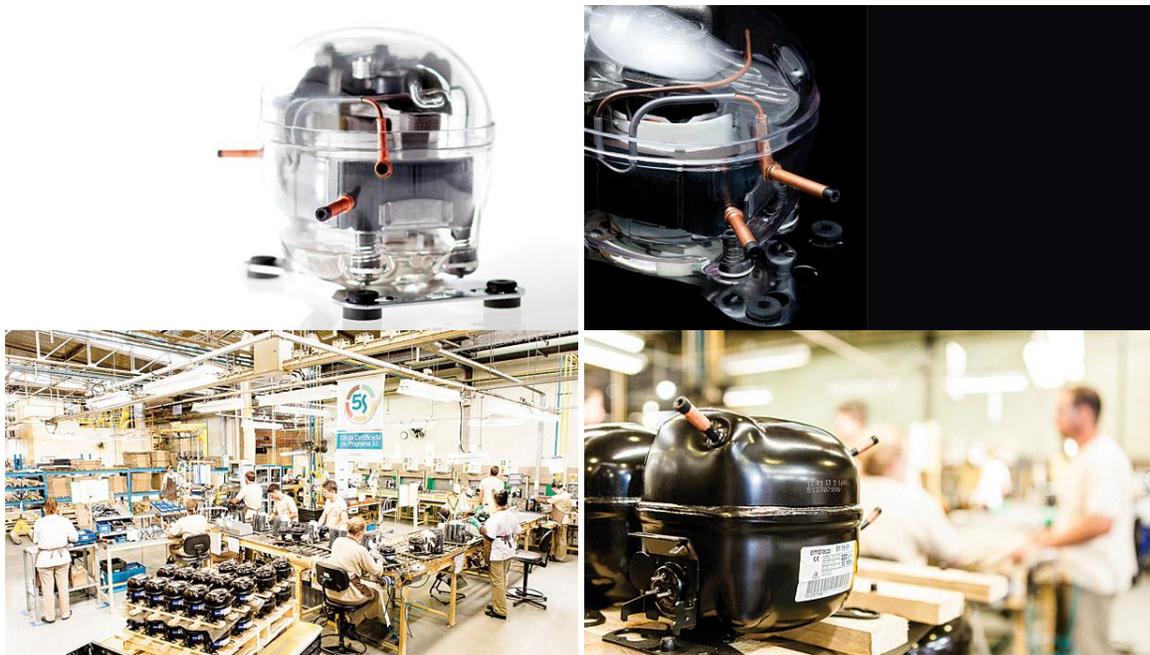


Cooling Technologies

Advances in Cooling Technology

Hydrocarbon refrigerants such as propane are critical to sustainability and future appliance designs.

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The United Nations Environment Program projected hydrocarbon usage to more than double by 2020. Hydrocarbon systems can significantly reduce energy consumption compared to synthetic fluids in commercial applications. Advances in cooling technologies, utilizing propane as a refrigerant specifically, can offer consumers and businesses a reliable, cost-effective and energy-efficient alternative. With growing market demand for environmentally responsible solutions, propane delivers a great option to consumers and companies today.

Though the international community is still far from a global agreement on emission reduction, the U.S. has made great strides in protecting our planet while driving innovation by fostering the use of alternative refrigerants. In December 2011, the U.S. Environmental Protection Agency (EPA) approved propane, isobutane and a chemical known as R-441A as acceptable refrigerants used to replace ozone-depleting substances in household refrigerators, freezers, combination refrigerator-freezers, and commercial stand-alone units.

The decision—made by the EPA’s Significant New Alternatives Policy (SNAP) program under the Clean Air Act—evaluates substitute chemicals and technologies for ozone-depleting substances (ODS). SNAP is unique and globally recognized as the only program designed specifically to evaluate substitutes for ODS and to focus on the industrial sectors that use them. Additionally, the federal government offers tax credits, exemptions and in special circumstances, Qualified Energy Conservation Bonds subsidized by the U.S. Department of Treasury at competitive rates to fund capital expenditures on qualified energy conservation projects for the use of alternative refrigerants such as propane.

The recent EPA SNAP results have opened the opportunity for U.S. household and light commercial [refrigeration applications](#). The approved charge limit of 150g of propane, however, can be a challenge for larger, light commercial appliances. One solution is to use a two-circuit plug-in unit that can lead to additional gains in terms of cabinet efficiency. The industry continues to work on a variety of solutions to overcome this barrier but more action is needed to move the market.

Despite the significant progress in alternative refrigerants, the lack of f-gases regulation continues to be a barrier in the U.S. The truth is, the world population is increasing and energy consumption is growing. The planet’s average temperature is increasing due to greenhouse gases and consequently the sea level is also increasing as polar ice caps melt from the damage caused by toxic gases over the decades. Worldwide, 15 percent of energy consumption comes from refrigeration and air conditioning. The conversion to alternative technologies such as propane cooling methods offers hope to help save our planet.

Propane (R-290) is a natural hydrocarbon (HC) refrigerant gas that can be easily applied in commercial and industrial refrigerators, freezers, air conditioning and [heat pumps](#). Besides having an Ozone Depletion Potential (ODP) of 0 and Global Warming Potential (GWP) of 20, propane has a Total Equivalent Warming Impact (TEWI) less than other refrigerant choices due to its thermal physical properties. In comparison, HFC 404-A has an ODP=0.04 and GWP= 3300.

When compared to natural refrigerant CO₂ (ODP=0 and GWP= 1), R-290 appears to be a weaker choice. However, due to the overall [system efficiency](#), a system utilizing R-290 consumes significantly less electrical power and therefore has less total effect on the environment. Properly applied, a propane system consumes up to 20 percent less energy. Additionally, R-290 cooling technologies generally operate at lower discharge pressures and temperatures than other refrigerants in similar applications and are therefore more reliable and can be expected to have a longer lifespan and require less service.

There are many benefits of using propane as an alternative refrigerant; however, there are also safety concerns due to its flammable nature. Following the proper safety rules can significantly reduce safety risks associated with the use of flammable refrigerants. Another safety solution is to ensure manufacturing training and certification of service professionals. Also, mandatory product and process risk assessments as well use of safer electrical components rather than minimum standard requirements is encouraged.

Ben & Jerry and their parent company, Unilever, are pioneers of using natural refrigerants. The company’s commitment to making their ice cream cabinets more environmentally friendly and energy efficient led to the creation of the first propane 60 Hz chest freezers in 2008. That same year, field tests for these hydrocarbon freezers began. Initially there were 250 propane charged Ben & Jerry’s “cleaner, greener, freezers,” undergoing pilot testing in the U.S. The company plans to bring thousands more to the marketplace in the next several years. See figure 1 for savings comparisons.

Blend of HFC refrigerants (R404A)	Propane (R290)	Savings
1650 kWh/year	1387 kWh/year	263 kWh/year
\$221	\$186	\$18M/year
9000 kg CO ₂	7046 kg CO ₂	977 kton CO ₂ in 10 years

Fig. 1. Energy consumption of propane appliances can even outperform current Energy Star levels. They are more efficient, more reliable and share similar costs to current HFC systems. Reducing CO₂ emissions through hydrocarbon refrigerants such as propane is critical to sustainability and future appliance designs.

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