

60 EXAMPLES OF NATURAL REFRIGERANT STORIES IN ARTICLE 5 COUNTRIES AND EITS JULY 2012

introduction

Dear Reader,

The use of ozone-depleting and high-global warming substances has become a rising concern to the international community, given their environmental impact from extended use, combined with tightening supply and rising raw materials cost. CFCs, HCFCs and HFCs used as refrigerants are either already covered by global agreements or currently discussed under phase-out schedules. Where individual Article 5 countries have taken the lead to ban the use of all fluorinated gases in the coming years, a majority is still hesitating as to whether non-fluorinated refrigerants constitute a viable alternative in all end-uses and circumstances.

The present collection of articles is intended for policy makers in search of solid proof for the viability of the natural substances ammonia, carbon dioxide and hydro-carbons used as refrigerants in the heating, refrigeration and cooling industry worldwide. The compilation was prepared after decision makers repeatedly expressed interest in having one reference document to summarise best-practice examples and address the various issues currently thought to prevent the use of natural working fluids in Article 5 countries: availability, cost, technology, safety, legislation, training & know-how and market-based barriers. The collection aims to highlight opportunities but likewise outline challenges encountered in adopting CO_2 , NH_3 and HCs as refrigerants.

The articles listed in this collection are taken from the online industry platforms www.ammonia21.com, www.hydrocarbons21.com and www.R744.com - each specialised on one refrigerant (group) with lowest global warming potential and no ozone depletion potential.

They were published over the last 12 months and were selected for their relevance to Article 5 countries and Economies in Transition (EITs). Where selected examples from non-Article 5 countries are included (e.g. Australia) this was done to highlight the viability of natural refrigerant solutions in high ambient temperatures - a precondition found in a majority of Article 5 countries.

To allow for a more efficient search, the articles are sorted by refrigerant, starting with CO_2 (R744), hydrocarbons (R290, R600a, etc.) and ammonia (R717). Within each refrigerant, the selection portrays examples from different end-use applications including:

- Industrial refrigeration
- Commercial refrigeration
- Domestic refrigeration
- Stationary air conditioning
- Mobile air conditioning
- Heating / heat pumps
- Training

About shecco

shecco is a marketing specialist helping its partners worldwide to advance the use of climate-friendly technologies. The Brussels-based organisation has developed special expertise on the use of natural refrigerants, including carbon dioxide, ammonia, hydrocarbons, air and water. shecco supports the global heating, air-conditioning and refrigeration industry in its transition from CFCs, HCFCs and HFCs towards more economically, ecologically and socially sustainable refrigerant options.





www.hydrocarbons21.com



www.r744.com



www.r718.com





One step closer to establishing universal CO₂ compressor performance standards

27 June 2012

AHRI, the US based Air-Conditioning, Heating, and Refrigeration Institute, has published CO_2 compressor performance rating standards. They are in line with the soon to be finalised corresponding standards in Europe that are currently being reviewed in order to accommodate for the increased interest in transcritical CO_2 refrigeration in the region.

The aligned standards establish common guidelines worldwide and will enable manufacturers to compare compressor behaviour and performance on a fair, "apple to apple" basis.

US, Europe and China work together to develop common standards

Titled '2012 Standards for Performance Rating of Positive Displacement Carbon Dioxide Refrigerant Compressors and Compressor Units', AHRI developed Standards 571 (SI) and 570 (I-P) in cooperation with the Association of European Refrigeration Component Manufacturers (ASERCOM) and the China Refrigeration and Air-Conditioning Industry Association (CRAA), with a view to harmonising the rating conditions with CO₂ standards under development in Europe and China. The AHRI standards, which concern CO₂ compressors for subcritical and transcritical



refrigeration applications, provide for the first time a rating method for compressors and compressor units that use CO₂ as a refrigerant in the US.

In Europe, the main compressor standards, namely EN1 2900 (Refrigerant compressors: Rating conditions, tolerances and presentation of manufacturer's performance data) and EN 13771-1 (Compressor and condensing units for refrigeration: Performance testing and test methods) are currently being revised to accommodate for the increased interest in transcritical CO₂ refrigeration in the region. Under the umbrella of ASERCOM, CO₂ compressor manufacturers Dorin and Bitzer have been leading this work to establish the European guidelines.

In scope of AHRI standard: refrigeration only

The new AHRI standards apply to electric motor driven, single and variable capacity, single and two stage positive displacement refrigerant compressors and compressor units operating with carbon dioxide in both subcritical and transcritical applications for refrigeration.

The standards do not apply to carbon dioxide compressors used in other applications such as heat pumps and air-conditioning, automotive air-conditioners or household refrigerators and freezers, etc.

Rating conditions

According to the AHRI standards, data should be reported at the following conditions for the compressor or compressor unit application usage intended:

Medium Temperature (e.g. fresh food display cases)

- Suction dew point temperature, -4 °F to 32 °F (-20 °C to 0 °C)
- Discharge dew point temperature for subcritical compression cycle, 32 °F to 77 °F (0 °C to 25 °C) or discharge pressure for transcritical compression cycle, 1160 psia to 1595 psia (80 bar to 110 bar)
- Useful superheat of 18 °F (10 K) for all operating points For subcritical applications, condenser exit subcooling of 0 °F (0 K)
- For transcritical applications, gas cooler exit temperature of 95 °F (35 °C)
- Refrigerating Capacity may include increased refrigeration effect provided by the subcooler per rating methods of section 5.5 of the standard

Low Temperature (e.g. freezer cases)

- Suction dew point temperature, -58 °F to 14 °F (-50 °C to -10 °C)
- Discharge dew point temperature for subcritical compression cycle, 32 °F to 77 °F (0 °C to 25 °C), or discharge pressure for transcritical compression cycle, 1160 psia to 1595 psia (80 bar to 110 bar)
- Useful superheat of 18 °F (10 K) for all operating points For subcritical applications, condenser exit subcooling of 0 °F (0 K)
- For transcritical applications, gas cooler exit temperature of 95 °F (35 °C)
- Refrigerating Capacity may include increased refrigeration effect provided by the subcooler per rating methods of section 5.5 of the

About AHRI, ASERCOM and CRAA

Based in the US, AHRI is one of the largest trade associations in the nation, representing more than 300 heating, water heating, ventilation, air-conditioning and commercial refrigeration manufacturers within the global HVAC&R industry.

ASERCOM is the Association of European Refrigeration Component Manufacturers, which among other issues elaborates safety and technical standards and promotes harmonisation of component standards and regulations.

Similarly, China Refrigeration and Air-Conditioning Industry Association (CRAA) also promotes standards harmonisation by international cooperation and works to improve the standardisation system for Chinese refrigeration and air-conditioning industry.



Coca-Cola Brazil displays 100 CO₂ coolers at Rio +20

20 June 2012

Coca-Cola Brazil, an official sponsor for Rio+20, is displaying 100 new R744 coolers provided by Metalfrio Solutions at several different conference locations. Rio +20 takes place from 20-22 June 2012 in Rio de Janeiro, Brazil.

Underscoring the main focus of the United Nations Conference on Sustainable Development, Rio +20, Coca-Cola Brazil is showcasing 100 coolers using the natural working fluid R744. Supplied by the commercial refrigeration company Metalfrio, apart from the benign environmental impact of using of CO_2 as a cooling gas, the VB43R coolers incorporate new energy efficiency standards and a longer component lifespan.

Referring to the price of these coolers, Mr Adilson Lemos, Metalfrio Marketing Manager said: "In comparison, the cost of the eco-friendly coolers is still more expensive today than our other models, however as demand for the new units increases, production costs will decrease which will result in reduced pricing to the customer".



HFC-free by 2015 with CO₂ coolers

As part of the global strategy, Coca-Cola Brazil is gradually replacing their coolers with HFC-free equipment and from 2015 all new coolers will use CO₂ gas in their compressors. According to the Sustainability report 2010/2011 published at the beginning of 2012, the Coca-Cola Company had by the end of August 2011 400,000 coolers using HFC-free refrigerants, including carbon dioxide and hydrocarbons.

As mentioned at the ATMOsphere America 2012 conference on 13 June, so far Coca-Cola has placed around 612,000 HFC-free natural refrigerant machines, out of which more than 202,000 units use R744. It is expected that more than 650,000 HFC-free machines will be installed.

With more than 10 million dispensers, vending machines and coolers in the global market, the Coca-Cola Company aims to reduce their impact on climate change through installing cooling equipment that is HFC-free. The Company's phase out of HFCs, is expected to avoid emissions of more than 52.5 million metric tons of CO2 equivalent over the life of the equipment.

Coca-Cola & Metalfrio - long-term partnership

Coca-Cola Brazil and Metalfrio's partnership to find sustainable technologies is not new: in the in 2007, they introduced refrigerators with an Energy Management Device (EMD) to the Brazilian market, which reduces the energy consumption by 30%. In 2010 Coke also started to use LED lighting in their refrigeration equipment, which consume 15% less energy than fluorescent lighting.

Coca-Cola's other sustainability initiatives at Rio+20

- Over 330 thousand Coke Plant bottles will be at Rio+20, with 30% renewable content in mass of the plastic obtained from the monoethylene glycol (MEG) derived from the sugarcane.
- In cooperation with the Rio+20 Secretariat, the United Nations Global Compact organised the Rio+20 Corporate Sustainability Forum from 15-18 June 2012, where Coke also agreed to set targets on their own water efficiency and wastewater.



Carrefour installs first CO₂ transcritical system in Turkey

19 June 2012

As part the Carrefour Group's bid to mitigate climate change by reducing HFC refrigerant charge and refrigerant leakage, the retailer recently installed its first CO₂ transcritical refrigeration system in Turkey (Istanbul), at the Kurtköy-Millennium Carrefour Express.

Put into operation on 9 May 2012, the Turkish Kurtkoy store with a retrofitted refrigeration system is one 4 sites by the retailer using 100% natural working fluids. Overall Carrefour will continue to set up new stores using natural refrigerants across Europe.

Reduction in GHG emissions and significant energy efficiency improvements

Food refrigeration accounts for two thirds of the Carrefour Group's greenhouse gas emissions. The problem arises from refrigerants leaking into the atmosphere, as well as electricity consumed by refrigeration units. To reduce these emissions more effectively, Carrefour Turkey is testing a highly innovative solution - both refrigeration units (fridges and freezer) at the Kurtkoy-Millennium Carrefour Express now use the natural fluid CO_2 . The technology adopted in Turkey is quite rare in this part of the world, and only the fourth time it has been used within the Group.



The technology has significantly reduced the environmental impact of the store:

- The CO₂ used in the refrigeration system pollutes 3,400 times less than the refrigerants previously used at Kurtkoy;
- The quantity of CO₂ needed for the refrigeration units is approximately one third less than the refrigerant charge required by a conventional system;
- The quality of the pipe fittings has been improved and refrigerant leaks should accordingly be reduced by 75%;
- The CO₂ solution improves the energy efficiency of refrigeration units by around 15%, which equally limits CO₂ emissions resulting from electricity consumption.

The CO₂ transcritical installation also offers very significant economic benefits. The Kurtkoy supermarket should not only reduce its overall energy bills by 7%, but it should also be able to reduce the amount spent on refrigerants, which is crucially important given that the price of synthetic gas is skyrocketing. For example, the most common of these R404a, is five times more expensive than CO₂.

Currently in its testing phase, this new technology should be extended to one or two additional Group sites by 2012. Its roll-out is scheduled to take place in 2013 according to the results achieved.

Technical specifications

Kurtkoy's CO₂ installation has the following dimensions:

- The numbers of showcases for positive temperature is 13, and for negative temperature is 2 sections, which equates to 33 meters of refrigeration displays;
- The capacity of the positive rack compressors is 40 KW, and negative rack compressors 4 KW.



BITZER Brazil: First CO₂ transcritical system in the Americas

11 June 2012

At the beginning of this year BITZER Brazil built a fully functional, transcritical CO₂ supermarket booster system in its training center and provides refrigeration and air-conditioning professional experts a hands-on experience.

BITZER Brazil is one of the biggest developers of CO_2 technology in South America, and since 2008 more than 1,000 technicians have been trained in CO_2 technology at the BITZER Brazil Training Centre. The focus of the Training Center, which is the only one of its kind in the Americas, is to present new technologies and to introduce carbon dioxide as a refrigerant and promote its application in industrial and commercial refrigeration systems. During the CO_2 training courses, safety issues, design features, installation, commissioning, servicing and maintenance procedures will be discussed in both practical and theoretical classes.



CO₂ Trancritical System

The system is built as a booster system with gas bypass. The gas from the low pressure compressor is mixed with gas from the gas bypass as well as from the

medium temperature evaporators. The gas that exits in the low temperature compressor is cooled and can then safely enter the high temperature compressor. The booster principle is used because it gives a safe oil return and good system efficiency.

General information about the CO₂ training course

The carbon dioxide course has been developed by BITZER Brazil's experienced engineers and, the information about the use of CO₂ in refrigeration systems was collected from many sources from around the world. The information has been put together into a five-module course that icnludes:

- CO₂ Fundamentals;
- Systems Safety with CO₂ Applications;
- CO₂ Refrigeration Systems;
- CO₂ Refrigeration System Components;
- Commissioning, Servicing and Maintenance Procedures.

The CO₂ training courses are intended for students, technicians, engineers, designers, installers and for those interested for this subject as well.

The course lasts 5 days with both theoretical classes and hands-on training; The training courses are provided in the Portuguese, Spanish and English versions.

For more information about the CO₂ training courses please contact Mrs. Viviennne Thudichum, Marketing Department, <u>vivienne.thudichum@bitzer.com.br</u>.



UNEP ECA Ozone network's members awarded by elearning-training.com

25 May 2012

UNEP and elearning-training.com, the online learning platform by Star Refrigeration, have joined forces to encourage online training for refrigeration engineers in the region of Europe and Central Asia (ECA). After passing a course by elearning-training.com, participants of the UNEP's Regional Ozone Network meeting held in Kyrgyzstan in March were awarded a diploma.

The project aims to promote the use of online courses supported by information and communication technologies to train engineers in the refrigeration, air-conditioning and heat pump sector as part of national hydrochlorofluorocarbon (HCFC) phase-out management plans across all different countries with a view of eliminating barriers to introducing ozone and climate friendly technologies. The courses allow students to complete the Web Based Training in their own time and in a variety of locations. The main advantages include complete flexibility coupled with significant economic savings.

Certified diploma from elearning-training.com

All the countries that participated in the UNEP's meeting of Regional Ozone Network for Europe and Central Asia including Albania, Armenia, Russian Federation, Bosnia and Herzegovina, Croatia, Georgia, Kyrgyzstan, Macedonia



Practitioners had an opportunity to study Continuing Professional Development certified learning material, which is the same course used by EU countries to prepare their engineers to obtain the mandatory F-Gas Certification, without which they are not allowed to install, commission, service or maintain refrigeration, air conditioning and heat pump systems.

The online training included materials on the use of refrigerants that deplete the ozone layer and have high global warming potential (GWP) but also alternatives and natural refrigerant-based technologies in the RAC sector such as CO₂ refrigeration, which is currently growing in popularity.

During the meetings roundtable discussions question and answer sessions were led by Lynton Perry, an assessor from elearningtraining.com, part of the Star Refrigeration Group to explain the e-learning methodology and qualification tool. Vasil Ciconkov, president of the National Association of RAC technicians of Macedonia and one of the "students" that received the award congratulated the organisers of the event for the learning initiative "it was a very good opportunity for all UNEP members to access the F-gas regulation's material to update knowledge in a very convenient set up".

What comes next?

Star Refrigeration will continue to cooperate with ECA network countries and national RAC associations and promote online learning as a cost-effective training tool. The training material will be adapted to language needs of other countries in the region.

A recommendation has been made to produce Serbian and Croatian language versions of the online learning material as well. Under the scheme, national RAC experts from ECA network countries can register for the online course free of charge until the end of the year.

About elearning-training.com

eleaning-training.com offers both online training via elearning-training.com and practical training for the refrigeration, air conditioning, heat pump and BSE industries as well as the world's first interactive CO₂ refrigeration course.

More than 12,000 students have joined this online learning website which have now awarded 20,000 Continuing Professional Development diplomas. Overall, elearning-training.com has awarded more that 2,000 Continuing Professional Development (CPD) Certificates in Refrigeration & Air Conditioning basics since last March and more than 10,000 in the last 5 years.

Contact information

If you would like to contact <u>elearning-training.com</u> for any enquiries, you may send a request to <u>Astrid Prado</u> directly.





Exclusive Interview with Shaoming Jiang, Vice Chief Engineer of Yantai Moon Group

18 May 2012

Yantai Moon Group is a Chinese pioneer in manufacturing R-744 refrigeration systems, and have produced China's first domestically made NH_3/CO_2 screw cascade refrigeration system. R744.com talked to Ms Shaoming Jiang, the Vice Chief Engineer of Yantai Moon Group about their current R&D plans for CO₂ refrigeration products.

R744: Yantai Moon Group signed a cooperation agreement with the UNDP for a demonstration project for the conversion of HCFC-22 technology to ammonia/CO₂ technology, and will manufacturer these two-stage refrigeration systems in China. Can you talk about the project and its current progress?

Ms Jiang: Working together with the UNDP in China our ammonia/ CO_2 demonstration technology project is meant to promote the replacement of two-stage HCFC-22 based refrigeration systems. Moon Group first initiated its research on ammonia/ CO_2 cascade as a replacement technology for HCFC-22 in 2007. We put a lot of energy into promoting the technology to industry, showcasing the technology and prototypes at many international exhibitions. Luckily, we got financial support from the UNDP to modify production lines, promote product series and update test devices to measure product performance.



We have now finished the design phase and the UNDP has accepted the Phase 1 deliverables. At the end of May 2012, the UNDP will examine the deliverables of Phase 2, in particular the modification of our production lines and the manufacturing of prototypes. In Phase 3 we will focus on promoting the use of ammonia/CO₂ cascade technology at a commercial scale in integrated low-temperature refrigeration systems. Overall, the UNDP is very satisfied with progress of the project so far and appreciates our efforts to promote ammonia/CO₂ technology in China.

R744: Can you tell us more about the application status of ammonia/CO₂ cascade systems in China?

Ms Jiang: Up until today, Moon Group has worked on two prototype projects in China. One installed for Yantai Fengrun, a local fruit pudding supplier to McDonald's, and the other for Weihai Jiuye, a Chinese export-seafood supplier. Fengrun's ammonia/CO₂ cascade system has been in use for 2 years and the system already reduced electricity use for refrigeration by 8.6% to 11.2% every year for the company. There are more and more companies showing interest in the ammonia/CO₂ cascade systems. We will soon install the refrigeration system for our third client and I think there will be more Chinese end-users shifting to CO₂ refrigeration systems in the near future.

R744: In your opinion, what are the obstacles for a wider application of CO₂ refrigeration in China?

Ms Jiang: For Yantai Moon Group, technology is no longer the obstacle as our CO_2 refrigeration technology is mature. However, we do meet with many obstacles when it comes to promoting the technology on a larger commercial scale. CO_2 refrigeration is still new in China, and therefore companies see it as a more risky deicision to invest in CO_2 refrigeration systems. Lack of financial subsidies from government have created an uncertain investment climate for companies, even if they are consider adopting environmental friendly refrigeration systems.

R744: In your opinion what can the Chinese government do to promote commercial scale use of CO₂ refrigeration?

Ms Jiang: Unfortunately, until now China has not had preferential policies, as some western countries have had, to spur the use environmental friendly products in the refrigeration industry. Therefore, we hope the government will invest more in this area to encourage companies shifting to CO₂ Refrigeration systems.

Another key issue is that China urgently needs a national industrial standard for CO_2 refrigeration. Indeed, many companies and local governments are very interested in the CO_2 refrigeration systems we produced and have realized the benefits CO_2 refrigeration systems could bring in terms of energy efficiency. However, as there are no national standards to regulate their installation and operational safety, it is hard to get engineering approval from the relevant administrative departments. In addition, without common standards, the design, manufacture, installation, inspection and acceptance of refrigeration projects will meet various difficulties and barriers.

R744: What do you think about the future market for R-744 refrigeration in China?

Ms Jiang: As the Chinese government has banned any new projects using HCFC-22 as a refrigerant from 2013 and aims to reduce the

production and consumption of HCFC-22 by 10% compared with the average amount of 2009 and 2010 by the end of 2015, I personally estimate the potential market for CO_2 refrigeration is large in China. Although at present most large-sized refrigeration facilities in China still use R22, as the price of R22 rises this will result in a direct increase in operating costs, incentivising more and more facilities to shift to new refrigerants. In the refrigeration sector in China CO_2 refrigeration systems would as a result be a reasonable choice, especially for large-scale cold storage after 2015.

R744.com: Thank you for your insights, Ms Jiang.

About Yantai Moon Group

The Yantai Moon Group Co. Ltd. produces compressors and offers integrated systems for freezing and cold storage equipment and industrial refrigeration systems, as well as central air conditioning equipment and fresh fruit and vegetable technology. Over 70 per cent of its refrigeration products use ammonia as a refrigerant. In recent years, Moon Group has begun actively promoting CO₂ refrigeration products.



Large Asian retailer leading the way in HFC phase-out

06 April 2012

AEON, one of the largest Asian retailers with stores under several different brands in Japan, China, and Malaysia, has published a "Natural Refrigerants Declaration", outlining a pathway to gradual phase-out of HFCs. Member of the Consumer Goods Forum AEON is committed to using natural refrigerants in all new stores from 2015 onwards, while also progressively converting all 3,500 existing stores.

In November 2010, the Consumer Goods Forum (CGF) agreed to begin phasing out HFC refrigerants as of 2015 and replace them with "non-HFC refrigerants (natural refrigerant alternatives) where these are legally allowed and available for new purchases of point-of-sale units and large refrigeration installations".

One year later, in November 2011, one of its members, large Asian retailer AEON, is moving forward by publishing a "Natural Refrigerants Declaration", laying down the path to the gradual phase-out of HFCs.



Aeon has started to convert freezing and cooling showcases to natural refrigerants throughout the group's stores. First efforts are concentrated in the domestic retail



sector. From 2015 on, all new stores will feature natural refrigerant systems, while the 3,500 existing stores will be progressively converted. Aeon has taken the initiative to introduce natural refrigerants but aspires to work with policy and industry partners to facilitate system installations, amend regulations, lower initial costs, spread the technology and this way contribute to the fight against climate change.

More clearly, 10% of all new stores in 2012 will only use natural refrigerants, 15% of all new stores in 2013, 25% of all new stores in 2014, and finally 100% of all new stores from 2015 onwards. Also, the 3,500 existing stores will be gradually converted.

Testing CO₂ showcases since 2009

In August 2009, AEON installed for testing purposes at the Maxvalu Express Rokugodote Ekimae supermarket store in Tokyo a CO₂ direct expansion refrigeration system developed by Sanyo for supermarket freezer showcases. Since then, the retailer has worked closely with Sanyo in improving the system.

About AEON

AEON Group or Æon Group $(\forall \pi \vee \not \neg \nu - \neg)$ is a group of retail and financial services companies based in Chiba, Japan. It has sister companies in Mainland China, Hong Kong, and Malaysia, and also trades under the JUSCO name. It is ranked as the second largest Japanese retailer by sales in the Fortune Global 500 rankings and 10th worldwide in the retail food and drug store category.

AEON operates more than 292 JUSCO large scale general merchandise stores throughout Japan as well as in Malaysia, Thailand and China. They operate 361 Supermarket outlets - mostly known under the MaxValu logo. ÆON's alliance is the biggest Drug Store chain in Japan and runs more than 2,000 Convenience Stores and nearly 2,500 Specialty shops.



Refrigerants Review: Middle East weights natural refrigerant options

23 March 2012

During a two-day event held in Dubai, United Arab Emirates, the HVAC&R industry, international environmental bodies and local policy decision makers discussed available refrigerant options in a transition away from HCFCs. The Middle East has to carefully select technically viable solutions that can operate reliably in high ambient temperatures and that will not be subject to a likely early phase-out. Interest in CO₂ cascade supermarket refrigeration was therefore especially high.

The event, organised by the publishers of the dedicated "Climate Control Middle East" magazine, brought together around 100 participants from the Arab region, including National Ozone Officers, municipalities, engineers and international HVAC&R experts to discuss the question of which refrigerants would come close to being the ideal solution in a move away from ozone-depleting substances. Presentations and panel debates shed light on all available options, including natural and synthetic working fluids, but clearly showed that the wealth of different data in combination with obvious conflicting commercial interests were putting a barrier for Arab countries to make an informed choice. As a reaction to prevailing confusion and a lack of real-life case studies in hot climates to evaluate and compare technology options, the event attempted to structure refrigerant properties, explore safety and environmental concerns, and move one step forward towards a second event to be held in September this year.



One sustainable refrigerant choice to commit to

Yaqoub Al-Matouq, refrigeration expert at the Kuwait National Ozone Unit, urged the industry to make a "truly sustainable" choice where technologies selected would not be subject to an early phase-out shortly after their adoption. He referred to a situation in 2007 when industry heavily invested in HFCs as the most reliable alternative before shortly after realising that those would again not be a long-term solution. Al-Matouq concluded that to select the most viable option the Middle East industry would need to engage in proper research into different options before rushing into the next best available solution.

A similar message was conveyed by Ghaleb Abusaa, CEO of The Three Factors Company in Jordan with an experience of 39 years in the HVAC&R industry, who called on the industry to take a joint decision regarding the refrigerant choices to commit to over the coming years. Abusaa, having been involved in some of the largest ammonia refrigeration projects in the Middle East, stated that he would "personally like to see CO₂ dominating the whole district cooling business".

Training & Know-how lacking

As mentioned in several presentations and during the moderated sessions the lack of qualified personnel would pose a significant barrier to the viability of natural refrigerant solutions. In a presentation by the Dubai Municipality, Narciso M. Zacarias confirmed that no certified trainers for CO₂, ammonia and hydrocarbons would currently be available to transfer knowledge to the existing workforce in Dubai and beyond.

CO₂ as a solution for Middle East supermarkets?

- shecco GUIDE to Natural Refrigerants: Head of Market Research Nina Burhenne highlighted in her presentation the varied applications of CO₂, ammonia and hydrocarbons around the world, citing case studies and market data from the recent publication "GUIDE 2012: Natural Refrigerants Market Growth for Europe". She drew special attention to the fact that, while success stories can be found in a widest range of end-uses, solutions would always need to be adapted to the local requirements. This would be especially true for the Middle East where special temperature conditions prevail. Of special interest to participants was the R744 transcritical supermarket map for the first time outlining the number of CO₂-only supermarkets per European country, but also the use of R744 in district heating solutions, industrial refrigeration or vending machines.
- Danfoss CO₂ supermarkets: VP of Product Development Torben Funder-Kristensen updated participants about the experience gained with R744 in European applications, both in transcritical and subcritical mode. He presented performance comparison data where CO₂ transcritical as well as cascade solutions with ammonia and propane would always outperform an R404A-CO₂ cascade solution, depending on the climate. Referring to the high ambient temperatures in Arab countries Funder-Kristensen pointed to the significant development in the CO₂ refrigeration area that has taken place over the last 10 years but which would still leave "a lot of room for innovation".

The two presentations formed the basis for the discussion in the concluding panel, in which a heated debate between chemical

manufacturers and CO_2 proponents emerged around the temperature limit at which CO_2 -only solutions would not be a more energyefficient solution than comparable HFC-based systems. Experts concluded that the energy efficiency advantage of CO_2 cascade commercial refrigeration solutions would be significant above 15°C average temperature, being the most viable technology solution also for countries with outside temperatures of up to 54°C.



Exclusive interview: Beijing's first CO₂ refrigeration store to achieve 35% energy savings

27 February 2012

On 23 February 2012, retailer Tesco opened its second CO_2 cascade refrigeration store in China and the first one in the capital city of Beijing. The R744 system is expected to save 35% of energy. Carrefour is the next retailer considering the use of CO_2 refrigeration in one of its stores in China. Fute Refrigeration & Electrical Engineering Co, Ltd installed and commissioned both CO_2 refrigeration systems for Tesco. Mr. Zhang MengLong, Owner of Fute, provided R744.com with exclusive insights.

R744.com: Compared with FUTE's first CO₂ refrigeration system for Tesco's supermarket in Shanghai, what is the difference and improvement of the Beijing store?

Mr. Zhang MengLong: The Beijing store is around 10% larger than the first store in Shanghai. The big difference with the Beijing store is the level of outside expertise required. The rack for the Shanghai store was manufactured in Australia and there was support with the design, installation & commissioning from our Australian partners. However, the Beijing store's CO_2 rack was built entirely by Fute Refrigeration here in China, which also did the design, installation as well as the commissioning.



The main difference from a design point was the use of Dorin CO_2 compressors and the Presscon control system which controls all the CO_2 and high stage racks, all VSD devices, as well as MT display cabinets and cold/preparation rooms. The Presscon system also provides remote monitoring and controlling. In addition, we installed CO_2 ice makers by Maja. We also installed VSD to drive the water pump (water cool condenser).

R744.com: What is the reduction of CO₂ emissions and energy savings for this second CO₂ refrigeration system?

Zhang: Installing a CO_2 cascade system in the Beijing store has enabled us to reduce the HFC charge from 1500Kg to less than 200kg. We just downloaded the power consumption data of the Beijing system today, and the data shows at least 10% power consumption reduction compared with the first CO_2 store we installed in Shanghai. We expect the Beijing store to use 35% less energy than standard store designs. This should reduce annual electricity consumption and carbon emissions by approximately 550,000 kilowatt hours and 4391 tons respectively.

R744.com: Safety issues usually worry end users of CO₂ refrigeration systems. How did Fute solve the problem?

Zhang: The first Shanghai project demonstrated to our client that Fute had the ability and expertise to carry out such as unique project in China. Regardless of what kind of refrigeration system you use, safety to the end user and the company who carries out the system integration task is always a priority in our agenda.

Our experience dictates that to avoid and minimize hazards, system design, selection of equipment and components, and installation are factors that must be taken into careful consideration. Preventive periodical examination and maintenance of the system are very necessary to avoid potential safety issues. Particularly important is to exclude "cowboy" suppliers and unqualified personnel from your project.

In order to avoid safety risks, CO₂ gas detectors, ventilation system, warning signs and flashing/siren lights, CO₂ pressure vent and relief systems as well as emergency power (power generator) supply for the control and CO₂ vent system are installed to all necessary areas in our system. In addition, the end user has also been made fully aware of all the safety measures in place. We also provide regular training to end users to make sure all fixtures are used in the right manner.

R744.com: Will the maintaining of the system require additional costs?

Zhang: At this point we do not perceive that there should be any additional ongoing maintenance cost, our service personnel have found that the CO₂ liquid re-circulation systems are actually easier to service and maintain.

R744.com: Does Fute have other supermarket clients choosing CO₂ refrigerants? Do you have planned to further promote CO₂ refrigeration in other fields?

Zhang: Aside from Tesco China, for which we have completed two CO₂ refrigeration projects, there are other supermarkets in China who

also have expressed interest in converting to a CO₂ refrigeration system in the near future. Unfortunately I cannot disclose their identity at this early stage.

But we just received an official invitation from Carrefour China to submit a design for a $CO_2/R134A$ system in a new store, DX to low temperature fixtures and R134A to the MT system. Our company is also liaising with various other end users in the food processing and food distribution sectors with hopes of introducing natural refrigerant (CO_2/NH_3) into their refrigeration system. We hope that with further awareness of the advantages of a CO_2 refrigeration system, more end users will be willing to incorporate natural refrigerants into their refrigeration system.

R744.com: Thank you for your insights, Mr. Zhang.

Note: A second part of this interview will be published on R744.com very soon, to highlight general market trends and drivers for the uptake of R744 refrigeration systems in China.



QPlans CO₂/NH₃ cascade systems save 40% energy in Tesco and Auchan hypermarkets

22 February 2012

Specialised on the design, contract and assembly of natural refrigerant systems for commercial and industrial applications, Qplan has successfully installed NH_3/CO_2 systems for Tesco and Auchan over the last three years in Hungary. Results show that the four systems, utilising NH_3 at the higher temperatures and CO_2 at the middle and lower temperatures, have saved 40% of energy per year compared to an existing R404a plant.

Reason for the decision to design a NH_3/CO_2 cascade system was not only the need of minimising the carbon footprint but also the to benefit from the positive thermodynamically properties of NH_3 at upper temperature (condensation) level (HT) and the excellent transport properties and safety of CO_2 at the middle (MT) and lower temperature levels (LT).

Hungarian-based complete solution provider Qplan designed and assembled two of those systems at Tesco hypermarkets followed by two similar systems for Auchan hypermarkets in Hungary.



System description

Unlike usual cascades where the upper stage serves as condenser for the lower

stages, Qplan's cascade utilises the upper NH₃ stage both for indirect cooling on HT level and as a condenser for the CO₂ refrigeration cycle on LT level. Indirect cooling on HT level uses also CO₂ as two-phase coolant.

The upper stage is a regularly NH_3 cycle consisting of screw compressors, an evaporative condenser, devices for thermosyphon oil cooling and for economizer, a liquid separator and a plate heat exchanger (PTHE). The primary side of PTHE works as a gravity flooded evaporator with NH_3 .

The secondary side is divided into two parts. Part one functions as a regularly condenser for LT and part two as a condenser for the passive cooling cycle for the coolant of CO_2 . This CO_2 coolant circulates in a closed system consisting of a liquid separator, pumps and HT evaporators where the pumps deliver the liquid from the liquid separator into the evaporators, the vapour, returned from evaporators condenses in the part two of the heat exchanger and the condensate flows into the separator, closing the cycle. The LT cycle is a regularly DX system as a consequence of the relative small load, but there is no objections for applying flooded system to it.

The results: 40% energy saving

During the last three years the systems could prove their efficiency and reliability. All of the four systems work properly since the first start and saved yearly 40% energy, compared to an existing R404A plant in similar job with dry expansion, air cooled condensers in stores of same sizes.

Co. Trantner/Pressko in Germany helped to reach the positive results with their special design of heat exchangers and liquid-separators.

Design loads: HT/LT

- Tesco Balassagyarmat, 3000 m²: 180 kW/24 kW
- Tesco Miskolc,10000 m²: 360 kW/48 kW
- Auchan Miskolc, 15000 m²: 700 kW/80 kW
- Auchan Maglód, 15000 m²: 700 kW/80 kW

About QPLAN

Qplan's broad portfolio includes the design and contract refrigeration for complete establishments, technological advice, air conditioning, refrigeration techniques, electrical power transmission & automation solutions, and completion of architectural designs.

Today, the dynamic family enterprise employs more than 50 employees, including 8 mechanical and electrical engineers, 20 refrigeration technicians, welders and other skilled persons. It has a well-equipped 2800 m² workshop and production area and a countrywide service

network. New headquarters with a 1300 m² workshop area and office building have been inaugurated.

Contact Information

If you would like to contact <u>Qplan</u> for any enquiries, you may <u>send a request</u> to Sandor Murin directly.



6 nations found coalition to reduce HFCs and other short-lived gases

17 February 2012

The United States, Bangladesh, Canada, Ghana, Mexico, Sweden together with the UN Environment Programme have announced the foundation of the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants, including hydrofluorocarbons (HFCs), black carbon and methane.

The United States (US) Secretary of State Hillary Clinton announced the initiative yesterday. An initial \$15 million (about €11 million) has been committed to get the coalition up and running, \$12 million (about €8.8 million) of which coming from the US and \$3 million (about €2.2 million) from Canada. In contrast, however, ozone measurements have been cut back at several Canadian monitoring stations since August 2011 as budgetary cuts start biting in Canada. Sweden is also expected to contribute additional funding, however the amount has yet to be determined.

The initiative will seek to realise concrete benefits on climate, health, food and energy resulting from reducing the short-lived climate pollutants that together account for approximately one-third of current global warming.



carbon dioxide (CO₂) emissions, through instigating new actions but also reinforcing work under existing efforts such as the Arctic Council, the Montreal Protocol, and the Global Methane Initiative (GMI) etc.

Areas of action

The coalition will reduce short-lived climate pollutants by:

- Driving the development of national action plans and the adoption of policy priorities
- Building capacity among developing countries
- Mobilising public and private funds for action
- Raising awareness globally
- Fostering regional and international cooperation, and
- · Improving scientific understanding of the pollutant impacts and mitigation

Expanding the coalition

The coalition will be reaching out to other countries. There are a number of countries that have expressed interest, and it is anticipated that the small initial group of six will expand quickly.





Combining Australia's 2 most abundant renewable sources and R744

24 January 2012

As Australia's Renewable Energy Regulator is holding a public consultation on the methodology used for calculating the financial incentive for solar and air source heat pump water heaters, a local company is proposing a combination of the two most abundant renewable energy sources available in the country: direct solar and ambient heat harvested by heat pumps that use R744 (CO_2) as the refrigerant.

Australian hot water services manufacturer Edson is offering a solar boosted CO_2 heat pump water heater. Using a quiet and climate-friendly Japanese CO_2 heat pump (Eco Cute), the hybrid system can cover up to 90% of annual hot water needs from the sun via:

- Solar collectors: 65% contribution of hot water
- Solar energy stored in the environment using a heat pump: 25% contribution of hot water

Natural refrigerant CO₂ will not be subject to carbon equivalent pricing, unlike HFCs that as of 1 July 2012 will be charged at an initial price of \$23 AUD (about €17) per tonne of carbon dioxide equivalence Internalising the cost of carbon in their price and providing the right signal for a more widespread transition to climate-friendly refrigerants.

Financial incentives for renewable hot water systems



The subsequent trade in these certificates provides a financial incentive for the installation of solar water heaters and heat pumps. For the case of solar hot water/heat pumps, the majority of owners choose to assign their certificates to an electricity retailer or an installer in exchange for a financial benefit such as a discount off their invoice.

Between 12 January and 10 February 2012, the Australian Office of the Renewable Energy Regulator (ORER) is holding a public consultation on the amendments to the Regulation 19B Legislative Instrument – Small-scale Technology Certificate (STC) methodology for solar water heaters and air source heat pump water heaters.

In addition to the tradable certificates, the Australian Government offers rebates for replacing electric hot water systems through its Renewable Energy Bonus Scheme.





Second Brazilian supermarket invests in CO₂ refrigeration - Part 1

18 January 2012

In December 2011 hypermarket Condor opened its 33rd store in Sao José dos Pinhais, in Curitiba, Brazil. The hypermarket uses climate friendly CO_2 as a refrigerant in a subcritical system. In this first article about the installation we look at the key features of the equipment including the ECO₂LÓGICO cascade system.

Bitzer and Eletrofio Refrigeracao Comercial developed the CO_2 refrigeration technology used in the Condor hypermarket over a period of two years. The CO_2 system reduces the energy consumption of the freezers by 20%, which translates into a 5% reduction in energy consumption for the entire refrigeration system.

ECO2LÓGICO CO₂ cascade system

The CO₂ refrigeration system installed by Eletrofrio is called ECO2LÓGICO and is a cascade system that uses CO₂ as the refrigerant in the low-pressure (subcritical) stage, with direct expansion, and cools the freezers. Propylene glycol in used as the heat transfer fluid in a pumped system circulating in the CO₂ cascade condensers. In the high-pressure stage a very low R134a charge is used.



The freezer system that uses CO_2 was divided into 3 compact racks with 2 Octagon compressors installed in parallel. To save on space and facilitate installation and maintenance the CO_2 racks were installed on the ceiling of the underground car park, underneath the Condor shop floor, positioned in close proximity to the freezer islands.

The high-pressure system consists of 6 semi-hermetic Bitzer compressors installed in a "rack house".

Other system features include:

- Heat recovery system capturing heat from the high pressure stage, producing hot water for the entire store;
- Variable speed condenser fans, which guarantee greater condensing temperature stability. The condensing pressure varies with the ambient temperature, reducing energy consumption;
- Carel electronic expansion valves used in the propylene glycol heat exchangers;
- Carel rack controllers.

Advantages of the ECO2LÓGICO system

- Uses low GWP refrigerant CO2 that does not damage the ozone layer
- Lower Total Equivalent Warming Impact (TEWI) impact
- Lower discharge temperature
- Reduction in Energy consumption
- Reduction in tubing diameter
- Low cost of refrigerant CO₂
- Compact rack and installation thanks to smaller size of CO2 compressors and smaller number of compressors
- Increase in useful life of CO₂ compressors

Sustainable features of Condor hypermarket store

Architect Luiz Forte Netto designed the Condor store, and in addition to the CO₂ refrigeration system incorporates the following eco-friendly features:

- Glycol refrigeration system that reduces the MT HFC charge by 90%
- Store design maximises natural light;
- T5 fluorescent lighting that reduces energy consumption by 45% and lasts for 23 thousand hours;
- Presence control lighting and daylight switching that turns lights on an off depending on sufficiency of natural light available;
- Rainwater harvesting.

Background

Bitzer is a world leader in the manufacture of high quality and efficient refrigeration and air conditioning equipment. Since Bitzer Brazil inaugurated its CO₂ Training and Technology Centre in its São Paulo factory, interest from OEMs in CO₂ technology has been growing.

For the Condor installation all the Eletrifrio engineers and installers, and Condor maintenance technicians received training at the Bitzer CO_2 Training and Technology Centre.



Korean CO₂ HP water heaters by Samsung, new line up by Toshiba Carrier – Eco Cute Update

23 December 2011

The South Korean companies Samsung and LG have received government funding to develop Korean CO₂ heat pump water heaters. The 20-storey Gate-Tower in Iwate Prefecture features Eco Cute for hot water production. And Toshiba Carrier are bringing their new Eco Cute Estia line up on the market in January.

Competition under way: Korean Eco Cutes

End of November, it became public that Samsung Electronics had developed the prototype of a CO_2 heat pump water heater. The development of this Korean Eco Cute was carried out in the context of the South Korean's government Project to Support Technological Development of domestic companies. When the budget was allocated in November 2010, Samsung had been chosen to develop medium to large size commercial CO_2 heat pump water heaters and LG Electronics had been selected to develop smaller sized residential ones.

CO₂ heat pump water heaters (Eco Cute) have so far been almost entirely the domain of Japanese manufacturers and have also been mostly deployed in the domestic market. Depending on the price and quality of the Korean Eco Cute, Samsung and LG could potentially become competition for the Japanese companies.



It was not revealed yet whether the two companies acutally plan to commercialse the Korean Eco Cute in Japan in the future.

Gate-Tower features Eco Cute

In Morioka, capital of Iwate Prefecture in the Northeast of Japan, the Daiwa House company, Japan's largest homebuilder, specialising in prefabricated houses, has build a 20-storey apartment tower, close to Morioka train station. The Gate-Tower is equipped with the latest seismic isolation systems to make it earthquake-proof. In order for the building to be energy efficient, economic and low carbon, the tower has been designed to be all-electric, featuring i.a. Eco Cute for hot water production.

First full automatic, remote controlled, touch key Eco Cute series goes on sales in January

From January 2012 on, the JV Toshiba Carrier will put a new line up of seven models of the Eco Cute Estia on the market. This series is equipped with touch key remote controls and a hot water "navi" system, telling the user how much energy is used at any time.

Prices will range between ¥743,400 (~€7,290) and ¥885,150 (~€8,680).

The original articles are listed below in the order of appearance in the column.



Montreal Protocol Parties request more info on low-GWP alternatives

29 November 2011

For the third year, Parties to the Montreal Protocol did not reach consensus on taking action to control HFCs under the treaty. However, they did advance discussions on the availability, cost and potential of alternatives to ozone-depleting substances, with low impact on the climate and requested the Technology and Economic Assessment Panel (TEAP) to conduct a study in that respect.

Last week's 23rd Meeting of the Parties (MOP23) to the Montreal Protocol on Substances that Deplete the Ozone Layer, decided to request the Technology and Economic Assessment Panel (TEAP) to prepare within the next few months a report assessing the availability, cost and potential of alternatives to ozone-depleting substances, including those that encompass low climate impact by application and region. The prospect of a report by TEAP on this topic could prove a key point of reference when countries choose HCFC replacement technologies.

The availability of technologies encompassing low Global Warming Potential (GWP) was also addressed at a side event organised by the United Nations Environment Programme (UNEP). UNEP launched a new report titled "HFCs: A Critical Link in Protecting Climate and the Ozone Layer" that assesses that low-GWP alternatives, including CO₂, ammonia and hydrocarbons are commercially available in many



applications already today while more alternatives are being developed. The same report also examines the potential impact of rising HFC use on the global climate.

China, India and Brazil block discussions on HFC amendment proposals

Two sets of amendment proposals calling for an HFC phase down had been put forward by North American (US, Canada and Mexico) countries and Micronesia respectively for consideration at MOP23.

However, from the very outset of discussions it became evident that consensus would not be reached in that respect, with countries led by China, India and Brazil requesting that the HFC phase down proposals be deleted from the meeting agenda. Their main argument in blocking discussions was that the Montreal Protocol addresses ozone depletion and therefore non-ozone depleting HFCs should be rather treated under the UNFCCC's Kyoto Protocol that addresses climate change.

The same set of countries also successfully blocked discussion on a proposal to phase out potent greenhouse gas HFC23, a by-product of HCFC22 production.

Growing number of countries express support for taking action on HFCs

On a positive note, 29 delegations from both developed and developing countries, as well as environmental NGOs EIA and Greenpeace took the floor during the 2nd day plenary discussions to express their support for controlling HFCs under the Protocol, as opposed to 7 country delegations and 1 organisation from China representing HFC producers who expressed their opposition.

Many of the supporters of the amendments pointed out that decision XIX/6 encourages "Parties to promote the selection of alternatives to HCFCs that minimise environmental impacts, in particular impacts on climate [...]". "We created this mess and it is our moral and legal obligation to clean up this mess", said the Micronesian delegate Antonio Oposa during his presentation of the amendment proposal submitted by his country.

Besides decision XIX/6 and the fact that 91 countries out of a total of 196 that have ratified the Protocol, have signed a declaration urging action to reduce reliance on HFCs, the opposition expressed by some countries sufficed for the co-chair to conclude that consensus that would allow further discussions on the matter had not been reached.

Towards reaching consensus: the Bali declaration on transitioning to low GWP substances

Indonesia, the MOP23 host country, put forward the "Bali Declation on Transitioning to Low Global Warming Potential Alternatives to Ozone Depleting Substances". The initiative calls on Parties "to explore further and pursue under the Montreal Protocol the most effective means of achieving the transition to low global warming potential alternatives".

Already 50 countries had signed the Bali declaration by the closing of MOP23, with the EU and its 27 Member States also expected to sign soon. The US noted that the number of signatories of the similar in nature declaration that it had put forward at last year's meeting (MOP22) in Bangkok had risen to 107. With the Bangkok declaration now closed, it can be expected that its 107 signatories will also sign up to the Bali declaration.



Exclusive interview with Professor J. Chen about CO₂ heat pumps in China

04 August 2011

Dr. Jiangping Chen, Professor of the Institute of Refrigeration and Cryogenics at Shanghai Jiao Tong University, talked to R744.com about the imminent launch of CO_2 heat pump water heaters in China, the special conditions in the Chinese market, the main barriers to overcome and the prospect of success of the technology in the country.

R744.com: The launch of CO_2 heat pump water heaters in China is expected in 2012. Approximately how many manufacturers are currently working on launching CO_2 compressors and/or CO_2 heat pump water heaters?

Professor Jiangping Chen: The launch of CO_2 heat pump water heaters in China is expected in 2012, but this is not certain as several years ago industry already announced 2011 as the year for the market launch. It seems that the industry is still hesitating.

Many manufacturers are active in the development of CO₂ technology, including:

- exclusive interview with **JCHEN** Co, heat pumps in china
- **CO₂ compressors:** Highly (compressor brand of Shanghai Hitachi), Meizhi, Landa (for Gree), and Qin'an all developing CO₂ compressors.
- CO₂ heat pump water heater systems: Gree, Meidi, Shanghai Hitachi, Haier, as well as some small companies, have all developed prototypes.

R744.com: Has the Institute of Refrigeration and Cryogenics at Shanghai Jiao Tong University been working together with any of these manufacturers or conducting research on CO₂ heat pumps in general? Could you briefly describe the institute's work in this field?

Chen: Yes. In recent years we have been involved in component development, including CO₂ compressors with Highly, as well as in the development of electronic expansion valves. I think that the availability of components is really important for system development: if the companies cannot get good components, it is not easy to make the products.

We have finished the development, meaning that the CO₂ compressor and the electronic expansion valve are ready for mass production.

Regarding CO_2 heat pump water heating systems, we are as of recently helping a small local company to develop such a system, under a project supported by the Shanghai government. We will demonstrate the system in a hospital, and we will be installing the CO_2 heat pump this August.

We are also developing two prototypes for usage in the station of the Antarctic Pole, where they will support the station's sanitary hot water needs. These prototypes will be different from the previously developed system, as they will not be air source systems but rather exhaust air heat pumps that will recycle waste heat. This is a two-year project.

R744.com: Are most of these manufacturers Chinese or also companies with links to Japan?

Chen: Currently, most of the manufacturers are Chinese. But some Japanese companies like Panasonic have established research centres in China in an effort to reduce their price by developing all the components in China. However, this is not an easy endeavor, as the component price always depends on the volume. I also know - although this has not been formally expressed – that Japan has forbidden the export to China of technical components and equipment for CO₂ heat pump water heaters.

In any case, the Japanese products would need to be customised to take into account the water quality in China. For example, the gas coolers in Japanese products are only suitable for soft water. If you install this kind of units in China the gas cooler might not work as intended after only a few months.

R744.com: In what way will CO₂ heat pump water heaters have to be adapted to conditions in the Chinese market (e.g. climatic conditions, hot water use patterns, etc)?

Chen: The current Chinese hot water heater market is segregated between South China and North China. Currently, about 90% of the market in the South of China encompasses gas-fired water heaters, while in the North electricity is mostly used.

Several barriers have to be overcome for the launch of the CO_2 heat pump water heaters in China. In the North of China, the ambient temperatures are not suitable for heat pumps. This is a first barrier. On the other hand, in the South of China many heat pump water

heaters are being sold. But the refrigerant is not CO2, but R22, R134a and R410A.

The second barrier to overcome is the water quality in China (both in the South and the North), which is currently not good enough for heat pump water heaters, meaning that unlike the water quality in Japan, the water here is hard. I am actually now in the process of finishing a review on water tank corrosion caused by the water quality in existing heat pump products. The water quality is the main reason why Japanese products are not sold in China. If Japanese products are directly used in China they will present problems.

R744.com: Do you think that CO₂ heat pumps in China will be more suitable in small domestic applications or rather in bigger applications in commercial buildings and industrial processes?

Chen: Regarding heat pump water heaters in general, I think that currently their advantage is largely for commercial and industrial use. Most of the products sold in China are actually for commercial applications, like in hotels, restaurants etc. A really small number of units is sold for domestic applications. Most of these are installed in houses in the countryside rather than in city apartments, because the current size of the heat pump water heaters is too large. The house prices in bigger cities like in Shanghai and Beijing is really high, hence people are concerned about the appliance size. Another problem is the reachable water temperature. Most of the Chinese use hot water for cleaning (e.g. dishes), so the temperature should be 80-90°C. This is not to the advantage of heat pump water heaters, as current products can only supply 60°C which is not enough for cleaning dishes. Thus, heat pump water heaters for domestic use need to be improved.

R744.com: Would you expect CO₂ heat pumps to become a success in China, similarly to Japan?

Chen: Yes, I expect the market volume of heat pump water heaters overall (not just CO₂ based ones) to increase very fast. Already last year, 770,000 heat pump units were sold on the market. This year sales are expected to reach 1.35 million units, while in 2015 they are expected to reach 4.2 million units.

For the CO₂ based systems, the rate of success will greatly depend on their price. The main barrier to overcome then is how to reduce their price and make it more comparable to competing technologies. Currently the price in China of an air conditioner with 1.5 horsepower – i.e. a unit of similar size to the typical CO2 heat pump water heater placed on the Japanese market - is RMB 2,000 (about \leq 215). The price for an R22 heat pump water heater is RMB 4,500 (about \leq 486), while the price for the CO2 heat pumps sold in Japan is almost ten times higher. The gap is rather large.

Despite this, many end users in China are interested in CO_2 heat pump water heaters, as they do understand that with heat pumps they can save energy costs. However, end users cannot buy CO_2 products, as system manufacturers are still wondering if they can succeed in the market and are concerned about the high cost of the components. That is the reason why there is no company selling their systems at present. We already finished the development of the CO_2 compressor 4 or 5 years ago. The compressor manufacturing company is ready for the mass production of the CO_2 compressor, but system manufacturers so far have only been buying a few units for building prototypes, not for mass production.

The good news is that the Chinese government has listed CO₂ heat pump water heaters as a national key product in the next 5 years. This could mean that in the future the government will support research in the area.



Tesco opens its first CO₂ refrigeration store in China

17 August 2011

Early August 2011, retailer Tesco opened its 97th store in China, yet the first one to feature a CO₂ refrigeration system.

The 8,635 square meter supermarket includes a fresh area of 2,000 square meters and is located in the Cloud Nine Shopping Mall in the Minhang district of Shanghai.

The newly established store is the first in China to adopt a CO_2 refrigeration system, significantly reducing the amount of fluorinated refrigerant charge used and greenhouse gas emissions associated with refrigerant leakage.

25% less energy use than standard store designs

The Shanghai store uses 25% less energy than standard store designs and is expected to reduce annual electricity consumption and carbon emissions by 1.18 million kilowatt hours and 1,176 tons respectively.

It has been built according to an advanced Energy Management System (EMS) that Tesco has rolled out to all stores in China after having trialled it in environmental stores. The store features:

- Innovative use of CO₂ as a refrigerant, plummeting the amount of HFC refrigerant charge from 1,500kg to 120kg, hence reducing the potential damage to the ozone layer and the atmosphere. Designed, installed as well as commissioned by Shanghai Fute Refrigeration & Electrical Engineering Co, Ltd, the system is a cascade CO₂ / R404A one, encompassing a LT system capacity of about 60kW at -33 °C, and a MT system capacity of about 260kW at -9°C with a liquid circulating pump.
- Heat recovery technology: the exhaust heat from the refrigeration system is recovered and reused to cater for the store's hot water needs, thus saving the energy needed to heat the water.
- Free Cooling: The use of low outdoor temperatures in winter and in transitional periods will save considerable amount of energy.
- **Temperature regulation**: Sensors monitor the temperature and carbon dioxide concentrations to regulate temperatures and fresh air at comfortable levels for customers

More CO2 stores to come soon in China

Tesco plans to open a second store with CO₂ refrigeration in Beijing later this year, while it expects the number of CO₂ stores in 2012 to amount to at least four.

Early 2006, Tesco Group pledged to cut carbon emissions from it stores by 50% by 2020. Carbon dioxide refrigeration systems are an important means to achieving this target, as refrigerant emissions are currently responsible for about 16% of the retailer's total carbon footprint globally. Indeed in the past year, thanks to a relentless focus on refrigerant emissions as well as further progress on energy efficiency, the retailer reduced its absolute CO2e emissions in the United Kingdom (UK) by 5%.

Subsequently, in November 2010, Tesco along with other members of the Consumer Goods Forum, pledged to begin phasing out HFC refrigerants from 2015, where this is permitted by local and national regulations, and feasible in regard to climate and store format.

As a result of these commitments, Tesco has more than 57 stores running on HFC-free refrigeration in the UK and a further 23 outside the UK (e.g. Czech Republic, Hungary). The retailer is also actively looking at non-HFC systems that could work in tropical climates like Malaysia and Thailand, as well as in smaller format and existing stores.

About Tesco China

Headquartered in the United Kingdom, Tesco is one of the world's top retailers that is rapidly expanding its presence in China. The total number of Tesco stores in China amount to 97, with 20 of them located in Shanghai.



New Chinese CO₂ heat pump standard

14 July 2011

On 1 June 2011 a new Chinese CO_2 heat pump standard was formally implemented. Standard GB/T26181-2010 is for hermetic motorcompressors for household and similar use heat pump water heaters using CO_2 refrigerant, and is expected to accelerate the introduction of new products to the Chinese market.

The CO_2 heat pump standard delineates requirements for compressor cooling capacity, the coefficient of performance (COP), and noise levels. Based on the characteristics and features of products in the Chinese market, the standard is more than a copy of the Japanese benchmark.

It is likely that with further market development more stringent standards will follow in the future.

Product performance requirements

The following performance criteria are included in the standard:

- Cooling capacity no less than 95% of nominal values
- Coefficient of performance no less than 95% of nominal values
- Power input should not exceed 110% of nominal value
- Operating current should not exceed 110% of nominal value
- Testing methods
- Noise levels should comply with state laws and regulations, standards
- Vibration levels
- Moisture content
- · Packaging compressor shell surface coating should be uniform
- Transport and storage

Standard development

The standard has been developed in anticipation of the launch of CO_2 heat pump water heaters in 2012. Currently, no CO_2 heat pump water heaters are sold in China, whilst the compressor for such heaters is still under development, but industry stakeholders believe the new standard will accelerate the launch of new products.

The drafting of the standard involved many companies, such as Xi'ian Qing'an, Shanghai Hitachi, Guangdong Meizhi, Guangdon Vanward, Daikin Xi'an, Shanghai Mitsubishi Electric & Shangling Air conditioner and Electric Appliance and Panasonic Wanbao Compressor from Guangzhou.

Background

2009 saw the foundation of the China Heat Pump Water Heater Union, by the Chinese Energy Conservation Association, International Copper Association of China, and ten major air-to water (ATW) heat pump water heater manufacturers. The association was founded in response to the rapid rise in heat pump water heater sales in China, with sales reaching 250,000 units in 2008.

Whilst fluorinated refrigerants remain the most common refrigerant used, companies like SinoCredo and Midea have recently begun to develop CO₂ compressors and heat pump systems.

Lastly, whilst there are no national incentives for heat pump water heaters in China, the local government of Ningbo, a city on the Zhejiang Province introduced a 20% rebate for heat pump water heater projects.





Innovative Pakistan solar water heating project with CO₂ as working fluid

05 July 2011

A project to provide an alternate energy system in Gilgit-Baltistan, Pakistan, will see the development of an ecologically friendly hybrid solar water heating system that uses CO₂ as the working fluid. The project is a joint collaboration between the Pakistan-US Science and Technology Programme (USAID) and the Higher Education Commission (HEC) of Pakistan.

To reduce the use of firewood and electricity in providing heating and hot water in the Gilgit-Baltistan region, researchers are developing a solar collector technology that uses CO_2 as the working fluid. The aim of the project is to demonstrate that solar energy can be used in conjunction with CO_2 in a safe, efficient, cheap and environmentally benign system.

A joint technical project combining the work of professors at the University of North Dakota and COMSATS Institute of Information Technology (CIIT), the project received \$164,115 (€113,321) from USAID and \$76,566 (€52, 870) from the Pakistan HEC.



Hybrid system specifications

The multimode hybrid solar water heater is designed to work in sub-zero temperatures.

 CO_2 was selected as the working fluid as it has a low-freezing point compared to water. CO_2 only forms dry ice at -78°C and when heated to its critical point of 31.1°C demonstrates dramatic thermo-physical changes in the presence of small thermal variations which can lead to strong convection flow. In addition to this CO_2 it is low cost and non-toxic.

The hybrid system will combine a direct expansion heat pump with an evacuated solar collector, ensuring continuous operation and a reliable heat supply despite unstable solar irradiation during the winters.

The low temperature thermal requirement of the heat pump makes it a good match for the low temperature heat from the solar collectors. In the summer the convective flow of the supercritical collector fluid will be achieved via heating of the CO₂ through solar radiation and cooling of the CO₂ via heat transfer to a water tank.

The research project is due to be completed in November 2012.

Projects outcomes

Whilst the project has initially been developed for Gilgit-Baltistan, the technology will be transferrable to other areas where the ambient temperature falls below 0°C, and it is hoped that once the demonstration project is up and running a commercial project can be launched onto the market.

It is expected that the project will have the following benefits:

- Identification of operational parameters to achieve high system performance
- Optimisation of collector design and heat pump operation
- Creation of employment opportunities
- Reduction of deforestation in the region as fewer people need to burn wood for water heating
- Avoidance of indirect CO₂ emissions from electricity generation

Whilst it was recently reported that Pakistani manufacturers were unwilling to build the project prototype, due to the small scale and complex nature of the project, CCIT has now managed to secure a manufacturer for the tube-sheet-type collector at its own workshop.

Background

Gilgit-Baltistan is the northernmost political area in Pakistan, bordering Afghanistan, China and Kashmir. Home to the world's highest mountain ranges, the climate in region ranges from very hot during the day, to very cold at night, when temperatures can drop to -20°C. Gilgit-Baltistan in considered one of the most solar-adverse places in Pakistan, and up until now, the wind-chill and freezing temperatures have precluded the use solar water heating systems.

The joint Pakistan-US Science and Technology Cooperation Program began in 2003 with the aim of establishing a framework for cooperation between the science and education communities of both countries. The "Hybrid Solar Water Heating System Using CO₂ as Working Fluid" project was selected for funding under Phase 4 of the cooperation programme, announced in September 2010.



China releases national safety standard for flammable refrigerants

12 July 2012

At the end of June 2012, China released a national safety standard for flammable refrigerants, which will come into force on May 1, 2013. The new safety standard formally allows the adoption of flammable refrigerants like R290 in the production of air conditioners in China. It could potentially accelerate the market uptake of R290 air conditioners in the Chinese market.

Last month China released its first national standard on the use of flammable refrigerants. The "Household and similar electrical appliances – Safety - particular requirements for heat pumps, air-conditioners and dehumidifiers"(GB 4706.32-2012) was released by the General Administration of Quality Supervision, Inspection and Quarantine of P. R. China and the Standardization Administration of China on June 29, 2012.

The standard was jointly drafted by the China Household Electric Appliance Research Institute (CHEARI), the Guangzhou CVC Institute of Technology Detection and representatives from air conditioner and refrigerator/freezers manufacturers including Gree and Haier and Midea.



Regulation for flammable refrigerants

The safety standard formally allows the use of flammable refrigerants in China. In particular, it formalises the use of R290 in air conditioners for the first time.

The standard adopts the International Electrotechnical Commission (IEC)'s safety requirements for electrical heat pumps, air-conditioners and dehumidifiers containing flammable refrigerant (IEC 60335-2-40:2005). Compared with the old version (GB 4706.32-2004) released in 2005, the 2012 version of the safety standard sets out detailed rules for safe operation relating to safety warning, transportation, installation, storage and charging of flammable refrigerants. The new standard applies to heat pumps equipped with electric motors, compressors or room fan-coil units (including domestic hot water heat pumps), air-conditioners and dehumidifiers. The maximum rated voltage for a single unit cannot exceed 250V and the maximum rated voltage for other units cannot be more than 600V.

For refrigerant R290, the standard provides a formula for calculating the refrigerant charge quantity and security values for installation height, housing area and refrigerant concentration, etc.

Standard addresses safety concerns and reassures industry paving the way for R290 air conditioners in China

In the Chinese market, the key barrier affecting R290 air conditioners is the flammability risk posed by R290. With the safety standard for flammable refrigerants to guide the design, production and installation of R290 air conditioner, manufacturers and end users' reservations over safety will be greatly alleviated. After the formal implementation of the standard in May 2013, Chinese consumers will be able to purchase R290 air conditioners.

With the lifting of the ban on flammable refrigerants, a rapid market expansion of R290 air conditioners is foreseeable especially considering the acquisition of R290 technology by some Chinese air conditioner manufacturers. For air conditioner manufacturers that already have R290 air conditioner production capacity like Gree, Midea, and GMCC, the release of the standard removes potential policy and market barriers for production. AC producers like Haier and Hisense that have had preliminary R&D of R290 technology are likely to also enter into the market once they realize the significant market potential for R290 AC in China.



UNEP OzonAction webinar: hydrocarbon refrigerant is a viable long-term option for eliminating HCFCs

05 July 2012

In a webinar organised by UNEP OzonAction on June 28, National Ozone Units, industry experts and other key stakeholders discussed latest developments of alternative refrigerants and technologies to HCFCs and the implementation of phase-out management plans in developing countries. Low-GWP alternatives, especially hydrocarbons, are regarded as viable long-term options for eliminating HCFCs in the refrigeration and air conditioner sectors.

On 28 June, the UNEP OzonAction Program organised a webinar called "HPMP Implementation: Update on Technological Developments". The purpose of the webinar is to update National Ozone Units (NOUs), the industry and other key stakeholders about the latest development in the refrigeration /air conditioning sector and foam sector of alternatives and alternative technologies to HCFCs.

In the Webinar, officers from OzonAction and experts from the German International Cooperation Agency (GIZ) and Environmental Investigation Agency (EIA) informed about the implementation of HCFC Phase-out Management Plans (HPMPs) in developing countries and alternative refrigerants and technologies.

Alternatives are available but no clear idea of how to choose



Mr Shaofeng Hu, the regional OzonAction network coordinator introduced the

general implementation situation of HPMPs in developing countries. He confirmed that most developing countries are initiating the HPMP implementation. Although alternative technologies in foam, refrigeration and air conditioning sectors are widely available in most of the cases, companies in developing countries still lack a clear idea of how to choose alternatives. Indeed, the choosing and adopting of alternative refrigerants and technologies face a lot of concerns on GWP, flammability, energy efficiency, cost, and so on. In terms of choosing alternative refrigerants, the officer expressed that UNEP took a neutral position and welcomes all low GWP and high efficient alternatives.

Demonstration programs on HC-290 air conditioner are under way

Mr Markus Wypior from GIZ presented a case study on the conversion from HCFC-22 to HC-290 in residential air-conditioners in India and China. According to Mr Wypior, the use of hydrocarbon refrigerants in the refrigerator and freezer production is increasing globally. Even the US has introduced hydrocarbon refrigeration technologies to ice cream freezers and bottle coolers.

In India, GIZ has helped two Indian AC producers in the R&D of HC-290 air conditioners. The two types of HC-290 AC are said to reach the highest energy efficiency level among the same types of air conditioners in the Indian market. The HC-290 air conditioners have been sold in the Indian market and the sales situation is promising, according to GIZ.

In China, Gree has already built HC-290 split air conditioner production line. Besides Gree, Midea and Haier's HC-290 demonstration projects are also under way. China's HPMPs aims to convert 18 air conditioner production lines to HC-290 till 2015.

Low-GWP alternatives: path to a sustainable future

Mr Mark W. Roberts from EIA introduced possible options for eliminating HFCs. According to Mr Roberts, one possible long-term option could be to use fluorine-free substances with low or zero-GWP such as ammonia, hydrocarbons, water or CO₂. He analysed the current barriers to use these low-GWP alternatives such as regulations that prohibit the use of flammable or toxic alternatives, insufficient supply of components, increased investment costs and lack of trained technicians. Mr Roberts believed all these barriers can be overcome. He also provided a series of application cases of these low-GWP alternatives and stressed their high-energy efficiency compared to HFCs. Mr Roberts puts new HFCs, including HFC-1234yf and HFC-1234ez into the category of only Secondary Choices.

Mr Roberts concluded that Article 5 countries actually could avoid the cost and disruption to their industries of yet another phase-out by transitioning directly from HCFCs to low-GWP or not-in-kind alternatives.

How to make low-GWP alternatives available to the market in developing countries?

Regarding the choosing of alternative refrigerants and technologies, some practical questions were asked by national ozone officers such like how to ensure the low-GWP alternatives could reach smaller developing countries, how to make low-GWP alternatives go to the market, and what are the possible technical trainings in these countries.

According to the speakers, more completed regulations and standards, more comprehensive market servicing system and more sustained trainings to technicians are necessary to promote the implementation of the HCFC Phase-out Management Plans in developing countries.



Refrigerants front page news at Rio+20 agenda but naturals miss out

22 June 2012

Front page news of the New York Times this week is the global air conditioning boom, its threat to climate change and the refrigerant gases responsible: CFCs, HCFCs, and HFCs. Fluorinated gases have also hit the Rio+20 agenda, where senior political leaders from around the world could sign a document agreeing to an HFC phase down. However, solutions to this problem like hydrocarbons and other natural refrigerants are failing to get noticed.

With nations at Rio+20 facing a push to replace the fluorinated greenhouse gases (GHGs) that fuel air-conditioners, the New York Times has made air conditioning and refrigerants headline news. Whilst the rising profile of high Global Warming Potential (GWP) refrigerants is a step in the right direction when it comes to tackling climate change, something is missing: mention of alternative solutions to HCFCs and HFCs, such as natural refrigerants hydrocarbons, which exist, can be used safely, and are available.

"Relief in Every Window, but Global Worry Too"

The New York Times story focuses on the implications of the developing world's increasing reliance on air conditioning as they become more affordable for its growing middle and even working class. "Air-conditioning sales are growing 20 percent a year in China and India," write Elisabeth Rosenthal and Andrew Lehran.



The HCFC refrigerants in the units, leaking from factories and AC systems across the world, will work their way into the air, where as powerful greenhouse gases they contribute to global warming. The message in the article is clear: developing countries must switch to efficient air-conditioners with gases that do not contribute to global warming.

However, developed nations are not blameless, having contributed to the problem by previously switching from HCFCs to high GWP HFCs to comply with the Montreal Protocol. Developed nations are therefore essentially telling other nations to do what they have not: leapfrog this generation of coolants. Moreover, according to Rosenthal and Lehran "promising technologies" like hydrocarbon room air conditioners are "stalled in the wings".

But this is not strictly speaking true:

- Italian and Australian manufacturers of portable and split air conditioners have been producing models based on propane for over a decade;
- In China some hotels in Shenzhen are beginning to use hydrocarbon air conditioners and refrigeration systems;
- In Jamaica the Petroleum Corporation of Jamaica the distribution company Lascelles DeMercado is converting all 40 of their mini split and central units to hydrocarbons;
- In Malaysia the Jusco Melaka shopping centre has converted its cooling system to hydrocarbons, installing amongst other systems 100 hydrocarbon split systems.

Many more examples of hydrocarbon air conditioning exist around the world, so why are these HCFC/HF-Free solutions being overlooked?

Will "Phase-down in the consumption and production of HFCs" be agreed at Rio+20?

Over 100 global leaders have converged on Rio de Janeiro for the Rio+20 United Nations Conference on Sustainable Development this week. Back in 1992 at the first Rio summit climate change was top of the agenda, but the bold vision for stopping global climate change has not lowered GHG emissions. Although improvements have been achieved in other areas such as access to water and sanitation, non fossil-fuel emissions including HFC refrigerants are rapidly increasing.

At Rio+20 in front of the heads of state will be the draft document 'Future we want'. Under the heading 'Chemicals and Waste' the issue of refrigerants comes up and global warming comes up in paragraph 222, which states, "We recognize that the phase-out of ozone depleting substances (ODS) is resulting in a rapid increase in the use and release of high global warming potential hydrofluorocarbons (HFCs) to the environment. We support a gradual phase-down in the consumption and production of HFCs."

This proposal to eliminate HFCs for their warming effect is likely to face resistance because of the perceived lack of climate and ozone friendly alternatives. Available, environmentally friendly refrigerants, hydrocarbons are failing to get noticed, and a key opportunity to tackle climate change is being missed.



Hydrocarbons safety: an issue of controversy in China

22 May 2012

In China, two rival camps have emerged over whether the country should choose hydrocarbons as replacement for HCFCs, with the debate focusing on the safety aspect. HyChill China, a leading actor in hydrocarbons safety education in China believes that education to dismiss people's concerns over safety is the key step to promote hydrocarbons in the region.

Most air-conditioners produced in China currently use hydrochlorofluorocarbons (HCFCs) or hydrofluorocarbons (HFCs) as refrigerant gas. R22 and R410A are the two most commonly used refrigerants. As one of the biggest consumers of HCFCs and HFCs, China's refrigeration industry is currently urged to transition towards more climate friendly refrigerants, such as hydrocarbons.

Industrial roadmap supports hydrocarbons

At the end of 2011, China Household Electrical Appliances Association (CHEAA) released China's first industrial roadmap on replacing HCFCs with new refrigerants including R290 and R744. Regarding the foam sector, the roadmap calls for the wide industrialisation of R290 and declares the hydrocarbon gas as the main replacement for HCFC-141b.



After the release of the roadmap, the debate over whether hydrocarbons should be the main replacement option for HCFCs became vigorous and two rival camps seem to have gradually surfaced.

The debate mainly focuses on hydrocarbons' safety. CHEAA, environmentalists, certain research institutes and several leading air conditioner manufacturers are the main supporters of a transition to the use of hydrocarbons. They believe that hydrocarbon refrigerants are safe if handled and used with adequate safety measures. They look at the experience in many developed countries, where hydrocarbons are in widespread use and have been used commercially as replacement for HFC-134a and CFC-12 for more than 20 years. They highlight that hydrocarbons would not only cut greenhouse gas emissions but also achieve energy savings.

The other camp holds a comparative passive attitude towards hydrocarbons, although they confirm their advantages in reducing carbon emissions. This camp believes hydrocarbons do not constitute an ideal replacement for HCFCs because of flammability risks. They take the example of the US who until recently prohibited the use of hydrocarbons in domestic refrigerators and refer to figures by the US Environment Protection Agency that foresee up to 30,000 fires caused by the non-proper handling of hydrocarbon fuel every year in the US. From their point of view, because of safety concerns, hydrocarbons would be a temporary solution that like CFCs, HCFCs and R410A, would soon need be replaced.

HyChill China's hydrocarbons safety education

Some hydrocarbon refrigerant suppliers such as HyChill China, an independently owned enterprise that supplies HyChill (Australia) products into the Chinese markets, have realised that proper safety training in hydrocarbons of designers and service technicians, as well as end users is a key step to alleviate people's reservations over the hydrocarbons safety and promote their wide use in China.

The hydrocarbon refrigerant supplier is a leading actor in hydrocarbons safety education in China. It does not only provide training to its technicians on how to install and maintain equipment safely but also give detailed instructions to the non-technical staff and end users on safe handling of flammable refrigerants and important points for consideration. As a result, there has not been any reported fire incident related to HyChill's hydrocarbon products placed on the Chinese market.





Montreal Protocol: North America and Micronesia submit new proposals to reduce HFCs

11 May 2012

A joint proposal by Canada, Mexico and the United States and a proposal by the Federal States of Micronesia to amend the Montreal Protocol in relation to phase-down of the use of hydrofluorocarbons (HFCs) have been submitted ahead of the 32nd Meeting of the Open-Ended Working Group (OEWG) of the Parties to the Montreal Protocol.

Similar amendment proposals, calling for an HFC phase-down were put forward by North American countries and the Federal States of Micronesia at the 23rd Meeting of the Parties (MOP23) to the Montreal Protocol on Substances that Deplete the Ozone Layer in 2011. The discussions on HFC phase-down proposal were blocked at that time by countries led by India, China and Brazil, which argued that HFCs should be treated under the UNFCCC's Kyoto Protocol addressing climate change rather than under the Montreal Protocol addressing ozone depletion.

The North American proposal

While under the proposal presented by the North American countries at MOP23 last year developed countries would have to start the HFC phase-down in 2015 and developing countries (Article 5) in 2017, the new proposal suggests the control of



HFCs begins a year later, in 2016 and 2018 respectively. A gradual phase-down would lead to a reduction of HFCs to 15% of baseline levels by 2033 by developed countries. Developing countries would reach the same level ten years later.

The baseline for Article 5 countries is calculated based on hydrochlorofluorocarbon (HCFC) consumption and production respectively averaged over years 2005-2008, recognizing there are HFC data limitations in some countries. For developed countries, the baseline is determined from a combination of HFC plus 85% of HCFC consumption and production respectively averaged over years 2005-2008.

The Micronesia amendment proposal

The new amendment proposal to phase down HFCs under the Montreal Protocol submitted by the Federal States of Micronesia suggests that HFC consumption and production be reduced in all countries from the baseline by 15% every 3 years beginning in 2015 until 15% of the baseline in 2030 and ultimately 10% of the baseline in 2032 is reached. The baseline would be established using HCFC plus HFC production and consumption from 2004-2006. However, in order to satisfy the basic domestic needs of the developing countries, their calculated level of HFC sproduction may exceed the limit by up to 10% of the average of its calculated levels of production between 2004 and 2006.

TEAP report on low-GWP alternatives

In November 2011, the Parties to the Montreal Protocol requested the Technology and Economic Assessment Panel (TEAP) to prepare a report assessing the availability, cost and potential of alternatives to ozone-depleting substances, which could later prove to become a point of reference when selecting alternatives to HCFCs. According to the provisional agenda of the 32nd OEWG meeting the Technology and Economic Assessment Panel will present the report in July.

Next steps

Both amendment proposals as well as the TEAP report will be considered during this year's Meeting of the Open-ended Working Group of the Parties to the Montreal Protocol, which will take place in Bangkok on 23-27 July 2012.



Australian RAC industry steps up to the HFC carbon price challenge

02 May 2012

Today saw the official launch of the Australian Refrigeration Association (ARA), one of the few industry associations in Australia that has welcomed the introduction of carbon pricing on HFCs as of July 2012. ARA will have an important leadership role in collaborating with industry and government to achieve transition to proven, energy efficient, low GWP refrigerant solutions, quickly and cost effectively.

The formal launch of the Association took place at the historic Jubilee Room of the New South Wales Parliament.

ARA aims "to help the industry achieve high performance both commercially and environmentally by achieving high standards of safety, energy efficiency and environmental impact," said ARA President Mr Tim Edwards.

HFC carbon price: an impetus for establishing the Association

To a large extent the impetus for establishing the Association derived from the introduction of carbon pricing on hydrofluorocarbons (HFCs) based on their Global Warming Potential (GWP), but also the impending phase-out of hydrochlorofluorocarbons (HCFCs).



The HFC tax introduction in July 2012 brings along significant opportunities and challenges for the industry, and the new Australian Refrigeration Association has been established to prepare the Australian refrigeration and air conditioning industry for the impacts. "The [HFC] levy will increase refrigerant prices significantly. Refrigeration and Air Conditioning industry stakeholders that recognise and address the implications of this are likely to benefit commercially," said Mr Edwards.

Reducing exposure to the HFC levy through reduced leakage and low-GWP refrigerants

"ARA estimates that the industry is responsible for about 11% of national GHG emissions. The industry needs to step up to the challenge. Refrigeration and Air Conditioning suppliers can reduce their and their clients exposure to the [HFC] levy both by reducing leakage, and by adopting the proven, energy efficient, low GWP refrigerant solutions," Mr Edwards said.

"This is an opportunity at all levels in the industry from design, to engineering, contractor and service suppliers. We aim to assist all participants in the industry because we face a common challenge and opportunity."

ARA's focus areas

ARA will work with other RAC industry peak bodies, RAC user groups and government and education and training bodies to advance the science and practice of refrigeration by focusing on the following areas:

- Awareness: make the industry, governments and RAC users aware of the need for a comprehensive strategy for sustainability.
- **Planning**: develop a plan that recognises the need for industry collaboration and the need for an integrated strategy addressing the following functional dimensions.
- Funding: identify ways to fund the significant activities required and the resources and programmes required to deliver safe, efficient and sustainable practices.
- Documentation: compile and make available the many sources of information required to address each RAC sector including standards, codes of practice, training materials, legislation requirements, and research and development requirements.
- **Training**: develop training systems and resources that address the tens of thousands of people and organisations that will need educational assistance to achieve these outcomes.
- Legislation: identify the legislative tools required and the associated enforcement mechanisms. Recommend and gain the support of the Federal, State and Local Governments recognising the need for nationally consistent policies and practices.
- **R&D**: identify the priorities for R&D by sector and programmes to address these research needs by accessing both international achievements and domestic research capability.


2012 China Refrigeration Exhibition: hydrocarbon products on display

17 April 2012

The rapid development of hydrocarbon technology and its wider application in China, was in evidence at the 23rd China Refrigeration Exhibition 2012, held from 11-13 April in Beijing, where many Chinese stakeholders voiced their support for hydrocarbons as viable options to replace HCFCs in China's air conditioning industry. Several Chinese AC compressor manufacturers and refrigerant suppliers are vigorously pushing the technology forward.

The China Refrigeration Exhibition is one of the leading international exhibitions for the HVAC&R sector. This year the exhibition attracted about 1,100 participating suppliers and manufacturers and 50,000 visitors from all around the world.

Hydrocarbon refrigerants are being gradually introduced in air conditioner production lines as a replacement of CFCs, HCFCs and HFCs. Rapid research and development in hydrocarbon technology by several leading AC manufacturers in China has awakened many the Chinese industrial stakeholders and the Chinese government to the fact that hydrocarbons are a viable option to replace HCFCs.

China's HCFC Phase-out Management Plan stipulates that 18 of its R22 air conditioner production lines will be converted to R290 by the end of 2015. At the exhibition, many exhibitors presented their latest research into the production of R290 air conditioners, R290 compressors and hydrocarbon refrigerants.



GREE: At UNEP's "Ozone2Climate Technology Road Show 2012", which took place alongside the exhibition, GREE showcased their VDE certified R290 air conditioner. GREE's R290 production line can currently produce split fixed frequency and inverter household air conditioners, portable air conditioners, window ACs and dehumidifiers, all using R290 as the refrigerant. Whilst the fist batch of R290 ACs was originally exported to Maldives in May 2011, the European Union is GREE's main export market for the R290 AC. In the Chinese market, GREE is gradually shifting its AC production to HCFC-free air conditioners and in the near future R290 AC will be the main alternative.

Midea/GMCC: Midea's GMCC R290 Compressor Line officially became a Montreal Protocol Implementation Demonstration Project funded by the United Nations Multilateral Fund (MLF) in 2011. During the "2012 Ozone2Climate Technology Roadshow and Industry Roundtable" held by UNEP Midea presented their research into the development of an R290 air conditioner compressor, for which the company is now ready to start commercial production.

Yueon: Shandong Yueon Chemical Industry CO. LTD. Yueon is one of China's largest hydrocarbon refrigerant producers. The company presented their JINLAIER R290, R600a and R1270 refrigerants at the exhibition. Shandong Yueon has invested CNY100 million (about €12 million) to enlarge the production scale of R600a and R290 in recent years. The company declared that its annual R290 output will grow to 10,000 tons per year from annual 5,000-6,000 tons now, and the R600a output will reach 18,000 to 20,000 tons from the present 10,000 tons.

HIGHLY: Shanghai HIGHLY Group Co., Ltd. is the world's second largest air conditioner compressor supplier. At the exhibition, the company presented its G, L, H and TH series compressor models. Although its compressor range at present still focuses on traditional refrigerants, their R290 compressor research already covered all these models. HIGHLY has also obtained several patents regarding CO₂ and hydrocarbon technology in China and CO₂ and R290 compressors have become HIGHLY's key research field.





Indian manufacturer launches R290 AC production line

05 April 2012

A new production line of split and window-type R290 air-conditioners (ACs) has been inaugurated in India by Godrej & Boyce Mfg. Co. Ltd. With the highest energy efficiency in their class, the hydrocarbon refrigerant based ACs constitute a great value proposition for Indian consumers. + PHOTOS

The new R290 AC models are being launched in various cities in India and Godrej service technicians have been specifically trained in their safe installation and maintenance.

Back in 2002 Godrej was also the first to introduce climate- and ozone-friendly hydrocarbon refrigerants in refrigerators. Since then, several million, hydrocarbon refrigerators have been delivered to the Indian market, avoiding large amounts of greenhouse gas emissions.

R290's superior performance at high ambients: 23%+ energy savings compared to top of the line products



R290 (propane) technology is a very suitable alternative for climate-friendly cooling

even in high ambient temperatures. Designed on the basis of European and International safety standards, the newly developed air conditioners encompass the highest energy efficiency in their class.

For example, in the 1.5 T split category, which is the most common air conditioner segment in India, the Godrej 5-star R290 AC will consume at least 23% less energy than the current top-of-line 5-star models across brands.

Transitioning from HCFC to HC ACs: emissions savings opportunity in India and beyond

The introduction of energy efficient R290 based air-conditioners is an important step to reducing both energy-related and refrigerant greenhouse gas emissions from the sector, in view of the gradual phase out of hydrochlorofluorocarbons (HCFCs) - currently the most prominent refrigerants used in room air conditioners in India - from 2013 onwards.

Considering the high growth rates in the Indian air-conditioner market, there is a great emission savings potential from transitioning from HCFCs to alternatives that are both ozone and climate friendly.

Besides helping to spread the general awareness and knowledge of R290 based technology throughout India and in the wider region, the project is expected to also give an impulse to other air-conditioning manufacturers to select climate friendly refrigerants when replacing HCFCs.

About the project: a strategic partnership between India and Germany

The project is being implemented by GIZ Proklima under the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety in cooperation with the Government of India, represented by the Ozone Cell, Ministry of Environment and Forests. This strategic partnership between India and Germany will strengthen India's capacities in adopting environmental-friendly technologies for sustainable growth.



China's major refrigerant suppliers expand R600a and R290 production

03 April 2012

China's major refrigerant suppliers are all expanding their R290 and R600a production to meet the growing market demand, as China's refrigeration industry adopts hydrocarbons more widely.

At present, the demand for R600a in China's refrigerator industry is around 2,000 tons per year. According to Shandong Yuean Chemical Indesity CO. LTD., a company that has about 40%-50% market share of R600a refrigerant in China, there has been an R600a supply shortage recently in the market.

In response to meeting the growing market demand for R600a and R290, major refrigerant suppliers such as Puyang Zhongwei Fine Chemical, Shandong Yuean Chemical Indesity and Sinopec are all enlarging the production of R600a and R290.



Shandong Yuean Chemical Indesity has invested CNY100 million (about €12 million) to enlarge the production scale of R600a and R290. Its annual R600a output will reach 18,000 to 20,000 tons from 10,000 tons at present, and its R290 output will grow to 10,000 tons per year from annual 5,000-6,000 tons now.

Similary, Puyang Zhongwei Fine Chemical is enlarging their existing production line to increase the annual output of R600a and R290 to 70,000 tons in total, according to Mr Su Hongjun, the company CEO.

Stable market prices for R290 and R600a

According to Mr Ling Zhibo from Shandong Yuean, although cost of raw materials is rising, the price fluctuation of R600a and R290 is limited. The prices of Shandong Yuean's R290 and R600a range from CNY14,000 (about € 1660) to CNY18,000 (about € 2134) per ton. The prices of R290 and R600a produced by Puyang Zhongwei range from CNY12,000 (about € 1423) to CNY13,000 (about € 1541) per ton.

R600a refrigerators become new favourite; R290 ACs to follow suit

R600a is increasingly used by the Chinese refrigerator industry, with consumers able to choose among several brands of R600a refrigerators available on the market. Major R600a refrigerator manufacturers include Haier, AUX, Meiling, Konka and Frestech.

According to the country's HCFC Phase-out Management Plan, China aims to convert 18 of its R22 air conditioner production lines into R290 by the end of 2015. The annual output of R290 air conditioner is expected to be 4.5 million units, which needs at least 1,350 tons of R290 per year. As a result of the expected flourishing market for R290 air conditioners and the recent official lifting of the "essential" ban on hydrocarbons, market demand for R290 is also expected to grow rapidly in China.



Shenzhen: China's first pilot city for hydrocarbon air conditioning

13 March 2012

The city of Shenzhen is a pioneer in promoting the commercial application of hydrocarbon refrigerants as HCFC replacement in air conditioning. Market demand for hydrocarbon refrigerants is thus growing fast in one of Southern China's major cities.

Several Chinese media sources reported in early March 2012 that the city of Shenzhen in South China has been identified by the United Nations Environment Programme (UNEP) and the Ministry of Environmental Protection of China (MEP) as the first pilot city in China to promote environmental friendly air-conditioners using hydrocarbon refrigerants.

Shenzhen initiates "open up" policy to hydrocarbons

Some industrial stakeholders in China regard this as an official signal towards lifting the existing "essential" ban on hydrocarbons, a move that could eventually lead to rapid market expansion of hydrocarbons.





Shenzhen has been regarded as a test bed for economic reform in China in the past 30 years. Shenzhen is also a leader in implementing China's national HCFC phase-out plan.

In 2011, Shenzhen Environment Protection Bureau initiated China's first training programme on hydrocarbon technologies and R22 replacement for air conditioning technicians. The aim of the programme is to establish the correct awareness regarding hydrocarbon refrigerants and address concerns over safety.

Hydrocarbons implemented in hotels as energy saving measure

With electricity being a scarce resource in China, big electricity consumers such as air conditioning and energy saving measures are getting increased attention.

For example, some hotels in Shenzhen are beginning to use hydrocarbon air conditioners and refrigeration systems. According to figures reported by a refrigerant supplier, hotels using hydrocarbon refrigerants to replace R22 in their air conditioning systems are realising significant energy savings:

- 6 hotels reported 20% electricity consumption savings,
- 11 hotels reported 25% electricity consumption savings and
- 7 hotels reduced their annual energy consumption by 30%

Businesses including hotels and restaurants, but also schools and large-scale public buildings are considering a shift to hydrocarbon based air conditioning systems to save energy, according to the same hydrocarbon refrigerant supplier. The uptake of hydrocarbons is therefore expected to increase in the near future.

Hydrocarbon refrigeration technology was also adopted in the stadium used for the 2010 Asian Games that were held in Guangdong Province, the same province where the city of Shenzhen is located.

Hydrocarbons could propel the whole industrial chain

After lifting the "essential" ban on hydrocarbons, market demand for hydrocarbon refrigerants, air conditioning and refrigeration equipment and their parts are expected to increase. The entire industrial chain could thus benefit from a wider application of hydrocarbons. The use of hydrocarbon refrigerants could also enable Chinese manufacturers to break the green trade barriers in their exports, bringing them renewed hope and business opportunities.



Hydrocarbon refrigerants supplied to Eastern Caribbean States

17 February 2012

One of Grenada's leading suppliers of refrigeration and air-conditioning equipment has launched hydrocarbon refrigerants as its newest line of products for the Eastern Caribbean States market. The launch ceremony was followed by a demonstration during which several types of mobile air-conditioning systems were retrofitted to hydrocarbons.

About 50 people from the refrigeration and air-conditioning sector attended the launch ceremony of Duracool® hydrocarbon refrigerants by SNJ Electrical on 28 January 2012. Mr. Stephan Baldeau, the company's operations manager, highlighted the need for the products to be used only by technicians who are trained in Good Refrigeration Practices and Hydrocarbon Technologies. He outlined the benefits of using hydrocarbon refrigerants and their long-term desirable characteristics, such as them being non-ozone depleting, non-global warming, cheap and very efficient as a cooling agent, as well as the fact that equipment with hydrocarbons use smaller refrigerant quantities.

Retrofit demonstration of air-conditioners of 3 vehicle types

A product demonstration whereby the mobile air-conditioning systems of cars,

sports utility vehicles (SUV) and a large bus were retrofitted to use the hydrocarbon refrigerants, followed the launch ceremony. The owner of the refrigerant supplying company in Grenada, who had already converted the air-conditioner of his retail store to hydrocarbons, went one step further to also convert his SUV.

The results of those retrofits realised lower temperatures - as much as 10 degree Celsius - and significantly lower discharge pressures from the compressors.

Grenada establishes 3 more recovery and recycling centres

At the end of January 2012, the National Ozone Unit of Grenada announced it had established three more recovery and recycling centres bringing the total number of such centres in the country to twenty. The centres, that are established as part of Grenada's Hydrochlorofluorocarbon (HCFC) Phase-out Management Plan, will assist about 150 technicians in the islands of Grenada, Carriacou and Petite Martinique to carry out good refrigeration practices in the recovery and recycling of refrigerants.

The centres have been supplied by the Grenada Refrigeration Air-conditioning and Ventilating Association (GRAVA) with the following equipment: Recovery Units, Electronic Refrigerant Scales, Electronic Leak Detectors, Electronic Refrigerant Identifiers, Infra-red Thermometers, Recovery/Refillable Cylinders, Vacuum Pumps, Micron Gauges and Hose and Gauge sets.

National Ozone Officer, Mr. Leslie Smith, presented the equipment to the owners of the three workshops during a ceremony held at on 28 January 2012. In his presentation at the ceremony, Mr. Smith highlighted the need for technicians to be trained in Good Refrigeration Practices and to do continuous research to be able to keep abreast with the rapidly emerging new technologies in the refrigeration and airconditioning sector.

Background

Under the Montreal Protocol on Substances that Deplete the Ozone Layer, Grenada is required to freeze consumption of hydrocfluorocarbons (HCFCs) in 2013, to reduce consumption by 10% in the year 2015 and to further reduce consumption by 25% in 2020.

The island state of Grenada along with another 107 countries have signed a declaration recognising that the projected increase in the use of HFCs poses a major challenge for the world's climate system and declaring their intent to pursue further action to transition the world to environmentally sound alternatives to ozone-depleting substances.





Review on the use of hydrocarbons issued in Singapore

10 February 2012

In December 2011 the Singapore Civil Defence Force (SCDF) published a review on the use of hydrocarbon (HC) refrigerants across various applications. Despite acknowledging the environmental benefits of hydrocarbon refrigerants the SCDF has issued recommendations to restrict their use, although hydrocarbons in domestic refrigerators and air-conditioners remain permitted.

Over the years hydrocarbon refrigerants have been gaining greater acceptance as safety issues are overcome and better training becomes available for HVAC&R technicians. Across South East Asia several hydrocarbon conversions have been undertaken, such as in the Maldives, Indonesia and Singapore. A new policy in Singapore, however, will restrict their further use.

Restrictions on the use of hydrocarbons

To manage the safety concerns relating to hydrocarbon refrigerants the Singapore Civil Defence Force (SCDF) has recommended that the use of hydrocarbon refrigerants be regulated as of January 2012. The SCDF has issued the following recommendations:



- **Domestic refrigerators and air conditioners:** The use of hydrocarbon refrigerants is allowed in SPRING-regulated domestic refrigerators, subject to a charge weight cap of 150g of refrigerant, hermetically sealed within the refrigerator. Their use is also allowed in SPRING-regulated air conditioners;
- Air-conditioning systems: The use of hydrocarbons ought to be disallowed in building air conditioning systems and mobile air conditioning systems. Premises that have converted their air-conditioning systems into using HC refrigerant as a drop-in will be gradually phase-out by the end of 2016;
- Commercial refrigeration systems: The use of hydrocarbons ought to be disallowed in commercial refrigeration systems such as coldrooms in supermarkets and food storage factories;
- Industrial process refrigeration systems: The use of hydrocarbons should be disallowed unless the use of hydrocarbons is inherent to the industrial process, or has satisfied the MOM's workplace safety regime and SCDF's fire safety regulatory requirements.

SCDF u-turn despite previous approval given to hydrocarbon chillers

In 2005 the SCDF approved the installation of five air-cooled chillers with a nominal capacity of 700 kW, each containing a charge of approximately 25 kg of a refrigerant blend of R290 and (propane) and R1270 (propylene). The SCDF safety audit conducted ensured that there was adequate ventilation, no exposed electrical or fire source nearby, no smoking signs, proper control of access by the public, and that all electrical components and panels were sealed.

In spite of this approval the December 2011 SCDF recommendations will mean installations such as this will have to be phased out by 2016, an about policy turn by the SCDF.

According to the SCDF circular the new policy will be implemented because hydrocarbon refrigerants are flammable and pose a potential safety hazard. However, if technicians are properly trained, the correct procedures are followed and the right safety devices are in place, hydrocarbon chillers can offer safe and more efficient cooling when compared to fluorinated refrigerants.



Tesco Asia's first zero carbon store uses hydrocarbons

20 January 2012

Last month, Tesco Lotus opened Asia's first zero carbon hypermarket in Bang Phra, Thailand, incorporating hydrocarbon based refrigeration equipment.

"Our zero carbon stores use the latest technologies to reduce our environmental impact and really show our commitment to greener growth", said Helen Fleming, Group Climate Change Director at Tesco. "Our climate change programme is central to the way we do business - not only are our actions good for the environment, they also make good business sense. Our energy efficient measures reduce costs in the business by about £200m each year."

Previously, the Thai retailer was the first in Asia to have installed a cascade refrigeration system using natural refrigerant CO_2 at its Tesco Lotus Salaya store, about 1 hour west of Bangkok.



Store sustainability features

Among the sustainability features to reduce the environmental footprint of the store and ensure that the store's net emissions for lighting, air conditioning and refrigerants are zero over the year are:

- Replacing hydrofluorocarbon refrigerant gases with high Global Warming Potential (GWP) with hydrocarbons
- Use of lower wattage LED lighting and use of natural light on the sales floor
- A wind turbine and solar farm of photovoltaic cells to produce energy for the store, with any excess power being fed into the grid
- Use of biogas from waste for food preparation in the store
- Rainwater collection for use in the car wash and store toilets

About Tesco Lotus

The Thai retailer has set a target of 50% reduction in carbon emissions by 2020 against a 2006 baseline.

There are over 660 Tesco Lotus stores, of which 88 are hypermarkets, providing service to over 34 million customers each month.



New GIZ guideline on how to convert fridge production plants to hydrocarbons

19 January 2012

This last article on the series of recent publications by the German International Cooperation (GIZ) focuses on the "Production conversion of domestic refrigerators from halogenated to hydrocarbon refrigerants - A Guideline".

On behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), GIZ has published this guideline document that aims to provide a general idea of the segments and key considerations involved when planning a conversion from an existing production system of domestic refrigerators to one that uses hydrocarbons, such as isobutane (R600a) or propane (R290).

The guidelines take a holistic approach to the conversion process, discussing five key areas involved in the conversion, namely:

- Production equipment that involves installation, maintenance and safety
- Product that involves refrigerator redesign and testing
- Process, in terms of operator training and safety
- · Product support and technician training
- Marketing and customer education

Considerations for conversion

After discussing the marketing of hydrocarbon appliances as well as the barriers to converting production plants to hydrocarbons, the guidelines go over the considerations for conversion including:

- Unit design
- Foam production
- Production line
- Changes in the product components
- Training and after-sales servicing

A case study from an SME in Swaziland

The document focuses on the important aspects that small- to medium-size manufacturers need to consider and also provides a case study example of a manufacturer that has converted its production line to hydrocarbons in Swaziland, including practical issues, the problems and setbacks and the eventual benefits associated with the successful implementation of the conversion.





China: learning from Europe's experience in HC training and certification

04 January 2012

With hydrocarbons being one of the key alternatives that China is implementing for the phase-out of HCFCs, a Chinese mission has visited Centro Studi Galileo, the Italian expert institute in hydrocarbons training. Meeting participants concluded that China could learn from the experience of Europe in the process of strengthening its training & certification of refrigeration technicians and discussed the possibility to meet again in the coming months to decide on a collaboration agreement in that respect.

The Chinese delegation that visited the headquarters of Centro Studi Galileo, Italy, in December 2011 as part of a project organised by GIZ Proklima included representatives from China's Ministry of Environmental Protection as well as Shanghai Jiao-Tong University and China Household Electrical Appliances Association (CHEAA), the latter recently having issued China's first technology roadmap for the home appliance industry which puts a focus on replacing HCFCs with new refrigerants.

On the European side, meeting participants included representatives from the Centro Studi Galileo, the Italian Association of Refrigeration (ATF), the European Energy Centre (EEC) and the vice-presidency of the European Association of Refrigeration (AREA), while present was also the Indian TERRE Policy Centre.



Towards a collaboration agreement on training & certification?

Centro Studi Galileo, TERRE and China discussed the possibility to meet again in a few months' time in order to create, in due course, an agreement of collaboration on certification, training, education and sharing experiences.

Zhong Zhifeng of China's Ministry of Environmental Protection stated, "Building a strong bridge with Europe is important for us to ensure low GWP and energy efficient technology. Hydrocarbons are one of the important alternatives that China is implementing for the phase-out of HCFCs. This meeting is an important beginning for the training and capacity building in this direction".

Rajendra Shende, former Head of the United Nations Environment Programme and Chairman of the TERRE Policy Centre of India, who guided the meeting, stated that "Efforts of GIZ and Centro Studi Galileo in the field of improving the energy efficiency of refrigeration and air conditioning appliances and the use of natural refrigerants are the most timely and relevant for China who is embarking on the implementation of HCFC phase-out".

Sharing Europe's experience with natural refrigerants and plant visits

AREA's Vice President Marco Buoni presented the European experience on the elimination of HCFC gases, and the development of natural and alternative refrigerants, also presenting the results obtained in energy savings.

Participants also discussed the importance of harmonisation of policies on the safe handling of low GWP gases such as hydrocarbons for capacity building and their deployment globally.

The event also included visits to manufacturing plants including a plant that will produce natural refrigerant vending machines based on carbon dioxide for Coca Cola that will be deployed in the London 2012 Olympics.

Background

In December 2011, China's Ministry of Environmental Protection launched the HCFC Phase-out Management Plan (HPMP), a US\$270 million (€188 million) project that had previously been approved by the Executive Committee of the Multilateral Fund for the implementation of the Montreal Protocol in summer 2011 and which enables the country to achieve its target of a 10% reduction in the consumption of hydrochlorofluorocarbons (HCFCs) by 2015.

As part of the HPMP, 18 of the 32 air conditioning production lines in China will be converted to hydrocarbon refrigerant R290.



SolarChill large-scale demo and technology transfer project gets funding go-ahead

14 December 2011

The Global Environment Facility has approved \$2.7mio in funding for the "SolarChill Development, Testing and Technology Transfer Outreach" project in Kenya, Swaziland and Colombia. The project is expected to address some of the challenges to the wider deployment of SolarChill technology, which integrates the use of solar energy with "Greenfreeze" hydrocarbon refrigeration. It also eliminates the need for lead storage batteries by using solar direct drive compressors to create an ice bank thus storing the energy of the sun in ice.

"As the world is grappling to arrive at an urgently needed global agreement to reduce greenhouse house gas emissions, it is important to demonstrate through practical examples, such as SolarChill, that we can indeed meet human needs with practical innovations that integrate the renewable energy of the sun with climate friendly hydrocarbon refrigeration", said Janos Maté, International Coordinator of SolarChill Project and Senior Consultant to Greenpeace International.

Large scale demonstration and performance monitoring

The project plans include installing up to 75 SolarChill vaccine coolers and 25 SolarChill food refrigerators in different regions in each country. The units will be monitored and performance data collected.

The SolarChill vaccine coolers will be installed in community clinics that are off the grid.

The food refrigerators will be installed in a variety of settings, including community centers, schools, small commercial enterprises, hospitals etc.

Technology transfer

The plans also include technology transfer related initiatives. This will involve country wide and regional market analysis and outreach to potential manufacturers.

SolarChill Project partners and SolarChill manufacturers

Conceived in 2000, the SolarChill Project involves a unique, long lasting partnership between seven diverse international organizations, namely the Danish Technological Institute (DTI), German Government Development Agency, GIZ ProKlima, Greenpeace International, Programs for Appropriate Technologies in Health (PATH), United Nations Environment Programme (UNEP DTIE), United Nations Children's Fund (UNICEF) and the World Health Organization (WHO).

The SolarChill technology was developed at the Danish Technological Institute in concert with the guidance and directions of the SolarChill Partners. The SolarChill Project also benefited greatly from the involvement of industry participants, most notably that of Vestfrost and Danfoss Companies from Denmark, and more recently, Palfridge Company of Swaziland.

Today there are four factories producing SolarChill technology based products: Vestfrost in Denmark, Palfridge in Swaziland, Haier in China, and True Energy in the UK.





Natural refrigerant products on display at FEBRAVA 2011

07 October 2011

The 17th FEBRAVA trade fair took place in Sao Paulo, Brazil, on 20 – 23 September, bringing together leading market players for the HVAC&R sector in Brazil and internationally. The hot topic at this year's event was Brazil's HCFC phase out management plan. Several companies working with natural refrigerants exhibited their products.

Nearly 29,000 visitors attended FEBRAVA 2011, the largest trade fair in South America, where some 500 exhibitors displayed products and organised technical seminars. One of the five "Thematic Islands" at this year's conference was the "Environment Island" hosted by the Brazilian Environment Ministry (MMA), in collaboration with, the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA), GIZ, and the United Nations Development Program (UNDP), which aimed to raise awareness of Brazil's HCFC phase-out programme, launched this summer in Montreal, Canada.



FEBRAVA Exhibitors

 Danfoss – The Danish company has taken part in this trade fair since the first edition, and this year launched 8 new products, including a line of variable speed drives for CO₂, and electronically operated expansion valves for systems including those using ammonia as the refrigerant.

Speaking about the importance of Febrava, Sales Director of the Division of Refrigeration and Air Conditioning of Danfoss Brazil, said "FEBRAVA is the most important event of Latin America for the air conditioning industry, bringing together the main manufacturers and attracting buyers from several countries of the Latin America... With more than 40 years of operations in Brazil, we take advantage of the event to reinforce the visibility of our products."

- Gree: The Chinese company, which specialises in manufacturing air conditioners, and recently launched a line of hydrocarbon air conditioners in China, has been in operation in Brazil since 1998. At FEBRAVA the company presented a new line of air conditioners including the Gree R290 Inverter.
- **Tecumseh:** Tecumseh, a company working with hydrocarbon refrigerants and one of the leading compressor manufacturers in Brazil, presented the TA Hermetic compressor, a newer, lighter, and quieter solution for domestic refrigeration and light commercial refrigeration, for use with environmentally sound hydrocarbon refrigerants (R-600a/R-290).

Tecumseh was also involved in developing the air conditioning system for the electric car presented at FEBRAVA, for which it collaborated with CPFL/ITAIPU. Tecumseh is currently developing R290 and R600a Masterflux compressors for automotive air conditioning.

- Emerson: At this year's FEBRAVA Emerson presented its Copeland scroll compressor specially designed for high-pressure systems and available for CO₂.
- **SWEP:** The company that specialises in the heat transfer field presented its AsyMatrix plates that have an asymmetric channel configuration for maximum performance, and can be used in natural refrigrant applications.



Energy saving with hydrocarbons presented at Bangkok Energy Efficiency Summit

22 July 2011

An "Energy Efficiency Summit" held in Bangkok, Thailand on 12-13 July aiming to address the best practices in achieving energy savings and reducing operating costs while contributing to the environment, included a presentation on how to achieve energy savings with natural refrigerants such as hydrocarbons, and on the development of a Thai hydrocarbons production facility.

Organised within the context of a projected increase in energy demand of 53% and global carbon emissions increase of 55%, the Energy Efficiency Summit brought together 80 speakers to discuss topics related to improving energy efficiency in building, industrial processes and transportation.

Green Cooling Association presentation on energy saving with hydrocarbons

Among the speakers was Green Cooling Association Executive Director Brent Hoare, who delivered a presentation titled "Keeping cool and saving cash -Reducing electricity bills and emissions with natural refrigerants" to showcase examples from around the world of the use of hydrocarbon refrigerants to achieve energy savings.

The Green Cooling Association presentation covered the following topics:

- Opportunities to reduce electricity consumption through retrofit of existing air conditioning systems with hydrocarbon refrigerants experience in South East Asia and the Caribbean
- Emerging high efficiency hydrocarbon air conditioning systems in China and Australia
- Low charge ammonia commercial air conditioning systems examples of 50% power savings compared to conventional HFC systems
- · Energy efficiency opportunities from absorption air conditioning systems utilising waste heat
- Energy efficiency opportunities from the use of natural refrigerants in commercial and industrial refrigeration
- Current developments: Pure hydrocarbon facility in Thailand by Asian Green Fluids Co., Ltd.

"Use of hydrocarbon refrigerants in retrofitting existing HCFC R22 air conditioning systems has been widely demonstrated to achieve energy savings of 10-25% in many applications around the world, and is becoming increasingly popular in South East Asia", said Mr Hoare.

According to Mr Hoare, "Stiff competition will be faced from those attempting to promote HFC R32 as a "climate friendly" alternative, but with a 100 year GWP (Global Warming Potential) of 650 and a 20 year GWP of 2,330, these claims are clearly false, deceptive and misleading, and severely undermine the competitive advantage of genuinely climate and environmentally friendly refrigerants such as hydrocarbons and ammonia in air conditioning systems."

Centre for Energy Environment Research and Development (CEERD Co., Ltd.) - Asian Green Fluids project

Professor Thierry Lefevre, CEERD Director and one of the members of the conference Advisory Committee said CEERD was proud to endorse the conference to promote the need to achieve energy efficiency gains generally, and more specifically to promote awareness of the role hydrocarbons can play.

"We anticipate a large increase in demand for hydrocarbon refrigerants in coming years, and expect the increased use in existing systems will make a major contribution to reducing electricity use in several sectors, and to achieving the accelerated phase out of ozone depleting and powerful global warming gas HCFC R22. The Asian Green Fluids project being developed by CEERD Co., Ltd. is currently in the fund raising phase and looking for strategic and environmentally concerned partners. The plant is planned to be in full production by early 2013," said Professor Lefevre.

The CEERD is now calling on those developing and approving HCFC Phase-out Management Plans (HPMPs) around the world to closely evaluate the strong contribution hydrocarbons are able to make to achieving the objectives of the Montreal Protocol while at the same time protecting the climate by avoiding further dependence on HFCs in developing countries.





Exclusive interview Professor Roberto Peixoto, IMT, Brazil - Part 1

31 October 2011

With the rapidly expanding Brazilian market for R600a domestic refrigerators, hydrocarbons21.com spoke to Roberto Peixoto, Professor of Mechanical Engineering at the Instituto Maua de Tecnologia – IMT (Maua Institute of Technology) in Brazil, about the future for hydrocarbons in this leading emerging economy. In this first part of the interview Professor Peixoto talks about drivers influencing the development of hydrocarbon refrigerant technologies in Brazil.

hydrocarbons21.com: In June 2011 the Brazilian Environment Ministry organised a seminar entitled "Diffusion of alternative refrigerant fluids in refrigeration and air conditioning", at which you presented, endorsing hydrocarbon technology as an environmentally and ozone friendly technology suitable for use in a number of applications. Could you give a brief overview of this seminar and the situation for hydrocarbons in Brazil?

Roberto Peixoto: My presentation for the seminar you mention, which was about refrigerant alternatives for HCFCs, provided insights into the future of hydrocarbon technology in Brazil. One sector where Brazil no longer differs widely from the rest of the world is in domestic refrigeration. In my view it is very likely that most refrigerants. The reason I believe this will be the case relates to advantages that using hydrocarbons present: thermodynamic properties, efficiency, lubricant compatibility, etc.



Although one of the problems for hydrocarbons, but also flammable refrigerants in general is the amount of charge, in addition to which there are also issues relating to servicing, I think these concerns can be readily addressed and solved for domestic refrigeration.

hydrocarbons21.com: Do you believe that the development of the domestic hydrocarbon refrigeration market will benefit other applications? What other drivers will influence the development of hydrocarbon refrigerant technologies in Brazil?

Roberto Peixoto: With regard to knowledge and training that will be developed by those companies using of hydrocarbon refrigerants in domestic refrigeration applications, I think that this could benefit some other applications currently held back by problems relating to flammability due to higher charges. It is possible that in the future we will have small charge hydrocarbon air conditioners, such as room air conditioners, but this will depend on how the domestic refrigeration market develops.

The development of other hydrocarbon refrigerant applications will also be driven by regulation and legislation, and how Brazil evaluates the risk and safety of hydrocarbon technologies. In Brazil there has been little work done to date on addressing the safety issue of flammable refrigerants. However, a few years ago the Brazilian Standardisation Institute (ABNT) created a working group to develop standards for good practice in the use of refrigerants, covering safety, toxicity etc. This is still very general and does not specifically address flammable refrigerants.

hydrocarbons21.com: What role do multinational HVACR&R companies play in Brazil and how will this affect the future for hydrocarbons?

Roberto Peixoto: In the past we had a very strong influence from American companies, which were the main manufacturers of our HVAC&R technologies. However, now there is growing influence by non-US companies, and this may affect the use of hydrocarbons in a positive way.

In my point of view we need to have a very comprehensive approach to refrigerants in terms of their technical advantages such as energy consumption, and also with regard to cost and safety. For the applications where hydrocarbons present clear advantages I think the technology will be developed, which has been the case with domestic refrigeration.



Technicians in the Caribbean invest in hydrocarbon technology

14 September 2011

Two refrigeration and air-conditioning technicians in the island country of Grenada have invested in hydrocarbon refrigerants and compressors, enhancing the availability of hydrocarbon technology in the local market and other neighboring islands in the Caribbean.

The growing demand for hydrocarbon servicing components has led the two local entrepreneurs in Grenada to invest in the supply of:

- Hydrocarbon refrigerants: bringing the number of hydrocarbon refrigerant suppliers in the region up to two
- R600a compressors for the domestic refrigeration sector: according to the local entrepreneur, the R600a compressors are 30 – 40% more energy efficient, quieter, use less refrigerant charge, compared to comparable R134a models. Moreover, they operate at a lower "head" pressure and are expected to have a longer operating life.

The country's National Ozone Unit praised the initiatives and further encouraged other technicians to get involved in this new and emerging market in Grenada.





The two technicians had previously received training in natural refrigerant technology organised by the country's National Ozone Unit earlier this year (March 2011). Following the training sessions, demand for hydrocarbon servicing components for the retrofit of mobile air-conditioning and unitary split air-conditioning systems with hydrocarbons has been on the rise in Grenada. For several years now, hydrocarbon technology has also been introduced into the domestic refrigeration sector in Grenada.

Training of technicians in hydrocarbon technology is an ongoing process. More recently (July 2011), a technician from Grenada was funded to attend the "International Workshop on Alternative Technologies to HCFCs: Experience in use of Hydrocarbon Refrigerants", organised by the Cuban Ozone Technical Office. The workshop brought together technicians from several Latin American and Caribbean countries.

Background

In June 2011, the Government of Grenada recently launched the Hydrochlorofluorocarbon (HCFC) Phase-out Management Plan (HPMP) to phase out the consumption of R-22 refrigerants in Grenada. The plan supports the replacement of ozone depleting substances with ozone friendly technologies with low global warming potential such as hydrocarbons.



A worldwide first: Chinese manufacturer starts production of R290 room ACs

25 July 2011

The first original equipment manufacturer worldwide that is applying hydrocarbon technology in room air-conditioners (ACs) has announced the official opening of its production line. The final product complies with international safety standards and exceeds the minimum efficiency requirements for air conditioners within many countries, including China, India, Australia, Europe and Brazil.

Chinese air conditioner manufacturer Gree Electric Appliances Inc announced the official opening of the production line for room air-conditioners running with natural refrigerant propane (R290) on 14 July 2011. The production line will manufacture approximately 100,000 units of hydrocarbon room air conditioners per year.

With China holding a market share of about 75% of the world production of airconditioners, the completion of the production line will enable hydrocarbon technology to diffuse into the region but also worldwide and give an impulse to other air-conditioning manufacturers and markets to select sustainable hydrocarbon technology.



Ensuring product safety

All models conform to the international safety standard IEC 60335-2-40 (particular requirements for electrical heat pumps, air-conditioners and dehumidifiers) and are certified by the Association for Electrical, Electronic & Information Technologies (VDE), one of Europe's largest technical and scientific associations. Moreover, the final product has been certified by global leader in independent testing TÜV and is compliant with European standards.

Minimal global warming impact

Besides being safe, the hydrocarbon product is also saving direct greenhouse gas emissions, as the hydrocarbon refrigerant has a negligible global warming potential and indirect greenhouse gas emissions thanks to energy savings of up to 15% compared with conventional appliances.

The R290 models score well in terms of energy efficiency in different parts of world, exceeding the minimum efficiency requirements for airconditioners within many countries, such as:

- Europe: achieve A-rated air-conditioner efficiency labelling and minimum efficiency of forthcoming Eco-design regulation
- China: achieve Grade 2 rated energy efficiency label
- India: achieve Bureau of Energy Efficiency five-star rating
- Australia: exceed national minimum energy performance standards (MEPS)
- Brazil: exceed national minimum energy performance standards (MEPS)

Background information

The project under which the production line has been set up is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety within the framework of the International Climate Initiative and is implemented by the programme Proklima by the German International Cooperation (GIZ).

Since 2008, Gree has worked on the development of the new air-conditioners with support from Proklima.



UPDATED: Exclusive interview with A. Granger, Reymer Pty on HC MAC

25 October 2011

hydrocarbons21.com talked to Andy Granger, General Manager of Reymer Pty Ltd, the Australian manufacturer of the OKA on/off road vehicle that was the first OEM in the world to use hydrocarbon refrigerant in their air-conditioning system. UPDATED with information on the regulatory barrier preventing the use of hydrocarbons in Queensland.

hydrocarbons21.com: What triggered initially Reymer's decision to test, develop and employ hydrocarbon mobile air-conditioning (MAC) for the OKA special purpose on/off road vehicle?

Andy Granger: There are two main reasons why we opted for hydrocarbons. First of all, as an Australian company, we are constantly faced with the problem of ozone layer depletion. Skin cancer is a major issue here and we have a social responsibility not to use gases that are harmful to the ozone layer. But clearly we are a business and hence there are also business reasons for all decisions we take. Our development engineers were keen to use a "colder" gas as our vehicles operate in some of the hottest ambient temperatures in the world. Our packaging space is very limited and hydrocarbons give us a highly efficient solution whereby we can get more cold air out of the system for the same energy input and by using the same standard sized compressor.



This is a big advantage with hydrocarbons, as one of the challenges that we face as a vehicle manufacturer is that with increasingly stringent limits on pollutant emissions (NOx, CO, non-methane hydrocarbons, particulates etc), we actually need to air-condition the vehicle cabin more and more. Each time the emissions regulations get tighter, there is an increase in the amount of heat that is given up by the engine that goes partly into the cab structure, and which then goes into the driver's space. So we need to put more and more cold air in that space to effectively control the temperature. But we cannot keep on putting bigger and bigger air-conditioning systems in because we have a limitation on space.

hydrocarbons21.com: Who were the most valuable partners in OKA's project with hydrocarbon MAC?

Granger: We collaborate with HyChill, the Melbourne based manufacturer of HC refrigerants and who have been with us every step of the way in speccing the correct compressors, lubricants and trigger pressures.

We also had the valuable contribution of a qualified air-conditioning engineer - Ross Theobald - on our R&D team. He had a good insight into the benefits of upgrading the thermal efficiency of our system by using hydrocarbon refrigerants. Let's just say that hydrocarbon met our overall expectations.

hydrocarbons21.com: What type of measures have you implemented to address any safety concerns pertaining flammability of hydrocarbons?

Granger: We use HyChill Minus 30 refrigerant and have issued very complete instruction on the checking and charging of the system. This is very much safety oriented and is to be found on our public website. We make servicing workshops aware of the flammability issues through this service bulletin. However, we have to mention that in Queensland - a fairly important state here, the government essentially bans the use of hydrocarbon refrigerants in vehicles, largely due to mine safety regulations, so we have to charge with R134a for that application. In Queensland, technicians handling hydrocarbons are required to get authorisation from the Department of Mines, while hydrocarbon systems have to be registered with the same Department. License and system registration fees apply an effective trade barrier to the use of hydrocarbons.

Our view is that leaks from air-conditioning systems are gradual and that the high efficiency and non-toxic nature of hydrocarbons more than make up for any increase in flammability. The flammability issue has often been overplayed: after all vehicles are full of highly flammable materials - hydrogen from batteries, half full fuel tanks containing highly explosive petrol / gas mix and brake fluid which has a low flash point and which is implicated in many vehicle crash fires. Probably the biggest vehicle fire culprit is ordinary engine oil that gets over-heated in turbochargers.

hydrocarbons21.com: Earlier in 2011, you announced that in addition to the use of hydrocarbons in the "OKA" brand of four wheel drive vehicles, the entire line of European-built AVIA trucks, that would shortly go on sale, would also be equipped with HyChill hydrocarbon refrigerants. How is progress with this endeavour?

Granger: I have had a long involvement with AVIA - I was on their management team in Prague for several years. Reymer has the distribution rights for Australasia and the current exchange rates are conducive to bringing the trucks in. It's currently a matter of prioritising the use of funds. When we start, then we will charge the air-conditioning system with HyChill hydrocarbon refrigerant.

hydrocarbons21.com: Do your consider hydrocarbons suitable for road vehicles on top of on/off road vehicles and trucks? Why

in your opinion have they not widely been deployed yet in MAC worldwide?

Granger: Vehicle manufacturers (OEMs) tend to buy systems from tier 2 suppliers - we are a little different in as much as the supply chain for OKA is more fragmented and locally based. The tier 2 suppliers that provide the systems seem to be more dependent on large corporations and they are also risk averse. Hence OEMs were buying MACs on a design-deliver-install basis and which were optimised around R134a - it's classic corporate inertia. Recent legislation in the EU banning R134a from this year on in new vehicles has acted as a stimulus for OEMs to look more fundamentally at MAC development. This will result in alternative refrigerants being used and I think hydrocarbons now stand a good chance of rapid adoption by OEMs globally.

hydrocarbons21.com: What would be your top 3 recommendations to help hydrocarbons gain market share in mobile airconditioning worldwide?

Granger: Legislation, legislation and legislation. The auto industry is slow to react unless pushed by legislation or where it sees legislation on the horizon and acts to pre-empt it for commercial gain. The pressure to clean up on HFCs has been very much on the agenda of the European Green Party and as I have mentioned, this has had the significant result of R134a being banned in the EU in MAC through legislative means.

THANK YOU!



Propane air-conditioning project in Indonesia increases energy efficiency by 15%

15 November 2011

German International Cooperation (GIZ) and Indonesian company AICOOL are introducing different types of air-conditioning and refrigeration systems using propane (R290) to Indonesia. A cooling system based on optimised design and tailor-made equipment will be installed at a hotel in Bali. Parts of the system will also be on display during the 23rd Meeting of the Parties to the Montreal Protocol in Bali, Indonesia from 21-25 November 2011.

Proklima, as the global programme for green cooling in the GIZ, is working together in a public-private partnership with Indonesian company AICOOL to introduce different types of systems for refrigeration and air conditioning. By using primarly propane these innovative technologies aim to improve and optimise the present refrigeration equipments in Indonesia. Currently, the annual consumption of refrigerants and foam blowing agents in Indonesia equals about 14 Mt CO₂eq. Compared with currently applied technologies, the new project technologies have a minimal climate impact thanks to natural refrigerants.



Optimised products will be displayed at the Montreal Protocol Meeting in Bali

Due to its special physical properties the hydrocarbon refrigerant is best suited for hot climates and allows a substantial reduction of raw materials to be used for production. Based on optimised design and tailor-made equipment the new cooling aggregates

production. Based on optimised design and tailor-made equipment the new cooling aggregates using propane as refrigerant will be installed at a client's hotel in Bali, Indonesia.

The product can significantly improve energy efficiency by 15%. The successful project will be displayed during the 23rd Meeting of the Parties to the Montreal Protocol in Bali, Indonesia from 21-25 November 2011. In addition, the two project partners will be organising sidevisits to showcase the reliably running system to climate negotiators from around the globe.

Background Proklima

Proklima is a global programme of German International Cooperation (GIZ) aiming at reducing non CO₂ greenhouse gas emissions by transferring technology and the development of capacities to adapt, apply and optimise processes and products in the refrigeration, air conditioning and foam production sectors. GIZ supports national sustainable policies and helps countries to introduce climate friendly technologies in these fields. GIZ currently implements projects in 35 countries on behalf of the German Ministry for Economic Cooperation and Development (BMZ).



Exclusive interview with Professor J. Chen about hydrocarbon air conditioning and heat pumps in China

05 October 2011

Dr. Jiangping Chen, Professor of the Institute of Refrigeration and Cryogenics at Shanghai Jiao Tong University, talked to hydrocarbons21.com about research on propane (R290) air conditioners and heat pumps, the market for hydrocarbon air conditioners in China, and the Chinese HCFC Phase-out Management Plan (HPMP).

hydrocarbons21.com: At the 23rd IIR International Congress of Refrigeration you presented the paper "Experimental study of R290 enhanced system performance in residential air-conditioners and heat pumps". Can you tell us, what your main conclusions are regarding use of hydrocarbon R290 as the working fluid in air conditioners and heat pumps?

Jiangping Chen: The paper presented is a joint research project with a local air conditioning company, reporting on testing of room air conditioners and heat pumps. Our main conclusion is that propane system performance can still be improved, using technology such as thermal-expansion valves, and internal heat exchangers. Work is still ongoing.



Results showed the performance for cooling of an enhanced R290 is quite good but

not as good for heating. In fact for heating performance, it is about 10% lower. Overall we found the lower volumetric capacity of R290 compared to R22 resulted in a lower cooling capacity, but that this could be improved using a suction line heat exchanger (SLHX).

Whilst we are trying to improve performance, the key focus is refrigerant charge because of the safety issue.

Currently, there are now 2 companies in China with the technology for hydrocarbon room air conditioners.

hydrocarbons21.com: What is the focus of the Shanghai Jiao Tong University Institute of Refrigeration? What are the next steps regarding your research?

Jiangping Chen: The work focus at the Institute is on refrigerants for room, commercial and mobile air conditioning systems. The work we undertake supports low GWP refrigerants. As most of these alternative refrigerants are flammable we are trying to evaluate the risk and optimise systems to fit the properties of the refrigerant.

With regards to our research, as a next step we are trying to use microchannel heat exchangers to reduce the refrigerant charge to 150g so that propane systems will comply with European safety standards. Microchannel heat exchangers are already used but the size of those available is not as compact as we expected.

hydrocarbons21.com: How would you evaluate the market for in China for hydrocarbon air conditioners?

Jiangping Chen: Companies like GREE have invested large amounts in developing the technology for hydrocarbon air conditioners, so I think that technically we are ready. In my opinion the public is also ready. In China there is a move to further develop servicing standards and provide teaching and training for personnel dealing with hydrocarbons, to ensure that accidents are avoided when charging air conditioning systems.

The Chinese government has a project to evaluate the risk of propane as a refrigerant. This project will be finished in the coming months, and will evaluate what happens in the case of refrigerant leakage, for example, what is the risk in the case of refrigerant ignition? This risk assessment should be published this October.

hydrocarbons21.com: You mentioned GREE, which recently launched production of hydrocarbon air conditioners. How do you think the Chinese market has reacted to the launch and what future developments do you see as a result?

Jiangping Chen: I was part of the review team for GREE's project. Overall, sales will depend on the market. China is big country with varying climatic conditions. I think the air conditioners will definitely find a market in South China. For the Northern market, heat pumps will be of greater importance. Here we still have improvements to make with regard to performance, but I do not think that this is a big obstacle.

hydrocarbons21.com: When do you see hydrocarbon heat pumps being commercialised in China?

Jiangping Chen: Some customers have already approached GREE for propane heat pumps, but by and large most are waiting for the publication of the government risk assessment. I imagine GREE will eventually expand production to include heat pumps.

In China 90% of air conditioning systems are actually heat pumps. Whilst propane can have a good performance in heat pumps, this is only

true with a higher charge, which impacts system safety. Reducing the charge to take into account safety means heat pump performance is not so good.

hydrocarbons21.com: You mention the importance of developing servicing standards and training, what is the current situation with regard to HVAC&R technician training in China?

Jiangping Chen: I have been involved in a project in China to draft a training handbook, which is almost ready. Publication will depend on the Chinese government. It has already passed the review stage, and although I don't know the exact publication date I think it will be soon.

China's HPMP has already been approved, and within the HPMP it is clearly stated that by 2015 China will have 5 million propane air conditioners, therefore we will need a competent servicing industry.

hydrocarbons21.com: Does the Chinese HCFC Phase out Management Plan (HPMP) put an emphasis in natural refrigerants?

Jiangping Chen: I think that for China propane will be the primary natural refrigerant. Although there is interest in R161 (fluoroethane), it is also flammable. So for me propane should be the preferred working fluid - it is not necessary to use R161. Much less is known about the performance of R161. Studying it would require more money and more time to research its performance with oils and its reliability. Some local companies are promoting R161, but I think the road ahead for them is not easy.



Hydrocarbons gain favour in Africa

19 July 2011

With African countries embarking on ambitious plans to phase out HCFCs, hydrocarbons are gradually gaining favour as a viable refrigerant alternative. Following the June 2011 UNEP meeting of North and West African Montreal Protocol coordinators, the Mali representative highlights the potential for hydrocarbons, whilst a hydrocarbon instructors training workshop is launched in Benin.

On 27-30 June 2011 a thematic workshop on compliance with CFC phase out and preparation of hydrochlorofluorocarbons (HCFC) Phase out Management Plans (HPMP) in French speaking North and West Africa took place in the capital city of Mali at the initiative of the UNEP Ozone Compliance Assistance Programme (CAP).

Hydrocarbons represent great promise for Africa

In an interview following the UNEP Meeting with the "Journal du Mali", Dr Modibo Sacko, Coordinator for Montreal Protocol implementation in Mali spoke very highly of the potential for hydrocarbon refrigeration in Africa, and in particular, of the efficiencies achieved when using hydrocarbon refrigerants. Referring to hydrocarbons as a "new technology" with no harmful ozone of climatic effects, according to Dr Sacko a cost-efficiency study has shown energy savings of 40% for



hydrocarbon refrigeration. Hydrocarbons, he says, lead to cost savings, in addition to speeding up the cooling process. In Dr Sacko's view, hydrocarbons represent an environmentally sound technology with benefits for the consumer.

African hydrocarbon training workshops

On 15 June 2011 teaching workshops for instructors for air conditioning conversion technician training were inaugurated in the African country of Benin. The aim of the teaching workshops is to reduce the use of HCFCs by 10% in 2015, 30% in 2020, and 67,7% in 2025 and 100% in 2030.

According to Jeremy Bazye, UNEP OzonAction regional coordinator these workshops will enable participants to gain essential tools and information for the safe handling of hydrocarbon refrigerants. More specifically, the workshops will provide training on the safe storage and transportation of hydrocarbons, the necessary changes to be made before air conditioning systems are switched to hydrocarbons, refrigerant recovery, and air conditioning charge procedures for hydrocarbons.

Workshop participants came from Burkina Faso, Burundi, Cape Verde, Comoros, the Democratic Republic of Congo, Gabon, Ivory Coast, Malawi, Senegal, Uganda and Zambia.

African Hydrocarbon projects

Other African projects involving hydrocarbons include a pilot project in Swaziland to convert blowing agents in manufacturing to hydrocarbon gases. This was the first demonstration of hydrocarbon technology in Southern Africa, and in addition to cutting direct F-gas emissions by up to 29,000 tons of CO₂ equivalent, strengthened local manufacturer Palfridge's market position.

African Anglophone Ozone Officers meeting

Prior to the Francophone Mali workshop a four-day meeting of the Anglophone countries took place in the Seychelles, bringing together representatives from 23 African countries, to discuss opportunities for enhancing South-South cooperation and technology options for avoiding the use of HCFCs. Reviewing progress on fulfilling their obligations under the Protocol, the meeting highlighted the major milestones already accomplished by many African nations.

"Collective action by African countries to address the ozone layer depletion when they have contributed the least in causing that problem is iconic," said Rajendra Shende, Head of UNEP's OzonAction Programme.

Background

The OzonAction Porgramme provides capacity-building services to empower National Ozone units (NOUs) and includes training, regional networking and an information clearing-house. To provide direct assistance to countries, a Compliance Assistance Programme (CAP) was launched with regional CAP teams part of each of the UNEP regional Offices. The Africa CAP teams provide assistance to the two main networks of Ozone officers from Anglophone Africa and Francophone Africa.

Under the Montreal Protocol Multilateral Fund nearly \$175 million (€123 million) will be provided to countries across Africa for 1200 projects. However, this is only 10% of the funds received by all developing countries.



Ghana delegation receives hydrocarbons training in Italy

21 September 2011

From 7-9 September 2011, a delegation of technicians from Ghana received theoretical and practical training on the safe handling and design of equipment with hydrocarbon refrigerants at the headquarters of the Centro Studi Galileo, Casale Monferrato, Italy. The training is in line with the country's efforts to phase out HCFCs and establish a safe hydrocarbon and natural refrigerant use culture.

The purpose of the training was the transfer from Italy to Ghana of knowledge on the latest technologies in refrigeration that respect the environment and result in energy conservation. In particular, the objective is to replace hydrochlorofluorocarbons HCFC refrigerants with technology that uses climate friendly hydrocarbon refrigerants.

Marco Buoni, technical director of Centro Studi Galileo - the institute nominated to carry out the training - and Vice President of the European Association of Contractors in refrigeration, air conditioning and heat pumps technology, said: "this training is important not only for Ghana and for Africa, but for the entire world; it is extremely important to make the sector aware of the importance of handling those refrigerants correctly, especially as they are particularly efficient in domestic and commercial refrigeration applications, if handled in a proper and safe way. The



technicians we have trained will now go back to Africa to spread this message, and to allow African contractors to start working correctly, in the most effective way".

Elements of the hydrocarbon course attended by Ghana delegation

Several lecturers of Centro Studi Galileo and the Italian RAC industry took turns to deliver the theoretical training of the Ghanaian engineers, including:

- Prof. Del Col and Claudio Zilio, from the University of Padua
- Cattabriga Gianfranco, the lecturer of Centro Studi Galileo
- Bassi Marino and Renzo Casamassima, from Embraco manufacturing industry, the producer of hydrocarbon compressors
- Other experts, including Claudio Fossati of Mondial Group, a company producing refrigerated display cases

The programme also included the following elements of hands-on training:

- Training / practice at the facilities of Mondial Group
- Training / practice at the laboratory of CSG Palazzo Treviso

At the end of the training, Councillor Sirchia of the Casale Monferrato municipal administration delivered the certificates and gave the final salute to the technicians of the African country.

Background: hydrocarbons role in achieving Ghana's Montreal Protocol commitments

Ghana is a signatory to the Montreal Protocol, operating under Article 5 of the Protocol and is eligible for assistance under the Multilateral Fund. The estimated installed capacity of refrigeration and air conditioning units in the country, excluding domestic refrigeration units, amounted to about 1.86 million units in 2008.

A safe and sustainable use of hydrocarbons will play a key role in achieving a dual benefit of ozone layer and climate protection in Ghana, where it is expected that hydrocarbons will become a widely used refrigerant.

The current stage of the implementation of Ghana's HCFC phase out management programme (2010-2014) focuses on the establishment of safe hydrocarbon and natural refrigerant use culture to enable their safe use, through for example developing codes of good practices, training and certification of technicians, as well as activities to curb growing phase-in of HCFC-based refrigerant blends and an incentive programme to retrofit HCFC-based equipment to environmentally sound alternatives.



Natural refrigeration in the Middle East

01 July 2011

Over the past decade there has been a visible shift towards more sustainable refrigeration options in the Middle East. Hydrocarbon refrigeration is being considered more and more as a result of its energy efficiency and climate and ozone friendliness.

According to marketing manager Koma Middle East, Marc Doublichevitche, greater consideration is being given to environmentally sound refrigeration technologies across the Middle East. Martin Laws, marketing manager for Williams Refrigeration says there is a clearly visible move towards natural refrigerants, such as hydrocarbons.

Hydrocarbon refrigerants are seen as attractive because of their efficiency and energy saving potential, whilst flammability concerns have been largely overcome with safety devices such as hermetic sealing of systems.

The rapid economic development in countries like Bahrain, Kuwait and the United Arab Emirates and continued population growth means there is an ever-increasing demand for refrigerators and high-capacity food processing and distribution centres.

Natural refrigerants like hydrocarbons present a viable option to meet the region's growing needs.

Middle East attracts key hydrocarbon actors

In recognition of the positive approach to sustainability in the region, Carrier has launched the Distinguished Sustainability Lecture Series at the Higher Colleges of Technology, in the United Arab Emirates. Whilst the company believes propane based air conditioning systems for the Middle East need further research, the important point is that sustainability has taken root.

Other companies that do already supply hydrocarbon compressors to the Middle East include Danfoss and Tecumesh.

Factors affecting refrigerator choice in the Middle East

In addition to refrigerant choice, other environmental considerations include energy efficiency and saving.

"The recent trend in refrigeration design is working with suppliers to develop more energy-efficient components, for example low energy fans and compressors," says Mr Laws.

"No market is able to ignore energy saving concepts any longer," confirmed Björn Dewes, area manager for MIWE.

Other factors include:

- Looks: In the Middle East looks are an important consideration in refrigerator choice. Clients are looking for aesthetic cabinets to showcase items, such as wine for example.
- **Price:** According to Mohammad Zaatar of Nice Two Kitchens and Refrigeration LLC price is one of the essential elements taken into consideration when Middle Eastern consumers choose a product.
- Flexibility: For increasingly congested kitchens, Mr Laws of Williams refrigeration says "space saving is always seen as a priority".

Background

Throughout the Middle East there are already examples of natural refrigeration. International food and beverage company Kraft has an ammonia-chilled production plant in Bahrain that supplies food retailers through out the Middle East. Del Monte has an indirect ammonia refrigeration system in Dubai, whilst Saudi Arabian food retailer Panda installed a state-of-the art distribution centre in Riyadh.

MIWE is a German provider of specialist, baking equipment, including ovens, bakery refrigeration systems and automatic equipment. A family company started in 1919, MIWE now supplies its equipment across the globe.

Williams Refrigeration Dubai was established in 2003 and supplies commercial refrigeration solutions manufactured in China and the UK, to the Middle Eastern market.

Koma is a refrigeration company that specializes in pastry and bakery item conservation. With over 70 years experience in preservation and conditioning technologies, Koma is a global company with installations worldwide.





\$2,620,000 GEF grant for HCFC phase out & HFC-free promotion in Azerbaijan

05 July 2012

Countries with economies in transition (EIT) are typically not entitled to receive funding from the Montreal Protocol's Multilateral Fund (MLF) and the scarcity of available funding can be an impediment to achieving accelerated HCFC phase out schedules and to transitioning to climate friendly solutions. Yet, synergies between ozone and climate protection are climbing up the agenda of the Global Environment Facility (GEF), helping to fill the gap, as latest approved projects and meeting results indicate.

Ozone & climate synergies move up the agenda of largest public funder of green projects

In its latest meeting (June 2012), the GEF Council approved funding for a project in Azerbaijan titled "Initiation of the HCFCs Phase out and Promotion of HFCs-Free Energy Efficient Refrigeration and Air-Conditioning Systems".

The project will prepare a national strategy to support Azerbaijan in achieving the accelerated phase out of HCFCs, in line with Montreal Protocol requirements. To avoid double conversion in the future, any HFC-based alternatives will be excluded when possible from the project framework.



The strategy will have two major components:

- Institutional capacity building: The first project component will provide institutional capacity and the capability required to properly implement current ozone depleting substances (ODS) legislation, through robust monitoring, reporting and control of HCFC imports, consumption and exports. The development and dissemination of refrigeration best practice code/guidelines for leak minimization, best practice training for the RAC sector (to train the trainers) and the development of a national database for skilled technicians also fall within the first component.
- Conversion of manufacturing plants and assistance to the service sector: The second component aims at enabling the phase out of 18.95 ODP tonnes of HCFC-22 and HCFC-141b through the conversion of commercial refrigeration and manufacturing and polyurethane insulation panel manufacturing at 10 to 14 companies and through assistance to the refrigeration service sector through 70 to 100 service providers. The project will support the conversion of refrigeration manufacturers through the provision of production equipment necessary to adopt non-HCFC refrigerants that when possible will be natural refrigerants. Moreover, training of technicians will be paramount for the country to achieve a major reduction in HCFC demand for servicing, an essential component of the national phase out strategy.

GEF concept paper on ozone & climate: "funding from MLF and GEF can be combined"

Indicative of the increasing importance that GEF is giving to the synergies between ozone & climate protection is a concept paper that the body published titled "Concept Paper: GEF-5 Ozone, Climate and Chemicals Program".

This paper encompasses the Climate Change Mitigation Strategy the implementation of which would bring about energy efficiency and reductions of ODS, greenhouse gases and other pollutants through the replacement and proper disposal of refrigeration and airconditioning equipment, and pollutant stockpiles.

In a distinct sub-section, the paper discusses the "additional long term sustainable benefits [that] can be achieved by shifting appliance manufactures away from high-GWP refrigerants and foam blowing agents to low-GWP alternatives". The paper maintains that, "countries with manufacturing practices that use high-GWP refrigerants and foam blowing agents consider switching to more environmentally friendly alternatives as part of this program". In that respect, "funding from the MLF and the GEF can be combined", alluding to the fact that GEF funding may not only be available for countries that do not otherwise fall under the scope of MLF funding, like Azerbaijan and other EIT countries.

About GEF

The GEF unites 182 countries in partnership with international institutions, civil society organizations (CSOs), and the private sector to address global environmental issues while supporting national sustainable development initiatives. Today the GEF is the largest public funder of projects to improve the global environment. An independently operated financial organization, the GEF provides grants for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants.



China will release the first safety standard for cold stores

02 July 2012

In July 2012, China will release its first safety standard for cold storage facilities. The standard is a reflection of the development needs of the cold storage industry in China. It would help to remove the policy and market barriers for ammonia refrigeration systems and accelerate its market uptake in large cold storage projects.

The "Safety Code for Cold Stores" (GB 28009-2011) is to be announced this month by the General Administration of Quality Supervision, Inspection and Quarantine of P. R. China and Standardization Administration of China. According to the China Refrigeration Association (CRA), who helped to draft the standard, the codes will be formally released in July 2012 and will come into force on December 1, 2012. The safety standard is China's first national standard on cold storage safety.

A detailed regulation for ammonia cold storage

The standard sets out detailed safety rules and principles for cold storage design, construction, operation and maintenance management. The standard applies to both direct and indirect refrigeration systems using ammonia and HFCs as refrigerants. The codes include detailed rules regarding safety management for the



machinery room, refrigeration equipment and systems, refrigerating compressor, and other auxiliary refrigeration equipment.

In particular, the codes provide a series of requirements that apply to cold store personnel. For ammonia cold stores the codes stress that staff cannot bring into, or store, any explosive or inflammable items in the machinery room. When emitting non-condensable gases, ammonia cold stores must employ a special air separator and ensure non-condensable gases are emitted to water tanks. The ammonia charging station should be located outside the machinery room and employ security devices, and any type of heating is forbidden when adding ammonia to the refrigerant cylinder.

Safety codes: a reflection of development needs for China's cold storage industry

The standard reflects both the opinion of industrial experts' and manufacturers and end users' expectations concerning the development of the cold storage industry in China.

The standard has been jointly drafted by national professional associations and research institutes including: the China Refrigeration Association, the Internal Trade Engineering Design & Research Institute, representatives from refrigeration facility suppliers and manufacturers such as Yantai Moon Group, Dalian Refrigeration Company, food processing companies, and retailers such as Beijing East Friendship Food Supply & Delivery Company.

Absence of safety codes for cold storage was barrier to NH₃ refrigeration

The absence of safety standards for cold storage has until now seriously impeded the sustainable development of the cold storage industry in China. For refrigeration facility suppliers and manufacturers producing ammonia refrigeration systems, the lack of a national safety standard was a barrier for their products. According to Ms Shaoming Jiang, the vice chief engineer of Yantai Moon Group, as there were previously no concrete safety standards for ammonia refrigeration many local governments were reluctant to adopt ammonia as refrigerant in large scale cold storage projects due to potential safety hazards. The absence of safety codes also created a lack confidence in ammonia refrigeration systems among end users, resulting in many ammonia system manufacturers missing business opportunities in China's huge and fast growing cold storage market.

With a national standard, constructors of cold storage will now have concrete guidelines for the construction of cold stores that meet clear safety requirements. For end users like food processing companies and retailers, the safety codes provide a basis for protecting their rights and interests, removing safety hazards as an argument against using ammonia. Once the "Safety Code for Cold Stores" comes into force a key policy and market barrier to ammonia refrigeration in the Chinese cold storage market will be have been removed.



China builds Asia's largest productive cold storage

12 June 2012

A seafood processing company in Fujian will soon complete the installation of the largest cold storage facility not only in China but in the whole of Asia. Large cold storage construction projects of local governments in China bring ammonia refrigeration a golden period of development.

Ocean Star Aquatic Products CO., LTD, a Chinese seafood processing company claims to build Asia's to date largest cold storage facility. The new seafood processing facility is located on a 49.4 acre area in Zhsngzhou, Fujian Province, China.

Asia's largest cold storage for seafood processing

The facility consists of 300,000 square meter of freezing space with temperatures below -20°. The facility will also contain a 1000 square meter refrigeration engine room with an ammonia refrigeration system. Once completed, the total cold storage capacity of the cold storage is supposed to reach 300,000 tons.



The productive cold storage has 12 production lines with an annual seafood processing capacity of 800,000 million tons Expected overall production output is up to RMB 5 billion (€625 million). The cold storage will be mainly used to process and store the company's seafood including fish, crab, soft cephalopods, shrimp and abalone.

The cold storage facility will be starting operations soon. The total investment of the project is RMB 2 billion (€250 million). By April 2012, Ocean Star Aquatic Products has invested RMB 1.2 billion (€150 million) in the construction of the main body and the installation of frozen and chilled stores with ammonia refrigeration in the new cold storage.

Ammonia refrigeration faces golden period of development opportunity

The large market demand of fresh and frozen food brings the cold storage and logistic Industry a new development opportunity in China. In most of the large-scale cold storages being constructed or planned, ammonia refrigeration systems have become the preferred refrigeration system especially considering their high-energy efficiency in low temperatures.

In China, there are many local governments like Fujian Province who are building large-scaled cold storage to meet people's increasing demands of fresh and frozen food. According to the data of the National Bureau of Statistics of China, every year the country produces over 56 million tons of meat, 8.5 million tons of frozen foods, 10 million tons of beverages, 8 million tons of dairy products and 41.2 million tons of seafood.



Namibian summer heat puts NH₃ coldstore to the test

11 June 2012

An ammonia refrigeration system for a fruit and vegetable storage facility in Namibia, which employs GEA Grasso piston compressors, has proved its effectiveness after operating in the African summer (November through March), meeting expectations with respect to energy efficiency. Using the natural refrigerant ammonia allowed for significant efficiency gains in the central refrigeration complex.

GEA Refrigeration Africa, a subsidiary of GEA Refrigeration Technologies designed and implemented a refrigeration system for a fruit and vegetable storage facility that was commissioned in September 2011 in Aussenkehr, Namibia, on behalf of the Dutch company Cool Fresh International BV.

The new storage complex comprises four halls, including sorting, consignment, and receipt of incoming fruit and vegetables through a cooling tunnel and is designed to store products such as grapes, melons, dates, and tomatoes cultivated as part of the Orange River Irrigation Project of the government Agricultural Ministry, and marketed by Cool Fresh.

GEA Grasso ammonia piston compressors assure produce freshness

The refrigeration needed for the halls is provide by:

- 1 GEA Grasso G3.10 ammonia piston compressor and
- 2 GEA Grasso G4.10 ammonia piston compressors

The compressors operate in single-stage mode to cool the halls, as required, to the required temperature of about 0°C to a maximum of 12°C. At hall temperatures around 8°C, they offer cooling duty up to 180 kW (G3.10) and 240 kW (G4.10). In the halls, cooling is provided by zinc-plated evaporators via air flow.

Special solution for freezing dates

Storage of the dates, which are harvested from February to April, required a special solution to enable them to be frozen in one of the halls until export. The refrigeration system operates in two stages (-28°C/0°C and 0°C/+35°C) to achieve the required temperature of -20°C in the hall. Special valve units enable switch-over between the two-stage mode for freezing and the single-stage cooling mode.

About GEA Refrigeration Technologies

GEA Refrigeration Technologies is a leading global group in industrial refrigeration. GEA designs, engineers, installs, and maintains innovative key components and technological solutions. Typical applications include cooling processes for the food and beverage industries, marine, oil and gas industries, buildings, as well as leisure facilities such as indoor ski centers and ice-skating rinks.

Contact information

If you would like to contact <u>GEA Refrigeration Technologies</u> for any enquiries, you may send a request to Winfried Recker directly.





NH₃ in the Middle East: Authorities need to know that public safety is not compromised

05 June 2012

A project team working on an ammonia based indoor ski resort in Dubai resorted to self-regulation in order to prove to the local authorities that public safety would not be compromised. Mr Ali Sleiman, Director of engineering services company EN3 - The Three Factors Company, shares his experience from this project and discusses the suitability of ammonia in district cooling in the Middle East.

ammonia21.com: You recently gave a presentation at an event in Dubai dedicated to refrigerants on ADC involvement and experience in the ammonia refrigeration plant for the Ski Dubai project, the first indoor ski resort in the Middle East that opened in 2006. What led to the selection of ammonia for this project?

Ali Sleiman: ADEAREST, the local contractor I used to work for, was involved in the project. Every project has its set of givens, be it choices or restrictions. For Ski Dubai, the choice of ammonia came from two basic facts: First, the temperatures required by the process (-15 to -18°C) are best served with ammonia. Secondly, the end-user is making a commercial use of the direct use of the refrigeration equipment, i.e. use of efficient equipment minimises the running cost of the resort, mainly electric power.



ammonia21.com: Has the system performance met expectations?

Sleiman: By far, the system met all the expectations. The use of industrial grade equipment, which is the norm for ammonia systems, translated into a stable system, capable of delivering the design parameters and more. During the commissioning, we were producing up to 90 tons of snow, assisted with auxiliary cooling. The system was designed to produce 30 tons a day. We were running against time as the opening date of the mall in which the ski resort was located was already announced. After the opening, the system was put in stable operation.

ammonia21.com: How challenging was it, if at all, to get go ahead permission for the use of ammonia from the local authorities?

Sleiman: The lack of regulations forced the project team to go into a mode of self-regulation, which at times can be more stringent than a prescribed set of rules. The United Arab Emirates (UAE), at the time and even today, has not published a set of standards for the use of ammonia. Hence, the team of designers and contractors relied on the U.S. EPA regulations to study the effect of using ammonia in an urban setting. The study was submitted to the local building authority. The authority needed to know that public safety was not compromised. The Dubai Civil Defense (fire brigade) was informed of the presence of ammonia on this site. We received assurance that the firemen are trained to deal with ammonia emergency. Last, we had to assure the owner and operators of the resort that the system is safe.

ammonia21.com: What are the features that ensure safety and what is the experience with servicing/maintaining the system?

Sleiman: There are several features that were put in place to ensure safety:

- The plant room was designed to meet the ASHRAE 15 machine room safety. A similar standard is published by the IIAR.
- Ammonia is restricted to the mechanical room and a glycol solution (anti-freeze) is used to circulate in the snow dome.
- Full refrigerant recovery to the low pressure vessel.
- Full connectivity to a remote control room.
- Safety Personal Protective Equipment (PPE) are present at all times.

Operation, service and maintenance is being done by trained technicians whom we insisted that they would be present during the commissioning, with the personnel presence giving the operator the confidence that the on-site service personnel are well aware of the system from first day of operation.

ammonia21.com: The International District Energy Association (IDEA) estimates that the rapid rate of construction in the Middle East could generate demand for 10-20 million Tons of Refrigeration (TR). The same organisation estimates that the development of the Middle East district cooling sector will outpace North America's by a ratio of 2:1. Would you say that district cooling using ammonia refrigerant could be a promising solution for energy saving in the Gulf region, as the interest in refrigerants that provide high efficiencies whilst not damaging the environment increase?

Sleiman: Definitely, there is an interest to use ammonia refrigerant in large scale cooling projects. The market for large capacity chillers is there. However many obstacles are in the way, and one has to reflect on what was going on during the "boom years". Clients were asking

for complete plant rooms to be ready in 14 and 16 months. Delivery of large compressors or chiller skids requires a production line that is only available with air-conditioning machines. Another aspect is the scalability of compressors.

ammonia21.com: Is ammonia technology used in any of the district cooling projects that ADC has been involved with so far? Is ammonia among the refrigerants that you consider for the future?

Sleiman: Whilst centrifugal compressors used for other refrigerants (R134a and R123) can be scaled up to 2500 TR and even 5,000 TR with the new Siemens machine, screw compressors can barely reach their limits of 2000 TR. Screw compressors are good for a high lift, but they are positive displacement machines and this means that they cannot lend themselves to large swept volumes that the centrifugal compressor can do. The cost per ton of refrigeration in district cooling application is very low, and this also steers the choice towards commercial machines to be used.

Still, in some instances, the case for ammonia is not lost. There are applications where ice storage is required by the type of application, and this can shift the choice towards ammonia, as compared to any other refrigerant.

The day has to come when people pay refrigerant tax based on refrigerant used and its total equivalent carbon emission; only then the case for natural refrigerants can be won.

ammonia21.com: Where do you see the main opportunities but also the barriers to expanding the use of ammonia in the Middle East?

Sleiman: Some ideas that come to mind when thinking of ammonia can be:

- General perception of natural refrigerants and in particular for ammonia has to be improved. Case studies for commercial applications in Europe should be publicized and data published.
- Government regulations should be put in place to restrict people from using inefficient refrigerants.
- The tariff for electricity is still low, and the efficiency factor does not play a big role in deciding on the refrigerant.
- The application of dual tariff by utility companies in order to minimize electrical networks peak load can shift more users towards ice storage.
- Packaged ammonia chillers are not marketed well in the general construction industry and limited to industrial projects.



Turkmenistan: HCFC phase-out creates opportunity for naturals

14 May 2012

With the aim of informing national stakeholders involved in the preparation and implementation of the hydrochlofluorocarbon (HCFC) phase-out management plan in Turkmenistan, about alternative technologies using natural refrigerants, a seminar was held on 17-19 April 2012 in Ashgabat. The event met with a great success and it has been recommended that similar workshops take place in other developing countries to help deploy natural refrigerants in the region.

Supported by the United Nations Environment Programme (UNEP) and organised by the National Ozone Unit (NOU), the seminar targeted policy-makers as well as companies working in the refrigeration and air-conditioning sector. It was presented that in all sectors where HCFC-22 is currently applied, from commercial refrigeration, air conditioners and heat pumps, and water-heating heat pumps to liquid chillers and industrial refrigeration, alternative solutions deploying natural refrigerants exist in the region of Europe and Central Asia.

Big potential for natural refrigerants

The Government of Turkmenistan acknowledges that the refrigeration and airconditioning industry in Turkmenistan has a significant energy use. In order to meet the climate and ozone benefits, the country has committed to reducing the leaks and failure rates through improved practice and gradual replacement of old equipment with low-GWP alternatives whenever possible.



Given that Turkmenistan has experienced a GDP growth of about 10% in last years, the living standard is increasing and with the hot climate the use of air conditioning units is continuously expanding. Nowadays, most of them use HCFC-22, some are being replaced by HFC, but with the objective of deploying low GWP alternatives, the use of natural refrigerants has a great potential in air-conditioning in the future.

Barriers and proposed solutions

During the workshop several barriers to introduction of low-GWP technologies in Turkmenistan were identified, with lack of knowledge about these solutions being a top priority that needs to be addressed. Moreover, since the initial costs of equipment with ammonia and CO₂ is usually higher it was recommended that incentives should be initiated to help facilitate faster adoption of these climate-friendly solutions.

As a result of the seminar, the following recommendations were made to overcome barriers to introduction of natural refrigerants:

- Establishment of a RAC association as soon as possible;
- Organisation of training courses and preparation as soon as possible of new manuals for maintenance and servicing with natural refrigerants;
- Introduction of standards and regulations for design and safe operation of these systems, using the experience of the European standard EN378;
- Installation of demonstration units and systems with new technologies using ammonia and CO₂ not only in Turkmenistan, but also in other developing countries.

35% reduction of HCFCs by 2020

In 2010 an Agreement between the Government of Turkmenistan and the Executive Committee of the Multilateral Fund of the Montreal Protocol concluded in establishing the HCFC phase-out management plan. According to the plan, Turkmenistan has committed to freezing the consumption of HCFCs in 2013, by which time a 12% increase in HCFC-22 equipment is expected.

In order to achieve the target of a 35% reduction in HCFC consumption by 2020, the government foresees carrying out the following activities:

- Improvement of legislation and capacity building for enforcement through training of customs officers;
- Training of technicians in the refrigeration and air-conditioning sector, and;
- Reduction of demand for HCFC through recovery and recycling and provision of service tools.



Association of Ammonia Refrigeration founded in India

20 April 2012

As the new growth of the cold chain and food processing industry in India has increased the use of ammonia as refrigerant, the Association of Ammonia Refrigeration, India (AARI) has been formed to provide information and education to people and government for the safe use of the refrigerant. Anand Joshi, Secretary of AARI Board of Directors discusses the rationale for forming the Association and scheduled activities.

The Association of Ammonia Refrigeration, India (AARI) is based in Pune, also known as "Refrigeration Capital" of India, as most of manufacturers, consultants and contractors are based there. All major ammonia refrigeration equipment manufacturers, contractors and consultants support the Association, which was formally registered in February 2012, in an effort also supported by the International Institute of Ammonia Refrigeration (IIAR).

Long history of ammonia in India, but lack of common platform

"India has a long history of ammonia refrigeration, with the oldest existing ice plant with ammonia as refrigerant dating back to 1914", explains to ammonia21.com Anand Joshi, Secretary of the AARI Board of Directors and Past President of ISHRAE PUNE chapter (Indian Society of Heating Refrigerating and Airconditioning Engineers).



"The manufacturing base of ammonia equipment has been developed in India since 1960, and ammonia has been widely used for Industrial refrigeration, cold storages and ice manufacturing units", he continues. "At present more than 3,500 open type reciprocating compressors are manufactured every year in India for ammonia, as the new growth of cold chain and food processing industry has increased use of ammonia as refrigerant".

"However, the refrigeration segment is still largely disorganized and lacks common platform to share knowledge; training of new engineers, plant operators; advise government on various standards. In view of this we all decided to form an Indian based organisation".

Training programmes for dairies, cold storages, seafood processing plants

Since establishment AARI has conducted training programmes for various segments of industry such as:

- Dairies,
- Cold Storages,
- Seafood processing plants

The next training programme is sheduled on 12 May 2012 at Pune, India. It will dedicated to 'Safety in Ammonia Refrigeration Plant' and will be conducted by Mr. Godan, Life Member IIAR and ASHRAE.



Pakistan inaugurates Natural Fluids Refrigeration Center

18 April 2012

Yesterday, 17 April 2012, saw the official inauguration of the Natural Fluids Refrigeration Center (NFRC), established in Topi, Pakistan by GIK Institute of Engineering Sciences and Technology in collaboration with Isotherm, Inc. USA. The center serves as an R&D hub for natural refrigerants and offers hands-on training to students and professionals.

Senator Engineer Farhatullah Khan Babar, chief advisor to the President of Pakistan performed the ribbon cutting ceremony that was well attended by the national press, who were on hand to witness the occasion.

In a brief interview to Pakistan Television Dr. Zahid Ayub, Founder and Director of the Center explained that it was already operational for the last three years concentrating on world-class research and analytical services to industry, academia, private and government organizations.



The NFRC serves as a research and development hub covering all aspects of refrigeration technology, i.e., compressors, heat exchangers, controls, piping, novel materials and metallurgy. For example, the center has been actively conducting research on thermal-hydraulic characteristics of high efficiency heat exchangers

using natural refrigerants. Manned with highly qualified researchers and well-trained technical staff and state-of-the-art equipment, the center is ready to coordinate with different International Institutes and technical societies that have common goals.

About the test facility

Established to provide an experimental facility for industry to perform detailed analysis, the modular design of the test facility at NFRC provides operational flexibility and control of experimental parameters. The facility has been designed so that condensation and evaporation heat transfer experiments can be carried with minor changes in the set up. As a result, several types of experiments can be easily conducted for different refrigerants on different types of heat exchangers in single and two phase applications.

Training

NFRC provides researchers, graduate students and engineers from industry with education and training on natural refrigerants. Trainees can use high quality experimental facilities to get hands-on training and become acquainted with natural refrigerant based technology. Moreover, the NFRC offers short technical courses for professional engineers working in today's multi faceted industry.

About Isotherm

Isotherm, Inc. is a company specialising in the design and fabrication of heat transfer equipment for industrial refrigeration, petro-chemical and industrial process applications. The company's forte is enhanced heat transfer for natural refrigerants such as ammonia, carbon dioxide and hydrocarbons. This unique advantage has resulted in Isotherm products being compact with ultra low charge. The products include pressure vessels, shell and tube evaporators and condensers especially geared towards high pressure heat pump systems. The company also manufactures semi-welded plate and frame heat exchangers.

Contact information

If you would like to contact **<u>Isotherm</u>** for any enquiries, you may send a request to **<u>Zahid Ayub</u>** directly.



Middle East event explores potential of NH₃

26 March 2012

During a dedicated event on 20-21 March 2012 in Dubai, around 100 participants discussed available refrigerant options, including the potential of ammonia in industrial refrigeration and district heating. A major subject of discussions was the question of how to effectively remove safety concerns impeding a successful use of NH_3 in the Middle East, such as in the 22,500 m² in-door Ski Dubai resort or the world's biggest integrated dairy farm.

Organised by the "Climate Control Middle East" magazine, the event gathered participants from the Arab region, including national ozone officers, municipalities, engineers, and international HVAC&R experts to explore ideal refrigerant options from a technology, environmental and economic point of view in a move away from ozone-depleting substances. Presentations and panel debates showed that the Middle East faces special challenges such as high ambient temperatures and one of the highest energy consumption rates for air-conditioning in the world.

A major barrier for the use of HFC-free solutions such as ammonia can be found in safety concerns, which would mostly be rooted in a lack of awareness and the resulting misconceptions about the use and proper handling of ammonia as a refrigerant. Similarly, the lack of uniform standards and proper after sale service would constitute major challenges. This is despite successful applications in



different Arab countries showing the long-term reliability and efficiency of NH₃ refrigeration solutions.

Ghaleb Abusaa from The Three Factors Company, moderator of a dedicated session on the efficient use of natural refrigerants, highlighted in his introductory speech that a powerful business case could be made for HFC-free systems in high-temperature applications in the Middle East, following concrete examples from the food processing, cold storage and chemical industry applications.

Success stories: world's largest milk cow farm and indoor skiing

en3 Solutions – NH3 in industrial refrigeration: Abusaa highlighted in his presentation various case studies testifying the high reliability of NH3 solutions in power plants and food production. Since the late 1990s the Qaseem Power plant has been using R717 for inlet air cooling with a 66,500 kW peak cooling load. The plant uses GEA Frame 7EA combustion turbines, a 17,500 kW air cooled liquid overfeed NH3 vapor compression refrigeration plant and a 12,500 sqm ice energy storage tank.

Another example, the AI Safi Dairy farm, has been using 32 screw compressors in the world's largest integrated milk cow farm. As a last example, Qaseem Saudi Arabia uses NH3 in a centralised multi-purpose 10,000 tons cold storage, handling, processing and packaging facility.

ADC Energy Systems – Ski Dubai: At the first indoor ski resort in the Middle East, Ski Dubai, the use of ammonia refrigeration has proved to be the right choice. In operation since 2006, the system has been operating safely in a densely populated area within a shopping mall where space restrictions for the refrigeration plant providing snow on 22,500 sqm required a compact solution with high efficiency. Ali Sleiman urged all participants to not eliminate ammonia from the list of preferred refrigerants due to safety concerns that could be controlled with proper engineering and maintenance. ammonia21.com will publish an exclusive interview with Mr. Sleiman soon.

shecco- GUIDE to Natural Refrigerants: Nina Burhenne presented a variety of successful case studies mentioned in the latest publication about the use of natural refrigerants that was published in February, among them the use of ammonia chillers in cold rooms by Johnson Controls, and the use of ammonia heat pumps with heat recovery in a dairy plant by GEA. Also the use of ammonia in cascade systems with CO₂ refrigerant attracted interest by participants, as these would constitute a technically viable option for Arab countries with outside temperatures of up to 54°C.



The perfect catch for the fishery cold chain: ammonia refrigeration

20 February 2012

Whilst centuries ago salt enabled the preservation of fish, today ammonia is a choice refrigerant for modern environmentally friendly refrigeration systems across the fishery cold chain. From catch to consumer, ammonia refrigeration is used in the production of ice, to refrigerate seawater, refrigerate compartments and to cool cold stores, ensuring food safety, shelf life and appearance.

Thanks to its high refrigeration efficiency, zero ozone depletion potential (ODP), and zero global warming potential (GWP) ammonia has long been a refrigerant of choice in the fishery industry, particularly in the developing countries. For example, in China and India, ammonia is widely used in the large refrigeration systems of the fishery industry, due to its low cost and local production. Given the ever-growing need to reduce greenhouse gas emissions to the atmosphere the option of ammonia refrigeration systems in new installations is obvious.



When newly caught fish are frozen quickly and stored at a low temperature onboard, limits on the length of time a fishing boat can stay at sea are removed, and the need for fishing vessels to return with the fish room partly empty is avoided.



For freezing at sea the refrigerating capacity of fishing trawlers can be generated by NH3 screw compressors, which are used for both refrigeration plants and plate freezers. Such systems are cooled by seawater.

In addition, ammonia is used on large ships as bases for trawlers to bring their catch in. For example, the "American Freedom", one of the world's largest reefer ships, is fitted with a cascade refrigeration system that uses four ammonia screw compressors to generate a total output of 4,500 kW, in a system that is charged with 1,500 kg of ammonia. Fish pumped directly into the Freedom's hull are shock frozen in 36 vertical plate freezers and stored in cold stores in the hold.

Ammonia cools fish processing plants, cold stores, and ice makers around the world

As concern for the environment grows across the world, so too do the examples of fish processing plants, cold stores and ice makers that rely on ammonia refrigeration systems:

- **Greenland:** A 10,000 m³ cold fish store was installed at Qasiiannhuit (Christianshab) in only three weeks including an R-717 refrigeration system equipped with a two-stage system for an air blast freezer, a plate freezer and a cold store, and one-stage systems for air conditioning, ice production, and two chill stores;
- Iceland and the Faroe Islands: Fish processing installations in Faskruosfjorour and Vestmanna have a 1150 kW and a 1000kW ammonia refrigeration capacity;
- **Philippines:** Both block ice plants, capable of producing 9.2 tonnes of ice blocks per 24 hours in blocks of 25kg, together with a 15tonne storage container with a refrigeration unit, which ensures a storage temperature of -5°C, have been equipped with a complete R-717 refrigeration system;
- Pohnpei Island, in the Federated States of Micronesia: Sabroe was commissioned to construct a fish processing plant with a capacity to chill or freeze tuna and reef fish and pack them into consumer cartons. The R-717 refrigeration system is equipped with a two-stage system for an air blast freezer, a plate freezer and a cold store, whereas one-stage systems have been installed for air conditioning, ice production, and two chill stores;
- **Spain:** Descal, a Spanish company specialised in the design and installation of industrial and commercial air conditioning and refrigeration systems has installed an ammonia refrigeration system with a 630kW ice production and freezer capacity and 1555kW cold room capacity.

Background

Following the signing of the Montreal Protocol, the Food and Agriculture Organization (FAO) issued a code of practice that encourages fishers and those engaged in processing fish and fishery products to reduce and eliminate CFCs and transitional substances such as HCFCs. The code of practice states:

"Competent authorities should make provision for the phasing out of the use of chlorofluorocarbons (CFCs) and transitional substances such as hydrochlorofluorocarbons (HCFCs) in the refrigeration systems of fishing vessels and should ensure that the shipbuilding industry and those engaged in the fishing industry are informed of and comply with such provisions."

As a result ammonia is one of the low ODP refrigerants being encouraged within the fishing industry.



A Russian first: ammonia refrigeration plant for a sports facility

17 February 2012

GEA has been granted special permission from the Russian authorities for what will be the country's first ammonia based refrigeration plant to cater for the cooling needs of a Russian sports facility: the 1814 meter bobsleigh track in Krasnaya Polyana, about 60 km north-east of Sochi, Western Caucasus, which will host the 2014 Winter Olympics competition.

The contract includes project engineering of the complete refrigeration facilities, delivery and installation of the refrigeration equipment in the machine room, as well as a total of 4 km of main ammonia piping along the bobsleigh track.

At the heart of the new refrigeration plant are four ammonia screw-compressors:

- 3 screw-compressor units type WB-5A from the GEA Large Series three type WB-5A
- 1 screw-compressor model PB-5A from the GEA Large Series
- A total of 4.2 MW of cooling duty
- Ammonia refrigerant playing a key role in ensuring superior efficiency

The project agreement was signed in November 2011 between GEA Refrigeration Technologies and NPO Mostovik, one of Russia's largest construction companies.



Works are scheduled for completion in spring 2012, with the first international bobsleigh competition planned for the track already in March. The track is eventually slated to host the bobsleigh competition during the 2014 Winter Olympics.

Safety aspects

For this long bobsleigh track, which is served by 4 km of supply piping along the track, the great evaporation enthalpy and the aboveaverage volumetric cold duty provided make positive contributions. The required cooling duty can be transported with less volume of refrigeration and, in turn, in smaller diameter pipes.

A GEA Wiegand gas scrubber was installed to minimize the health risk in case of any leak in the machine room. This unit would filter any escaping ammonia out of the air and would drastically reduce the gas concentration. Rigorous pressure tests and quality inspections were conducted before start-up, to eliminate the chance of leaks from the very beginning.

Special permission for ammonia novelty in sports facilities

Safety regulation in Russia have until now hindered the use of ammonia as refrigerant in athletic facilities. The GEA project team was able to convince the responsible authority of the advantages of the natural refrigerant and get a special permission for this project.

Russian officials say 2014 winter Olympic venues on track

In 2007, Russia was chosen to host the 2014 Winter Olympics over South Korea and Austria. These will be the first Olympic Games to be held in Russia since the Moscow Games in 1980.

However, until recently there have been reports that several winter Olympic venues had been behind schedule, with the Russian sports minister Vitaliy Mutko admitting that the bobsleigh course and ski jump venues had caused more problems than anticipated. According to AFP, on 14 February 2012, Russian government officials stated that the venues hosting the 2014 Olympic Games will be completed well ahead of schedule.



How ammonia district cooling can be joined with desalination

12 December 2011

On the second day of the 3rd annual Middle East District Cooling Summit, in Doha, Qatar, Dave Pearson of Star Refrigeration gave a presentation on how 40% of the water cost can be saved using the waste heat from cooling systems as the thermal input to the distillation effect.

From 28-30 November 2011, over 300 delegates were invited to think differently about the future of cooling in Qatar and other countries in the Middle East. Experts were promoting the acceptance of ammonia for cooling projects. Dave Pearson, Director of Innovation for Star Refrigeration, together with Imtiaz Khan, Regional Energy Manager from Alfa Laval Middle East Ltd, explained how the use of ammonia refrigeration heat pumps could serve district cooling networks with waste heat from the cooling plant being turned into water and used for desalination purposes.



Water cost benefit

After showing how established desalination applications are in Middle East and giving a description of the equipment used for the cooling in the region, Pearson

explained that for 350MW cooling, large district cooling resulted in 700 000 liters of water used per hour whereas combined DC and desalination was resulting in 3 181 000 liters of purified water produced per hour, delivering as a result over 40% savings in water cost.

Every 3.3MW of chilling capacity produces enough heat to desalinate 30,000 liters of water per hour.

Energy benefit

Pearson also reminded the audience of the very high global warming effect of HFC solutions and how their increasing use is likely to undermine climate benefits achieved by the ozone depleting substance phase-out to date. He showed the typical 1% leakage rate as 1 million car miles (28 times around the world) for every 70MW of installed cooling capacity.

For 10MW cooling, large district cooling resulted in 2MW power and 12MW waste heat whereas combined DC and desalination was resulting in 3.85 MW power and 13.85MW waste heat. The total heat rejected from the Middle East's cooling facilities, at 200GW connected load is a greater quantity of energy than the output of one of the regions leading producers of crude oil.


Ammonia retrofit increases capacity of Coca-Cola Brazil plant by 107%

06 October 2011

A modification of the ammonia refrigeration system in the manufacturing plant of Coca-Cola Guararapes in the State of Petrolina of Brazil allowed cooling capacity to be increased by 107% whilst avoiding the need for a costly plant restructuring. A new packaging line was also added.



The Coca-Cola Guararapes plant, which was founded in 1982 and produces and distributes Sucovale beverages, needed to double its cooling capacity to cope with an increase in production demand. A solution was sought that would fit the existing structure of manufacturing plant.

According to plant manager Wladimir Tavares, due to limited space, the increase in production capacity had to be achieved without adding new components.

Cooling capacity increased by 107%

The manufacturing plant refrigeration system was originally composed of three compressors working in conjunction with 75 hp motors. To increase cooling capacity, the existing compressors were altered and the motors replaced with 125 hp units. This meant other components also had to be changed: a larger liquid separator was installed together with a condenser and new oil separators, whilst the diameter of the discharge lines was increased. Overall, the cooling capacity was increased by 107% from 372 000 kcal/h to 762,000 Kcal/h.

Marco Dolis, service manager at the Northeast Division of Johnson Controls said the motor exchange was key to the increase in cooling capacity, increasing compressor rotation from 1170 rpm to 1500 rpm. Because of this, the refrigerant pipes had to be increased. The new evaporative condenser provides about 490,000 kcal / h and was installed adjacent to the condenser.

Retrofit continues to use ammonia due to its advantages

Of the decision to continue using an ammonia system, Mr Dolis said, "We continue to use the refrigerant R-717 (ammonia) because of its advantages when compared halogenated fluids, such as lower purchasing cost, sustainability - ammonia does not affect the ozone layer and does not contribute to the greenhouse effect - and greater energy efficiency".

According to Mr Dolis, Johnson Controls were responsible for the modification of the compressors, start-up of the plant after the retrofit and supervision of installation of piping, together with sizing calculations.

System composition

Overall, the flowchart of the system remains the same as before. The old system, which had a capacity of 372,000 kcal / h was composed of:

- 3 compressors Sabroe SMC 106 S / 1170 rpm / 75 hp;
- An evaporative condenser;
- 1 liquid separator.

The new system, which has a cooling capacity of 762,000 kcal / h is composed of:

- 3 compressors Sabroe SMC 106 E/1500 rpm / 125 hp;
- 2 evaporative condensers;
- 1 liquid separator.

About Coca-Cola Brazil

Coca-Cola Brazil has four factories, in Jaboatão dos Guararapes, Suape, Petrolina and João Pessoa, and four distribution centres, in Arruda, Caruaru, Garanhuns and Campina Grande. The company's annual beverage production is 650 million litres. The company has a fleet of more than 650 vehicles, and a sales force of approximately 500 people.



NH₃ quick freezing system for one of India's largest food parks

05 August 2011

A novel food processing infrastructure project that is being set up in India to provide end-to-end linkage to the food processing sector, will integrate global best practices and high-end technology. Included will be an innovative ammonia based quick freezing system for mango products supplied by Star Refrigeration's specialist arm on innovative freezing and chilling systems.

Supplied by Starfrost (part of the Star Refrigeration group), the system is a pumped natural ammonia IQF Freezing Tunnel that ensures high cooling efficiency and fast response to product temperature or capacity flow changes.

Custom design of the ammonia quick freezer

Starfrost is custom designing a new Modular Series Turbo Freezing Tunnel of 6m length x 4m width for the individual quick freezing of 1,000 kg/hr of diced fresh mango.

The freezer features:

- IE2 high efficiency electric motors with variable speed drives for optimum freezing and low energy consumption
- A stainless steel and aluminium evaporator with variable pitch fins throughout, that ensures maximum heat transfer and extended operation between defrosts
- An all stainless steel structure and fully welded floor for ultimate hygiene
- The Star-D-Belt filter system that ensures the interior remains as clean as possible, allowing for efficient cleaning with minimal water consumption

The mango product will first pass through an initial crust freezing zone with cascade and variable control agitation, then be transferred to a deep fluidised bed for final freezing, ready to be sold on the domestic retail market and get packaged for export.

About the 'Mega Food Park' food processing infrastructure project

Strategically located at the Chittoor district, Andhra Pradesh, the Mega Food Park is a first-of-its-kind project that is expected to harness the potential of food processing industry in India.

Supported by the Ministry of Food Processing Industries, the park occupies an area of 141 acres (about 570,000 m²) and aims to be the model infrastructure provider to the food processing industry in India by adopting global best practices, high-end technology and providing end-to-end linkage to the food processing sector.

Its central processing centre will feature facilities for sorting, grading and packing, a dry warehouse, an aseptic filling line, an IQF (individual quick freezing) line, cold storage, a testing laboratory, reefer vans etc.

The Mega Food Park could serve as a model on the basis of which more food parks would be built across the country. Indeed the Indian government has plans to open 30 mega food parks by 2012.

Cold chain opportunities in India

With India being the second largest producer of fruits and vegetables worldwide, and more than 25% of its fresh produce being wasted due to lack of cold chain infrastructure capable of preserving it, there are growing business opportunities for the cold chain industry in India.

Currently, the cold chain industry is estimated at about US \$2,000-3,000 million (€1,467.39 - 2,201 million) and is expected to grow substantially. There are about 6,000 cold storage facilities in India, with the average size of a cold store being 5,000 metric tons. Of these, 80% are for storing potatoes only, while just 17% of the facilities are multipurpose. More than 65% of existing cold stores are concentrated in two states, namely Uttar Pradesh and West Bengal.

However, the existing technology used in facilities is not appropriate for providing appropriate storage conditions, while several bottlenecks are present in the market such as the lack of know-how and training of manpower.

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news

- articles on latest product developments
- reporting from all major industry events worldwide
- daily policy, market and technology updates

products

- extensive database of hydrocarbon refrigeration products and services with direct sales contacts
- global directory of hydrocarbon companies
- database of technical papers, reports, presentations V

community (coming in 2012)

- global business contacts database allowing you to network and to share knowledge
- find people, projects & business opportunities
- events updates, file sharing, forum discussions and more V

lu

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partnership advantages

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products

- extensive database of ammonia refrigeration products and services with direct sales contacts
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- ✓ database of technical papers, reports, presentations

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5-7 November 2012 in Brussels



NATURAL REFRIGERANTS - SOLUTIONS FOR EUROPE:

Already in its fourth year, this interactive workshop and conference on Natural Refrigerants (CO_2 , ammonia, hydrocarbons, water, air) will be organised in Brussels from Tuesday to Wednesday, 6-7 November, with a pre-event on 5 November. This year the emphasis will be on case studies, experiences, and discussions - meaning solutions - to how natural refrigerants can be viable alternatives to f-gases across Europe.

A main topic of this year's **ATMOsphere Europe** will therefore be the new F-Gas Regulation that the European Commission intends to present shortly before the event. This proposal will have a significant influence on the future of natural refrigerants in Europe and the 200+ policy and industry experts attending will have the opportunity to discuss it and give their input directly to the European Commission and Parliament representatives.

5 to 7 November, 2012 Crowne Plaza Le Palace Hotel, Brussels w w w . ATMO.org/Europe2012

Main Programme

6 November

Policy Session: F-Gas Regulation and Ecodesign

- Ms Connie Hedegaard, The European Commissioner for Climate Action
- Representatives from the European Parliament, the European Commission as well as the member states

Will discuss the new proposal on F-Gases and developments for the **Ecodesign Directive**

Workshop discussion and reporting

Technology Case Study Session 1

Four innovative case studies will be presented followed by a Q&A and a panel discussion (to be selected from the Call for Case Studies)

Parallel Sessions

Different sessions, including:

- F-Gas Debate involving key EU stakeholders
- Business networking

Reception & Dinner

7 November

Market Overview for Europe

- For natural refrigerants in Europe with presentations from industry and the financial community
- Workshop 10-point action plan

End User Session: Food Retail

- Urs Berger, Migros
- Knut Lutnæs, COOP Norway
- Robert Arthur, Marks & Spencer, tbc
 Joe Gomez, Tesco, tbc
- Q&A and panel discussion

• Jean-Michel Fleury, Carrefour, tbc

End User Session: Industrial

• Antoine Azar, The Coca-Cola Company • PepsiCo, tbc

• René van Gerwen, Unilever

Q&A and panel discussion

Technology Case Study Session 2

Four innovative case studies

www.ATMO.org

Go to our events website to find all presentations, pictures, speaker profiles and news updates about upcoming and previous events.



The afternoon and evening of the 5th November will be reserved for a smaller group for in depth discussions and preparations as well as a dinner in the European Parliament. As space is limited, this pre-event is by invitation only with priority given to our sponsors and speakers.

ATMOsphere Methodology

Our special Methodology ensures a truly interactive and fruitful networking event and includes:

- Combining perspectives from: Policy Industry End users
- Moderated workshop discussions
- Targeted discussion questions, realtime polling and more for maximum interactivity
- Networking opportunities incl. business networking and speed networking
- 10-point action plan