Bonne Année à tous,

The IIR has been creating different initiatives to make refrigeration more appealing to young engineers, researchers and technicians for some years. Although a growing and innovative sector – particularly regarding pressing environmental issues – it attracts few young people due to a lack of visibility and positive images.

That is why the IIR has created special membership categories (juniors under 30, juniors aged 30-35), free services (Cool Offer) and prizes and competitions. A call for abstracts is now in place for the next International Congress of Refrigeration, which will take place in Montreal in August 2019. The congress will establish a new competition for students.

The IIR has set up a Working Group, Careers in Refrigeration (CaRe), which has held several meetings and made a number of presentations at conferences. Their next meeting will take place at the IIR conference on the cold chain in Beijing in April 2018. You can sign up for this event now: www.iccc2018.org/en/. If you become a member of the IIR first, your registration fee will be heavily discounted.

The IIR also takes part in an initiative of French origin: an exhibition on refrigeration for the general public. The exhibition just opened in Paris at the Cité des Sciences et de l'Industrie, and will run until the end of August 2018. Subsequently, we hope that the exhibition will travel and be held in other settings dedicated to the scientific and technical knowledge of the public, including children, all over the world.

Encourage your children and other young people that you know to discover refrigeration and its fundamental role for human life and our environment.

I wish you all a happy new year.

Didier Coulomb,
Director General of the IIR

Activities of the IIR Sub-Commission D2 CERTE on Test Stations (Refrigerted Transport)

The IIR Sub-Commission CERTE regroups the official test stations of the Agreement concerning the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such Carriage (ATP). The objective of this sub-commission, which meets every year, is to establish common standards for the test stations of the 50 countries that have signed the ATP. Eric Devin, secretary of the Commission D2, is the Chairperson of the Sub-Commission CERTE. Organisations such as Transfrigoroute International and CEN (the European Committee for Standardization) are invited to join and take part in these exchanges every year.

CERTE encourages debate and discussion of subjects concerning ATP test stations, with the main objective of advancing the rules of the agreement. These discussions result in recommendations, which are presented on behalf of the IIR to the Working Party on Transport of Perishable Foodstuffs of the United Nations Economic Commission for Europe Committee (UNECE) - commonly known as WP.11 - every year. This Working Party meets in Geneva once a year, usually in October or November. The main functions of WP.11 are to develop and update the ATP agreement that was made in Geneva in 1970, and to promote the facilitation of international transport of perishable foodstuffs by harmonising the regulations that apply to refrigerated transport. 48 countries signed the ATP agreement, two of which (Morocco and Tunisia) are outside of the UNECE area.

The main topics of recent years include:
• a method of measurement of the surfaces of integrated insulation;
• renewal testing of in-service direct driven equipment;
• testing methods of cryogenic engines;
• testing refrigeration units with liquefied gas systems;
• certifying refrigerants with low GWP as drop-in alternatives;
• harmonising test reports;
• calorimeters used to test refrigeration units;
• marking and renewal testing of multi-temperature engines;
• accrediting test stations;
• test procedures that allow the usage of new low GWP refrigerants (including R452A);
• a new approach for estimating air flow design criteria;
• organising inter-comparison at the European level.

The adoption of the amendment regarding the simplification of testing refrigeration units in case of a change of refrigerants, which was adopted unanimously, is an example of the advances obtained through the action of the Sub-Commission CERTE. It will facilitate the conversion of vehicles operating with R404A refrigeration units to lower GWP alternatives. The growing involvement of the IIR Sub-Commission CERTE on Test Stations in the preparation of technical amendments was recommended at the 72nd meeting of the WP.11 in October 2017. The next CERTE meeting will take place in Munich, Germany in April 2018.

Eric Devin
President of the IIR Sub-Commission D2 CERTE
The Conference of the Parties on climate change (COP23) took place on November 6-17, 2017 in Bonn (Germany). Little progress regarding the application of the Paris Agreement was made. The IIR held a booth and had meetings with country representatives and various associations. The Director General delivered a statement during the high level segment of the conference. http://bit.ly/NL73-COP23

The Meeting of the Parties to the Montreal Protocol took place in Montreal (Canada) for its 30th anniversary. The way to phase down HFCs following the Kigali Amendment was the main issue discussed. The Director General delivered a statement during the high level segment and was interviewed by Radio Canada. http://bit.ly/NL73-COP23

On November 21-24, 2017 at the FAO head office in Rome (Italy), the IIR participated in the 14th FAO Conference Meeting on Cold Chain Development. The overall aim was to discuss cold chain development in terms of technological options, in order to identify actions required for expansion of the Cold chain in developing countries. This event gathered worldwide representatives from governments, academia, producers, consumers and private sectors. Please refer to the articles on “Cold chain in developing countries” on page 3 to see some of the outcomes of this meeting.

EPEE and EVIA associations, representing companies in refrigeration, air conditioning, heat pumps and ventilation in Europe, organised the second EUREKA meeting on the new generations and the future needs of their sectors. It took place in Berlin (Germany) on December 11-12, 2017. Didier Coulomb and Andy Pearson presented the cold chain and food issues.

On December 6-8, 2017, the 48th International HVAC&R Congress and Exhibition took place in Belgrade (Serbia), gathering 810 participants from all professions and specialising in cryogenics, refrigeration and air conditioning. compressor engineering, and other refrigerant handling activities. This conference focused on refrigeration and air conditioning, compressor engineering, and high performance buildings will take place on July 9-12, 2018, in West Lafayette, Indiana (USA). Registration opens soon.

 Held only every two years, the 2018 Purdue Conference for Refrigeration and air conditioning, compressor engineering, and high performance buildings will take place on July 9-12, 2018, in West Lafayette, Indiana (USA). Call for abstracts now open!

 IIR members receive a discount on IIR conference registration fees and discounts on IIR conference registration fees. IIR members receive a discount on IIR conference registration fees equaling up to a one-year IIR private membership from a paid-up Member Country.

IIR co-sponsored conferences

 The 6th International Conference on Cryogenic and Refrigeration, April 12-14, 2018 in Shanghai, China, will reunite experts specialising in cryogenics, refrigeration and air conditioning. Registration opens soon.

 The International Conference on Emerging Technologies for Sustainable and Intelligent HVAC&R Systems, organised by The Institution of Engineers - India will take place on July 27-28, 2018 in Kolkata, West Bengal (India). Call for abstracts now open!

Please consult our Conference Calendar on the last page for details on upcoming IIR events.

From December 2017 to August 2018, the “Cité des Sciences et de l’Industrie”, a scientific and technical museum in Paris, will hold an exhibition on Refrigeration in order to show to adults and children what refrigeration is, with applications in different uses (food, cryogenics, etc.). Many IIR members were involved in the preparation of the exhibition. http://bit.ly/NL73-Expo

Projects

CryoHub successful progress

The CryoHub consortium is pleased to announce that Frigologix will host the CryoHub demonstration plant at the Frigologix site in Lommel, which will combine food processing, storage and energy handling activities. This is good news, especially as a lot of the CryoHub work has already focused on the Frigologix warehouse: http://bit.ly/NL73-CryoHub Organised by the TU Sofia partner, a CryoHub dissemination event will take place on March 27, 2018 as a part of the 14th South-East European Conference on Energy, Environment & Renewable energy in Sofia (Bulgaria). More: http://bit.ly/NL73-CryoHub2

REAL Alternatives 4 LIFE e-Newsletter

To be regularly informed of the progress of the REAL Alternatives 4 LIFE project, sign up for the quarterly e-newsletter. Please sign in to register: http://bit.ly/NL73-Real

New IIR publications

In November 2017, the IIR published an Informatory Note on the impact of the refrigeration sector on climate change. Thorough analysis of numerous publications and commentaries was conducted for this note, which was also examined by numerous IIR experts. The note aims to clarify concepts and data in the face of the confusion surrounding the topic. The refrigeration sector, including air conditioning, heat pumps and cryogenic, accounts for 7.8% of global greenhouse gas emissions (based on IIR estimates for 2014). Among these emissions, 37% are direct emissions of CFCs, HCFs and HFCs, and 63% are indirect emissions related to the production and transport of the energy consumed by refrigeration systems (CO₂ emissions mainly). The Kigali Amendment to the Montreal Protocol, which entered into force on January 1, 2016, intended to reduce the production and consumption of HFCs, should help prevent an increase in average global temperatures between 0.1 °C and 0.3 °C by 2100.

Given the importance of this subject, we have prepared a Summary for policymakers, which is accessible to all. The note in its entirety, along with the annexes detailing the estimates, is reserved for IIR members. You also can test your knowledge on refrigeration and the environment with the IIR 10-question Quiz: http://bit.ly/NL73-Quiz

The IIR also just published an Informatory Note on flammable refrigerants. Following the Kigali Amendment under the Montreal Protocol concerning the phase-down of HFCs, it is highly likely that flammable refrigerants will be used in refrigeration and air conditioning. compressor engineering, and high performance buildings. Hence, the IIR has conducted a thorough analysis of numerous publications and commentaries to clarify concepts and data related to the application of flammable refrigerants. This Informatory Note aims to provide an introduction to these matters. A Summary for policymakers has also been published, and the documents can be consulted at: http://bit.ly/IIRNotes

New Working Groups

Two new IIR Working Groups (WGs) have been set up at the initiative of Prof. Xianting Li, President of Commission E1.

Upcoming events

IIR events

Taking place in Beijing (China) on April 6-8, 2018, the 5th IIR Conference on Sustainability and the Cold Chain (ICCC 2018) will provide delegates with the opportunity to showcase and discuss cutting-edge developments in sustainability, retail refrigeration and the cold chain. Registration now open!

In Orford, Quebec (Canada) on May 21-23, 2018, the 12th IIR Conference on Phase-change Materials and Slurries for Refrigeration and Air Conditioning (PCM 2018) will bring together researchers and key stakeholders from the industry to exchange on the latest developments in the field. Early bird registration ends February 23!

Attracting an international audience and the attention of researchers and industry stakeholders, the 13th IIR-Gustav Lorentzen Conference on Natural Refrigerants took place on June 18-20, 2018 in Valencia (Spain), will address critical issues on the future of the phase-down of HFCs, and explore new and more sustainable solutions with natural fluids. Registration is open.

Hosted by the IOR, the first ever IIR International Conference on the Application of HFO Refrigerants will be held in Birmingham (UK) on September 11-13, 2018. The three-day conference will provide a focus for global experience on the use of low flammable AZL refrigerants in compressing the new generation of HFO refrigerants. Early bird registration ends May 16!

The 8th International Conference on Magnetic Refrigeration at Room Temperature (Thermag VIII), scheduled to take place on September 16-20, 2018 in Davos (Switzerland) is the ideal environment to present the latest developments in the field of magnetocaloric materials and cooling techniques. Registration opens soon.

Call for abstracts for ICR 2019 now open! Abstract submission is open until January 15, 2018 for the 25th International Congress on Refrigeration (ICR) to be held in Montreal, Canada from August 24-30, 2019. ICR 2019 will be a major event for all major refrigeration stakeholders from science, academia and industry. Typically attracting over 1,000 experts from across the globe, ICR 2019 will provide the ideal forum for all stakeholders to engage on the latest developments and outlook of the sector.

For information on themes, topics and updates, visit the Congress website: www.ICR2019.org.

Discounts on IIR conference registration fees

IIR members receive a discount on IIR conference registration fees equaling up to a one-year IIR private membership from a paid-up Member Country.

IIR co-sponsored conferences

The 6th International Conference on Cryogenic and Refrigeration, April 12-14, 2018 in Shanghai, China, will reunite experts specialising in cryogenics, refrigeration and air conditioning. Registration opens soon.

The International Conference on Emerging Technologies for Sustainable and Intelligent HVAC&R Systems, organised by The Institution of Engineers - India will take place on July 27-28, 2018 in Kolkata, West Bengal (India). Call for abstracts now open!

Please consult our Conference Calendar on the last page for details on upcoming IIR events.

From December 2017 to August 2018, the “Cité des Sciences et de l’Industrie”, a
a WG on Demand-oriented Non-uniform Indoor Environments, chaired by X. Li and divided into three sub-groups: Subgroup A: Theory of Demand-oriented Non-uniform Indoor Environments (X. Li); Subgroup B: Application in Residential and Commercial Buildings (Prof. Kunio Mihara of Tokyo Institute of Technology); and Subgroup C: Application in Industrial Buildings (Prof. Yi Wang). Recently, building non-uniform indoor environments and focusing only on occupants has resulted in a very high efficiency of space conditioning. Different parameters can be maintained in one common space and the energy consumption of space conditioning decreases greatly.

In order to make more engineers, building owners and the general public understand the concept, the working group will collect information and disseminate it in different ways, including annual reports, a review paper for the International Journal of Refrigeration and an Informatory Note.

a WG on Dehumidification in Air Conditioning, chaired by Dr. Baolong Wang and Prof. Xue Zhang and comprising three sub-groups: Subgroup A: Dehumidification in industrial air-conditioning system (Dr. Baolong Wang); Subgroup B: Dehumidification in Air Conditioning for human comfort (Prof. Xue Zhang), Subgroup C: Humidity control in residential buildings (Yunho Hwang). Being able to control humidity precisely while consuming minimal energy has become an important objective for air-conditioning research. The goal of the WG is to share research progress on dehumidification in air conditioning, including chemical dehumidification, refrigeration dehumidification, desiccant dehumidification, etc. A review paper for the IIR and an Informatory Note will also be prepared. IIR members and experts in the fields of these new WGs are welcome: xingli@tsinghua.edu.cn

Obituary

The IIR would like to express its sincere condolences to the family and relatives of Sajo Sumida, who died on November 1, 2017 at the age of 91. Sajo Sumida was a member of IIR Commission C1 (1976-1983) on cryobiology and cryomedicine, and the President of the Commission (1983-1991) and became an honorary member of the IIR.

Sajo Sumida was a pioneer on blood transfusion and an active advocate of a blood bank. He was an active scientist and continued to be active in his own clinic and laboratory until his death. He was the President of the International Society of Cryosurgery (1984-1986) as well as many other societies in Japan and other countries. He was a member of the editorial board of the Society for Cryobiology and Cryomedicine and an Honorary Member of the Society. Sajo Sumida was a great friend of many IIR cosponsored and Japanese conferences. He received several awards in Japan (Ministry of Health and Welfare, etc.). In 1989, he received an Honorary title of Corporate member, received the bronze medal at the Solutrans Innovation Award in November 2017 for his new SUPER refrigeration unit running on NaturalINE, which is a non-ozone depleting substance (ODS). Before 1960, the -16 to 26 ton straight trucks, it can cool up to 3 compartments in positive and negative temperatures. In this system, all the components, the vehicle engine and refrigeration unit to be powered by a single fuel source, reducing CO2 emissions by up to 20%.


The NaturalINE container refrigeration units produced by Carrier Transicold have recently been improved and are now able to achieve and maintain a temperature of -40 °C. The engineers are said to have refined the refreezer’s control logic to take full advantage of the unit’s design and the properties of the CO2 refrigerant used in this system. 100 NaturalLINE containers were recently ordered by the leading container leasing company Seaco Global. http://bit.ly/NL73-Carrier-NaturalINE

The IIR is delighted to welcome the following members:

Private members:

- Alan Delaney, Ireland; Carlos Quesada, Costa Rica.

Junior members:

- Ammar Bajaj, US; Nastase Gabriel, Romania; Harshad Inamdar, US; Sharat Raghunandan, US; Fernando Tello Oquendo, Spain.

In the news

Markets and figures

World chiller market

According to BSA, world chilled demand was at USD 7.47 billion in 2016, down 3.2% compared with 2015. Major chiller markets are China (30% of the global market), Europe (17%) and the US (14%). Air-cooled chillers represent 42% of world demand. Water-cooled chillers (58% in total) are divided between centrifugal chillers (29%), positive displacement (screw, scroll and reciprocating types) chillers (20%) and absorption chillers (9%).

Even if they have experienced a decline of 1% in 2016, centrifugal chillers are the fastest growing segment as their demand has increased by about 140% in value over the last decade. This has been because of refrigeration chillers in China tripling over this period due to rapid urban development.

JARN, November 25, 2017

European heat pump market

The European Heat Pump Association (EHPA) recently published its European Heat Pump Market and Statistics Report 2017, giving interesting figures for the year 2016. For example, heat pump markets in Europe have grown for the third year in a row, with an increase of 13% in 2016 (999,682 heat pumps sold). 88% of the European market volume was sold in only ten countries (including 220,000 in the UK, 157,000 in France, 101,000 in Sweden). Air remains the dominant energy source for heat pumps: their applications continue to become larger thanks to technical developments. All types of air source heat pumps are now reversible. Air/air heat pumps and variable refrigerant flow heat pumps account for 75% of the total growth of the market.

All heat pumps sold and installed in 2016 provided 10.2 TWh of renewable heat, and the heat pumps that were sold and installed in the last 20 years have already produced 106 TWh of green energy in 2016. According to simulations, 2.6 Mt of CO2 emissions were avoided in 2016 thanks to heat pumps.

The full report is downloadable on www.ehpaa.org.

Refrigerator market growth in China and Japan

China’s airsource heat pump market has been growing rapidly since the beginning of 2017. Airsource heat pumps for space heating increased the share of the country’s heating equipment market to 33%, up from 25% in 2016. The annual market share of airsource heat pumps in 2017 is expected to almost equal that of boilers. This market has seen a particularly marked increase is the north of China: the market share of airsource heat pumps rose from 10% in the first half of 2016 to 40% in the first half of 2017. Airsource heat pump technology could help China reduce its energy consumption and high levels of pollution. Meanwhile, the Heat Pump & Thermal Storage Technology Center of Japan (HPTCJ) is promoting the usage of heat pumps in an attempt to reduce greenhouse gas (GHG) emissions. HPTCJ has estimated the possible reduction in consumption of primary energy and GHG emissions that would result from an expansion of the use of heat pumps, replacing boilers in both the private sector and the industrial sector. In light of the Paris Climate Agreement goal of limiting the world’s average temperature by 2 °C, the expanded use of heat pumps could account for approximately 7% of the reduction target of 950 million t-CO2 by 2050. JARN September 25, 2017 JARN October 25, 2017

Frozen food market in the USA and Europe

In the USA, frozen food sales reached USD 53 billion in 2016, up from USD 50.4 billion in 2013. Ice cream and frozen novelties were the best-selling items at USD 2.6 billion.

In Europe, Germany was the most important frozen food market in Europe by a margin of 8.8 billion euros and a market share of 21%, followed by the United Kingdom (8.6 billion euros, 20%), France (5.5 billion euros, 13%) and Italy (5 billion euros, 12%). Frozen ready meals and ice creams had the largest market share (respectively 28% and 22% of the total sales value). http://bit.ly/NL73-FFmarket


Stock and sales of refrigerators and freezers

- Australia and New Zealand: A recent report entitled Decision Regulation Impact on Smithsonian Refrigerators and Freezers estimates the refrigerator stock in Australia at 12.5 million units in 2016, and at 2.3 million in New Zealand. The freezer stock was estimated at 3.3 million units and 1.1 million respectively.

In the same year, approximately 900,000 refrigerators and 150,000 freezers were sold in Australia, in Australia, at a value approximated at USD 1.1 billion. In New Zealand, approximately 212,800 refrigerators and freezers were sold.


In France, 2.651,000 refrigerators were sold in 2016, according to GIPFAM. It represents an increase of almost 1% compared to 2015. http://bit.ly/NL73-GIPFAM

Refrigerant news

Kigali Amendment impact on global warming

The 8th Emissions Gap Report, published in November 2017 by UN Environment (UNEP) and The Energy Foundation (TEF) acknowledges the potential contribution of short-lived climate pollutants (SLCPs) including methane, tropospheric ozone, black carbon, and hydrofluorocarbons (HFCs), could make a significant global effort to keep global warming below 2 °C while avoiding above-prior industrialized levels below 2 °C. Stringent SLCP reductions based on existing, demonstrated technologies could reduce warming over the period from 2018 to 2050 by between 0.32 and 0.86 °C relative to current emissions projections.

The Kigali Amendment is the Kigali Agreement to phase down HFCs under the Montreal Protocol. Agreed upon in October, 2016, the Amendment has the potential to decrease HFCs emissions by more than 85% between 0.05 and 0.09 °C of warming by 2050. However, the report stresses that reductions in SLCP emissions cannot be considered equivalent to reductions in long-lived greenhouse gases, as many impacts are not directly proportional to global mean temperature change at a given point in time. For this reason, climate change mitigation policies need to consider these two classes of emissions separately.
HCFCs are R22 (68.7% of the total consumption in tonnes (or 23,019.3 ODP tonnes). The main 147 A5 countries have an established HCFC quota system, as required by the European F-Gas Regulation since January 1, 2015. It gives figures for the 2007-2016 period. F-gases, mostly (more than 90%) HFCs, accounted for about 3% of overall greenhouse gas emissions in tonnes CO₂ equivalent in 2015. 2015 was the first year of declining EU F-gases emissions (4%) in 15 years. In 2016, these figures increased by mass but decreased by 2% in CO₂ emissions, illustrating the move towards gases with lower GWPs. In the refrigeration sector, large international brands relying on HFCs in Europe stay 4% below the 170.3 Mt F-gas phasedown limit for 2016. Nevertheless, a bigger step will be taken in 2018, when the maximum quantity of refrigerants that can be placed on the market should be 63% of that of 2015. For comparison, this ratio was of 93% in 2016 and 2017. eu: High-GWP HFC shortages and price rises Several refrigeration associations in the EU have warned of severe refrigerant supply problems in their countries. This situation is linked to the implementation from January 2018 of the EU F-Gas Regulation. As a result, the quota allocated to producers/importers for placing HFCs on the market within the 2014 F-Gas Regulation. Since this quota system is based on CO₂ equivalents, refrigerants and suppliers are effectively able to place on the market far more low-GWP than higher-GWP refrigerants. This has led to record price increases of up to 60% for high-GWP refrigerants R404A and R507A, and up to 30% on R104A in December 2017. Even the lower-GWP R404A alternatives R448A and R449A face price increases of up to 50%. Refrigeration industry association SNEFFCA noted a multiplication by 5 of R404A prices from early 2017. This also led to refrigerant shortages in several countries, including Austria, France, Germany and Spain. eu: High-GWP HFC consumption and production in developing countries On the occasion of the 80th meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol, data on the HCFC production and consumption of Article 5 countries (or A5 countries, or developing countries) were submitted to the Committee. 147 A5 countries have an established HCFC quota system, with an approved latest consumption level of 359,969 metric tonnes (or 23,019.3 ODP tonnes). The main HCFCs are R22 (81.5% of the total consumption measured in ODP tonnes), R414B (27.8%) and R142b (3.3%). The production of R22 by A5 countries is estimated at 16,191.2 ODP tonnes in 2016, increasing by 3% since 2014. The production of R22 consumption is valued at 14,288.7 ODP tonnes in 2016 and decreases since 2012. Refrigerant charging and refrigerant servicing represent the refrigeration sectors where the HCFC consumption is greatest, with 13,049.8 ODP tonnes in 2016 (more than 55% of the total HCFC consumption).

The Brazilian Ministry of Environment announced that the Brazilian Program for the Elimination of CFCs and HCFCs (HCFCs) had already achieved the reduction of 34% of the consumption of these gases from 147 A5 countries. Montreal Protocol’s target was 35% for the year 2020. The second phase of the Brazilian HCFC Program plans to reduce consumption by 51.6% from the last HCFC substance is to be completely eliminated in 2030. eu: High-GWP HFC consumption and production in developing countries EU: High-GWP HFC consumption and production in developing countries

In the USA, 4,900 tonnes of ozone-depleting refrigerants and heat pumps R22 were reported as reclaimed by EPA certified reclaimers in 2016. This is a rather good number in itself, but compared to EPA projections, which estimated the shift away from R22 alone to be four times greater, it is rather disappointing. Reusing (instead of reclaiming), underestimation of leak rates, and many assumptions in the existing federal regulations on refrigerant venting are possible explanations for the figure. eu: High-GWP HFC consumption and production in developing countries eu: High-GWP HFC consumption and production in developing countries

Refrigerant recycling and reclaiming In the USA, 4,900 tonnes of ozone-depleting refrigerants and heat pumps R22 were reported as reclaimed by EPA certified reclaimers in 2016. This is a rather good number in itself, but compared to EPA projections, which estimated the shift away from R22 alone to be four times greater, it is rather disappointing. Reusing (instead of reclaiming), underestimation of leak rates, and many assumptions in the existing federal regulations on refrigerant venting are possible explanations for the figure. eu: High-GWP HFC consumption and production in developing countries eu: High-GWP HFC consumption and production in developing countries

EU: High-GWP HFC shortages and price rises EU: High-GWP HFC shortages and price rises

In Chile, the first recycling plant for HCFCs and HFCs registered in the country. The recycling centre ‘will allow us to have less consumption of refrigerants, more energy efficiency and lower GHG emissions’, said Environment Minister Marcelo Mena. Owing to recycling gas being sold at a price between 20 and 30% less than the one currently imported. eu: High-GWP HFC consumption and production in developing countries eu: High-GWP HFC consumption and production in developing countries

European retailers and transition from HFCs In a survey mandated by Emerson, 140 French, German and British professionals in the retail sector commented on their awareness of more sustainable technologies related to the phasedown of HFCs. The survey shows that 56% of the respondents have started making the shift away from HFCs. Among them, 47% have switched for low GWP HFCs or HFOs, 37% for CO₂ and 16% for hydrocarbons. But it is interesting to underline the discrepancy between reality and the ideal choice evoked by the retailers, since their preference was for CO₂ (38% of the respondents), followed by hydrocarbons (25%) and low GWP HFCs and HFOs (21% of the respondents). eu: High-GWP HFC consumption and production in developing countries eu: High-GWP HFC consumption and production in developing countries

Cold chain news Cold chain news

Some interesting figures on developing countries were published during the FAO Technical Meeting on Cold Chain Development in which the IIR participated:

- Halima Thraya, IIR Delegate of Tunisia and chairperson of the IIR Working Group on the cold chain in warm countries, reported that in Tunisia, the refrigerated storage capacity has increased from only 1,000 m³ to about 2,400,000 m³ in 50 years. 89% of cold stores are operated by the public sector against 11% by the private sector. Of refrigerator capacity, 73% is dedicated to fruits and vegetables. H. Thraya estimates that this remarkable evolution is mainly due to financial and fiscal incentives adopted by the Tunisian government to promote investments in the cold sector (e.g. in Tunisia, custom duties for refrigeration equipment are exempted, more than 45% in some other African countries).
- Nepal produces an estimated 4.8 million litres of milk daily, half of which is consumed by farmers themselves, 15% sold to dairies and 35% goes to local markets. Around 567,000 litres of milk are cooled per day in the milk collection network. It is estimated that the dairy sector accounts for 9% of the GDP. Billion tonne NFR (over EUR 120 million) have been invested into dairies which also provide direct employment to 20,000 individuals.

According to NEPAD-FAO report, the value of African countries’ capture fisheries is estimated at USD 24 billion. Inland fishery provides one third of the total catch in Africa whereas aquaculture production has significantly increased and generated about USD 3 billion. In Tanzania, fish farming is estimated at roughly 3.5 million tonnes per year, with 62% of fish coming from Lake Victoria. Aquaculture production is estimated at 10,000 tons per year.

Development of the cold chain in China China’s cold chain network is developing apace. Cold chain logistics bases in north-eastern cities Dalian, Shenyang and Changchun were completed in 2014, and a refrigerated train network is under construction in the region. Refrigerated trains have been operating between Dalian and Beijing since 2016. Yanbian and Dalian since 2016 and June 2017 respectively. These routes transport fresh food between coastal ports and inland cities. Road and in-transit logistics centres, which have been created, have great potential in cold chain logistics. The cold chain logistics centre in Dalian has been working on not only rail but also marine and highway transport connections since February 2016. In addition, the approval of the first logistics centre with refrigerated warehouses in Chongqing in the centre of the country will further revolutionise the cold chain in China. RMB 4 billion (over EUR 500 million) have been invested in the logistics centre, which will allow China to import food from Europe by direct express train. Until now, meat was transported to inland cities like Chongqing by sea shipping and road, via coastal cities such as Tianjin, Shanghai and Qingdao. The logistics centre in Chongqing will drastically reduce the logistics period - it will now only take 12 days for imported meat to reach Chongqing. The cost of importing food to China from Europe will also be reduced by over 10%. Two more cold chain logistics centres are in the works in order to enable the distribution of products to surrounding cities. JARN September 25, 2017

Out of the ordinary Out of the ordinary

Vegan ice creams Vegan ice creams

During the HostMilano 2017, dedicated to the world of catering and hospitality, an entire hall was dedicated to the vegan philosophy, with a presentation of ice cream. Vegan ice cream made with plant-based milk, seems to be the trend. For instance, the Galalea company presented a vegan ice cream made with spirulina, a high protein green-blue algae. As a result, the ice cream produced is also blue, and claimed to be quite healthy since the color is obtained with no dye. eu: High-GWP HFC consumption and production in developing countries

Technology Technology

Domestic refrigeration Domestic refrigeration

Temperature and energy performance of domestic cold appliances A paper from A. Biglia et al. presents the results of a large-scale survey of domestic cold appliances in households in England, UK. Similar measurements of cold appliances inside and outside of the cold appliances, as well as the electricity consumption, were obtained over a period of seven days for 998 cold appliances. The cold appliances monitored in the survey included fridge-freezers (52%), refrigerators with ice-box (6%), larder fridges (14%), chest freezers (9%) and upright freezers (10%). The mean ambient temperature was 18.5°C. The mean refrigerator temperature was found to be 5.3°C, slightly higher than the recommended range of 0 to 5°C. The mean...
freezer temperature was −20.3 °C, lower than the recommended temperature of −18 °C. The mean electricity consumption was 354 kWh per year. Significant differences between the electricity consumption of different types of cold appliance were determined from statistical analysis. The compressor size and efficiency, resonant operation, small size and simple capacity modulation. A number of linear compressors have been incorporated into vapour compression refrigeration systems (VCR) and domestic refrigeration systems, including fridge/freezers and air conditioners. Oil-free operation allows the use of micro-channel heat exchangers for refrigeration systems for electronics cooling. The moving magnet type linear motor has become a major trend due to its high efficiency and compactness. Typically, a linear compressor consists of a linear motor (driven by a piston and suspension springs, operated at resonant frequency in order to reduce the input current required). Designing compact suspension systems for higher resonant frequency is very challenging. However, the main challenge is cost. For electronics cooling, a miniature linear compressor means that the miniature VCR system is not cost effective compared with other solutions. For household refrigeration, the major cost of manufacturing linear compressors comes from the rotating electrical parts, such as permanent magnets (e.g. NdFeB) which can be cost effective. Contacting seal designs can be considered, as they seem to be an attractive option for some manufacturers and reduce material requirements (coating etc.) and therefore cost. In order to manufacture linear compressors on a large scale, a minimum of 10,000 per year are required. Decorative sensors can be used for detecting the piston position. With further R&D, more cost effective linear compressor products will hopefully appear in the near future.


Heat pumps

Heat pump and ice storage for heating and cooling an energy neutral German office building

Schrne, a German company, has designed its new building with an innovative energy concept, combining ice storage, a heat pump and solar energy. The centrepiece of the facility is a subterranean ice tank with a 350 m³ capacity and an ice production period of closed-loop cooling. Filled with a mixture of water and anti-freeze, this serves as a heat exchanger for the brine/water heat pump installed within the building. During the heating phase, heat is drawn from the water in the ice tank and delivered to the building via the heat pump. The further withdrawal of heat causes ice to form on the piping. This ice layer expands within the ice tank from the inside outwards during the heating phase. At the end of the heating phase, the ice tank contains almost 100% ice.

In the subsequent warm season, the stored ice is used to cool the building. This natural cooling process is used until the ice has fully melted and the water temperature in the tank rises to approx. 10 °C. As a consequence, around 70% of the cooling energy required in summer is naturally covered by the stored ice. If the water temperature now rises further, the heat pump can also be used as a cooling unit. Waste heat from the pump is in turn now stored in the ice tank, whereupon a new sequence can now begin.

On the roof of the building is a 320 m³ photovoltaic system for power generation with a peak capacity of 50 kW and an annual output of approx. 46,000 kWh, which covers the building’s usage, with any excess power then fed into the grid. http://bit.ly/NL73-GermanHeatPump

A ground source heat pump at Cornell

The Bloomberg Center at the tech campus of Cornell University (New York, USA) was recently equipped with a Ground Source Heat Pump (GSHP). It delivers enough good thermal domestic hot water without any direct combustion of fossil fuels. Eighty boreholes have been drilled to a depth of 400 feet, interlinked and connected to the thermal bedrock. The system then takes advantage of this water to increase its efficiency. The combination of the facility’s low energy design, solar PV photovoltaic panels and GSHP Energy’s GSHP system is expected to save up to 500 tonnes of CO₂ per year.


Personal cooling systems

A new efficient and portable electroaloric cooling device

In a paper published in the journal Science, researchers with the University of California and SRI International have developed an electroaloric (EC) cooling device and its possible applications. They developed a cooling device with a high intrinsic thermal efficiency using a flexible EC polymer film and an electrostatic actuation mechanism. Reversible electrostatic forces reduce parasitic power consumption and allow for compact designs. They have shown that this last claim by actually building such a device and using it to cool down a battery heated by ordinary use—after only 5 seconds, the temperature of the battery had lowered by 8 °C. Comparatively, air cooling the battery reduced its temperature just 3 °C in 50 seconds.


Personal thermal comfort thanks to a dual-mode textile

Maintaining human body temperature is one of the most basic needs for living, which often consumes a huge amount of energy to keep the ambient temperature constant. To expand the ambient temperature range while maintaining human thermal comfort, the concept of personal thermal management has been recently demonstrated in heating and cooling textiles separately through human body infrared radiation control. Carrying out these two opposite functions within the same textile is an excellent scientific challenge. Scientists at Stanford University, California (US) have demonstrated a dual-mode textile that can perform both heating and cooling using the same piece of textile without any energy input. The dual-mode textile is composed of a blayer emitter embedded inside an infrared-transparent nanoporous polyethylene (nanoPE) layer. They have shown that the asymmetrical characteristics of both emissivity and nanoPE thickness can result in two different heat transfer coefficients and achieve heating when the lowemissivity layer is facing outside and cooling by wearing the textile inside out when the highemissivity layer is facing outside. This can expand the thermal comfort zone by 6.5 °C. Numerical fitting of the data predicts 14.7 °C of comfort zone expansion for dualmode textiles with large emissivity contrast.


Cryogenic testing completed on the successor of Hubble Telescope

The NASA Hubble Space Telescope (HST) has been orbiting the earth since 1990. It observes the near ultraviolet, visible, and near infrared spectra. It could last until 20302040 but a scientific successor, the James Webb Space Telescope (JWST) is scheduled for launch in the spring of 2019, in Kourou, French Guiana. JWST will observe infrared bands which are preferred for studying high redshift and lowtemperature objects, objects generally older and farther away in the universe (like the first galaxies formed in the Universe, for example). NASA engineers completed final cryogenic testing on JWST in November 2017. The telescope had been sealed for 12 m diameter, 40 tonne door chamber at Johnson Space Center in Houston. The tests were designed to ensure the telescope functioned as expected in an extremely cold, airless environment akin to that of space. While the telescope was inside the chamber, engineers monitored it using thermal sensors and specialized camera systems. Indeed, the telescope will be kept extremely cold in space, in order to be able to detect the infrared light from all objects. JWST and its instrument have an operating temperature of about 40 K (around -233 °C). It relies on a cryocooler to lower its temperature to less than 7 K (-266 °C). The telescope is protected from light by a five layer, tennis court sized sunshield that acts like a parasol. The sunshield divides the observatory into a warm, sunlit front chamber (reaching temperatures close to 85 °C) and a cold side (-240 °C). Source: Cryogenic Society of America http://bit.ly/NL73-JWST

UK: AI and data centre cooling

Data centre traffic is on the rise – projected to grow by 27% per year from now until 2020 – so many companies are looking at how they can use artificial intelligence (AI) to make their data centres more efficient. However, according to Dr Stu Redshaw, Chief Technology Officer at EkkoSense, many risk seeing AI as a magical solution. AI solutions cannot solve problems on their own without huge amounts of data and clever algorithms. A key part of ensuring that AI solutions are actually effective, therefore, is machine learning. In spite of recent developments, it seems that many UK data centres are performing poorly when it comes to cooling: according to a survey carried out by EkkoSense, 60% of installed cooling equipment does not deliver any active cooling benefits. Perhaps more worryingly, almost 8 out of 10 data centres do not comply with ASHRAE guidelines for comfort cooling. According to ASHRAE, temperature data should be collected from at least one point every 3 m to 9 m of rack aisle in data centres. In reality, this is very difficult to achieve – individual racks would need to have their own dedicated thermal sensors if the data centre operators want to obey target limits. AI solutions will need to

Briefs

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identify these performance exceptions and be able to manage them in order to improve data centre cooling. The continued, significant investment in cooling equipment will hopefully move UK data centres in the right direction – overall energy levels have already been reduced by 30%, but further progress would be possible with a truly AI-led approach. http://bit.ly/3L7-AI-DataCentre

- Solar-powered reefer in California

Tested over five months in California’s San Joaquin Valley, the first solar-powered transport refrigeration unit on a city delivery truck produced positive results. Compared to a diesel truck reefer unit, it has been estimated that the "Rayfrigeration" could reduce nitrous oxide by 98%, carbon dioxide by 86%, and particulate matter by 97%. The 1,800 W eNow solar power system provided more than enough energy to maintain proper temperature throughout a typical day of opening and closing the doors while the refrigerated truck delivered fresh dairy products in California’s summer heat. The unit’s cold plates and batteries are initially charged from utility power only, but while on a delivery route, the power is provided by solar photovoltaic panels mounted on the truck’s roof.


- Small steps toward facilitating wider use of flammable refrigerants

- During a meeting in Russia in October 2017, the International Electrotechnical Commission (IEC) Sub-technical Committee SC61C decided to advance the draft amendment of IEC 60335-2-66 to the next stage in the process (Committee Draft for Vote).

The final version of the draft amendment proposes to increase the propane charge limit to 500 g. The proposed charge limit is based on 13 times the low flammability limit (LFL) of propane. In order to ensure safety, the draft amendment will require a minimum room area where the system can be placed, and it must pass the leakage test that will show the relative absence of flammable concentrations around the system, besides other construction requirements. The charge limit increase will cover all safety classes of flammable refrigerants, but with different limits. The present international standard for hermetically sealed commercial refrigeration equipment limits the use of flammable refrigerants to 150 g.

Provided that more than two thirds of the committee members vote in favour of the draft, a new version of the IEC standard is expected at the beginning of 2019.

http://hydrocarbons21.com/articles/7895/higher_hc_charge_limits_in_commercial_refrigeration_come_one_step_closer

- At the European level, the European Commission has requested European standardisation bodies CEN/CENELEC to analyse the existing European standards barriers to using flammable refrigerants, the relationship of risk, increased charge and risk mitigation requirements. Moreover, the standardisation bodies shall assess and identify mitigation options to enable wider use of flammable substances in refrigeration and air-conditioning equipment. The specifications drafted should serve as a basis for the development of national codes, standards and legislation in EU member states. http://bit.ly/3L7-CEN

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The Newsletter of the IIR is a quarterly publication of the IIR Managing Editor: Didier Coulomb
Editor: Jean-Luc Dupont
Graphic Design: EdiConseil