

The Future Of HVACR in Australia

Why do refrigerants matter?

Because they are central to refrigeration and air conditioning (HVACR). Without refrigerants we would not have the benefit of 53,000,000 installations of refrigeration and air conditioning in Australia that serve just about everyone, everywhere. They are pervasive and fundamental to our quality of life.

Why are refrigerants changing?

Because the vast majority of refrigerants in use today are not energy efficient and have a high global warming impact caused by synthetic refrigerants (fluorocarbons, HFC, HCFC). Synthetic refrigerants were developed beginning about 80 years ago when our engineering capabilities were not sufficient to address the safety controls required for natural refrigerants. At the time we didn't understand the environmental risks associated with ozone depletion and global warming. We now understand that these environmental risks are a major threat to the quality of life and will be increasingly so if we do not discontinue the use of high GWP synthetic refrigerants.

There is global agreement to the need to eliminate the use of Ozone Depleting synthetic refrigerants. As a result the 197 countries that are signatories to the Montreal Protocol have agreed to eliminate their use – in the industrialised world, including Australia, by 2020. The quota for importing of these refrigerants into Australia is now a small proportion of the historical rate. As a result HVACR equipment that uses ozone depleting refrigerants (CFCs & HCFCs) are being replaced.

There is also effectively global agreement that high global warming synthetic refrigerants have to be eliminated ("phased down") as well. Whilst these refrigerants (HFC) were developed to replace Ozone Depleting refrigerants, it is now clear that their global warming impact is a real and current source of environmental harm. It is critical to understand that the global warming impact of HFC refrigerants is caused by both their low energy efficiency and their high global warming potential.

We need to replace synthetic refrigerants with refrigerants that are energy efficient and low Global Warming, the natural refrigerants: hydrocarbons, ammonia, carbon dioxide, air and water. This means replacing or converting HVACR systems to use natural refrigerants.

The switch to natural refrigerants is being promoted and incorporated in international agreements worldwide. The European Union has established legislation for this purpose. Negotiations to enable global agreement for the phase down of HFC refrigerants has begun in earnest. It is highly likely to become the responsibility of the Montreal Protocol. As a result manufacturers of HVACR equipment are switching to natural refrigerants because they are more energy efficient. We need to be prepared and able to use this new technology. We need to embrace and encourage the use of this technology under Australian conditions.

Why does the global warming impact of refrigerants matter?

Because energy use and global warming are two sides of the same coin. When you choose an HVACR system you choose a refrigerant because the HVACR system is designed for a particular refrigerant. When you choose a refrigerant you choose energy efficiency and global warming. There is no reason not to realize both benefits by choosing natural refrigerants.

Because all HVACR equipment leak refrigerants sooner or later. It is hard and expensive to stop the leakage of high global warming refrigerants – synthetic refrigerants. By using natural refrigerants with low global warming we eliminate the problem and gain energy efficiency.

The global initiative to reduce the use of high global warming synthetic refrigerants reflects the forecast that HFC refrigerants will become as much as 19% of global emissions by 2050 if we do not dramatically reduce their use. This forecast is based on the 100 yr. GWP of synthetic refrigerants, which dramatically understates the risk. HFC refrigerants have an atmospheric life of 21.7 yrs. on average. Their 20 yr. GWP is twice their 100 yr. GWP. As a result the true forecast of the global warming impact of synthetic refrigerants is far greater. This is why the Climate and Clean Air Coalition refers to HFCs as short-lived climate pollutants (SLCP) and calls for dramatic reduction in their use in the next 15 years.

What is the future of refrigerants?

Most refrigerants in use today are high GWP synthetic refrigerants. They need to be replaced by low Global Warming Potential (GWP) refrigerants. This switch is considered inevitable and is rapidly becoming a matter of international agreements. There are three kinds of low GWP refrigerants:

- Natural Refrigerants – hydrocarbons, ammonia, carbon dioxide, air, water
- Hydrofluoroolefins (HFOs) – low global warming synthetic refrigerants.
- HFO / R32 blends – not low global warming

Natural refrigerants are highly energy efficient, low cost and environmentally preferable.

HFOs are not more energy efficient than the high GWP Synthetic refrigerants they will replace, very expensive and carry serious WH&S risks.

HFO blends like HFO & R32 have been suggested. These have been offered as low GWP but they in fact are not. The 20 yr. GWP of R32 is 2330 times carbon.

So the future of the HVACR industry is Natural Refrigerant based technology vs. HFO refrigerant based technology. Read on to make your assessment.

Why are refrigerants so controversial?

Because there is a clear division between synthetic refrigerant manufacturers and natural refrigerant manufacturers. Synthetic refrigerant suppliers have enormous investments in the production of patented synthetic refrigerants and therefore have a great deal to lose if their products are replaced by natural refrigerants. As a result they tend to be highly critical of natural refrigerants despite the extensive evidence that natural refrigerants are energy efficient and widely accepted in many sectors.

Synthetic refrigerants were originally developed, 80 years ago, because they were, at the time, considered safer than natural refrigerants. Our ability to manage refrigerants has changed a great deal over the period. Natural refrigerants can now be used safely. But the synthetic refrigerant suppliers would rather criticize their competitors than recognize the truth. They create the controversy that serves their purpose regardless of the importance and benefits of natural refrigerants and the risks of low GWP synthetic refrigerants.

How energy efficient are natural refrigerants?

It is not possible or accurate to give one number because there are many variables. However it is the innate characteristics of natural refrigerants that make them more energy efficient, they absorb and release more heat than synthetic refrigerants. It is a fact that each natural refrigerant used in the right way in a given HVACR application has the potential to deliver at least 10% greater energy efficiency and often as much as 40% greater energy efficiency than a synthetic refrigerant used for the same purpose. If you are replacing old HVACR equipment using HFC or HCFC with new technology using natural refrigerants the gain in efficiency can be as high as 50%.

If you combine new HVACR equipment with better energy management and heat load management you can achieve far greater energy efficiency; 60/70%.

There is an enormous amount of research proving this fact. It is not a matter of debate. There are 700,000,000 hydrocarbon refrigerators in use worldwide and about 100,000,000 manufactured every year. They have been proven to be more energy efficient.

The energy efficiency of HFOs is as yet unclear but there is little evidence that they are importantly more energy efficient than the high GWP refrigerants (HFCs) that they are proposed to replace. Why invest in an HVACR system that is not more energy efficient than your current system when you can realize important increases in energy efficiency by using natural refrigerant based technology and future proof your HVACR investment.

Can HVACR equipment be converted to the use of natural refrigerants?

There is no simple answer to this question because each installation has unique characteristics. However it is absolutely true to say that the vast majority of HVACR equipment can be converted to the use of natural refrigerants if the new system is designed by a competent professional. Equally an untrained user of any refrigerant can offer a design that is not as safe as it should be.

What will be the outcome of replacing refrigerants?

Australia can reduce its energy use in HVACR by at least 50%, a saving of about \$4.5B PA. Most of this improvement will come from replacing the refrigerants in use to natural refrigerants. Together with other means of increasing HVACR efficiency we can achieve this level of savings and possibly a great deal more, potentially \$10B PA.

At the same time we can reduce our greenhouse gas emissions from refrigerants by virtually 100% and help other countries do the same.

For individual buyers and users of HVACR equipment the transition to natural refrigerants will deliver important energy cost savings.

How Much Refrigerant do we use?

We import about \$700M PA in synthetic refrigerants. We manufacture most natural refrigerants in Australia. By replacing synthetic refrigerants with natural refrigerants we can reduce imports by up to \$700M and increase both domestic production of natural refrigerants and exports of natural refrigerants and HVACR services.

Are there any risks associated with the use of refrigerants?

The frequency of WH&S incidents in the HVACR industry is very low, in fact so low that there is not reliable reporting on the frequency of HVACR safety incidents. The frequency of WH&S incidents worldwide is also not reported but it is certainly far lower than the health and well being harm of climate change today, let alone in the future.

The environmental harm of synthetic refrigerants is well known and growing. If we don't replace them their use they will continue to grow and become a major source of greenhouse gas emissions with serious health and well being consequences.

All refrigerants must be and can be handled with care by trained professionals. As we transition to low GWP refrigerants it is important that we train HVACR technicians in their use.

What are the safety risks associated with refrigerants?

Each refrigerant has a unique set of safety considerations. All refrigerants have safety risks that require particular engineering and management practices to ensure safe use. All natural refrigerants can be used safely by trained professionals. The safety standards of the industry are currently under review in Australia.

Hydrocarbon refrigerants are flammable just like the flammability we depend on for natural gas heating, cooking, in aerosols and in lighters. We use natural gas extensively and handle these risks with minimal consequences. The risks associated with using small amounts of hydrocarbon refrigerants for HVACR purposes are trivial by comparison.

Small charge uses of hydrocarbon refrigerants in domestic refrigerators and small air conditioning systems present an extremely low risk. Larger charge uses of hydrocarbons need to be controlled by engineering solutions that detect leakage and eliminate the risk.

HFO and R32 (a synthetic refrigerant being offered as having low GWP despite having a 20 yr. GWP of 2330) are also flammable. However when they burn they generate highly toxic materials that can be lethal. Leading car manufacturers like Mercedes, Porsche, Audi, Volkswagen, and BMW have refused to use the HFOs for motor vehicle air conditioning because their research indicates they are too dangerous.

Ammonia is toxic and flammable but widely used for industrial and commercial HVACR purposes through the use of engineering solutions that virtually eliminate these risks. Because ammonia is a highly energy efficient refrigerant it is widely used in industrial and commercial applications.

Carbon Dioxide is non flammable but high pressure. It is also a high efficient refrigerant that is used in a wide range of commercial refrigeration applications.