Programme

The 10th IIF/IIR Gustav Lorentzen Conference on Natural Refrigerants

Delft, The Netherlands
June 25-27, 2012

www.gl2012.nl
Education

The Department Process & Energy offers a Master of Science in Mechanical Engineering. Track: SPET (Sustainable Process and Energy Technologies) for graduates with extensive modeling skills for Process and Energy Systems and related components.

http://www.studiegids.tudelft.nl/a101_displayProgram.do?program_tree_id=10725

Process & Energy Research

- Visit http://www.pe.tudelft.nl/ to view the mission and vision of the department.
- This website also gives an overview of the research groups within the department.

Engineering Thermodynamics

- Your partner for research projects in the field of sustainable refrigeration and heat pumps.
- This includes solar driven systems: the publication of the group "Solar refrigeration options - a state-of-the-art review" published in the International Journal of Refrigeration, Volume 31, 2008, Pages 3-15 was Elsevier's 13th most downloaded Mechanical Engineering journal article in 2011.
- Visit http://www.pe.tudelft.nl/Chairs/ETh to view the running projects within the department.
Dear Participants

On behalf of the Organizing Committee of the 10th IIR Gustav Lorentzen Conference on Natural Working Fluids, it is at great honour to welcome the international refrigeration family to the Netherlands.

Refrigeration and its development can be considered as one of the main technological outcomes of twentieth century. Through this marvellous technology humanity has been able to create a very comfortable environment for its living even in areas where because of very high ambient temperature, living is difficult. We can say in many circumstances the technology has helped man to create heaven in hell, and have some well preserved food to eat as well.

It should be noted that the common refrigeration systems need power for their operation. They also require a suitable working fluid which in this case is called refrigerant. Both of these two requirements i.e. power and refrigerant can have high environmental impacts and contribute to global warming. The 10th IIR Gustav Lorentzen Conference on Natural Working Fluids (GL2012) addresses the second element and emphasises natural refrigerants as real alternatives.

The conference has been organized on behalf of the International Institute of Refrigeration (IIR) by the Royal Dutch Refrigeration Association (KNVvK), Delft University of Technology (TU Delft) and the GL 2012 conference committee.

This successful conference has now travelled around the world from Germany (Hannover) 1994, to Denmark (Aarhus) 1996, Norway (Oslo) 1998, USA (Purdue) 2000, China (Guangzhou) 2002, UK (Glasgow) 2004, Norway (Trondheim) 2006, Denmark (Copenhagen) 2008 and Australia (Sydney) 2010. We are proud and honoured that IIR has given us the opportunity to bid you welcome to the Netherlands.

Held at the Conference Centre of the Delft University of Technology from June 25-27 2012, the conference aims to continue the evolving work relating to new research and practical implementation of natural refrigerants, and of course to foster friendships and future relationship across the globe to further the uptake and technology relating to natural working fluids.

Our call for papers has triggered more than 180 abstracts from 33 countries all over the world, covering a broad range of topics that are important in order to forward robust solutions based on natural working fluids. These conference proceedings consist of 141 peer-reviewed papers from 31 countries which have been accepted for the conference.

The organizers therefore feel confident that the conference will be another important event, where companies, organizations, research institutes and universities once more will gather to present and discuss their latest knowledge, technology and solutions. Solutions that might solve problems of great concern to the international society.

The organizing committee would like to express our sincere thanks to the keynote speakers, presenters, authors of all papers, reviewers, the sponsors and the conference delegates for their invaluable contributions to the success of the conference.

Sincerely,

Gerard Vos
Chairman of the Organizing Committee
10th IIR Gustav Lorentzen Conference on Natural Working Fluids (GL2012)
June 25-27, 2012, Delft, the Netherlands

Scientific Committee
The International Committee of the 10th IIR Gustav Lorentzen Conference on Natural Working Fluids (GL2012) reviewed more than 180 abstracts and approximately 140 papers.

The members of the Committee were:

Carlos Infante Ferreira (Chairman) Delft University of Technology, The Netherlands
Pradeep Bansal University of Auckland, New Zealand
Robert de Boer ECN, The Netherlands
Clark Bullard University of Illinois, USA
Piotr Domanski NIST, Gaithersburg, USA
Geert Doornbos Alfa Laval Groningen BV, The Netherlands
Michel Feidt LEMTA-GESPE, France
Dick Havenaar KNVvK, The Netherlands
Neil Hewitt University Ulster Jordanstown, United Kingdom
Michael Kauffeld Karlsruhe University of Applied Sciences, Germany
Gerrit Jan Koster Gea Grasso BV, The Netherlands
Renato Lazzarin Padova University, Italy
Per Lundquist KTH Stockholm, Sweden
Min Soo Kim Seoul National University, South Korea
William Murphy University of Kentucky, USA
Joachim Paul Danish University of Technology, Denmark
Fons Pennartz KWA Business Consultants, The Netherlands
Yong Tae Kang Kyung Hee University, South Korea

Organizing Committee
The members of the Organizing Committee of the 10th IIR Gustav Lorentzen Conference 2012 on Natural Working Fluids (GL2012) were:

Didier Coulomb International Institute of Refrigeration (IIR)
Gerard Vos (Chairman) Royal Dutch Association of Refrigeration (KNVvK)
Kees van Heiningen Danfoss BV
Bob van den Hoogen Royal Dutch Association of Refrigeration (KNVvK)
Erik Hoogendoorn Cofely Refrigeration BV and Chairman of the Royal Dutch Association of Refrigeration (KNVvK)
Carlos Infante Ferreira Delft University of Technology (TU Delft) and Chairman of the scientific committee
The 10th IIF/IIR Gustav Lorentzen Conference on Natural Refrigerants

Monday 25 of June

08:30 Registration opens
09:00 Coffee break
10:00 Opening Ceremony
Welcome on behalf of Organizing Committee, Gerard Vos
Welcome on behalf of IIF, Didier Cousten
Chair: G. Vos
10:15 Plenary Keynote Lecture 1
GL-001 Technologies needed to advance the position of major natural refrigerants: HC, NH3, or CO2
Hydrocarbons (i.e., propane, isobutene, propene, ethane, etc.), ammonia, and carbon dioxide are the three major natural refrigerants that could be really strong contenders for dominant positions in certain applications throughout the world. Actually, a few of them have already achieved this position: ammonia in large industrial refrigeration mostly in the USA and Europe, isobutene in household refrigerators mostly in northern Europe, CO2 in heat pumps for water heating in Japan. This paper discusses which technologies or improvements are needed to increase the number of successful applications. Major directions are: charge reduction for each candidate, hermetic ammonia compressors, use of less costly materials in ammonia systems, further improved compressors for CO2, as well as better heat exchangers (HX) and work recovery options.

About the speaker:

Prof. Predag Hrinjak
Prof. Hrinjak is research professor at the University of Illinois at Urbana Champaign, USA. He is associated with the Mechanical Engineering Laboratory and co-director of the Air Conditioning and Refrigeration Center at this university. He was the receiver of the Gustav Lorentzen Medal during the 23rd International Congress of Refrigeration in Prague last Summer for his extensive work related to natural refrigerants.

He is the author of 79 refereed journal papers of which 59 are identified as refrigeration topics. Most cited of these papers concern heat transfer and minimization of refrigerant contents in heat exchangers in relation to the use of natural refrigerants. For the academics: his h-index is 13 indicating that 13 of his papers have been cited 13 times. His most cited paper has been cited 36 times.

(cited 10 times)
Welcome by the President of the KNVvK

On behalf of the Royal Dutch Association of Refrigeration I would like to welcome the participants and speakers of the 10th IIR Gustav Lorentzen Conference.

During our 100th anniversary in 2008, looking back in time, we found natural refrigerants to be the constant factor in refrigeration. This made us decide to propose IIR to organize the GL conference in the Netherlands.

We are delighted to see that the interest in natural refrigerant is a shared interest amongst our colleagues around the world.

Welcome by the chairman of the Scientific Committee

Dr. Carlos Infante Ferreira

Delft is about to host the 10th Gustav Lorentzen Conference on Natural Working Fluids (GL2012). This series of biennial conferences started in Hannover, Germany in 1994 and has moved around the world. The goals of the Gustav Lorentzen Conference have remained the same as for previous conferences: to discuss the latest research results and advances related to the use of natural working fluids in different types of systems and application areas.

I would like to, first of all, acknowledge the efforts of the authors of the 138 technical papers, which will be presented during this conference, to present relevant and updated progress in the field of the use of natural working fluids in refrigeration applications. Taking into account the received papers, the scientific committee has distinguished a number of areas of present interest of the refrigeration community in relation to natural working fluids:

- Present and future global warming gases emissions policy
- Advances in CO₂ systems (using ejectors, other specific components, specially designed compressors, heat pumps and (heat recovery in) supermarket systems)
- Advances in ammonia systems (specially designed high pressure / temperature compressors, heat pumps)
- Advances in hydrocarbon systems (specially designed compressors, safety aspects and drop-in requirements)
- Advances in heat transfer (condensation and evaporation) of natural working fluids and design aspects of (finned tube) heat exchangers
- Sorption processes and systems (fundamentals, prototypes, solar applications and desiccants)
- Energy savings, thermal storage and secondary refrigerants
- Specific control aspects of natural refrigerant systems
- Not-in-kind refrigeration systems

The review of the technical papers represents a huge effort of the members of the scientific committee who I, on behalf of the organizing committee, would like to thank. Also I would like to thank the Dutch Refrigeration Association and their representatives, all authors and session chairmen that have given such generous assistance in many ways.

I hope that this meeting will promote the building of bridges between the several disciplines of the refrigeration community and will stimulate the community to work on more sustainable refrigeration technologies for the future generations.

Carlos Infante Ferreira
Chairman of the Scientific Committee
GL-002 MAGNETOCALORIC MATERIALS FOR COOLING APPLICATIONS NEAR ROOM TEMPERATURE

The efficient coupling between lattice degrees of freedom and spin degrees of freedom in magnetic materials can be used for refrigeration. This coupling is enhanced in materials exhibiting the giant magnetocaloric effect. The coexistence of strong and weak magnetism in alternate atomic layers has recently been shown to be a tool to design new materials. The weak magnetism of Fe layers (disappearance of local magnetic moments at the Curie temperature) is responsible for a strong coupling with the crystal lattice while the strong magnetism in adjacent Mn layers ensures Curie temperatures high enough to enable operation at and above room temperature. Varying the composition on these magnetic sublattices gives a handle to tune the working temperature and to achieve a strong reduction of the undesired thermal hysteresis. In this way we design novel materials based on abundantly available elements with properties matched to the requirements of an efficient refrigeration cycle.

About the speaker:

Prof. Ekkes Bruck
Professor Ekkes Bruck is Professor Fundamental Aspects of Materials and Energy at TU Delft. He was previously associated with the University of Amsterdam.

He is author of 375 refereed journal papers of which 48 concern refrigeration topics. Most cited of these papers concern developments in magnetocaloric refrigeration and magnetocaloric refrigeration near room temperature which is his specialization. For the academics: his h-index is 22 indicating that 22 of his papers have been cited 22 times. His most cited paper has been cited 824 times.

One of his recent frequently cited publications is:
DELFT UNIVERSITY OF TECHNOLOGY

Established 1842 by King Willem II, Delft University of Technology (TU Delft) has a rich tradition reaching back more than 160 years. Initially, the university focused predominantly on civil engineering but today there are eight faculties offering fifteen BSc and twenty-nine MSc programmes. With approximately 13,000 students and an academic staff of 2,100 (including 200 professors), TU Delft is the largest and most comprehensive university of engineering sciences in the Netherlands.

TU Delft is an entrepreneurial state university at the forefront of technological development in the interests of society. It conducts cutting edge research and provides first class education. In addition to national accreditation, many of TU Delft’s educational programmes have also been acknowledged by international organisations such as the American Board of Engineering & Technology (ABET).

TU Delft’s research portfolio is clustered around thirteen interdisciplinary technological themes. Research is conducted within the faculties, research institutes and research schools. Each year, the University’s cumulative research results in an average of almost 200 PhD dissertations, and over 4,000 publications in scientific journals. Research and education are interrelated. This is most notable in the MSc programmes which are research driven and challenge students to make their own contributions.

DELFT

Delft is one of the oldest cities in the Netherlands, which was already established as early as 1246. Delft is nicknamed ‘de Prinsenstad’ (the Princes’ City), because William of Orange, the first in the Dutch royal line, held court in Delft in the 16th century. Other famous historical figures who once lived and worked in Delft are the painter Johannes Vermeer and the inventor of the microscope, Anthonie van Leeuwenhoek.

Delft has a pleasant, well-preserved, lively historical centre, with characteristic canals, ancient merchant houses, old churches and the splendid city hall, making it valued by tourists throughout the year. Visitors can choose from a variety of good-quality accommodations. Delft has approximately 96,000 inhabitants, including a significant share of students and employees of Delft University of Technology (TU Delft). The university has attracted a large number of technology-oriented companies.

CLIMATE

The Dutch climate is temperate, with warm summers and soft winters that occasionally allow ice-skating on the country’s many lakes, rivers and canals. Also under the influence of climate change this however occurs less frequently. The transitional seasons can be both tempestuous and calm, producing the characteristic skyscapes that inspired the famous Dutch painters.

Daytime temperature varies between zero and ten degrees Centigrade in winter, between five and twenty degrees in the spring and autumn, and between fifteen and thirty degrees during the summer. Average rainfall accounts are 750 mm. Annually.
GL-003 DEVELOPMENTS IN NEW COMPONENTS AND APPLICATIONS OF REFRIGERANTS IN COMMERCIAL AND INDUSTRIAL HEATING AND COOLING

New equipment for use with natural refrigerants is developed in response to market needs and technology trends. Many factors influence developments in the refrigeration industry across its many different applications and sectors. These factors include among others legislation, energy prices (driving the need for energy efficiency for both cost and CO₂ emissions reduction purposes), end user customer policies, the environmental lobby, the RAC industry lobby (and particularly the refrigerant gas manufacturers). This paper considers some of the new developments in refrigeration equipment from a large manufacturer such as GEA in response to these driving factors and the direction of these developments in the future.

About the speaker:

Mr. David Bostock
Mr. Bostock is president sales West Europe at GEA Refrigeration Technologies. He was previously managing director of GEA Grenco Ltd (UK and Ireland).

He studied mechanical engineering at the University of Strathclyde, Glasgow, United Kingdom. He covers contracts, servicing, and component sales for all GEA Refrigeration Technologies’ operations and activities in Germany, France, Italy, Spain, Belgium, Luxemburg, the Netherlands and Scandinavia. The main customers are in the food, marine and oil and gas industries. He has a keen interest in new refrigeration technologies.

He chairs the Air Conditioning and Refrigeration Industry Board of the UK.
GUSTAV LORENTZEN DINNER ABOARD THE “MAJESTEIT”

Europe’s largest paddle
Participants of the Gustav Lorentzen Conference will be cruising through the Rotterdam harbour aboard an authentic paddle steamer that dates from 1926. At more than 80 metres in length and almost 16 metres in width, and powered by a 750 horsepower steam engine, the Majesteit’s (Her Majesty’s) giant paddles run smoothly and take you on a leisurely trip round Europe’s largest harbour. It is a return to a bygone era. Historically, the Majesteit steamed proudly up and down the Rhine river as a passenger liner. It still is one of the largest paddle steamers ever built. The ship was in use until 1982 and seemed destined to rust away, until Klemens Key discovered it and returned it to former splendour.

Indeed, most steam ship renovators replace old steam driven machinery with diesel engines. With the Majesteit however, Klemens chose a different approach; he proudly restored every component of the original steam technology.

Passengers of the venerable Majesteit will revel in its nostalgia. The steamer’s lounges are beautifully decorated in varying period styles. Once aboard, you will experience a throw-back to a golden age of river travel, when steamboating was affordable only for the upper class.

Steam
Since the Gustav Lorentzen conference is a technological gathering, a description of the Majesteit’s refurbished machinery is in place here. The paddles of the ship are powered by a two-stage compound reciprocating steam engine. Water is turned into steam, the engine’s working fluid, in a so-called Scotch marine boiler at a pressure of 10 bar ga. It expands in two stages for mechanical action. To maximize efficiency, the steam is superheated some 100 degrees, at a temperature higher than water’s boiling point. This was quite a technological advancement at the time the Majesteit was built. The ship engine's double-acting high pressure pistons, as well as a low pressure piston driving the crankshaft, act in unison with the paddles. And unlike steam engines in locomotive trains, the steam is supplied to the cylinders through valves instead of slides, again for higher efficiency. A condenser operating slightly under vacuum completes the Rankine steam cycle. Some specific features of the steam machinery include a Stephenson valve gear to reverse the rotation of the paddle wheels, and the Morgan patented paddle blades, which are always in a vertical position during the rotation of the paddle wheels.

The 750 horsepower steam engine gave the Majesteit in its day a high sailing speed on the open water. At full steam and 38 rpm for the paddle wheels, the ship will attain a speed of 24 kilometres per hour (17.4 mph). Cruising at optimal efficiency allows a sailing speed of around 15 km per hour (9.3 mph). No automation was added to control the ship’s speed. The captain still uses a traditional ship telegraph to instruct the engineer down in the machine room.
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<td>GL-192 Development of commercial refrigeration systems with Heat recovery for supermarket buildings Armin Hafer, Stefano Poppi, Peter Nebkla, Silvia Minetto and Tyrge W. Elekev</td>
<td>GL-255 Small ammonia heat pump with variable speed compressor Behzad A Mostafaei and Bjørn Palm</td>
<td>GL-168 New development of air cooled finned heat exchangers for CO2 applications Stefano Filippini</td>
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<td>09:55</td>
<td>GL-247 Dynamic modeling of a combined supermarket refrigeration and HVAC system Miren Titze, Nicholas Lemke, Peter Nebkla, Armin Hafer and Jornen Kühne</td>
<td>GL-112 Combining the use of thermal storage and indirect evaporative cooling to minimize the installed chiller capacity Gert Nielsen</td>
<td>GL-259 Numerical study of performance variation with frost growth of a refrigerating system in a refrigerated truck Sanghun Kim, Chaski Park, Honghyon Cho</td>
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**Wednesday 27 of June**

08:30 Plenary Keynote Lecture 5 Chair: G. Vie GL-005 Market successes of natural refrigerants: twenty years of progress Andy Pearson

09:00 Coffee break

10:15 Coffee break

**Session 8 - Room A - Secondary Refrigerants Chair: B. van den Hoogen Page 89**

10:30 GL-135 Experimental and theoretical studies on CO2 hydrate slurry production Corin Groen, Catalina Vasilescu and Carlos Infante Ferreira

GL-270 Natural or synthetic refrigerants – what options for high temperature heat pumps? Paul de Lamattin and Damien Amour

GL-284 Modelling of surplus heat exploitation in a dairy Arne Lind, Eva Rosenberg and Stein Rune Nordvold


GL-196 Ammonia and carbon dioxide heat pumps for heat recovery in industry Wietke Birx, Stefano W. Christensen, Michael M. Markusen, Lars Reinholdt and Brian Elmegard

GL-134 The effect of reduced air fan speed on freezing times and energy consumption in a freezing tunnel K. N. Widell, T. M. Elkevich, H. T. Wailum


GL-309 Industrial-sized, high-temperature heat pumps: technologies and application Larss Reinholdt, Michael Markusen, Tage Petersen, Peter Broundom

GL-277 Comparison of refrigeration cycles with natural refrigerants for very rapid food freezing Alessia Artonesi, Caterina Brandoni, Giovanni di Nicola, Fabio Polonara

11:30 GL-209 Design considerations of long length evaporative CO2 cooling lines Bart Verstraete and Joao Notte

GL-211 Practical experience with ammonia add-on heat pumps Jan Gerstten

GL-296 Measurement and modelling of ice rink heat loads Maye Karupampour and Jürgen Rogatschn


GL-199 Heat pumps for steam production from waste heat Daniel Rohde, Yves Lodden, Harald Taxt Wauthum and Peter Nebkla

GL-205 World’s oldest 400 m artificial skating rink, the “Jaap Eden Baan” at Daniel Rohde, Yves Lodden, Harald Taxt Wauthum and Peter Nebkla

12:10 GL-233 Thermodynamic and phase behaviour of natural refrigerants embedded with nanomaterial structures Vitaly Bondarenko, Denis Kuleshov, Michael Kemenyuk, and Victor Mazur

GL-311 Simulation of the performance of carbon dioxide and hydrocarbon heat pumps for medium- and high temperature heating Minsung Kim, Young-Jin Baik and Ho-Sang Re

GL-261 Experimental study of performance in a refrigerated truck using electronic expansion valve Chiwook Myung, Jeekyoong Oh, Honghyon Cho

12:30 Lunch break

**Session 9 - Room A - Thermal Storage Chair: Y.-J. Kang Page 98**

**Session 9 - Room B - CO2 Systems Chair: P. Lynndvist Page 101**

**Session 9 - Room C - Not-in-Kind Systems Chair: E. Hoogenboom Page 104**

13:30 GL-160 Energetic benefit of latent cold thermal energy storage Michael Kauffeld and Karin Rüthling

GL-212 Energy efficient dairy shed milk cooler and water heater using carbon dioxide as refrigerant Håvard Rekstad, Armin Hafer and Sigmund Jenssen

GL-151 Performance enhancement of CO2 refrigeration systems by thermoelectric subcooler Jonathan Schonfeld, Yunho Hwang and Reinhard Rodemacher

13:50 GL-186 Energy optimization of a solar cooling plant with PCM heat storage Renato Lazzanin, Filippo Busato and Marco Nono

GL-159 A comparative cycle and refrigerant simulation procedure applied on air-water heat pumps Gunde Moeder, Bjørn Palm and Brian Elmegard

GL-297 The transient behavior of pulsed supercooling for thermoelectric coolers (TEC) Jian Ma, Huasbin Chen, Xiaobing Qian

14:10 GL-291 Numerical investigation on PCM solidification in a finned thermal storage based on enthalpy method Antarshasain Mosaffa, Parampat Panb, Marc A. Rosen, Carlos Infante Ferreira and Hassain Basirat Tabrizi

GL-283 Experience from the Danish regulation of F-gases and implications for the refrigeration industry Per Henrik Pedersen and Mikkel Aamann Sørensen

GL-185 Mathematical modelling of a low approach evaporative cooling process for space cooling in buildings Mehdi Naseriadi, Donal Finn and Ben Costello

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**Plenary Keynote Lecture 4**

**GL-004 HEAT TRANSFER AND PRESSURE DROP OF NATURAL REFRIGERANTS IN MINI-CHANNELS (LOW CHARGE EQUIPMENT)**

The paper presents a comprehensive overview of the most recent research works on heat transfer with natural refrigerants in minichannels, aimed at proper design of heat transfer equipment. About boiling heat transfer, so far no predicting procedure finds wide acceptance either for HT coefficients or for droplet conditions; experimental HT results are mainly fitted by empirical correlations relating to the common mechanisms used in more conventional geometries (nucleate and convective boiling); evaporation heat transfer through thin film liquid around vapour plugs is at times considered. About shear dominated condensation heat transfer, suggested design tools again mostly refer to the extension of the semi-empirical correlations earlier established for conventional geometries. As two-phase heat transfer cannot be regarded disjoined from the associated frictional pressure drop, recent experimental results on this subject are considered as well. For CO2 heat transfer at supercritical conditions, such as in a gas cooler, is also treated. Finally the concept of the Penalty Factor is applied to shear condensation in minichannels to establish the heat transfer performance of the different working fluids, the superior effectiveness of minitubes over macrotubes, and the optimization of minichannel condensers.

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**About the speaker:**

**Prof. Alberto Cavallini**

He is full professor of Energy Science with the Engineering Faculty of the University of Padova. He has been Director of the Institute of Fisica Tecnica of the University of Padova, and of the Refrigeration Institute of the Italian Research Council. He is the past President of the Scientific Council of the International Institute of Refrigeration (1995-2003), Member of the Management Committee, Honorary member and Honorary President of the same Institution. Within the same Institution he has held the office of Head of Section E (Heat Pumps and Energy Recovery). He is the author of 70 refereed journal papers of which 43 are identified as refrigeration topics. Most cited of these papers concern heat transfer and pressure drop during condensation and evaporation in tubes including minichannels. For the academics: his h-index is 15 indicating that 15 of his papers have been cited 15 times. The most cited paper has been cited 93 times.

SCIENCE AND ECONOMY
The Kamerlingh Onnes Award was officially established in 1948, at the 40th anniversary of the NVvK (Dutch Association of Refrigeration). Kerkhoven, a prominent (honorary) NVvK member, came up with the idea in 1947. One year later he presented a detailed proposal. The name of the award is intended to keep the memory of Kamerlingh Onnes alive. We must note that Kerkhoven and other people involved, such as Vattier Kraane, Keesom and van Oyen, were all co-founders of the NVvK association and therefore had known Kamerlingh Onnes personally. The memory of Kamerlingh Onnes was still very alive in 1948. The Kamerlingh Onnes award was meant to reflect the dual character of the NVvK. As Kerkhoven put it: pure science and economy should harmoniously live together like a happily married couple and should be high above divorce. Other important requirements in Kerkhoven’s proposal were: a high international standing and a periodical presentation of the award to a person of whatever nationality who has done exceptionally meritorious work for science or for economy. In 1948 the assembly of the NVvK accepted the proposal and one year later Kerkhoven’s requirements were laid down in official regulations which have remained unchanged ever since. There was a preference for internationalization. For the award presentation ceremony an IIR conference was considered most appropriate, if possible in combination with another international organization.

ESSENCE OF THE KAMERLINGH ONNES AWARD
What is the essence of the Kamerlingh Onnes award? Gorter, the chairman of the jury in 1955, gave a clear definition of the essence when he presented the award to Rudolf Plank. In the past, the aim of establishing awards was to promote scientific innovations. However, experience shows that scientists have other motives than pursuing prizes and that science has its own dynamics. Therefore, the Kamerlingh Onnes award is purely a recognition of special merits and does not relate to the future. Thus, the advanced age of most of the laureates corresponds well with the character of the award. Since the achievements of the laureates must be similar to those of Kamerlingh Onnes himself, the award will hold his memory in esteem. Below you will find an overview of all award winners. From 1948 to 1983 all candidates were chosen because of their pioneering scientific work. The only exception may be Plank, who scientifically operated less profoundly, but who has done meritorious work with regard to governance, organization, education and knowledge transfer. In 1983 Vahl was decorated for the same broad orientation, just like Van Hiele and Cohen. In the spirit of Prof. dr. Heike Kamerlingh Onnes (1852-1826), most awards have been assigned to efforts in order to achieve ultra-low temperatures. The most recent award for this type of effort was presented to Frossati (in 2000) for his innovation in dilution refrigerator technology.

SCIENCE AND SOCIETY
Looking back at all Kamerlingh Onnes awards, there have been many important developments which led to great improvements for humanity. Big names within the field of refrigeration, but does the public know them? Although refrigeration technology is a vital element in our society, it is relatively unknown to the outside world. As a test case, Prof. It. Henk van der Ree tried to look up the Kamerlingh Onnes laureates in various reference works (such as encyclopaedia). His research confirmed the assumption that our top scientists are hardly mentioned, except for Nobel Prize winner Kapitza and Rudolf Plank. What Van der Ree did find, were namesakes who were writers, poets, politicians, financiers, lawyers, painters, philosophers or baseball players. Apparently those professions are considered more important.

During the plenary meeting and opening ceremony of the conference, Dr. P. Lebrun will present his cryogenic work, for which he was nominated to receive this special award.

On June 25th 2012 the chairman of the KNvK, Ir E.J. Hoogendoorn, will present the Kamerlingh Onnes Medal to Dr. P. Lebrun of CERN during the 10th IIR-Gustav Lorentzen conference. Before the award presentation, the chairman of the jury, Prof. dr. P. Kes, will illustrate the considerations which led to the selection of this specific candidate.

Philippe Lebrun works at CERN, the European Organization for Nuclear Research in Geneva, on the application of superconductivity and cryogenics to high-energy particle accelerators. He led CERN’s “Accelerator Technology” department during the construction of the Large Hadron Collider (LHC), a 27 km circumference accelerator using several thousand high-field superconducting magnets operating in superfluid helium below 2 K. A graduate from Ecole des Mines (Paris) and the California Institute of Technology (Pasadena), he is Auditeur de l’Institut des Hautes Etudes pour la Science et la Technologie (Paris), and Doctor honoris causa of the Wroclaw University of Technology (Poland).
Although having an industry career he has a number of academic publications related to natural refrigerants.

Below you will find an overview of all Kamerlingh Onnes Medal bearers. In 2008, the year of the 100th anniversary of the NVvK, two medals were presented. During that same year, on September 23th, the birthday of Kamerlingh Onnes (co-founder and first chairman of the NVvK), the NVvK itself was royally decorated. Since then, our association is known as KNVvK (Royal Dutch Association of Refrigeration).

Kamerlingh Onnes Medal bearers

Very low temperatures, liquid hydrogen and helium.

1955 Prof. R. Plank, Karlsruhe, Germany.
Refrigeration technology in a broad sense.

1958 Prof. S.C. Collins, M.I.T.-U.S.A.
Low temperatures, especially with regard to equipment for the production of liquid helium.

Development of cryogenerator.

1963 Dr. F. Kidd and Dr. C. West, Cambridge, England.
Research storage conditions of fruit.
Founders of CA storage.

1968 Prof. P.L. Kapitza, Moscow, Russia.
Low temperatures, scientifically and technologically.
Expansion turbine.

1973 Ms. Dr. A. Smith, Stanmore, England.
Introduction of cryoprotectants; cryobiology.

1979 Dr. J.E. Kuzuler, Bell Labs., U.S.A.
Superconductivity.

1983 Prof. Dr.-Ing. L. Vahl, Delft, Netherlands.
Refrigeration technology in a broad sense.

1988 Ir. T.A. van Hiele, Sprenger Instituut, Wageningen, Netherlands.
Application of refrigeration technology on agricultural and horticultural products.

1989 Dr. T. Meryman, American Red Cross, U.S.A.
Preservation of blood, tissues and organs.

1995 Prof. Dr.-Ing. Dr. h. c. Horst Kruse, FKW Hannover, Research Centre for Refrigeration Technology and Heat Pumps, formerly Technical University Hannover, Germany.
Contributed to technological progress, education and knowledge transfer and did meritorious work for cold and heat pump associations.

Optimization of pulse tube refrigerators for temperatures below 4 K.

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Minutes Kamerlingh Onnes judging-committee, October 22th, 1976.
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RCC Koude- en luchtbehandeling, September 2008 by Prof. Ir. Henk van der Ree, Emeritus professor TU Delft
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