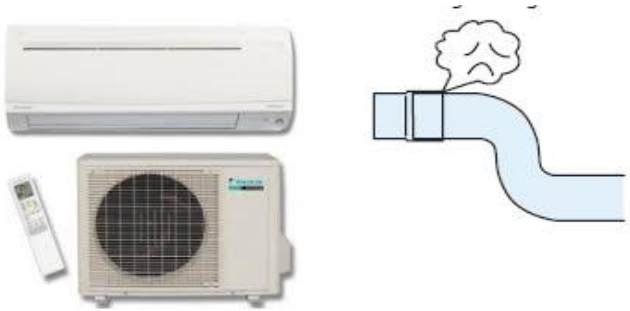
New EU F gas regulation

Impact on air conditioners & heat pumps

Hilde Dhont, Daikin Europe N.V.
Environment Research Center
Belgrade- 4 December 2014

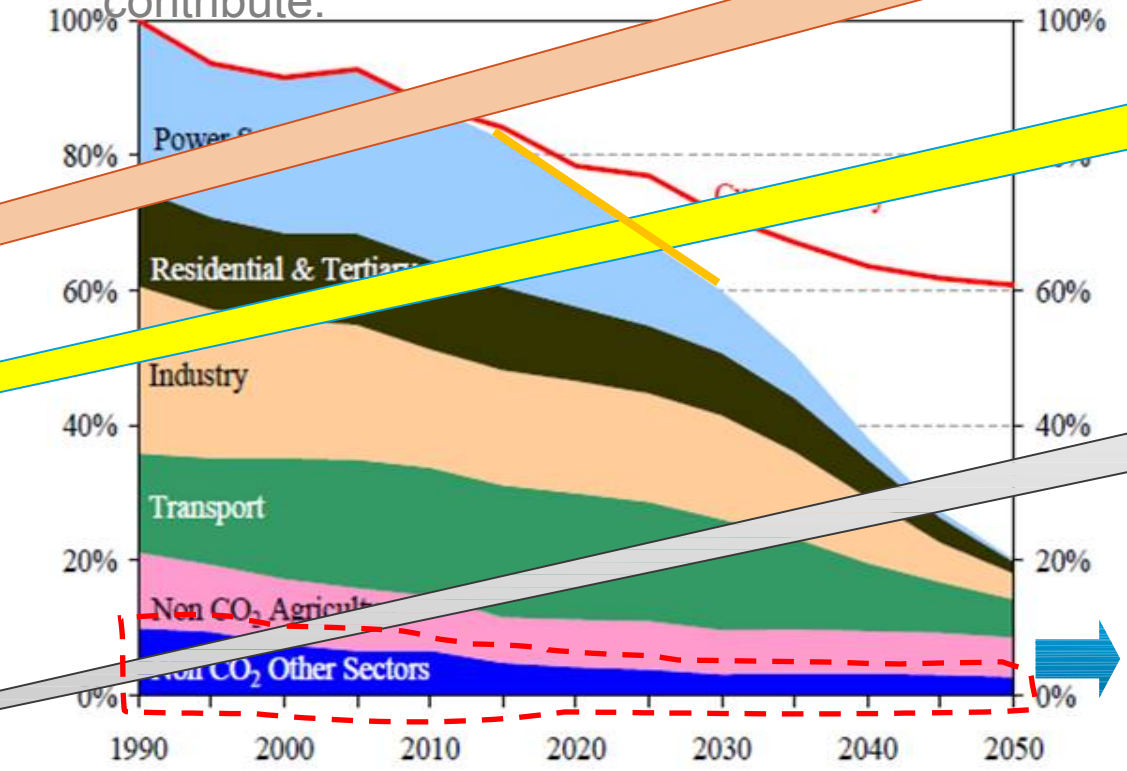
What are “F gases”

- HFCs, PFCs and SF6 are “F gases” = fluorinated greenhouse gases.
- They do not deplete the ozone layer, but account for 2% of the overall EU greenhouse gas emissions.
- Nearly 80% of F gas emissions are due to the emissions of HFCs used as refrigerants in air conditioners, heat pumps and refrigeration products



EU targets to reduce greenhouse gas emissions

Targets will be mostly achieved by the change of electricity generation & by reducing energy consumption. However also other sectors need to contribute.



Source: EU low carbon roadmap 2050

EU 20-20-20 policy

- 20% reduction by 2020

NEW EU agreement for 2030

- 40% reduction by 2030

EU low carbon roadmap 2050 80% reduction by 2050

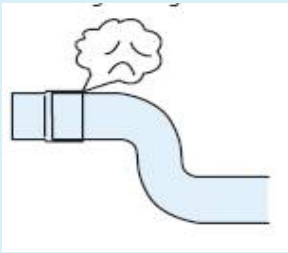
F gases such as HFCs used in our air conditioners and heat pumps belong to the group of “non CO2 other sectors”

History

The EU already had 2 types of legislation on F gases since 2006, one is called “the F gas Regulation” and the second “the MAC Directive”.

1) The 2006 F gas Regulation mainly focused on preventing emissions during the use phase of equipment & at end of life.
   Ű This Regulation is now revised into the “2014 F gas Regulation”.

2) The 2006 MAC Directive bans the use of HFCs with a GWP Í 150 in air conditioners for passenger cars, which is mandatory for all new cars from 2017 onwards Ű This Directive is not revised, so still valid.



2006 F gas Regulation EC/842/2006 -Ű modified into 517/2014

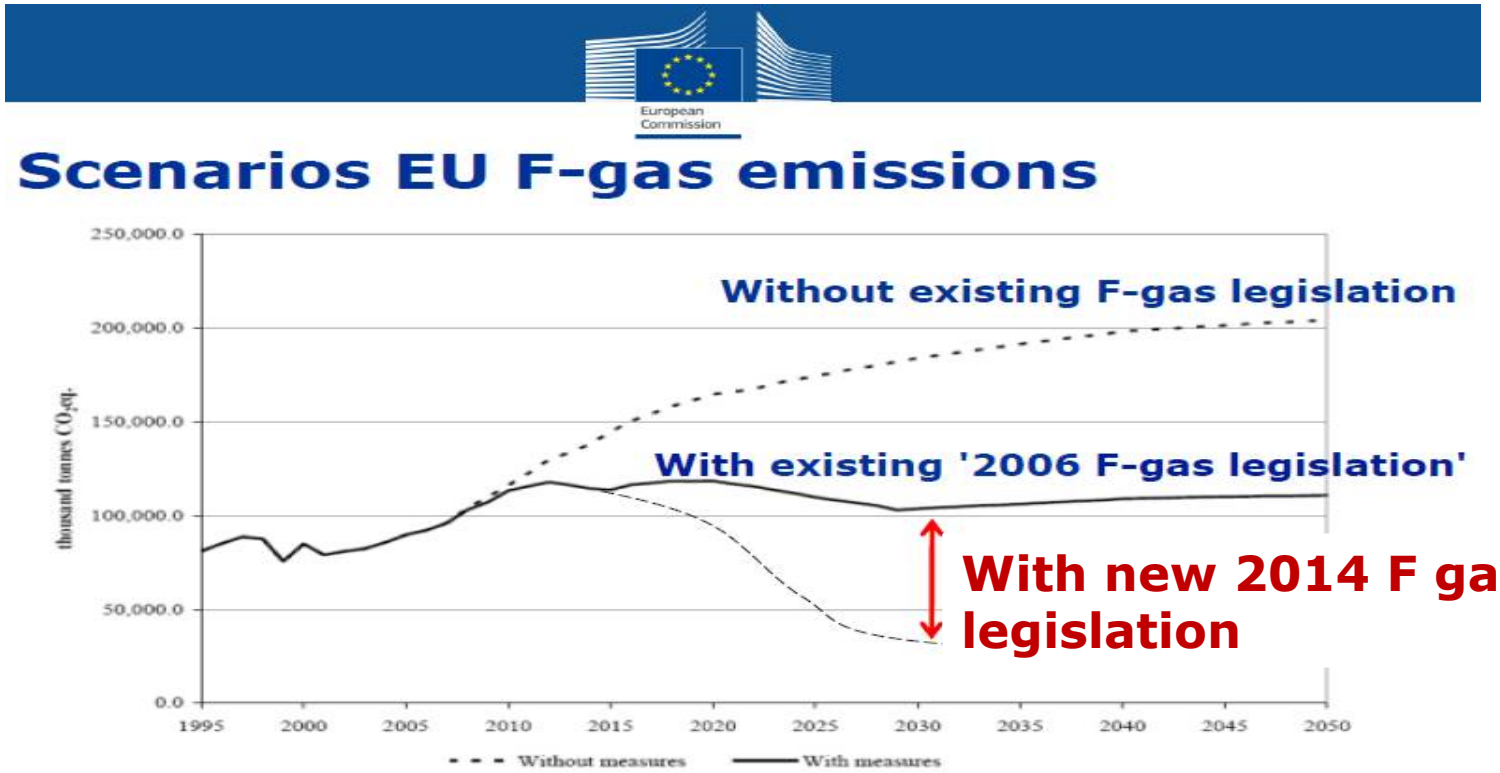
- 2006 Regulation focused on “emission prevention” by training & certification, regular leak checking and recovery + some limited product bans.
- 2014 Regulation takes additional measures to lower F gas emissions

2006 MAC Directive 2006/40/EC Ű REMAINS

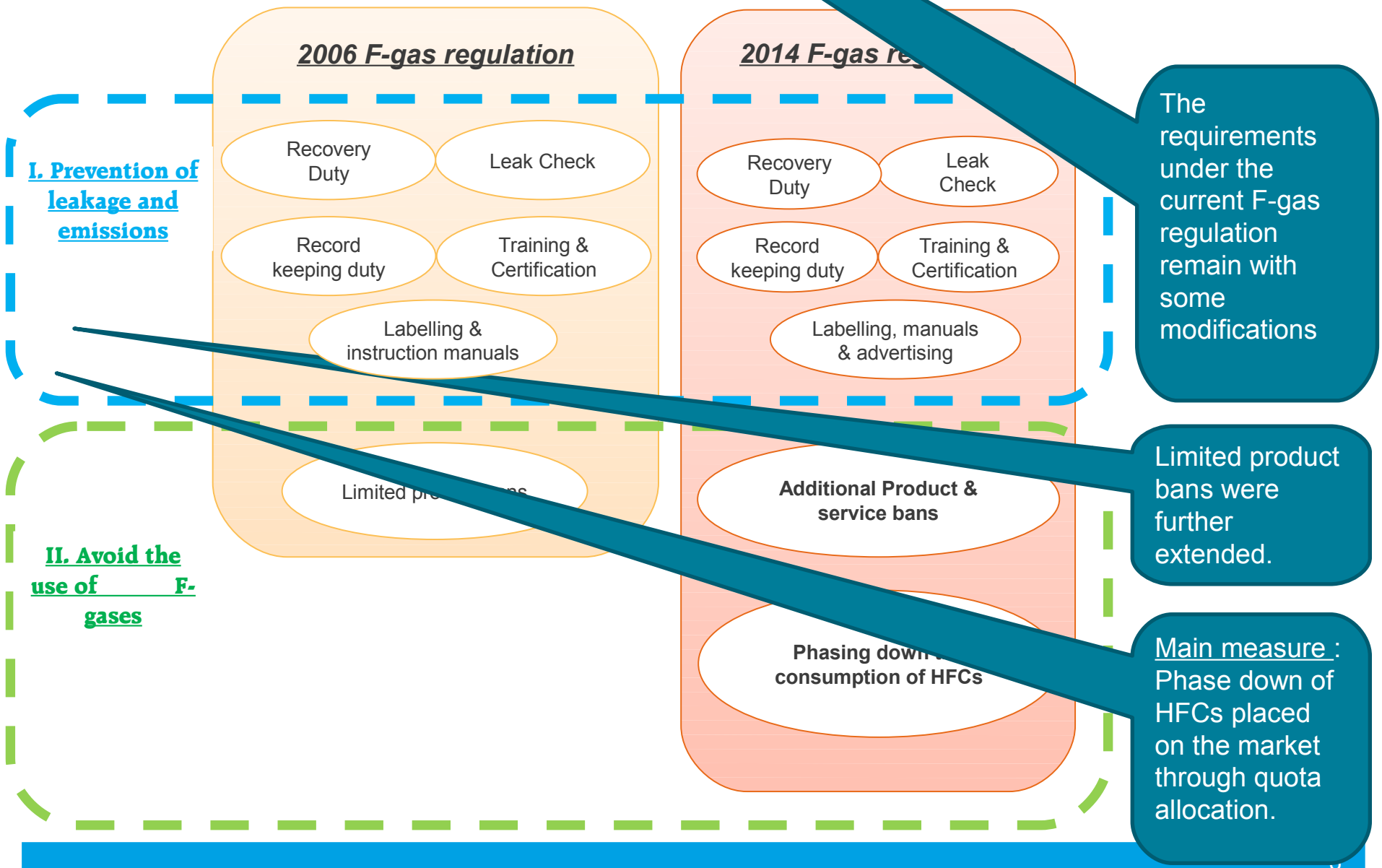
- Bans HFCs with a GWP>150 for AC in passenger cars
  - For all new cars from 2017

EU legislation on F gases

- The 2006 F-gas regulation , together with the MAC directive, will stabilize emissions of F gases despite their growing use.
- To achieve the goals of the EU low carbon roadmap more action is needed Ű The new 2014 F gas legislation aims to cut emissions of F gases by two thirds by 2030 (Agreed April 2014, effective from 2015)



Difference between 2006 and 2014 F-gas regulation



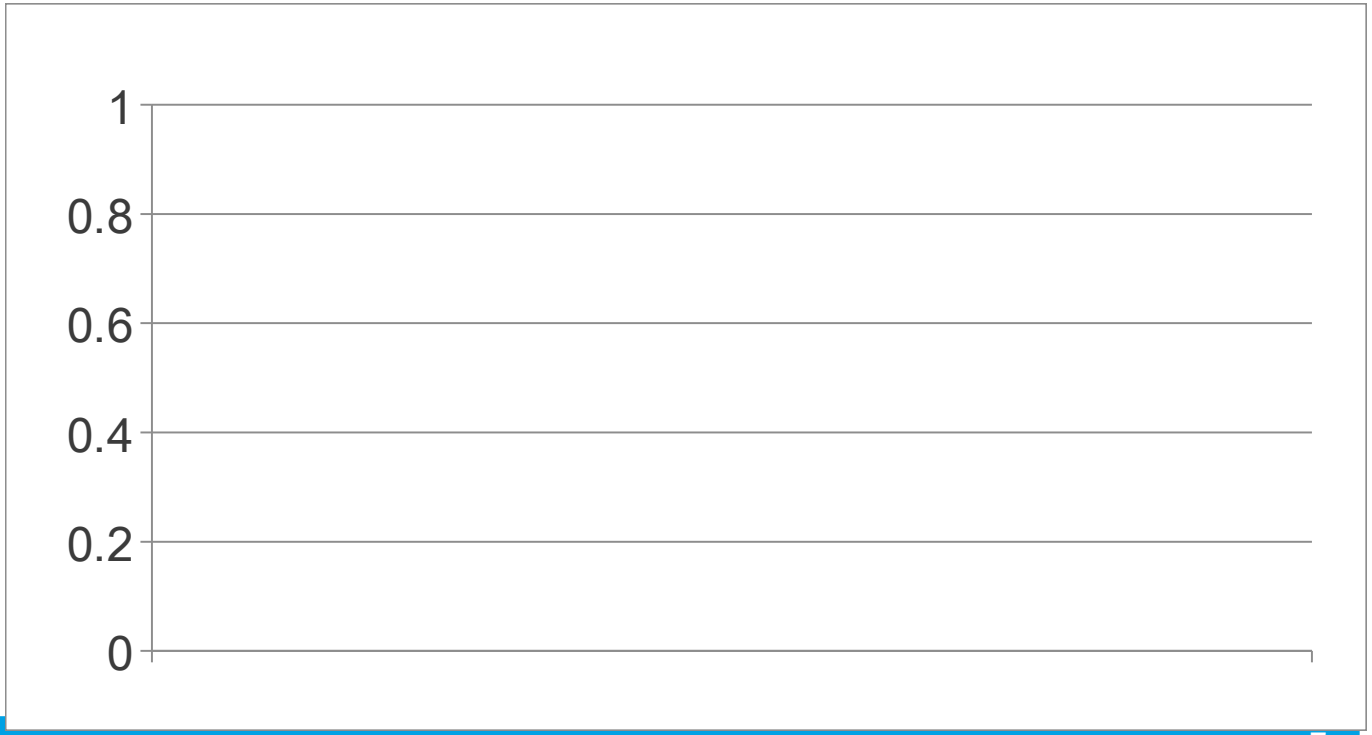
The HFC phase-down schedule

Main principles:

1. Quota are in CO2 equivalent (kg x GWP value)
2. Quota are imposed from 2015 onwards on the bulk HFC producers or importers that place HFCs on the EU market for the "first" time

Ű push on the suppliers will trigger the users to go for alternative solutions

Year	Reduction by
2009-2012	Baseline
2015	100% (Freeze)
2016-17	93%
2018-20	63%
2021-23	45%
2024-26	31%
2027-29	24%
2030	21%



How to achieve this HFC phase down ?

A combination of :

1) Change to HFC refrigerants with a lower global warming potential (GWP)
2) Change to non-HFC refrigerants
3) Reduce the HFC refrigerant quantity
4) Recover and reuse HFCs

New F gas regulation : additional GWP limits on refrigeration products

- Service ban on existing refrigeration systems with charge of > 40TCO2eq : GWP must be <2500 (new gas 2020, recycled/reclaimed gas 2030)
- In all new stationary refrigeration GWP must be <2500 from 2020
- More strict GWP limits on :
  - Residential & commercial fridges & freezers (GWP<150) (2020/2022)
  - Multipack supermarket systems >40kW (GWP<150 or cascade GWP<1500+GWP<150) (2022)

New F gas regulation : additional GWP limits for air conditioners & heat pumps

GWP limitations

For portable AC : GWP must be **<150** from 2020

Â **R410A : Not OK**

á **R290 : OK**

For SINGLE split air conditioners with a charge BELOW 3 kg : GWP must be **<750** from 2025

Â **R410A : Not OK**

á **R32 : OK**

International tendencies

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Tel: +81-3-3584-4704 Fax: +81-3-3584-4708 E-mail: jarn@jarn.co.jp
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Japan Starts Moving to R32

While the direction the global air conditioner market will take in selecting next-generation alternative refrigerants is still uncertain, momentum in Japan to adopt R32 as the next-generation air conditioner refrigerant is visibly building. The debate over R32's mild flammability and environmental load has gone on for some time among air conditioner manufacturers in Japan, but a consensus finally seems to have been reached to adopt the refrigerant in their room air conditioners (RACs). Following Daikin's product

A display of RAC outdoor unit using R32

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DAIKIN

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A display of RAC outdoor unit using R32

models that use R32 refrigerant for the Japanese market this fall.

In November 2012, Daikin released its Uru-Sara 7 series of RACs that use R32 refrigerant in Japan, a world first. The Uru-Sara 7 has enjoyed strong popularity in the Japanese market, achieving cumulative sales of more than 200,000 units up to September 2013. Following these brisk sales, Daikin moved to adopt R32 in all of its wall-mounted RAC models for the Japanese market, whose cumulative sales as of September 30, 2013, was estimated to surpass 1 million units.

Mitsubishi Electric is releasing 11 models in its premium Kirigamine Z series from early November as new products for 2014. According to the company, the new models adopt R32 refrigerant and a high-efficiency compressor that reduces refrigerant compressor loss. Mitsubishi Electric is planning a total monthly production volume of 20,000 units for the series. *See pages 46–47 of the September issue of JARN*

Panasonic has also adopted new refrigerant R32 in its 2014 model RAC's in the X series to be released

RACs' improved energy savings due to the new refrigerant.

Starting in late October, Hitachi Appliances is releasing a total of nine models in its new Stainless Clean Shirokuma-kun Z series that adopt R32 refrigerant. It is planning a monthly production volume of 30,000 units for the series. *See page 50*

According to industry sources, other Japanese manufacturers are also preparing to launch R32 RAC models in the Japanese market.

Not stopping at the Japanese market, these air conditioner manufacturers are also moving to launch R32 models in the global market.

Three years ago at Chillvenia in Germany, Daikin and Fujitsu General exhibited RAC models designed for R32 for the first time in the world. Daikin also launched R32 RAC models in India this March and in July announced the autumn 2013 launch of an updated Ururu Sarara range for Europe, where intense debate over next generation refrigerants has been unfolding.

Panasonic has pledged to launch R32 RACs in Indonesia by 2015. Indonesia has received approval from the United Nations Multilateral Fund to convert to R32 refrigerant.

[Continued on page 6]

Top Interviews

UTC Climate, Controls & Security

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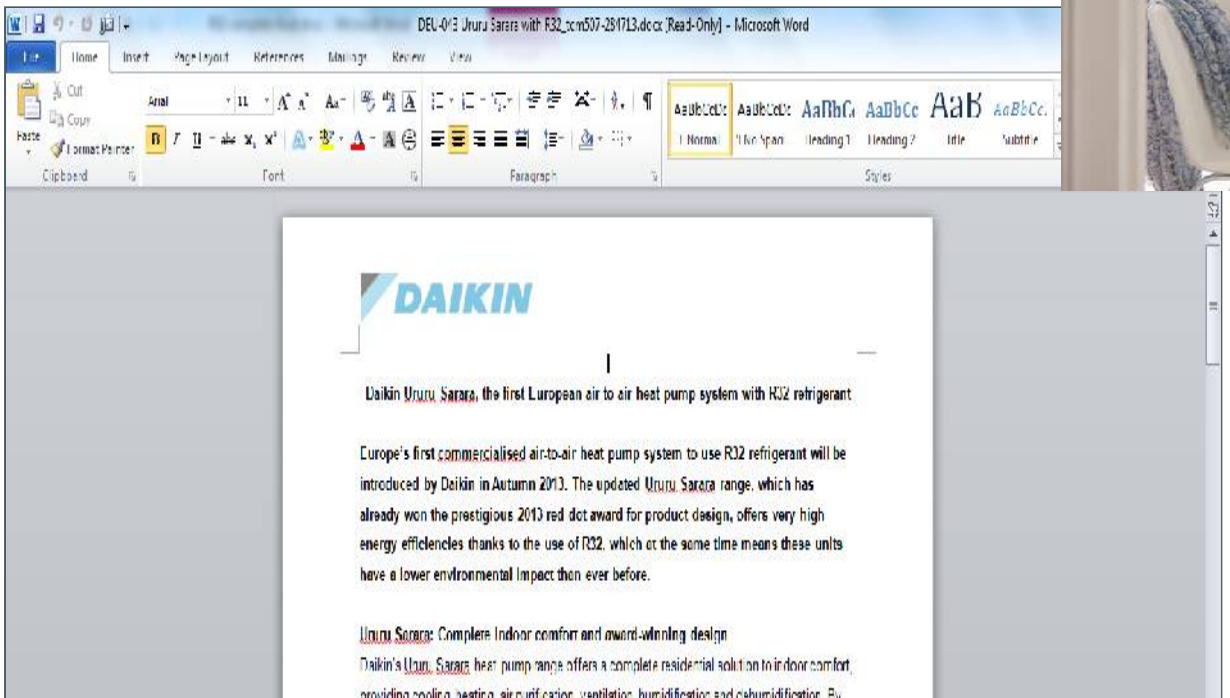
European Union

First models were introduced in EU since Autumn 2013



DAIKIN

Daikin Ururu Sarara, the first European air to air heat pump system with R32 refrigerant

Europe's first commercialised air-to-air heat pump system to use R32 refrigerant will be introduced by Daikin in Autumn 2013. The updated Ururu Sarara range, which has already won the prestigious 2013 red dot award for product design, offers very high energy efficiencies thanks to the use of R32, which at the same time means these units have a lower environmental impact than ever before.

Ururu Sarara: Complete Indoor comfort and award-winning design

What is R32 ?

- R32 = CH2F2 “difluoromethane”, a single component HFC
- Not depleting the ozone layer
- Already known today as a component of the blend refrigerant R410A (=50%R32+50%R125)
- The GWP is only 1/3rd of the GWP of R410A

Refrigerants			Properties			
			Pcond (MPa)	Vol Cool Capacity	ODP	GWP（IPCC 4th）
HFC	R22 (baseline)	Single	1.73	100%	0.05	1810
	R410A	Azeotrope like	2.73	141%	0	2088
	R32	Single	2.79	160%	0	675

Why R32 for air conditioners & heat pumps?

R32 is the most balanced solution

- Not depleting the ozone layer
- GWP only one third of R410A
- Reduced refrigerant charge possible
- Higher Energy Efficiency compared to R410A & R22
- More compact design possible
- Acceptably safe because only slightly Flammable (Class A2L)
- Refrigerant Production capacity is available (R32 is a component of R410A)
- Easy to recycle and reuse (single component refrigerant)
- Affordable for developing (A5) countries

Impact on energy efficiency and/or system dimensions : various design possibilities

Case of Japan sales model (Nov.2012 on sale)

High

R32

R410A

4.0kW

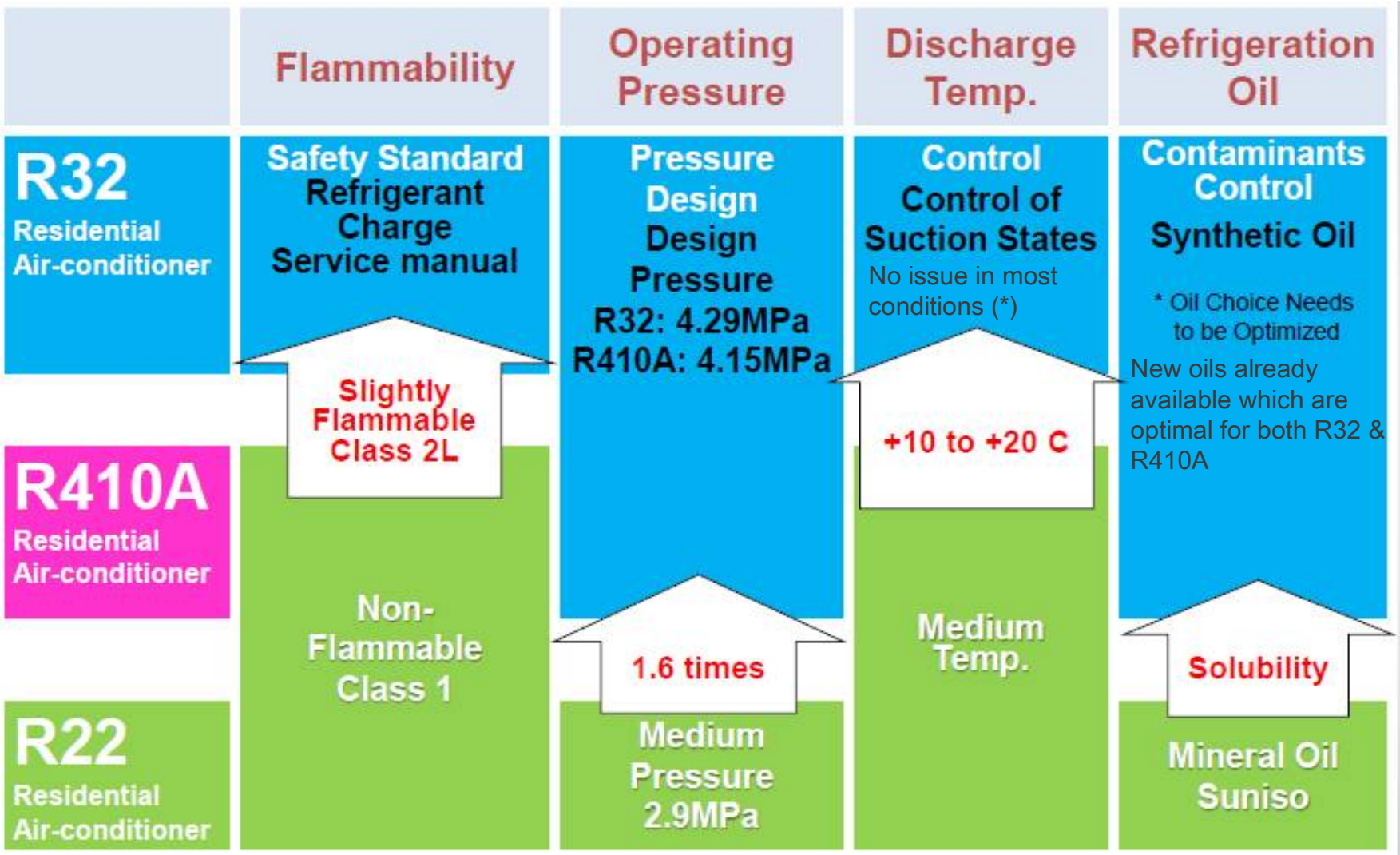
iciency + 6%

Volume - 18%

erant Charge

- 20%

Design changes



(*) With R32, In very low ambient heating condition, discharge temperature may need to be controlled, e.g. by wet suction control

Installation / service aspects

Because R32 is a single component refrigerant (no blend) :

1. It is easier to handle
   - can be charged in both gas and liquid phase
   - no need to worry about composition change after leakage

2. It is easier to recycle and reuse.

Installation / service tools

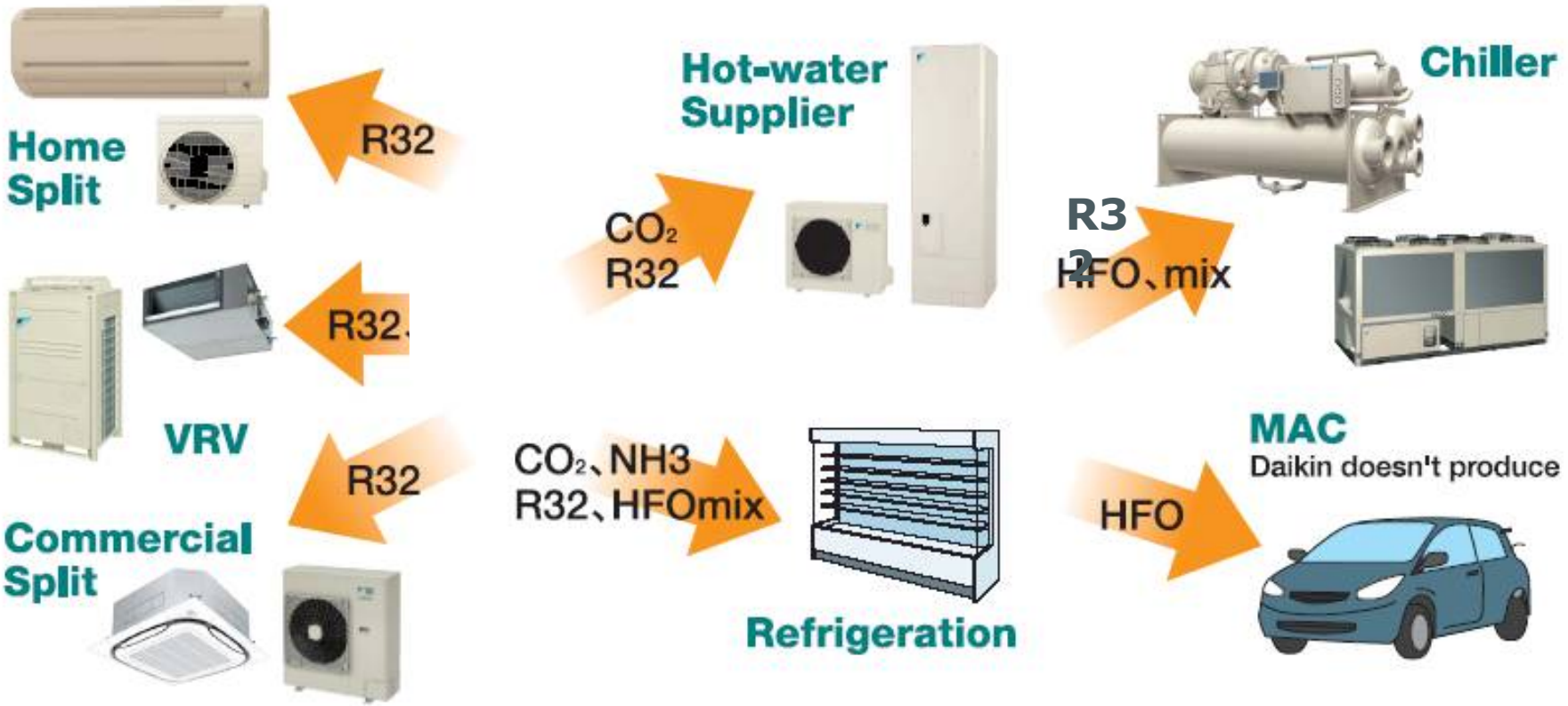
Technically, installation of R32 unit is the same as R410A

Tools are slightly different (dual use tools possible)

Tooling	R410A	R32
Manifold	Normal	Different (dual use types possible)
Scale	Normal	Normal
Vacuum pump	Normal	Normal
Leak detector	Normal	Different (dual use types possible)
Recovery unit	Normal	Different (dual use types possible)
Ventilation	Recommended	Necessary

There is no “one-size-fits all” refrigerant

- Each manufacturer needs to make choices depending on the application and the needs of the market & taking into account energy efficiency, safety, affordability, local legislations & standards.
- Daikin is developing R32 split air –conditioners from residential to commercial range because R32 is suitable for these applications



Progress of standardization

International & European standards are taking the increasing use of flammable refrigerants into account

- Defining refrigerant classes
- Defining safe system charge in different applications

	Class 1	Class 2L	Class 2	Class 3
	Non flammable	Low flammable LFL* > 3,5% by volume Heat of combustion < 19 000 kJ/kg burning velocity ≤10 cm/s	Flammable LFL* > 3,5% by volume Heat of combustion < 19 000 kJ/kg burning velocity >10 cm/s	Highly flammable LFL* ≤ 3,5% by volume Heat of combustion ≥ 19 000 kJ/kg
Class A low toxic	R744 (CO2) R410A	R1234yf / ze **R32**	R152a	R290
Class B High toxic		R717 (Ammonia)		

New class 2L : Flammability of 2L refrigerants is very low. The burning velocity (≤ 10 cm/s) is too slow to cause horizontal flame propagation or explosion.
Classification according to ASHRAE34 & ISO817.

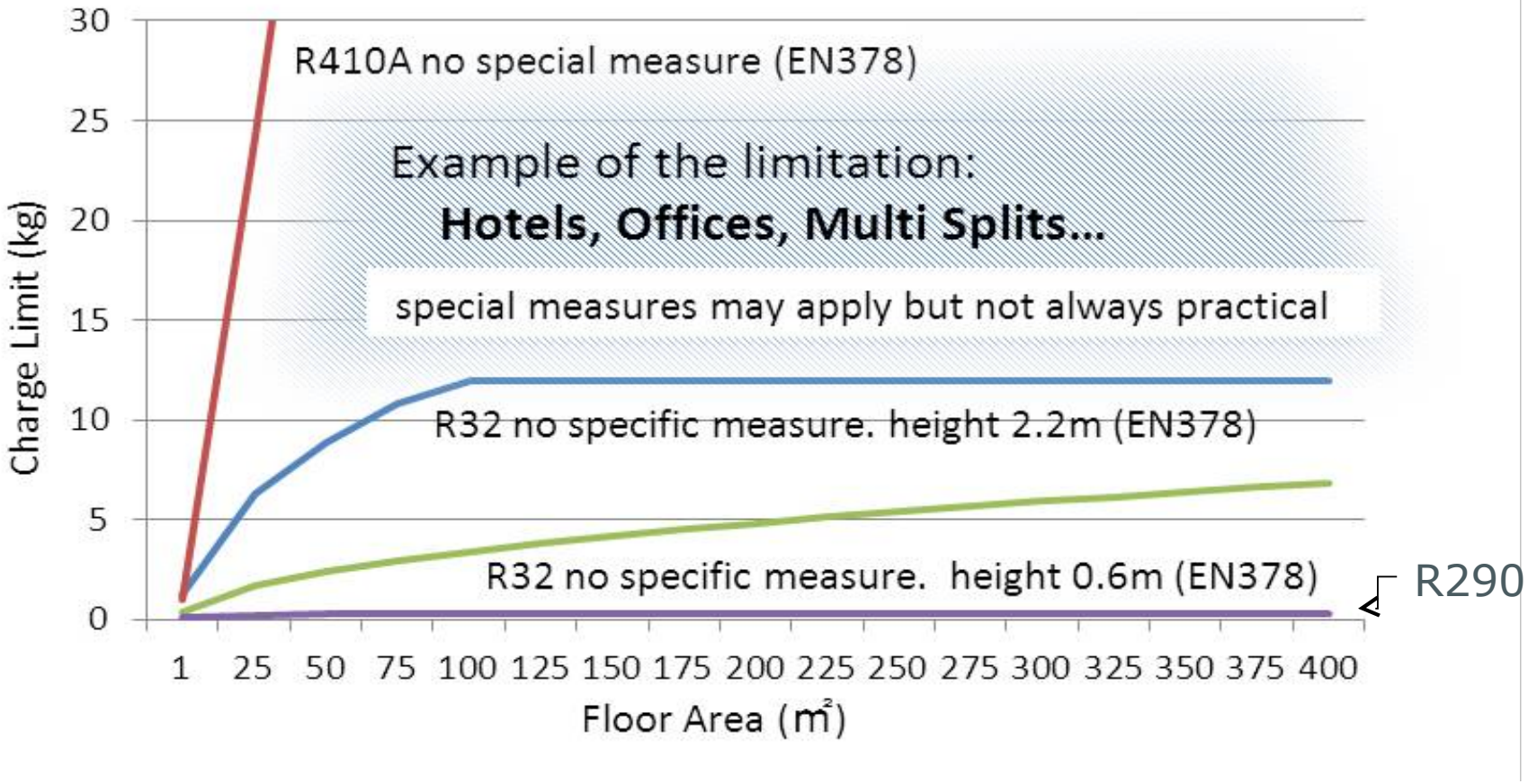
Progress of standardization

ision of international & European standards is ongoing

Field	International	Europe	US
Refrigerant Classification	ISO817 Revised 2014	-NA- (based on ISO)	ASHRAE 34 UL 2182
Usage Restriction for Safety	ISO5149 Revised 2014	EN378 Under revision	ASHRAE 15
	IEC60335-2-40 Under revision	EN60335-2-40 Based on IEC	UL 207 UL 250 UL 471 UL 474 UL 484 UL 984 UL 1995 UL 60335-2-40

EN378

Example of refrigerant charge limitations in current EN378 standard (2008 version)



Currently under review based on ISO5149

Worldwide research & risk analyses on flammable refrigerants

USA


AHRI

INTERIM REPORT:

AHRI LOW-GWP ALTERNATIVE REFRIGERANTS EVALUATION PROGRAM (LOW-GWP AREP)

China

Japan

JRAIA INTERNATIONAL SYMPOSIUM KOBE 2014

Thank you !