# HYDROCARBON REFRIGERANT CONVERSION REPORT

For

# GDI PROPERTY GROUP BUILDING ADELAIDE TERRACE, PERTH, W.A.



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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 air conditioning 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.



**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 engas 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.

**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.

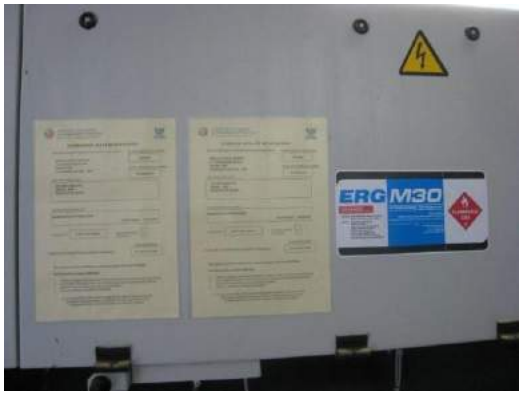
**General Observations.**

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.




## Conclusions

## Benefits and points of interest

There are two enormous benefits for the building owners now that the Carrier Chiller has been converted to engas 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 (CO2), 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 CO2 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 CO2 equivalent/KG over 20 years. Therefore 587,400 KGs of CO2 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 CO2.

## Energy Saving

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

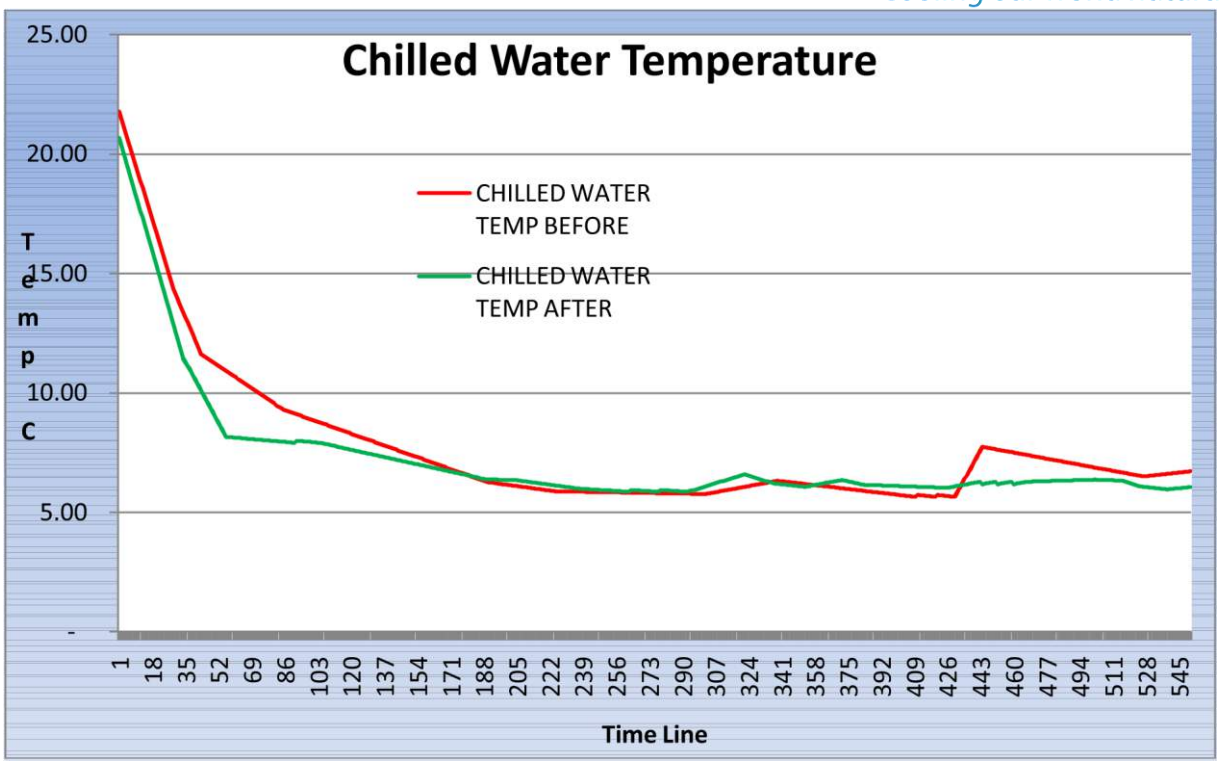
1) The thermal efficiency of Hydrocarbon Refrigerants is far better than Chemical Refrigerants.
2) The density of Hydrocarbon Refrigerants is approximately half that of Chemical Refrigerants.
3) It is not necessary to raise the pressure or temperature of Hydrocarbon Refrigerants to the same level as 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.

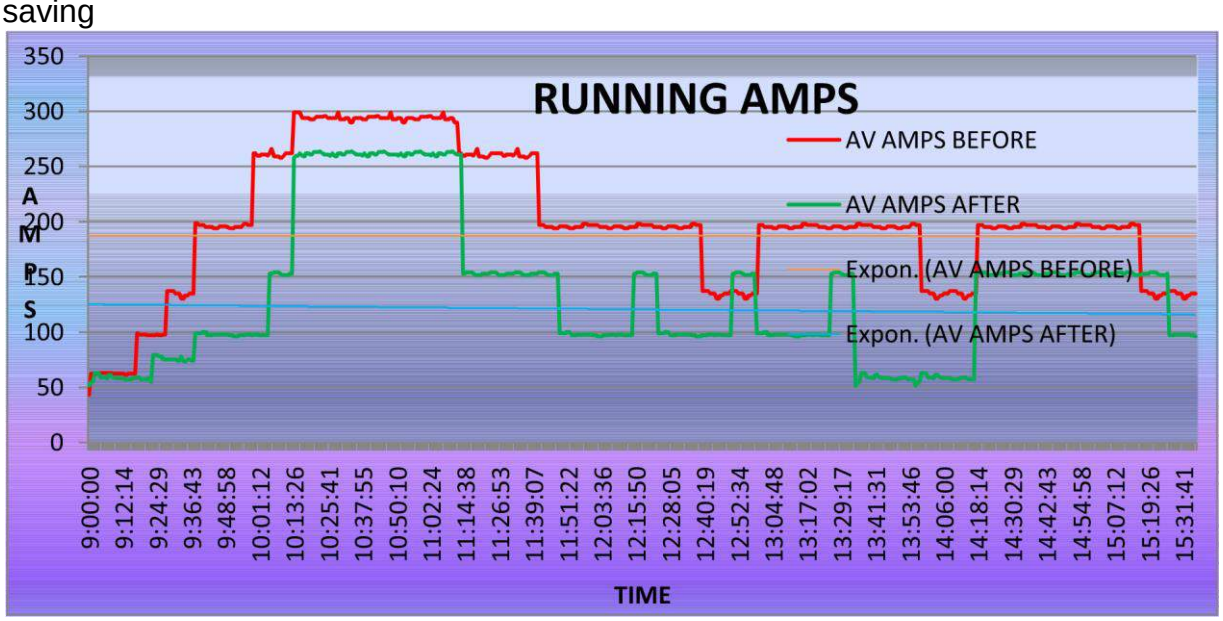
Chilled Water Temperature.

The graph shows the water temperature falling faster post conversion.



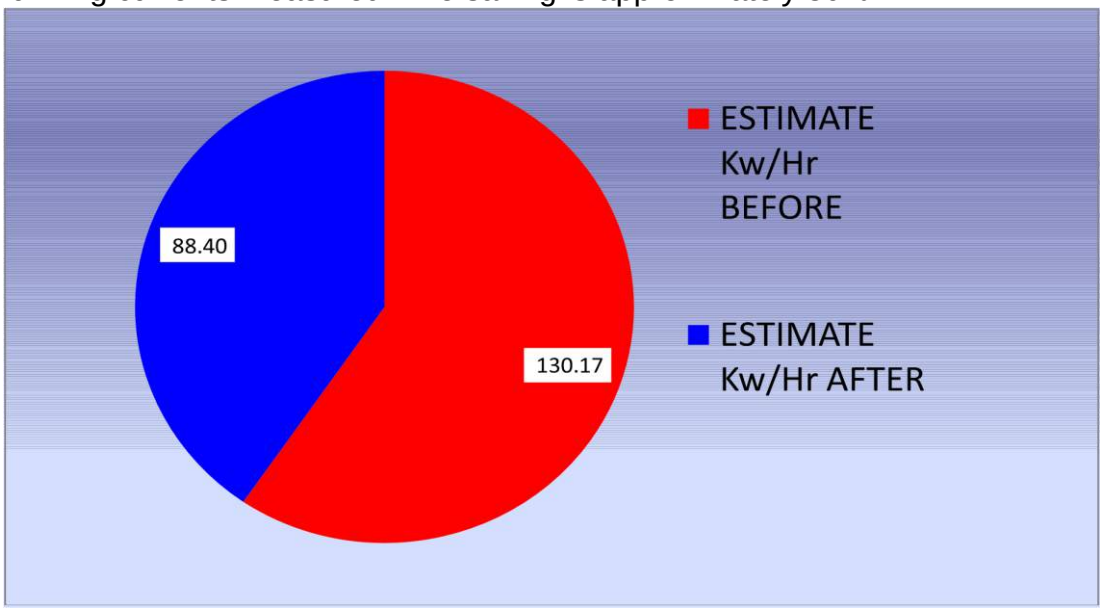

Running Amps

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



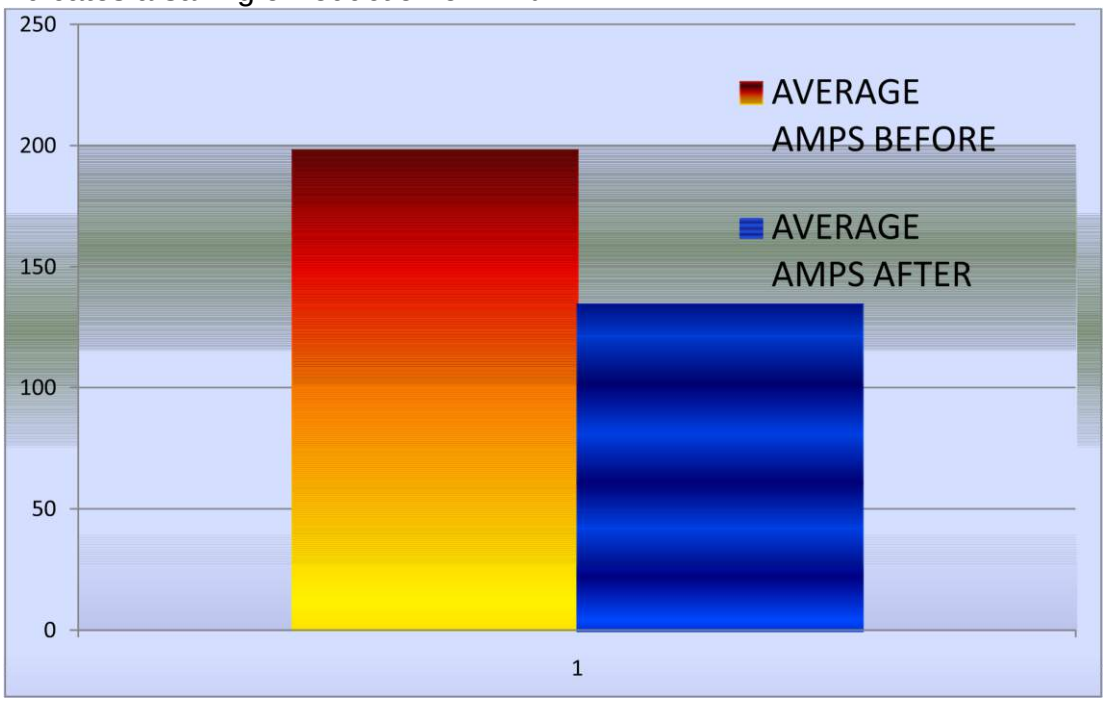
Kilowatt Hours

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




Run Load Amps

The graph clearly displays average amps before and average amps after. This indicates a saving or reduction of 21%



## Conclusion on Energy Saving

The Energy saving based on the recorded data and taking into consideration actual power saving appears to be 25% at the point of the conversion.