FutureBridge

Futuristic Opportunities for HYDROFLUOROOLEFINS (HFOs)

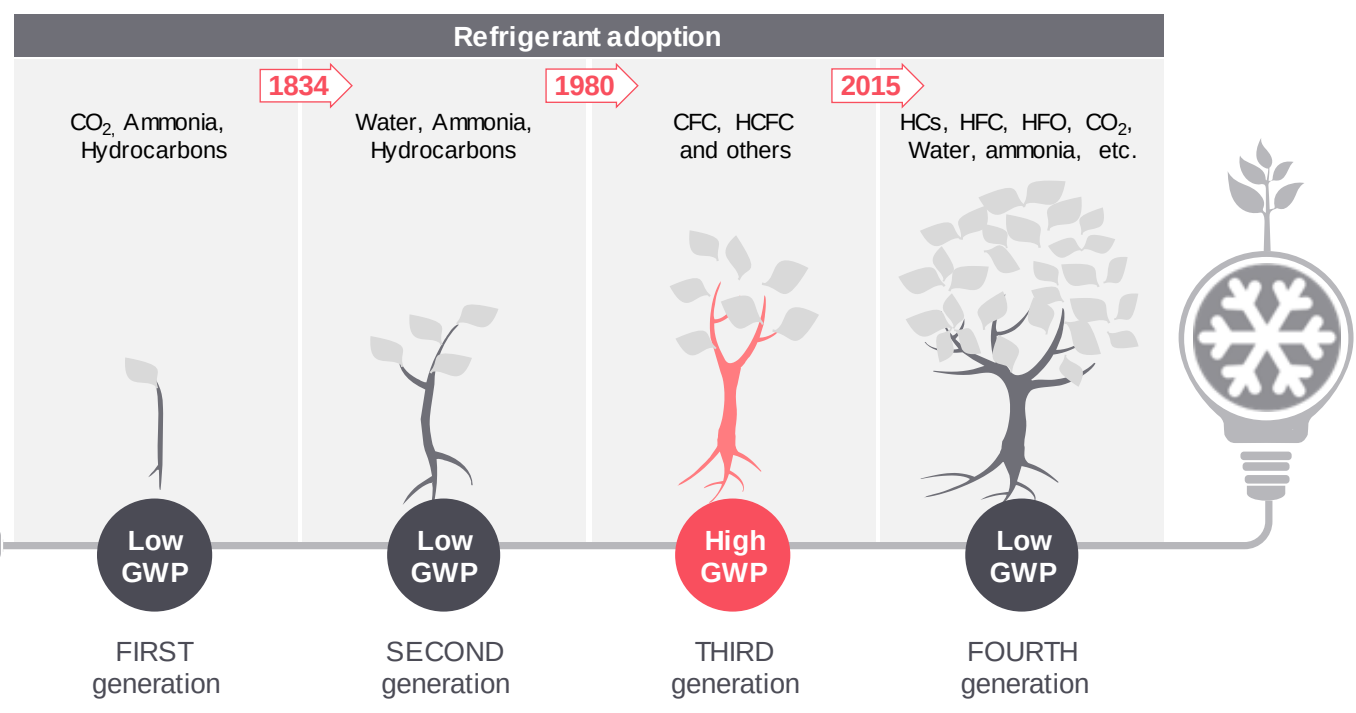
Kigali Amendment: Phasing Down CFCs and HFCs

- Agreed to on Oct 15, 2016, at the 28th Meeting of the parties to the Montreal Protocol
- Sets out on HFC phasedown that reduces consumption by 85% in CO_2 tons equivalent.
- Timelines for phase out the HFCs and HCFCs
  - **2019 – 2036:** In developed countries
  - **2024 – 2047:** In developing countries

Constant development of new products is driven by the ozone-depleting potential of CFCs and HCFCs, as well as the environmental impact of first and second-generation products.

Many of these substances (HCs and HFCs), while being low in ozone depleting potential, possess a high global warming potential, necessitating their replacement.

On 5 April 2022, the European Commission made a legislative proposal to update the F-gas Regulation to align regulations with the European Green Deal and the European Climate Law – this is currently under negotiation with member states.



Core Thoughts on HFOs

By 2050, energy efficient cooling would reduce the demand for 1300 GW electricity generation

Till 2021, the use of HFO in refrigerants and blowing agents has helped avoid the release of **170 million metric tons** of CO_2e into the atmosphere.

– As explained in a Honeywell sustainability article

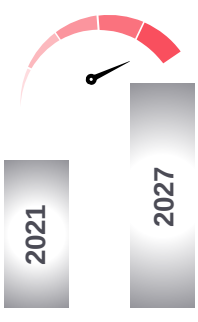
Production Capacity

Low: <5 KT

High: <10 KT

Production Capacity increase

HFO 1234yf

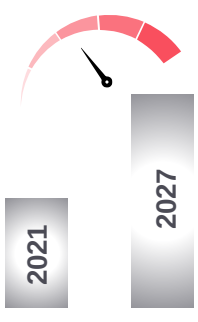


Mobile air conditioning (MAC) is a major application for HFO 1234yf, with commercial refrigeration being the second most preferred application.

MAJOR SUPPLIERS

Honeywell, ARKEMA, Chemours

HFO 1234ze

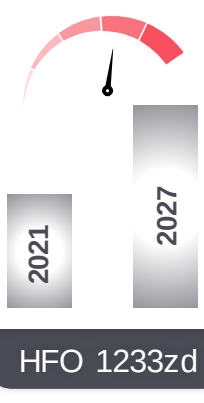


The major application of HFO 1234ze is as a foam blowing agent, holding a significant share in the market. Other applications include aerosol propellants, refrigerants, and more.

MAJOR SUPPLIERS

Honeywell, Beijing University of Science and Technology

HFO 1233zd

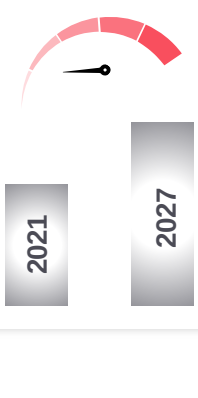


The major application of HFO 1233zd is as a foam blowing agent, holding a significant share in the market. Other applications include high-performance solvents, refrigerants, and more.

MAJOR SUPPLIERS

Honeywell, Central Glass

HFO 1336mzz



The foam blowing agent is a major application of HFO 1336mzz, holding a significant share in the market. Other applications include aerosol propellants, refrigerants, and more.

MAJOR SUPPLIERS

Chemours

The usage of HFO will be limited to only a few companies in highly regulated markets, primarily in the foam blowing application.

Mapping of Suppliers and Key Factors Impacting Prices of HFOs

MAJOR MANUFACTURERS OF HFOs AND HFCs

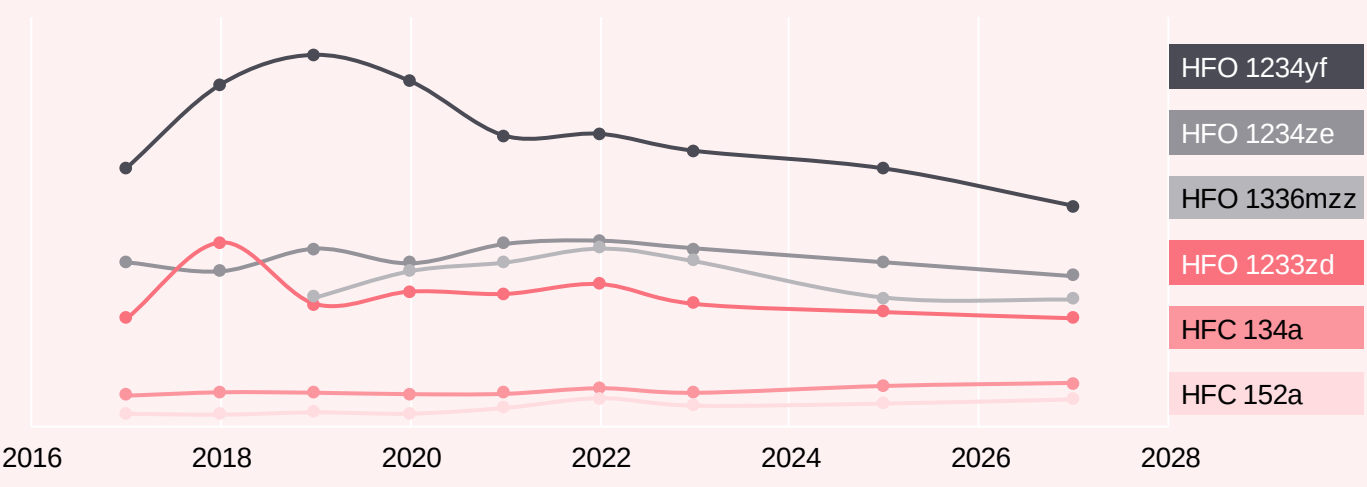
The color indicates product offerings

Producers	HFC-134a	HFC-152a	HFO-1234yf	HFO-1234ze	HFO-1233zd	HFO-1336mzz
Honeywell	■	■	■	■	■	
Chemours	■	■	■			■
DAIKIN	■	■				
ARKEMA	■		■			
HuonXin			■			
Beijing University of Science and Technology			■	■		
Central Glass					■	

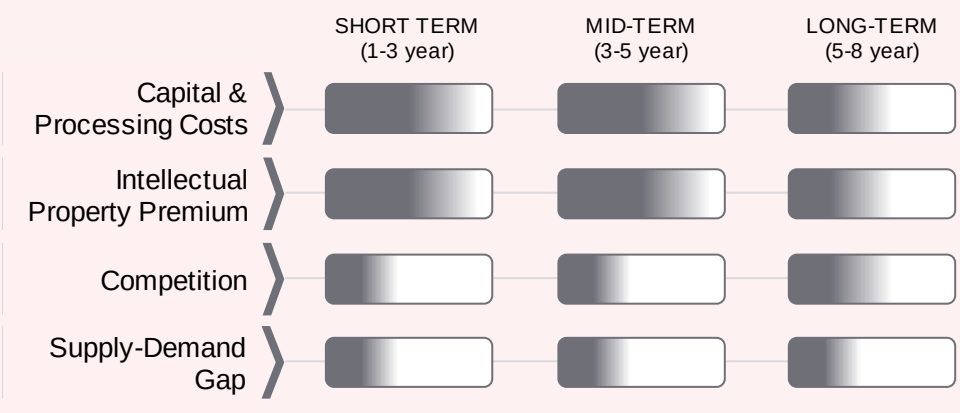
The production process of HFOs is capital intensive and involves intellectual property rights.
Moreover, only a few players are involved in the production process, such as Honeywell, Chemours, Arkema, and others.

As a result, prices of HFOs can vary due to the supply-demand gap caused by the limited number of players and the influence of intellectual property rights.
To meet the future demand, companies are expanding their production capacity by 2024.

YEAR-ON-YEAR PRICING SCENARIO



KEY FACTORS IMPACTING PRICES



High capital costs, patenting, and licensing rights by key manufacturers have led to high prices for HFOs

Conclusion

- Efforts to reduce high global warming refrigerants through the **Kigali Amendment and Montreal Protocol** are necessary steps towards combating climate change and creating a **sustainable future.**
- These regulations have shifted market demand towards **alternative/fourth-generation refrigerants** like **HFO, ammonia, and water**, creating **opportunities for chemical companies** while protecting the environment.
- The shift towards eco-friendly refrigerants not only benefits the environment but also contributes to **economic growth** by creating **new market opportunities and fostering innovation in the chemical industry**.

About FutureBridge

FutureBridge tracks and advises on the future of industries from a 1-to-25 year perspective.

We keep you ahead on the technology curve, propel your growth, identify new opportunities, markets and business models, answer your unknowns, and facilitate best-fit solutions and partnerships using our platforms, programs, and access to global ecosystems and players.