

HVAC&R NEWS

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WHERE TO NOW?

The path forward for refrigerant transition



The HVAC&R industry has a roadmap to phase down HFCs and move to more environmentally friendly alternatives. But Europe is considering a new course that has people talking. Louise Belfield reports.

The Montreal Protocol, adopted back in 1987, regulated the production and use of ozone depleting substances. For the HVAC&R industry, that meant a move away from CFC and HCFC refrigerants to alternatives such as HFCs.

But HFCs also have their drawbacks – specifically, they exacerbate global warming. And so, in 2016, the Kigali Amendment to the Montreal Protocol laid out a plan for the world to move away from HCFs refrigerants with high global warming potential. At last count, 151 countries have signed up, including Australia.

Our HFC phase-down started in 2018, and laid out a plan for reducing HFC use right through until 2036. The Australian government, with industry support, moved quickly and strongly – a 25 per cent reduction in baseline that was more than 30 per cent below the minimum requirements under the international agreement.

But recently, Europe has proposed a new roadmap, with a faster phase-down. The Europeans are also considering bans on the use of HFOs – the low-GWP refrigerants that in many cases were supposed to replace HFCs – because of concerns around their environmental impacts.

So, where does that leave Australia?

AUSTRALIA NOW

Refrigerants Australia Executive Director Greg Picker says there is a long history of transition in the industry.

“We have shifted away from CFCs and HCFCs and are getting set for another period of marked change as we move away from high-GWP hydrofluorocarbons,” he says.

“That said, we have gotten comfortable – probably too comfortable – with the suite of gases we currently use. This will need to change quickly.”

The most likely place he sees an impact is in the use of R404A in refrigeration. With a “very high GWP – nearly 4,000”, there are replacements that can be used in the same equipment with the same safety classification.

These have been approved by manufacturers, Picker says, and he believes this market will shift strongly here over the next 18 months, with other sectors following after that.

University of Melbourne Associate Dean of Environment and Sustainability at the School of Geography, Earth and Atmospheric Science, Associate Professor Robyn Schofield says the Kigali Amendment to the Montreal Protocol means the production and use of HFCs is being phased down.

But Australia’s current implementation of the phase down is unlikely to achieve the desired result.

“Air conditioning is a major growth sector for greenhouse gases, with quotas only on refrigerant recharging, not on pre-charged equipment such as fridges, heat pumps and EVs,” Associate Professor Schofield says. “And while HFOs don’t have GWP, they are considered forever chemicals and as such present other environmental concerns.”

CA Group Services Director Ian Tuena, AM.AIRAH, is direct. “We’re going backwards,” he says.

And he puts that down largely to a lack of education and understanding of natural refrigerants and how to handle them.

“If you look at the *Cold Hard Facts 2022* report, the refrigerant bank is climbing, not declining. And we can’t move to natural refrigerants because, of the approximately 33,988 qualified mechanics we have in the country, there may be just 1,000 who could work on one of the refrigerants of the future.

“That number drops to about 200 who could work on two of those refrigerants – ammonia and hydrocarbon – and drops to about five who could competently work on all three. So, the bulk of [the 33,988] have grown up

on a diet of synthetic refrigerants [and] they've never been exposed or educated in the others.

"We simply don't have the people who have the skillset to work on the transition or the new refrigerants."

Scantec Refrigeration Managing Director Stefan Jensen, F.AIRAH, also does not believe Australia has progressed very far since the government introduced the CO₂-based HFC import quota that took effect in January 2018.

FOLLOWING EUROPE'S LEAD

As well as proposing a more ambitious phase-down timetable, Europe is also considering a ban on PFAS, which would include some HFO and HFC refrigerants.

The European Chemicals Agency (ECHA) has characterised many thousands of chemicals as PFAS or "forever chemicals", Jensen says. "With very few exceptions, most of the so-called fourth-generation refrigerants (HFOs or HFO/HFC blends) are within the basket of chemicals that ECHA have labelled as belonging to the PFAS category."

In late March or early April 2023, the EU Commission voted overwhelmingly in favour of a ban on these substances, Jensen points out. There are two additional votes that the ECHA proposal must pass for it to become law. Member states would also need to adopt the regulations, and at this stage many countries have not made their positions clear. But almost all synthetic refrigerants could eventually be banned in new equipment within the EU.



Australia has its own PFAS issues in relation to the run-off of fire extinguishing materials from airfields causing soil contamination on the properties of adjacent landholders, Jensen says. There is an ongoing class action in relation to this matter.

"Nevertheless, the PFAS issues in relation to chemical refrigerants does not yet appear to have caught the attention of [Australia's] politicians and regulators, but it should," he adds. "At the April 2023 IIR/IIF conference in North Macedonia, several speakers documented PFAS contamination in soil, water, and food supply."

Greg Picker, however, says there is lack of understanding about PFAS.

"PFAS is used in an unbelievably wide variety of things: non-stick pans, food packaging, clothing and textiles, smart chips, gaskets, wiring harnesses," he says. "It's in tons of stuff that is essential."

"DEFRA (the Department for Environment, Food & Rural Affairs in the UK) has said that regardless of the question of whether HFOs create harmful PFAS or not – and despite what some people

say, it's not settled science – we have to have some sort of assessment of where we need these substances and where we don't, and they think we absolutely need it for heat pumps and refrigeration and air conditioning equipment. This is not a non-essential use."

Picker also believes that, sometimes, "we focus on Europe too closely". At the recent Montreal Protocol negotiations, Picker noted that EU representatives agreed that their approach works for them, but, "other countries need to develop approaches that work best for them and not follow the EU".

But he notes that the rules of EU policy will be felt worldwide.



Sometimes we focus on Europe too closely

"The Europeans are certainly trying to change the technology mix around heat pumps, air conditioning and refrigeration but they have not yet come to a landing."

However, our industry is truly global, he says, and is driven by the large markets and manufacturing centres across the world.

"The United States is commencing implementing the AIM Act, which sets a new approach for refrigerants, and Japan has embarked on a tremendously exciting program of research and deployment of new technology.

"If we're going to base our phase-down schedules on [other countries' approaches], I'd look to Japan. Why? Because that's where most of our equipment comes from, or if it's not from Japan, it's from companies that are based in Japan manufacturing in the region.

"Japan is doing it differently, but they're doing some very innovative stuff that's as good as the Europeans, and I would contend with a bit more recognition about what's technically possible. Government and industry are working on this together – it's more collaborative.

"We're in a global race to push technology development and deployment as quickly as we can. Regulations will help deliver this outcome, but they need to be well calibrated. Time will tell which countries have the right settings."

RISKS AND OPPORTUNITIES

"Getting the phase-down right is critically important," Picker says. "Done well, it will drive change quickly and will ensure the critical services provided by heat pumps, refrigeration and air conditioning equipment are not curtailed. If those settings are wrong, the negative consequences could be profound, either making cooling and heating more expensive and less available, or increasing emissions."

Understanding the impact from various decisions won't be easy, Picker adds.

"Too sharp a phase-down and industry won't be able to deliver services easily and may end up using high-GWP refrigerants already deployed to service new equipment and actually increase emissions."

But according to Jensen, there is a major risk associated with doing nothing.

"The UBA (Umwelt Bundesamt) report titled *Persistent Degradation Products of Halogenated Refrigerants and Blowing Agents in the Environment: Type, Environmental Concentrations, and Fate with Particular Regard to new Halogenated Substitutes with Low Global Warming Potential* published by the German EPA makes clear that the increased use of R1234yf in motor vehicle air conditioning systems coincides with a rapid rise in TFA (trifluoroacetic acid) in waterways and lakes recorded over a two-year period. TFA is an acid that is about 30,000 times stronger than HCL."

And currently, there are no methods readily available for removing this contaminant, he adds.

"Only about 1 per cent of the water on Earth is suitable as drinking water. TFA has the capacity to damage or destroy this resource. The opportunity for Australia and other nations is to adopt a top-down approach and introduce refrigerant bans sooner rather than later.

"It was a similar approach that Denmark adopted in 1996 under the then Danish Minister for the Environment Svend Auken. This contributed to making Denmark one of the world leaders in natural refrigerant applications.

"Australia could be the Scandinavia of the Pacific. Instead, we appear to be doing what we can to retain status quo."

Ian Tuena agrees. "We give the illusion that we're doing a lot, but we're actually not," he says. "We should be introducing policies like Denmark did in 2012."

Associate Professor Schofield is also on board. She says while some natural refrigerants require special handling because of their flammability or may be less efficient, as with CO₂ in space heating/cooling, they are absolutely where refrigerants need to be going.

HOW TO MOVE FORWARD

Picker says at the moment, there is no capacity to adjust the quota downwards; however, Australia should look to accelerate its transition to refrigerants with lower impact so we can consider this in the future.

He says Refrigerants Australia has, for more than five years, called for the federal government to put in place GWP limits on small air conditioners (which the government announced this June), for refrigeration uses to transition away from R404a (which the government is investigating), and in car air conditioners (a recent consultation on vehicle fuel efficiency standards considered this issue).

"Once these transitions are in place, it may be possible to further tighten the quota, but to do so now would be premature," Picker says.

But Stefan Jensen says Australia needs to do what Denmark already has done and what the EU is now considering doing.

"During his presentation at the Eurammon Symposium on the 27 June, Cornelius Rhein of the EU Commission outlined the ongoing discussions within the Commission with respect to strengthening the HFC phase-down and possibly move towards a ban for certain substances. These discussions are anticipated to be finalised around November/December this year.

"As outlined above and in Dr Michael Kauffeld's report to the EIA published in 2012, bans of unwanted substances are the most effective way of reducing

A QUESTION OF QUOTAS

In Australia, we don't count refrigerant in imported pre-charged equipment in our HFC quota.

Scantec Refrigeration's Stefan Jensen, FAIRAH, says the official reason provided by the Australian government representatives is that HFCs imported in pre-charged unitary equipment are subject to the HFC controls in their respective countries of origin.

"Some of these countries of origin, however, are categorised as Article 5 countries (developing nations), and as such, the HFC phase-down in these countries takes place over a significantly longer period than in Australia.

"It is therefore questionable as to what extent the HFC controls within these nations have a measurable impact on Australia's HFC imports," he says. "If the purpose of the Australian HFC import quota is to reduce HFC importation, then the only logical approach is to make that quota applicable to all HFCs, regardless of how these enter the country.

"HFCs imported within pre-charged unitary equipment will ultimately either leak out into the environment or they will be recovered and destroyed/re-used. Either way, these substances circumvented the HFC import quota and contributed to the environmental damage that the CO₂e-based HFC import quota is there to mitigate."

Associate Professor Schofield of the University of Melbourne says the pre-charged issue is illustrative of how the effective management of CFCs under the Montreal protocol worked well in contrast to how GHGs are managed.

"Given that most of our refrigerants are imported in pre-charged goods it is ineffective policy not to control at the point of entry."

Refrigerant Australia's Greg Picker, however, says Australia is following international best practice in how we manage refrigerants.

"Australia, like every other country in the world, is required by the Montreal Protocol to be responsible for bulk gases entering the country," he says. "Refrigerant contained in pre-charged equipment is accounted for in the country of manufacture.

"The Europeans have chosen to account for imports in pre-charged equipment. But it is worth noting that less than 10 per cent of refrigerant entering in the market in Europe comes in pre-charged equipment – it is a non-issue there. In Australia, that amount is in excess of 40 per cent and we simply could not incorporate refrigerant from equipment into the quota as it is not included in the baseline."

He adds that the government can support technology changes through GWP limits on equipment types, like those recently announced for small air conditioners.

"Also, Australia has a long history of being fast adopters of new technology in this industry," says Picker. "We were the second country in the world to adopt R32 for example – and it is fanciful to think we will reject this tradition." ■

the emissions of HFCs. A failure to do so could mean that the HVAC&R industry is caught either unprepared or insufficiently prepared for the impact of these kinds of overseas political initiatives,” Jensen says.

Associate Professor Schofield says the EU policy development in this area is “absolutely where the Australian public would like the energy transition to be taking them”.

“I’d like to see Australia having strict and clear HFC import bans and being across the latest science and alternatives for HFOs so we don’t end up with a forever chemical issue in 5–10 years’ time.

“We have a carbon-intensive electric grid, so a full life-cycle analysis should be required for small studies (i.e., government) and large AC refrigeration installations (required of all commercial builds),” she says.

“Ensuring energy efficiencies and air quality through insulation and heat and enthalpy recovery systems is also vital. Heat pumps and chilled beams don’t refresh the air and have caused COVID superspreader events indoors.”

The public expect policies to be holistic, Associate Professor Schofield says. This means incentives to replace gas heating with heat pumps should not indirectly increase GHGs or add to our forever chemical burden via their pre-charged refrigerants.

Tuena also wants to follow the lead of Europe, and particularly Denmark.

“Denmark started to force technology and change in 2012 basically by banning systems

In March, the European Parliament’s ENVI Committee agreed to amendments to the F-gas regulation that would see bans on fluorinated gases in refrigeration and air conditioning equipment over the next five years.



with a charge over 10kg – you had to put a low GWP in – and that government policy forced the adaptation of technology,” he says.

“The country became the leaders in transcritical systems, and everyone’s followed from that.

“If we implemented the Danish plan, that would significantly hasten the transition to natural refrigerants, by the consumer, by the architect and consultant, and by the industry. But you’ve still got to get the skill set up.”

And Tuena says there are funds available to back the training. He believes more could be done with the money collected through levies and licences.

Tuena became so frustrated and disillusioned with the current state of training, he personally invested half a million dollars and built his own CO₂ trans-critical mobile training pod. It travelled across the country last year and successfully trained 250 mechanics with hands-on practical experience in transcritical CO₂ systems, he says.

“If a small business like mine can spend half a million and build the necessary equipment to train, why can’t those who receive significant funding via levies and licence fees do the same?” he asks. “The interest alone earned from funds in investment accounts held others in the industry that has been collected through levies on refrigerants would go a long way in helping retrain the industry.” ■