

## REASONS WHY HFO REFRIGERANTS ARE A STRONG ALTERNATIVE TO NH<sub>3</sub>/AMMONIA

### PILLAR 1 - COSTS SAVINGS



#### INTRODUCTION

When installing an industrial chiller in a food, beverage, or dairy setting, it is important to consider whether NH<sub>3</sub> (ammonia) is indeed the most appropriate refrigerant solution.

In food and beverage processes, it has been a traditional approach to have the cooling process applied by an "Industrial" cooling system, typically using ammonia as refrigerant. Some reasons are based on unconscious bias, some other reasons are the "natural" aspect of ammonia.

But now companies that need a mild freezing cooling system are increasingly turning to Hydrofluoroolefin refrigerants – known as HFOs – to improve sustainability, boost performance, and significantly reduce costs.

The ideal refrigerant for these sectors needs to be non-toxic, non-flammable, non-explosive, non-corrosive, not harmful to the environment, cheap and easy to produce / work with and have good thermodynamic properties. Luckily, HFOs meet this criterion. And simply put, HFO solutions are always lower cost versus NH<sub>3</sub>/ammonia.

HFO refrigerants are categorised as having zero ozone depletion (ODP) potential and low global warming potential (GWP) and R1234ze is a synthetic refrigerant, rather than a natural refrigerant like ammonia. Interestingly the GWP value of R1234ze is less than the GWP another natural refrigerant CO<sub>2</sub> (being 1) and importantly R1234ze doesn't create TFA (trifluoroacetic acid and its salts).

Here we look at the aspect of cost savings.

#### COST OVERVIEW

There are various reasons why specifying a chiller running on R1234ze refrigerant is cheaper than selecting an ammonia refrigerant chiller (which have been traditionally and historically found in certain food, beverage and dairy facilities). These include the cost of copper (and it also has better heat transfer properties), lower hazard level, standard design and economies of scale.

ICS Cool Energy have worked on several projects in the food, beverage, and dairy markets where significant cost savings have been achieved, especially following the ramp up of HFOs over the last 2-3 years and these successes have been supported by a special "mild freeze" version within our chiller platform.

As a global HVAC / process leader with ambitious plans to deliver energy efficient and cost-effective cooling solutions to customers across EMEA, we are looking forward to delivering excellent savings for our customers across Europe. It is critical to understand the scenarios where R1234ze could be a strong alternative to ammonia, bringing financial savings yet still remaining kind to the environment and keeping sustainability at the forefront of our minds (2030 Gigaton Challenge\*). It is important to note however that there are still some specific scenarios where ammonia will still be a sensible choice, almost solely due to chiller size/kW cooling demands. These cases can all be determined following a comprehensive site survey and with full understanding of the customer's expectations.

\*The Gigaton Challenge is explained here:

<https://www.tranetechnologies.com/en/index/sustainability/gigaton-challenge.html>

#### PRODUCTION

Chillers running on R1234ze benefit from a lower first cost because they don't have to be built to meet the rigorous specifications that ammonia systems need to adhere to. Being a standard design and produced according to ICS Cool Energy's standard production processes, economies of scales means that prices will generally be lower. A chilled water system running on ammonia refrigerant is a non-standard product and with that requires more design time, is produced in a more bespoke way, and therefore carries higher associated project costs (e.g., materials like copper are not compatible and must be avoided during manufacture).

#### SAFETY COSTS

Safety precautions with ammonia chillers will certainly incur additional (seemingly hidden) costs beyond just the chiller itself. Given the toxicity of the gas, should a leakage occur, buildings and sometimes surroundings will need to be evacuated. Special planning permission to mitigate hazards or documentation to adhere to local regulations may imply further financial investment. Furthermore, ammonia as a refrigerant is volatile and if mixes with air in the 16%-25% range it can cause explosions capable of causing significant damage. A standard HFO chiller running on R1234ze can be easily installed without these safety concerns, implications, or considerations.

## **COSTS FOR SERVICE, MAINTENANCE AND CONTINGENCY PLANS**

There will be increased ongoing costs associated with service and maintenance of ammonia chillers due to the toxicity of the refrigerant and keeping it suitably contained. Every sensor, every valve and every other safety measure reduces reliability, so it's no surprise the fewer the components there are the better, cheaper, and easier it is to maintain. Chillers running on ammonia refrigerant need a more robust contingency plan to cope should breakdowns occur. Because of this, prices are likely to go up in-line with the expert response required in such situations. Conversely, planned preventative maintenance of HFO chillers is for the most part routine and inexpensive in comparison.

In a recent project for a global brewery based in the UK, the customer initially had preference to purchasing a new ammonia chilled water system. In this case however, the ammonia chiller quotation from a third-party supplier came in at double the cost of the HFO solution quoted by us, considering some calculations not only for the initial investment, but life cycle costs of servicing and maintaining an ammonia system. The customer had these costs to hand as this was what they had been doing until now on their other cooling plant. It was therefore easy for our sales engineer to demonstrate the lifetime costs of our solution by showing examples of service contract and parts costs for HFO chillers. It is no surprise that the ammonia quote was immediately disregarded and the HFO solution selected.

## **TO KEEP IN MIND**

In certain and very individual scenarios when opting for an ammonia system is still favoured, it is critical to take in account:

- NH3 systems are often designed and calculated based on component performances that each add their performance tolerance level to the equation. HFO systems are designed and tested with the end result / overall unit performance being tested and documented within industry tolerances. This is verified by third party testing and certification.
- There are no testing capabilities before the system is installed on site (due to the nature of the installation being built/assembled on site).
- The need for additional safety devices.

## **AN ALTERNATIVE TO CAPITAL INVESTMENT**

In a dynamically changing world, a different approach to capital costs is also available and comes in the form of ICS FLEX is our long-term rental program for bespoke temperature control equipment

without the need for capital investment. This means our customers can benefit from the latest most efficient chiller technology and low GWP refrigerants with the peace of mind that all planned maintenance and emergency breakdown repairs are included for a known subscription cost. The flexibility and risk transfer of a rental solution are the best way to meet modern-day demands and perform upgrades, new installations, or replacements to satisfy cooling whilst achieving cash flow optimisation.

## **SUMMARY**

For the manufacturing industry, the importance of high performing, energy-efficient and sustainable process cooling solutions is, of course, nothing new. Manufacturing companies need to balance the rising costs and energy emissions of the plant while at the same time maintaining product quality and process efficiency. This is particularly important in processes such as food and dairy manufacturers, breweries, soft drinks production, and chemical and pharmaceutical industries, where manufacturers must live up to a plethora of standards and regulations related to the quality of the end products.

HFOs offer a safe non-toxic, non-flammable at 30°C, non-explosive, and non-corrosive alternative to ammonia. With zero ozone depletion potential (ODP) and near-zero global warming potential (GWP), HFOs deliver the best balance between environmental impact and safety risks.

HFO refrigerants can substantially reduce the Total Life Cycle Cost of your investment and are ideal for almost every application – a perfect cooling alternative to ammonia.

## **7 REASONS TO CHOOSE AN ICS COOL ENERGY HFO CHILLER OVER AN AMMONIA CHILLER**

- Cost effective solution
- Zero Toxicity
- Ease of maintenance and operation
- Low GWP
- Standardized range of products with fast customisation options
- Proven performance
- Compact footprint