

BACK-UP

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Applications for refrigeration technology

- **Compiled by Dr. Rainer M. Jakobs**

The range of applications for refrigeration technology has grown substantially since it was first used to keep drinks and foodstuffs cool. There are essentially two principal areas of application: improving living and ambient conditions for humans, and improving commercial and industrial manufacturing processes.

The most obvious example of the direct benefit of this technology to humans lies in keeping foodstuffs fresh. Today, refrigeration technology in this area, in the form of regular normal refrigeration and freezing, has become widely established as a means of preserving all kinds of foodstuffs, and thus helps to maintain valuable sources of nutrition. Cooling and freezing help to keep the quality of meat, fish, vegetables, butter, eggs, milk, etc., virtually unchanged.

Special products can be preserved using freeze-drying processes to best maintain their quality, with no need for cold storage.

Refrigeration technology also plays an important role in foodstuff manufacture, not only in preservation, for instance in the manufacture of beer, margarine, chocolate or ice cream.

One area that shows promise is the recovery of fresh water from sea water. Refrigeration technology is used mainly in air-conditioning as a means of further improving ambient conditions. The use of air-conditioning in office buildings, theatres, schools, private homes and vehicles of all kinds is expanding greatly. It is essential, or improves comfort, in aircraft and ships, trains and vehicles.

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Veranstalter

Organizer

NürnbergMesse GmbH
Messezentrum
90471 Nürnberg
Tel +49 (0) 9 11. 86 06-0
Fax +49 (0) 9 11. 86 06-82 28
chillventa@nuernbergmesse.de
www.chillventa.de

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Heat pumps, a by-product of refrigeration technology, also help to improve ambient conditions. They can be used to heat residential and office buildings, entirely without exhaust gases and at a lower power cost than electric heating, and with lower emissions than combustion-based solutions. They can also be used as air-conditioning systems. Environmentally friendly operation of residential hot water systems and clothes driers using heat pumps is also a possibility now. Heat pumps are also used to heat open-air swimming pools, since they are more economical and environmentally friendly. They also seem likely to prove useful in the future as a means of using waste heat for both commercial and industrial applications.

Making ice is still an important field for refrigeration technology. Because of their high latent heat of fusion and sublimation heat, ice from water and dry ice store considerable volumes of cooling energy, and so they can be used for cooling in locations where it would be impossible or uneconomical to use actual cooling plants, e.g. to cool foodstuffs during transportation or for process cooling in special chemical processes.

There are many areas where refrigeration technology can be used in commercial and industrial contexts.

In the chemical industry, for example, it can be used to separate gas and fluid mixtures, to draw off reaction and solution heat, and to crystallise salts from solutions. Refrigeration can be used in the petroleum industry to deparaffinise oils to manufacture fuels and lubricants with the appropriate composition.

Liquefaction of gases

The growing use of low-boiling gases in technology is making the use of refrigeration processes to liquefy gases increasingly important. The increasing need for oxygen in steel manufacture, hydrogen for space rockets and helium for superconducting magnets in nuclear research centres, for electrical superconductors and superconducting electrical machinery has added to the importance of low-temperature technology.

Liquefaction for the purpose of transporting natural gases is another promising area of application for refrigeration, considering the fact that low-emission liquefied gas is starting to be used for vehicles and the level of importance it has already achieved in terms of generating heat for industrial and private purposes.

Other applications for refrigeration technology will be mentioned only in passing for the purpose of this overview, simply to show the wide range of applications involved, e.g. to shrink metals, to provide cooling in machining and non-cutting forming work, to break down scrap iron, to cool concrete used in dams, to sink shafts and tunnels in loose ground by freezing it first, in commercial and industrial cleaning (spraying dry ice) and in bobsled runs, ice rinks, snow machines and skiing halls.

Refrigeration saves lives

In the fields of medicine and biology, refrigeration technology is used to preserve blood, bone marrow, sperm, organs and bodies, to provide cooling for artificial hypothermia for treatment and surgery, and for local surgery or anaesthesia in the expanding field of cryotherapy.

The use of refrigeration in scientific research must also be mentioned, e.g. in materials testing, air and space research using simulation chambers, and for vehicle and engine research in cold test facilities.

- Cold treatment of foodstuffs

Meat, poultry, meat and sausage products, ready-to-eat meals, fish, milk (cow/goat/sheep), dairy products: butter, quark, cheese, yoghurt

- Processing, storage, freezing

Fruit: apples, pears, stonefruit, grapes, berries, nuts, almonds, chestnuts, quince, pineapple, figs, olives, dates, citrus fruit, bananas

Vegetables: tomatoes, onions, savoy cabbage, red and white cabbage, cauliflower, broccoli, asparagus, beans, peas, cucumbers, root vegetables, potatoes

Cereals, pastries: bread, biscuits, pastry products

Confectionery, cocoa products, chocolate and sweets

Ice cream

Beverages: beers, wine, sparkling wine, mineral water, fruit and vegetable juices

Collection of vegetable and animal fats and oils

- Cold processing of plants and vegetable products

Seed storage, cold storage of seedlings, cool storage of cut flowers

International Exhibition
Refrigeration | AC & Ventilation | Heat Pumps

- Foodstuffs industry:
 - Ice production – Milk and dairy products
 - Brewing – Breeders and dairy factories
 - Cellar operations – Fisheries
 - Cool storage – Meat processing plants
 - Meat preservation – Quick-freezing plants
 - Freeze-drying, etc.
- Refrigeration for retail trade and transportation
 - Cool stores – Refrigerated vehicles (goods vehicles)
 - Cooler display cabinets – Drink vending machines
 - Bars – LPG pipes
 - Transport vehicles for LPG – Containers
 - Ships – Rail transport vehicles
 - Aircraft
- Chemical industry
 - Gas liquefaction – Fertiliser
 - Plastics – Spun rayon
 - Artificial rubber (Buna®)
- Petroleum industry
 - Manufacture of LPG/natural gas – Gas separation
 - Plastic manufacture
- Medicine and pharmacy
 - Preservation of plasma, organs, medications
 - Manufacture of medications – Body storage
 - Cryomedicine
- Research
 - Physics: superconductivity – Botany: plant breeding
 - Biology: Preparation and preservation of thin sections
- Miscellaneous
 - Sport: artificial ice rinks, swimming pools, bobsled runs, ski halls, indoor cross-country facilities, snow machines
 - Ventilation for mining
 - Civil engineering, freezing of hole-throughs, fitting heating pipes in permafrost
 - Server and computer cooling – Magnetic monorails
 - Air-conditioning and wind tunnels

International Exhibition
Refrigeration | AC & Ventilation | Heat Pumps

- Residential refrigeration
 - Refrigerators – Freezers
 - Combined fridge-freezers – Wine refrigerators
 - Cold storage cells – Cooling for pharmaceuticals and cosmetics

Heat pump:

- Heating – Hot water
- Clothes driers – Dehumidifiers

For further information about Chillventa and the industry as a whole, see the new Chillventa Newsroom at chillventa.de/en/news

Media and Press Contacts

Bertold Brackemeier, Ariana Brandl
T +49 9 11 86 06-82 85
F +49 9 11 86 06-12 82 85
ariana.brandl@nuernbergmesse.de

All press materials, including further information, photos and film, are available at: www.chillventa.de/press