

# AHPNW NEWSLETTER



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## From Korea

### ■ Hot Issues in 2016 from KOREA

In 2016 there were some hot issues raised in the heat pump industry of KOREA ; Air source heat pump as renewable energy application, the use of natural refrigerants, and alternative refrigerants, Chiller using low-GWP refrigerant, and so on forth.

Heat pump industry forum of KOREA, a non-profit organization has been established 2014 in order to support heat pump industry and encourage heat pump technology approved by the Ministry of Trade, Industry and Energy, held an annual seminar at BEXCO, Busan, 1st September 2016 to present hot issues in 2016.

This seminar has provided the hottest 5 topics in a heat pump industry of KOREA ;

△ Air source heat pump can be recognized as renewable energy application in Korea, Dr. Jun Young CHOI, KTL

△ Development of new refrigerant and global regulations of existing refrigerants, Mr. Gichul YU, Honeywell Korea

△ National and International trends of Low-GWP refrigerants, Dr. Yook Joong KIM, KIMM

△ Economic analysis and empirical results of air source hybrid heat pump for residential application, Dr. Noma PARK, LG Electronics

△ CO2 heat pump technology and Case Study, Mr. Seongcheol HAN, Dewar Korea

△ Air source heat pump can be recognized as renewable energy application

Dr. CHOI presented the status of new and renewable energy application for air source heat pump in major economies around the world.

Germany, United Kingdom, France.

Sweden and the EU have recognized geothermal, hydrothermal, and air source as renewable energy sources in 2009. EU had set up a new and renewable energy development plan for heat pump applications and the guidelines for the calculation of renewable energy using heat pump in 2013.

Japan established a multi-layered and diversified energy supply and demand structure as its basic plan and recognizes utilization of thermal difference energy. They has built a multilayered energy supply structure that takes advantage of each energy source and complements its weaknesses.

China plans to increase the share of non-fossil energy in primary energy consumption to 15% by 2020 and form an energy open-market and competitive market. Currently, local governments such as Zhejiang Province, Fujian Province, Handan City and Hebei Province have recognized all heat sources including air source as renewable energy. The central government, which has recognized only geothermal heat pump as renewable energy application so far as, fulfilled a new project "Research and analysis of technology for air source heat pump as new and renewable energy application" to consider air source heat pump as the recognition of new and renewable energy application.

He said, "In Korea, it is urgent to recognize various renewable energy sources such as overseas major countries. To do so, it is necessary to establish a reasonable standard for COP and to develop a reliable verification method."

△ Development of new refrigerant and global regulations of existing refrigerants

Mr. YU, Honeywell presented 'Global Refrigerant Regulation Trends and New Refrigerant Development Status' and

introduced changes in refrigerant regulations and global refrigerant regulations.

At present, the world is tightening regulations on HFC with high GWP. In 2015 the US, EPA started to restrict the use of HFCs in automobiles, air conditioners, commercial refrigeration systems, blowing agents and aerosols. In March 2016, they expanded the limits to chillers and refrigerators. Canada has banned HFCs for specified sectors in 2016, and Europe is tightening overall regulations for certain sectors such as under GWP 2,500 by 2020 and below GWP 150 by 2022.

Denmark, Norway, Slovenia, Spain and other countries also pay indirect taxes to HFC. Since 2016 Korea has been regulating HFC as an incentive for automotive air conditioning systems.

In line with this trend, Honeywell has developed new refrigerants that can replace refrigerants used in various industrial sectors. There are currently available alternatives refrigerants ; R123 to HFO-1233zd, R134a to R450A and R515A, R410A to R452B and R447B. These alternatives refrigerants provided lower GWP than regulated, offering similar efficacy to existing refrigerants.

#### △ National and International trends of Low-GWP refrigerants

Dr. KIM, KIMM presented 'National and International trends of Low-GWP refrigerants' and introduced F-gas emission status, refrigerant regulation plan and low GWP refrigerant application in the world.

Particularly, he introduced the national research project 'Development of original technology for low-GWP ( $\leq 100$ ) refrigerant system', which has been fulfilled by KIMM and consortium. There are two basic tasks, the first task is the development of original technology for low GWP refrigerant system,

which consists of sub tasks such as development of heat exchanger design technology, the development of general cycle analysis program, the evaluation and analysis of candidate refrigerant and oil, and the development of heat exchanger for turbo refrigerator. The second task consists of the development of 500RT class high efficient refrigerator with using low GWP refrigerant, the development of high efficient turbo compressor, system integration and performance evaluation, and the development of turbo refrigerator control system.

#### △ Economic analysis and empirical results of air source hybrid heat pump for residential application

Dr. PARK, LG Electronics presented 'Demonstration of monitoring and economic analysis of air source hybrid heat pump for residential application', unifying the energy source of the home with electricity, and using all the high- efficiency heat pump to provide space heating and hot water supply. Based on this case, it raised the necessity of introducing electric energy housing in Korea. In addition, the results of the economic analysis of the heat pump for space heating and hot water supply in the Korean type electric energy house were obtained through an empirical test.

#### △ CO<sub>2</sub> heat pump technology and Case Study

Mr. HAN, Dewar presented a new heat pump system using CO<sub>2</sub> refrigerant developed by Dewar, and introduced one case study in Korea. Due to the growth trend of the hot water heat pump market, it is expected that the application range of CO<sub>2</sub> heat pump capable of leaving hot water at 110 °C is also expected to expand. He said, "Companies will continue their efforts to reduce energy costs, and it is expected that the market will expand using CO<sub>2</sub> refrigerants in accordance with the policy benefits associated with the GHG

mitigation."

(source: 2017/1/20, KHARN, "2016 Heat Pump Industry Forum Seminar", BEXCO, Busan, )



## From Thailand

### ■ Topic from Department of Alternative Energy Development and Efficiency

Department of Alternative Energy Development and Efficiency (DEDE) grants Matching Fund provides matching fund to government hospital about \$ 2.1 million for one hospital. The aim of program is to improve and/or change the existing equipment, devices or material to higher energy efficiency equipment that significantly decrease energy consumption in the hospitals. The proposed measures should be focused in district cooling system, variable speed water pump/ air handling unit, smart control for air conditioning, ventilation, and lighting system, energy management, waste heat recovery from air conditioning system and other energy saving measures. The saving from the measures must be returned within 7 years. The proposal must be submitted to DEDE until July 29, 2016. For more information, see the DEDE Matching Fund website

(source: 2016/12/29, DEDE, Thailand)



## From China

### ■Energy development Thirteen-Five-Year Plan of China

In accordance with the requirements of the Outline of the Thirteen-Five-Year Plan, the main objectives of energy development in 2020 are put forward, comprehensively consider factors such as safety, resources, environment, technology and economy.

- Total energy consumption. The total energy consumption will be controlled within 5 billion tons of standard coal, the total coal consumption will be controlled within 4.1 billion tons. The total electricity consumption is expected to 6.8 to 7.2 trillion kWh.

- Energy consumption structure. The proportion of non-fossil energy consumption will be increased to 15% or more, the proportion of natural gas consumption will reach 10%, the proportion of coal consumption will be reduced to 58%. Coal for power generation accounted for the proportion of coal consumption will be increased to more than 55%.

- Energy environmental protection. Carbon dioxide emissions per unit of GDP will be decreased by 18% compared with 2015. The environmental protection level of the energy industry will be significantly improved. The emission of pollutants from coal-fired power plants will be significantly reduced, and the coal-fired generating units with the transformation conditions will achieve ultra-low emissions.

(source : 2016/12/30,National Energy Administration, China)



## From Japan

### ■Latest Refrigerant-related Activities in Japan ~ Risk Assessment of Mildly Flammable Refrigerants for Proper Utilization ~

In the air conditioning and refrigeration (AC&R) industry, a shift from the existing types of refrigerants to next-generation types of refrigerants with low global warming potentials (GWPs) must be implemented as soon as possible. However, since many of the next-generation types of refrigerants are mildly flammable, they must be subjected to risk assessment based on scientific findings.

Responding to this situation, the New Energy and Industrial Technology Development Organization (NEDO) launched a project called 'Technology Development of High-efficiency Non-fluorinated Air-conditioning Systems.' Working side by side with this project, the Japan Society of Refrigerating and Air Conditioning Engineers (JSRAE) created a Research Committee on Risk Assessment of Mildly Flammable Refrigerants, and the Japan Refrigeration and Air Conditioning Industry Association (JRAIA) set up a working group that performs risk assessment for each product category including room air conditioners (RACs), packaged air conditioners (PACs), variable refrigerant flow (VRF) systems, and chillers.

Additionally, JRAIA and JSRAE have set up a risk assessment deliberation system based on government, industry, and university collaboration including the University of Tokyo that participated in the NEDO project, and submitted a report on the results of risk assessment of R32, R1234yf, and R1234ze(E) by March 2016.

In September, the 'Risk Assessment of Mildly Flammable Refrigerants for Proper Utilization' won the Minister Prize of Economy, Trade and Industry, which is

the highest honor among the 19th Ozone Layer Protection and Global Warming Prevention Awards in Japan, since it was recognized that this project formulated highly valuable safety measures, an industry standard and a guideline for mildly flammable (A2L) refrigerants based on government, industry, and university collaboration.

In this project, methods for measuring various flammability characteristics of refrigerants were established, and various types of data such as the frequency of occurrence of a flammable volume when refrigerant leaked indoors or outdoors were collected. As a result of trial calculation of the fire breakout probability for each accident scenario, i.e. during air conditioner transportation, installation, and use, the fire breakout probability in all scenarios was demonstrated to be below the allowable probability. Thus, it was confirmed that R32, R1234yf, and R1234ze(E) can be used safely. However, since it was found that there is a probable risk in certain large products or installation spaces, additional countermeasures were developed, such as driving a fan in the indoor unit when a leak has been detected in order to reduce the concentration of leaked refrigerant gas by agitating it indoors, and industry guidelines were formulated for respective product categories.

Since there had been no regulations concerning mildly flammable refrigerants in the Refrigeration Safety Regulation that stipulates the safety of refrigerant use, charge, collection/recovery, transport, and storage, and also in the High Pressure Gas Safety Act, mildly flammable refrigerants have been subjected to severe regulations as in the case of strongly flammable hydro-carbon refrigerants. However, reflecting the results of risk assessment publicized this time, it has been decided that the regulation on mildly flammable refrigerants should be relaxed and mildly flammable refrigerants should be positioned as a type of inert gas provided that measures be taken to prevent the refrigerant from remaining during leakage etc.

At present, in the Japanese market, R32 is adopted in RACs and PACs. Due to the relaxation of regulations under the High Pressure Gas Safety Act, it has become possible to use R32 in VRF systems from now on. If VRF systems adopting R32 emerge, the Japanese market will exert a great impact on a global scale. While the timing of the launching of R32 VRF systems into the market depends upon each manufacturer's decision, since legal proceedings have been completed to a large extent, they are ready for shipment.

Tetsuji Okada, president of JRAIA, stressed the strengthening of information dissemination capability abroad as one of the global strategies Japan should implement. The relaxation of the regulation thanks to the current project is surely an example of information to be publicized overseas. Venues for such information dissemination are overseas expositions and international conferences. At the Chillventa exhibition held in October in Nuremberg, Germany, Mr. Okada made a presentation titled 'Implementation of Alternative Refrigerant Management in Japan Latest Activities for Safety.' In this presentation, he explained the background behind the choice of A2L refrigerant by Japanese manufacturers as an alternative for air conditioning products to facilitate the prevention of global warming. The latest activities in Japan include the Japanese government's policy and legislation for safer use, side by side with projects conducting risk assessment. JRAIA also emphasized the key factors which must be taken into account when other countries also adopt similar steps for risk assessment of mildly flammable refrigerants.

In reply to JARN's interview, Mr. Okada gave the following insight. "Ahead of other countries in the world, JRAIA is proceeding with various activities toward the prevention of global warming. At the same time, we are attaching importance to safety as one of the aims to which top priority should be given. To realize this, JRAIA regards it an important mission to promote safety-guaranteed products by

strictly checking the safety when using flammable refrigerants by performing risk assessment."

JRAIA intends to make the final report on the results of A2L refrigerant risk assessment at the International Symposium on New Refrigerants and Environmental Technology 2016 (Kobe Symposium) to be held in Kobe in December.

Through joint government, industry, and university collaboration, Japan is resolved to deploy products by emphasizing not only advanced technologies but also top-level safety.

(source : 2016/11/25,JARN)

### **■Relaxing Regulations, Japan Builds Momentum for Mildly Flammable Refrigerants ~Report of the Kobe Symposium 2016~**

Held once every two years and organized by the Japan Refrigeration and Air Conditioning Industry Association (JRAIA), the International Symposium on New Refrigerants and Environmental Technology 2016 (Kobe Symposium 2016) successfully concluded on December 2 in the port city of Kobe in Japan. A number of research findings were presented, and the Symposium posted record attendance of nearly 600 air conditioning and refrigeration (AC&R) industry professionals.

(source : 2016/12/25,JARN)

### **■Comments on Impact of HFC Phase-down from Global Association Leaders ~JRAIA~**

Following the Paris Agreement reached at the COP21 event in December last year, HFC phase-out was agreed upon as the Kigali Amendment at the MOP28 event held in October this year with the participation of representatives of many nations in the world. While the Paris Agreement aims at further improvement of energy efficiency

and requires further reductions in HFC emissions, the Kigali Amendment requires step-by-step reductions in HFC production and consumption from a long-term point of view. Both the Paris Agreement and the Kigali Amendment pursue the replacement of refrigerants now in use by refrigerants that are friendly to the global environment. However, since most refrigerant : that are friendly to the global environment have flammability to some extent, JRAIA has taken the lead in the field of risk assessment of mildly flammable refrigerants, starting about five years ago. JRAIA also have been urging the Japanese Government to relax regulations on mildly flammable refrigerants, resulting in the recent Japanese regulation relaxation. In this manner, conditions to introducing mildly flammable refrigerants for commercial uses into the market are being prepared in Japan. From now on, education and instructions concerning safety will become an important issue. Toward that end JRAIA is ready to extend cooperation to the greatest extent possible.

(source : 2016/12/25,JARN)

### **■Current Market news in Japan**

The Japanese economy is continuing to show a gradual upswing reflecting the improving employment/income environment, dropping crude oil prices, and other factors influenced by the implementation of economic and fiscal policies. However, the real GDP in 2015 showed only 0.8% growth. The main cause was a drop in private consumption expenditures.

According to a breakdown of domestic chiller shipments in fiscal year 2015 (end March 2016) from the Japan Refrigeration and Air Conditioning Industry Association (JRAIA) data, centrifugal chillers showed a 12.5% increase, absorption chillers showed a 7.4% increase, and positive displacement type chillers showed a 3.6% increase, thus showing a marked upturn.

From now on, it is predicted that domestic chiller shipments will continue to show a

mild upturn. Among underlying factors supporting this prediction, ongoing large-scale urban redevelopment in view of the Tokyo Olympics in 2020, the replacement of existing equipment, and 17 projects in the Special Economic Zone in Tokyo dominate. Domestic chiller shipments during the run-up to the Tokyo Olympics will very likely peak in 2019.

(source : 2016/11/25,JARN)

efficiency heat pump systems in these regions will be confirmed.

In addition, a workshop will be held annually among the countries participating in the AHPNW, and the above-mentioned research results as well as measures and recommendations for the expansion of the use of high-efficiency heat pump systems will be shared by government officials of the AHPNW member nations and industry representatives.

(source : 2016/12/25,JARN)

### **■HPTCJ Starts Joint Project to Expand the Use of Heat Pumps**

The Heat Pump and Thermal Storage Technology Center of Japan (HPTCJ) has been promoting the understanding of heat pumps and thermal storage systems in Southeast Asia joining with the International Copper Association (ICA) and the Japan Copper Development Association (JCDA) through the activities of the Asian Heat Pump Thermal Storage Technologies Network (AHPNW).

With the Paris Agreement coming into effect, HPTCJ, ICA, and JCDA taking into account that preventing global warming is an urgent issue facing every Asian country, reached an agreement to implement a joint project aimed at expanding the use of heat pump technology to an even greater extent. On October 13, 2016, the three organizations signed up for a project prospectus titled 'ICA Project Proposal'. By implementing this project as a new activity of the AHPNW, heat pump systems, which include air conditioning and refrigeration equipment and water heaters, will be widely used in Asia, thus contributing to CO<sub>2</sub> emissions reductions.

The ICA Project Proposal will carry out research into the heat pump market in Japan, Korea, and Taiwan from January 1, 2017 to December 31, 2019 to find out to what extent high-efficiency heat pump systems are penetrating the markets and to examine their future potential. Then, tasks and measures for further growth of high-



## Asian Heat Pump Thermal Storage Technologies Network

To promote energy savings and combat global warming, there is an urgent need to spread efficient heat pump and thermal storage technologies on the demand side. Countries in Asia, which are enjoying rapid economic growth, should coordinate with one another to spread this technology. Five to ten years from now, Asia will become a global economic powerhouse and heat pump technologies will play a considerable role in all sectors. Asian countries will therefore need to address common issues and problems that have already been faced in Europe and North America. Concerning the building of connections and networks among countries, it is essential to share information on diffusion policies, technology trends, applications, etc., and then to make incremental improvements. Further, situations which can or should be handled through collaboration should be handled flexibly, on a case-by-case basis, with the collaboration of all countries. In order to encourage the use and development of heat pump and thermal storage technologies in Asian countries we have established AHPNW in 2011.

### Participating Countries and Entities

**CHINA:** China Academy of Building Research (CABR)

**INDIA:** The Energy and Resources Institute (TERI)

**JAPAN:** Heat Pump and Thermal Storage Technology Center of Japan (HPTCJ)

**KOREA:** Korea Testing Laboratory (KTL)

**VIETAM:** Hanoi University of Science and Technology (HUST)

**THAILAND:** King Mongkut's University of Technology Thonburi (KMUTT)

**INDONESIA:** Heating, Cooling & Thermo Fluids Technology Indonesia (HCTFTI)

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