



"Next-Generation Refrigerants for Energy Efficiency and Climate Protection"

5th March'2014

Daikin Air-conditioning India Pvt. Ltd.

Daikin Worldwide

Daikin Industries Ltd.

- Turnover: 1.3 Trillion Yen
- No. of employees: 51,398
- Start of business: 1924

(FY2012 Consolidated)

Air conditioners, heat pumps, refrigeration

86.8%

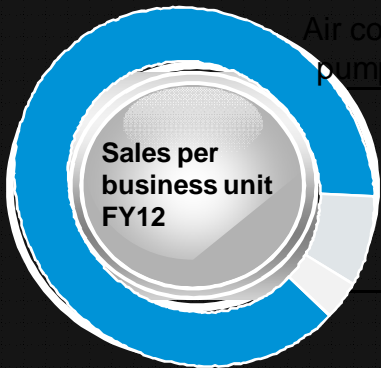
Chemicals

9.6%

Other

3.6%

Sales per business unit FY12



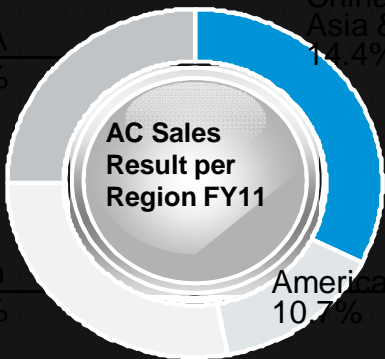
China: 18.2%
Asia & Oceania: 14.4%

AC Sales Result per Region FY11

EMEA
18.4%

Japan
38.3%

America
10.7%



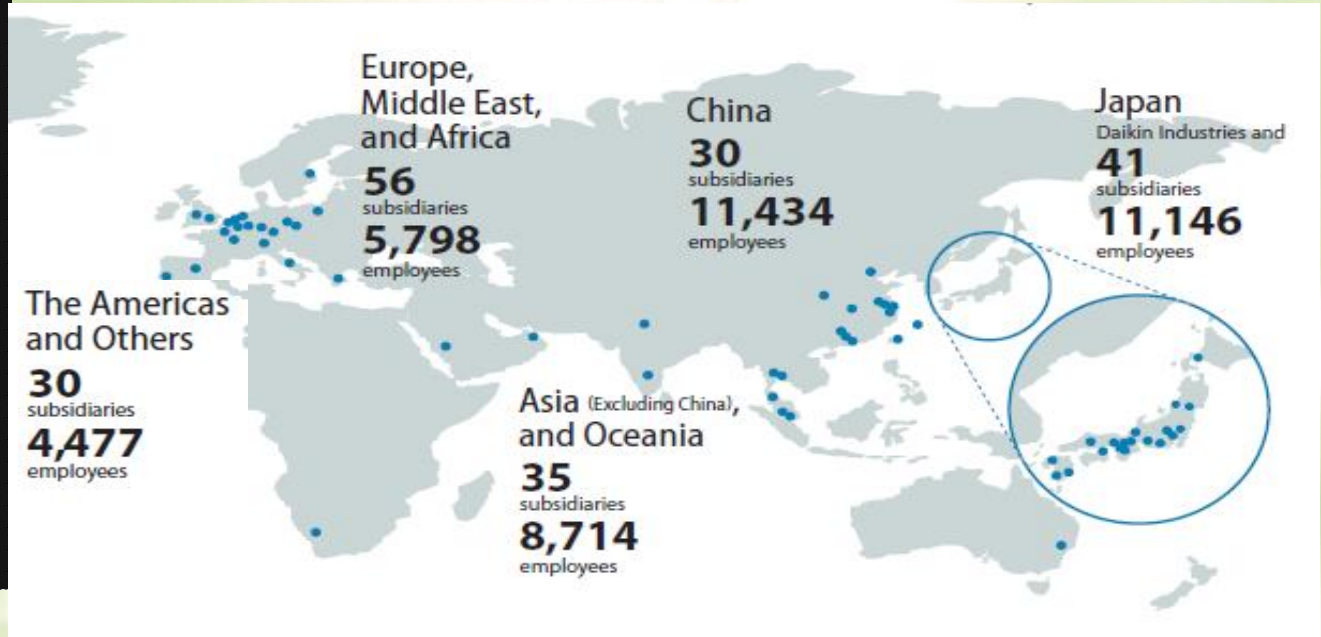
Daikin Industries, Ltd is one of leading air conditioner manufactures. Our product range is from residential to commercial air conditioners.

Daikin has over 51,000 employees at 207 group companies around the world.

Daikin Air-Conditioning India was established in 2000.

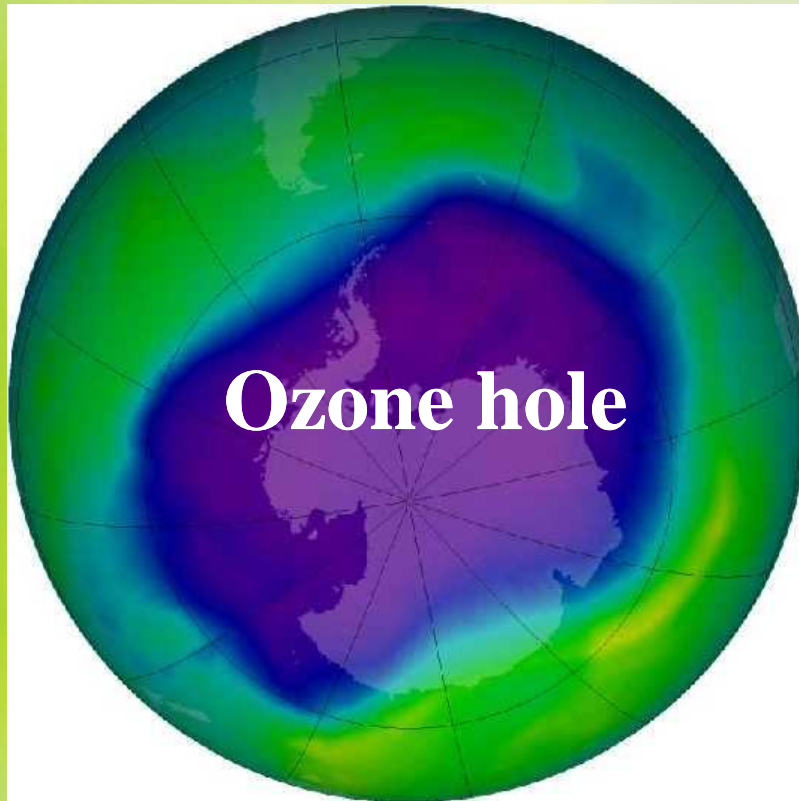


Daikin Group Worldwide

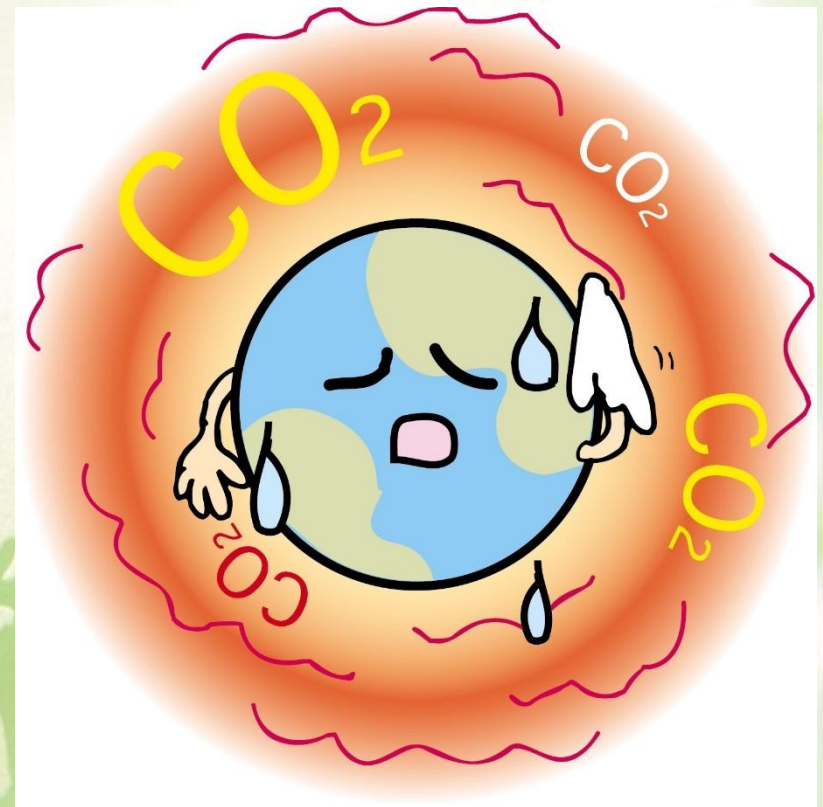


Urgent Environment Issues

Ozone depletion



Global Warming

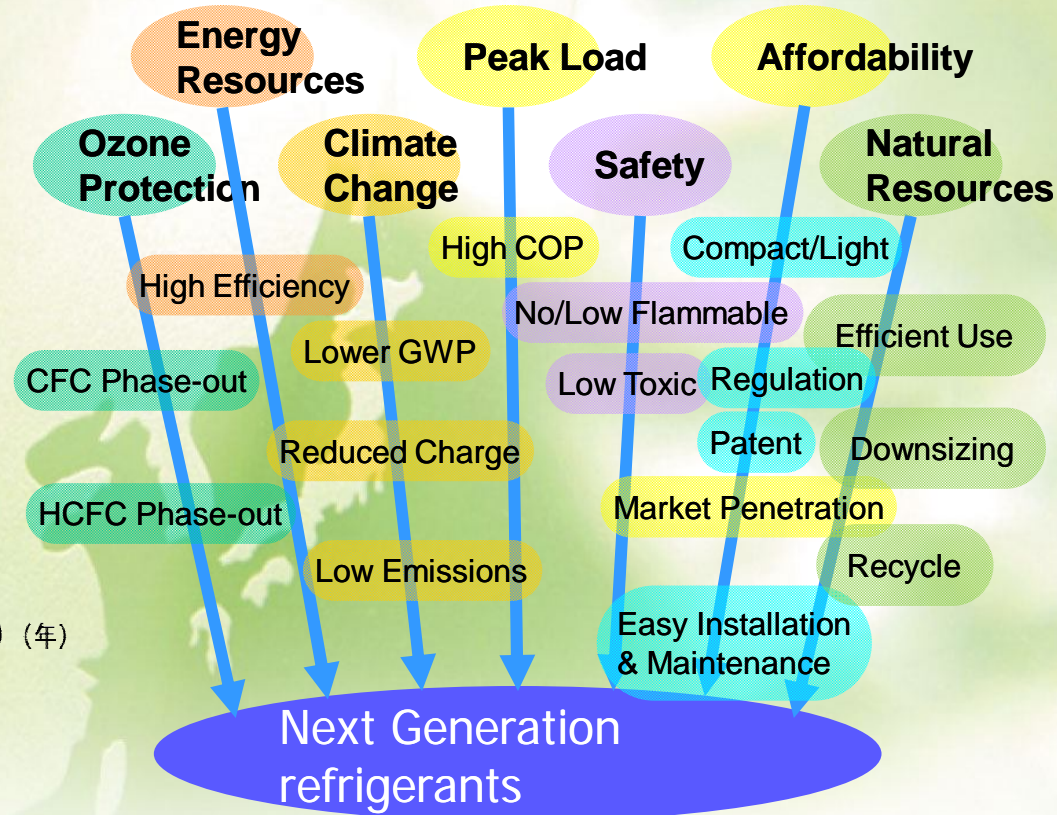
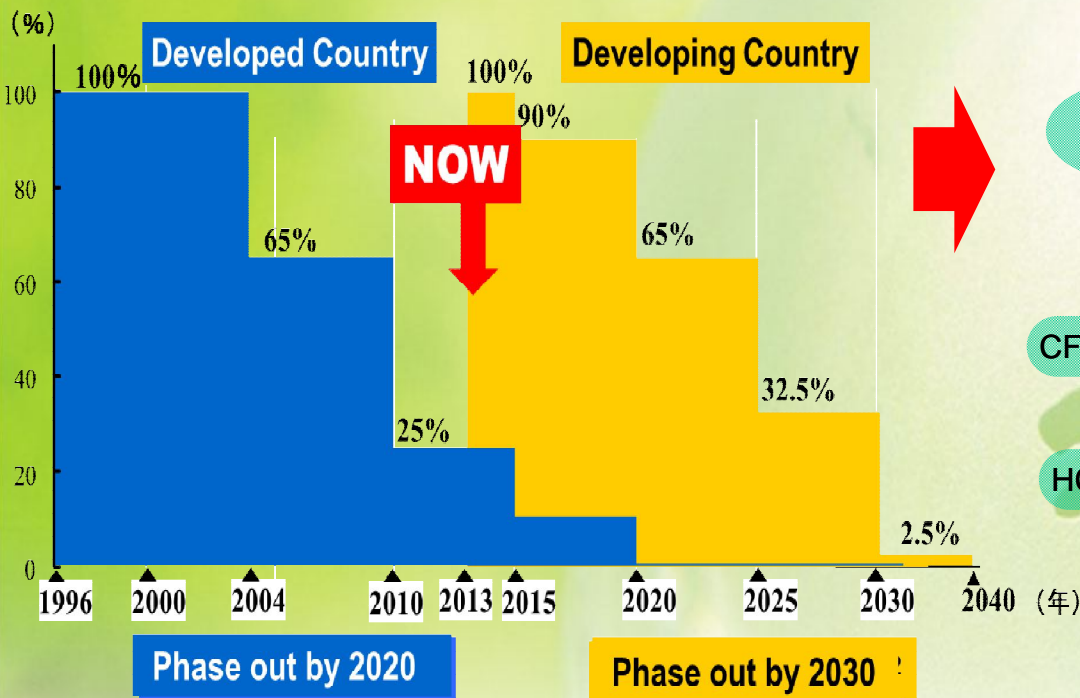


HCFC Phase out and change of Refrigerant

In developing countries, HCFC22, or R22, is one of main stream refrigerants for air conditioners. R22 must be phased out due to its ODP and converted to substances with zero ODP. When making choice for alternative to R22, various aspects must be taken into account.

HCFC (ex. R22) Phase out Management Plan (HPMP) started in Developing Country

Screening Factors for the Alternative Refrigerant



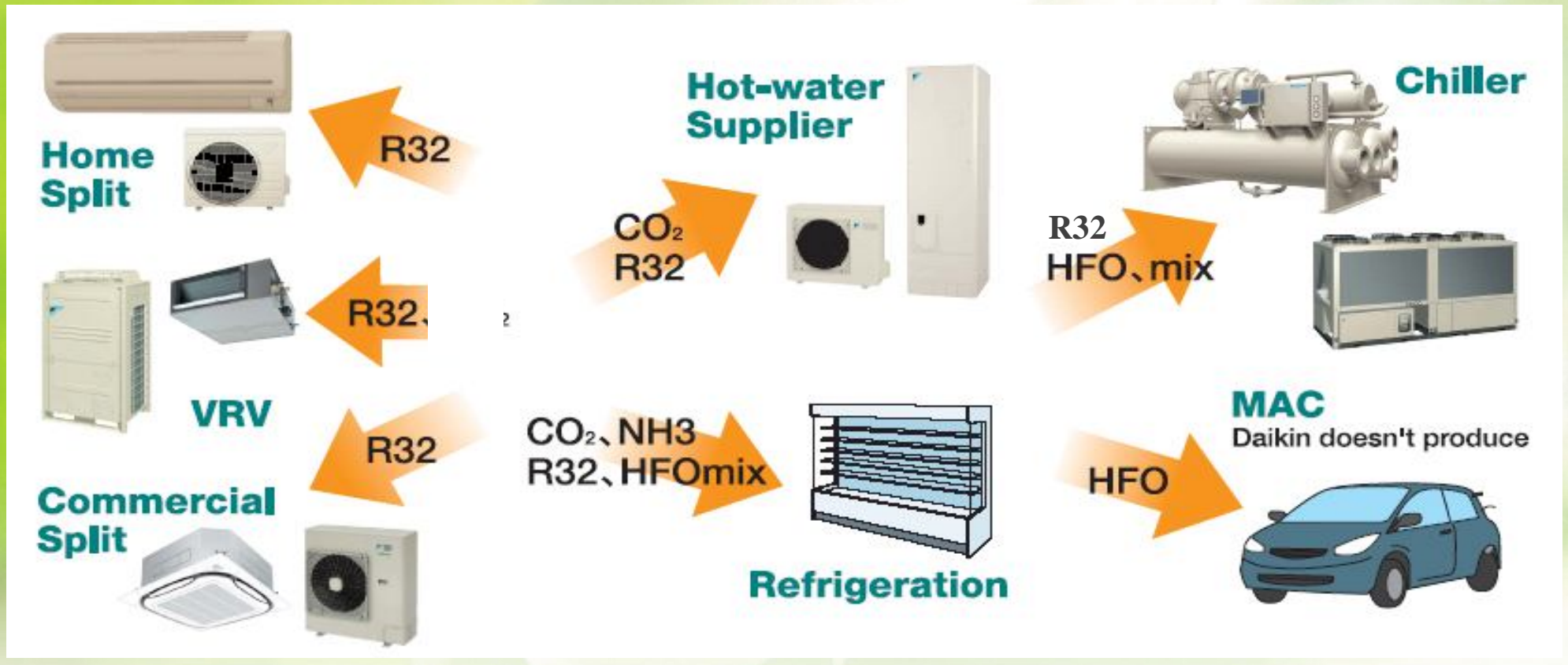
Refrigerant Candidates for Stationary ACs

Refrigerants		Properties					
		P_{cond} (MPa)	Vol. Cool. Capacity (vs R22)	Theoretical COP (vs R22)	ODP	GWP (IPCC4th)	
	R22	Single	1.73	100	100	0.05	1810
HFC	R407C	Zeotrope	1.86	102	99	0	1770
	R410A	Azeotrope	2.72	141	92	0	2090
	R32	Single	2.80	160	97	0	675
	R1234yf	Single	1.16	57	90	0	4
	HFO-Mix	Zeotrope	?	?	?	0	?
Non-HFC	R717(NH ₃)	Single	1.78	116	106	0	0
	R290 (Propane)	Single	1.53	83	98	0	<3
	R744 (CO ₂)	Single	10	243	41	0	1

Candidates for the next generation working fluids

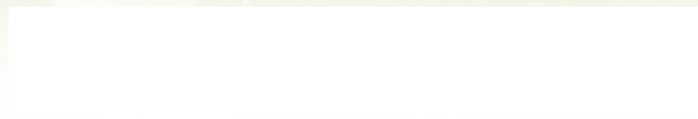
Diversity of Refrigerant Choice

- There is no one-size-fits-all solution
- All refrigerant are included on the table of refrigerant choice
Choose whatever refrigerant is best suited for each application.
- Daikin is developing R32 split Air-conditioners from residential to light commercial range because R32 is better suited to these applications



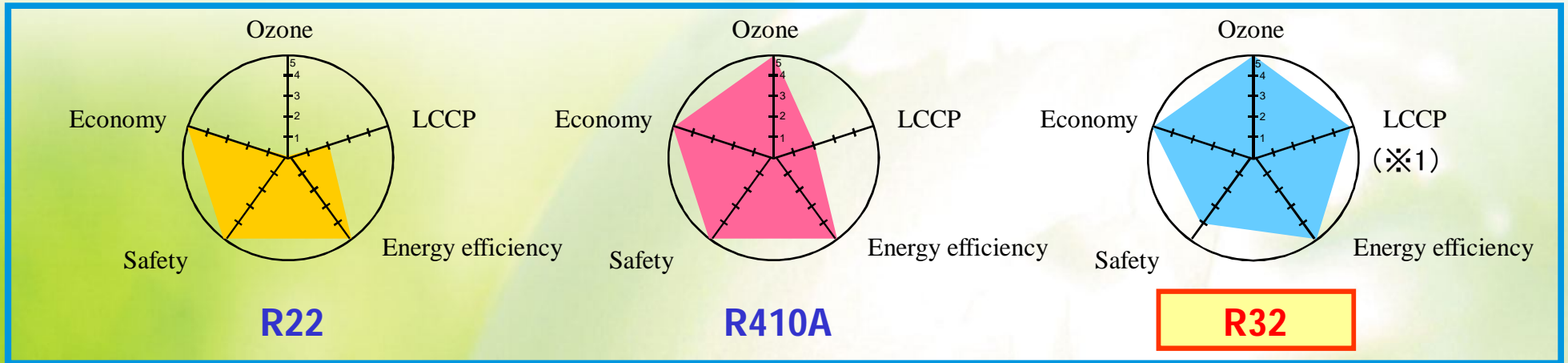


Superior Performance of R32

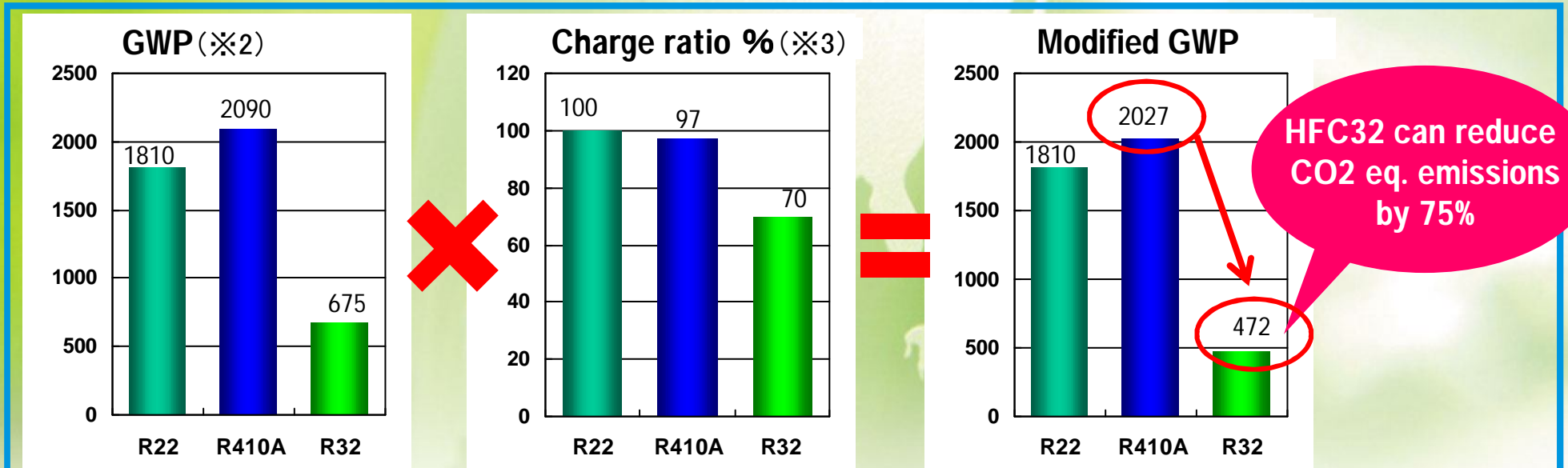


Total Assessment of Refrigerant

R32 is the most balanced Refrigerant and can reduce GWP by 75%



(※1) LCCP: (Life Cycle Climate Performance)



HFC32 can reduce CO2 eq. emissions by 75%

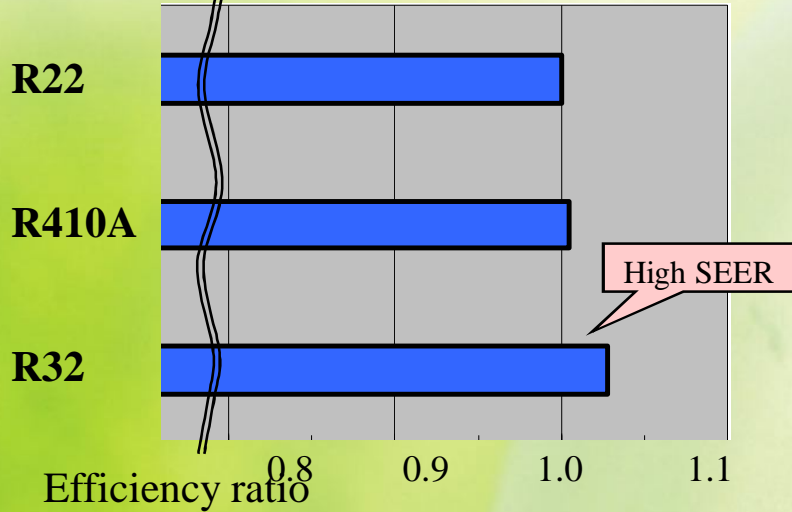
(※2) Based on IPCC 4th report (※3) In case that all refrigerant have the performance equivalent to R22



Energy efficiency and Total Emissions

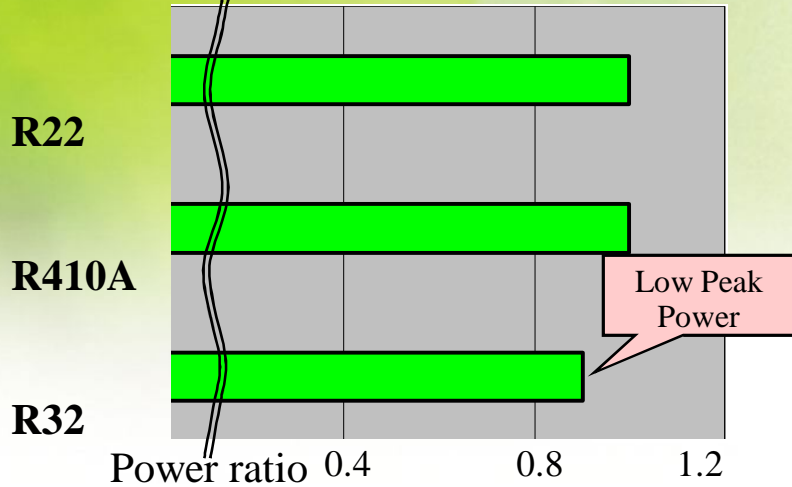
1. SEER Comparison (cooling mode)

HPs (Reversible) - 3.5kW-Room AC



2. Peak power comparison

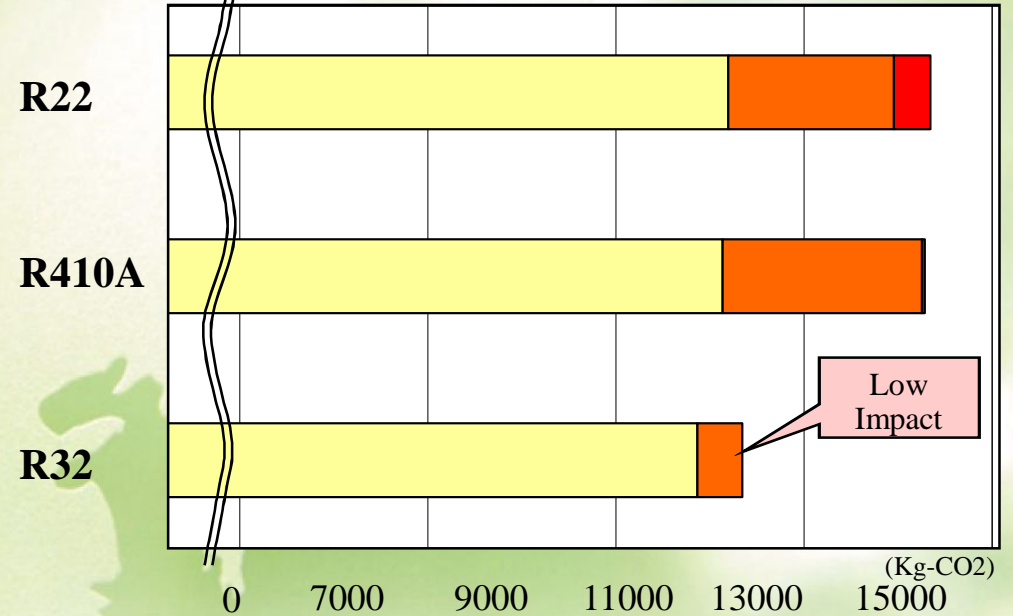
under cooling condition Outside 35°C, room 27°C



3. Total Emissions (LCCP comparison)

LCCP: Life Cycle Climate Potential

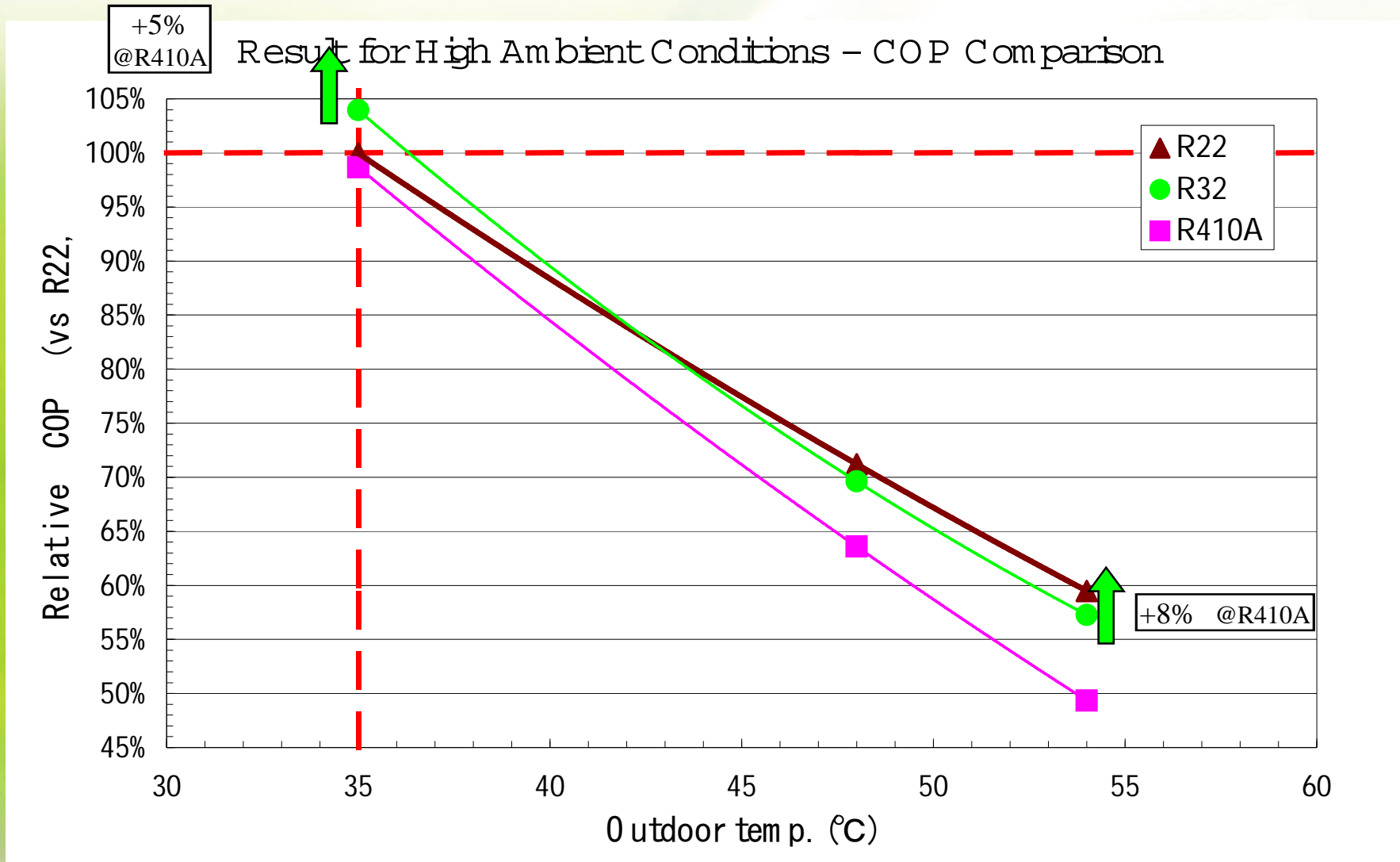
$$\text{Total Emissions} = \text{(1) Indirect Emissions} + \text{(2) Direct Emissions} + \text{(3) Emissions During Refrigerant Production}$$



R32 is the best solution for global environment.

(Precondition for Calculation) *1 Taking low pressure loss into consideration, narrower HEX was used to reduce charge volume. *2 To improve efficiency, HEX size was increased: Indoor HEX x 1.1 + Path x 2, Outdoor HEX x 1.2, and connecting pipe increased from 3/8" => 5/8" *3 To meet IEC requirements, charge volume was reduced: Indoor HEX x 0.8, Outdoor HEX x 0.5, narrower piping was used. *4 To improve efficiency: Outdoor unit HEX was increased x 1.1 (HEX= Heat Exchanger)

High Ambient Temperature Performance



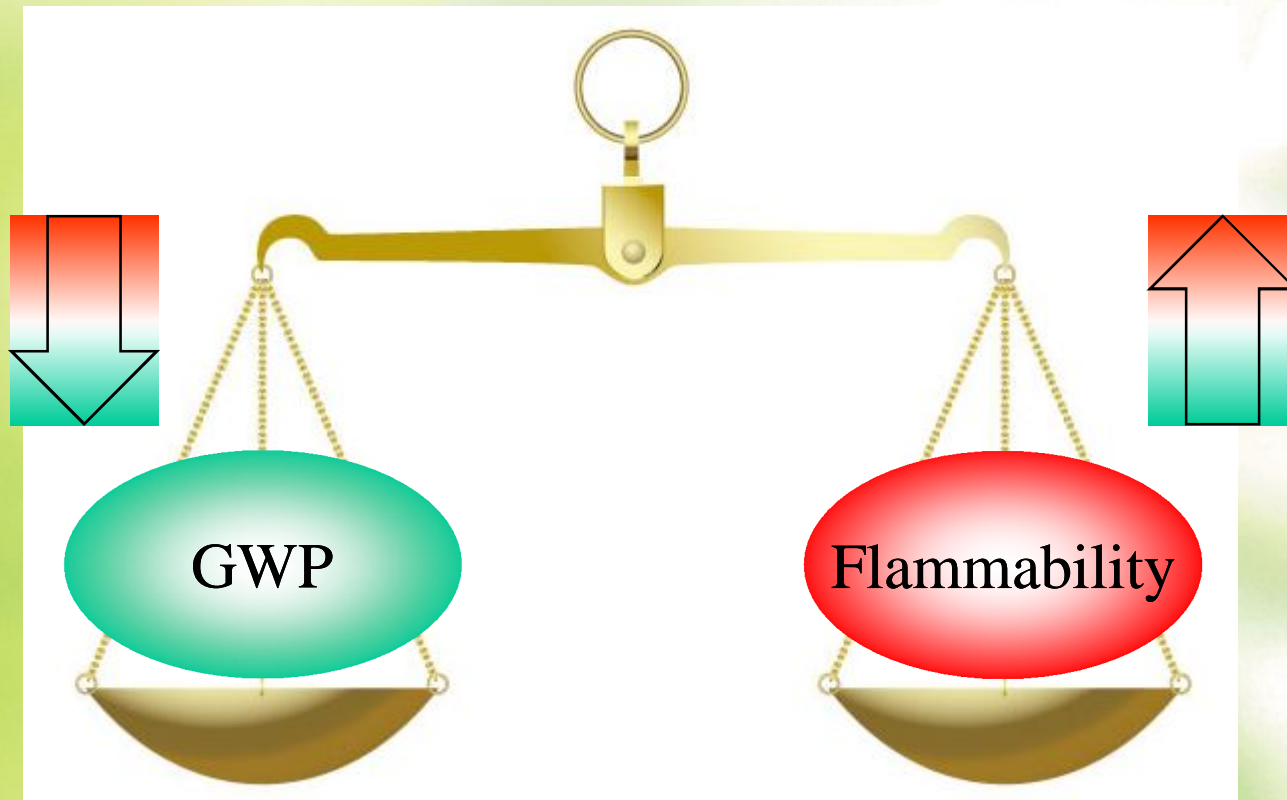


Refrigerant and Flammability



Global warming and Flammability of Refrigerant

Tradeoff relation between Global warming and Flammability



Safety Comparison

Consideration of 2L classification by ASHRAE and ISO.

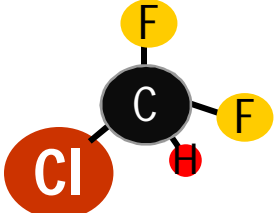
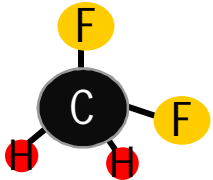
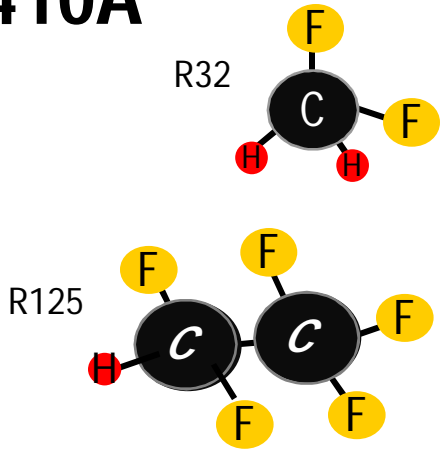
Class	Class 1 No Flammable	Class 2L Slightly flammable Burning Velocity (≤ 10 cm/s)	Class2 Low flammable	Class3 Higher flammable
Example	CO2 R410A R22	R32 R1234yf Ammonia (higher chronic toxic)	R152a	Propane




The burning velocity (<10 cm/s) is too slow to cause horizontal flame propagation nor explosion.

Evaluated after long discussion in ASHRAE

Flammability of 2L refrigerants is very low.

What is R32 ?

Refrigerants	ODP	GWP (IPCC4)	Flammability (ASHRAE34)
R22 	0.055	1810	1
R32 	0	675	2L
R410A 	0	2090	1

Atoms	Advantage	Disadvantage
	Good Solubility with Mineral Oil	Ozone Depletion
	Anti-Combustible	Higher GWP
	Lower GWP High Performance	Combustible

When does Fire Accident Occurs ?

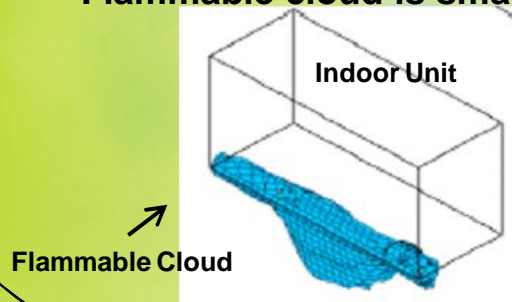
A fire accident triggered by flammable refrigerant can only occur when all 3 conditions are met.

1. Occurrence of Rapid Refrigerant Leakage

Rapid leakage is rare

2. Mixture with Oxygen

Flammable cloud is small



3. Contact with Ignition Source

Cannot be ignited from Switch or Cigarette lighter



Main Standards related Refrigerant

ISO5149 was re-voted (Nov.11, 2013)

⇒ Received the information from the ISO central office (Jan 13,2014)
that ISO5149-1, 2, 3 are all approved.

Field 分野	International 国際規格	Europe 欧州規格	US (affects ME&A) 米国及び中東
Refrigerant Classification 冷媒分類	ISO817FDIS → approved(2014)	-NA- (based on ISO)	ASHRAE 34 UL 2182
Usage Restriction for Safety 冷媒の安全使用	ISO5149FDIS	EN378	ASHRAE 15
	IEC60335-2-40 Under revision	EN60335-2-40	UL 207、UL 250 UL 471、UL 474 UL 484、UL 984 UL 1995 UL 60335-2-40

The standard of many countries is referring to ISO or has quoted ISO.

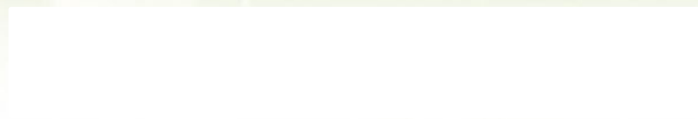
ex. Japan (KHK), China (GB standard), Australia

Asian countries are also gazing at the trend of Japan, China, etc.

Part	Content	Voting by the Participate members				Voting by the Participate and Observed members (Only dissenting votes counted)				Judgment
		Affirmative votes	Valid votes	% affirmative	Result	Dissenting votes	Valid votes	% dissenting	Result	
1	Definitions, classification, etc.	15	19	79%<66%	Majority affirmative	5	32	16%<25%	Minority dissenting	Approved
2	Design, construction, etc.	15	18	83%>66%	Majority affirmative	4	31	13%<25%	Minority dissenting	Approved
3	Installation, etc.	16	19	84%>66%	Majority affirmative	4	31	13%<25%	Minority dissenting	Approved



Modification in Manufacturing & Service Process



Design Changes for R32 from R22

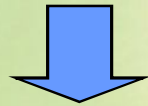
	Flammability	Operating Pressure	Discharge Temp.	Refrigeration Oil
<p>R32 Residential Air-conditioner</p>	<p>Safety Standard Refrigerant Charge Service manual</p> <p>Mildly Flammable Class 2L</p>	<p>Pressure Design Design Pressure R32: 4.29MPa R410A :4.15MPa</p> <p>1.6 times</p>	<p>Control Control of Suction States</p> <p>+10 to +20 degC</p>	<p>Contaminants Control Synthetic Oil</p> <p>Solubility</p>
<p>R410A Residential Air-conditioner</p>	<p>Non-Flammable Class 1</p>	<p>Medium Pressure 2.9MPa</p>	<p>Medium Temp.</p>	<p>Mineral Oil Suniso</p>
<p>R22 Residential Air-conditioner</p>				



Capacity Building in India

R32 Service Technician Training in India

- Project conducted under Feasibility Study Program for energy efficient home appliances sponsored by METI
- Daikin established a technician training program to expand the Indian servicing network for R32
- 76 sessions were given and **3,600 local installers** were trained in this project















Through this project India is developing the necessary expertise to service R32 equipment throughout the country.

Locations of Training Sessions

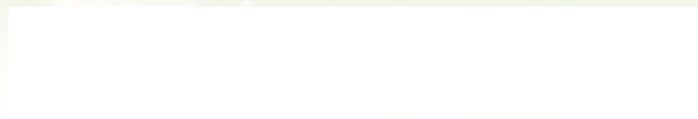


Service Tools Compatibility

Tools (*)	R32	R410A	R22
(1) Gauge manifold 	Compatible		
(2) Charging hose 	Compatible		
(3) Scale 	Compatible		
(4) Pipe bender 	Compatible		
(5) Flare tool 	Compatible		
(6) Torque wrench 	Compatible		
(7) Pipe cutter 	Compatible		
(8) Cylinder adaptor 	Compatible		
(9) Vacuum pump 	Compatible		
(10) Refrigerant recovery unit 	Compatible		
(11) Refrigerant recovery cylinder 	Compatible		
(12) Electric gas leak detector 	Compatible		



Progress on Launch of R-32 Air-conditioners



DAIKIN

Launching R32 Room AC in Japan

Daikin launched the world's first air conditioners to use R32 into the Japanese market on November 1, 2012.

The 4.0, 5.6, 6.3 and 7.1 kW models of Uru Sara 7 residential-use air conditioners have received awards from the Energy Conservation Center of Japan.

FY2012 Grand Prize for Excellence in Energy Efficiency and Conservation

Minister's Prize, The Ministry of Economy, Trade and Industry

Product Category & Business Model Category

Specified Models: S40PTRXP, S56PTRXP
S63PTRXP, S71PTRXP

**FY2012
Grand Prize for Excellence in
Energy Efficiency and Conservation**
Product Category & Business Model Category
Sponsored: The Energy Conservation Center of Japan



“Prime Minister's Award” in The 5th Monodzukuri Nippon Grand Award

Judging process and valued points

Strategy for the new refrigerant R-32 in developing countries

Following the first round of inverter air conditioners, making global-warming friendly **R-32 air conditioners a de facto standard, eventually leads to a step-up and strengthening of international competitiveness of Japanese companies.**

Basic Patent of R32 refrigerant which reduces 75% of global warming effect is opened to expand its use and to improve the environmental standard.

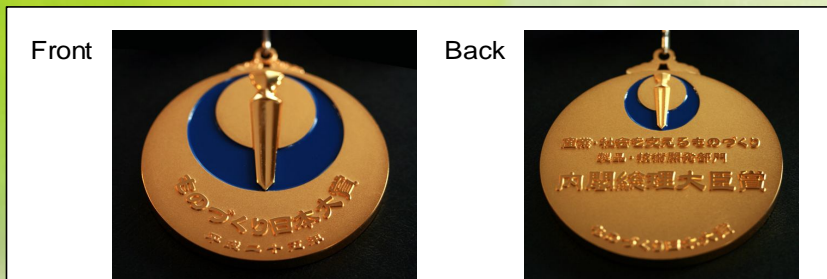
Scene in the award presentation ceremony (Sept. 18th 2013)

< Scene of greeting by Prime Minister Abe >

< Recipients explaining the award-winning work >



< Receiving a prize medal >



The logo comes from the tradition of AMENONUBOKO described in KOJIKI (a record about Ancient Matters) as motif.

R32 RAC Line-up Expansion

Premium Model

Basic Model

NEW MODEL



<p>RX series NEW ▶ 23ページ</p> <p>加湿や除湿、空気清浄と多彩構造・気流も一新した新冷媒採用エアコン</p> <p>ホワイト R32</p>	<p>AX series NEW ▶ 27ページ</p> <p>気流や除湿機能に加え、地球環境に配慮した新冷媒を採用</p> <p>ホワイト R32</p>	<p>DX series NEW ▶ 29ページ</p> <p>ムラの少ない新気流を採用した-25℃対応「高暖房」シリーズ</p> <p>ホワイト R32</p>	<p>WX series NEW 2013年4月発売 ▶ 33ページ</p> <p>からだにやさしい運転の「らくらく」エアコンがさらに進化</p> <p>ホワイト R32</p>	<p>FX series NEW ▶ 35ページ</p> <p>立体気流&快適除湿で控えめ空調でも心地よく</p> <p>ホワイト R32</p>	<p>CX series NEW ▶ 37ページ</p> <p>空気清浄機能に加えて、エアコン内部もフィルターも自動でお掃除</p> <p>ホワイト R32</p>	<p>E series NEW ▶ 39ページ</p> <p>快適機能をシンプルにまとめたベーシックモデル</p> <p>ホワイト R32</p>
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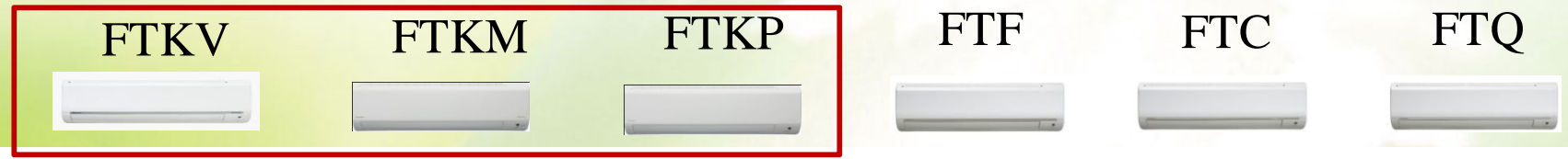
Capacity

2.2kW							
2.5kW							
2.8kW							
3.6kW							
4.0kW							
5.0kW							
5.6kW							
6.3kW							
7.1kW							
8.0kW							

**Full replacement of R410A models
Total Sales 1,000,000**

■ November, 2012: 4 models
■ Today : 53 models

R-32 RAC Line-up in India



Capacity	FTKV	FTKM	FTKP	FTF	FTC	FTQ
2.2kW	INVERTER					
2.5kW						
3.35kW						
3.4kW						
3.5kW						
4.0kW						
5.0kW						
5.2kW						
6.0kW						
6.4kW						
7.1kW						

Complete line-up of R32 models launched in Fy14
Sold over 30,000 units since last year

- 2013 - 2 models
- Today - 18 models



R32 Commercial air-conditioner

Daikin launched R32 Commercial AC



Daikin launched Commercial air conditioners using R32 in Japanese market on November 1, 2013.

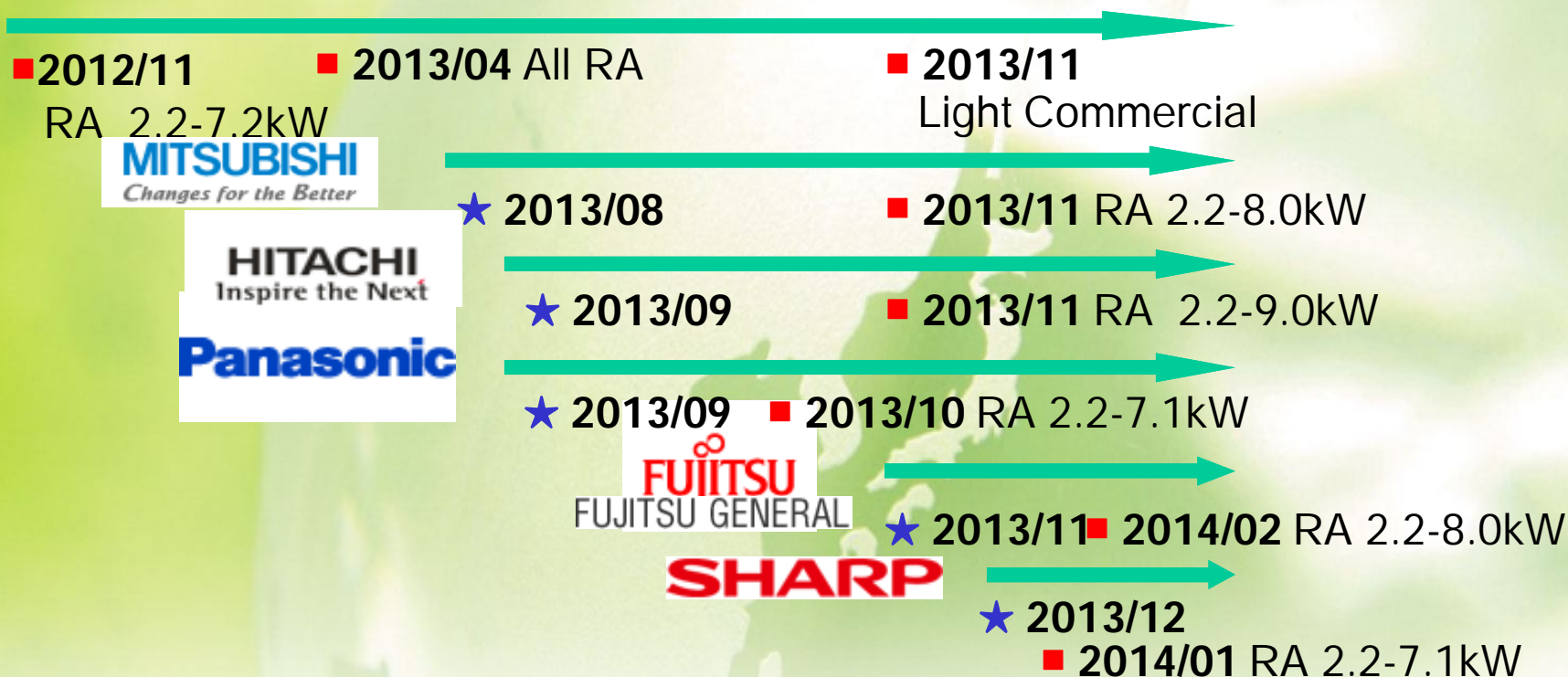
『FIVE STAR ZEAS』

Other AC Manufacturers in Japan

- Daikin is the 1st to launch R32 Air Conditioners
- Mitsubishi, Hitachi, and Panasonic are next to follow

Launch date by Company 会社別投入時期

★ Press Release
 ■ Launching



DAIKIN Promotion of R32 Products by different Companies

FUJITSU
FUJITSU GENERAL

さらに、環境に配慮した新冷媒R32を採用。

2090	1/3	新冷媒 R32
8434	572	82

MITSUBISHI
Changes for the Better

さらに、環境に配慮

MSZ-ZH64S-K

2009 DESIGN AWARD 2009

MSZ-ZH64S-K	MSZ-ZH434S-K
ZR64S	ZR43S
ZR64S	ZR43S
ZR64S	ZR43S

Panasonic

研ぎ澄まされた、

新冷媒 R32

高効率を最大限に引き出す 新開発・新設計!

R32	約 1/3	R410A
575		2,060

HITACHI
Inspire the Next

CV-PAM制御

環境配慮 新冷媒 R32 を新採用

従来の冷媒R410Aに比べて、地球温暖化係数が約1/3のR32を採用し、環境に配慮しています。

DAIKIN



Thank you for your Attention!!

