES-1. Emissions of ODSs and their substitutes.** Global emissions of ODSs (CFCs, halons, HCFCs, and others) and their non-ozone depleting substitutes (HFCs) from 1950 to 2050. Emissions are the total from developing and developed countries. The legends identify the specific groups of substances included in each panel. The high and low HFC labels identify the upper and lower limits, respectively, in global baseline scenarios. The blue hatched regions indicate the emissions that would have occurred, in the absence of the Montreal Protocol, with 2–3% annual production increases in all ODSs.

**Top panel:** Global mass-weighted emissions expressed as Megatonnes per year. The yellow dashed line shows HCFC emissions calculated without the provisions of the 2007 accelerated HCFC phaseout under the Montreal Protocol.

**Middle panel:** Global Ozone Depletion Potential-weighted emissions expressed as Megatonnes of CFC-11-equivalent per year. The emissions of individual gases are multiplied by their respective ODPs (CFC-11 = 1) to obtain aggregate, equivalent CFC-11 emissions. The dashed line marks 1987, the year of the Montreal Protocol signing.

**Bottom panel:** Global GWP-weighted emissions expressed as Gigatonnes of CO<sub>2</sub>-equivalent per year. The emissions of individual gases are multiplied by their respective GWPs (direct, 100-year time horizon; CO<sub>2</sub> = 1) to obtain aggregate, equivalent CO<sub>2</sub> emissions. Shown for reference are emissions for the range of CO<sub>2</sub> scenarios from the Intergovernmental Panel on Climate Change (IPCC) *Special Report on Emission Scenarios* (SRES). The CO<sub>2</sub> emissions for 1950–2007 are from global fossil fuel use and cement production. Beyond 2007, the shaded region for CO<sub>2</sub> reflects the maximum (A1B) and minimum (B2) SRES scenarios. The dashed line marks 2010, the middle year of the first commitment period of the Kyoto Protocol. Also shown is the magnitude of the reduction target of the first commitment period of the Kyoto Protocol, which is based on a 1990–2010 projection of global greenhouse gas emission increases and the reduction target for participating countries.

# Training

- An essential prerequisite for a natural refrigerants transition
- In Australia delivered by Technical and Further Education (TAFE) Colleges in association with an industry reference group
- Natural refrigerants training courses in CO<sub>2</sub> and Hydrocarbons delivered with Government support by RACCA NSW (Refrigeration and Air Conditioning Contractors Assn of New South Wales)
- CO<sub>2</sub> and HC training videos



# RACCA training manuals

RACCA NSW worked in partnership with TAFE NSW, through the Project Stakeholder Committee and Technical Reference Groups for Hydrocarbon (HC) and Carbon Dioxide (CO<sub>2</sub>) Refrigerants, to:

1. Develop and deliver accredited training programs for the natural refrigerants CO<sub>2</sub> and HC for upskilling regional refrigeration technicians
2. Run awareness and information sessions on natural refrigerants for refrigeration technicians across regional NSW
3. Obtain equipment operating on natural refrigerants for regional TAFE campuses through industry donations
4. Upskill TAFE NSW teachers in regional refrigeration campuses to deliver safety awareness and systems training in natural refrigerants.

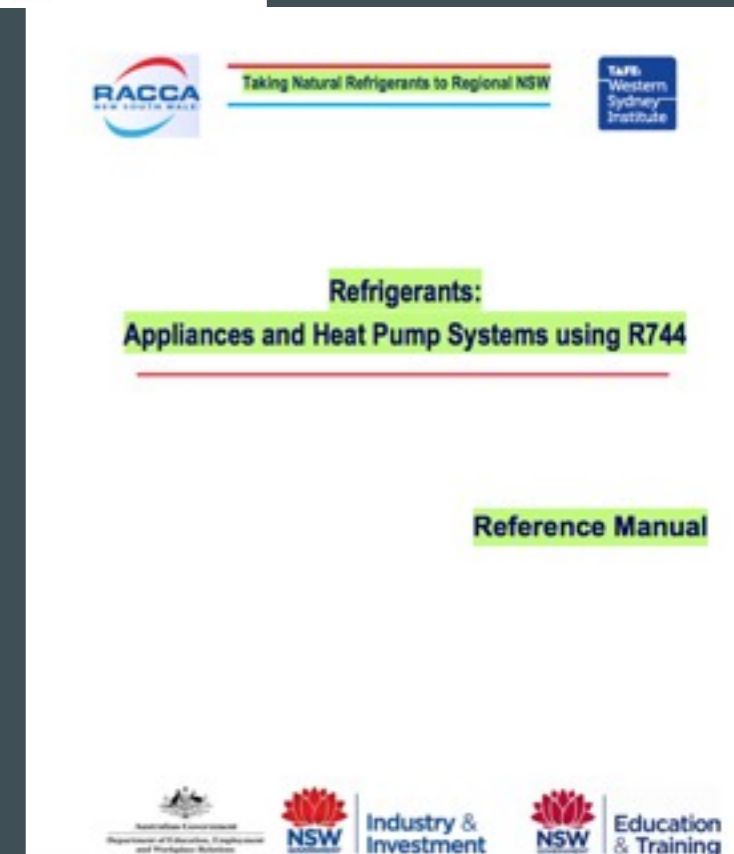
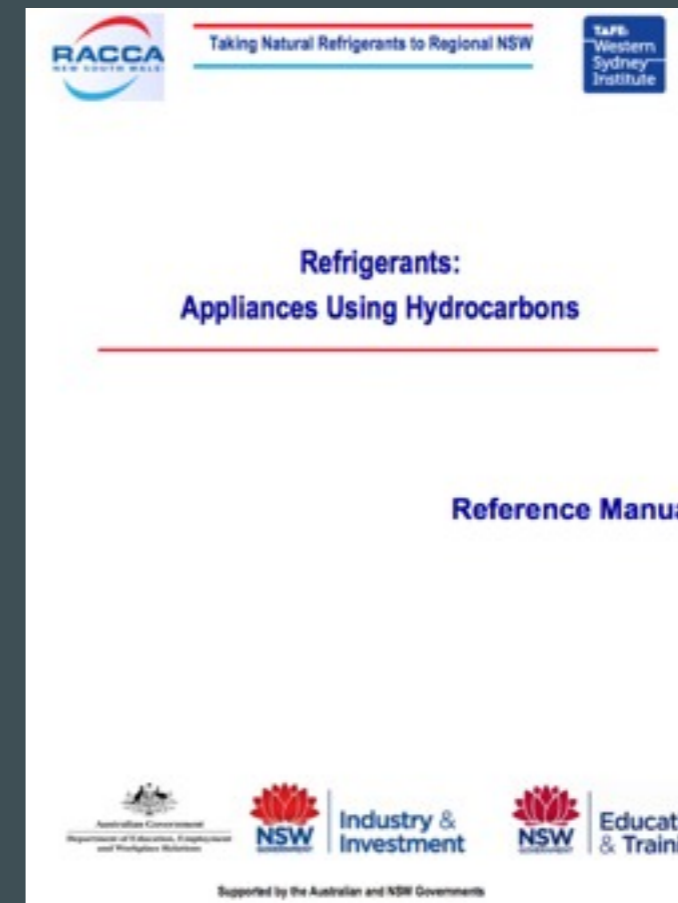
<http://www.raccansw.asn.au/>

*Technical Reference Group (Carbon Dioxide)*

• BOC Limited • Bitzer (Australia) Pty Limited • Coca-Cola Amatil • Danfoss (Australia) Pty Ltd • Heatcraft • Minus 40 Pty Ltd • Mitsubishi Electric Australia Pty Ltd • TAFE NSW

*Technical Reference Group (Hydrocarbon)*

• Electrolux • Kingloc Commercial Refrigeration • Minus 40 Pty Ltd • Mitsubishi Electric Australia Pty Ltd • Pioneer Air • TAFE NSW • Unilever Australasia.



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# RACCA Training Videos

- Many TAFE colleges in Australia now teach the safe uses of HC's in MAC's as part of their normal training for tradesmen/apprentices.



## Hydrocarbons - Part 1

<http://www.youtube.com/watch?v=UJW949PRpH4>

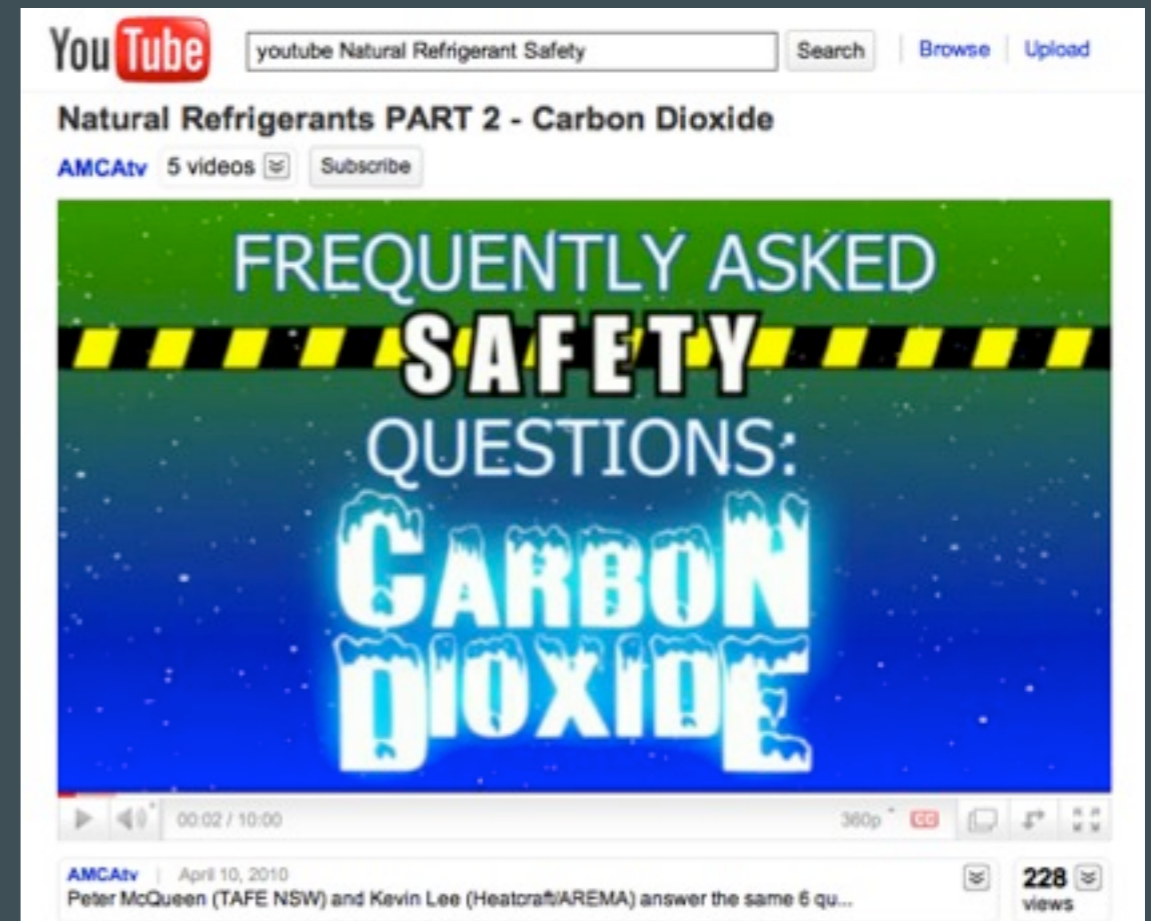
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# HCs in Australia - Mobile Systems

Two main domestic refrigerant suppliers

- Hychill - [www.hychill.com.au](http://www.hychill.com.au)
- Technochem - [www.technochem.com.au](http://www.technochem.com.au)
- Imports from China and Singapore growing



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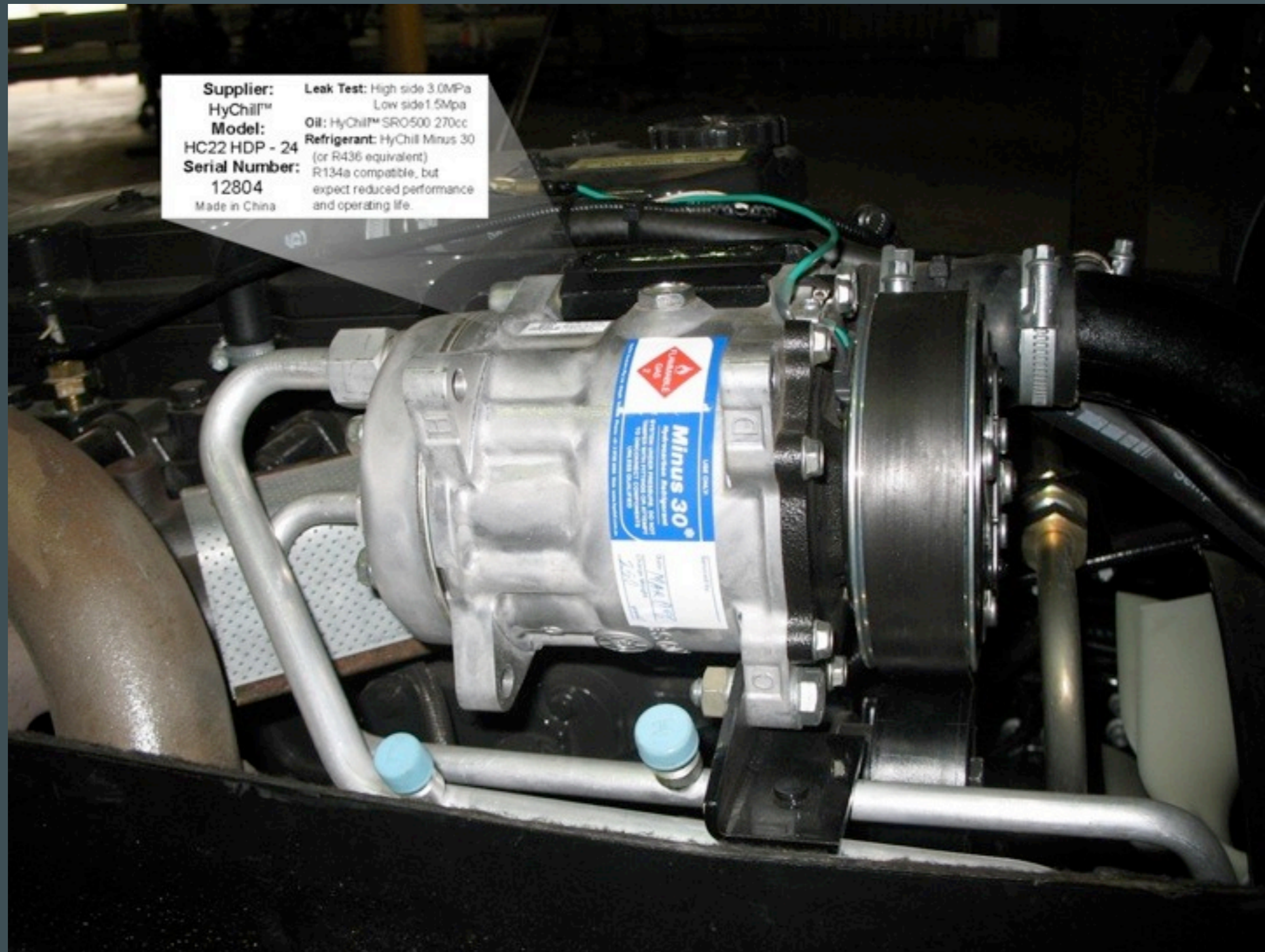




# HyChill - Growing Success

- **HC in MVACS – The Australian Story 2009 Edition**
- Started in 1990 - First batch of Australian made R12/R134a replacement of 50kg produced by LPGMT for Esanty.
- Since that date over 200 tonne of HC has been sold in Australia to the MAC re-gas market. (Note: 200 tonne of HC replaces 600 tonne of R134a thus avoiding over 800,000,000kg of CO2 emissions) AND HyChill is one of 3 suppliers to the market in Australia and so the total is something greater than this number.
- At least one small scale vehicle OEM uses HyChill in their production. Another is seriously considering the issue because of the excellent results being achieved by one of their distributors who converts the systems to HC prior to delivery.
- A number of OEM distributors are removing R134a and replacing it with HC prior to delivery of new vehicles.





# First OEM use of HCs in MAC

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**Supplier:**  
HyChill™  
**Model:**  
HC22 HDP - 24  
**Serial Number:**  
12804  
Made in China

**Leak Test:** High side 3.0MPa  
Low side 1.5Mpa  
**Oil:** HyChill™ SRO500 270cc  
**Refrigerant:** HyChill Minus 30  
(or R436 equivalent)  
R134a compatible, but  
expect reduced performance  
and operating life.

# First OEM use of HCs in MAC

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First OEM use of HCs in MAC

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**AIR CONDITIONING**

## HyChill continues to make its mark

For auto air-conditioning guys who have actually tried HyChill, they know why it is so successful.



The word is getting around that HyChill works better, it's easier to work with, it operates at lower head pressures so the system doesn't need to work so hard and it keeps working on those really hot days, it has superior miscibility with all the lubricants, it does not have the

compressor failure problems of R134a, even some compressor remanufacturers use and recommend HyChill, and the bottom line is much better too.

HyChill Minus30 works in the old R12 systems without the expensive retrofit normally required and HyChill also goes into current systems. The mining industry loves the performance of HyChill because it keeps working even when it is well over 50°C and they don't have the expensive downtime previously experienced.

### No licence required for auto air-conditioning

One thing that makes HyChill refrigerant attractive to automotive air-conditioning technicians is that the Federal refrigerant handling licence is not required when working with HyChill refrigerant (though a hydrocarbon refrigerant handlers authorization is required in Queensland).

On the other hand, synthetic fluorocarbon refrigerants such as R134a are controlled substances under the Australian Government's Ozone Protection and Synthetic Greenhouse Gas Management Regulations. Technicians must have a Refrigerant Handling Licence to handle fluorocarbon refrigerants (CFCs, HCFCs and HFCs) and the business must hold a refrigerant Trading Authorization to purchase and store these gases. If a technician (including a repairer or dismantler) removes fluorocarbon refrigerant from an air-conditioning system and wants to replace this gas with natural refrigerants, they must hold, as a minimum, a Restricted Refrigerant Recovery Transitional Licence.

### Environmentally Preferable – GECA Certified

Natural refrigerants are naturally occurring gases that include

# First OEM use of HCs in MAC



# Hychill in OEM MVAC



- The small scale Original Equipment Manufacturer user had a small setback - their compressor supplier refused to provide warranty because they had moved to HC
- HyChill in association with a compressor importer/rebuilder arranged supply of suitable compressors
- On arrival in Australia, the compressors are tested, the standard oil is removed and replaced with HyChill SRO 500 - a high quality oil that is compatible with all refrigerants, the required labels are attached and they are then dispatched to the vehicle manufacturer
- Now that this project is working satisfactorily, HyChill is working on 2 more projects with small scale importers/manufacturers of vehicles as well as one very large scale manufacturer in a “far away” country



# Hychill in Australian MVAC



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- Total sales into Australian Automotive AC aftermarket:



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- This represents in excess of 1,000,000 (1 Million) vehicle charges, with no safety defect trend even in it's current application as a drop-in replacement in existing R12 and R134a systems.
- The consumption (and subsequent emission over time) of 700+ tonnes of f-gases has been avoided by using these hydrocarbons.

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# HyChill - Mining Success

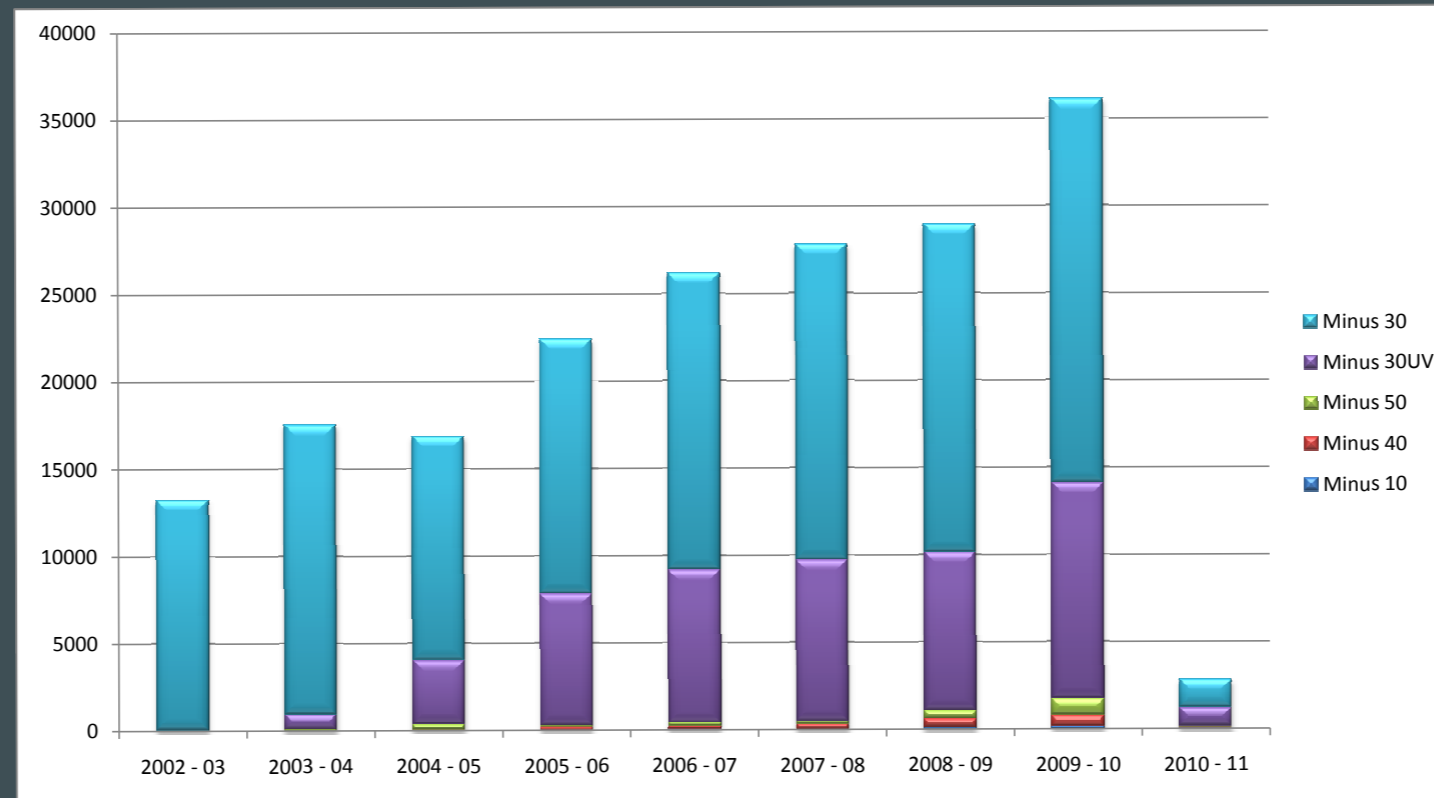
- A number of mining operators have a policy that HFC's are prohibited from their site in all vehicles and all MUST be changed to HC before being brought into service.

## Reasons include:

- Environmental impacts of the gas and the oil
- Improved performance in extreme conditions
- Because their (mandatory) risk assessments show there is no significant additional safety risk - they are of the view that HC and mineral oil are a lower overall risk than HFC and PAG oil. Mining companies have the expertise in house to do a their own risk assessments
- There are many examples of R134a approaching critical temperature leading to equipment failure in high ambient temperature environments
- [HCs are also used in mines in other countries]



# ● HC in Australian MVACS – 2010 Update



- HyChill had an increase in sale of 25% for the year 2009 – 10.
- Good news for the environment as well as HyChill! (See graph – sales for July & Aug 2010 are also up 25% on the same period last year)
- Collated industry data indicates that approximately 10% to 15% of vehicles on the road use HC's.

## ● Sales volumes 2009–10:

- M10 (R600a) - 4 tonne
- M30 (R290/R600a blend) - 34.5 tonne
- M40 (R290) - 0.8 tonne
- M50 (R290/R170) - 1.0 tonne

**Total: 40.3 tonnes**



# Hychill Exports

- Exporting small quantities to Malaysia and Thailand for some years - last year they each used around half a tonne
- Almost 5 tonne sent to Taiwan earlier this year, customer ordering another 4.5 tonne
- Just negotiated a contract in China for 36 tonne per year. The first 8.4 tonne is booked to leave mid October. The customer has been purchasing HC's from "elsewhere" and found that when they used HyChill they get significantly better performance from their products - AC splits & heat pump hot water systems
- Industry needs to be careful about the fact that some suppliers of HC's may not know how to produce refrigerant quality HC's - meaning that the customers are unable to achieve the energy efficiencies that are available using HC's



# HyChill - Future Success

- Media coverage of the impending change from R134a to HFO1234yf and an understanding of the many years of safe use of HC's has caused a few users to consider using HC's
- Superior thermodynamics and don't have the toxic products of combustion of HFO1234yf.
- There are rumors of an OEM in China and HyChill is working with another – not from China – to introduce HC refrigerant on to their production line.
- HyChill has been working with a manufacturer of Heat Pump hot water services for the last 2 years - they are now preparing to change their production from R22 to HC.
- Manufacturer was planning to use R417A (non- ODP but GWP 1950), but after a thorough test program have decided on HyChill. Final testing and certification are underway, full production imminent.



# [www.technochem.com.au](http://www.technochem.com.au)



**Technochem Australia Pty Ltd**

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## OS-12a

Hydrocarbon Refrigerant

OS-12a is a blend of purified R600a and R290, these are two natural hydrocarbon refrigerant gases. The blend of OS-12a has been specifically designed for the Automotive, Transport, Mining and Agriculture airconditioning systems as a complete drop in replacement for CFC-12 and HFC-134a

#### Environmental friendliness :

OS-12a, a hydrocarbon blend refrigerant has been proven to be an environmentally safe refrigerant with zero ozone depletion potential (ODP=0) and near zero global warming potential (GWP=3 ) compared to that of HFC-134a that has zero ozone depletion potential (ODP=0) but with a high global warming potential (GWP-1300)

#### Drop-in replacement :

OS-12a offers a similar volumetric capacity as CFC-12 enabling the use of CFC-12 compressors without any change due to similar thermodynamic properties as those of CFC-12.

#### Compatibility with mineral lubricant :

After thousand hours of heavy load test, autoclave test and compatibility test with several lubricants in domestic refrigerators and test rigs, no problem was found in all parts of a compressor and no degradation of mineral oil was shown. Also OS-12a is fully compatible with a mineral oil of ISO viscosity grade 22 or 32 which is readily available from any local vendor. OS-12a is also compatible with PAG and PAO automotive oils

#### Automotive:

Compatible with all automotive air conditioning systems such as compressors, condensers, evaporators, pipes and seals

#### Economic benefit in operation and maintenance :

The mass flow rate of OS-12a in refrigeration equipment is lower than that of CFC-12 and the amount of charge is reduced by 65% as compared to CFC-12 and HFC-134a.

#### High Energy Efficiency :

OS-12a provides 3.5% higher COP than CFC-12.

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# Technochem - Refrigerant Reclaim Services

- Looking after the other end of the business!
- Refrigerant reclaimed worth only AUD\$10.50
- Fee charged to car wreckers, mechanics
- Law exists requiring those “handling” HFCs, including disposal, to be licensed - negligible enforcement of recovery requirements
- Recovery rates very small proportion of recoverable volumes



[www.refrigerantreclaimservices.com.au](http://www.refrigerantreclaimservices.com.au)

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**ARC**

What are You Doing with Your Contaminated or Unusable Refrigerant?

Under the Ozone Protection and Synthetic Greenhouse Gas management Regulations 1995, it is a requirement for the refrigeration and air conditioning industry to recover, return and safely dispose of ozone depleting and synthetic greenhouse gas refrigerants.

Under the regulations it is an offence of strict liability to acquire, possess or store refrigerant without a current Refrigerant Trading Authorisation or to handle refrigerant without a current or Refrigerant Handling Licence. Businesses or individuals conducting these activities without a current permit will be referred to DEWHA.

Businesses that acquire, possess or dispose of fluorocarbon refrigerant without a Refrigerant Trading Authorisation (RTA) commit an offence under r112 of the Regulations. The maximum penalty for this offence is \$1,100 for a natural person and \$5,500 for a corporation.

Persons or individuals that handle fluorocarbon refrigerant without a Refrigerant Handling Licence (RHL) commit an offence under r111 of the Regulation. The maximum penalty is \$1,000.

Where a person engages in conduct that results in the unlawful discharge of fluorocarbon refrigerant, they commit an offence under s45B of the Act. The maximum penalty is \$11,000 for a natural person and \$55,000 for a corporation.

**Don't risk the fines. Call RRS**

**1300 585 757**

**RRS REFRIGERANT RECLAIM SERVICES**

**THE MOBILE RECLAIM SOLUTION**

**Call us to see how we can help you**

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**RRS**

Whether your requirements are large or small Refrigerant Reclaim Services will provide a solution that best fits your business.

Our service also offers full reporting on refrigerants reclaimed to assist with your ARC and RRA requirements taking the hassle away from you, which allows you to carry on with the core of your business.

Refrigerant Reclaim Services will:

- Save you time and money on refrigerant recoveries
- Free your skilled technicians for other more profitable work
- Significantly reduce recovery times
- Provide full reclamation records for your reporting

At Refrigerant Reclaim Services we pride ourselves in our customer service and our understanding of industry needs, whether it's turnaround time on your requirements, return of reclaimed refrigerant or a program to fit your individual needs we have it all.

With the ongoing legislative requirement aimed at zero emissions of CFC, HCFC and HFC refrigerant gas from systems, Refrigerant Reclaim Services can assist its customer to help achieve their environmental objectives by simplifying the refrigerant reclamation process.

As a mobile reclamation service we are able to offer our full reclamation services at any location throughout Victoria.

Our services can assist in the reclamation of refrigerant gases from the following:

- Automotive Air Conditioners
- Domestic and Commercial Refrigerators
- Domestic and Commercial Air Conditioning
- Any system containing refrigerant gas

Our services are available, but not limited to the following:

- Automotive Wrecking Yards
- Automotive Repair Workshops
- Waste Stations
- Refrigeration Mechanics

**Call RRS on:**  
**1300 585 757**

**THE MOBILE RECLAIM SOLUTION**

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**REFRIGERANT RECLAIM SERVICES**

Home | Our Service | ARC | RPA | Links | Contact

### Home

Refrigerant Reclaim Services - A mobile reclamation service for all refrigeration and air conditioning systems. Make sure your compliant. Call 1300 585 757 to find out more.

#### News

**01/06/2010**  
Refrigerant Reclaim Services launches its services to the Auto Recycling Industry in conjunction with The Melbourne Hotline offering a mobile reclamation service for the removal of refrigerant gases from vehicle air conditioners.

**01/06/2010**  
Welcome to our new website. It is still under construction so please visit again for regular updates.

#### Welcome

**What does RRS do?**  
With the ongoing Australian Government Legislation requirements aimed at zero emissions of CFC, HCFC and HFC refrigerant gas from refrigeration and air conditioning systems, Refrigerant Reclaim Services can assist your business to comply with legislation and help achieve your environmental objectives by simplifying the reclamation process.

As a mobile service RRS offers you a full reclamation services at any location throughout victoria.

**Who can use the service?**  
The service that RRS offers can assist in the reclamation of refrigerant gases from the following:

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# Victorian Transport Refrigeration

- A partnership of Southern Cross Mechanical Services, Melbourne Victoria
- Using Hychill Minus 40 Propane (R290)
- Building new and converting transport refrigeration systems
- See case study in GTZ hydrocarbon guidelines, section 7.9



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- 350 systems on the road
- 100 new and 250 converted systems (50/50 trucks and vans)
- Plans for rapid expansion, introduction of equipment approved for HC use from China



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# What do VTR's customers say?

The greatest benefit to my business has been the elimination of product losses from the greatly improved reliability of hydrocarbons

I was sceptical at first, but the improved performance and reliability and reduced maintenance costs of VTR's hydrocarbon systems have sold me!

We converted our entire delivery fleet to hydrocarbons and there are great fuel savings!

Since we changed to hydrocarbons the pull down times are faster than I've ever seen!



# Benson Air Conditioning

- Perth based company
- Selling range of Hydrocarbon AC systems since 2007
- Australia and overseas markets served, orders welcome!



Auto Fan	The fan will operate on low fan speed when room is within one degree of the set temperature, at medium speed when the variance is one to two degrees and at high speed when the variance is greater than two degrees.	
Fan Speeds	An inverter drive system varies the motor speed to provide optimum performance in all conditions	
Quiet Mode	The unit can be run on low fan speed for quiet operation.	
Self Fault Diagnostic	The Benson system contains a fault diagnostic and will turn the unit off automatically if a fault is detected.	
Timer Control	The unit can be set to a set time to turn on and off (e.g. turn on at 4.30pm and turn off at 11.30pm). These times need to be set every day.	
Power Failure	Following a power failure, units have an automatic restart function. This can be switched to manual if required	
Low Noise	The outdoor units have been designed with the lowest noise level outdoor fan blades currently available	
Modes	Heating	Used to heat and the recommended temperature setting is 21°C
	Cooling	Used to cool and the recommended temperature setting is 24°C
	Auto	Automatically selects heating or cooling with no auto change over
	Dry	On very humid days this setting can be used to reduce humidity quickly
Fan Settings	Auto	This setting can be used as the system will optimize the performance of the unit
	Set	Set airflow to meet your requirements.
	Full movement	To create complete movement all over the room.
Pre-heat Heating	During the off cycle, the indoor fan runs at a super-low speed to give accurate temperature control, when the system sensors indicate that it needs to warm, the fan will stay on the super-low setting until the coil temperature has risen enough for the fan to speed up and heat the room.	
Sleep / Night Economy	Night set back function during sleeping hours will adjust the set point temperature by one degree per hour to a maximum of two degrees to compensate for the human body metabolic rate reduction during sleep. This will reduce costs during the night-time cycle.	
Over Heat Protection	The unit will automatically cycle the condenser fan to reduce the head pressure and allow the system to heat in high ambient conditions 7°CDB and above. Please remember these units have been designed to heat from 15°CDB to -5°CDB ambient conditions.	
Compressor Anti Cycle	A random delay has been incorporated in all of our systems of between three and five minutes for compressor protection. This also allows all the compressors to start at random times if all are switched on at once.	

**EnviroDrive**

**envirodrive INSIDE**

CFC & HCFC FREE

**r290**

Engineered with 290 refrigerant technology, our range of air conditioners is the most environmentally sustainable on the market.

All other air-conditioning systems in Australia use the very harmful R410A and R22 among others. As an example, R410A has a global warming potential of 1890 while R290 has a very attractive global warming potential of 3.

[Read more](#)

**Plasma Airstream**

Plasma Airstream is Benson's ionisation air purification system which comes standard in all our ducted systems.

Soon to be standard in all wall-splits. This benefit makes Benson an Air "Conditioner" in every sense of the word.

[Read more](#)

**Recycled Heat**


With all of our unique Recycled Heat Technology (RHT) systems, the consumer also receives FREE hot water for the life.

This is a patented technology and is the only air conditioning, heating and hot water co-generation system in the world.

[Read more](#)

# Benson Air Conditioning

- Perth based company
- Selling range of Hydrocarbon AC systems since 2007
- Australia and overseas markets served, orders welcome!



**Benson** Wall Split Systems  
Benson Enviro 3 Reverse Cycle


Technical Specifications

		Model							
		BENSON 24V (1.5kW)	BENSON 24V (2kW)	BENSON 24V (2.5kW)	BENSON 24V (3kW)	BENSON 24V (3.5kW)	BENSON 24V (4kW)	BENSON 24V (4.5kW)	BENSON 24V (5kW)
Cooling Capacity	Watts	2200	2800	3500	4200	4900	5600	6300	7000
Heating Capacity	Watts	2000	2600	3300	4000	4700	5400	6100	6800
Energy Efficiency Cooling	EER (kW/1kW)	3.10	3.17	3.24	3.31	3.38	3.44	3.51	3.57
Energy Efficiency Heating	SEER (kW/1kW)	3.71	3.77	3.83	3.89	3.95	4.01	4.07	4.13
Dehumidifying Capacity	L/hr	1	1.2	1.5	2	3	3	3	3
Refrigerant (kg)	kg	35.10	35.10	35.10	41.10	41.10	41.10	41.10	41.10
Power Source	V/Hz/Ph	240/50/1-1							
Power Consumption Cooling	Watts	710	880	1100	1280	1460	1640	1820	2000
Power Consumption Heating	Watts	600	670	740	810	880	950	1020	1100
Operation Current Cooling	Amperes	3.0	3.6	4.6	5.4	6.3	7.2	8.1	9.1
Net Dimensions (mm)	W x H x D (mm)	78 x 275 x 200	78 x 275 x 200	100 x 275 x 200	100 x 275 x 200	120 x 275 x 200	120 x 275 x 200	120 x 275 x 200	120 x 275 x 200
Net Weight (kg)	kg	12	12	15	15	15	15	15	15
Net Weight (kg)	kg	12	12	15	15	15	15	15	15
Plung Length (mm)	mm	5	5	5	5	5	5	5	5
Plung Length (mm)	mm	12	12	15	15	15	15	15	15

**Benson Airconditioning**  
Phone: 1300 4 BENSON (1300 4 236766)  
Email: [benzonac@bigpond.net.au](mailto:benzonac@bigpond.net.au)  
Web: [www.bensonairconditioning.com.au](http://www.bensonairconditioning.com.au)

Disclaimer: The information in this brochure is intended as a guide only. Benson Airconditioning is not responsible for any errors or omissions.

**EnviroDrive**



**envirodrive INSIDE**

CFC & HCFC FREE


**r290**

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[Read more](#)



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**Benson** Mini Chiller Wall Split  
Benson Enviro 3 Reverse Cycle

The Benson Enviro 3 Mini Chiller Wall Split system was developed for underground mining modules. It has now been modified for normal domestic or commercial application.

**What makes this system so special?**  
It is the true "self-install" system, if you are a handyman. The condensing unit is self-contained and can be changed over in 10-15 minutes, meaning even non-qualified people can change the system over or install one on site. The system even self primes.

**Unit Capacities**  
3.3kW Cooling / 3.4kW Heating T1 test conditions  
2.8kW Cooling T3 High ambient conditions (32°C indoor and 52°C ambient)

**Distributor**  
**Benson Airconditioning**  
Phone: 1300 4 BENSON (1300 4 236756)  
Email: [benzonac@bigpond.net.au](mailto:benzonac@bigpond.net.au)  
Web: [www.bensonairconditioning.com.au](http://www.bensonairconditioning.com.au)

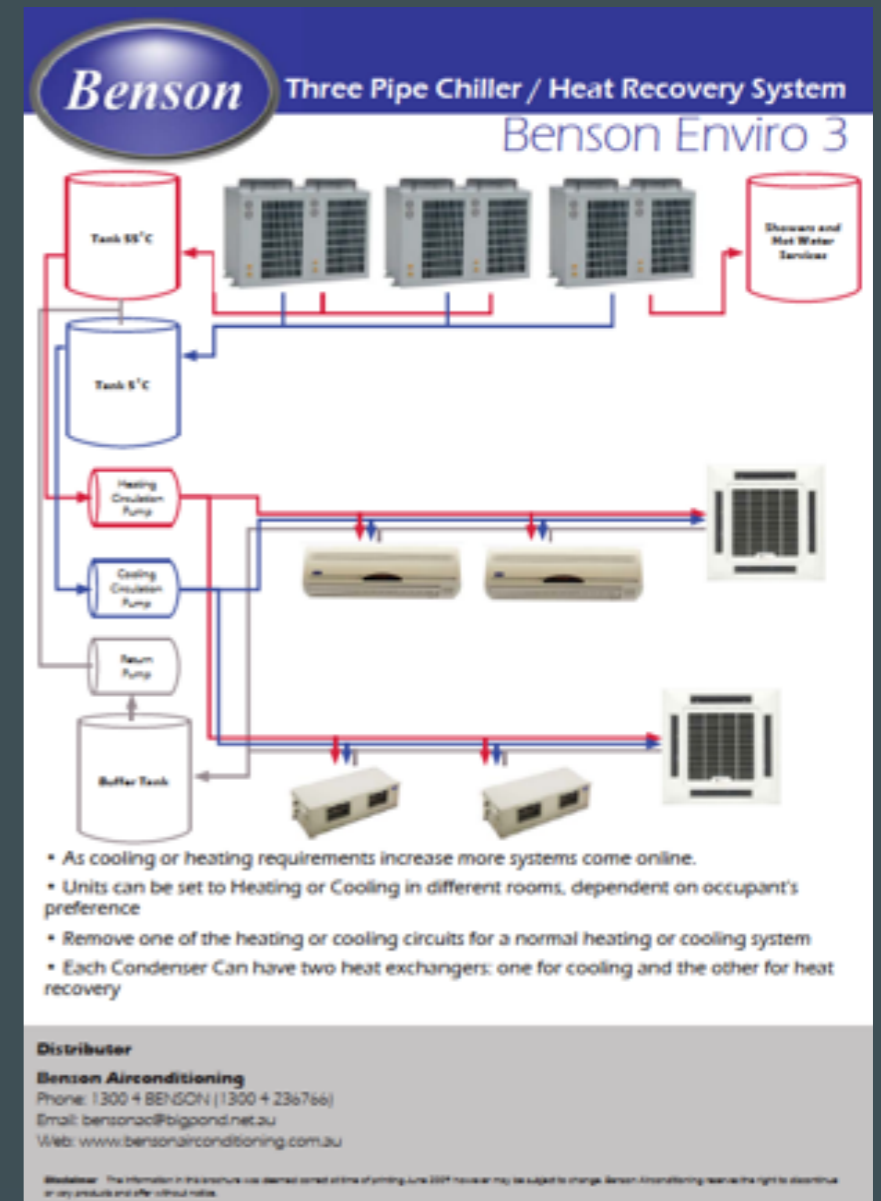
Disclaimer: The information on this website is for general information only. It is not intended to be used as a substitute for professional advice. Benson Airconditioning does not warrant the accuracy of any products or services offered.

<p><b>EnviroDrive</b></p> <p><b>envirodrive INSIDE</b></p> <p>CFC &amp; HCFC FREE</p>	<p><b>r290</b></p> <p>Engineered with 290 refrigerant technology, our range of air conditioners is the most environmentally sustainable on the market.</p> <p>All other air-conditioning systems in Australia use the very harmful R410A and R22 among others. As an example, R410A has a global warming potential of 1890 while R290 has a very attractive global warming potential of 3.</p> <p><a href="#">Read more</a></p>	<p><b>Plasma Airstream</b></p> <p>Plasma Airstream is Benson's ionisation air purification system which comes standard in all our ducted systems.</p> <p>Soon to be standard in all wall-splits. This benefit makes Benson an Air "Conditioner" in every sense of the word.</p> <p><a href="#">Read more</a></p>	<p><b>Recycled Heat</b></p> <p>With all of our unique Recycled Heat Technology (RHT) systems, the consumer also receives FREE hot water for the life.</p> <p>This is a patented technology and is the only air conditioning, heating and hot water co-generation system in the world.</p> <p><a href="#">Read more</a></p>
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# Saladin Lodge, Narbethong, Victoria



- Destroyed in “Black Saturday” bushfires in February 2009
- Saladin lodge rebuilt this year, using 13 Benson split systems
- User reporting excellent performance
- One of many happy customers!





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# Benson Air Conditioning - examples

- Bookshop rooftop in Ballarat, Victoria
- 100Kw unit at the warehouse
- Hot water AC unit in West Australia



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# Benson Air Conditioning - examples

- Sales to date: approx 3000 Split systems
- Mini Chillers
- Hot water AC unit - Patent holders
- Significant sales growth forecast
- International orders sought!

**Why Choose a Bensons Enviro3 as your next Air Conditioner?**

- 100% Australian Owned
- Carbon Neutral – 2 Trees planted for every unit sold
- CFC and HCFC Free
- Naturally occurring
- Non – toxic
- Non Ozone Depleting
- Environmentally sustainable refrigerant
- Higher operating temperatures, T3 Tested to 52° ambient
- 1,100 Benson Enviro3 units can be installed to every 1 Inverter R410a system, for the same GWP
- Global Warming Potential of only 31 Compared to R410a GWP of 1,890
- Environmental Choice of Australia Tick, given to Hychill for R290
- Plasma Air Stream standard on all Ducted units.
- Some of the Highest Energy Ratings, as advised on [www.energyrating.gov.au](http://www.energyrating.gov.au)

**1,100 Benson Enviro3 units can be installed to every 1 Inverter R410a system, for the same GWP**

**CFC and HCFC FREE**

**THINKING OF AIR CONDITIONING? WANT THE GREEN ALTERNATIVE?**

**Benson**

**AIR CONDITIONING**

**1300 4 BENSON**  
1300 4 236766  
Email: [info@bensonwa.com.au](mailto:info@bensonwa.com.au)  
[www.bensonairconditioning.com.au](http://www.bensonairconditioning.com.au)

**Benson**

**ENVIRO3 AIR CONDITIONING**

**1300 4 BENSON**  
1300 4 236766  
[www.bensonairconditioning.com.au](http://www.bensonairconditioning.com.au)

**All Benson Enviro3 units use R290 and NOT R410a!**

Reduce Global Warming



# Benson Air Conditioning - examples

- Sales to date: approx 3000 Split systems
- Mini Chillers
- Hot water AC unit - Patent holders
- Significant sales growth forecast
- International orders sought!

**SPLIT SYSTEMS**  
Available in 2.4kW, 3.4kW, 5.1kW, 6.3kW, 8.2kW, 10.2kW & 12.1kW units.  
Also available - 12.6kW 3 PHASE.

**DUCTED FULL HOUSE SYSTEMS**  
Available in 8.2kW, 10.4kW, 12.3kW & 16.4kW units.  
Also available - 12.8kW & 17.5kW 3 PHASE!

**AC HOT WATER SYSTEMS**  
Available in 3.4kW, 4.5kW & 6.3kW units.  
Also available - 12.3kW DUCTED.

Want FREE Hot Water with your Air Conditioner?

**carbonneutral**  
**HyChill**

**BENSON AIR CONDITIONERS OFFER A MASSIVE POINT OF DIFFERENCE OVER OTHER REFRIGERATED AIR CONDITIONERS**

**Recognised World Leader in High Powered Hydro Carbon Air Conditioning -**  
For the past 7 years Benson Air Conditioning has been leading the world in developing high performance hydro carbon refrigerated Air Conditioners and Chillers. Benson Air Conditioning has been recognised and is supported by the United Nations Environmental Department, the United Nations Environmental Development Organisation and Green Peace International. In fact when the United Nations Environmental Program required a Key Note Speaker on the effects of HCFC's and the benefits of Hydrocarbons, it was the Benson Founder and Director Steven Smith who received the call. Green Peace are now supporting R290 as the refrigerant of the future.

**Environmentally Sustainable -**  
Benson emiro3 Air Conditioners are the most Environmentally sustainable and responsible range of refrigerated Air Conditioners on the planet. ON THE PLANET! Benson units utilise R290 which is a naturally occurring Hydrocarbon refrigerant. This refrigerant not only helps with energy efficiency, but more importantly has only 3 Global Warming Potentials per kilogram (or equivalent to 3kg of CO<sub>2</sub> per kg of refrigerant) as opposed to R410a which has 1,890 Global Warming Potentials per kilogram (or equivalent to 1.89 tonnes of CO<sub>2</sub> per kg of refrigerant) combine this with the fact our units only require 40% of the refrigerant of a comparable R410a unit. Example. Our 8.5kW Wall Split only requires 1,100 grams of refrigerant and has a GWP of 1.8 where as a R410a equivalent unit, requires 2.5kgs of refrigerant and has a GWP of 4,800! That's equivalent to 1.8kg's of CO<sub>2</sub> as opposed to 4.8 tonnes.



# Fujin - Recom Engineering

- WA company working with China based manufacturer to introduce propane AC Hot Water systems
- Available soon...
- [www.recom-eng.com.au](http://www.recom-eng.com.au)

**Fujin**  
Refrigeration Condensing Unit (with heat recovery for hot water)



Function:  
1.Refrigeration  
2.Water Heating  
3.Two operation mode:Refrigeration only and Auto running

[www.recom-eng.com.au](http://www.recom-eng.com.au)



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# TIA - Truely Innovative Air

- Sydney based partnership
- Formed to commercialise HC air-conditioning systems
- Using R410a systems to establish brand awareness and dealership networks
- Introducing HC RAC and “HDXI”



domestic air conditioners

wall split  
ducted split

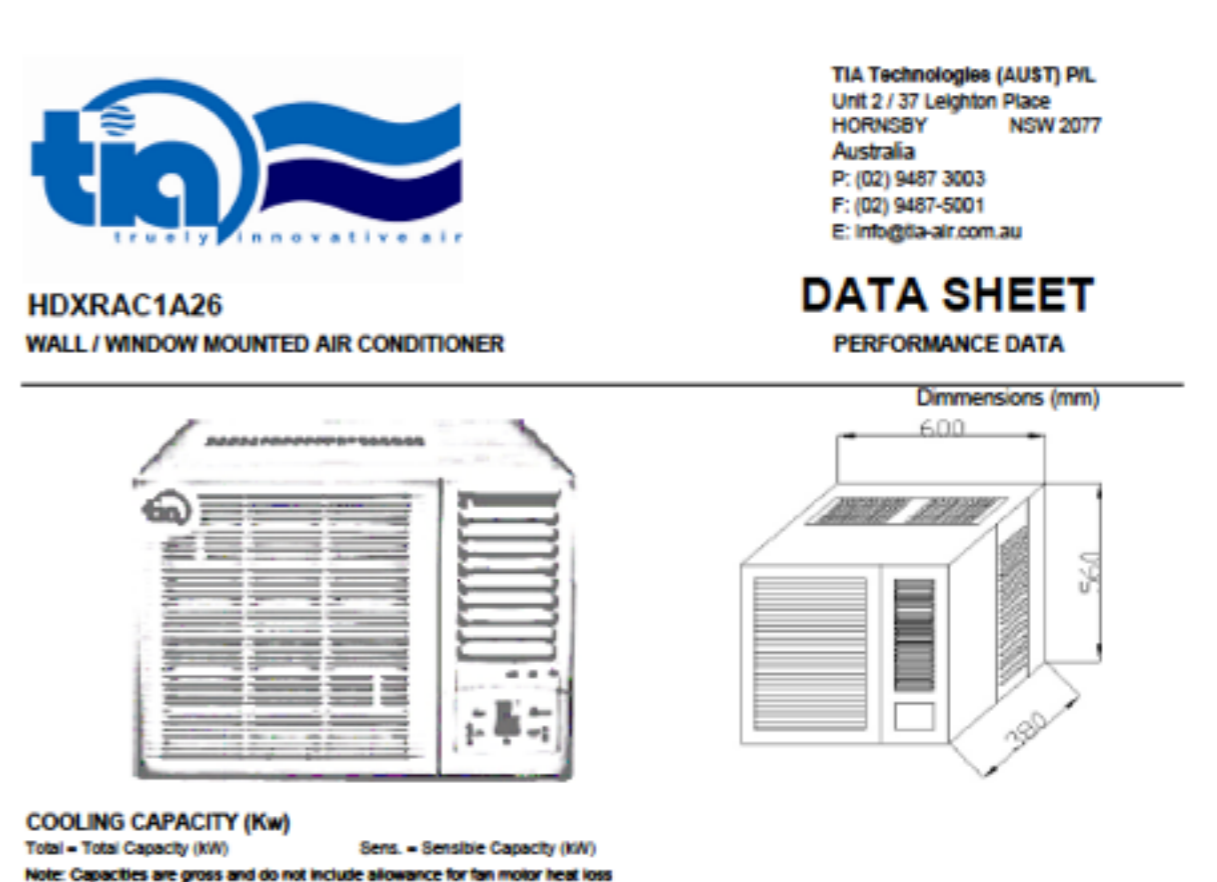
[www.tia-air.com](http://www.tia-air.com)



# TIA - HDX RAC



- Small Room Air Conditioners <250g
- 2.6 Kw/1Hp
- interest from mining industry - replaces R22 & R410a units in portable accommodation - “dongas”
- Very high failure rates of R410a units in high ambient conditions an important factor driving demand



**TIA Technologies (AUST) P/L**  
Unit 2 / 37 Leighton Place  
HORNSBY NSW 2077  
Australia  
P: (02) 9487 3003  
F: (02) 9487-5001  
E: info@tia-air.com.au

**DATA SHEET**  
PERFORMANCE DATA

**HDXRAC1A26**  
WALL / WINDOW MOUNTED AIR CONDITIONER

Dimensions (mm)  
600  
560  
280

**COOLING CAPACITY (Kw)**  
Total = Total Capacity (kW)      Sens. = Sensible Capacity (kW)  
Note: Capacities are gross and do not include allowance for fan motor heat loss


The data sheet includes a photograph of the HDXRAC1A26 air conditioner unit on the left and a technical drawing of the unit on the right. The technical drawing shows the unit's dimensions: a width of 600mm, a height of 560mm, and a depth of 280mm. The unit is shown from a three-quarter perspective, highlighting its compact, rectangular design.



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**DATA SHEET**  
PERFORMANCE DATA

---

Dimensions (mm)

**AIR FLOW PERFORMANCE**

INDOOR FAN		
SPEED	AIR Flow	Noise Level
HIGH	128	51
MED	116	49
LOW	100	47

OUTDOOR FAN		
SPEED	AIR Flow	Noise Level
HIGH	230	80
MED	205	58
LOW	177	56

**QUICK REFERENCE**

Electrical Input Watts (Cooling)	700-850
Electrical Input Watts (Heating)	760-880
E.E.R.	3.8 estimated
C.O.P.	3.5 estimated
Running Amperage (Total)	3.5
Fan Motor Full Load Amperage	0.4
Electrical Supply Required	1 ph 220-240V 50Hz
Recommended External Fuse Size	10 Amp
Refrigerant / Amount g	R450A / 250
Global Warming Potential	3 per Kg
Filter	Panel
Compressor Type	Rotary

Dimensions			
Height	Width	Depth	Weight
mm	mm	mm	kg
380	600	560	37



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- Very high failure rates of R410a units in high ambient conditions an important factor driving demand

## APPLICATIONS

These units have been developed for air conditioning of room and small commercial spaces

### Minimum Room Sizing

In accordance with AS 1677 Part 2 HDXRAC1A26 installation must meet the required conditions

Category 1 Installation The air conditioning unit must be installed in a room no smaller than 1.5 mtrs x 1.5 mtrs x 2.0 mtrs High or 4.5 m<sup>3</sup>

Category 2 Installation The air conditioning unit must be installed in a room no smaller than 2.5 mtrs x 2.5 mtrs x 2.0 mtrs High or 8 m<sup>3</sup>

NOTE: If the room is shared between Category 1 and 2 i.e. is a shared sleeping and kitchen area, then Category 2 requirements are to be met.

Window / Wall mounted units. Where a unit is located half internal / half external then the unit is required to be installed no closer than 2.5 mtrs from any open external inlet sources i.e. external gas hot water service.

### FEATURES

**Efficient:** Our modeling shows an EER of 3.6 (the highest of any RAC available on the market today)

**T3 Ambient Conditions:** using Hychill R450A hydrocarbon refrigerant means these units will work in high ambient temperature of 53° C and possibly beyond.

**Quiet:** Utilising unique fan assembly and drives will lower operating noise dramatically

**Healthy:** Our HDX RAC system will come standard with antibacterial gold fin condenser coils

**Environmentally Sustainable:** These units will use less energy to operate and have no damaging HCFC, CFC or HFC refrigerants.

**Simplified:** No need for a refrigeration mechanic unit can be simply installed.

**MEPS and Beyond:** With industry leading energy efficiency these systems will meet MEPS 2010, 2011 and beyond.

**Disclaimer:** The descriptions and specifications in this preliminary specification are relevant as of the date of publication.

In the interest of product development Tia Technologies (AUST) P/L reserves the right to carry out alteration and improvements to this products specifications. Tia Technologies (AUST) P/L retains all intellectual property for this product including but not limited to all design, specifications, manufacturing techniques, trademark and intellectual property in regard to this product. Tia Technologies (AUST) P/L is hereby to be held indemnified from any and all liability if the product is unable to be produced due to unforeseen issues which may or may not arise during transition from conceptual to production.

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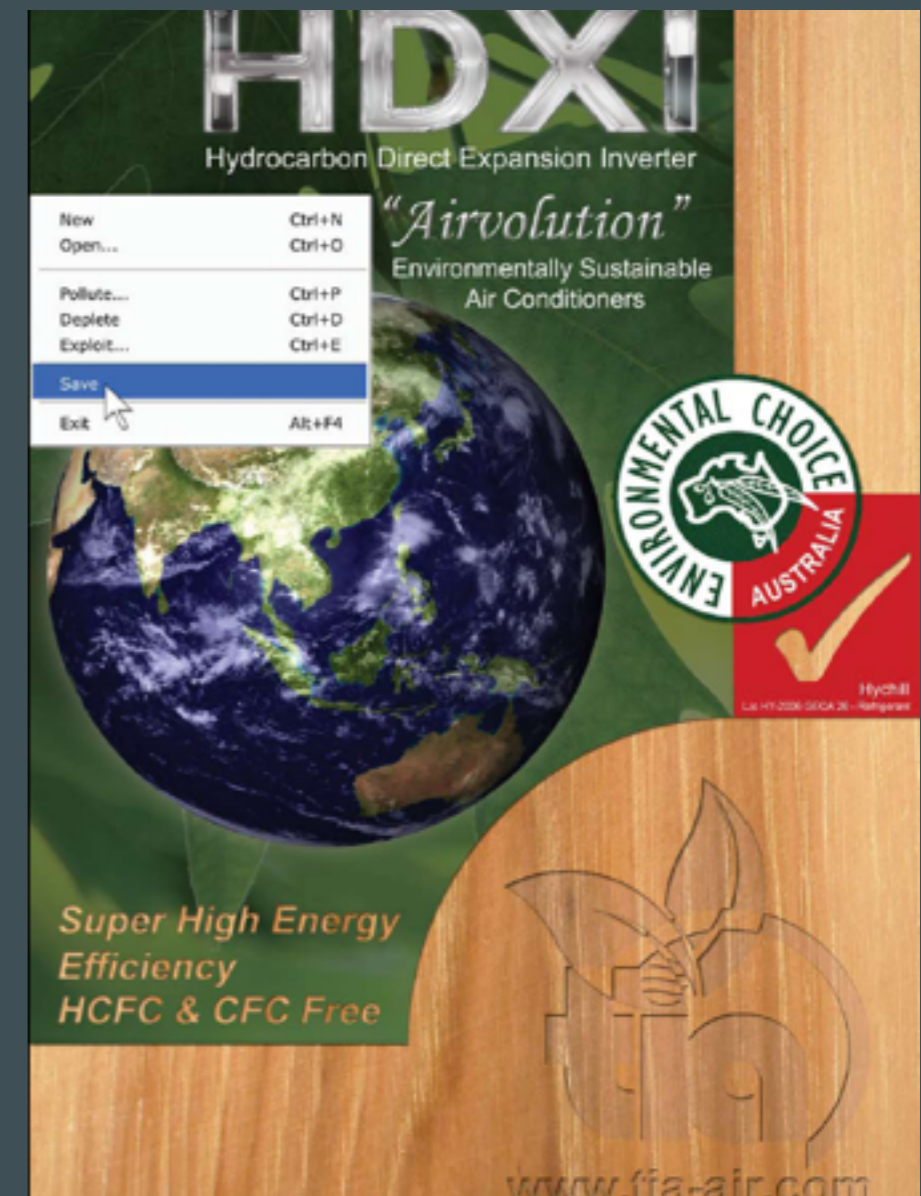


# TIA - HDXI

-Hydrocarbon Direct Exchange Inverter



- Charge size min 3.86 Kg, a wide range of units are in development and ready soon for production
- Production delayed by uncertainty about proposed charge limit of 2.5 Kg in DIS 5149
- AS/NZS currently under review
- Accelerating development of RAC systems - until uncertainty about charge limits in Australian and ISO standards is resolved



green cooling association



# TIA - HDXI

-Hydrocarbon Direct Exchange Inverter



- Prototype announced at ARBS, April 2010
- Environmental marketing strategy of key importance
- Strong competitive threat exists from “dodgy” environmental claims about HFCs
- False and misleading claims made in commerce illegal in Australia, not in US, but Europe...?

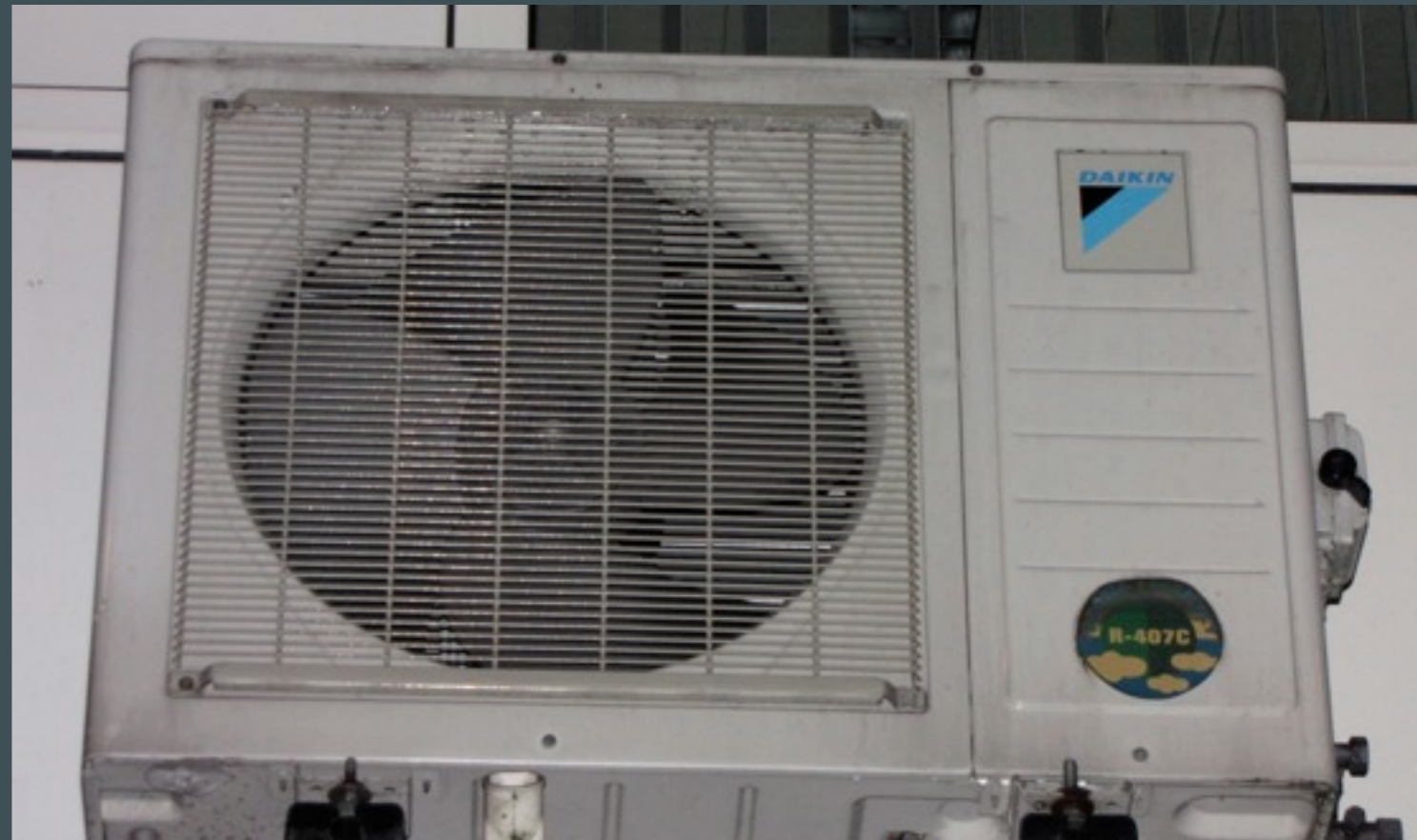


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# SE Asia Snapshots

- Indonesia



green cooling association



# SE Asia Snapshots

- Indonesia



green cooling association



# SE Asia Snapshots

## ● Indonesia

### HYDROCARBON REFRIGERANT



#### What are hydrocarbons?

Hydrocarbon refrigerants are environmentally friendly, non-toxic, non-ozone-depleting replacement for chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). From a chemical point of view, a hydrocarbon is the simplest organic compound, consisting entirely of hydrogen and carbon. Hydrocarbons (HC) are naturally occurring substances. The majority can be found in crude oil, where decomposed organic matter provides an abundance of carbon and hydrogen.

#### What are their main advantages?

Hydrocarbons are one of the most climate-friendly and cost-efficient refrigerants to heat, cool and freeze:

- Non-ozone depleting: Ozone Depletion Potential = 0
- Not climate damaging: Global Warming Potential = for most HCs below 3
- Non-toxic safe: Hydrocarbons are flammable but safe with proper handling. Hydrocarbons are also non-toxic and non-explosive.
- Energy-efficient: usually better energy efficiency than CFC or HFC systems
- Easy replacement: able to replace many F-gases in existing systems without the need to change components or oils
- Cost-efficient: low refrigerant purchase price as well as lower system running costs

### Refrigerant Replacement

Which hydrocarbons can be used as a refrigerant?

Synthetic Refrigerant	Hydrocarbon Refrigerant (HC/Natural Refrigerant)	Description	ARTEK® Hydrocarbon Refrigerant (ARTEX Coding, equivalent with International Nomenclature of HC)
CFCs:			
R11	R1270a	Isopentane (C5H10)	AR11
R12	R290/R600a	Blend of Propane/Isobutane (C3H8/C4H10)	AR12
R502	R290/R170	Blend of Propane/Ethane (C3H8/C2H6)	AR502
R503, R13, R23	R170	Ethane (C2H6)	AR23
HCFCs:			
R22, R1381	R290	Propane (C3H8)	AR22
HFCs:			
R134a	R290/R600a	Blend of Propane/Isobutane (C3H8/C4H10)	AR134a
R404a, R507, R407a & R407b, R508a, R508b	R290/R170	Ethane (C2H6)	AR404, AR407, AR507, AR508, AR502
R407c, R410a, R410b	R290/R170	Propane (C3H8)	AR22, AR407c, AR410a, AR410b
NH3 (Ammonia)	R290	Propane (C3H8)	AR22



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# Musicool - Pertamina



## Musicool Hydrocarbon Refrigerant

As a substitute for Freon Alternative Products, Musicool produced and adapted to the products that will be replaced, Freon. The Musicool range includes:

1. **MC-12®**, manufactured as a replacement refrigerant **R-12 CFCs that damage the ozone layer and can lead to global warming.**
2. **MC-134®**, manufactured as a replacement refrigerant **HFC R-134a which can lead to global warming.** Used AC cars manufactured after 1993, Refrigerator, Freezer, Water Dispenser, Cold Storage, etc.
3. **MC-22®**, manufactured as a substitute for **HCFC R-22 refrigerants that damage the ozone layer.** Used for AC room like, AC Split, AC Windows, Central AC, Chiller, etc..
4. **MC-600®**, manufactured as a substitute for **CFC**

For reservations call us at 021-95493863 or email to [info@globalindoprima.com](mailto:info@globalindoprima.com)

We only sell Musicool HC to the company or technician who has been accustomed to and trained in the use of Hydrocarbon Refrigerant.



green cooling association



# Musicool - Pertamina



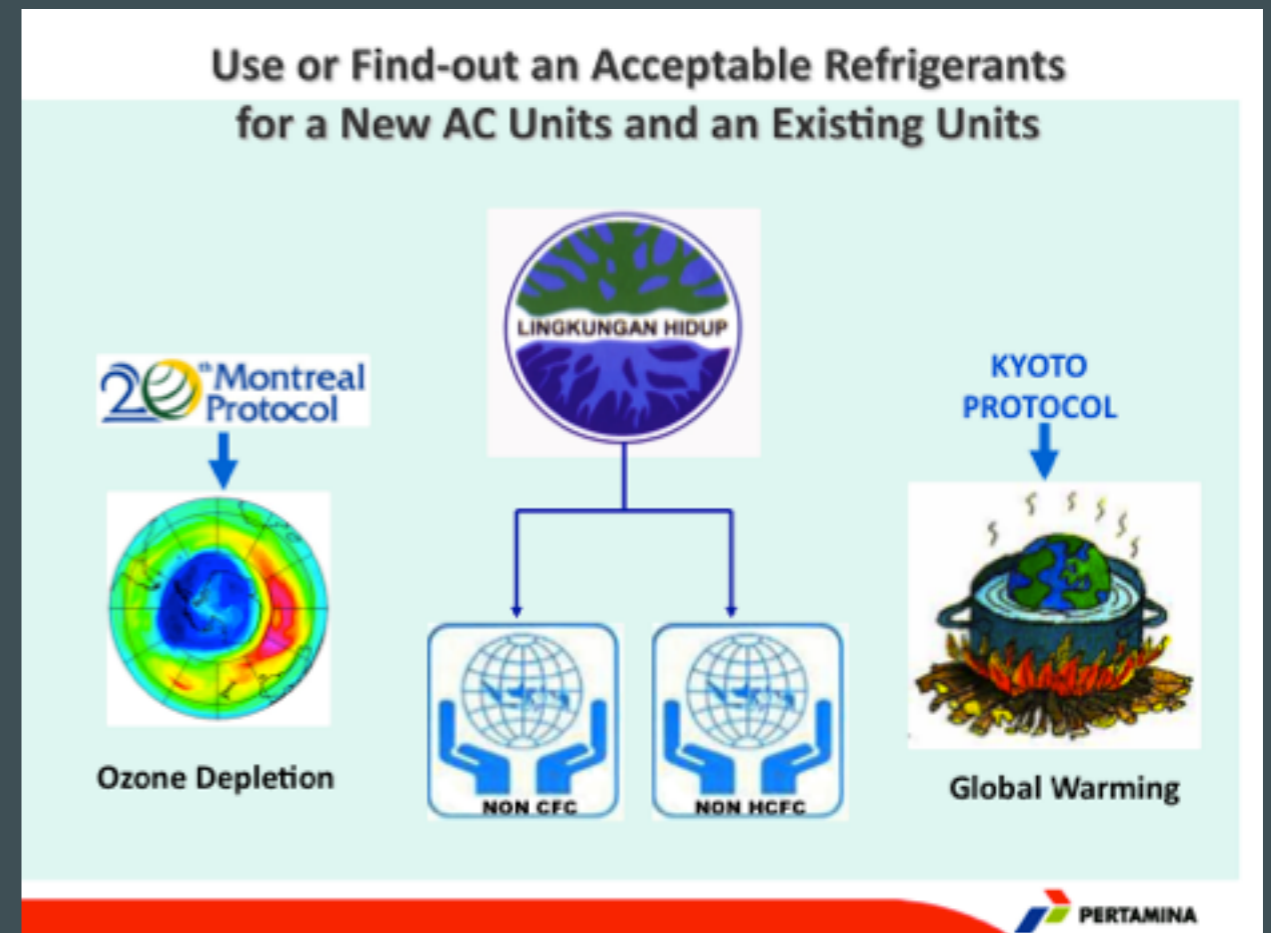
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3. **MC-22®**, manufactured as a substitute for **HCFC R-22 refrigerants that damage the ozone layer.** Used for AC room like, AC Split, AC Windows, Central AC, Chiller, etc..
4. **MC-600®**, manufactured as a substitute for **CFC**

For reservations call us at 021-95493863 or email to [info@globalindoprima.com](mailto:info@globalindoprima.com)

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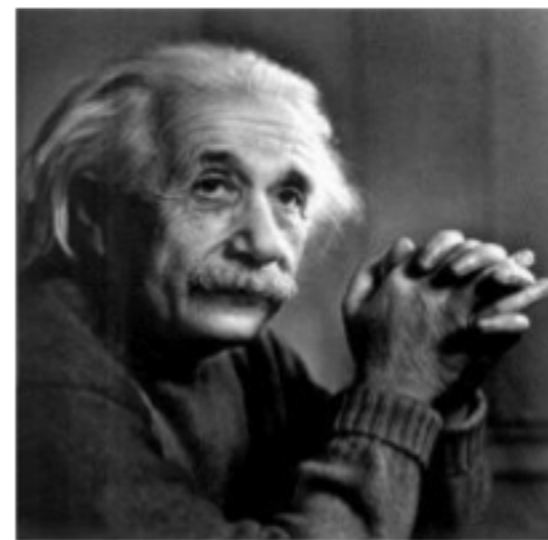
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### REFRIGERAN HIDROKARBON

Selain Ramah Lingkungan, dibandingkan refrigeran sintetik refrigeran hidrokarbon memiliki keunggulan dalam hal sifat Fisika dan Termodinamika, diantaranya :

- Enthalpy yang lebih besar
- Konduktivitas termal lebih besar
- Tahanan aliran (viskositas) lebih kecil
- Density yang lebih kecil



Pembuktian keunggulan refrigeran  
refrigeran hidrokarbon

**Albert Einstein Recommends  
Hydrocarbon Gas in 1926  
Refrigeration Patent  
Application**

*If Einstein says Hydrocarbons  
are king of refrigeration,*

**who are we to argue with the  
world's greatest intellect?**



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### Region IV Pertamina expects Musicool sell 193 metric tons

Thursday, February 25, 2010 | 12:10 PM ET

**SURABAYA, kabarbisnis. Com:** PT Pertamina (Persero) Region IV (East Java, Bali and Nusa Tenggara) optimism can increase sales product Musicool Hydrocarbon refrigerant cooling instead of synthetic.

This year, Pertamina Region IV Musicool sales target reached 193 metric tons, an increase of more than two times higher than actual sales in 2009 amounted to 80-90 metric tons per year.

"This year we are optimistic that can increase sales Musicool. And we are targeting to sell about 193 metric tons per year," said Region IV Manager Domestic Gas PT Pertamina Arsono Kuswardanu in the office of Pertamina, Jalan Jagir Wonokromo, Surabaya on Wednesday (25/02/2010 .)



(Dok. kabarbisnis.com)

Increasing the target for the region of East Java, Bali and Nusra was in line with the development of support facilities this year.

According to Soni, Arsono Kuswardanu close calls, the next month, Musicool tank facilities in the area of Tanjung Perak Port will be operational. So that the agent no longer perform the charging of Pelaju or Jakarta, because they can take from Tanjung Perak.

"The tank container sized 3x6 Musicool metric tons with a capacity of 18 metric tons in Tanjung Perak will start operating in March," he said.

Soni said, still the largest consumer and corporate industries which reached 75%. Meanwhile, retail consumption is still very small with a contribution of about 25% of total sales.

Director of Source Safe, one of the agents Musicool in Surabaya, Bambang Setiyawan, revealed, the market response to the product in Surabaya and its surroundings is quite good.

In fact, several agencies and industry have been many who use it, such as Surabaya Government Offices, County Government Pamekasan, Hotel Shangri-la, and several other major industries.

"In addition to environmentally friendly, electricity-saving products also about 20%," he said. **KBC 6**

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REFRIGERANT FOR EXISTING AC EQUIPMENT

**MUSICOOOL**  
REFRIGERANT



Refrigeran Hidrokarbon paling berpotensi untuk menjadi pilihan utama pengganti **HCFC (R-22)** di Indonesia.



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### Product Type

Musicool came in several product types:

**MC-12**, compatible with cooling machineries using R-12 refrigerant such as car air conditioning, refrigerator, freezer, water dispenser, and the likes.

**MC-22**, compatible with cooling machineries using R-22 refrigerant such as AC Window, AC Split, and the likes.

**MC-134**, compatible with cooling machineries using R-134a refrigerant, like car air conditioning, freezer, water dispenser, and the likes.

**MC-600**, as replacement for R-600a refrigerant, give technical advantages on pressure and lower compressor sound.



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## Bengkel-Bengkel AC yang menggunakan Musicool



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A screenshot of the Globalindo Niaga Prima website. The header includes navigation links like "GNP Profile", "Products &amp; Services", "News", "Forums &amp; Blogs", "Awards &amp; References", "Contact Us", and "Reseller Program". The main content area features a banner for "Keunggulan MUSICOOOL" with bullet points: "Hemat listrik penggunaan AC hingga 25%", "Proses pendinginan lebih cepat, dan lebih dingin.", "Meringankan kerja kompresor dan memperpanjang umur AC", "Tidak perlu mengubah atau mengganti kompresor AC", "Memenuhi Standar Mutu Internasional untuk ekspor", and "Tidak beracun, aman, bukan Bahan Perusak Ozon &amp; bukan Gas Rumah Kaca". Below this is a photo of a technician working on an AC unit with the caption "GLOBALINDO NIAGA PRIMA: CONVERSION OF SYNTHETIC REFRIGERANT FREON REFRIGERANT WITH MUSICOOOL THE ELECTRICITY SAVING AND BANK BNI '46 - JATINEGARA, JAKARTA". A sidebar on the left contains a "Main Menu" with links to Home, Hydrocarbon Refrigerant, Retrofit, Discussion, News GNP, Photo Gallery, Web Links, Download, Tips &amp; Tricks, and Sitemap. Another sidebar on the right has a "Member Login" section and a "Join Us On Facebook" section for "Musicool Hydrocarbon Refrigerant on Facebook".

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# RedTek in Asia

- Red Tek - Produced by Thermofluid Technologies Inc, xxx, USA
- Distributed in Asia by APL Asia, Bangkok
- Singapore/Malaysia distributor - Nat Energy Resources (no longer with ERG)
- Also active in Philippines



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USE ONLY:

**ECOSPAN-M10**™

HYDROCARBON REFRIGERANT

SERVICED BY:

CONTACT NO:

CHARGE WEIGHT:

DATE:



ECOSPAN Pte Ltd  
www.ecospan.com.sg  
Product of Singapore



SYSTEM UNDER PRESSURE. DO NOT  
TAMPER WITH FITTINGS OR ATTEMPT  
TO DISCONNECT COMPONENTS  
UNLESS QUALIFIED

THIS UNIT IS CHARGED WITH HYDROCARBON REFRIGERANT

# Ecospan - Singapore

- Newest hydrocarbon refrigerant manufacturer
  - Product available since early 2010
  - Provide installation and servicing

green cooling association



USE ONLY:

**ECOSPAN-M30**™

HYDROCARBON REFRIGERANT

SERVICED BY:

CONTACT NO:

CHARGE WEIGHT:

DATE:



ECOSPAN Pte Ltd  
www.ecospan.com.sg  
Product of Singapore



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UNLESS QUALIFIED

THIS UNIT IS CHARGED WITH HYDROCARBON REFRIGERANT

# Ecospan - Singapore

- Newest hydrocarbon refrigerant manufacturer
  - Product available since early 2010
  - Provide installation and servicing

green cooling association



USE ONLY:

**ECOSPAN-M40**™

**HYDROCARBON REFRIGERANT**

SERVICED BY:

CONTACT NO:

CHARGE WEIGHT:

DATE:



ECOSPAN Pte Ltd  
www.ecospan.com.sg  
Product of Singapore



**SYSTEM UNDER PRESSURE. DO NOT  
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UNLESS QUALIFIED**

**THIS UNIT IS CHARGED WITH HYDROCARBON REFRIGERANT**

# Ecospan - Singapore

- Newest hydrocarbon refrigerant manufacturer
  - Product available since early 2010
  - Provide installation and servicing

green cooling association



USE ONLY:

**ECOSPAN-M50**<sup>TM</sup>  
**HYDROCARBON REFRIGERANT**

SERVICED BY:

CONTACT NO:

CHARGE WEIGHT:

DATE:



ECOSPAN Pte Ltd  
www.ecospan.com.sg  
Product of Singapore



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# Two examples of conversions



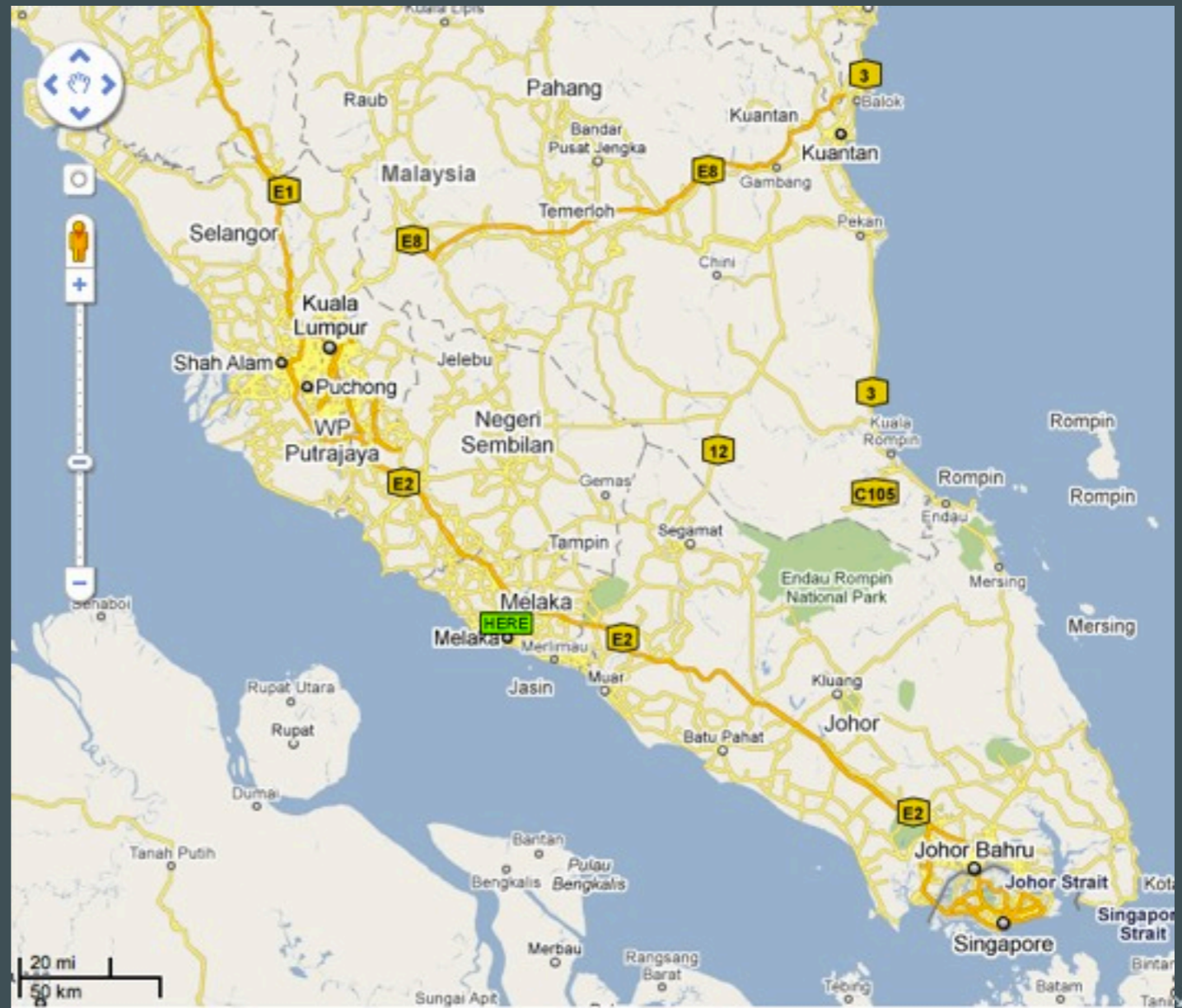
- Malaysia - Large shopping centre - Jusco Melaka
- Singapore - Jurong Country Club



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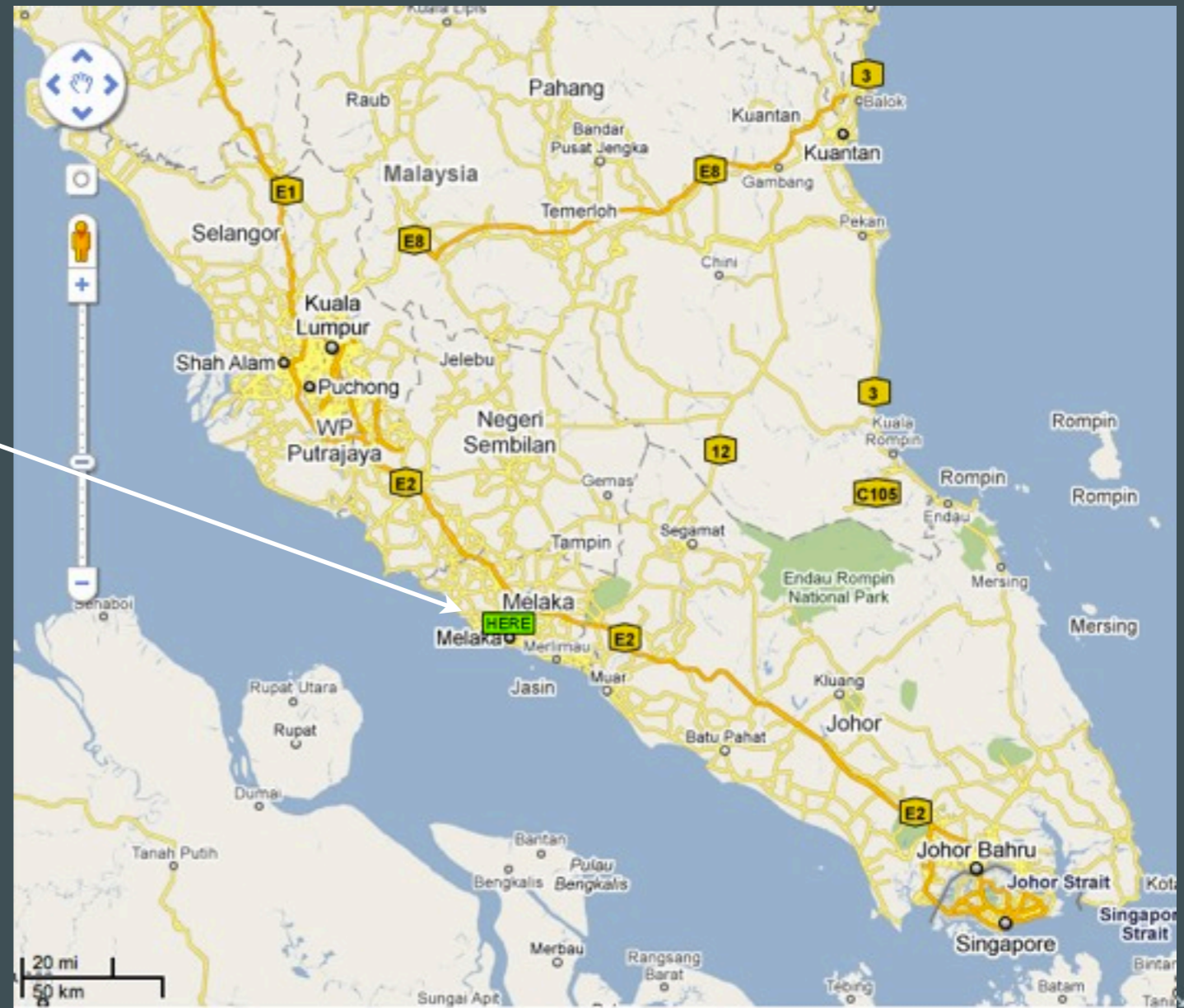
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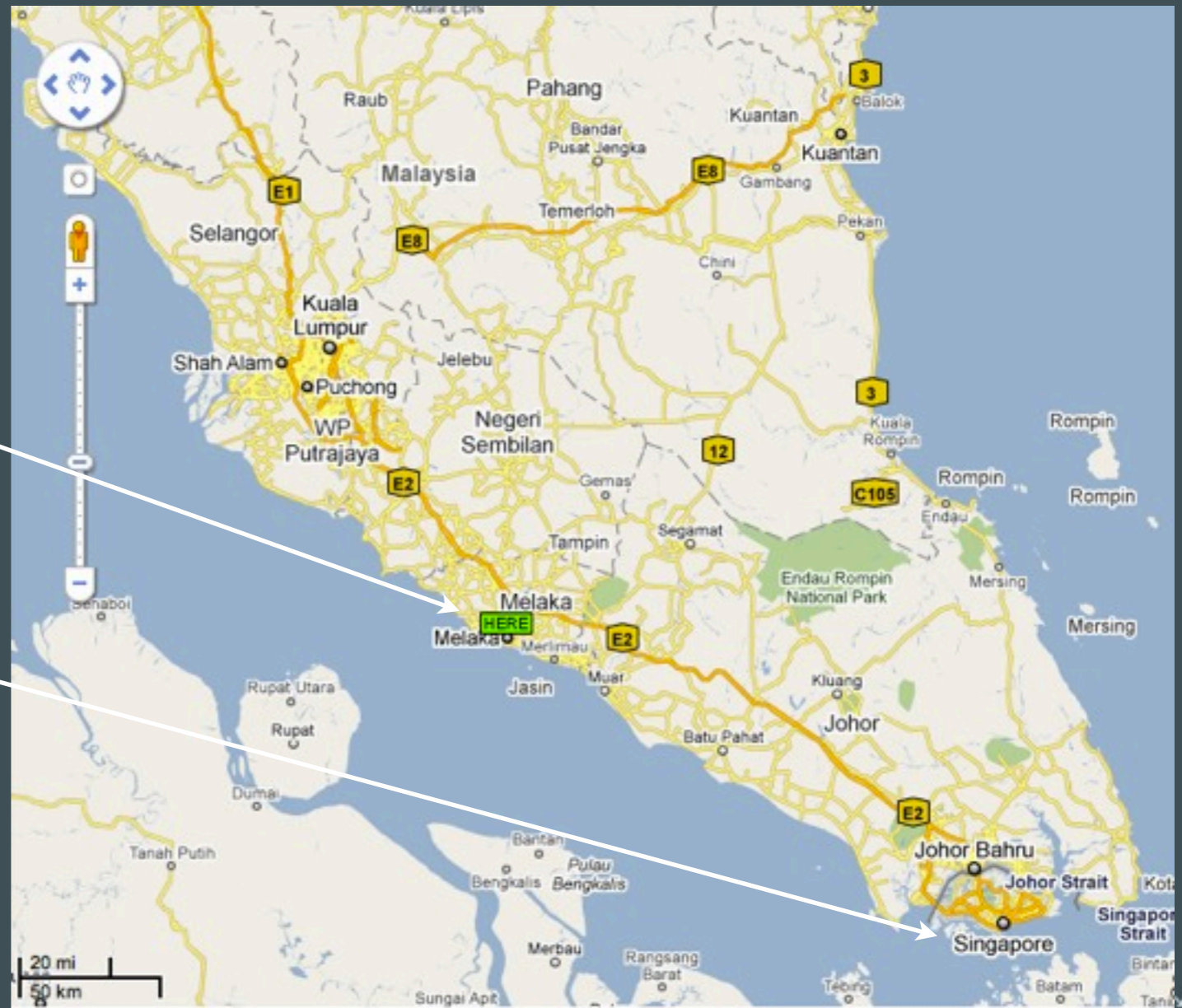




# Two examples of conversions



- Malaysia - Large shopping centre - Jusco Melaka
- Singapore - Jurong Country Club



# Jusco Melaka shopping centre, Malaysia



- Ecospan converted large retail complex to hydrocarbons in July - August 2010
- Around 50 x 25-50 KW Water Cooled Package Units
- 100 split systems
- Performance monitoring to demonstrate energy efficiency improvements



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# Jusco Melaka shopping centre, Malaysia



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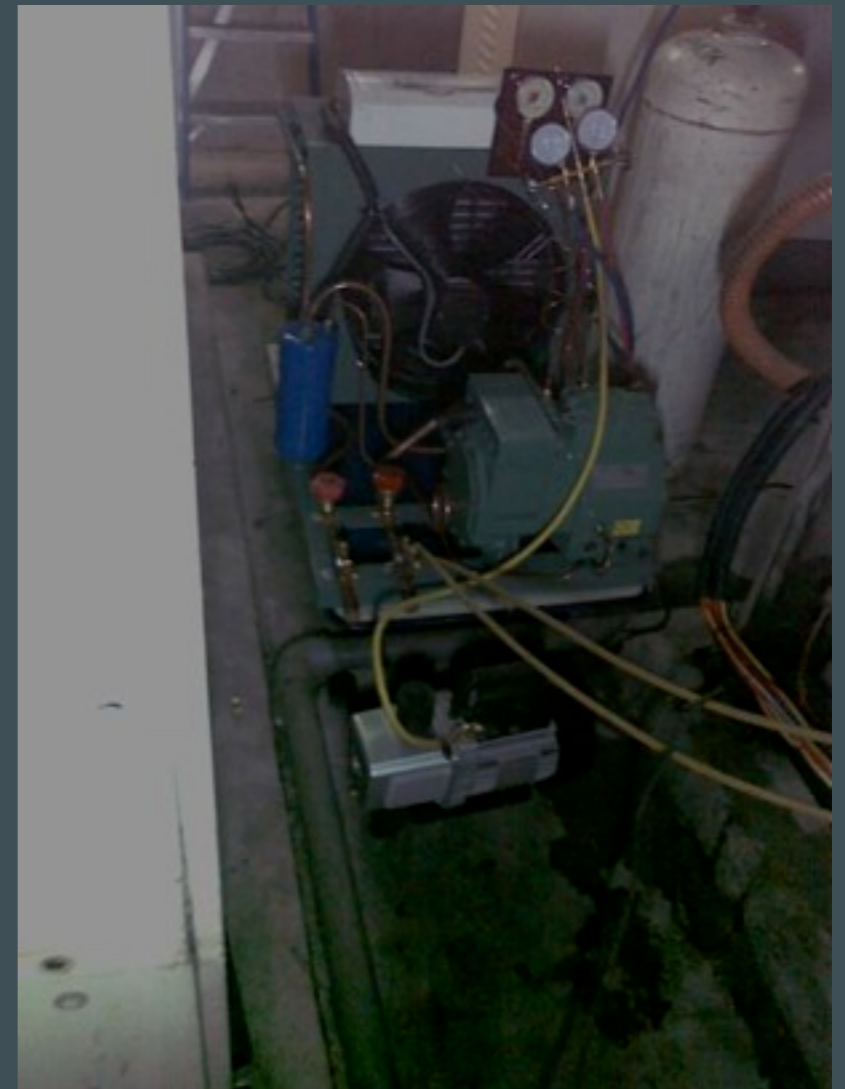
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Hydrocarbon - (Jusco Melaka) Data Comparison between Pre and Post Conversion AHU 1.xls

KAISEI ENGINEERING SDN BHD ( 353461-U )  
 No. 14, 2nd Floor, Jalan SS2/61, 47500 Petaling Jaya, Selangor D.E., Malaysia.  
 Tel : (603) 7878 8081 Fax : (603) 7846 2055

Jusco Melaka Shopping Centre, Conversion Report  
 ( AHU 1, Ground Floor )

Location	Equipment No.	Brand	Model	RTV	Capacity (kW)	Capacity (HP)	No. of Compressor	Pre Conversion		Post Conversion	
								Monitoring Period	Conversion Completion Date	Monitoring Period	Monitoring Period
AHU 1, Level 0	WCP-0-1A	Ducan	WCP-0-1A	1	35.000	35	2	1st Jul 2010	1st Jul 2010	1st September 2010	1st Jul 2010
	2nd Jul 2010							2nd Jul 2010	1st September 2010	1st Jul 2010	
AHU 1, Level 0	WCP-0-1A	Ducan	WCP-0-1A	1	35.000	35.01	20.00	17.00	10.07	24.00	16.00
	17.00							10.11	24.11	16.11	
AHU 1, Level 0	WCP-0-1A	Ducan	WCP-0-1A	1	35.000	35.000	20.000	16.25%	10.00%	24.00%	16.00%
	17.24%							10.00%	24.00%	16.00%	
TOTAL (AGGREGATED) SAVINGS								16.25%	10.00%	24.00%	16.00%



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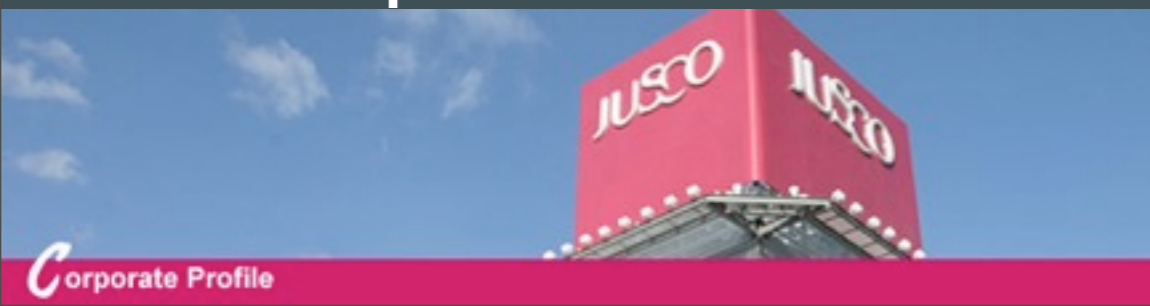
Customer Name: JUSCO MELAKA SHOPPING CENTRE  
Project Name: GREENING JUSCO MELAKA SHOPPING CENTRE TO A GREEN RETAIL CENTRE  
Equipment: BLUENIX BLUENIX UNIT MODEL: 100P-100  
Compressor: TOTAL 1-COMPRESSOR  
Refrigerant: HYDROCARBON REFRIGERANT  
Capacity: 24.2 KW

**OVERALL SAVINGS ACHIEVED CALCULATION DATA SHEET**

ENERGY SAVINGS ACHIEVED					
Pre Conversion	Post Conversion	Pre Conversion	Post Conversion	Total Savings	%
10.0	8.0	10.0	8.0	2.0	20.0%
Total kWh	10.0	Total kWh	8.0	2.0	20.0%

ELECTRICITY APPROPRIATE SAVINGS ACHIEVED					
Pre Conversion	Post Conversion	Pre Conversion	Post Conversion	Total Savings	%
10.0	8.0	10.0	8.0	2.0	20.0%
Total Average Amp	10.0	Total Average Amp	8.0	2.0	20.0%

COOLING EFFICIENCY ACHIEVED					
Pre Conversion	Post Conversion	Pre Conversion	Post Conversion	Total Savings	%
10.0	8.0	10.0	8.0	2.0	20.0%



# Jurong Country Club



- Hydrocarbon Conversion - Jurong Country Club Ltd, Singapore, Feb 2010
- Two large R22 Air Handling Units
- Pre and post conversion performance measured
- Energy efficiency improvement of 20%



# Jurong Country Club



- Hydrocarbon Conversion - Jurong Country Club Ltd, Singapore, Feb 2010
- Two large R22 Air Handling Units
- Pre and post conversion performance measured
- Energy efficiency improvement of 20%

A poster for an energy conservation campaign. The top part has a yellow background with the word "Save" in large green letters, followed by "Money" and "Environment" in smaller grey letters. Below this is a red banner with the text "LET'S DO OUR PART TO SAVE ENERGY!". The bottom part has a green background with a cartoon illustration of a man holding a plug and a coin. The text on the poster reads: "Dear Colleagues, In our recent electricity contract, our energy cost will be increased by 41% at an additional \$430,000 per year. This is largely due to the rising oil prices. The increment will affect our profitability directly. We, as staff of JCC, can help to reduce the impact of this increment."/>

**Save** Money Environment

LET'S DO OUR PART TO SAVE ENERGY!

**Energy Conservation Campaign**


Dear Colleagues,  
In our recent electricity contract, our energy cost will be increased by 41% at an additional \$430,000 per year. This is largely due to the rising oil prices. The increment will affect our profitability directly. We, as staff of JCC, can help to reduce the impact of this increment.



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- Pre and post conversion performance measured
- Energy efficiency improvement of 20%



## Overall Summary

---

Client: **Jurong Country Club Ltd** Date: **February 18, 2010**

Location: **9 Science Centre Road Singapore 609078**

Our Ref: **ECO/R/1017**

Pre-conversion monitoring period: **February 02, 2010 to February 08, 2010**

Post-conversion monitoring period: **February 08, 2010 to February 18, 2010**


S/No.	Equipment Description	Location	Average kW per Hour			Average Running Amperes			Delta Temperature (°C)		
			Pre	Post	% Savings	Pre	Post	% Savings	Pre	Post	% Increase
1.	Mitsubishi - PA-201D (Compressor 1)	Level 3 AHU Room	9.48	7.58	20.04%	18.1	14.0	22.65%	9.0	10.5	16.67%
	Mitsubishi - PA-201D (Compressor 2)		9.18	7.20	21.57%	17.7	14.3	19.21%	9.0	10.5	16.67%
<b>Total Aggregate Savings (%)</b>					<b>20.81%</b>	<b>20.93%</b>	<b>16.67%</b>				



# Jurong Country Club



- Hydrocarbon Conversion - Jurong Country Club Ltd, Singapore, Feb 2010
- Two large R22 Air Handling Units
- Pre and post conversion performance measured
- Energy efficiency improvement of 20%



## Compressor 1 Summary

---

**Air Conditioning System Data**

Location : Level 3 AHU Room ( Compressor 1 )  
 Brand : MITSUBISHI  
 Model : PA-20YD  
 Type : Air Handling Unit  
 Serial No. : 17A0015  
 Cooling Capacity : **99,200** BTU **8.27** TR  
 Existing Refrigerant : R22  
 New Refrigerant : ECOSPAN HYDROCARBON

**Data Recording**

Description	Parameter Before	Parameter After	% Saving
Start Date of Data Recording	February 2, 2010	February 8, 2010	
End Date of Data Recording	February 8, 2010	February 18, 2010	
Room Temperature	23.5 °C	23.5 °C	
On-Coil / Air Temperature IN	24.5 °C	24.0 °C	
Off-Coil / Air Temperature Out	15.5 °C	13.5 °C	
Delta Temperature	9.0 °C	10.5 °C	16.67%
Current, Comp 1, Red ( Amp )	16.7 A	14.1 A	
Current, Comp 1, Yellow ( Amp )	16.6 A	14.4 A	
Current, Comp 1, Blue ( Amp )	17.0 A	13.2 A	
Average Current ( Amp )	16.1 A	14.0 A	22.65%
Low / High Pressure, Comp 1 ( Psi )	70   315	70   250	
Average Power ( kW per Hour )	9.48	7.58	20.04%
kWTR	1.15	0.92	
COP ( BTU/Hrs. )	3.07	3.84	
EER	10.46	13.09	






# Jurong Country Club



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- Two large R22 Air Handling Units
- Pre and post conversion performance measured
- Energy efficiency improvement of 20%



## Compressor 2 Summary

---

**Air Conditioning System Data**

Location : Level 3 AHU Room ( Compressor 2 )  
 Brand : MITSUBISHI  
 Model : PA-20YD  
 Type : Air Handling Unit  
 Serial No. : 17A0015  
 Cooling Capacity : **99,200** BTU **8.27** TR  
 Existing Refrigerant : R22  
 New Refrigerant : ECOSPAN HYDROCARBON

**Data Recording**

Description	Parameter Before	Parameter After	% Saving
Start Date of Data Recording	February 2, 2010	February 8, 2010	
End Date of Data Recording	February 8, 2010	February 18, 2010	
Room Temperature	23.5 °C	23.5 °C	
On-Coil / Air Temperature IN	24.5 °C	24.0 °C	
Off-Coil / Air Temperature Out	15.5 °C	13.5 °C	
Delta Temperature	9.0 °C	10.5 °C	16.67%
Current, Comp 1, Red ( Amp )	16.3 A	14.6 A	
Current, Comp 1, Yellow ( Amp )	17.9 A	14.7 A	
Current, Comp 1, Blue ( Amp )	16.8 A	13.7 A	
Average Current ( Amp )	17.7 A	14.3 A	19.21%
Low / High Pressure, Comp 1 ( Psi )	80   300	80   250	
Average Power ( kW per Hour )	9.18	7.20	21.57%
kWTR	1.11	0.87	
COP ( BTU/Hrs. )	3.17	4.04	
EER	10.81	13.78	



# Jurong Country Club



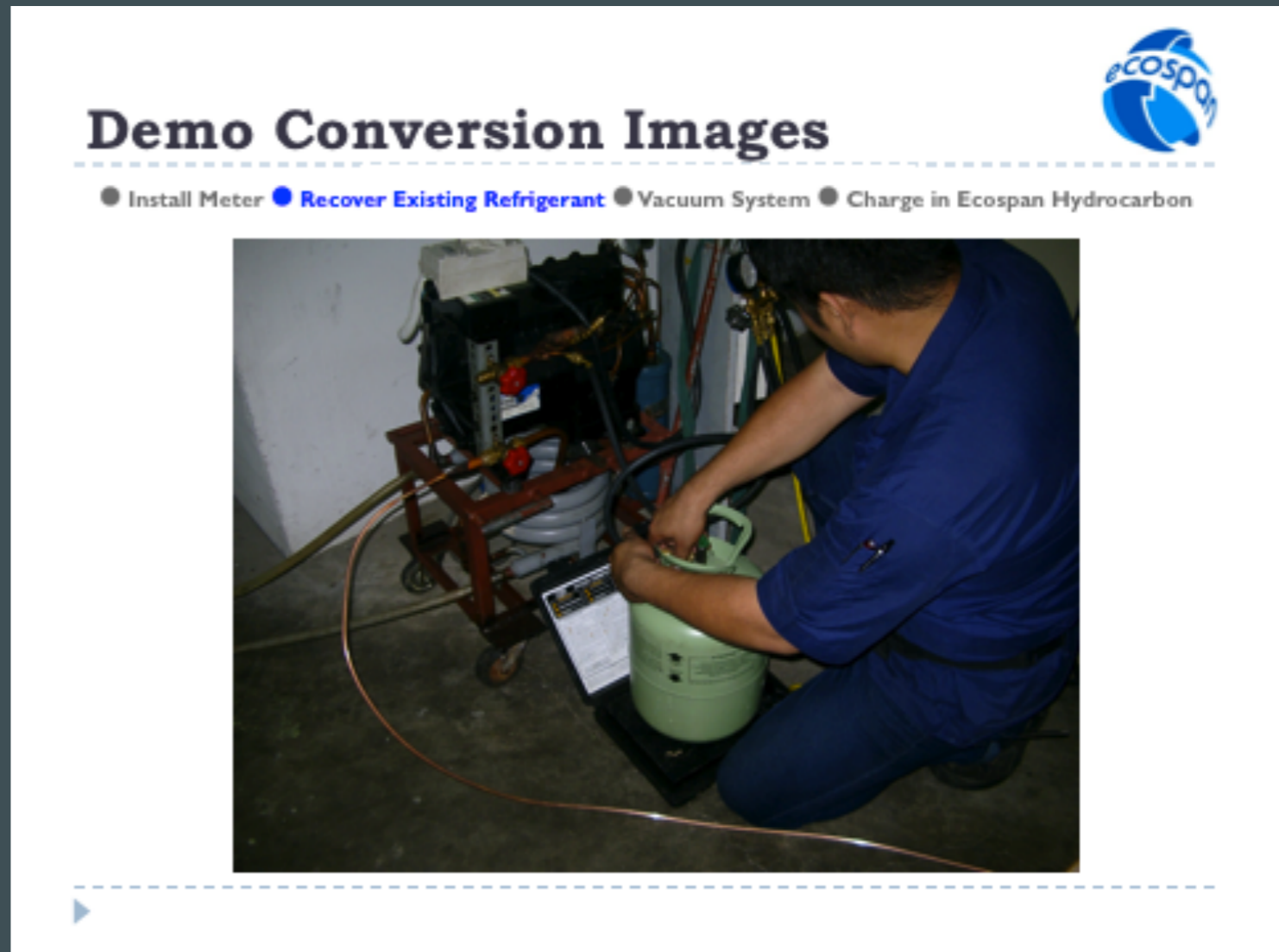
- Hydrocarbon Conversion - Jurong Country Club Ltd, Singapore, Feb 2010
- Two large R22 Air Handling Units
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# Jurong Country Club



- Hydrocarbon Conversion - Jurong Country Club Ltd, Singapore, Feb 2010
- Two large R22 Air Handling Units
- Pre and post conversion performance measured
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**HOME ABOUT US / CONTACT US**

**Be A Savings Partner Hydrocarbon Refrigerant FAQ Useful Links**

## Be Our Energy Savings Partner

Does your company have an existing non-centrifugal air-conditioning system that could benefit from a performance upgrade?

ECOSPAN's fast and effective energy solution renders existing aircon systems more efficient and eco-friendly.

We get your aircon systems to cool faster and reduce energy consumption by at least 12%, guaranteed.

Air-conditioning systems that benefit from Ecospan's energy saving solution range from small split-units, VRV systems, package units that are up to 50 horsepower in capacity, to large chillers.

See more benefits of being a savings partner [here](#).

### GET TO KNOW HYDROCARBON REFRIGERANT

- Superior Heat Transfer  
uses less energy to cool
- Drop-In Solution  
no system retro-fitting required
- Reduces Wear-and-Tear  
extends component life
- Zero Global Warming Potential  
not a greenhouse gas

more information [here](#)



**realise**  
your clean energy  
**POTENTIAL**

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green cooling association



# HC Conversions - Australia

- A number of conversions of commercial AC Chillers have been undertaken by Coolquip, an RAC services company in West Australia
- Systems are in Perth, interest has been received from other States, and more projects are expected
- Results demonstrate energy efficiency improvements of 25%
- Potential market is significant, once recognition is achieved
- [www.coolquip.com.au](http://www.coolquip.com.au)



Perth, Australian based consultancy and contracting organisation operating with Natural Refrigerants

- Presentation by Mr Selwyn Wallace, Director of Coolquip Consulting.
- Refrigeration Engineer from Perth, Western Australia.
- Owner and operator of the Consultancy and Contracting Business for 10 years.
- Involved with the design, supply, installation and commissioning of Commercial and Industrial Refrigeration and Air conditioning Equipment.

green cooling association



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## Initial Survey of Building & Equipment.

The building is an 18 story building, comprising of a ground floor retail tenancy and 17 floors of offices. The building is situated in the heart of the Perth C.B.D.

The airconditioning system is a central roof mounted water cooled chiller plant. Two chillers service the building. The Carrier chiller which is the subject of this report is approximately 5 years old. The Carrier chiller details are as follows:

Model: 30HXC230  
Type: Multi Screw Liquid Chiller  
Capacity: 822 kilowatts or 230 ton  
Compressors: 3 x Carrier Hermetic Twin-Screw  
Refrigerant: HFC134a



It was ascertained that the Chiller was in good condition and was suitable to convert to Hydrocarbon Refrigerant.





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## Safety Audit

A safety audit was conducted prior to the commencement of the conversion. This was to ensure there was adequate ventilation, no exposed electrical or fire source nearby, no smoking signs and proper control of access by the public. Where necessary, all these matters were addressed.

Gas sensors were not required but have been installed to achieve maximum best practice.

## Pre Conversion Data Logging.

Data was gathered on the operational performance of the machine prior to the conversion. A Grant Squirrel Data Logger was used to record temperature, Amperage draws and Compressor run times etc.

## Recovery of Chemical Refrigerants.

The existing refrigerant HFC134a was recovered and stored in dedicated industry approved recovery cylinders. The amount of refrigerant was weighed and the weights recorded to ascertain current refrigerant charge.



## Leak Tests and Evacuation

Once it was ascertained that there was no leaks the system was evacuated over night to ensure the complete removal of all chemical refrigerant. New Filter/Drier Cores were also installed to ensure a clean and dry system.

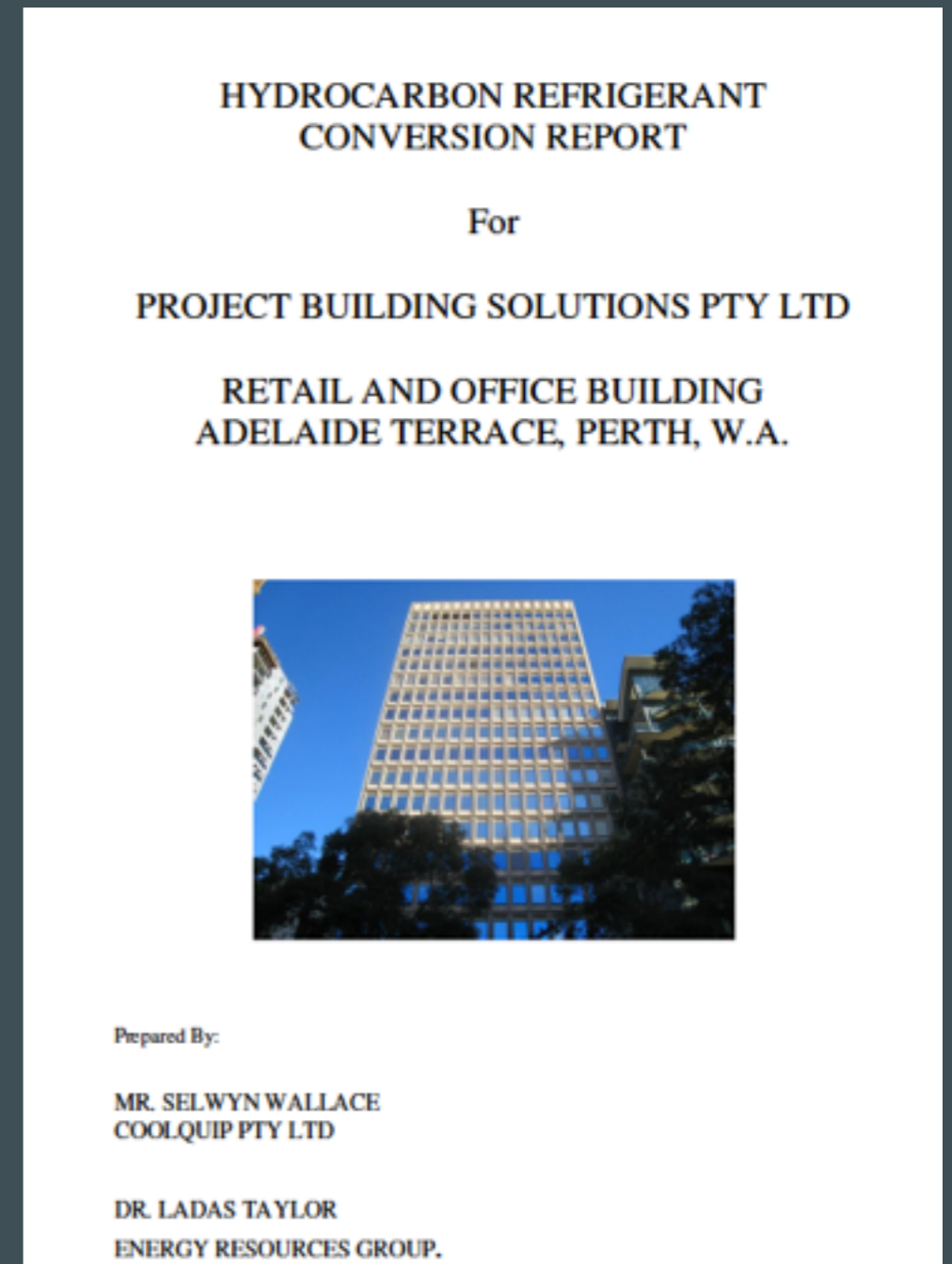
## Charging with Natural Refrigerant ERG M30.

The quantity of Hydrocarbon Refrigerant required for the Chiller was determined by a combination of factors. These included the manufacturers' original charge weight specifications and the quantity of refrigerant recovered. The Hydrocarbon Refrigerant was weighed into the machine electronically.



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## Conclusions:

### Benefits and points of interest

There are two enormous benefits for the building owners now that the Carrier Chiller has been converted to Energy Resources Group M30 Natural Refrigerant. The first is the Environmental benefit and the second is the Energy Saving.

### Environmental.

GWPs (Global Warming Potential) are used by, among others, policymakers to compare the impact on the climate system of emission of different greenhouse gases. The GWP index is relative to carbon dioxide (CO<sub>2</sub>), which is normalised at 1. As greenhouse gases differ in their atmospheric lifetimes, GWPs also have a time component. Time horizons of 20 years and 100 years are used to enable the proper evaluation on the environment.

Research has shown that for most Refrigeration or Airconditioning systems the impact for Global Warming will be greater from energy consumption (Indirect Global Warming Impact) than from CO<sub>2</sub> equivalent emission (release) of refrigerants. (Direct Global Warming Impact)

Therefore the Total Equivalent Warming Impact = leakage + energy consumption.

### Leakage:

Carrier Chiller Model 30HXC230 has a specified Refrigerant Charge of 178 KGs of HFC134a.  
Refrigerant HFC134a has a GWP of 3300 kg CO<sub>2</sub> equivalent/KG over 20 years.  
Therefore 587,400 KGs of CO<sub>2</sub> equivalent saved from the atmosphere.

### Energy Consumption

The air conditioning System at the GDI Building had an electricity consumption of 668780 KWH for 2008. Therefore 668780 divided by 2 = 334390 x 21% = 702219 x 20 years = 1,404,438.

Total Equivalent Warming Impact = 1,404,438 + 587,400 = 1,991,838 KG CO<sub>2</sub>.



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## Energy Saving

There are several reasons why Hydrocarbon Refrigerants are more efficient than Chemical Refrigerants.

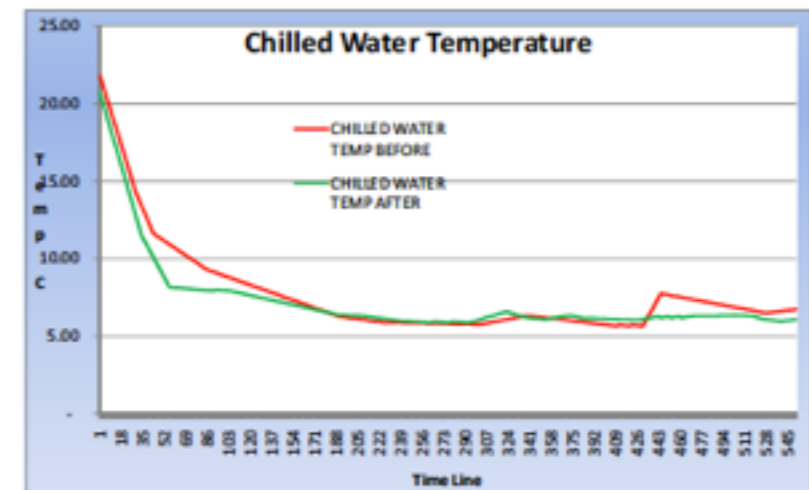
- 1) The thermal efficiency of Hydrocarbon Refrigerants is far better than Chemical Refrigerants.
- 2) The density of Hydrocarbon Refrigerants is approximately half that of Chemical Refrigerants.
- 3) It is not necessary to raise the pressure or temperature of Hydrocarbon Refrigerants to the same level as Chemical Refrigerants in order to ensure good condensation.
- 4) Hydrocarbon Refrigerants have better (higher) critical temperatures.

Therefore it is important to analyse an air conditioning or refrigeration system prior to converting to Hydrocarbon Refrigerant in order to establish as close as possible the actual energy saving.

For this project we used a 24 channel Grant Squirrel Data Logger to record the performance of the machine before conversion and post conversion. The information has been exported in graph and chart format. The information is included in this report.

Chilled Water Temperature.

The graph shows the water temperature falling faster post conversion



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## **Fine Tuned to optimise performance.**

The compressors were restarted and the system operational pressures were noted. Hydrocarbon Refrigerant was added as required until the system was indicating a satisfactory refrigerant charge.

## **General Observations.**

The system was monitored and observed over the next five days. The Grant Squirrel Data Logger continued to gather information on the post conversion performance of the Chiller.

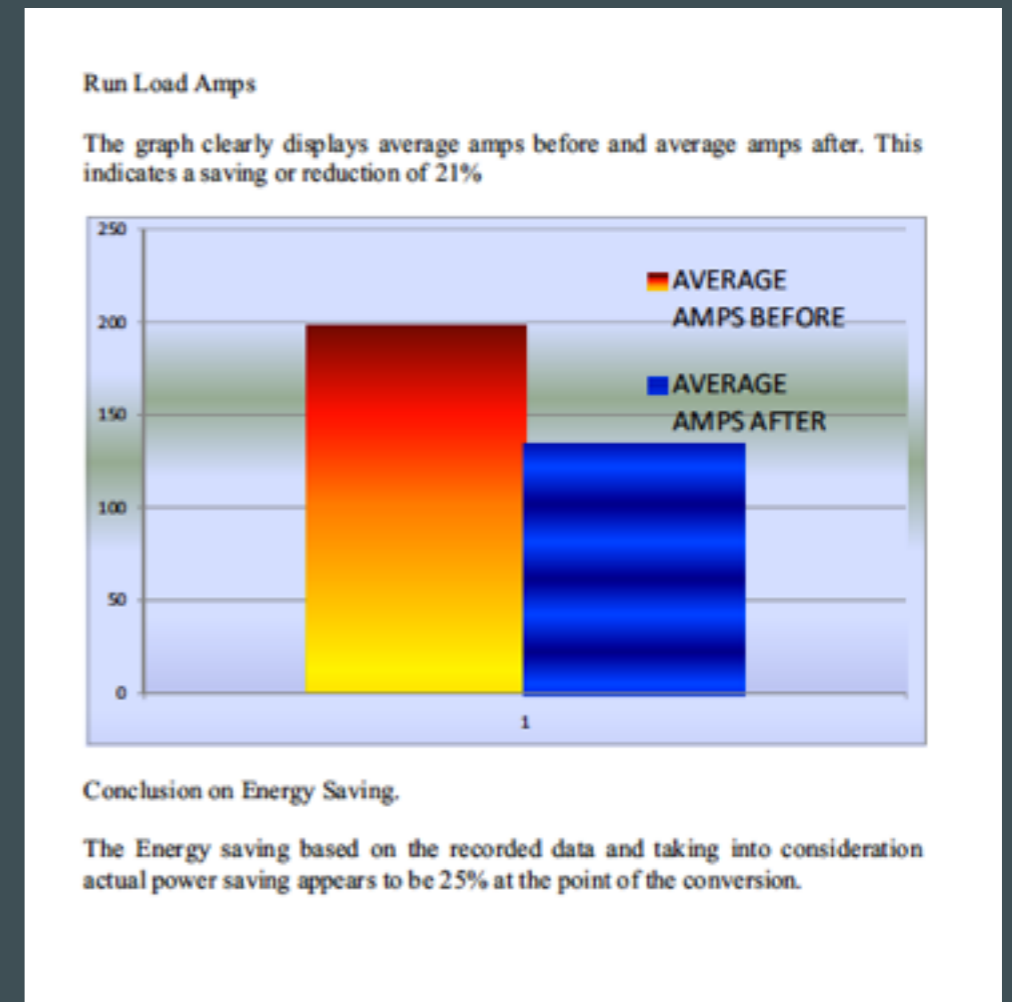
## **Labelling and Restriction of Access.**

Access to the Machinery room has been restricted by an electronic lock, an electronic alarm and monitoring system. The Area is also under electronic surveillance. Labelling on the machinery is as equally an important issue as the alarm system. The Labels clearly state the refrigerant in use and the fact that it is flammable.



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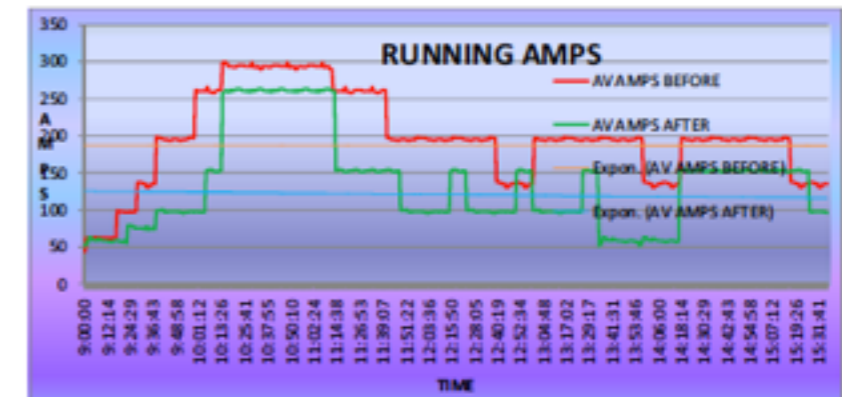


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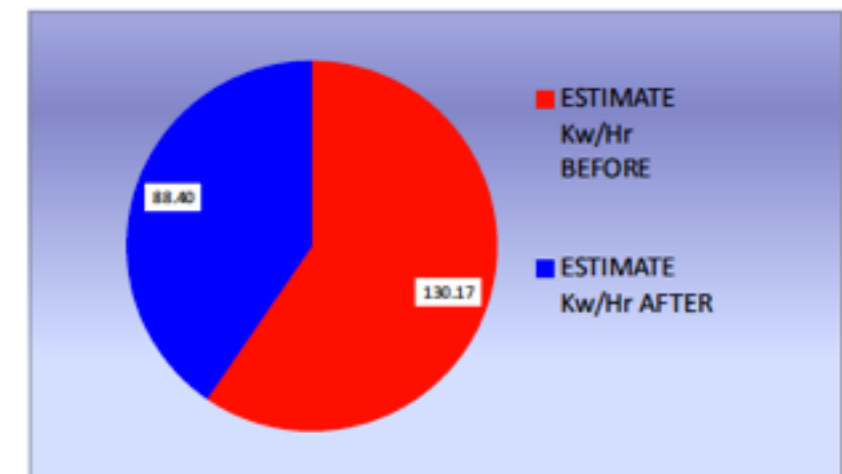
Running Amps

The graph shows a definite drop in run load amps and the evidence points to a 21% saving





Kilowatt Hours

The Chart shows Estimated Kilowatt hours before and after, calculated from the running currents measured. The saving is approximately 30%



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•This Air conditioning Unit is a Daikin 5HP (13.5 Kilowatt) reverse cycle ducted split system which provides heating and cooling for a home.

•I ran this system for 2 years on R22 and then converted it to Hydrocarbon Refrigerant M40.

•On the day that I converted (or retrofitted) this machine to Hydrocarbon Refrigerant the outdoor temperature was 36 degrees Celsius. The compressor was drawing 9amps per phase.

•After conversion to Hydrocarbon Refrigerant the compressor was drawing 7.4 amps per phase.

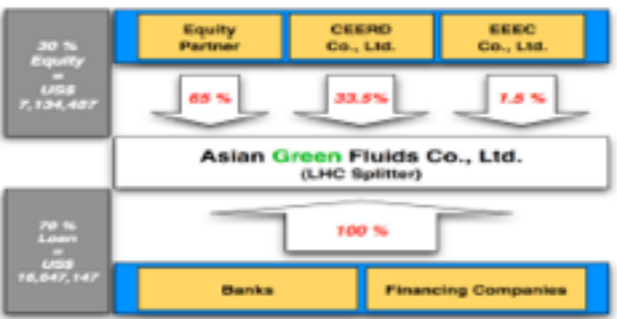
DAIKIN DUCTED SPLIT SYSTEM  
AIR CONDITIONING UNIT  
RESIDENTIAL APPLICATION





# Approval of HC production plant in Bangkok imminent from Thai Board of Investment

## High Grade Pure Hydrocarbon Project Summary

<b>Project Description</b>	Setup a High Grade Pure Hydrocarbon Plant by CEERD Co., Ltd – Operated by Asian Green Fluids Co., Ltd.
<b>Expected Location</b>	Eastern Seaboard of Thailand
<b>Rationale</b>	High Grade Pure Hydrocarbon (HGPHC) products replace the traditional refrigerants and aerosol-Propellants such as dichlorodifluoromethane (FC12) and chlorofluorocarbons (CFC's). The traditional refrigerants and aerosol-propellants (CFC, HCFC, HFC and PFC) destroy the stratosphere Ozone Layer and have also been found unacceptable, due to its high global warming potential. 140 countries are signatory to the "Kyoto Protocol" and to the "Montreal Protocol" which commit countries to phase out traditional refrigerant and aerosol-propellants. High Grade Pure hydrocarbon refrigerants and/or aerosol-propellants do not deplete the Ozone Layer and do not contribute to the Global Warming.
<b>Objective</b>	Manufacture and Supply Asian countries with environmentally friendly High-grade Pure Hydrocarbon (99.5% in volume) products used as Refrigerants, Aerosol Propellants or Foam Blowing Agents: - Propane, N-Butane, Iso-Butane, Pentane and Ethane
<b>Plant Capacity</b>	6,000 metric tons per year (~18 metric tons per day)
<b>Raw Material</b>	Liquefied Petroleum Gas (LPG)
<b>Estimated Investment</b>	USD 22,000,000
<b>Employment Generated</b>	43 Persons (refer to next page for labor details)
<b>Estimated Project IRR</b>	29.6%
<b>BOI Privileges</b>	Currently under consideration by BOI (Board of Investment of Thailand)
<b>Project Status</b>	Government Agencies, suppliers and potential off takers have provided support and delivered LOIs. Feasibility study is finalized. The Management Team is working on securing the investment.
<b>Expected Initial Financial Arrangement</b>	 <p>The diagram illustrates the financial structure of the project. It shows a total investment of USD 22,000,000. This is split into 30% Equity (USD 7,100,000) and 70% Loans (USD 15,000,000). The equity is provided by an Equity Partner (65%), CEERD Co., Ltd. (33.5%), and EEEC Co., Ltd. (1.5%). The loans are provided by Banks and Financing Companies (100%). The project is owned by Asian Green Fluids Co., Ltd. (LHC Splitter).</p>

- For further information please contact us at

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[www.ceerd.net](http://www.ceerd.net)

green cooling association



# Johnson Controls - HC Chillers

- One chiller in NZ, but not yet in Australia, hopefully soon...
- Substantial energy benefits from using natural refrigerants driving sales more than avoidance of direct emissions
- York has sold more than 250 “V” shaped chillers
- Sold more than 500 horizontal



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**Hydrocarbon air-cooled chillers** 

– for long-term environmental solutions

<b>Environmental care</b> The use of hydrocarbons as refrigerant results in zero ODP (Ozone Depletion Potential) and negligible GWP (Global Warming Potential).	<b>Microprocessor</b> Provides all information concerning the unit in a comprehensive digital display.
<b>Safety</b> All chillers are designed and equipped for use with hydrocarbons, and are delivered with CE- and PED-certification.	<b>Frame and enclosure</b> Weather-resistant design ensures long working life.
<b>Energy efficiency</b> One of the most energy-efficient chiller programmes available on the market.	<b>Noise</b> Three different noise levels at each chiller star and cover panels that absorb sound combine to ensure a low noise level.
<b>Reliability</b> These chillers can be manufactured with two independent dual-circuit refrigeration circuits.	<b>Year-round operation</b> Every chiller is equipped with speed-controlled condenser fans.
	<b>Standard equipment</b> All chillers are factory tested before delivery.



Hydrocarbon chiller - without cover panels Hydrocarbon chiller



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**YORK air-cooled HC chiller**  
with frequency-controlled screw compressor  
and V-coil condenser



cal wiring and cold water connections. The piping system has been pressure-tested and evacuated, ready for refrigerant filling at the installation site. All elements comply with current EU directives.

The chiller is subjected to a test of functions based on realistic operating conditions on our test bench at the plant prior to delivery in order to ensure correct functionality and minimise the start-up time and costs at the installation site. The customer is welcome to attend at this test.

**A long-lasting eco-friendly solution**

The use of hydrocarbon as a refrigerant is becoming more and more widespread, and recent legislation prohibiting the installation of chillers with quantities of traditional HFC exceeding 10 kg will make these hydrocarbon chillers the choice of the future.

Hydrocarbons involve no ozone-depletion and only very limited greenhouse effects. Consequently, they are designated as eco-friendly refrigerants and not regulated by legislation.

**Full pay-back within a few years**

The chiller is not only a winner because of the eco-friendly refrigerant. Thanks to the high COP factor, the additional investment in these hydrocarbon systems instead of solutions involving HFC chillers that comply with current legislation will pay back within a few years. And when considering total system service life, you can save a lot of money by investing a little bit more in the installation.

**Safety**

All chillers are CE-marked and have been approved in accordance with the EU Directive on Pressure Equipment.

**Control**

The standard YORK Chiller series comes with Carel pCO microprocessor-based chiller control. Compressor speed control via frequency converter.

**All-inclusive chiller**

The YORK air-cooled V-coil chiller with frequency-controlled screw compressor was developed in order to improve or maintain quality levels in areas like:

- Minimise foot print
- Increase production flexibility
- Shorter delivery time
- Maintain high quality
- Maintain low noise levels
- Good COP in all control areas

With our three V-coil models, we have achieved a significant foot print reduction by using a V-coil condenser. The compressor and the exchanger are fitted under the V-coil, giving a finished height of 2.6 metres.

The chiller design ensures production flexibility, but our development and design efforts have not compromised our high quality levels. The V-coils and the compressor were chosen to ensure low noise levels, even for our standard chiller.

The standard compressor comes with frequency control, ensuring a wide control range, a highly flexible chiller and a high COP factor, even at low system loads.

The chillers are supplied as a complete factory assembly with the entire cooling system, electri-



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## Ammonia Chillers

Air- and liquid cooled cooling plants

**Description**

If requested the plants can be delivered including air-cooled or liquid-cooled condenser. Both types of plant are equipped with a single piston compressor, plate heat exchanger, liquid separator, automatic oil return, and electric board including electronic control in front panel.

Plants are delivered according to PED (European Pressure Equipment Directive) as standard.

At request it is possible to achieve more customized plants including different options. For instance twin and triple plants.

**Acoustic Housing**

As standard the cooling plant can be delivered including acoustic housing for outdoor mounting. Another possibility is to separate the plant by placing the air-cooled condenser outdoor and the compressor unit indoor. Due to the compact design and the acoustic housing the plant is very easy placed - in- or outdoor.

**Hydro kit**

Hydro kit comprising pump, buffer tank, expansion vessel, filter, and necessary valves, can be built into weatherproof cabinet and factory tested.

**Hydro kit**

Hydro kit comprising pump, buffer tank, expansion vessel, filter, and necessary valves, can be built into weatherproof cabinet and factory tested.

Johnson Controls Ammonia Liquid Chiller - JALC



**JALC comprises the following**

- YD starter board
- Internal threading
- Electronic control including display
- Vibration dampers
- Capacity regulation of compressor
- Automatic oil return
- Acoustic housing is an option
- Factory test of complete unit
- Delivered according to PED

Type	JALC	JALC	JALC	JALC	JALC	JALC	JALC	JALC
Cooling capacity	42	49	59	78	90	117	135	161
Electric motor	42	49	59	78	90	117	135	161
Electric motor	11.0	11.0	15.0	15.0	18.5	30.0	30.0	37.0
CO2 refrigerant	-	5.78	5.69	5.75	5.87	5.85	5.85	5.85
Sweep volume	m <sup>3</sup> /h	39.4	47.1	56.1	73.6	84.5	110.5	131.6
Cylinders	-	4	4	4	4	4	6	6
Capacity steps	-	2	2	2	2	2	3	3
Flow evaporator	m <sup>3</sup> /h	7.1	8.1	10.2	13.4	15.4	20.2	23.4
Δp H <sub>2</sub> O	kPa	27.2	35.3	32.5	36.1	30.5	34.8	32.1
Flow condenser	m <sup>3</sup> /h	9.2	10.6	12.8	16.8	19.4	25.2	29.1
Δp brine [kPa]	kPa	28.0	24.3	35.1	42.3	42.3	39.2	39.1
Charge	kg	30	30	30	30	30	24	24
Dry weight	kg	940	940	990	1040	1060	1120	1170
Length	mm	1900	1900	1900	1900	1900	1900	1900
Width	mm	1350	1350	1350	1350	1350	1350	1350
Height	mm	2100	2100	2100	2100	2100	2100	2100
Pressure sound in 10 m <sup>3</sup>	dB(A)	55	55	55	55	55	55	55

Evaporator: Water, inlet 12°C, outlet 7°C. Condenser: 30% ethylene glycol, inlet 30°C, outlet 30°C.  
\* Flow area



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Johnson Controls Ammonia Aircooled Chiller - JAAC



**JAAC comprises the following**

- Acoustic housing and condenser on common base frame
- YD starter board
- Internal threading
- Electronic control including display
- Vibration dampers
- Capacity regulation of compressor
- Automatic oil return
- Factory test of complete unit
- Delivered according to PED

Type	JAAC 40	JAAC 47	JAAC 57	JAAC 73	JAAC 84	JAAC 111	JAAC 127	JAAC 152	
Cooling capacity	kW	40	47	57	73	84	111	127	152
Electric motor	kW	11,0	15,0	15,0	18,5	22,0	30,0	30,0	37,0
COP compressor	-	4,53	5,03	4,70	4,78	4,86	5,01	4,91	4,83
Sweep volume	m <sup>3</sup> /h	39,4	47,1	56,1	73,8	84,5	110,5	126,8	151,8
Cylinders	-	4	4	4	4	4	6	6	6
Capacity steps	-	2	2	2	2	2	3	3	3
Flow evaporator	m <sup>3</sup> /h	7,1	8,1	9,3	12,5	14,5	19,1	21,9	26,2
Δp H <sub>2</sub> O	kPa	27,2	35,3	29,8	31,8	30,3	31,2	33,4	35,4
Number of ventilators	Stk	3	2	2	2	1	4	4	2
Charge	Rg	24	26	28	30	34	38	40	50
Dry weight	Kg	1160	1260	1300	1470	1650	1750	1915	2120
Length	mm	2775	2400	2400	2800	3800	3300	3700	6200
Width	mm	1900	2195	2195	2195	1541	2195	2195	2195
Height	mm	2150	2150	2150	2150	2150	2150	2150	2150
Pressure sound in 0 m <sup>2</sup>	dB(A)	55	55	55	55	55	55	55	55

Evaporator: Water, inlet 12°C, outlet 7°C. Condenser: T<sub>surroundings</sub> 27°C, RP 80%  
\* Flow area

**Advantages**

- Refrigerant being environmentally sound and adapted for future requirements
- Low operation costs compared to HFC plants
- Compact design - easy to place
- Design prepared for acoustic housing
- Factory test of plant
- Low mounting costs

**Options**

- Acoustic housing for type YALC
- Frequency regulation of compressors and condenser blowers
- CTS/EMS communication
- Special coating for mounting in aggressive environments
- NH<sub>3</sub> detector
- Hydro kit
- Epoxy coating for condenser fans

The data mentioned above may be changed without warning.

Johnson Controls  
 Johnson Controls Denmark, Køleteknik  
 Sortevaj 30, 8543 Hornslet  
 Telefon: 87 36 31 00, Fax: 87 36 31 01  
 www.johnsoncontrols.dk  
 E-mail: cg-eur-dk-koleteknik@jci.com

Marts 2009



# North American market

- Four well established manufacturers competing for market share
- **Duracool** [www.duracool.com](http://www.duracool.com)
- **Enviro-Safe** [www.es-refrigerants.com](http://www.es-refrigerants.com)
- **Redtek** [www.redtek.com/index.html](http://www.redtek.com/index.html)  
(check out video at [http://www.redtek.com/products\\_refr.html](http://www.redtek.com/products_refr.html))
- **A.S. Trust** <http://www.hcr188c.com/>

**DURACOOOL® Refrigerants**  
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Non-Ozone Depleting  
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- **Redtek** [www.redtek.com/index.html](http://www.redtek.com/index.html)  
(check out video at [http://www.redtek.com/products\\_refr.html](http://www.redtek.com/products_refr.html))
- **A.S. Trust** <http://www.hcr188c.com/>

The screenshot shows the Enviro-Safe website interface. At the top, the logo 'ENVIRO-SAFE' is followed by navigation links: 'REFRIGERANT & SUPPORT FLUIDS', 'A/C TOOLS', 'INDUSTRIAL SUPPLIES', 'RESOURCES', 'ABOUT US', and 'CUSTOMER SERVICE'. Below the navigation is a banner image of a coastal landscape with the text: 'We want to hear from you! If you have any comments or questions about our products, our website, or your order, please [contact us](#).' The main content area features a product listing for 'Industrial 12a Refrigerant' with a 'Return to Product Listings' link. The product details include a price option of '\$6.00 for 6 oz can', a quantity selector set to '1', and an 'ADD TO CART' button. Below this is a link to the 'MSDS' (Material Safety Data Sheet) for the product. A central image shows a white refrigerant cylinder with the Enviro-Safe logo. To the right of the cylinder, text states: 'The 30 lb cylinder = 12 lbs of Enviro-Safe Refrigerant and is EQUIVALENT to 32 lbs of 134a' and 'The 50 lb cylinder = 20 lbs of Enviro-Safe Refrigerant and is EQUIVALENT to 52 lbs of 134a'. On the far right, a 'Customers Also Bought' section lists 'Stop Leak' (a way to minimize costly repairs) and 'Oil Charge 3' (a blend of selected oils). Both items have their own price options, quantity selectors, and 'ADD TO CART' buttons. At the bottom right, there is a partial listing for '22a Refrigerant'.



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(check out video at [http://www.redtek.com/products\\_refr.html](http://www.redtek.com/products_refr.html))
- **A.S. Trust** <http://www.hcr188c.com/>

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Thermofluid Technologies is committed to the continued growth of its manufacturing and trading operations, constantly investing in development of new products and technologies.

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Click Here for A/C Components and Competitive Cross Reference Part Numbers

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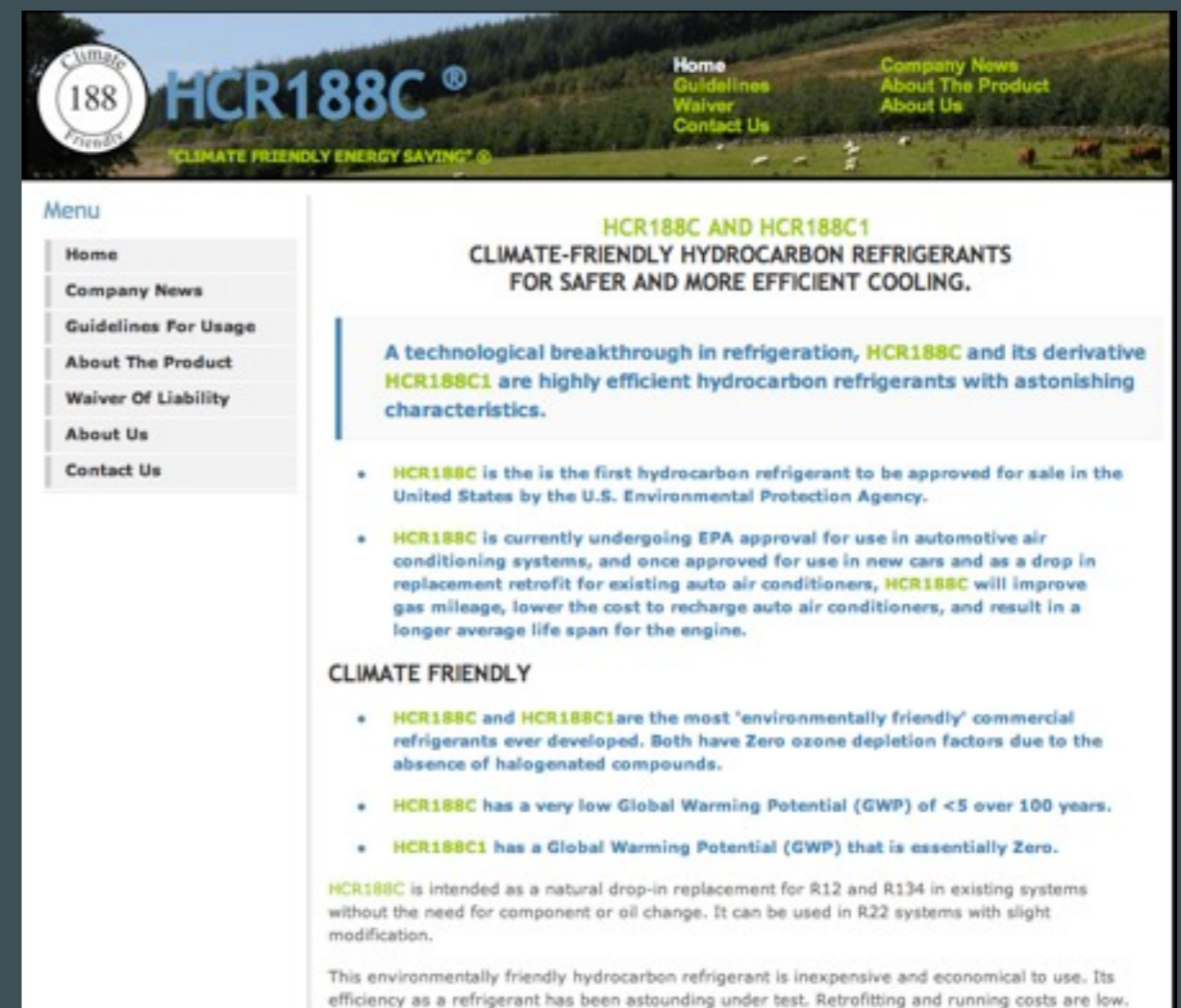
**FEATURED PRODUCTS**

- RED TEK® 12a**
- RED TEK® ProSeal**
- RED TEK® Oil Analyzer**
- RED TEK® Grease**



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(check out video at [http://www.redtek.com/products\\_refr.html](http://www.redtek.com/products_refr.html))
- **A.S. Trust** <http://www.hcr188c.com/>

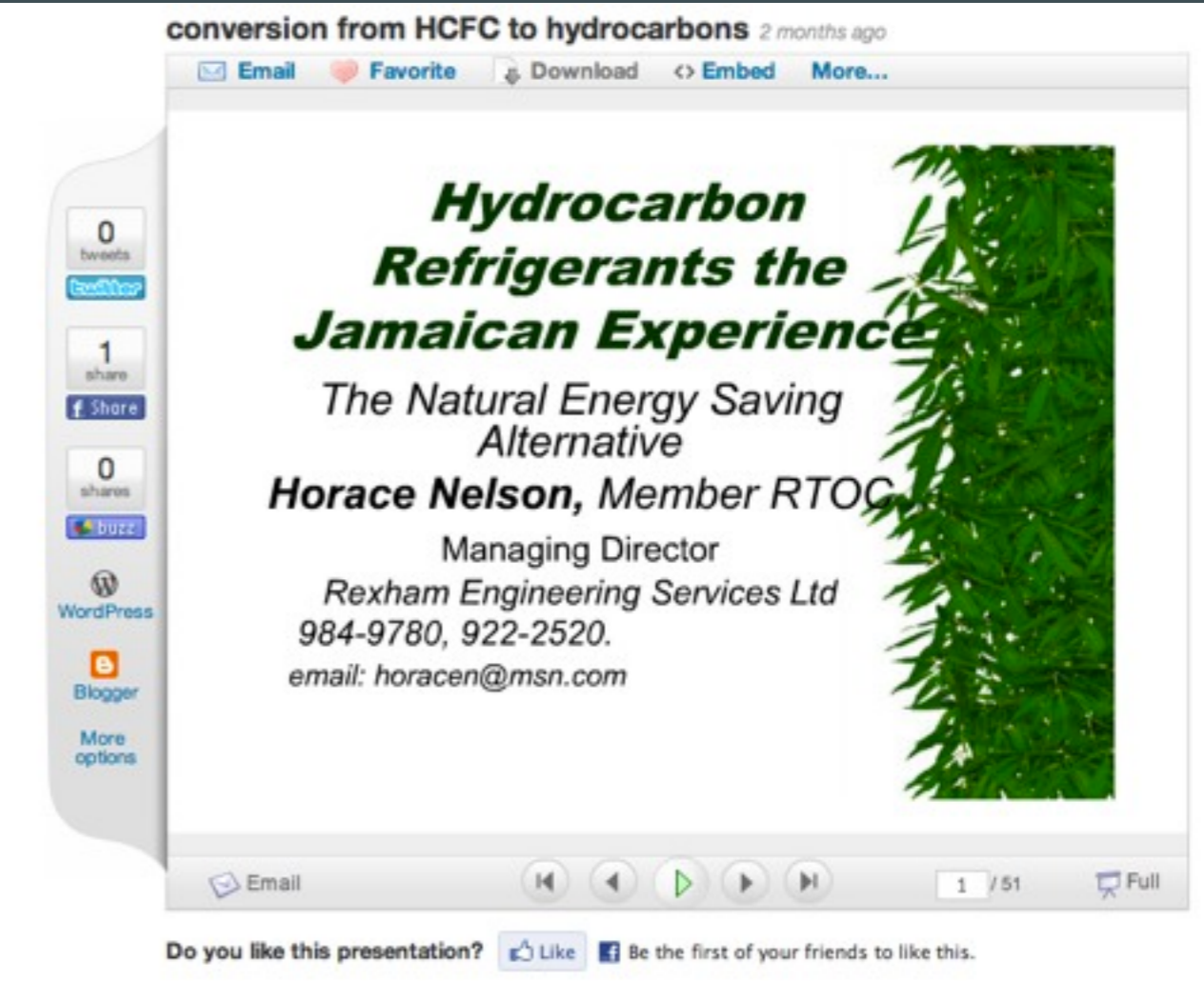


The screenshot shows the website for HCR188C, a climate-friendly hydrocarbon refrigerant. The header features the HCR188C logo with a 'Climate 188 Friends' seal and the tagline 'CLIMATE FRIENDLY ENERGY SAVING'. Navigation links include Home, Guidelines, Waiver, Contact Us, Company News, About The Product, and About Us. A menu on the left lists Home, Company News, Guidelines For Usage, About The Product, Waiver Of Liability, About Us, and Contact Us. The main content area is titled 'HCR188C AND HCR188C1 CLIMATE-FRIENDLY HYDROCARBON REFRIGERANTS FOR SAFER AND MORE EFFICIENT COOLING.' It describes a technological breakthrough and lists key features: HCR188C is the first hydrocarbon refrigerant approved for sale in the US; HCR188C is currently undergoing EPA approval for automotive use; HCR188C and HCR188C1 are the most environmentally friendly commercial refrigerants; HCR188C has a very low GWP of <5; and HCR188C1 has a GWP that is essentially zero. It also notes that HCR188C is a natural drop-in replacement for R12 and R134 and is inexpensive and economical to use.



# Duracool HCs used in Jamaica

- Horace Nelson, Rexham Engineering Services, RTOC member
- Using Duracool22a to achieve significant reductions of HCFC emissions and around 20% energy savings in chillers and split systems
- Presentation available at: <http://www.slideshare.net/ozonaction/3-hc-refrigerants-the-jamaican-experience>
- Highlights many advantages - technically easy, suitable to high humidity, available, cheaper, quieter...
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**Hydrocarbon Refrigerants the Jamaican Experience**

The Natural Energy Saving Alternative

**Horace Nelson, Member RTOC**

Managing Director  
Rexham Engineering Services Ltd  
984-9780, 922-2520.  
email: horacen@msn.com

Email

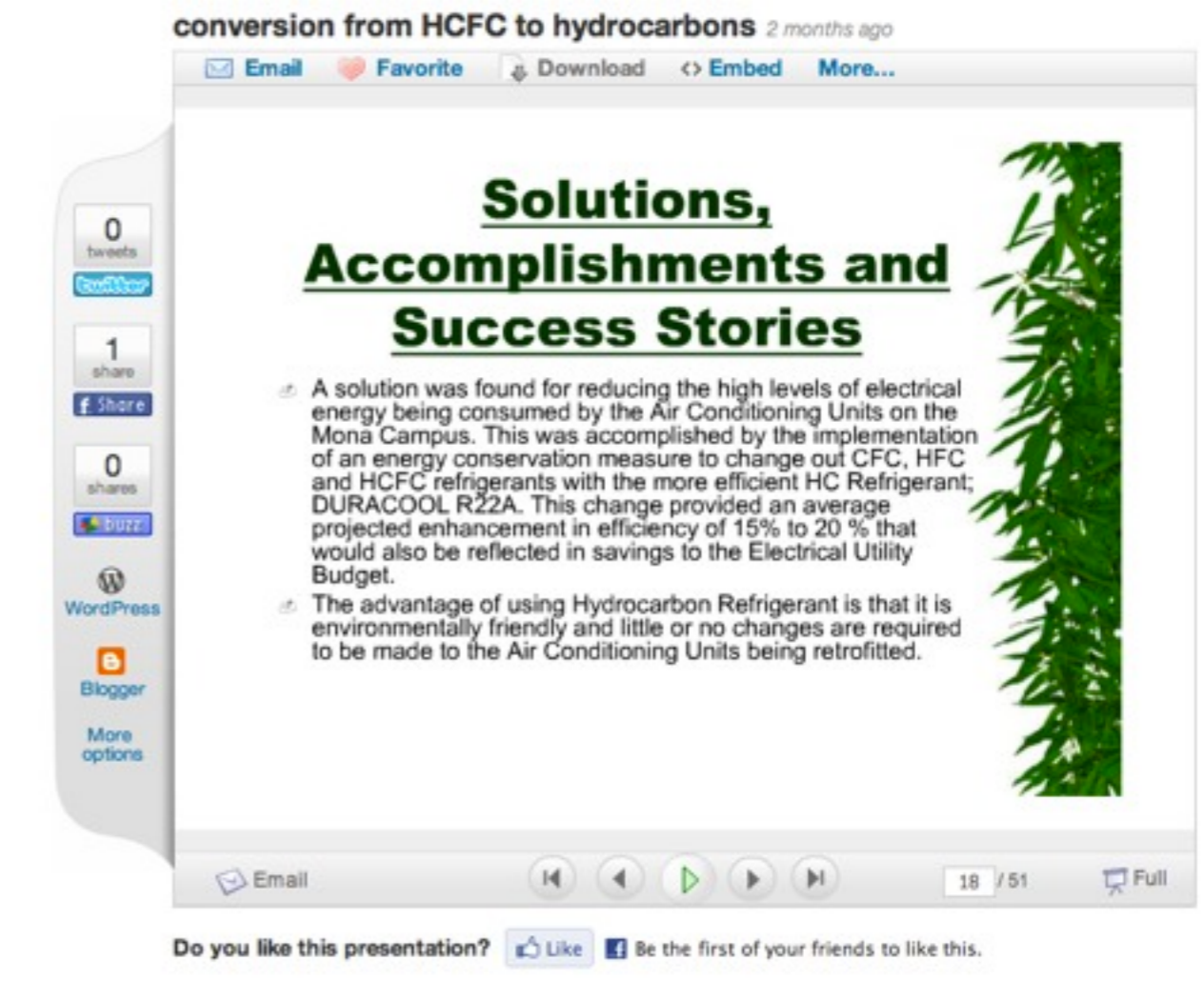
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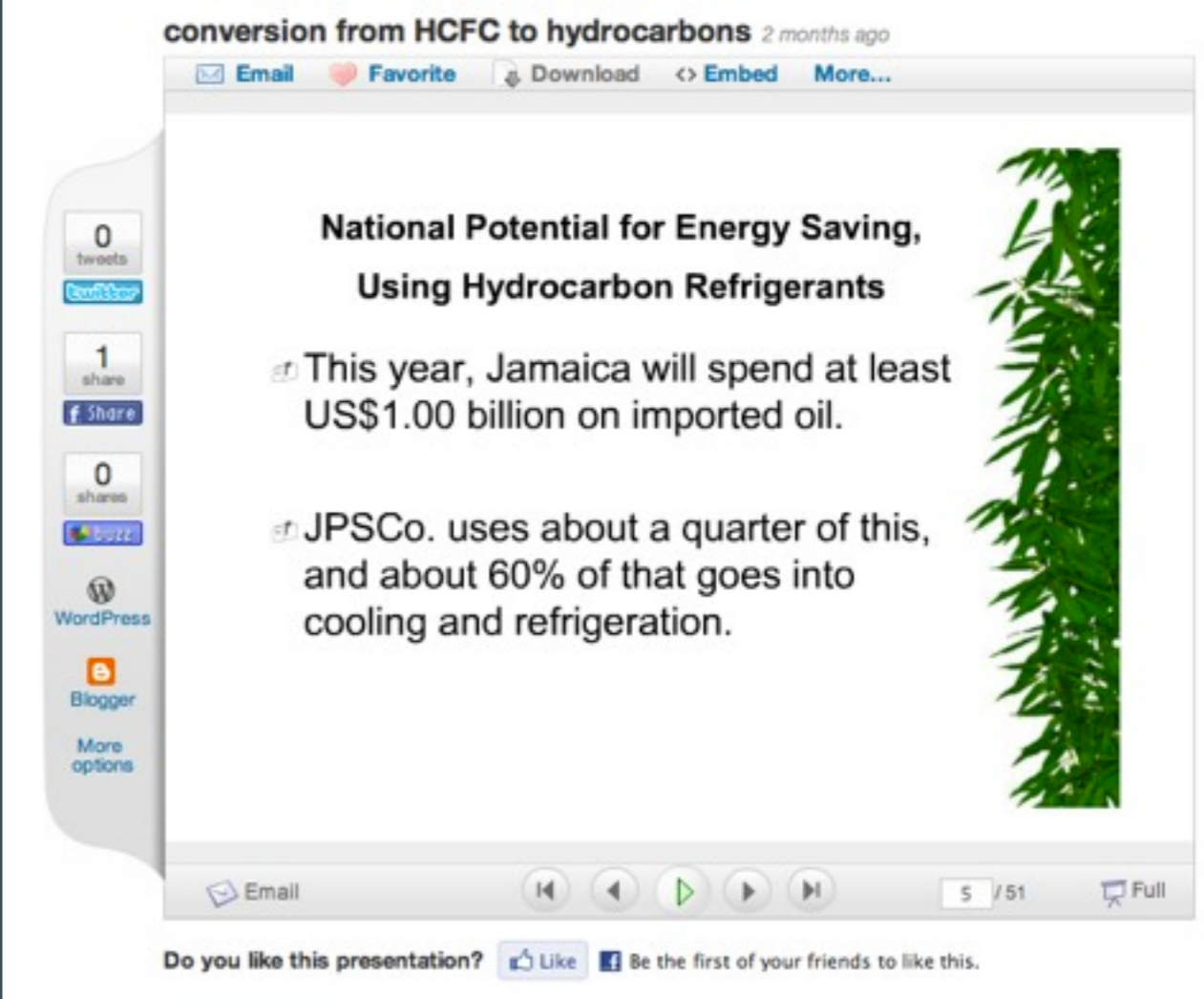


The screenshot shows a presentation slide titled "conversion from HCFC to hydrocarbons" with a timestamp of "2 months ago". The slide features a navigation bar with "Email", "Favorite", "Download", "Embed", and "More..." options. The main content area is titled "Solutions, Accomplishments and Success Stories" in green text. It contains two bullet points: one describing a solution for reducing electrical energy consumption at the Mona Campus by switching to DURACOOOL R22A, and another highlighting the environmental benefits of hydrocarbon refrigerants. A vertical image of green leaves is on the right side. The slide includes social media sharing icons (Twitter, Facebook, Buzz, WordPress, Blogger) and a "More options" link. At the bottom, there are navigation controls (back, forward, search, etc.), a "Full" screen button, and a "Do you like this presentation?" prompt with a "Like" button and a Facebook link.



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conversion from HCFC to hydrocarbons 2 months ago

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**National Potential for Energy Saving,  
Using Hydrocarbon Refrigerants**

• This year, Jamaica will spend at least US\$1.00 billion on imported oil.

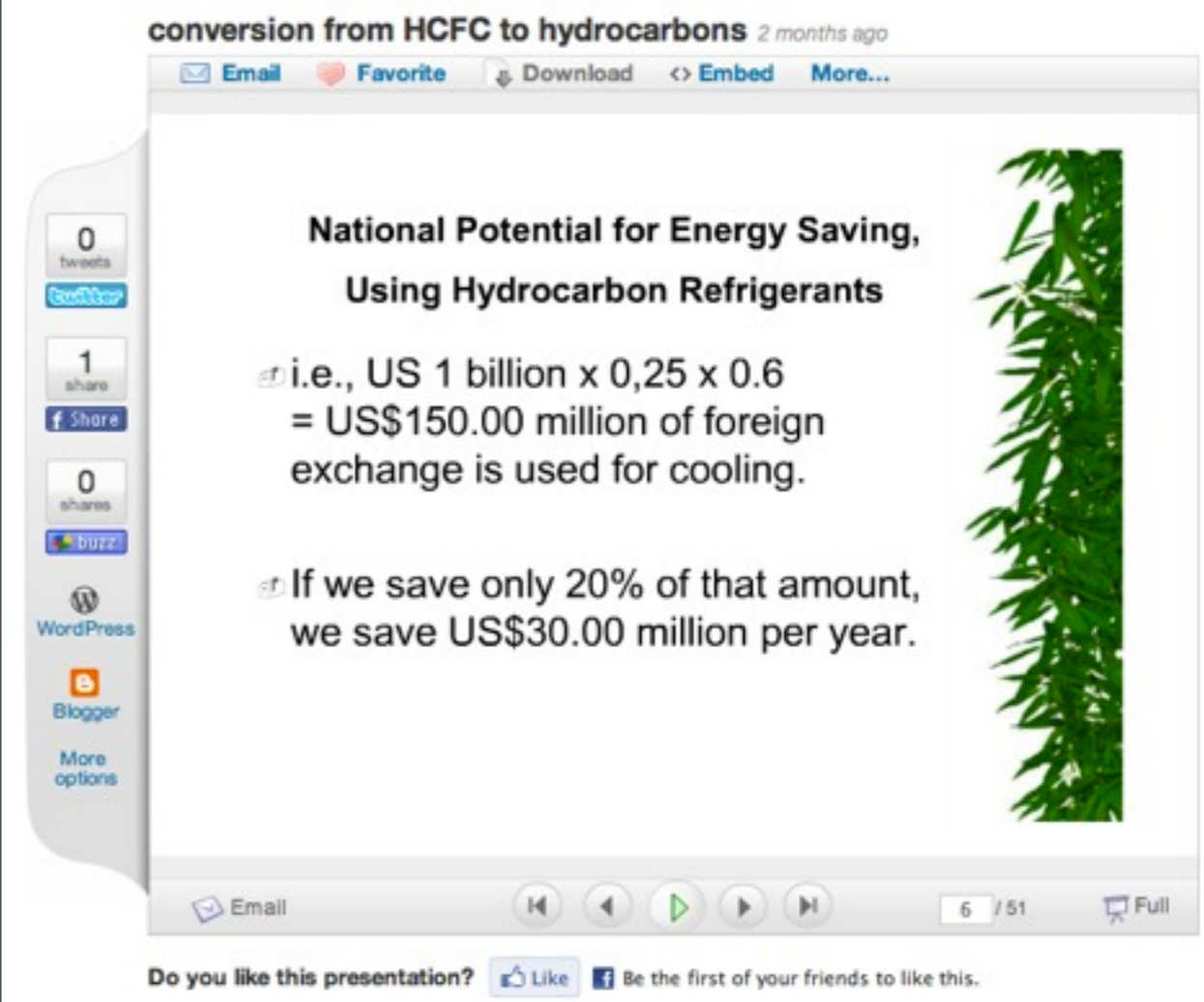
• JPSCo. uses about a quarter of this, and about 60% of that goes into cooling and refrigeration.

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National Potential for Energy Saving,  
Using Hydrocarbon Refrigerants

i.e., US 1 billion x 0,25 x 0.6  
= US\$150.00 million of foreign  
exchange is used for cooling.

If we save only 20% of that amount,  
we save US\$30.00 million per year.

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## HC Technician

Is carrying out pioneering work in the application of HC Refrigerants.

Developing new ways in utilizing alternative refrigerants.



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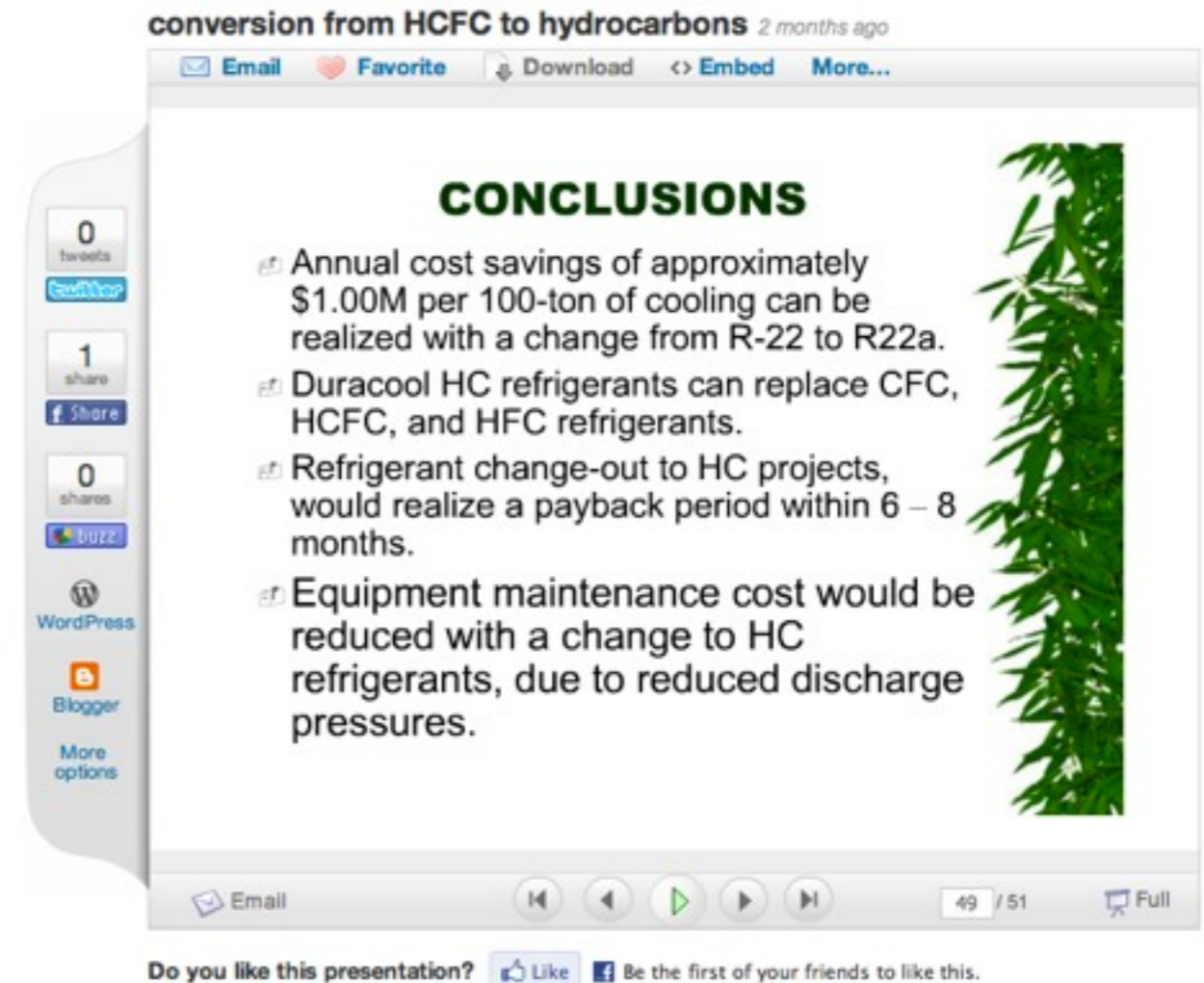
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## CONCLUSIONS

- Annual cost savings of approximately \$1.00M per 100-ton of cooling can be realized with a change from R-22 to R22a.
- Duracool HC refrigerants can replace CFC, HCFC, and HFC refrigerants.
- Refrigerant change-out to HC projects, would realize a payback period within 6 – 8 months.
- Equipment maintenance cost would be reduced with a change to HC refrigerants, due to reduced discharge pressures.

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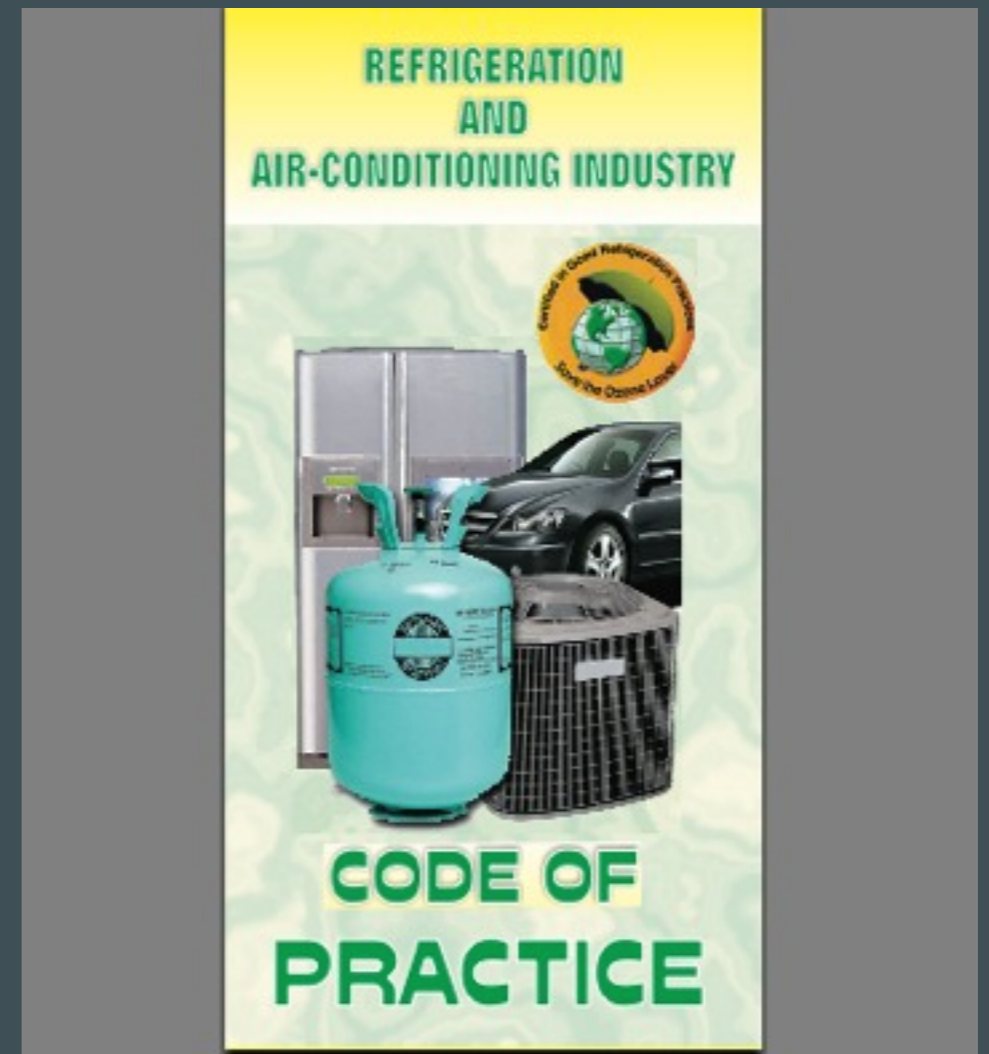
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## 4.9 Retrofitting and Alternatives

It is often expensive and not economically advisable to dispose of some systems just because they contain ODS. It is therefore advisable to fit the new or alternative gases into the old system. Retrofitting to alternative refrigerants should be considered when replacement of the existing system is economically unacceptable.

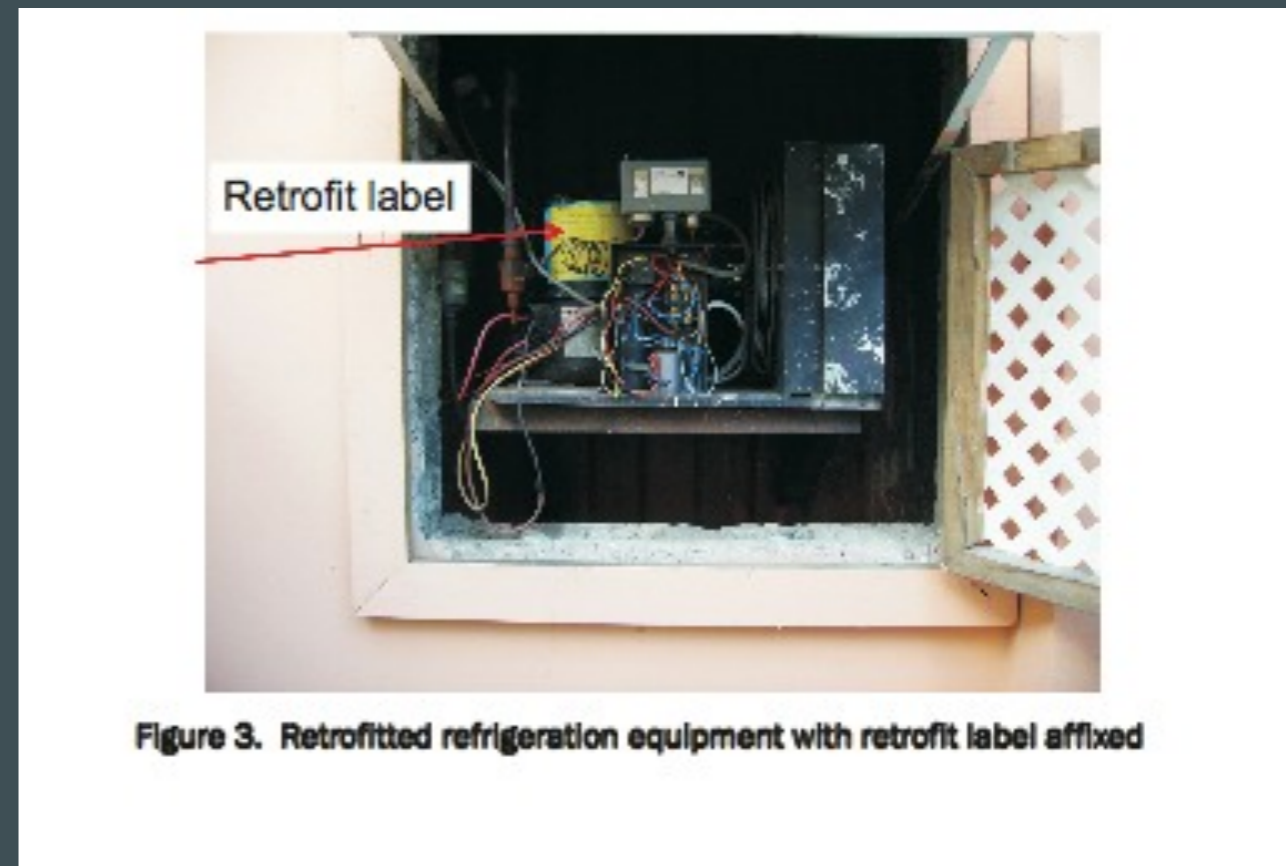
### PRACTICES TO FOLLOW

1. Consider the expected energy efficiency, performance and operating costs of the retrofitted system in addition to the direct retrofit costs.
2. Consider the properties of the alternative refrigerant such as flammability, toxicity and its global warming potential; some of these properties may require additional safety measures.
3. Consider retrofitting when major damage of the existing system requires expensive repair work.



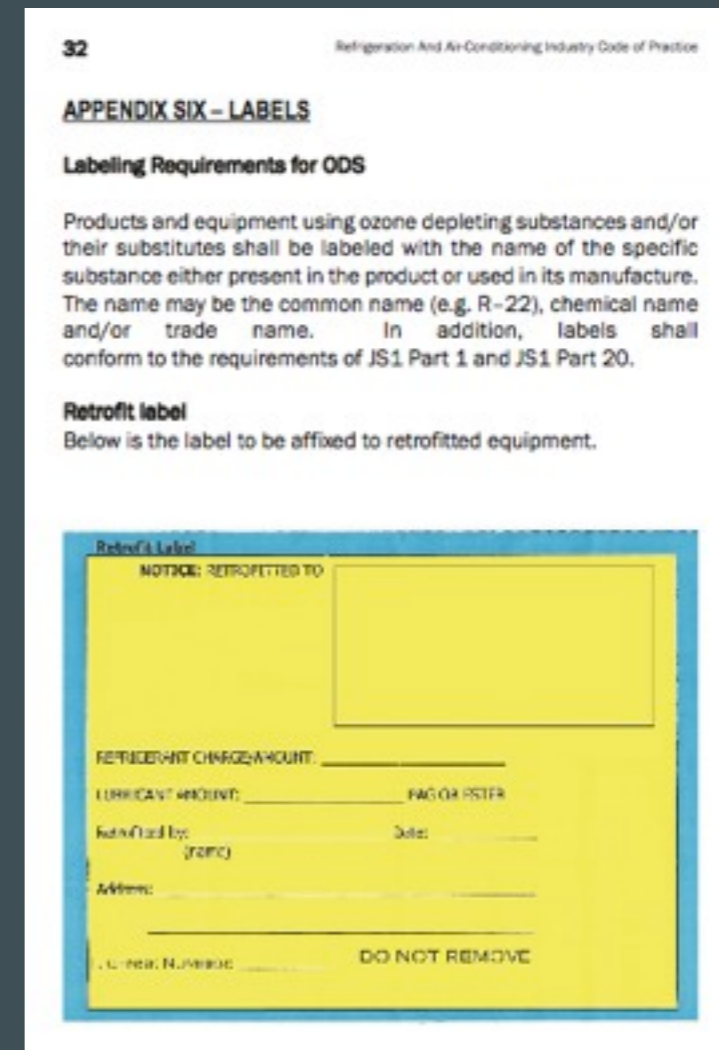
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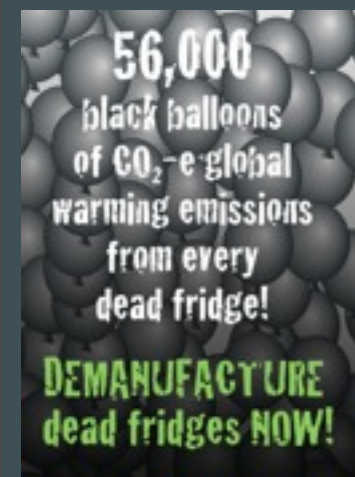
# Thanks for your attention



- Contact for further information:

[brent@greencooling.org](mailto:brent@greencooling.org)

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