As seen in
Air Conditioning | Heating | Refrigeration
theNEWS

February 3, 2020

Global HVACR Industry Will Continue to Improve with Each Generation

Future-proof Solutions Are a Myth

In an ideal world, we would respond to the global phasedown of hydrofluorocarbon (HFC) refrigerant gases by transitioning to a refrigerant technology that would never have to be replaced again: a "future-proof" solution that would ensure no further disruptions or further regulations.

Some are trying to sell us that dream. But is it realistic? Is there anything out there that is actually future-proof? The short answer is a definitive no. The long answer is a bit more complicated.

The basic cooling technology employed by most refrigerators, air conditioners, and heat pumps is vapor compression — essentially, a continuous closed loop where a refrigerant is alternatively compressed and expanded inside an electrically powered mechanical system. Vapor compression has been around for more than a hundred years. Working fluids used for this technology must meet various criteria — safety, efficiency, material compatibility, and minimum environmental impact.

The gases that were initially used did not meet the most important criteria — safety. Toxic ammonia and sulfur dioxide and explosive hydrocarbons, while providing generally good efficiencies, were acutely dangerous to handle. In fact, chlorofluorocarbons (CFCs) were invented in the 1930s to provide a safe and efficient alternative; they became the standard. In the 1980s, as their negative environmental impact on the ozone layer became known, the industry met the challenge with HFCs, which have no ozone layer impact. Today's challenge is to address HFCs' potential climate impact. Once again, the industry is ready to provide safer and more efficient solutions.

The new generation of choices available today all have a reduced impact on climate. All of them, including those marketed as "natural refrigerants," are in fact factory-made. Ammonia and HFOs are synthesized in chemical reactors. Hydrocarbons are petrochemicals produced by cracking in oil and gas refineries, and CO2 is a purified industrial gas. All must also be further refined to meet the purity requirements of today's equipment. All consume raw materials and energy and produce waste when manufactured. All must be packaged and transported. In short, all require tradeoffs. The user must decide which tradeoffs they can accommodate to best meet their needs:

- Hydrofluorocarbons (HFOs/blends) — familiar, non-toxic, efficient, but some can be mildly flammable.
- Hydrocarbons (such as propane) — non-toxic and efficient, but highly flammable or explosive.
- Ammonia — efficient, but highly toxic and mildly flammable.
- CO2 — non-toxic and not flammable, but requires very high operating pressure, complicated controls, and may not be efficient in all climates.

Can any of the above solutions provide us with a future free of disruption? What kind of disruption are we willing to tolerate? If your facility has to be evacuated because of an ammonia leak, that is disruptive. If you have a hydrocarbon-related explosion, that is disruptive. If your system frequently breaks down due to the complicated system required to run under a very high pressure, that is disruptive. If you cannot find skilled workers to service complex new systems, that is disruptive. And, of course, transitioning itself is tremendously disruptive.

No one knows with certainty what challenges we will have to address in the future. We do know the global HVACR industry can and will continue to improve. To call any solution "future proof" means that users will be forever satisfied with the status quo and will not seek better alternatives. Are we willing to settle for the solutions before us today in perpetuity?

Rather than espouse an unrealistic — and misleading — dream scenario that we have found the silver bullet of refrigerants and that no better options will emerge as we see advances in science and innovation, industry can and should continue to challenge itself to focus on what we know are important factors: maximizing efficiency over the lifespan of our equipment and seeking to improve continuously with each new generation while keeping a focus on the environment and safety.

Author: Jordan Smith, Executive Director, globalFACT