



October 2008

International Institute of Refrigeration  
Institut International du Froid

## Editorial

For many years, the IIR has been seeking to improve the performances of natural refrigerants in order to address the issues of ozone depletion and global warming.

The Gustav Lorentzen Conferences have been consistently highly successful. The latest was held in Copenhagen, Denmark, on September 8-10, 2008 and attracted 397 participants. The next event in the series will take place in Sydney, Australia, on April 12-14, 2010. CO<sub>2</sub> is still the most investigated refrigerant.

Ammonia is still very widely used and is also very efficient, despite the risks that it presents and the IIR is convinced that it also has a great future. Since 2005, the IIR has held conferences on ammonia in Ohrid, in the former Yugoslavian Republic of Macedonia. The next one will be held on May 7-9, 2009 ([www.mf.ukim.edu.mk/web\\_ohrid2009/ohrid-2009.html](http://www.mf.ukim.edu.mk/web_ohrid2009/ohrid-2009.html)). In 1999, the IIR published a bilingual French-English book, *Ammonia as a Refrigerant*, that was a best-seller. Because of recent events and trends, a new revised and augmented edition has just been published in English (the French version is to follow).

You can order *Ammonia as a Refrigerant* via the IIR's Web site: [www.iifir.org](http://www.iifir.org)

With the agreement of the United Nations Environmental Programme (UNEP), the IIR will hold a workshop on ammonia during the next United Nations Conference on ozone depletion which will be held in Doha, Qatar, in November 2008. This conference will also provide a good opportunity to promote ammonia as a refrigerant. Of course, the IIR will also have an opportunity, during this conference and during the United Nations Conference on Climate Change in Poznan, Poland, next December, to speak during the high-level segments, as it has over the past years.

We will come back to this in the next issue of the Newsletter.

**Didier Coulomb,**  
Director of the IIR



L'IIF a depuis longtemps cherché à améliorer notamment les performances des frigorigènes naturels afin de lutter contre l'appauvrissement de la couche d'ozone et le réchauffement climatique.

## IIR focus

### *IIR Working Party on Refrigerant Charge Reduction in Refrigerating Systems: Join Us!*

■ Suitable design of refrigerating systems has several benefits in terms of limitation of the environmental impact thanks to a reduction in the energy consumption and the limitation of refrigerant emissions. The direct greenhouse effect accounts for 20% of the total effect, which clearly shows that addressing refrigerant charge reduction or refrigerant emissions alone would leave 80% of the problem intact. Refrigerant charge reduction in systems is an important issue because it falls within environmental policy regarding refrigerants' contributions to the greenhouse effect. In addition, this subject receives little coverage at an international level.

A year ago, it was proposed to the Science and Technology Council of the IIR to set up a working party dealing with reduction in the refrigerant charge used in refrigerating plants. Today this has been achieved.

The main objectives of this WP are to add new results to currently applied design knowledge regarding refrigerant charge reduction in refrigerating systems and to help improve these new findings by mutual exchange of know-how. The WP also intends to deal with various aspects of the reduction of the environmental impact of refri-



Mini-channel heat exchangers allow minimization of refrigerant charge

gerating systems achieved by reduction in the refrigerant charge. This working party could initiate a work dynamic leading for instance to new rules on refrigerating plant design. One activity of the group will consist in evaluating the possible application fields of charge reduction: fields in which considerable savings could be achieved (for instance: commercial refrigeration, air conditioning), fields in which some benefits are possible, fields with very few potential benefits (applications using very compact systems). Later, the focus would be on the fields where the benefits are the greatest. Regulatory aspects related to refrigerant charge will also be discussed. The kick-off meeting of this WP took place at Cemagref, Antony (near Paris) on April 10, 2008 and brought together 14 experts, researchers and engineers from 6 countries. During the recent 8<sup>th</sup> IIR-Gustav Lorentzen Conference on Natural Working Fluids in Copenhagen, a key activity of this WP was announced: the organization of the

Les conférences Gustav Lorentzen connaissent un succès qui ne se dément pas. La dernière a eu lieu à Copenhague (Danemark) du 8 au 10 septembre 2008 et a rassemblé 397 personnes. La prochaine aura lieu à Sydney (Australie) du 12 au 14 avril 2010. Le CO<sub>2</sub> est pour l'instant le fluide le plus étudié.

Mais l'ammoniac reste un fluide très utilisé et très efficace, malgré les risques qu'il présente et l'IIF est convaincu qu'il a aussi un grand avenir. L'IIF organise ainsi maintenant depuis 2005, tous les deux ans, une conférence à Ohrid (ancienne République yougoslave de Macédoine) sur l'ammoniac. La prochaine aura lieu du 7 au 9 mai 2009 ([www.mf.ukim.edu.mk/web\\_ohrid2009/ohrid-2009.html](http://www.mf.ukim.edu.mk/web_ohrid2009/ohrid-2009.html)). L'IIF avait édité en 1999 un guide bilingue français-anglais sur l'ammoniac qui a connu un succès notable. Compte tenu de l'actualité, une nouvelle édition, amendée et complétée, vient de sortir, dans sa version anglaise (la version française suivra ultérieurement).

Vous pouvez commander le guide sur le site de l'IIF : [www.iifir.org](http://www.iifir.org)

Avec l'accord du Programme des Nations Unies pour l'Environnement (PNUE), l'IIF organisera un atelier sur l'ammoniac lors de la prochaine conférence des Nations Unies sur la couche d'ozone qui se tiendra à Doha (Qatar) en novembre 2008. Ce sera aussi une bonne occasion de promouvoir l'ammoniac. Bien entendu, l'IIF aura aussi l'occasion pendant cette conférence, tout comme pendant la Conférence des Nations Unies sur le changement climatique qui se tiendra à Poznan (Pologne) en décembre prochain, d'intervenir pendant les sessions de haut niveau, comme il l'a fait depuis plusieurs années.

Nous en reparlerons dans notre prochain numéro.

**Didier Coulomb,**  
Director of the IIR

1<sup>st</sup> International Workshop on Charge Reduction; it is scheduled to take place in Paris early April 2009.<sup>1</sup>

We renew here our call to everyone interested: researchers, technical centres, industrial firms, institutional stakeholders... to take

part in this WP and its activities. Commissions B1 (Thermodynamics and transfer processes) and B2 (Refrigerating equipment) are especially concerned by activities of this WP which also remains open to other commissions such as D1, D2, E1 and E2.

Information provided by Mohammed Youbi-Idrissi.

<sup>1</sup>For more information, please contact **Hélène Macchi-Tejeda** (the Chairman of the WP): [helene.macchi@cemagref.fr](mailto:helene.macchi@cemagref.fr) or **Jacques Guilpart**, [jacques.guilpart@cemagref.fr](mailto:jacques.guilpart@cemagref.fr)

## IIR events

### International events

■ The 8<sup>th</sup> IIR-Gustav Lorentzen Conference on Natural Working Fluids (GL2008) was held in Copenhagen on September 7-10, 2008. The event attracted 397 participants from 32 countries. The initial conferences in the series tended to attract participants from universities and research centres, whereas the industry has now become very interested in these events: roughly half the attendees were from the manufacturing, designing, installer, consultancy and service sectors. This demonstrates that the focus is clearly on applications. The IIR and several manufacturers ran stands. A total of 130 papers, including 50 on CO<sub>2</sub>, were presented. Fifteen papers dealt with heat pumps, 8 covered ammonia and 8 dealt with hydrocarbons, 8 were on sorption and 10 dealt with secondary refrigerants including two-phase and slurry technology. 4 technical tours took place: Energy efficient refrigeration with natural refrigerants CO<sub>2</sub> and R-1270 in a full-scale Føtex supermarket; transcritical CO<sub>2</sub> refrigeration booster system for Coop supermarket; Denmark's largest transcritical industrial cold and frost storage system with CO<sub>2</sub> at Inco Denmark; efficient supermarket refrigeration with transcritical CO<sub>2</sub> applied by SuperBest. Mark the date of the 9<sup>th</sup> Gustav Lorentzen event in your diaries: it will take place in Sydney, Australia, on April 12-14, 2010. Purchase the GL2008 proceedings: [www.iifir.org](http://www.iifir.org)



In the foreground on the left: Prof. Joachim (Joe) Paul, the main organizer of GL2008. Photo courtesy of [www.scanref.com](http://www.scanref.com)

■ An IIR event, **HVAC Energy Efficiency Best Practice Conference**, was organized in Melbourne by AIRAH (Australian Institute of Refrigeration, Air Conditioning and Heating), on September 17-19, 2008. Various topics were covered: the rating of energy systems, district cooling, highly efficient HVAC systems, solar cooling and heating... with a practical approach. There were 71 attendees, from Asia, Australasia, Europe and North America.

■ The latest Purdue Conferences (19<sup>th</sup> International Compressor Engineering

Conference and 12<sup>th</sup> International Refrigeration and Air Conditioning Conference) took place on July 14-17, 2008, in West Lafayette (Indiana, USA). The total attendance of the conference and the short courses (534 people) was almost the same as in 2006, with slightly higher attendance of the refrigeration conference and slightly fewer attendees at the compressor event. This major IIR-co-sponsored event was followed by the 50th Anniversary of the Herrick Laboratories (July 18-19), with interesting technical tours and of course festivities.

■ The Dutch Association of Refrigeration (NvVK) was founded in 1908, like the IIR with which it has been strongly linked over the years. It celebrated its 100<sup>th</sup> Anniversary in Arnhem (The Netherlands) on September 23, 2008 (in the zoo!), after having organized other events earlier in the year. The conference on September 23 summarized these events and presented the IIR's history and challenges. NvVK obtained official recognition: it became a Royal Dutch Society. [www.nvvk.nl](http://www.nvvk.nl)

### Conference update

■ A record number of IIR events will be held in 2009 and there's something for everyone!

• With "Explore the future: Green, lean, and cost-effective cold storage and distribution operations" as theme, the 12<sup>th</sup> European Cold Chain Logistics Education Program & Trade Show is to be held on January 26-27, 2009 in Amsterdam. This event will enable analysis and discussion of operations-oriented topics, with a focus on lean and cost-effective activities, green and sustainable policies, new logistic concepts, automatic loading and unloading systems, refrigerants, liability and insurance, reefer logistics, energy efficiency and saving, EU regulations and market trends.

[europe@gcca.org](mailto:europe@gcca.org)

[www.iarw.org/hg/europeaneducation/index.asp](http://www.iarw.org/hg/europeaneducation/index.asp)  
IIR members can register at IARW/WFLO member rates.

• The 1<sup>st</sup> IIR Cold Chain Conference will take place in Singapore, on April 27-29, 2009. Keep updated: [david@airah.org.au](mailto:david@airah.org.au) or [brendan@airah.org.au](mailto:brendan@airah.org.au) [www.airah.org.au/iir-coldchain09.asp](http://www.airah.org.au/iir-coldchain09.asp)

• The next conference in a series of leading-edge IIR events on ammonia is to be held in Ohrid, Macedonia, on May 7-9, 2009: **Ammonia Refrigeration Technology**. Submit an abstract and register: [ristoci@ukim.edu.mk](mailto:ristoci@ukim.edu.mk) [www.mf.ukim.edu.mk/web\\_ohrid2009/ohrid-2009.html](http://www.mf.ukim.edu.mk/web_ohrid2009/ohrid-2009.html)

• The 3<sup>rd</sup> International Conference on Magnetic Refrigeration at Room Temperature will take place in Des Moines, USA, on May 12-15, 2009. Register for this cutting-edge event: [vtkp@ameslab.gov](mailto:vtkp@ameslab.gov)

• The 8<sup>th</sup> Conference on Phase-Change Materials and Slurries is to be staged by the IIR working party in this field in Karlsruhe, Germany, on June 3-5, 2009. Contact [stefanie.tolmie@hs-karlsruhe.de](mailto:stefanie.tolmie@hs-karlsruhe.de) or [laurence.fournaison@cemagref.fr](mailto:laurence.fournaison@cemagref.fr) to present a paper and register. [www.iifir.org/en/doc/conf/pcm2009.pdf](http://www.iifir.org/en/doc/conf/pcm2009.pdf)

• The 3<sup>rd</sup> Conference on Thermophysical Properties and Transfer Properties of Refrigerants is to take place in Boulder (CO) USA on June 23-26, 2009. Submit a paper and register: [piotr.domanski@nist.gov](mailto:piotr.domanski@nist.gov) or [mark.mclinden@nist.gov](mailto:mark.mclinden@nist.gov) [www.iirboulder2009.org](http://www.iirboulder2009.org)

• For an update on the state of the art in the compressors field, register for the 7<sup>th</sup> International Conference on Compressors and Coolants – Compressors 2009 to be held in Casta Papiernicka, Slovak Republic, on September 30-October 2, 2009. Present a paper and register: [zvazchkt@isternet.sk](mailto:zvazchkt@isternet.sk) [www.isternet.sk/szchkt](http://www.isternet.sk/szchkt)

### New publications



■ The new version of the IIR's guide **Ammonia as a Refrigerant** has just been published! It was prepared by **Dr A.B. Pearson**, member of IIR Commission E1. The overarching aim is to enhance decision-makers', designers', fitters' and end-users' knowledge of the potential uses of ammonia as a refrigerant, in this way promoting demand for plant and equipment designs that utilize the economic benefits of ammonia while safeguarding operating personnel, refrigerated products and the environment. Main topics: thermophysical properties of ammonia - exposure to ammonia, safety precautions - design of ammonia installations - ammonia applications - future prospects - standards and regulations - bibliography.

Order the English version (39 €): [www.iifir.org/en/details.php?id=1166](http://www.iifir.org/en/details.php?id=1166)

■ The IIR has issued a new Informatory Note, **RFID for Cold Chain Applications**, prepared by Silvia Estrada-Flores, member of IIR Commission D2, and David Tanner, President of the IIR's Science and Technology Council.



It presents an overview of the advantages and future applications and challenges of RFID-based monitoring technologies for the cold chain of perishables. Consult it: [www.iifir.org](http://www.iifir.org)

## Obituary

■ The former Managing Director of Frigoscandia AB, **Per-Oskar Persson** of Helsingborg, Sweden, died on August 26, 2008 at the age of 84. He was an Honorary Member of the IIR and former President of Commission D1, 1971–1979, and Head of Section D (1979–1987). He was a pioneer in a wide range of refrigeration technologies used in food freezing, cold storage, tunnel construction and medicine. Read Prof. Eric Granryd's tribute to Per Oskar Persson and

his outstanding achievements:  
[www.iifir.org/en/news.php?rub=1&page=1&id=1798#1](http://www.iifir.org/en/news.php?rub=1&page=1&id=1798#1)

## New IIR members

■ The IIR welcomes the following new members:

### Corporate members

JBT FoodTech AB, Helsingborg, Sweden  
Playcube SARL, Paris, France  
Air Products & Chemicals Inc,  
Allentown PA, USA

### Private members

Mr Michael Aarup, Denmark  
Dr Maria Luisa Doldi, Austria  
Mr Panagiotis Moutevelis, Greece  
Mr Roland Houdault, France  
Mr Lennart Rolfsman, Sweden

### Junior members

Mr Ki-dong Son, South Korea  
Mr Yunusa Iyanda Ogunbi, Nigeria  
Mr Konstantinos Papageorgiou, Greece  
Prof. Wu Chen, China  
Mr William A. Mauro, Italy

## News from IIR members

■ The **IIAR** has teamed up with RETA and IARW to produce an **Ammonia Refrigeration a Training Guideline** in order to make training more comprehensive and consistent. The guideline can be used to set up tailored training programmes. The aim is to enhance safety and operations thanks to better trained operators. Order at [www.iiar.org](http://www.iiar.org).

## In the news

### The HCFC phase-out challenge (4)

■ The results of a recent study (1) sponsored by the refrigerants manufacturer DuPont show that 65% of refrigerating plants in 9 key European Union markets were still using HCFC refrigerants 18 months before the ban on use of virgin HCFCs in EU refrigerating plants as of January 1, 2010 in application of Regulation 2037/2000 on substances that deplete the ozone layer. Although awareness levels of the legislation are high – 90% of respondents claimed to be aware of the impending ban – the large banks of HCFCs suggest that “it has not been coupled with a sense of urgency to ensure compliance”. DuPont noted that the estimated 130 000 tonnes of HCFCs in use – primarily in the form of R-22 – would require tens of thousands of these installations to be serviced every week, creating a “significant strain on contractor services”. Although recycled HCFCs are authorized until 2015, DuPont said given the high cost of the recycling process, stocks might meet only 15% of the capacity needed to service remaining plants using HCFCs.

End-users have been warned to expect continued rise in the price of R-22; 10 to 15% increases in price are likely to become the norm every quarter until December 2009, according to industry sources.

In order to help European end-users to cushion the upfront investment required to comply with legislation, companies such as UK-based Klima-Therm and Cool-Therm propose to replace R-22 chillers with modern equipment and to recondition and export the R-22 plant to developing countries including China and India where consumption of HCFCs is permitted under the Montreal Protocol until 2030 (2). Even if this option enables European end-users to get high-efficiency replacement systems for a reduced cost and developing country end-users to get low cost reconditioned refrigerating plants, this practice is questionable: it simply shifts the consumption of ozone-depleting HCFCs from industrialized to developing countries and does not provide the latter with incen-

tives to move to environmentally friendly refrigerants.

(1) Based on a cross-industry study in UK, Ireland, France, Spain, Italy, Germany, Belgium, The Netherlands and Poland between April and June 2008

(2) [www.acr-news.com](http://www.acr-news.com)

## Trends and Figures

### ■ World AC heat pump market

The use of heat pumps (HPs) is increasing in the European Union (EU), Japan, and China. According to JARN's figures, the global market for room air conditioners (RACs) and packaged air conditioners (PACs) was about 78.7 million units in 2007, 72% of which were HP type air-conditioning (AC) systems.

In China, the largest AC market (24.5 million units), the proportion of HP types has continued to increase over the past few years. Makers claim that about 82% of the RACs sold in China are HP systems.

Japan boasts the most advanced HP technologies, a mature HP market and the highest proportion of heat pumps among AC systems with 98% of the RACs and 94% of the PACs, 8 million units in all.

In the US, the size of the HP type AC market in the US in 2007 was 1.9 million units, most of which are used in the sunbelt States. Half the packaged terminal AC market (490 000 units) comprised packaged terminal heat pumps.

In recent years, the European Union (EU) has evolved as a high potential market for HP technology. EU legislation, including the F-gas Regulation, the Kyoto Protocol targets, and soaring energy prices, are strong incentives to use renewable energy solutions, most importantly HP solutions. France has the largest air-water HP market (over 100 000 units operating). In 2005–2007, the market size increased from 12 700 to 56 000 units. A key success factor was the French government's incentive policy.

JARN, August 25, 2008

### ■ Healthcare: big business for the liquid gas sector

It is estimated that healthcare accounts for around 10% of GDP of most developed nations and in 2003 it was estimated that it had consumed around 25% of the GDP of

the US. Both the North American and Western European markets are believed to dominate the sector worldwide, accounting for respectively 34.7% and 34.3% of it. Furthermore, because of constant technical improvements, an ageing population and increasing demands, the scope for growth seems endless...

Applications using liquid gas (gas chromatography, blood gas analysis and other static or portable medical products) are rife in the sector which represents big business for the industrial gas community. As an example, Air Liquide – probably the biggest player in the field with a 23.6% share of the industry – has recently decided to reinforce its operations in healthcare in Western Europe and the US. Linde follows closely behind with a 15.8% share and has also grown considerably in recent years, in particular through the acquisition of BOC (7.7%), leading them to 23.5% of the market. Other companies also have an important share; Praxair has 15% and fellow US firm Air Products 11%. Efforts to improve the overall level of facilities and services in the healthcare industry, coupled with the rapid technological advances in the gas industry, many of which more specifically target desired improvements in the healthcare sector, could offer to medical gas companies major opportunities in the future.

[www.gasworld.com](http://www.gasworld.com)

## Transport and storage sharing

■ The **Sustainable Distribution Initiative**, a cooperation scheme aimed at responding to spiralling energy costs and the demands of consumers to reduce the number of food miles in product distribution is being initiated by IGD, a food and grocery think tank. Currently, 37 of the UK's largest companies have signed up for the initiative, including Coca-Cola and Heinz. IGD claims it will result in the removal of 800 trucks from UK roads this year, cutting energy use by about 23 million litres of diesel per year.

Similarly, on a European level, a **Global Commerce Initiative (GCI)** working party presented the results of its “Future Supply Chain,” an even more ambitious project at the ECR (European Conference Review) conference in Berlin in June 2008. This new supply chain solution is a distribution and

storage network – including amongst others, Wal-Mart, Nestlé, Carrefour, Crown Holdings Inc, Kraft Foods, Ahold, Procter and Gamble, Metro Group, Loblaw and Unilever. Each warehouse and truck is being used by several competitors, and it is hoped this could potentially save up to 25% emissions per pallet. Participating suppliers would relinquish their own warehouses and deliver directly from the manufacturing facility into a collaborative warehouse that is run jointly with other suppliers. From there the goods would be shipped either to city hubs that supply urban stores or regional centres that deliver to rural zones.  
[www.foodnavigator-usa.com](http://www.foodnavigator-usa.com) ECSLA Newsletter, September 2008

## LHC accelerating science

■ The first beam in the Large Hadron Collider at CERN was steered around the full 27 km of the world's most powerful particle accelerator on September 10, 2008, in Geneva. Beams of protons circulating in opposite directions were brought into collision and the resulting spray of particles will be analysed. High-field superconducting magnets are required to guide and focus the beams. This implies high electrical currents, which can only be accommodated by superconducting windings offering no resistance to electricity, and therefore no dissipation. To maintain the magnet windings in the superconducting state under high currents and high fields, they must be cooled down to  $-271.3^{\circ}\text{C}$ , just  $1.9^{\circ}\text{C}$  above absolute zero by sub-cooled helium (See IIR Newsletter No. 29). Unfortunately, on September 19, during commissioning (without beam) of the final LHC sector at high current, an incident occurred resulting in a large helium leak (about 2 tonnes) into the tunnel. According to CERN, the most likely cause of the incident is a faulty electrical connection between two of the accelerator's magnets. The time necessary to achieve room temperature, inspection and repairs precludes a restart before CERN's obligatory winter maintenance period, bringing the date for restart of the accelerator complex to early spring 2009. CERN specified that "Particle accelerators such as the LHC are unique machines, built at the cutting edge of technology. Each is its own prototype, and teething troubles at the start-up phase are therefore always possible." In spite of this delay, CERN remains optimistic and the official inauguration is still scheduled on October 21, 2008.



The cryogenic systems of the superconducting dipole magnets were tested here before being installed in the LHC tunnel"

The aim of the LHC experiments is to "allow physicists to complete a journey that started with Newton's description of gravity. Gravity acts on mass, but so far science is unable to

explain the mechanism that generates mass". LHC experiments will also "investigate the reason for nature's preference for matter over antimatter, and they will probe matter as it existed at the very beginning of time." Information provided by Philippe Lebrun, Head of the IIR's Section A and from CERN press releases:  
<http://press.web.cern.ch/press/PressReleases/List.html>

## MAC news

■ During the IAA Exhibition for commercial vehicles in Hanover on September 24, 2008, the German Environment Agency (UBA) presented the **first service vehicle** – a standard Volkswagen Touran – **equipped with a CO<sub>2</sub> air-conditioning system**. According to UBA, results from first testings showed that at  $28^{\circ}\text{C}$  ambient temperature, the CO<sub>2</sub> mobile air-conditioning (MAC) system consumes 45% less additional fuel than current systems using R-134a and at high ambient temperatures of  $35^{\circ}\text{C}$  it consumes 14% less fuel. After all tests have been completed, the CO<sub>2</sub> car will be used as a regular service car by UBA, as a means of testing long-term reliability.  
[www.umweltbundesamt.de/uba-info-presse-el/2008/pdf/pe08-067.pdf](http://www.umweltbundesamt.de/uba-info-presse-el/2008/pdf/pe08-067.pdf)

■ **Solar air conditioning for Toyota's Prius**  
 Toyota's ecological Prius gas-electric hybrid car is to take solar air conditioning on board next year, Japanese newspaper *Nikkei* reported in early September. The solar panels on the roof of the new Prius model will provide 2.5 kW of electricity – not enough to power the air-conditioning system alone but of symbolic importance.  
[www.usatoday.com](http://www.usatoday.com)

## Briefs

■ **Iran has LNG plans on a very large scale**  
 Iran is reportedly planning to finance up to 120 billion USD for LNG production over the next 12 years and become the world's largest LNG exporter. As of now, there are no LNG industries in Iran, but there are gas resources estimated at 27.5 trillion m<sup>3</sup>, over 15% of the total global gas reserves. In an interview with *Emirates Business*, Ali Kheirandish, Managing Director of the government-controlled LNG company, declared: "Our forecast is to produce 80 million tonnes of LNG by 2020." He also said that his company would pump more than half the country's output and had already enough markets in Asia and Europe for its products.  
 LNG World News

■ **HARFKO 2009** will be held at Kintex in Koyang City, South Korea, on March 18-21, 2009. Full information: [www.harfko.com](http://www.harfko.com)

■ **The 7<sup>th</sup> Cryogen-Expo** will be held on November 11-13, 2008 at Expocentre in Moscow, Russia. The 5th International Conference Cryogenic Technologies and Equipment. Prospects of Development will be held during the exhibition, on November 12-13, 2008. For full details and a list of exhibitors:  
<http://www.mirexpo.ru/eng/exhibitions/cryogen08.shtml>

## Out of the ordinary



### ■ Cool Olympics

During the Beijing Olympic Games held in Beijing in August 2008, a number of athletes benefited from cooling technology. Concerned about the high temperatures usually encountered in Beijing in summer, several teams turned to cooling technology. The **DS Kool cooling vest** was developed specifically to keep athletes cool. Circulating water at normal air-conditioning temperatures draws heat from the body and the vests are cooled by placing them in an air-conditioned room. The vests are fitted with a temperature control valve and are worn before or after a race or during training to achieve an optimal body temperature. Former ice-gel cooling jackets tended to chill the skin and induce shock, leading to shivering, headaches and dizziness.  
<http://www.prlog.org/10101350-cooling-vest-in-beijing-2008-olympic-games.html>

## Technology

### Chillers: efficiency takes off

■ Chillers are key refrigerating systems since, according to the Department of Energy, in the US, they account for about 13% of the power consumed by the nation's buildings and 9% of the overall demand for electric power. Examples below illustrate recent progress achieved regarding chillers in terms of energy efficiency.

• The "**free cooling**" chiller concept is gaining importance in Information Technology (IT) and commercial building applications. It specifically refers to package air-cooled chillers with an integral free cooling circuit and a self-contained control system. Ambient air, temperature permitting, is used to cool the chilled water supply as in a conventional air-cooled chiller, but with the addition of an integral dry cooler circuit – built into the same mechanical assembly that supports the condenser coils and fans, – thereby reducing power consumption and direct expansion mechanical cooling. According to K. Carpenter, Sales Manager at Emerson Network Power, in applications where the load is relatively constant, such as data centres and offices highly populated with IT, a free cooling chiller will typically reduce energy consumption by about 35%. When designing a free cooling system, it is important to bear in mind that the higher the chilled water temperatures, the higher will be the energy savings. An efficient free cooling chiller requires the use of peak efficiency twin rotor screw or fully hermetic scroll compressors. Coil areas are maximized so that airflow rates and fan power requirements are similar to those of conventional chillers.

• **Chillers based on the oil-less centrifugal Turbocor compressor** are known to deliver high efficiency thanks to variable speed capability, magnetic bearings and compact design. Two recent projects in the UK, using the Turbomiser chiller – developed by Geoclima and harnessing the benefits of this



compressor – have been reported to show significant energy savings. The chiller's outstanding energy performance is due to the use of a combination of flooded evaporators to maximize heat exchange and control technology fully integrated with the compressor control, plus high-efficiency fans. This approach ensures that high COP is delivered at all times, optimizing chiller performance in response to changing ambient temperatures and load.

A 3-MW-installation at the Dorchester Hotel in London has replaced the existing water-cooled chillers and cooling towers and is expected to deliver a payback in the first year on the premium over conventional chillers through improved energy performance and use of an air-cooled condenser, saving on water and chemical treatment costs.

The second installation at the Hilton Hotel in Stansted Airport is anticipated to deliver 30% energy savings compared with traditional designs based on reciprocating, screw or scroll-based compressors thanks to a high part-load performance.

RAC, August 2008. *Service Engineer*, Autumn 2008

- **Nanotechnology used in a refrigeration lubricant additive** could significantly boost the energy efficiency of chillers, according to the US National Institute of Standards and Technology (NIST). NIST has found that dispersing the right amount of copper oxide particles in a standard polyester refrigerant lubricant and combining it with R-134a improves heat transfer by between 50% and 275%. The particles, which are 30 nanometres in diameter, are thought to stimulate double bubbles – secondary bubbles that form on top of bubbles initiated at the boiling site. Bubbles can carry heat away from the surface, and the fact they are being formed more efficiently means the heat gets transferred more readily. Just how nanomaterial additives to lubricants improve the dynamics of heat transfer in refrigerant/lubricant mixtures is not thoroughly understood, but the right concentration of nanoparticles seems to be crucial.

[www.nano.org.uk](http://www.nano.org.uk)

### Air paths inside fruit

- Microscopically small structures inside pears and apples allow them to “breathe”. Researchers at the **Catholic University of Leuven** and the **European Synchrotron Radiation Facility (ESRF)** have visualized these pathways for the first time, therefore proving their previously hypothesized existence and allowing a better understanding of how fruit degrades after harvest. The structures appear as irregular cavities between cells in apples, and as tiny interconnected channels in pears. The three-dimensional images of the fruit help to determine and explain the gas exchange rates, oxygenation, and when the fruit cells start to die and browning starts. The Leuven team used the ESRF in Grenoble, France, to perform tomographic imaging of



fruit samples, with 3-D images that are accurate below 1/1000<sup>th</sup> of a millimetre.

It is still unclear how the airways develop and why they are different in apples and pears but the results help explain that pears are very prone to decay during storage: the micro-channels are so small that oxygen supply is very limited.

[www.esrf.eu/news/general/fruit](http://www.esrf.eu/news/general/fruit)

### Ultracold polar molecules

- Scientists at **JILA**, a joint institute of the **National Institute of Standards and Technology (NIST)** and the **University of Colorado at Boulder (CU-Boulder)**, have applied their expertise in ultracold atoms and lasers to produce the first high-density gas of ultracold “polar” molecules that are both stable and capable of strong interactions. The long-sought milestone in physics has potential applications in quantum computing, precision measurement and designer chemistry. These molecules are potentially a new form of matter, a quantum gas with strong interactions that vary by direction and are externally controlled, for instance by using electric fields. They also have a long lifespan for the quantum world (about 30 milliseconds). JILA's ultracold polar gas has a density of 10 quadrillion molecules per cm<sup>3</sup>, a temperature of 350 nanoKelvin above absolute zero (-273.15°C), and a measurable separation of electric charge. The research performed by JILA is part of a larger effort to develop techniques to understand and control the complex features of molecules and their interactions. Practical benefits could include new chemical reactions and processes for making designer materials and improving energy production, new methods for quantum computing using charged molecules as quantum bits, new tools for precision measurement such as optical molecular clocks, and improved understanding of condensed matter phenomena such as colossal magnetoresistance (for improved data storage and processing) and superconductivity (for perfectly efficient electric power transmission). [http://www.nist.gov/public\\_affairs/releases/ultracold\\_polar\\_molecules.html](http://www.nist.gov/public_affairs/releases/ultracold_polar_molecules.html)

### Briefs

- **Ice cubes at over 10°C**

Ice slurries are well known for their capacity to transport heat within confined systems. **Cemagref** is currently working on a new type of two-phase secondary refrigerant: a **gas-hydrate slurry** which could pave the way for applications in the industry and in air conditioning. In the early 2000s, in the framework of a study on the crystallization of water, researchers at Cemagref in Antony, France, observed the formation of gas-hydrate crystals at positive temperatures, over 10°C, which proves to be very interesting for the air-conditioning sector as it enables domestic cooling without entailing such cold temperatures and uses an environmentally friendly secondary refrigerant.

The team that set up an experimental prototype of an ice-slurry making system is led by Laurence Fournaison, who is incidentally the chairperson of the IIR's Phase-Change Materials and Slurries for Refrigeration and Air Conditioning Working Party. The aim of the prototype is to characterize the thermal

and hydraulic properties of the slurry and model its behaviour. It was thus discovered that hydrate slurry was very efficient. One kg provides 500 kJ of energy on melting, whereas 1 kg of ice crystals provides only 333 kJ. [www.cemagref.fr](http://www.cemagref.fr)



- In order to identify specimens for forensic investigations, medical research or blood, plasma and semen donations, reliable identification is vital. Labels used for deep-frozen material need to be durable and legible and must remain where they are adhered. **LG International** has developed resistant **cryogenic labels**. They are tear-resistant that are not weakened by moisture or extreme cold. They are top-coated and used with thermal transfer printers. Identification is customized: barcodes and serial numbers can be used. LGI's cryogenic adhesive, when applied to a wide range of clean surfaces such as plastic, poly, metal or glass at room temperature, will withstand extreme cold temperatures to -80°C. The labels are suitable for clinical specimens, pharmaceutical suspensions and other perishable items.

[www.lgintl.com/cryogenic-labels.htm](http://www.lgintl.com/cryogenic-labels.htm)

- **A comeback for Einstein's fridge?**

Scientists at Oxford University have rebuilt one of Einstein's early inventions in an attempt to develop an environmentally friendly refrigerator that runs without electricity. They have built a prototype of a fridge patented in 1930 by Einstein and his colleague Leo Szilard. It has no moving parts and uses only pressurized gases to refrigerate. The original refrigerators were used until supplanted in the 1950s by more efficient models using compressors and freons. Einstein's fridge used ammonia, butane (in the evaporator) and water and took advantage of water's lower boiling temperature when the pressure was lowered. Current research is focused on ways of improving the efficiency by replacing the gases (expected to quadruple the efficiency) in the fridge and hopes to power it with solar energy. The fridge will be maintenance-free because it has no moving parts, and this will be of vital importance in rural areas.

<http://www.guardian.co.uk>

- **Flat-panel fridge**

According to researchers at Pennsylvania State University, a new approach to refrigeration and cooling could make for high-efficiency, portable, and quiet refrigerators in the future. The method works by repeatedly applying an electric field to long molecules called polar polymers. Researchers consider that the method will be significantly more efficient than conventional systems. The flat-panel technology takes its cooling power from the ordering and disordering of the polymers, which are distributed in a thin film just a millionth of a metre thick. In an electric field, the molecules spontaneously line up, creating heat. Removing the field causes the polymers to cool down again as a result of the electrocaloric effect. Though the temperature range of the new system is still too high to result in ice-cold beer, it has achieved a cooling of 12°C, showing that polar polymers might achieve suitably low temperatures.

<http://news.bbc.co.uk/2/hi/technology/7568035.stm>

## IIR conferences

2009	April 27-29	Singapore Singapore	<b>2009 1<sup>st</sup> IIR Cold Chain Conference</b> Brendan Pejko: brendan@airah.org.au David Leach: david@airah.org.au Fax: +61 3 9614 8949 <a href="http://www.airah.org.au/iir-coldchain09.asp">http://www.airah.org.au/iir-coldchain09.asp</a>	<b>IIR Conference</b> C2, D1, D2
	May 7-9	Ohrid Macedonia (FYROM)	<b>Ammonia Refrigeration Technology</b> Risto Ciconkov: ristoci@ukim.edu.mk <a href="http://www.mf.ukim.edu.mk/web_ohrid2009/ohrid-2009.html">www.mf.ukim.edu.mk/web_ohrid2009/ohrid-2009.html</a>	<b>IIR Conference</b> B2 with B1, D1
	May 12-15	Des Moines United States	<b>3<sup>rd</sup> International Conference on Magnetic Refrigeration at Room Temperature</b> Vitalij K. Pecharsky: vitkp@ameslab.gov	<b>IIR Conference</b> A1, B2, E2
	June 3-5	Karlsruhe Germany	<b>8<sup>th</sup> Conference on Phase-Change Materials and Slurries</b> Stefanie Tolmie: stefanie.tolmie@hs-karlsruhe.de Laurence Fournaison: laurence.fournaison@cemagref.fr Fax: +49 721 925 1915 <a href="http://www.iifir.org/en/doc/conf/pcm2009.pdf">http://www.iifir.org/en/doc/conf/pcm2009.pdf</a>	<b>IIR Conference</b> B1, B2, D1
	June 23-26	Boulder USA	<b>3<sup>rd</sup> Conference on Thermophysical Properties and Transfer Processes of Refrigerants</b> Piotr Domanski: piotr.domanski@nist.gov Mark McLinden: mark.mclinden@nist.gov Fax: +1 301 9758973 <a href="http://www.IIRBoulder2009.org">http://www.IIRBoulder2009.org</a>	<b>IIR Conference</b> B1
2010	Sept. 30 - Oct. 2	Casta Papiernicka Slovak Republic	<b>7<sup>th</sup> International Conference on Compressors and Coolants - Compressors 2009</b> Peter Tomlein: zvazchkt@isternet.sk Fax: +421 2 45646971 <a href="http://www.isternet.sk/szchkt">http://www.isternet.sk/szchkt</a>	<b>IIR Conference</b> B1, B2 with E1, E2
	April 12-14	Sydney Australia	<b>9<sup>th</sup> IIR-Gustav Lorentzen Conference on Natural Working Fluids (GL2010)</b> Brendan Pejko: brendan@airah.org.au David Leach: david@airah.org.au Fax: +61 3 9614 8949 <a href="http://www.airah.org.au">http://www.airah.org.au</a>	<b>IIR Congress</b> B1, B2 with E1, E2
2011	August 21-26	Prague Czech (Republic)	<b>23<sup>rd</sup> IIR International Congress of Refrigeration: Refrigeration for Sustainable Development</b> Ladislav Cervinka: icaris@icaris.cz	<b>Congress</b> All Commissions

## IIR-co-sponsored conferences

2008

■ Berlin – Germany – November 4-7

**Postharvest Unlimited 2008**

Andrea Gabbert: gabbert@atb-potsdam.de

Fax: +33 49 331 5699 849

<http://www.atb-potsdam.de/postharvest08>

■ Tokyo – Japan – November 21-23

**Cryomedicine 2008**

Dr Sajio Sumida: cryomedicine@aol.com

<http://www.ksueoka.jp/jsltm35>

■ Belgrade – Serbia – December 3-5

**39<sup>th</sup> International Conference on Heating, Air**

**Conditioning and Refrigeration (the IIR's 100<sup>th</sup> anniversary will be celebrated during this event)**

Dr Branislav Todorovic: todorob@eunet.yu

Fax: +381 11 337 0364

<http://www.kgh-kongres.org>

2009

■ Amsterdam – Netherlands – January 26-27, 2009

**12<sup>th</sup> European Logistics Cold Chain Education**

**Program**

Alien Wolbink or Theo Van Sambeek: europe@gcca.org

Fax: +31 38 4546550

<http://www.iarw.org/hq/europeaneducation/index.asp>

2010

■ Oran – Algeria – April 18-21

**LNG 16 - Liquefied Natural Gas**

**LNG Conference Secretariat - Oran:**

Ing I6-secretariat@avl.sonatrach.dz

Fax: +213 41 489 190

<http://www.lng16.org>

shall be considered technically and economically feasible, and therefore mandatory". In the press release that accompanies the proposed regulation, estimates suggest that "by 2015 the global ODS banks will add up to 2 million ozone-depleting potential (ODP) tonnes or 13.4 billion tonnes of CO<sub>2</sub>eq – hence the need for further action". Priorities of the European Commission "will notably include ensuring that the global phase-out of HCFCs leads to the introduction of climate-friendly alternatives, tackling ODS banks in developing countries, reducing and monitoring global controls on new ODS adequately and, if necessary, stepping them up".

<http://ec.europa.eu/environment/ozonelreview.htm> R744.com

\*2020 corresponds to the ban on production; ban on use of virgin HCFCs is from 2010 (see "The HCFC challenge")



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The **IIR Newsletter** is a quarterly publication of the IIR

**Managing Editor:** Didier Coulomb

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Gerard Vidal, Cornelia Keizer, Thomas Michineau

**Graphic Design:** Arobase Communication

## ■ Edible optics to prevent food poisoning



Edible nanosensors made from silk could alert consumers regarding potential contamination of food thanks to a hologram-type indicator embedded in the pack. Researchers at Tufts University in the US are working on the development of bioactive silk sensors (in the form of lenses, microlens arrays and holograms) that will indicate the presence of *Escherichia coli*, salmonella and other potentially dangerous microorganisms in bags of fresh produce. To form the devices, the team boiled cocoons of the *Bombyx mori* silkworm in a water solution and extracted the glue-like sericin proteins. The purified silk protein solution was poured onto negative moulds of ruled and holographic diffraction gratings with spacing as fine as 3600 grooves/mm. The cast silk solution was dried to create solid fibroin silk films. A similar process was followed to create lenses, microlens arrays and holograms. The films with thicknesses ranging from 10 to 100 µm were characterized for transparency and optical quality. [www.ajc.com](http://www.ajc.com)

## Regulations-Standardization

■ The European Commission presented on August 1, 2008, a **proposal to amend current Regulation 2037/2000** on ozone depleting substances (ODS) highlighting the interplay between both the ozone depleting and global warming effect from such substances ([http://ec.europa.eu/environment/ozonel/pdf/sec\\_2366\\_en.pdf](http://ec.europa.eu/environment/ozonel/pdf/sec_2366_en.pdf)).

The draft amended regulation:

- brings forward the production phase-out of HCFCs from 2025 to 2020\* in line with the recent decision under the Montreal Protocol adopted by the Parties in 2007;
- introduces a list of new ODSs in the regulation for the first time for which the reporting of volumes produced and imported is required;
- tightens current provisions on the recovery and destruction of ODS contained in products and equipment ("ODS banks"). The Commission will be "empowered to compile a list of products and equipment for which recovery, or destruction without prior recovery, of controlled substances