The IIR's mission is to disseminate the outcomes of research on refrigeration technologies and applications. Through its Framework Programmes for Research and Technological Development (FP RD) the European Union regularly funds major research projects operated on a call-for-bids basis on a regular basis through. The 2008 edition had a cold-chain component. Several bidders asked the IIR to handle the dissemination of research outcomes aspect of their projects. The IIR accepted to handle this, and will continue to do so for other projects, because this is an essential part of the IIR's mission, and involves cooperation with a number of IIR members in most EU countries or allied countries within FP RDs.

The FRISBEE (Food Refrigeration Innovations for Safety, consumers Benefit, Environmental impact and Energy optimization along the cold chain in Europe) project was invited to attend this flagship event: workshops and conferences that will open to the outcomes of the research work through accepted and will be launched in September 2010. The IIR will handle the dissemination of the outcomes of the research work through workshops and conferences that will open to everyone interested, beginning with the Prague Congress in August 2011 – you are cordially invited to attend this flagship event: www.icr2011.org: the IIR will also publish summarizing documents, starting in 2012. This new action will be coordinated with our other conference, publications and working-party activities and data available via our Fridoc database.

We therefore hope to provide you with additional practical data in the near future and hope to enhance your performance in this manner.

Didier Coulomb
Director of the IIR

La mission de l'IIF est de diffuser les résultats de la recherche sur les technologies du froid et ses applications.
L'Union Européenne finance régulièrement, dans ses « Programmes-cadre de recherche-développement » - PRD, de grands projets de recherche dans le cadre d'appels d’offres. Celui de 2008 comprenait le thème de la chaîne du froid. Plusieurs commissionnaires ont demandé à l'IIF d’assurer le volet « diffusion des résultats de la recherche » de leur projet. L'IIF a accepté, et continuera à accepter d’assumer ce rôle dans d’autres projets, parce que cela correspond pleinement à sa mission, qu’il agit ainsi en coopération avec plusieurs de ses membres et que la quasi-totalité des pays de l’Union Européenne ou alliés à celle-ci dans les PRD sont membres actifs de l'IIF.

Le projet FRISBEE a été retenu et débuttera en septembre 2010. L'IIF assurera la promotion de ses résultats à travers des ateliers et conférences ouverts à tous, et en premier lieu à l’occasion du Congrès de Prague en août 2011, auquel vous êtes tous cordialement invités à participer.

2017 (consumption limited to 85% of the baseline) until 2043 (15% of the baseline). The second proposal, from Micronesia, is similar but with a different schedule (2013-2030 for developed countries and 2019-2036 for developing countries) and a lower plateau (10%). The climate benefits expected in terms of CO2 emissions avoided are 88 000 MMTCO2eq through 2050 for the trilateral proposal and 93 000 MMTCO2eq for the Micronesian proposal. The numerous opponents of these proposals emphasized the need to assess the financial implications of these amendments, the need to focus efforts on the accelerated HCFC phase-out and stressed that HCFCs are the mandate of the Kyoto Protocol.

No decisions were made, but an open-ended informal group on HCFCs was set up. Further discussions will take place during the 22nd Meeting of the Parties (MOP-22) to the Montreal Protocol to be held in Kampala, Uganda, in November 2010. Consult the Geneva meeting documents here: www.unep.ch/ozone/Meeting_Documents/oewg/30oewg/conf-presession-en.shtml

The IIR will naturally participate in MOP-22, present its actions and statements and will keep you informed on this key issue. Furthermore, the IIR will continue to develop and promote its numerous actions on refrigerants: French and Spanish versions of the IIR guide to ammonia, a new guide on CO2; conferences on natural refrigerants, on thermophysical properties of refrigerants, on phase-change materials and slurries, on ammonia…; working parties on mitigation of greenhouse gas emissions, on refrigerant charge reduction, on refrigerant system safety… (become a member of the IIR and you will be able to join them). Consult our Web site for full information: www.iifiir.org

Didier Coulomb
Directeur de l'IIF

The IIR focus

The future of HFCs was at the heart of discussions in Geneva

Several issues of importance for the refrigeration sector were handled during the 30th meeting of the Open-ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer in Geneva, June 15–18, 2010 where the IIR, as an intergovernmental organization, was represented by Jean-Luc Dupont.

- The 2010 progress report of the Technology and Economic Assessment Panel (TEAP) on available and emerging alternatives and substitutes to HCFCs was presented. The TEAP proposed a classification of alternative refrigerants according to their GWP: high: >1000, moderate: 300–1000 and low: < 300, with several subdivisions. Many representatives suggested to simplify this classification and to reduce the limit value for low-GWP refrigerants. The TEAP concluded that each refrigeration sub-sector "had a variety of low or moderate GWP alternatives available or under development" and that parties should “select alternatives with the lowest climate impact.” A report on HCFC alternatives for high ambient temperature regions was also presented.

- Two proposals of amendments to the Montreal Protocol were discussed. The first proposal from US, Canada and Mexico includes a gradual phase-down of 20 HFCs + 2 HFOs (R-1234yf and R-1234ze) with a plateau. For developed countries, it starts in 2014 (consumption limited to 90% of the HCFC and HFC consumption and production, averaged over 2004 to 2006) and ends in 2033 (consumption limited to 15% of the same baseline, corresponding to the plateau). For developing countries, it starts in

Entreprise

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(www.icr2011.org) ; à travers aussi des documents synthétiques à paraître à partir de 2012.

Cette nouvelle action sera coordonnée avec nos autres actions en matière de conférences, de publications, de groupes de travail et de mise à disposition des données de la recherche via Fridoc.

Nous espérons ainsi être à même prochainement de vous fournir davantage de données pratiques pour améliorer vos performances.

Didier Coulomb
Directeur de l'IIF
The IIR-sponsored 9th International Conference on Sustainable Energy Technologies (SET 2010) will take place in Shanghai, China, on August 24-27, 2010. For full details: www.set2010.org

Pôle Cristal Symposium, an IIR-sponsored event, will be held in Dinan, France, on October 7-8, 2010. It will focus on solutions for energy-efficient buildings. For full details: www.pole-cristal.tm.fr

Statutory meetings

The IIR’s statutory committees met in Paris on June 9-11, 2010. In particular, the committees took decisions regarding IIR publications policy and the new information system and related new IIR services that will be implemented in 2011. The aim is to have a greater number of services open to everybody (Fridoc database, certain publications…) but to give more free accesses and on-line services to our members, according to their category levels and degree of involvement. More details will be given as soon as the new system is operational.

Mr Qiu Zhongyue has been awarded the French Refrigeration Association’s prestigious Charles Teller Medal. Mr Qiу has worked at the Chinese Association of Refrigeration for over 30 years and has led many actions designed to enhance international cooperation in the refrigeration sphere. He has translated many scientific articles from French into Chinese and played a key role in the organization of the IIR’s 22nd International Congress of Refrigeration held in Beijing in 2007. The IIR warmly congratulates Mr Qiу! www.car.org.cn

Obituary

Prof. Josef Ota, member of the International Advisory Board of the International Journal of Refrigeration, of the board of Chalzeni a Klimatizace (a Czech journal of refrigeration and air conditioning) and member of Commission B1, Associate Professor at the Czech Technical University in Prague, died recently.

Prof. Zdenek Dvorak, an honorary member of the IIR, passed away recently. The IIR conveys its sympathy to Ota’s and Dvorak’s families and colleagues.

A pleasant indoor climate and no energy costs. This is what it feels like to live in the Zero+ house – the first home in Denmark that produces more power than is actually consumed. The house supplies its own heating and electricity and generates excess electricity. The Zero+ house is in central Sonderborg, southern Denmark. The superbly insulated house is installed with a ventilation system with heat recovery, which ensures that half the air inside is replenished automatically every hour. The 200 m² house is equipped with a combination of Danfoss technologies that reduce energy consumption. The ventilation system uses heat recovery, the ground-heat system and the energy-efficient pump that produces the necessary heat and utility water. The heat is emitted via fast-acting floor-heating, a SpeedUp system which reacts and regulates the temperature in just 15 minutes. The need for power is covered by 60 m² of solar cells mounted on the roof. In the first year this produced 5160 kWh, despite the fact that the solar cells were covered by snow for 2½ months. Since the family has only used 5133 kWh, this left them with a surplus of 27 kWh over a 1-year period. The family has saved 2687 € on its annual energy bill. The house is connected with a local combined heat and power plant via the electricity network. www.danfoss.com
Trends and markets

- **AC market: slow recovery is expected in 2010**
  - According to a recent BSRIA press release, the air-conditioning market contracted by 11% compared to 2008, reaching USD 63.2 million in 2009. It is expected to see a slow recovery in 2010 with an expected growth rate of around 5%. In terms of distribution, Asia Pacific remains the largest world region for air-conditioning (AC) sales (49% of the total market). The Chinese market, the largest market in the world, produced 66% of the world-air-conditioning units in 2009, a 7% increase, compared with 2008. It is followed closely by the Japanese market, with a value of USD 10.5 billion, which puts the USA market in third position with USD 8.7 billion in 2009. However, it is expected to regain its initial second position by 2013. The European market was hit the hardest and declined by 25% by value. The worst affected markets were Turkey, the UK, Russia, Poland, Italy, Greece, Germany, and Spain, but the overall European market is expected to show its first signs of recovery this year with around 3% growth compared to last year. [www.bsria.co.uk](http://www.bsria.co.uk)

  - Similar trends are expected by Global Industry Analysts which estimates that the global market for air-conditioning systems is expected to recover from the recession and a fall in growth and reach 78.8 million units in volume sales by 2015. Growth in the short- to medium term period will be driven by factors such as focus on energy efficient air conditioners including inverter based air conditioners, growing replacement needs in mature markets such as the US and Europe and rising demand from developing markets such as Asia-Pacific. [www.prweb.com/printer/4131994.htm](http://www.prweb.com/printer/4131994.htm)

- The IARW Food Industry’s Return on Investment Guidelines provide valuable information regarding cold storage construction costs and trends in 2010. There are a number of variables that affect the cost of a project, ranging from building size to site conditions. The average size of facilities ranges from 3500 m² in China, 4000 m² in Central Europe, 5000 m² in India, 6000 m² in Latin America, 6500 m² in Western Europe to 18 000 m² in North America. However, IARW anticipates moderately growth in cold storage construction in North America, Central Europe, the former Soviet Union and Russia. Moreover, an overall 10% per year expansion of cold storage capacity is anticipated in Latin American countries such as Mexico, Venezuela and Brazil. China is considered “the most promising region for cold storage construction and cold chain development”. Current construction starts are up an estimated 10% and are anticipated to hold that level for a few years. Much of the development will be focused on urban areas. [Cold Facts, March-April 2010](http://www.sae.org/mags/AEI/8074)

- **HFCs: projected emissions**
  - Two recent studies on projected emissions of HFCs have been published:
    - **US:** according to the June 2010 US Climate Action report under the Uniform Air Quality (UAAQ) from 2005 through 2020, total US greenhouse gas (GHG) emissions are projected to rise by 4% under a "with measures" scenario, from 7109 Tg CO₂eq to 7416 Tg CO₂eq.
      According to the report, with additional mitigation measures, such as those that would be implemented under the American Clean Energy and Security Act of 2009, the US would have a GHG reduction goal of 17% by 2020, though US GDP is projected to grow by 40% over that period. Over the same period 2005-2020, emissions of HFCs are estimated to increase by 140% from 116 Tg CO₂eq (1.6% of all GHGs) to 279 Tg CO₂eq (3.8%). This projection does not take into account reductions which could result from a possible adoption of the amendment to the Montreal Protocol proposed by the US, Canada and Mexico (see Focus).
    - **EU:** in a report prepared for the European Commission, IIASA provides estimates on HFC emissions evolutions from 2005 to 2030 in the European Union (EU-27) for various applications of the refrigeration sector:
      - Commercial refrigeration
        - Emissions in 2005 (Mt CO₂eq): 21.0
        - Variation 2005-2030 +63%
      - Mobile air-conditioning (1)
        - Emissions in 2005 (Mt CO₂eq): 6.4
        - Variation 2005-2030 -91%
      - Industrial refrigeration
        - Emissions in 2005 (Mt CO₂eq): 5.9
        - Variation 2005-2030 +119%
      - Stationary air-conditioning
        - Emissions in 2005 (Mt CO₂eq): 5.0
        - Variation 2005-2030 +117%
      - Refrigerated transport
        - Emissions in 2005 (Mt CO₂eq): 2.2
        - Variation 2005-2030 -25%
      - Domestic refrigeration (2)
        - Emissions in 2005 (Mt CO₂eq): 0
        - Variation 2005-2030 +0.3 Mt CO₂eq
      - Total
        - Emissions in 2005 (Mt CO₂eq): 40.5
        - Variation 2005-2030 +49.6%

  - **(1)** This prediction takes into account the F-gas Directive (2006/842/EC) which requires that from 2011, the use of HFC-134a in mobile air conditioners should be replaced by a refrigerant with a GWP of less than 150 in all new vehicles placed on the market.
  - **(2)** A large majority of European domestic refrigerators and freezers use hydrocarbons. Overall, HFC emissions from these refrigeration applications are projected to increase by 50% during the period 2005-2030.

  - [www.state.gov/documents/organization/140636.pdf](http://www.state.gov/documents/organization/140636.pdf)

**HFO-1234yf news**

- **HFO-1234yf**, developed by DuPont and Honeywell as a substitute for HFC-134a in mobile air-conditioning applications in response to EU 2006/40 Directive which bans the use of refrigerants with a GWP higher than 150 in new types of vehicles by January 1, 2011, was the subject of much discussions over the past few months.

  - On May 20, the German automotive association (VDA) announced it would follow other carmakers in their choice of R-1234yf, turning its back on CO₂ as best choice as a refrigerant in MAC, adopted in 2007.

  - Yet, during the Society of Automobile Engineers (SAE) World Congress in April 2010, HFO-1234yf had faced opposition. According to SAE, “unless there are significant policy changes, it could be limited to original equipment (OE) installations, and perhaps fewer than anticipated”. Long-standing objections have focused on the anticipated refrigerant cost, which the US EPA estimates initially at at least 15 times the current refrigerant price for R-134a. The manufacturing of HFO-1234yf will require new plants rather than conversion of existing facilities and no chemical company has built a new plant yet. However, Honeywell and DuPont announced on May 21 a manufacturing joint venture with the intent to jointly design, construct and operate a manufacturing facility in Chongshu, China, to produce HFO-1234yf by the fourth quarter of 2011. A further complication is that at least one leading refrigerant supplier, Arkema, is unwilling to commit to R-1234yf until all patent issues are resolved.

  - Carmakers will install HFO-1234yf in systems upgraded to deal with the refrigerant’s mild flammability. However, studies indicate that the same systems also could be run with HFC-134a at similar performance levels. Further, work is being done to use the same polyethylene glycol (PAG) oil with both refrigerants. That would raise the question of whether HFO-1234yf use in the service industry, maybe in Europe and certainly in the US where legally car dealers will be able to service HFO-1234yf with any refrigerant on the EPA SNAP list which includes R-134a and other refrigerants approved for CFC-12 retrofit.

**Briefs**

- **China interested in NH₃/CO₂ and R-32 as HCFC alternatives**

  - Late April 2010, China took a step in the quest for alternative refrigerants in the context of the HCFC phase-out under the Montreal Protocol (freeze of HCFC production in 2013 and complete phase-out in 2030). Instead of switching to high-GWP refrigerants such as R-410A (GWP = 1725), the country is exploring the viability of NH₃/CO₂ (negligible GWP) and HFC-32 (GWP = 550).
The site provides information on cryogenic treatment and companies engaged in this field also:
www.iifiir.org/en/resources.php?rub=1

**Cemafr oid, a French refrigerated vehicle testing and certification organization with sites in Annecy and Lyons, celebrated its 10th anniversary on June 3-4, 2010 at its Antony site. The birthday celebration took the form of a conference with 200 participants from 70 companies, and an exhibition. Consult the presentations (in French):** www.cemafr oid.fr

**Following the retirement of Wan-Keun Lee, former Chairman of Shinsung Holdings, as Chairman of the Korea Refrigeration and Air-conditioning Industry Association (KRAIA), Hwan-Yong Nho was appointed KRAIA Chairman on May 31, 2010. Hwan-Yong Nho is currently President and CEO of LG Electronics Air Conditioning Company.** JARN, June 2010. www.kraia.or.kr

**Sean Treweek has been appointed President of the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH), replacing John Bosci.**

**Don’t miss DKV’s annual conference to be held in Magdeburg, Germany, on November 17-19, 2010. Full details: info@dkv.org www.dkv.org**

**Chillventa 2010 is to take place in Nuremberg, Germany, on October 13-15. The highly successful Chillventa premiere in 2008 continues to have an impact. Contrary to the overall current economic trend, the industry has confirmed Chillventa’s importance. The international refrigeration, air-conditioning, ventilation and heat pump industry responded to the invitation to exhibit at Chillventa: almost 400 companies from all over the world have committed themselves to Chillventa. Drop in at DKV’s booth to see the IIR’s latest publications and pick up a wide range of information.** www.chillventa.de/en

**Out of the ordinary**

**Lifesaving pocket refrigerator**

During the severe heatwave in Europe in 2003, Uwe Diegel realized that his brother was encountering pastoral problems keeping his insulin refrigerated while travelling. So the inventor decided to invent a small refrigerator based on the Peltier effect discovered in 1834. Inside the mini-refrigerator, electric current is passed through thousands of tiny cubes with different densities, inducing a temperature change. The invention recently won a prestigious Concours Lepine prize. The pocket Medifridge maintains drugs at a temperature of 2 to 8°C for up to 30 hours and is designed for vaccines, insulin, eye drops and other drugs requiring refrigeration. The inventor has also developed Poucho, an insulated pouch designed above all for insulin pens that keep insulin cold for up to 4 days without electricity and can be re-used hundreds of times by immersing the pouch in water for 90 seconds. www.lexpress.fr

**One of the exhibits at the Dreamlands exhibition currently showing at the Centre Pompidou in Paris is Kader Attia’s skyscrapers. The shimming skyscrapers are in fact exquisitely decorated refrigerators. It’s all done with mirrors… and black paint.** www.rfi.fr

**Solar cooling perspectives in Australia**

A paper by P. Kohlenbach and M. Dennis presented at the 9th IIR Gustav Lorentzen Conference on Natural Refrigerants in Sydney gave an outlook and future perspectives on solar cooling in Australia, focusing on a comparison between the current potential energy and greenhouse gas savings in photovoltaic (PV) vapour-compression systems and solar thermal cooling with an absorption chiller and a grid-connected reference chiller. It was found that under current economic conditions and given assumptions, a solar thermal cooling system had a lower lifetime cost than a PV-based system. However, both had higher lifetime costs than conventional grid-connected systems. A sensitivity analysis on electricity prices showed that solar thermal cooling was more economic than PV-based cooling under an AUD 0.28/kWhel but the PV system offers cheaper cooling at electricity prices exceeding AUD 0.54/kWhel. However, solar systems become more economic than conventional systems for electricity prices above AUD 0.67/kWhel while greenhouse gas emissions were found to be the lowest for the PV-based system due to the excess power generated over the system lifetime and the solar thermal system saves around 75% of the emissions of the conventional system.

The residential air-conditioning market in Australia is around 800 000 units per year and has increased significantly over recent years, since in 2006, 70% of Australian households had air conditioning (35% in 2000). The combination of good solar resource and a large air-conditioning market seems like a perfect match for solar cooling and refrigeration applications. However, solar cooling remains a niche technology because of economic and technical market barriers (low electricity prices, lack of trained staff, etc.)

Solar cooling for developing countries

In order to help Jean-Louis Julliard, a French professor, maintain his pre-cooked meals in Mali, Lionel Bataille improved existing solar-cooling technology developed by a CNRS laboratory in Perpignan, France. The cooling system used a solar-heated powdered gas thermoechemical reaction. Thanks to financial assistance from Oséo, Bataille designed a prototype capable of producing 7 kg of ice daily. In order to avoid being dependent on battery-assisted load regulators between the photovoltaic cells and the cooling systems, he connected the solar panel directly to the adsorber. Cool charcoal can absorb energy, but sufficient to power the refrigeration system, which is well insulated thanks to a composite material. They launched the Freecold range in 2009, starting with 150-450 l autonomous solar freezers already sold to distributors in Lebanon and Tunisia, but also a water-cooled air-conditioning system using similar technology.

L’Usine Nouvelle, May 2010

Low-cost solar vaccine refrigerator

About 2 million people around the world die each year of diseases preventable by widely used vaccines. In Africa and parts of Asia, over half of all vaccines that require refrigeration spoil before they can be administered. Millions of lives and billions of dollars are lost due to a lack of refrigeration.

The Appropriate Technology Collaborative (ATC) worked with engineering students and professors at Michigan State University to create the technology. The ATC Solar Vaccine Refrigerator is a robust, easy-to-maintain technology that can be made in the country or region where it is to be used, using simple materials found in most cities: steel, charcoal, and ethanol or methanol. The finished product has no moving parts that need maintenance and it doesn’t use electricity. The steel box is the solar collector/adsorber. The box is painted black so that it converts sunlight to heat. When the solar collector gets hot in sunlight the charcoal rejects ethanol vapour. The rejected ethanol vapour flows into the condenser, which is a series of pipes with cooling fins. The temperature of the ethanol vapour is reduced to the ambient air temperature and it condenses into a liquid. The liquid then flows to the evaporator, inside an insulated box. This process produces liquid ethanol in the evaporator and cool charcoal in the adsorber. Cool charcoal can absorb ethanol vapour again. At night, some of the liquid ethanol is adsorbed back into the charcoal. The ethanol that remains behind in the evaporator becomes very cold and the temperature in the insulated box drops to the desired temperature of 0 to -10°C.

http://content.techbriefs.com/medical-2010/448

Green buildings

- Expo 2010 in Shanghai, China is on, and is expected to draw 70 million visitors. With a theme of “Better City, Better Life”, it aims to explore the full potential of urban life in the 21st century and how to create an eco-friendly society. Japan’s purple solar powered pavilion is attracting a lot of attention. Its Chinese nickname is Zi Can Dao, meaning “purple silkworm island.” Covering approximately 3900 m², it features the world’s first pillow membrane with built-in amphibious solar cells. The test solar power system has a generation output of 20–30 kW. Hybrid wind turbines are also used at the site to help generate power for use in the building. Other energy efficiency features include the use of LED and organic EL lighting, heat pumps, “ecotubes” under the floor of the building that reduce temperatures by around 3°C and transpiration cooling systems that spray a fine mist of collected rainwater on the roof. The ecotube system also allows sunlight into the building and the cooled floor also increases the chimney effect of the tubes, reducing the air-conditioning load by drawing in air. Exhibitions within the pavilion include a look at how technology is being used to create “zero-emission towns” in Japan.

www.energymatters.com.au

- Following the meeting of the IIR’s Science and Technology Council (STC) on June 10, 2010, Prof. Renato Lazzarin, University of Padua in Vicenza, Italy, AICARR President, and President of Commission E1 (Air conditioning) of the STC gave a lecture entitled Heating and cooling of existing buildings: technological possibilities in the refurbishment. The lecture explored many technologies including frozen smoke, an aerogel claimed to be the world’s lightest solid. Frozen smoke is extremely strong, highly insulating and transparent, and is now being used to radically reduce heat exchange across windows. See a video on frozen smoko’s properties:


Briefs

- Cryogenic treatment of heart diseases

Russia has made its first steps in the cryogenic treatment of heart arrhythmia. A new method was recently implemented by specialists at the V. A. Almazov Federal Heart, Blood and Endocrinology Centre in St. Petersburg. Cryotechnology is used for the treatment of auricular fibrillation, which is one of the most widespread types of arrhythmia. Tennis of thousands of people suffer from this disorder in St. Petersburg alone, and hundreds of thousands of people are affected all over Russia. Such an arrhythmia often leads to a attack in which the heart immediately stops beating. Dmitry Lebedev and his team at the Centre of Heart, Blood and Endocrinology are freezing the sections of the cardiac muscle involved in this pathology. The method makes it possible to eliminate auricular fibrillation and fibrillar arrhythmia, both of which are severe disorders. The cryoablation methods implemented reduce operation time, lessen the risk of complications, obviate the need for lifelong treatment with expensive anti-arrhythmic drugs and make it possible to treat large numbers of patients.

http://english.ruur.ru/2010/05/12/7721065.html

- Sustainable fishery in Namibia

Since November 2009, Hangana Seafood has frozen a pre-sorting facility at the Walvis Bay harbour, Namibia, which uses ammonia as a refrigerant. The 2800 m² sorting facility has a 0°C chill room for holding unsold fish, two 16°C temperature-controlled sorting and grading rooms (one to separate hack flake-catch, the other to separate a flake-ice maker, a 100-tonne ice bunker, an ice raking system and a pneumatic ice conveyor system to discharge ice directly into the fishing vessels, a refrigeration machine room, and 2 aeration systems for the by-catch, among other equipment.

The ammonia refrigeration plant has two Grasso screw compressors with 220 kW motors, operating at a suction temperature of -36°C and a single Grasso reciprocating compressor with a 90 kW motor operating at -8°C. A thermostatic oil cooling system lowers the energy consumption of the compressors and allows the system to operate with a floating discharge pressure, further increasing system COP. Ammonia is used as a secondary refrigerant in the cooler coils of the blast freezers, chilling hard goods to -36°C and coils of the ice bunker. It is also used in 3 surge drums, one at -36°C for the blast freezers, -8°C for the chill cold store and 1°C for the plate heat exchangers. Water cooled to 4°C thanks to an ammonia-to-water heat exchanger is used as cooling media in the processing areas, which are equipped with a controlled atmosphere system with filtered and pressurized 100% outside air.

The Cold Link, March/April 2010

CO₂ heat pumps for train AC

A paper presented at the 9th Gustav Lorentzen Conference on Natural Refrigerants by A. Haffner, O. Christensen and P. Nekša envisaged the opportunity to use R744 (CO₂) as a refrigerant in air-conditioning (AC) systems in trains. They claimed that in 2006, 75% of air-conditioning systems in trains used HFC-134a, which has a GWP of 1410, whereas R744 has a GWP of 1(0). The other 25% used HFC-407C. The rolling stock of the railway, tram and metro operators consisted of 175 000 units, 65 000 of which are equipped with air-conditioning systems. The total refrigerant charge in the railway sector amounts to 1605 tonnes CO₂ eq. and the annual leakage rate averages 5%, which is lower than the 40% leakage rate in marine units but still represents substantial emissions. Estimations based on the assumption that these refrigerant ratios remain identical show that HFC emissions from the railway sector could double to 174 tonnes CO₂ eq. by 2020 (while emissions from the marine sector will increase threefold to 1141 tonnes CO₂ eq.) Using CO₂ to replace these refrigerants would have a major positive effect on the environment.

Three technical solutions were envisaged to switch back and forth from heating to cooling mode by changing the direction of the refrigerant flow through the system, by changing the configuration of the air streams through the heat exchangers to hatches, and lastly by rotating by 180° the whole heat pump placed on a turntable unit. Experiments from the marine sector will increase threefold to 1141 tonnes CO₂ eq.) Using CO₂ to replace these refrigerants would have a major positive effect on the environment.

I. A. Hoffner, O. Christensen and P. Nekša: Reversible R744 Heat Pumps Applied in Public Trains
Hydrocarbon refrigerants have now been used for over 10 years in countries such as Germany, the UK, Australia and Japan, mainly because of their zero-ozone-depletion potential and very low global-warming potential. The US EPA is proposing to list 4 types of hydrocarbons, namely isobutane, propane, HCR-188C and HCR-188C1 as acceptable substitutes, subject to use conditions, for CFCs well ahead of the schedule limits are now required for ODS producers and consumers. These regulations will also involve high penalties. For example, facilities and systems that illegally produce ODS will be dismantled and demolished and subjected to fines of approximately USD 150,000.


The French decree of November 19, 2009 relative to general prescriptions applicable to classified installations declared under paragraph number 1136 (use and storage of ammonia) replaces the previous decree of February 23, 1998, which was rescinded as of April 24, 2010. This new decree, applicable since April 2010, should facilitate the implantation of ammonia refrigeration installations in France thanks to the reduction of their minimal distance from property limits from 150 g and 57 g for the latter. Since 1992, over 300 million hydrocarbon-refrigerant fridges have been produced worldwide and 40% of the world’s domestic refrigerators are now using isobutane. www.hydrocarbons21.com