1 Feature

Environment

Dissemination of Next-Generation Refrigerants

Taking the Next-Generation Refrigerant R32 around the World

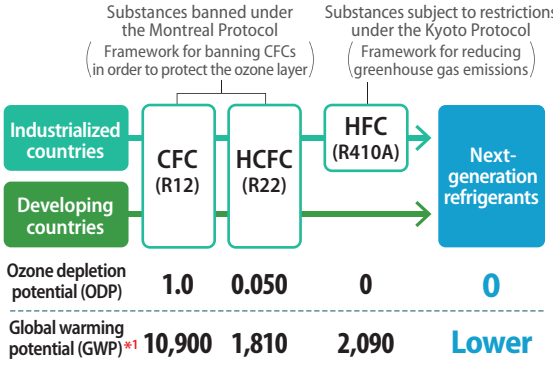
Next-Generation Refrigerants Protecting the Ozone Layer and Reducing Global Warming

Refrigerants are crucial to air conditioning, circulating inside the air conditioner and transporting heat. However, the Montreal Protocol and the Kyoto Protocol restricted the use of conventional refrigerants that deplete the ozone layer and contribute to global warming, and the world needs refrigerants that mitigate these harmful effects. Industrialized countries have already converted to HFCs like R410A that don't deplete the ozone layer, but these refrigerants still have the problem of having a high global warming impact.

In 2013, developing countries began phasing down the use of conventional HCFC refrigerants. Air conditioner demand is growing in developing countries, and if these countries follow industrialized countries in adopting R410A, global warming will accelerate. It is therefore crucial that the world convert to a next-generation refrigerant. Industrialized countries are also aiming to reduce HFC emissions and concerned parties are actively seeking to find next-generation refrigerants.

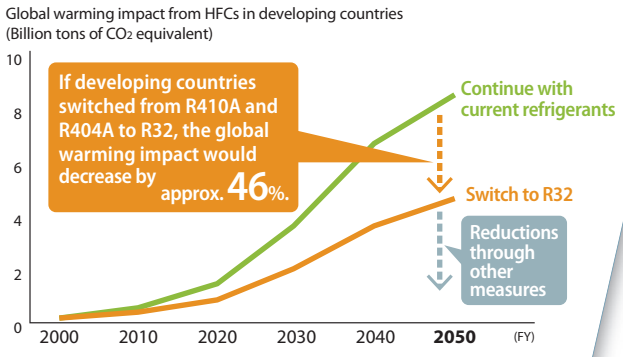
As the world's only company making both air conditioners and their refrigerants, Daikin has been searching for and developing next-generation refrigerants. Our efforts have led us to choose R32, which has a low global warming impact.

Air Conditioner Refrigerants: Environmental Impact and Transition



*1 GWP is quoted from the Fourth Assessment Report of the IPCC and the Japan Fluorocarbon Manufacturers Association.

Effect of Dissemination of R32 (Projection)



Note: This projection was created based on Supporting Information from "The large contribution of projected HFC emissions to future climate forcing" Guus J. M. Velders et al. The graph shows the effect of converting 100% of R410A usage and 50% of R404A usage to R32.

Production line in Thailand making R32-refrigerant air conditioners, which went on sale in March 2014

At trade fairs and showrooms around the world, Daikin is promoting the R32 refrigerant.

Daikin's Approach

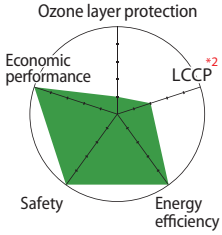
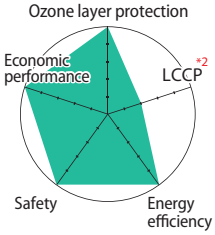
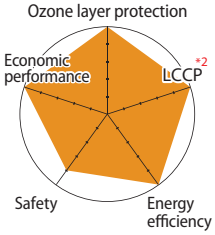
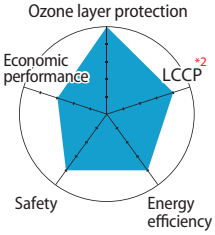
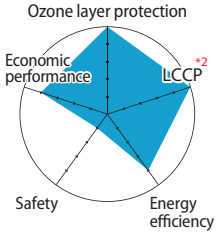
Daikin First to Adopt R32, with One-Third the Global Warming Potential of Conventional Refrigerants

Choosing a next-generation refrigerant must take into consideration not just environmental performance, but also other overall factors such as safety and economic performance. Moreover, converting to a new refrigerant must take into account a range of international standards including those of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), as well as domestic regulations and standards of each country.

As a result of our participation in international discussions and our own assessments and studies, Daikin has determined that as of the present time, R32 is the most suitable refrigerant. We made this decision because R32 has just one-third the global warming potential of R410A and it can be easily recovered and reused. It is also offers high energy efficiency and so less of it is needed per air conditioner than other refrigerants.

In fiscal 2012, Daikin released the world's first residential air conditioner using R32. Our goal is to have R32 used around the world.

Characteristics of Possible Next-Generation Refrigerants (for Residential and Commercial Air Conditioners)

Refrigerants currently used in developing countries	Refrigerants currently used in industrialized countries	Next-generation refrigerants		
R22 (HCFC)	**R410A** (HFC)	**R32** (HFC)	**R1234yf** (HFO)	**R290** (Propane)
				
Global warming potential (GWP) *1 1,810	2,090	675	4	3.3

*2 LCCP: Life cycle cost performance. Global warming impact over the entire lifecycle of the air conditioner (impact of air conditioner use and refrigerant emission).

International conference (UNEP Montreal Protocol Meeting)

R32 Air Conditioners Launched in Europe and Australia, Too

Daikin launched residential air conditioners using the R32 refrigerant in Japan and India in fiscal 2012. Since 2013, an increasing number of other air conditioner manufacturers have been releasing R32 air conditioners, mainly in Japan, as R32 gains growing recognition as a next-generation refrigerant.

In Europe, work is underway for a 2015 enactment of a revised version of the F-Gas Regulation which supports the phase-down of fluorinated greenhouse gases (F-gases). Daikin provided technical information on R32 to industry groups and other relevant organs so that regulations would have sufficient content to go into effect. In November 2013, Daikin Europe N.V. launched a residential air conditioner using R32, and in January 2014 sales of the product began in Australia. We plan to launch R32 air conditioners in a growing number of regions around the world.

Working with Governments and Local Companies to Disseminate R32 in Developing Countries

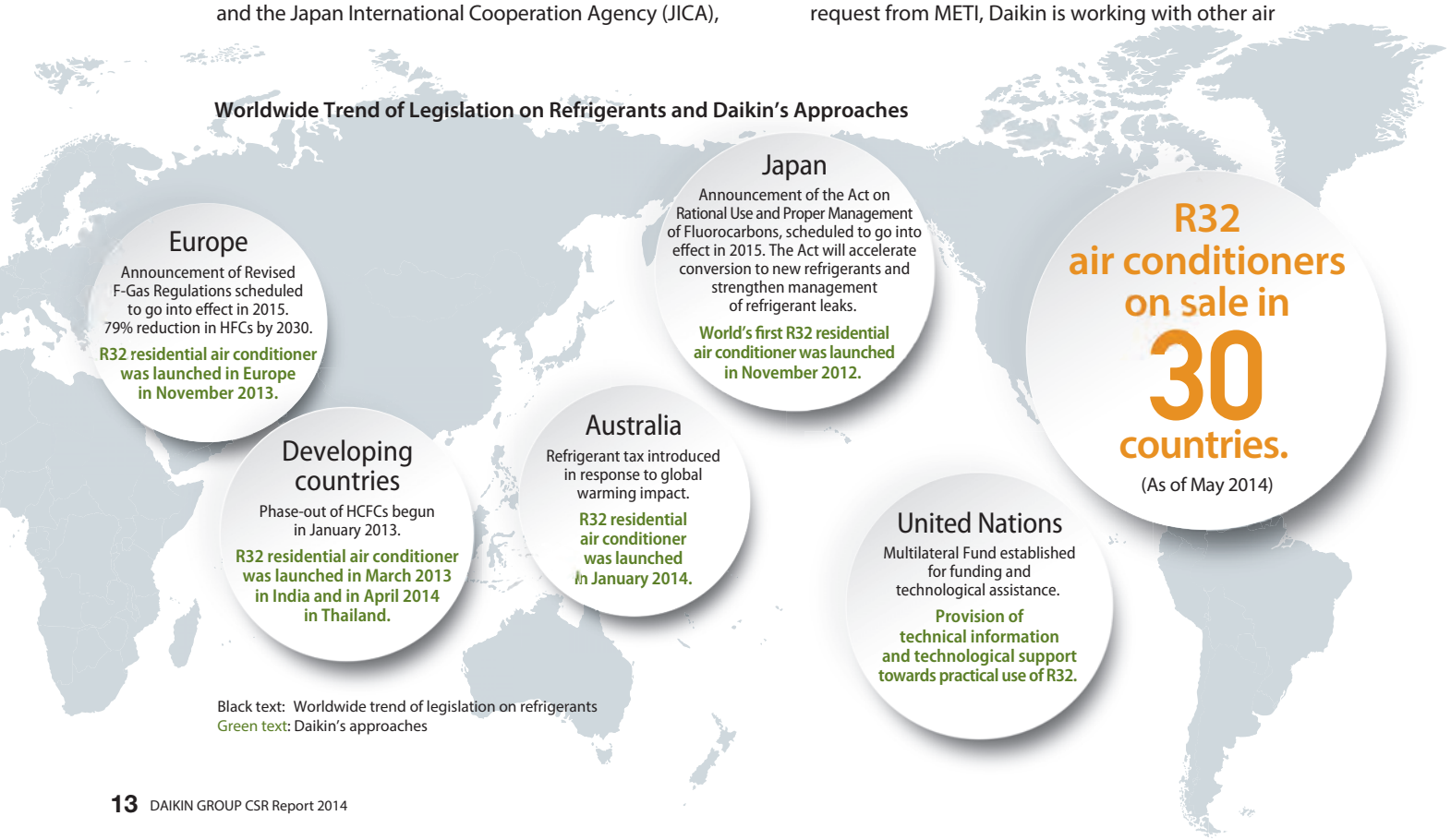
The conversion to next-generation refrigerants is not far off for developing countries, and to increase accessibility to R32 in developing counties, Daikin is giving free access to its "Basic Patent Indispensable for the Manufacture and Sale of Air Conditioners Using R32 Single Component Refrigerant." Daikin also participated in a developing country support program sponsored by organs such as Japan's Ministry of Economy, Trade and Industry (METI) and the Japan International Cooperation Agency (JICA), under which we hosted trainees from developing countries and provided manufacturers and sales companies in these countries with technical support.

R32 is highly energy efficient: using it to replace the conventional R22 (HCFC) refrigerant would save up to 10% in electricity consumed. And combining R32 with inverter technology would further reduce electricity consumption.

In fiscal 2012, Daikin was chosen for inclusion in METI's Global Warming Mitigation Technology Promotion Project, under which the company conducted tests in India showing how R32 inverter air conditioners can effectively reduce CO_2 emissions. In December 2013, with the cooperation of METI and the Energy Conservation Center, Japan, we held a seminar as part of efforts to disseminate highly efficient air conditioners. The event was successful in promoting understanding of R32 as we presented the results of the tests and explained the benefits of R32 to the audience, which included the Indian government officials and some members of the Refrigeration And Air Conditioning Manufacturers Association (RAMA).

Daikin also took part in a project to convert to R32 in Thailand, where METI is offering financial aid as part of support for developing countries under the Montreal Protocol. R22 use will be banned in Thailand starting in 2017, and the Thai government's policy is to convert from R22 to R32 as a next-generation refrigerant. On request from METI, Daikin is working with other air

Worldwide Trend of Legislation on Refrigerants and Daikin's Approaches



Black text: Worldwide trend of legislation on refrigerants
Green text: Daikin's approaches

Daikin is building an R32 distribution network in India.

At Daikin plants, we provide visiting government officials with technical information on R32.

conditioner manufacturers to help Thai manufacturers convert to R32 and is offering technical training to Thai service engineers. In April 2014, we launched an R32 air conditioner in Thailand.

Daikin is also taking part in a United Nations-led project to convert refrigerants in the Gulf nations. Middle Eastern countries are looking at R32 as a potential next-generation refrigerants, and Daikin is providing relevant government officials and local air conditioner manufacturers with the information needed to choose a next-generation refrigerant.

We are also continuing to use international conferences and visits by foreign government officials to Japan as opportunities to provide technical information on R32 and thus help disseminate this refrigerant.

And to build a refrigerant distribution network needed to disseminate R32, we are maximizing our strength as a refrigerant manufacturer.

Stakeholder's Voice

R32 an Important Refrigerant for India, Where Air Conditioners are Being Disseminated

P.K. Mahindra

Senior Officer, Refrigeration And Air Conditioning Manufacturers Association (RAMA)

The dissemination of R-32, which is a low-GWP and energy efficient refrigerant, is being promoted by Daikin, which is providing technical information and service training. We consider R-32 as one of the most important refrigerants for air conditioners as it contributes to the mitigation of global warming.

In India, there is a big rise in the income levels and aspirations of the middle class, which is leading to a great increase in air conditioner sales. Due to this, there are growing concerns about the exponential increase in electric power consumption.

We firmly believe that the promotion and propagation of air conditioners with R-32 in India will lead to reduction in the electric power consumption and also an increase in the customers' consciousness about environment conservation and energy savings, at the same time meeting their cooling needs.

R32 Adopted in Commercial Air Conditioners

Daikin is working to take R32 adoption beyond just residential air conditioners. In November 2013, we launched the FIVE STAR ZEAS, the first light commercial air conditioner using R32.

In Japan, Daikin conducted risk assessment as part of a team of experts that included the Japan Society of Refrigerating and Air Conditioning Engineers (JSRAE), government research institutes, universities, and air conditioner companies. The parties assessed the safety of mildly flammable refrigerants through numerous tests.

Although R32 is being disseminated in countries worldwide, Daikin's refrigerant research is far from over. We continue our quest for the ideal refrigerant, one best suited to each application, as we strive to contribute to protecting the ozone layer and mitigating global warming.

Increasing Variety of Air Conditioners Using R32 (Japan)

Air conditioners on market using R32

Residential air conditioners → **Light commercial air conditioners**

Honors for R32 residential air conditioners

Fiscal 2012

- **Minister's Prize, the Ministry of Economy, Trade and Industry in the fiscal 2012 Grand Prize for Excellence in Energy Efficiency and Conservation**

Fiscal 2013

- **16th Ozone Layer Protection/Global Warming Protection Award**
- **The Prime Minister's Prize, 5th Monodzukuri Nippon Grand Award**

Honors for R32 commercial air conditioners

Fiscal 2013

- **Director-General's Prize, The Agency for Natural Resources and Energy, 2013 Grand Prize for Excellence in Energy Efficiency and Conservation**

In November 2013, Daikin launched the FIVE STAR ZEAS, the world's first* commercial air conditioner using R32. Recognized for its high energy efficiency, the product received the Director-General's Prize, The Agency for Natural Resources and Energy, 2013 Grand Prize for Excellence in Energy Efficiency and Conservation.

* According to Daikin (launched on November 1, 2013)