All Seasons

CLIMATE COMFORT

Heating

Air Conditioning

Applied Systems

Refrigeration

Energy Efficiency in HVAC equipment applications

Workshop – 6 September 2012 – Midrand.

All Seasons

CLIMATE COMFORT

- Heating
- Air Conditioning
- Applied Systems
- Refrigeration

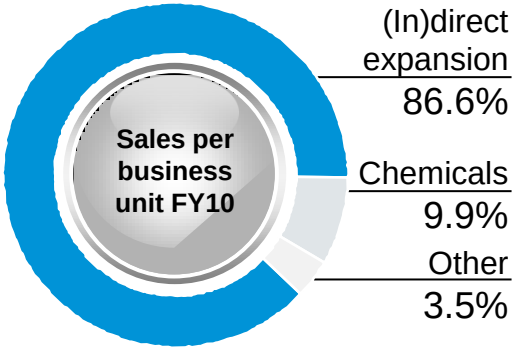
Daikin Corporate Presentation

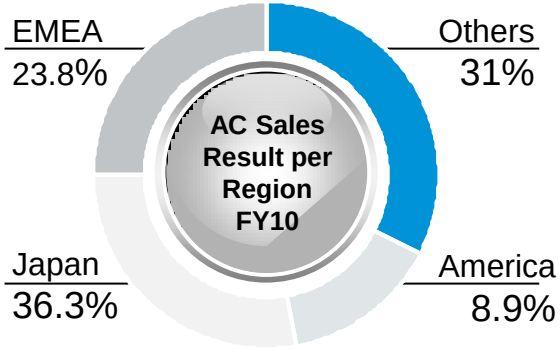
PUBLIC

Daikin Industries Ltd.

Corporate Profile (as of March 31, 2011)

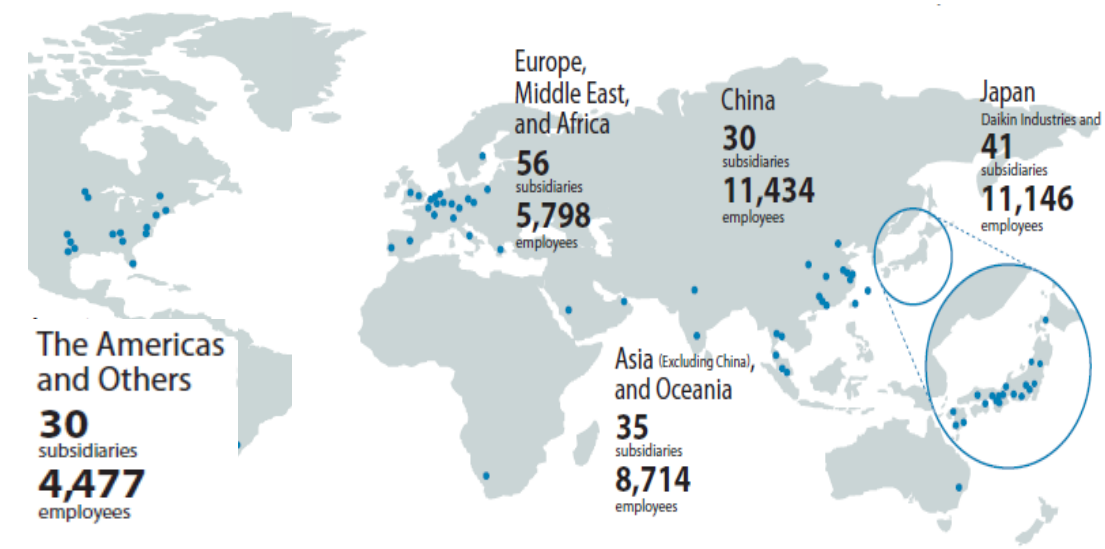
Established:	1924
Head Office:	Osaka (Japan)
Chairman & CEO:	Mr. Inoue
Cons. turn-over:	10.268 Mio €
# Employees:	41.569



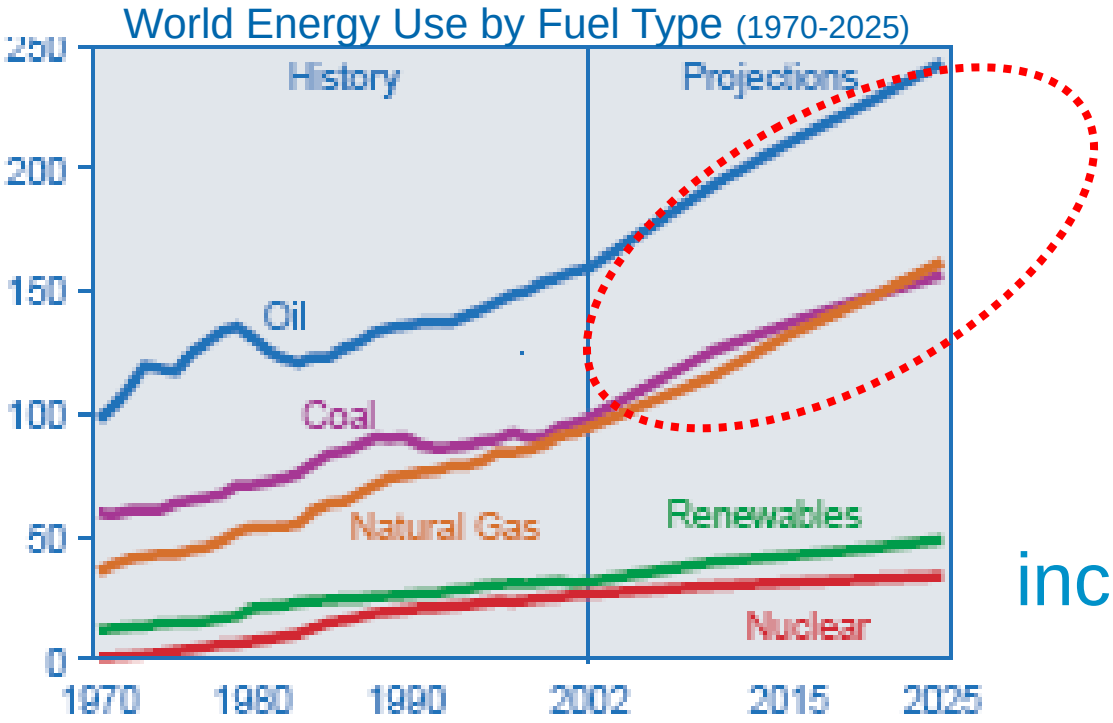


As the only company in the world manufacturing both refrigerant and equipment,
Daikin has a special responsibility
to provide environmentally beneficial products that mitigate global warming

Daikin Group Worldwide



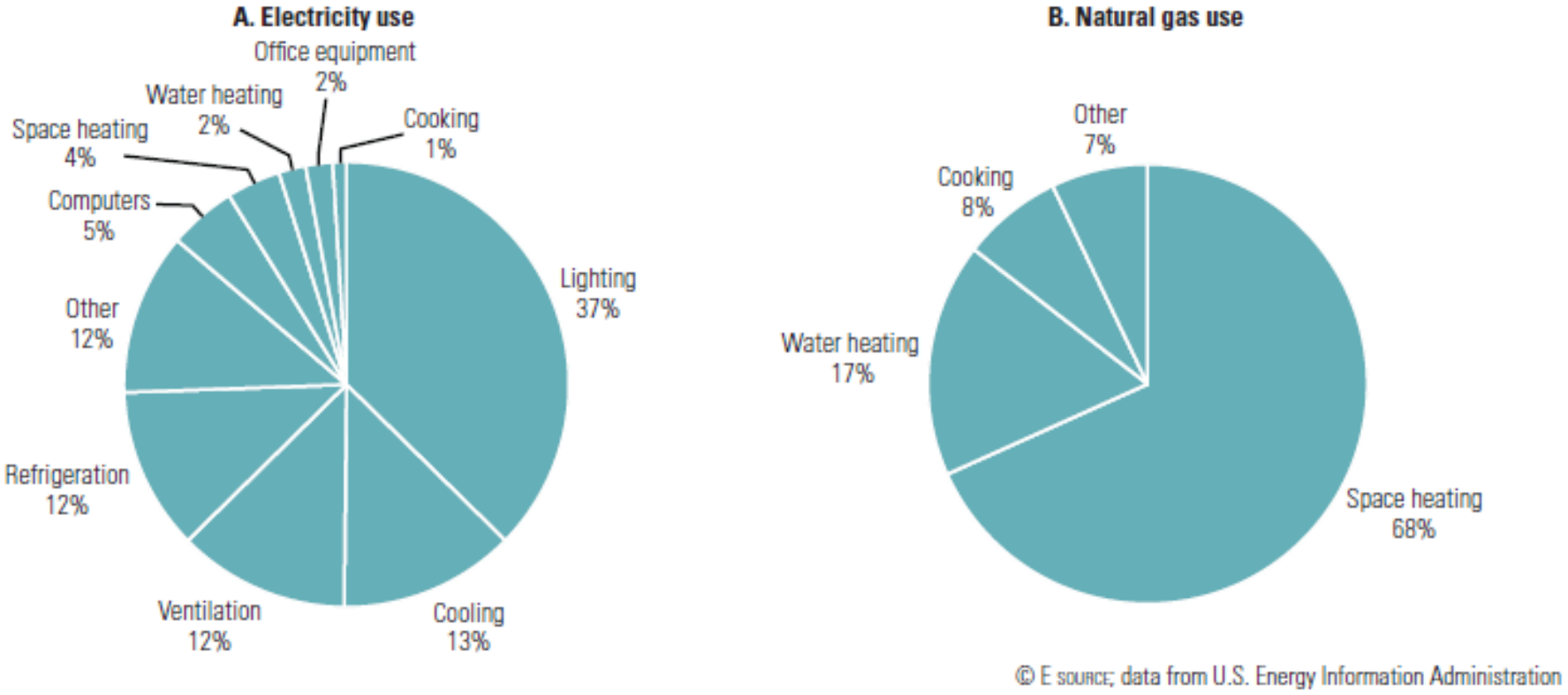
Several Oil crisis in the 70s and 80s …



increasing cost of energy

Electricity & Natural gas consumption in commercial buildings

HVAC and hot water production is responsible for almost half of the energy consumption in commercial buildings



HVAC and building energy consumption

1. Reduction of Heat transfer energy.
2. Eliminates excess cooling and heating
3. High efficiency in partial load
4. Heat recovery & Free cooling

ENERGY SAVING

Environment: legislation

Economic development

20% less primary energy use compared to 2020 projection

Global warming

CO2 emissions: 20% reduction by 2020

ENERGY

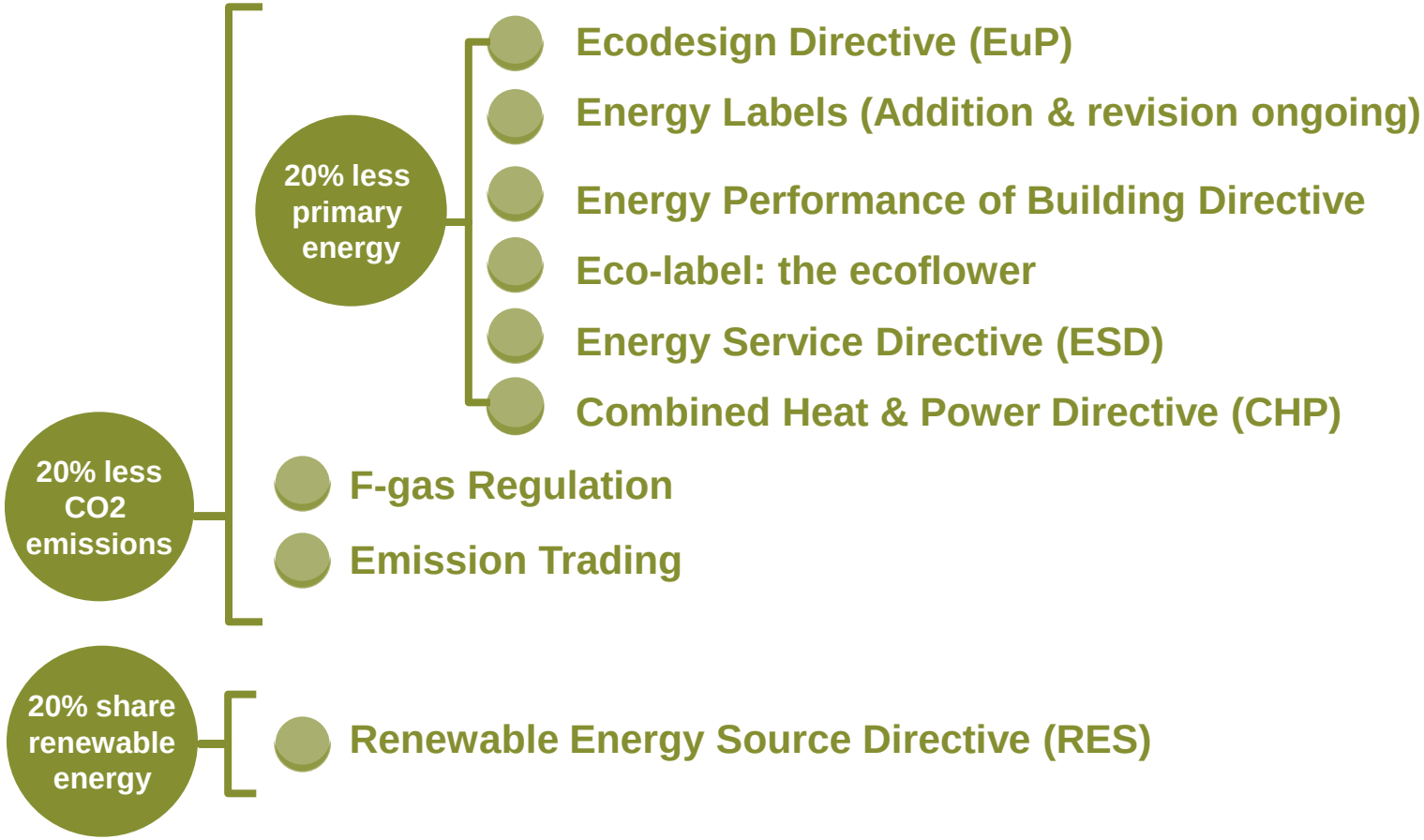
Energy independency

20% share of renewable energy sources by 2020

EU 20 – 20 – 20 policy

Environment: legislation

European Union Climate Change Action Plan: 20-20-20 Policy



Environment: our vision.

Turn the environmental developments into OPPORTUNITIES

Contribute to CO_2 reduction by promoting heat pumps

Reduce Environmental Burden from Business Activities

To be No.1 in high efficient product range

No.1 as HVAC-R energy solution consultant

Reduce impact of refrigerant emissions towards non-HCFC's

environment

All Seasons

CLIMATE COMFORT

Heating

Air Conditioning

Applied Systems

Refrigeration

New refrigerants

R22 phase-out and retrofitting

- There are a lot of R22 installations in the field
- R22 phase out date is very near (Montreal protocol)

Table 6: HCFC-22 consumption in the refrigeration and air-conditioning (AC) servicing sector

Type of equipment	Average charge HCFC-22 (kg)	Current population (equipment units)	Capacity installed (mt)	Share on capacity installed (%)	Average leakage (%)	Service demand 2010 (mt)	Share on service demand (%)
Window units	0.6	18,000	11	0	15	1.5	0
Unitary AC units	1.4	1,100,000	1,540	11	24	300.6	10
Central AC	165	18,100	2,987	22	21	508.0	17
Chillers	160	190	30	0	18	4.9	0
Commercial refrigeration	22	380,000	8,360	61	30	2,032.0	67
Industrial refrigeration	194	3,050	592	4	30	144.2	5
Transport refrigeration	7	400	3	0	24	0.8	0
Marine	380	340	129	1	39	40.5	1
Other	400	60	24	0	19	3.2	0
Total			**13,676**			**3,035.6**	

Source: United Nations Environment Programme project proposal for South Africa

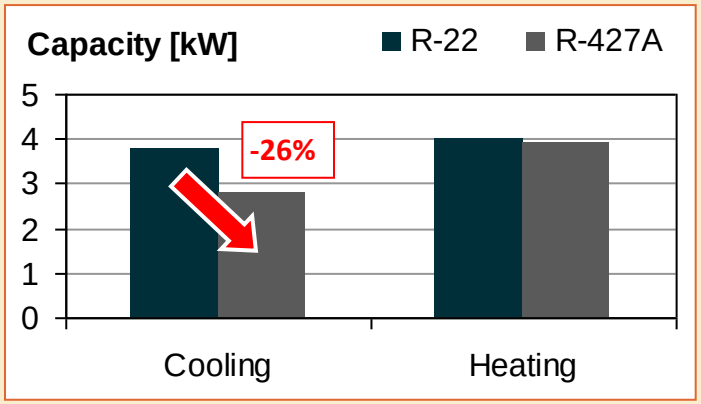
R22 phase-out and retrofitting

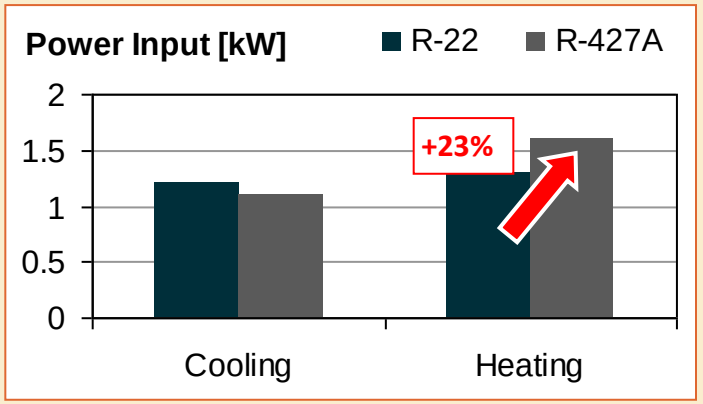
Drop in refrigerants are not an option in room air-conditioners

Tests show drop in performance – lower efficiency, lower capacity

➔ **Operating costs increase, capacity may be insufficient, reliability questionable**

Retrofit with R-427A (Forane FX100) RXD35DVMA + FTXD35DVMA



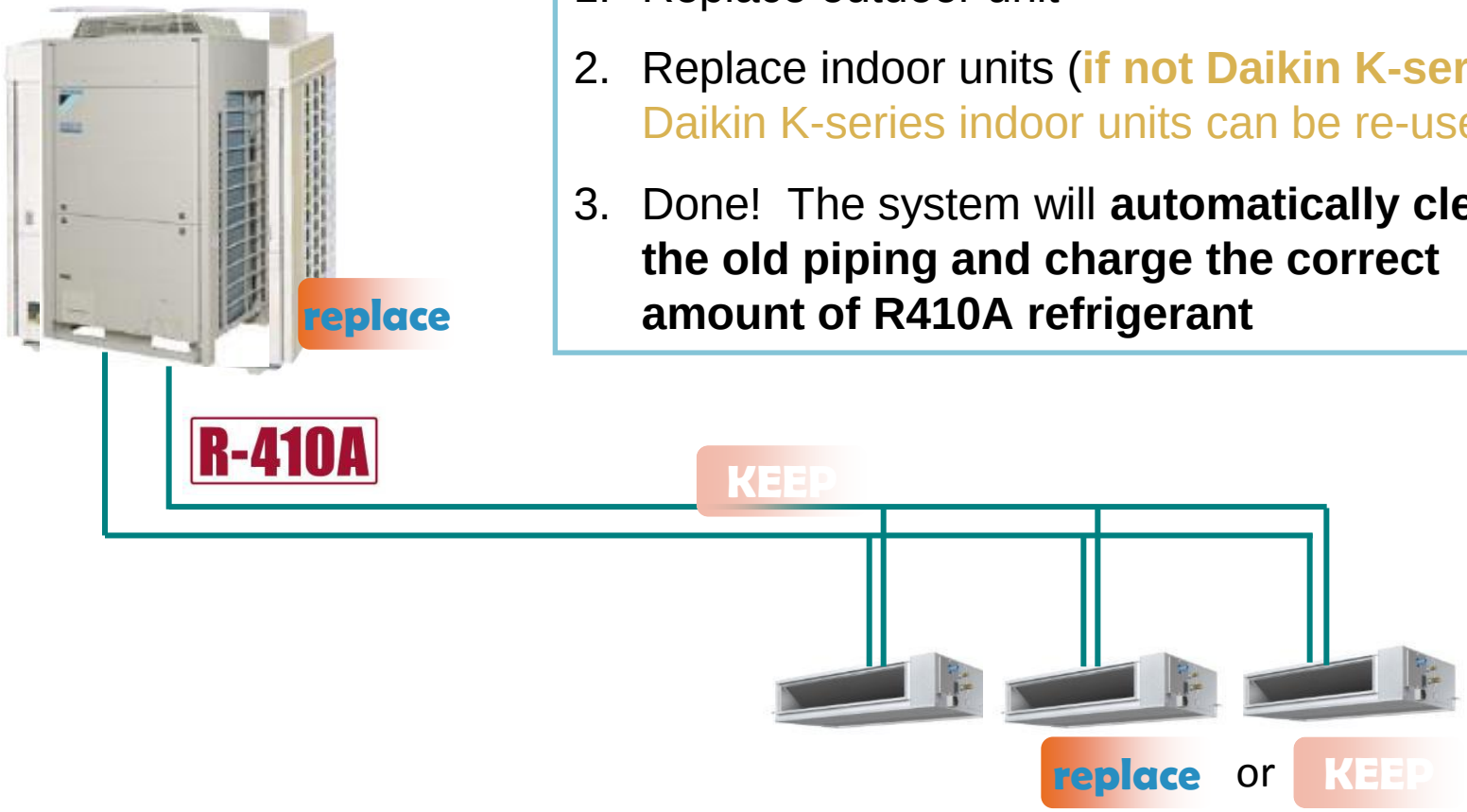


R22 retrofitting in commercial applications

- Using the **Daikin Replacement VRV®**

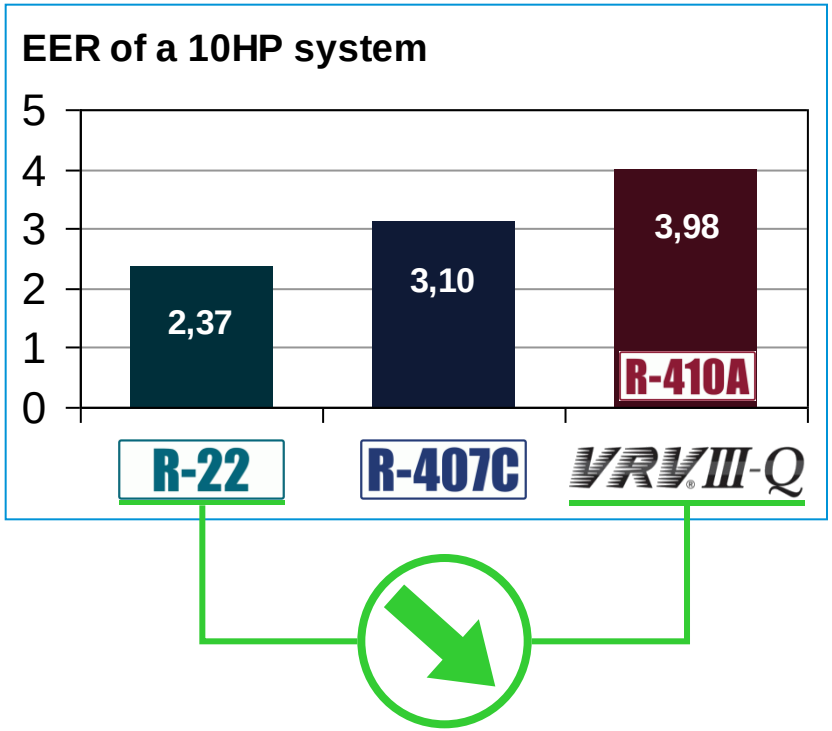
Replacement Procedure

1. Replace outdoor unit
2. Replace indoor units (**if not Daikin K-series –** Daikin K-series indoor units can be re-used)
3. Done! The system will **automatically clean the old piping and charge the correct amount of R410A refrigerant**

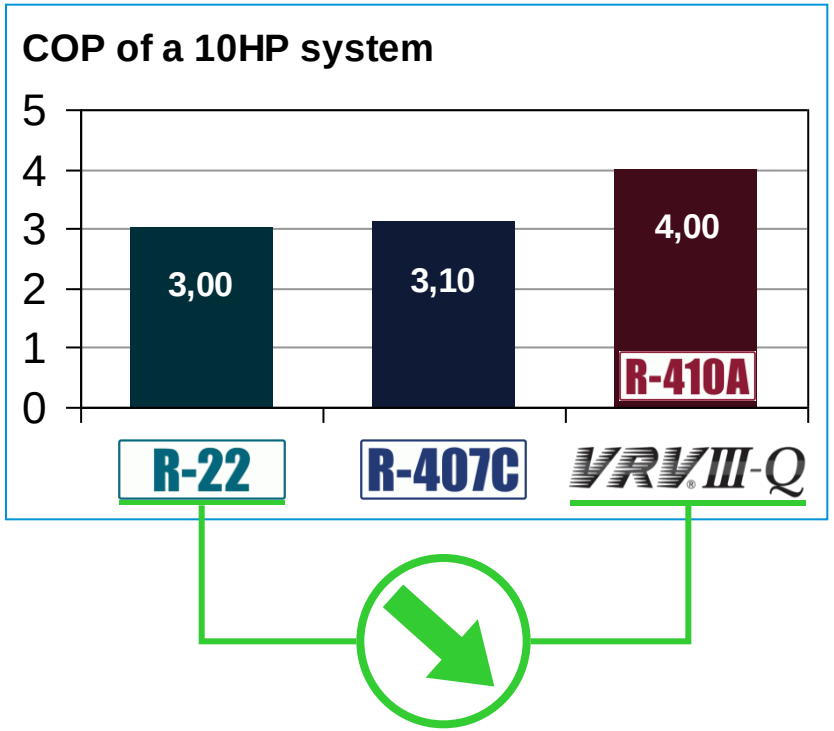


Daikin Replacement VRV® = Ideal system for energy retrofitting

- Newest technology
  - ➔ **Lower energy consumption / higher efficiency**

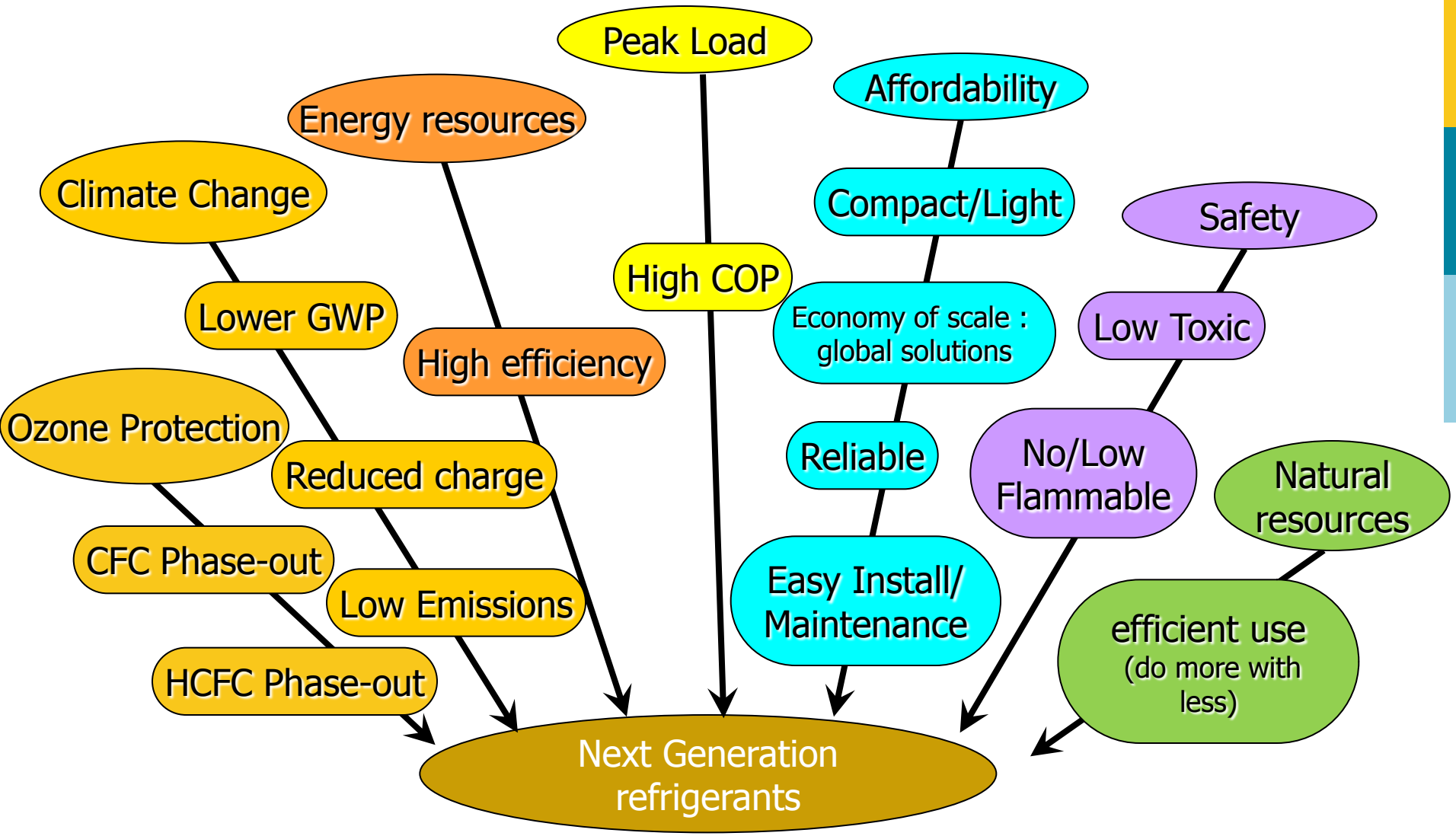


68% better EER
40% lower power input



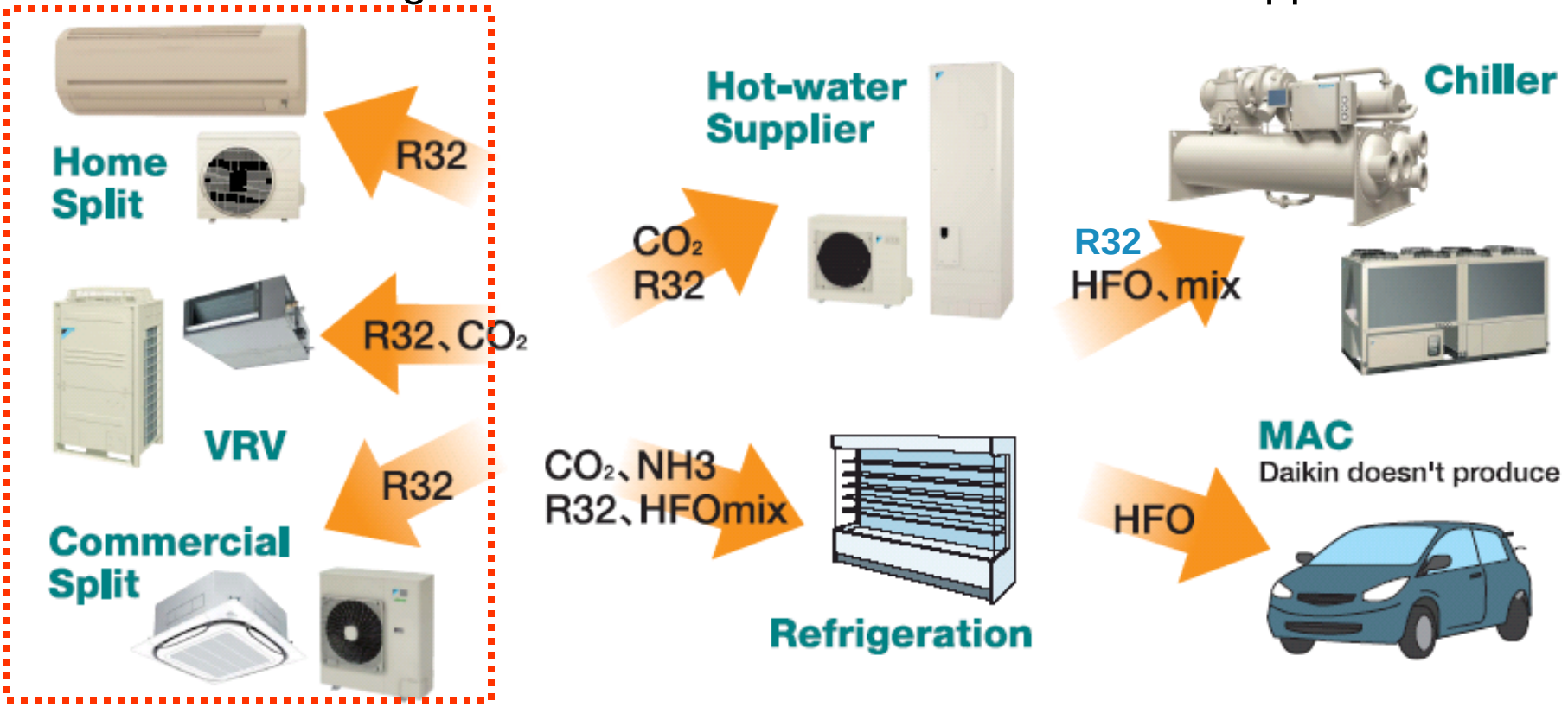
33% better COP
24% lower power input

Factors to consider when introducing new refrigerants



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 commercial range because R32 is better suited to these applications



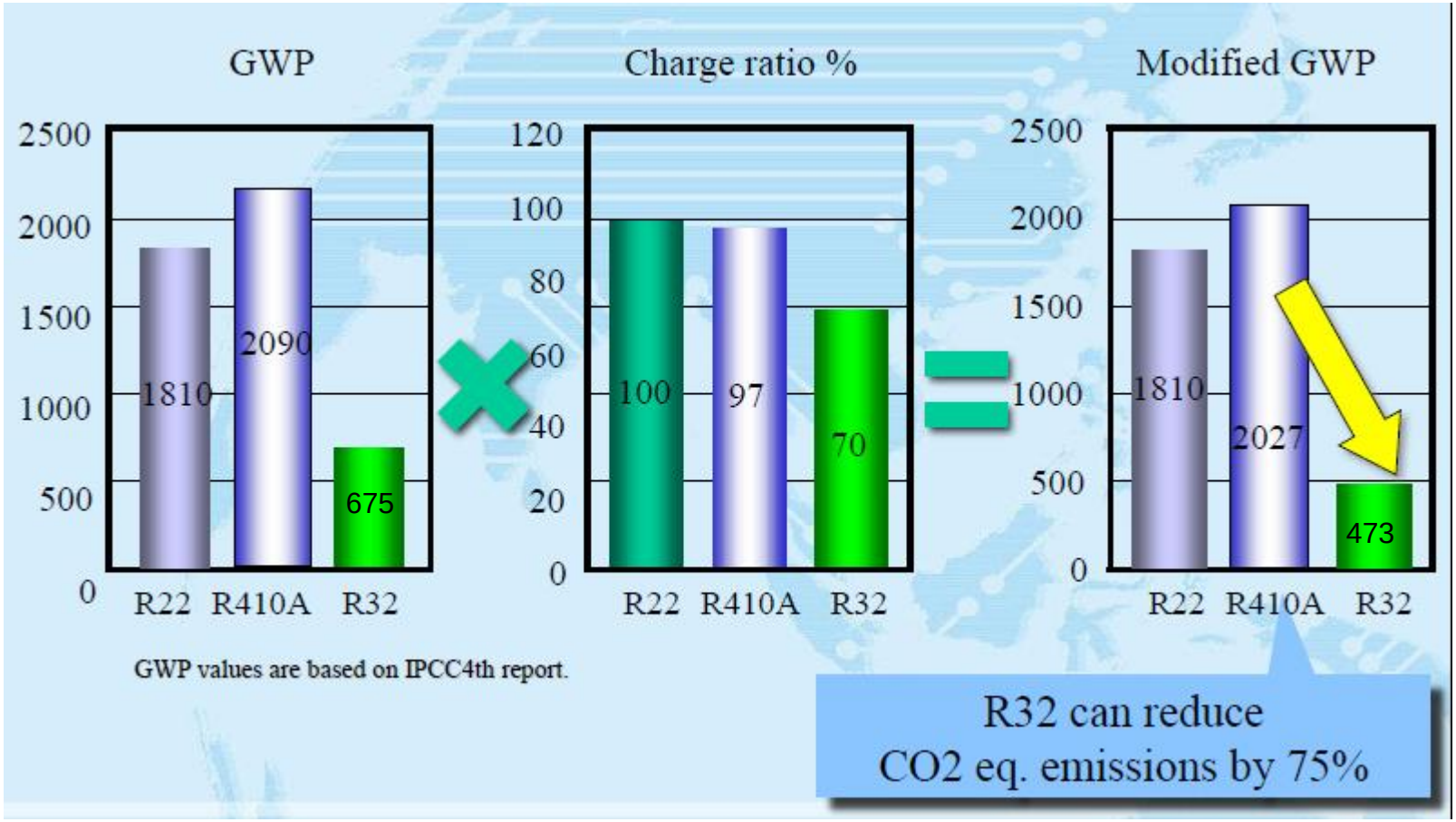
What are the future options?

Refrigerant properties compared to R410A

			Refrigerant physical properties					
			Cond.Press. MPa	ODP	GWP (IPCC4)	Life Year	Flamm -ability	Toxicity
HFC	R410A	Azeotrope	**2.72**	**0**	**2090**	**5-29**	**No**	**Low**
	R407C	Zeotrope	**1.86**	**0**	**1810**	**5-29**	**No**	**Low**
	R32	Single	**2.80**	**0**	**675**	**5**	**Low** (1)	**Low**
	HFO1234ze	Single	**0.88**	**0**	**6**	**11 days**	**Low** (1)	**Low** (3)
	HFO1234yf	Single	**1.16**	**0**	**4**	**7 days**	**Low** (1)	**Low** (3)
	HFO mixture	**Under investigation**						**Low**
Non-HFC	Propane (R290)	Single	**1.53**	**0**	**<3**	**Some days**	**High**	**Low**
	CO2(R744)	Single	**10.0**	**0**	**1**	**120**	**No**	**Low** (2)
	Ammonia (R717)	Single	**1.78**	**0**	**0**	**0**	**Low**	**High**

*1 According to ISO817 draft
*2 Practical limit is 0.1 kg/m^3 according to EN378
*3 Based on latest data proposed for ASHRAE34

R32 has a favorable impact on GWP

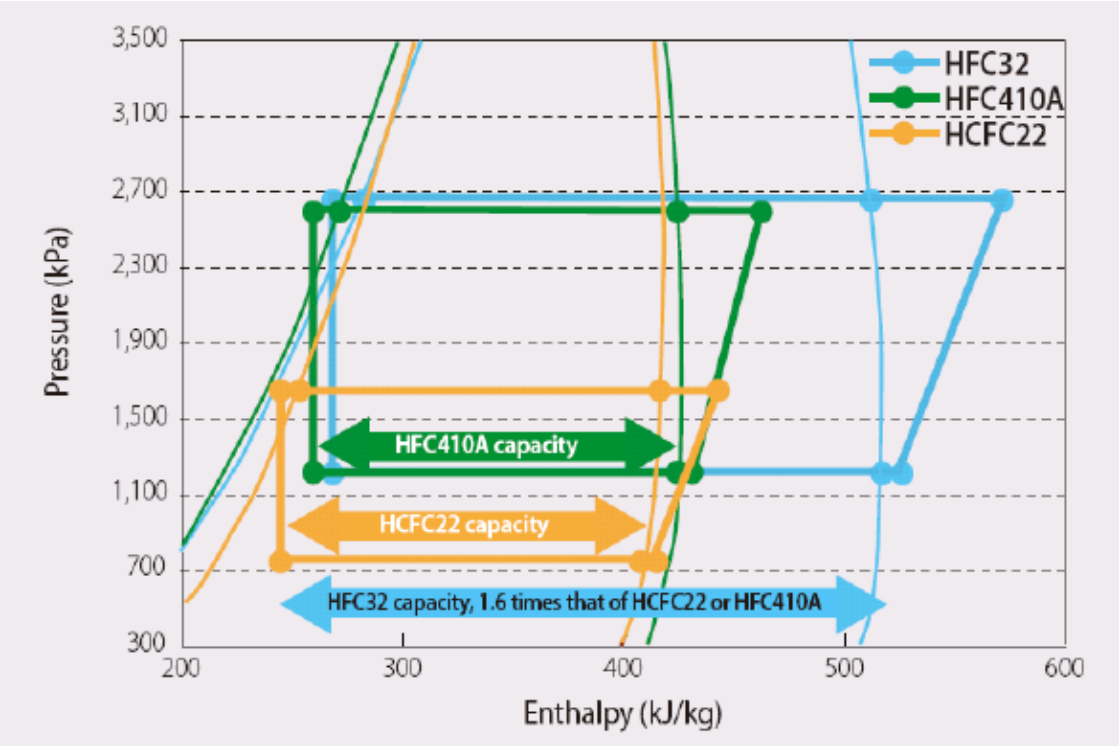


- **The GWP of R32 is only 1/3rd of R410A**
- **The combined impact of GWP and Quantity can be up to 75% lower**

GWP values are based on IPCC 4th report.
(Note : for the EU F gas regulation, the GWP values of the IPCC3 apply where R410A is 1975)

Properties of R32

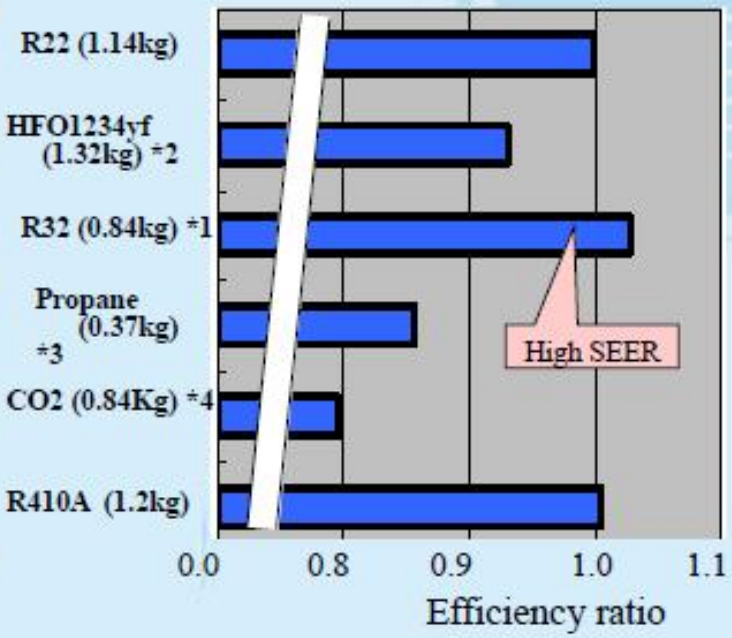
- Refrigeration capacity of R32 is 1.6 times higher than R410A
- Lower pressure loss when the capacity is the same → smaller piping diameter
- Higher heat transfer coefficient than R410A
- Charge volume reduction:
  - Liquid density: 90% of R410A
  - Volume reduction → total 30% reduction against R410A



Energy Efficiency

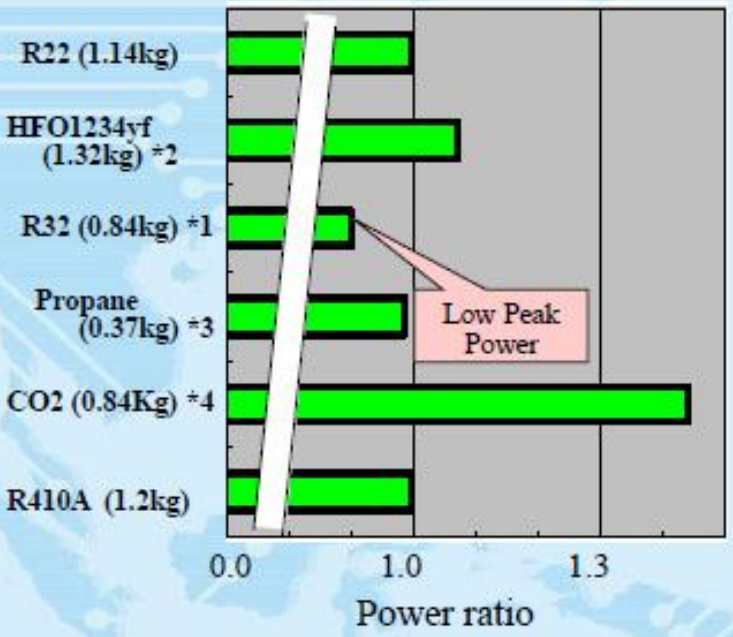
1. SEER Comparison (cooling mode)

HPs (Reversible) - 3.5kW-Room AC



2. Peak power comparison

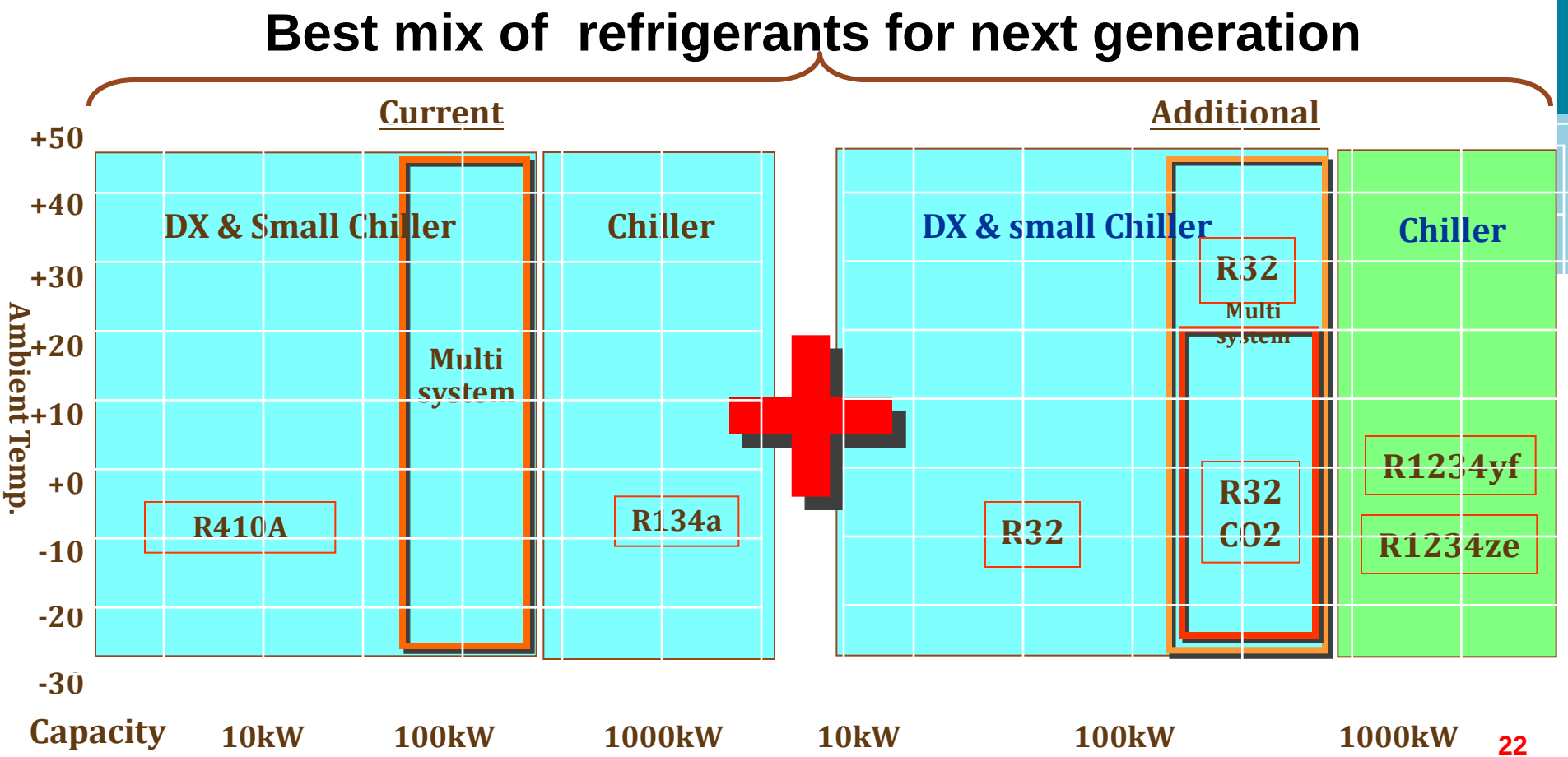
under cooling condition Outside 35°C, room 27°C



(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)

Refrigerant application map for air conditioners and heat pumps

Recommendations for a Sustainable Future: Best MIX of Current & additional refrigerants depending on application



Conclusion

1. **Not only GWP but other impacts** on safety, environment, economy, energy supply should be considered.
2. There is **no one-size-fits-all solution**.
3. The sooner the better. **This is the time to act.**
4. **R32 is the most balanced and feasible** alternative for most ranges of air-conditioning and heat pump applications for now.

Daikin will launch R32 products in Japan and other countries wherever possible.

All Seasons

CLIMATE COMFORT

Heating

Air Conditioning

Applied Systems

Refrigeration

SKYAIR® Product Line Up.

New Seasonal Inverter – RZQSG Range

All Seasons
CLIMATE COMFORT

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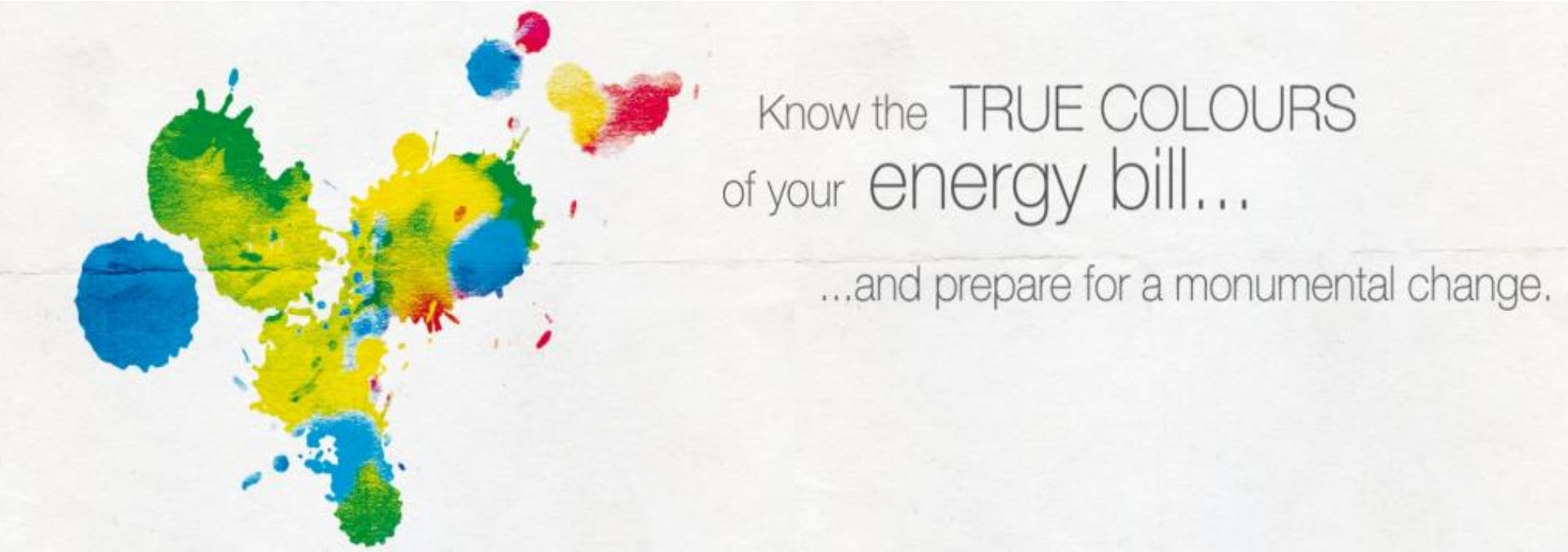
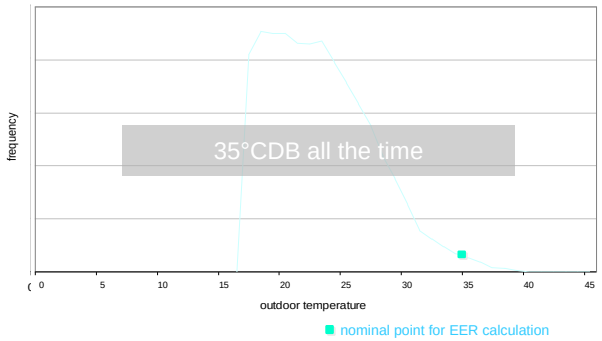
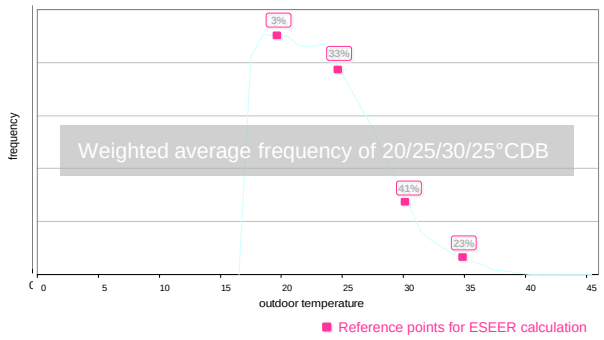
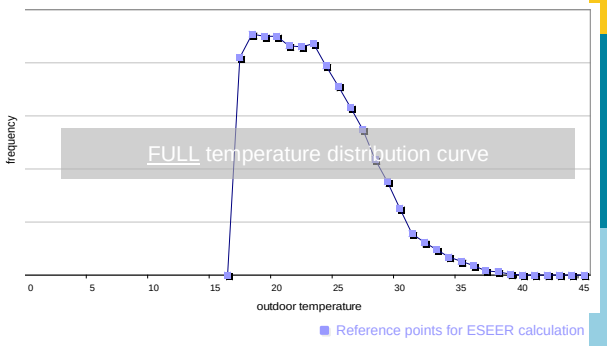
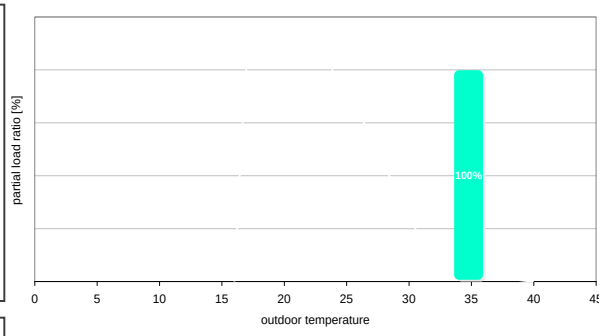
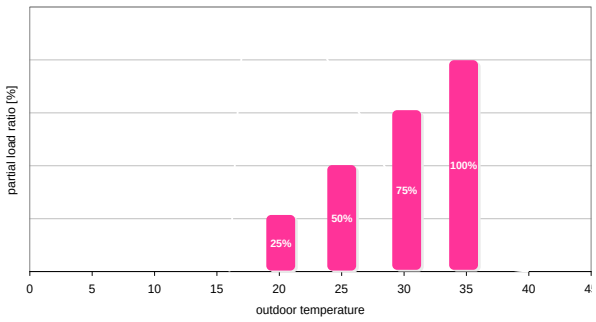
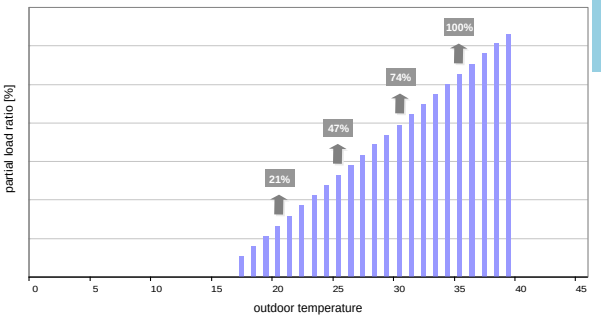
EER *vs.* ESEER *vs.* SEER – overview

Energy Efficiency Ratios:

What does it all mean?

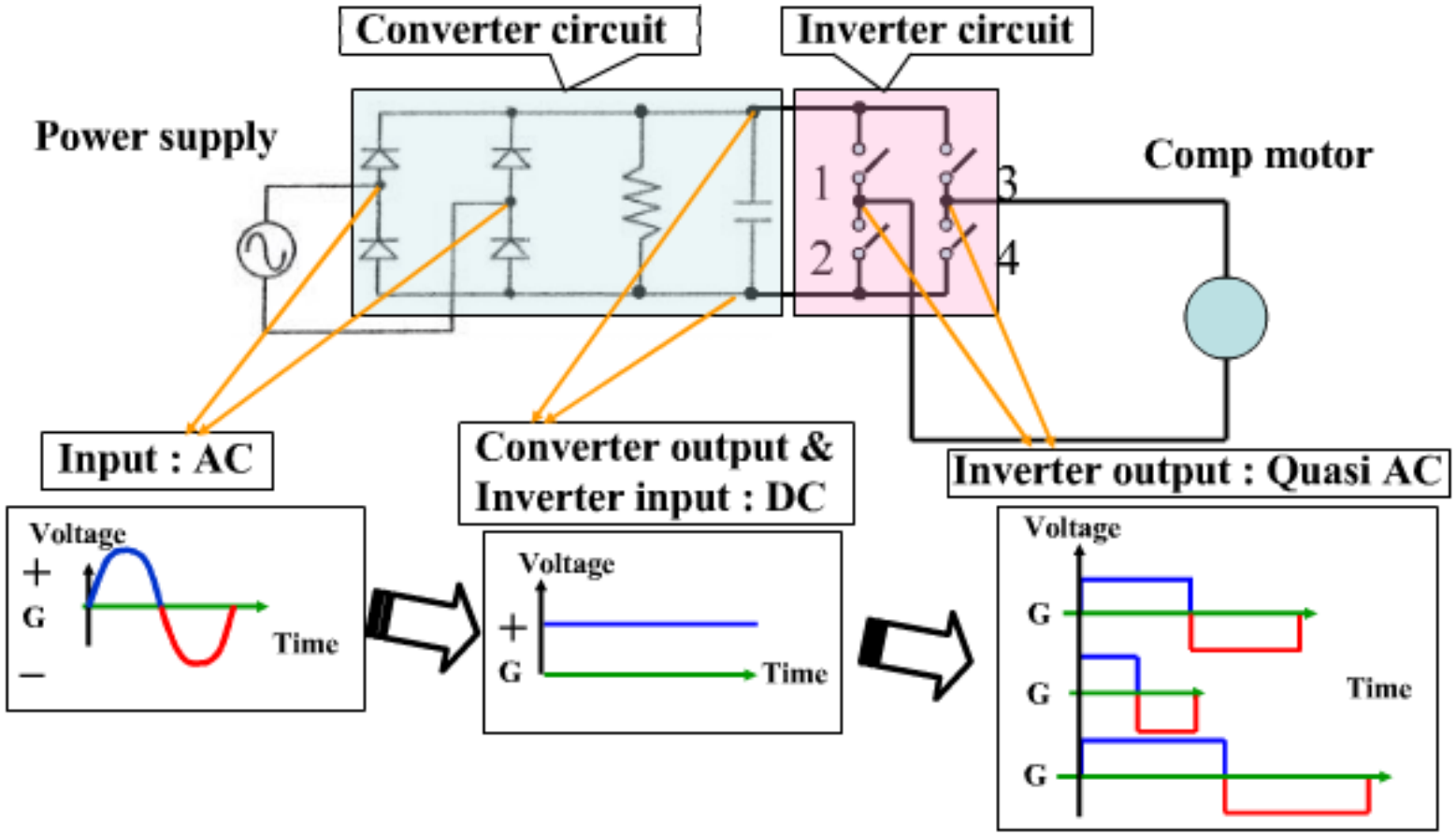


EER *vs.* ESEER *vs.* SEER – overview

	EER	ESEER	SEER
Temperature conditions			
Load conditions			
Formula	$EER = \frac{\text{RATED CAPACITY OF THE UNIT}}{\text{POWER INPUT TO GENERATE THIS CAPACITY}}$	$ESEER = A*EER_{100\%} + B*EER_{75\%} + C*EER_{50\%} + D*EER_{25\%}$	$SEER = \frac{\text{TOTAL ANNUAL ENERGY OUTPUT}}{\text{TOTAL ANNUAL POWER INPUT}}$
Conclusions	EER indicates how efficient operates an air conditioner at nominal conditions (35° CDB)	ESEER indicates how efficient operates an air conditioner, based on 4 representative points.	SEER indicates how efficient operates an air conditioner over an entire cooling season.

Principle of the inverter

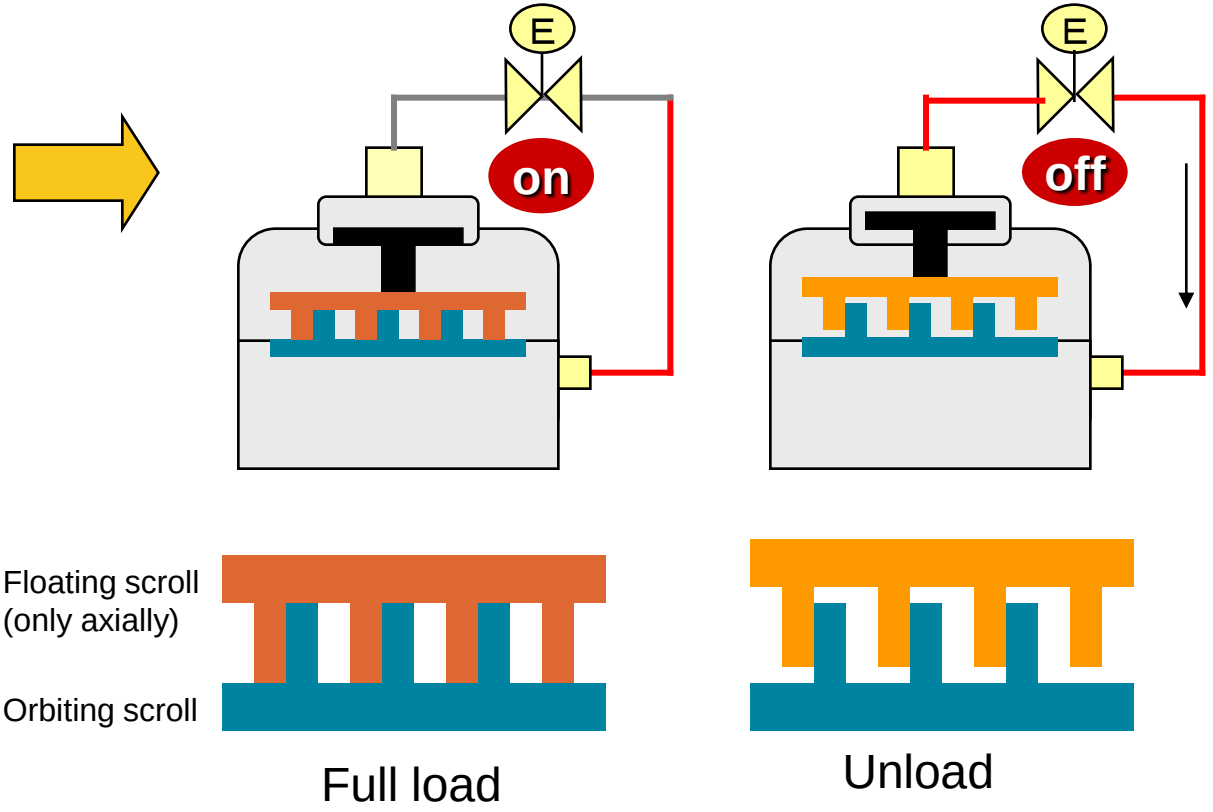
Inverter ► Electrical



Inverter versus digital scroll

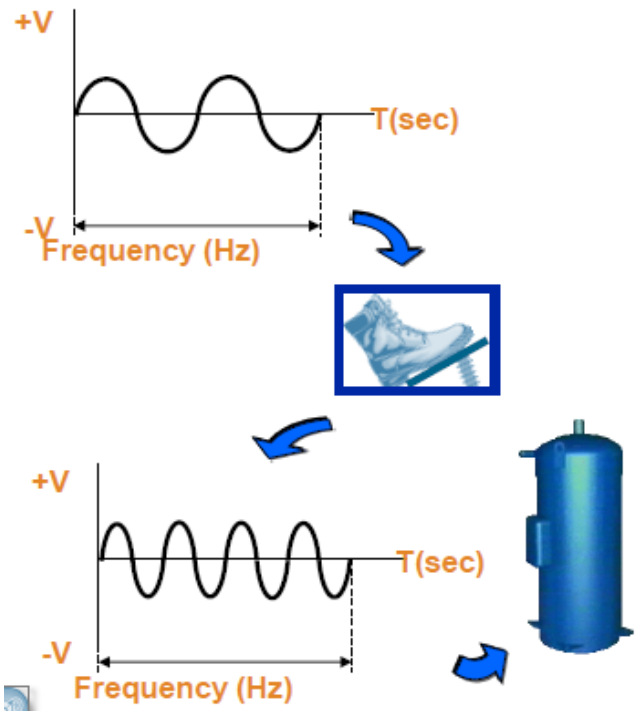
Digital Scroll ► Mechanical

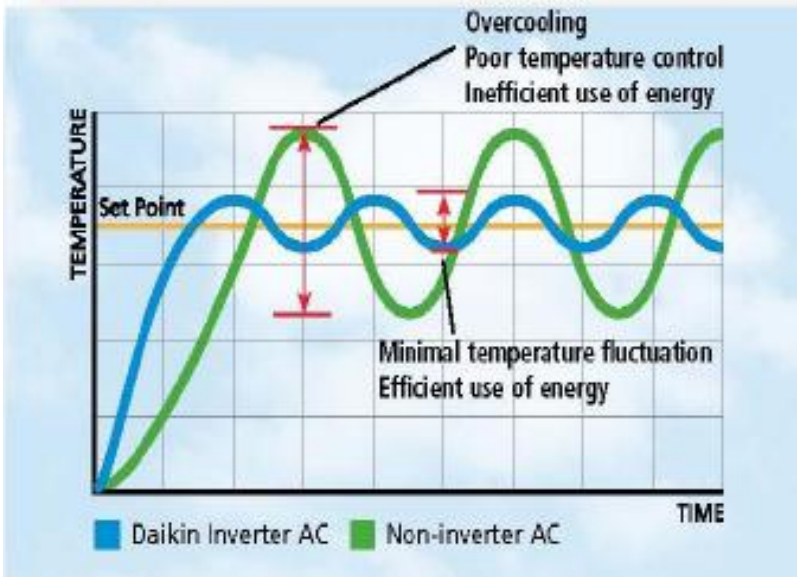
More moving parts



Advantages of the inverter

Inverter	► No over-cooling or over-heating	→ Energy saving
	► Precise temperature control	→ increased comfort



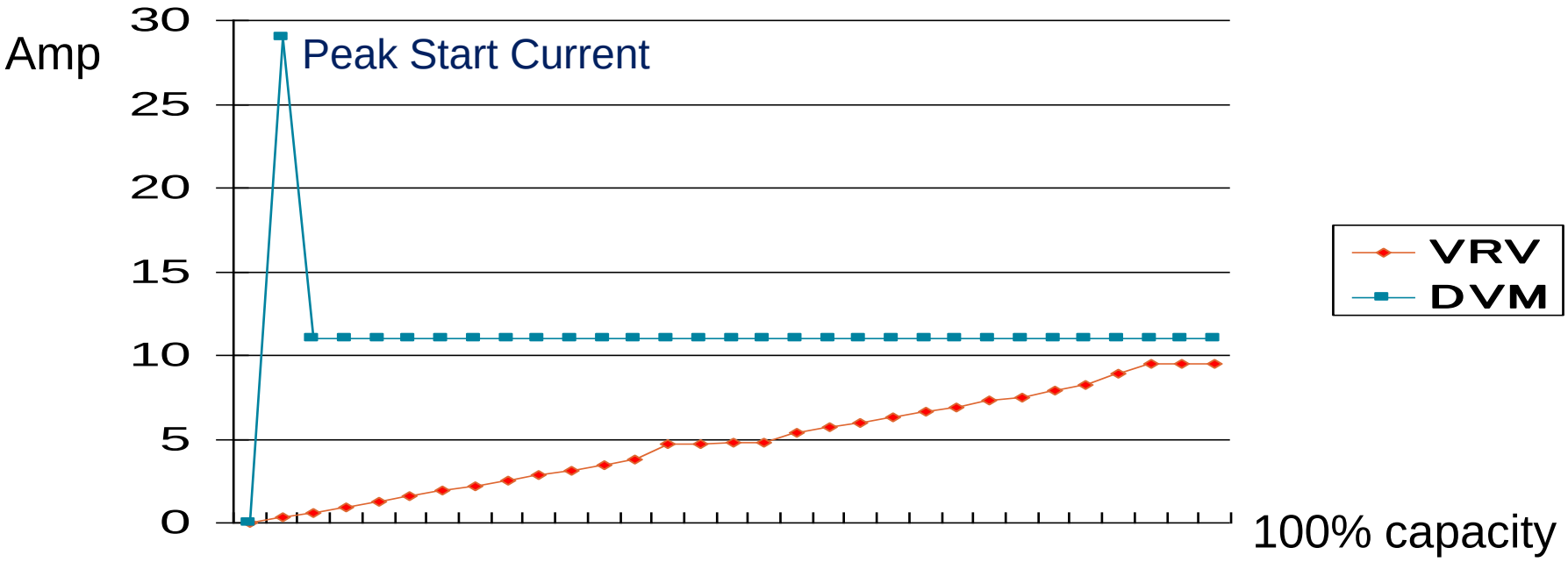


Advantages of the inverter

Inverter ► Very low start up amperage

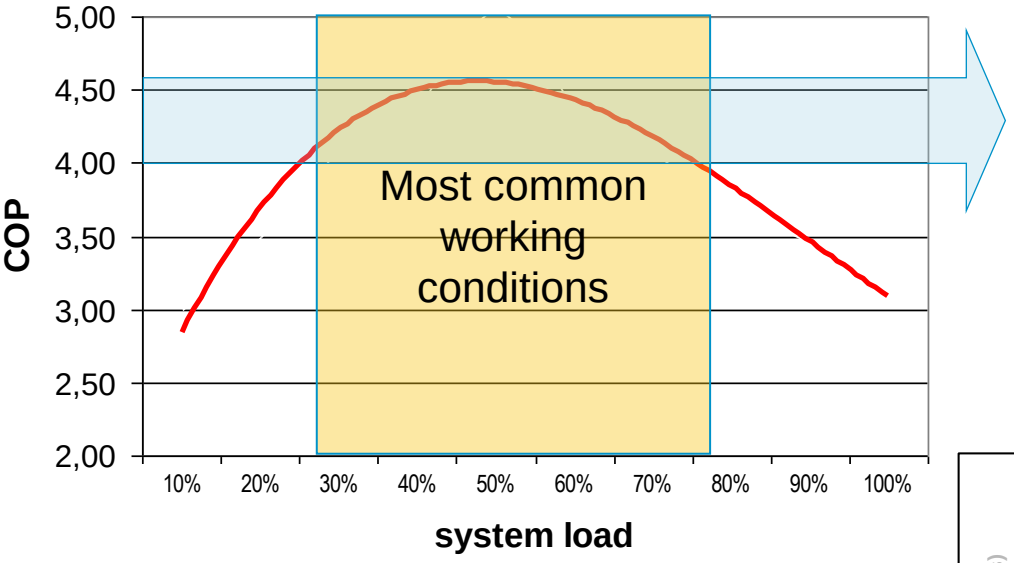
→ smaller electric supply cables & fuses

→ lower electrical installation cost



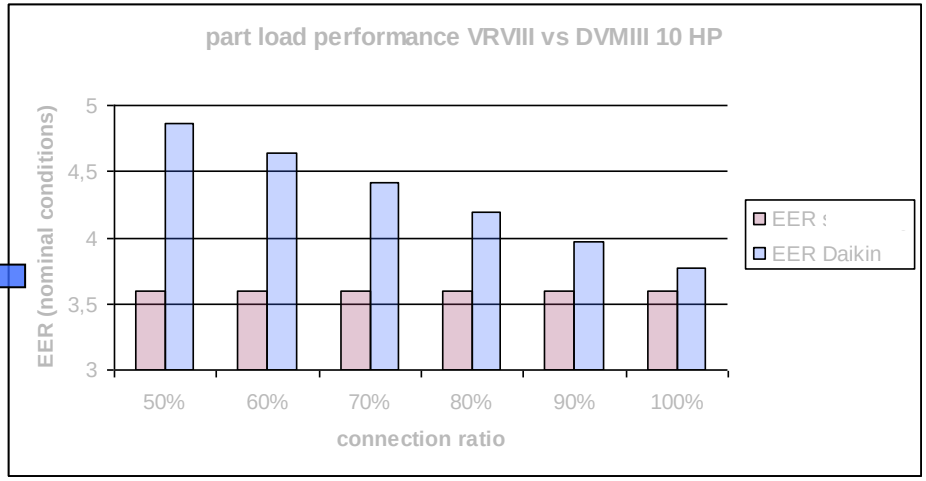
Advantages of the inverter

Inverter ► High Energy Efficiency in partial load



High seasonal COP

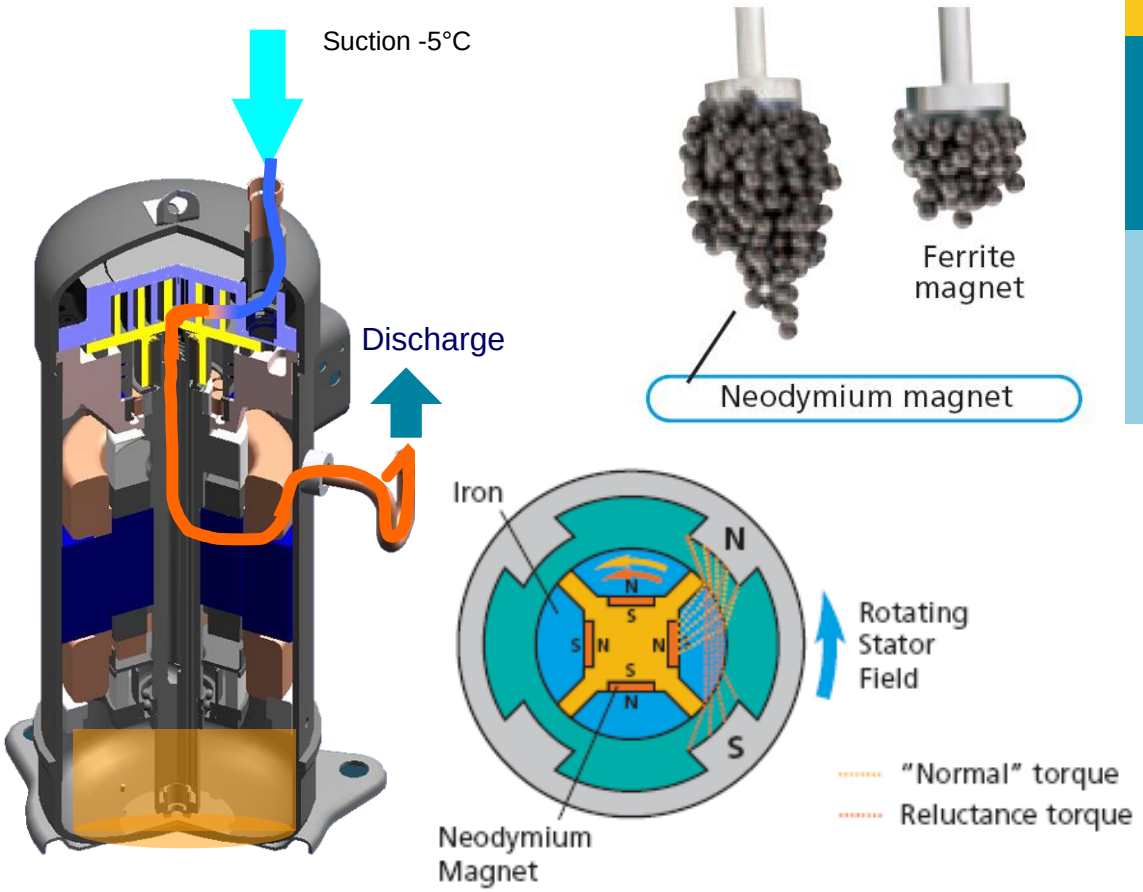
At 50% part load the inverter is 35% more efficient than non-inverter



New DC Inverter compressor technology.

- Reluctance DC Motor
- Optimized Scroll (R-410A)
- High Pressure Shell
- Improved Sealing
- Stable oil temperature
- Speed regulated by inverter
- Low sound level

Improved Efficiency
Improved Reliability



New Sky Air series: Seasonal Inverter Models

HOW?

- Optimization of the inverter control
- Re-design of auxiliary modes
- Optimization at low ambient

Seasonal Inverter

New Product Line up:

Models : RZQSG 71 ~ 140 LV1/Y1

3HP	4HP	5HP	6HP
			

- 7 to 14 kW
- 1ph and 3ph

Seasonal Inverter

New Cassette Line up:

Seasonal cassette

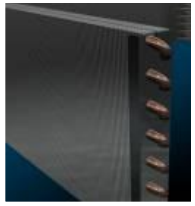
SEASONAL CASSETTE – TECHNOLOGY

Main new elements : *complete new body, new decopanel and sensors*

NEW!

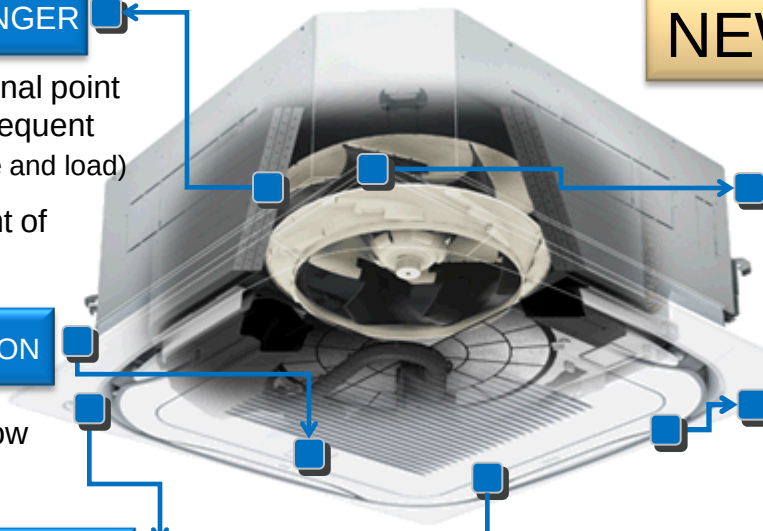
Drastic improvement of energy efficiency while improving comfort level and flexibility *vs.* FCQ

NEWLY DESIGNED HEAT EXCHANGER



Optimized not at nominal point only but at the most frequent conditions (temperature and load)

⇒ Great enhancement of energy efficiency



NEW DC FAN MOTOR

Contributes to the improvement of the energy efficiency.

OPTIONAL AUTOCLEANING FUNCTION

- Maintain optimal efficiency & airflow

NEW DC DRAIN PUMP

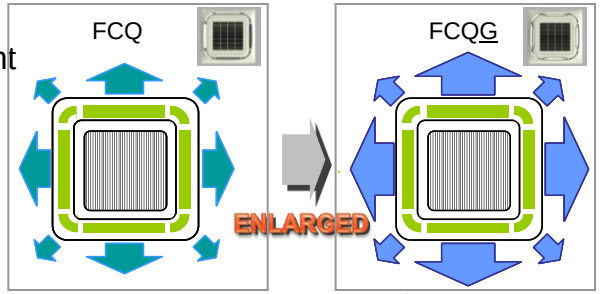
To reduce power consumption, DC drain pump has replaced the AC drain pump

OPTIONAL PRESENCE & FLOOR SENSOR

- Further energy saving
- Increased comfort

NEW DECOPANEL

- Increased efficiency thanks to enlargement of the outblow air (via external flaps)
- Maintain current airflow pattern: unique 360° air distribution
- Increased flexibility thanks to possibility to close 1/2/3 flaps (via BRC1E52 or via option)



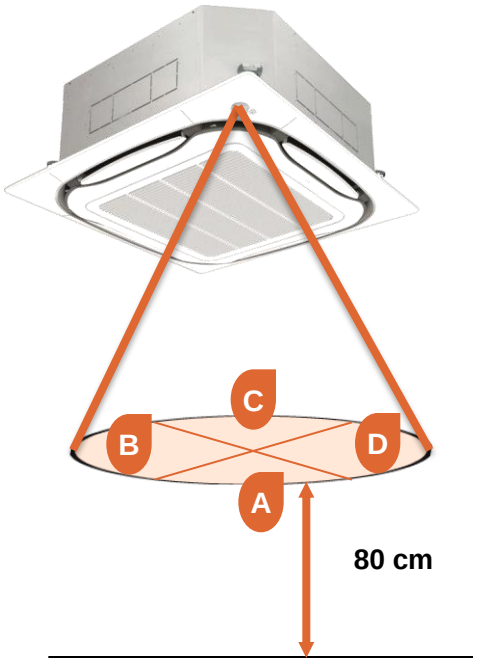
New Cassette Features:

Seasonal cassette

SMART USE: ENERGY SAVING

NEW!

Further energy saving thanks to smart use

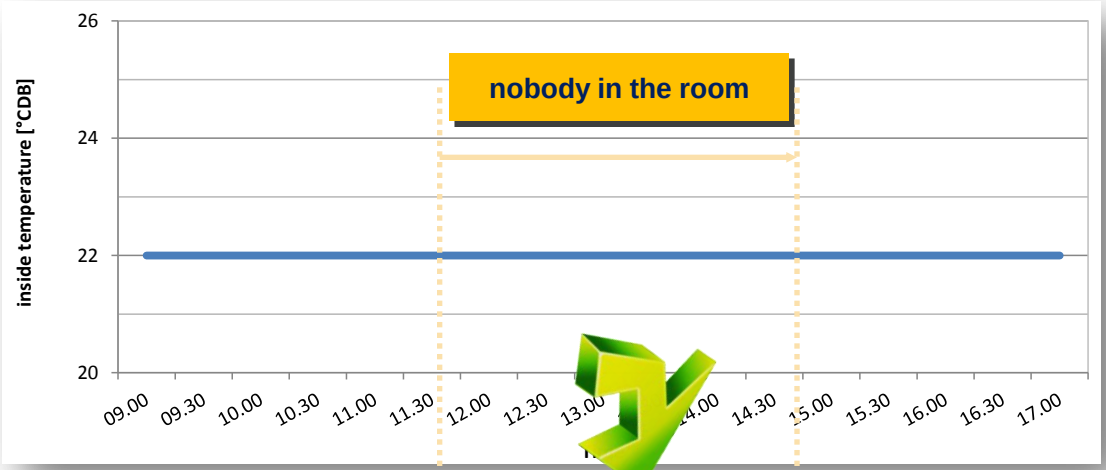


- Adjustment of temperature in case of no occupancy
- Combination with improved setback function

New Cassette Features:

Seasonal cassette

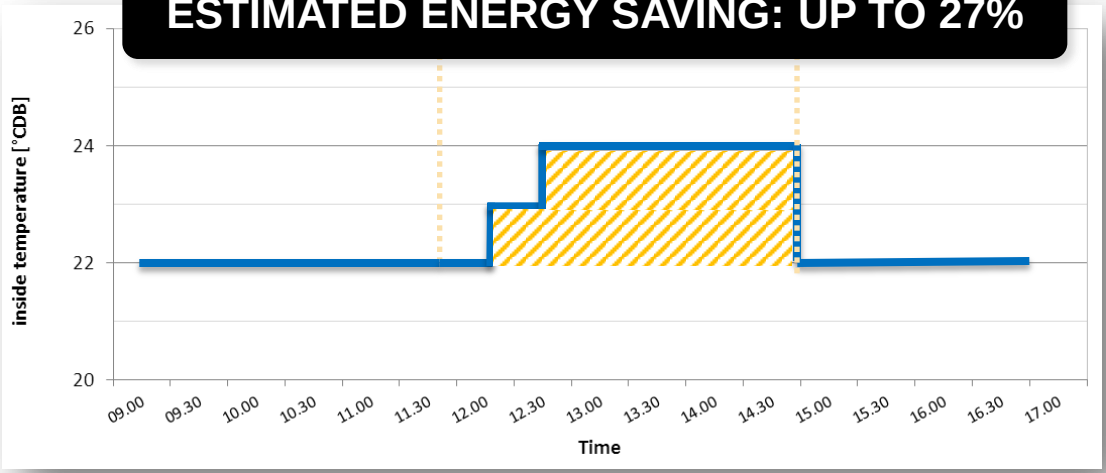
ENERGY SAVING



WITHOUT SENSOR

Set point: 22° CDB

ESTIMATED ENERGY SAVING: UP TO 27%



WITH SENSOR

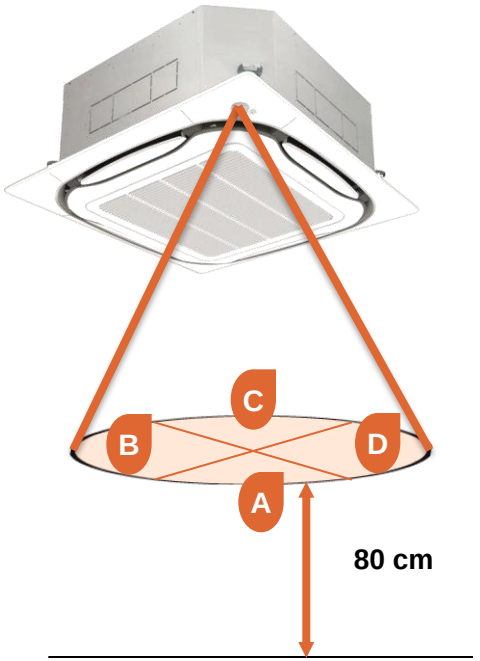
Presence sensor parameters		COOLING
ΔT:	1	°CDB
time interval:	30	minutes
$T_{max\_cooling}$	24	°CDB
Activation setback:	ON	
Setback activation time:	10	hours

New Cassette Features:

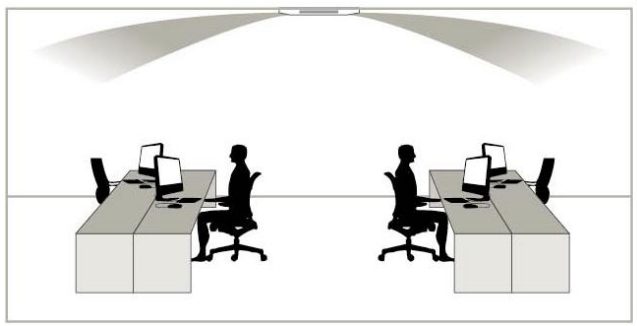
Seasonal cassette

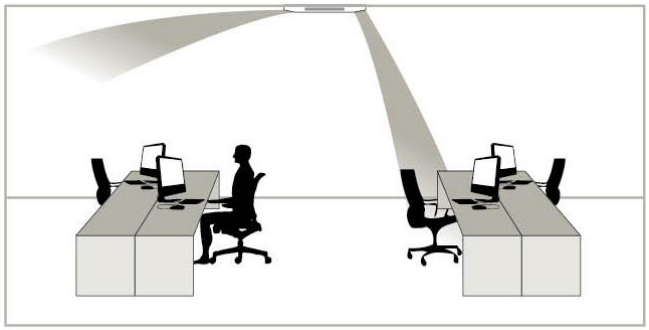
COMFORT: OPTIMIZED AIR DISTRIBUTION – PRESENCE SENSORS

NEW!



- Airflow control: prevent blowing on a person if detected
  (activation independent from adjustment of temperature)





Drastic improvement of energy efficiency while further enhancing comfort level of current FCQ thanks to sensors

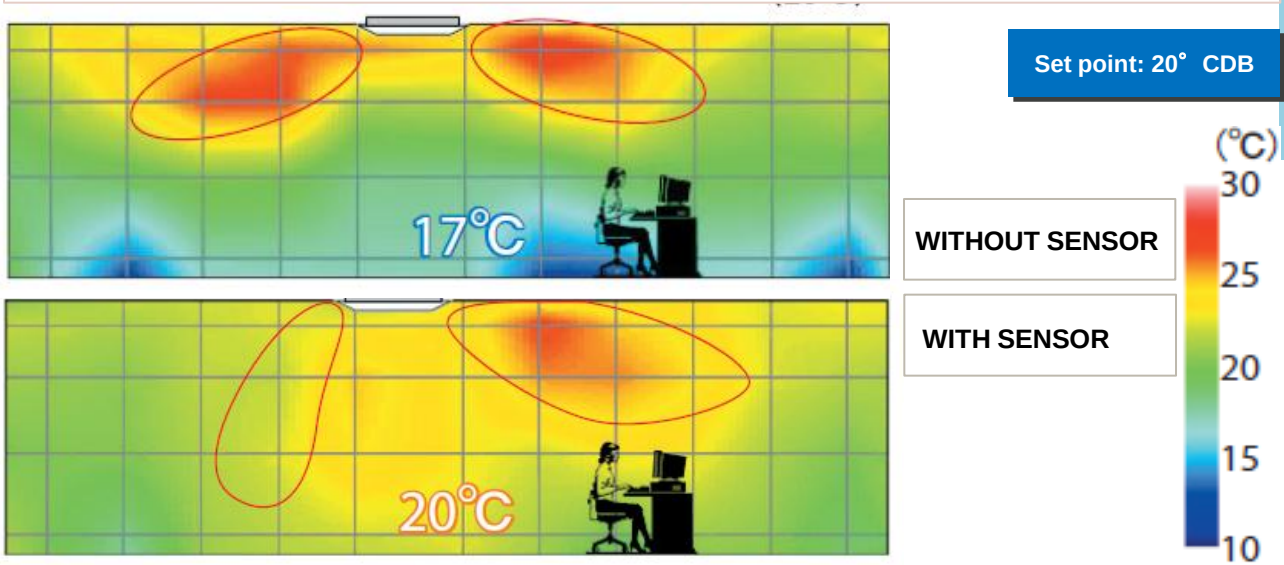
New Cassette Features:

Seasonal cassette

COMFORT: OPTIMIZED AIR DISTRIBUTION – FLOOR SENSOR

NEW!

- Automatic airflow adjustment to make uniform the temperature between the ceiling and the floor

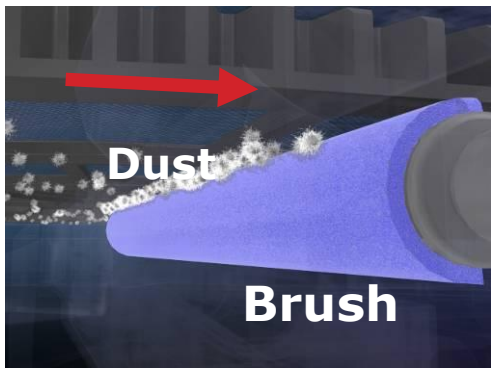


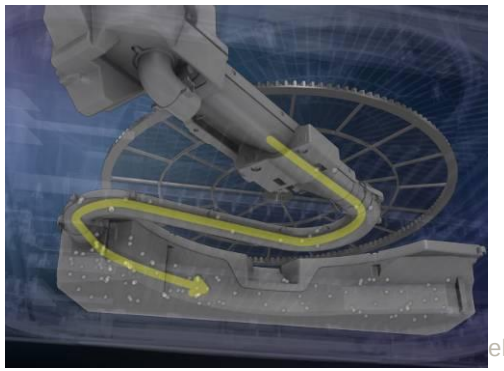
Drastic improvement of energy efficiency while further enhancing comfort level of current FCQ thanks to sensors

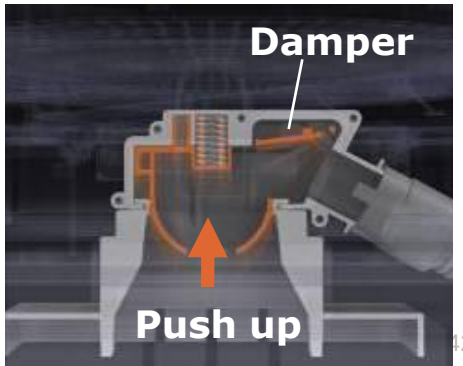
AUTO CLEANING DECORATION PANEL

Auto cleaning decoration panel (optional)

- Energy savings up to 50% thanks to automatic daily filter cleaning
  - During the night the filter rotates to pass by a special brush
  - The brush collects the dust and it is send to the dust box
  - Every half year the dust box is emptied with a normal vacuum cleaner
- Faster maintenance
  - No ladders and rearrangement of the shop required
  - No qualified personnel required
- Cleaner appearance
- Increased comfort thanks to optimal airflow





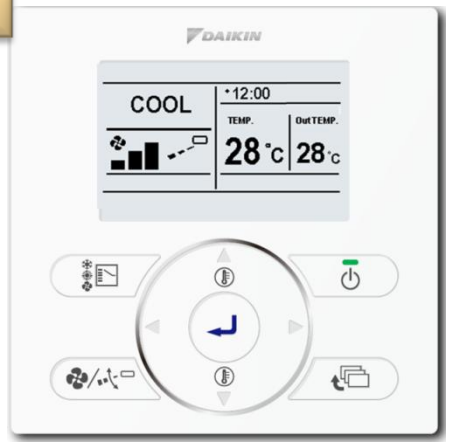


SMART USE – CONTROLLER : BRC1E528

NEW

New functions and improvements:

- **Energy saving mode: activation of a series of energy saving functions (customization is possible)**
  - Temperature range limit
  - Integration of presence sensor function (programmable)
  - Setting temperature auto reset
  - Off timer
- kWh indication
- Improved setback function
- 3 different weekly timers
- …



All Seasons

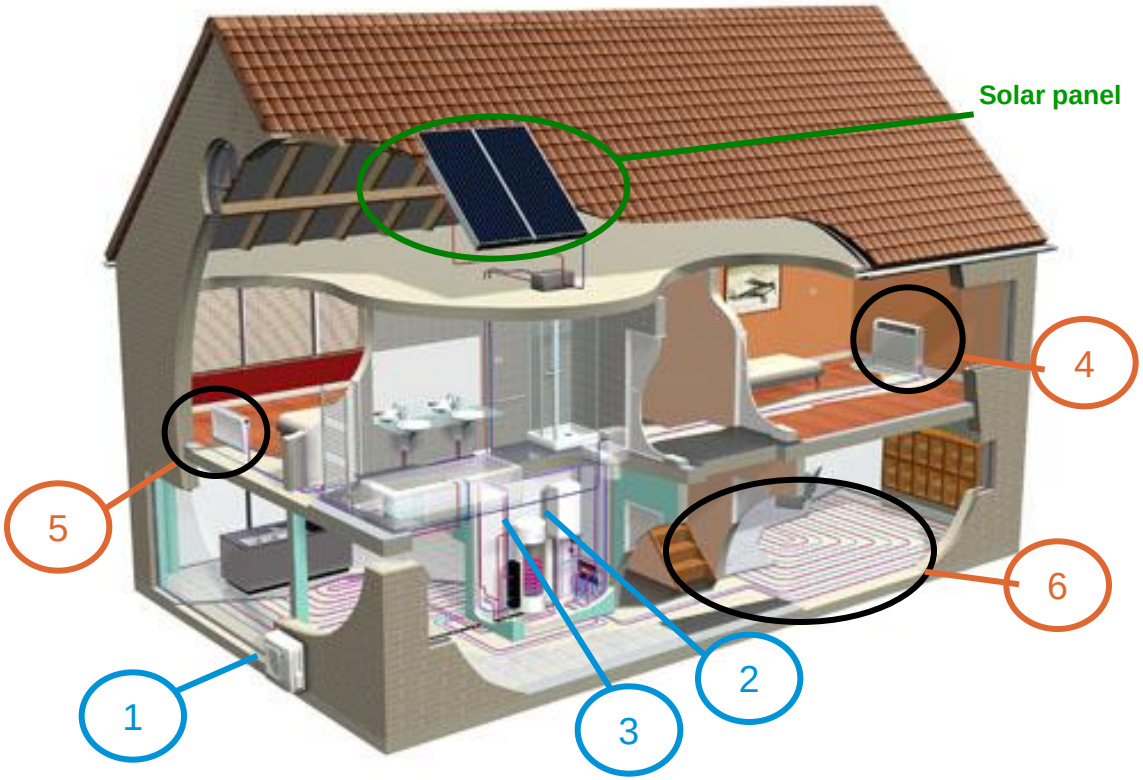
CLIMATE COMFORT

- Heating
- Air Conditioning
- Applied Systems
- Refrigeration

Daikin Altherma Flex: cooling, heating & hot water production

Daikin Altherma, the intelligent way to comfort

Product concept



CAPACITY RANGE:

- room heating : 5.7 – 16.0 kW
- domestic hot water: 150 – 300 l
- room cooling: 5.1 - 13.0 kW

COMPONENTS:

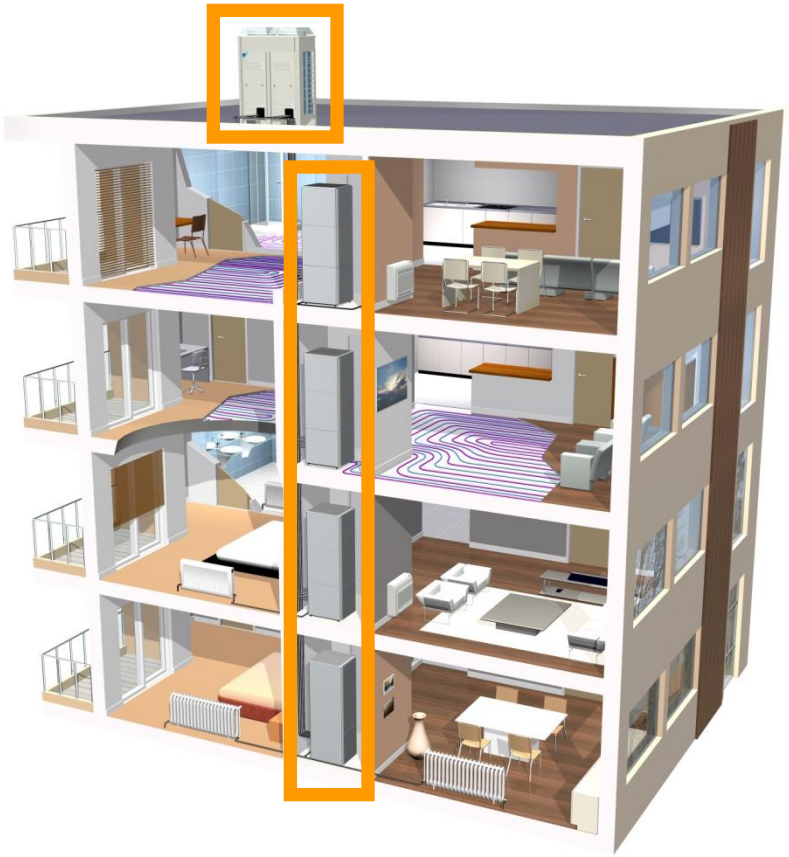
1. Outdoor unit
2. Indoor unit = Hydrobox
3. Domestic hot water tank (optional)

EMITTERS

4. Fan Coils
5. LT radiators
6. Floor heating

heating

Residential applications



independant heating / cooling / hot water production **per apartment**

common heating / cooling / hot water production for the **whole building**

Commercial applications

Offices	**Hotels**	**Spa solutions**	**Gymnasium**	**Prisons**
Shops	**Schools**	**Student dorms**	**Factories**	**Stadiums**

Cascade technology

SPACE HEATING

High capacities and efficiencies with low ambient T°

Water temperatures **25-80°C => Suitable for all emitters**

▪ New and existing **radiators**	**45°C – 80°C**
▪ **Under floor heating**	**25°C – 35°C**
▪ **Heat pump convector**	**35°C – 45°C**
▪ **Fan Coil units**	**35°C – 80°C**

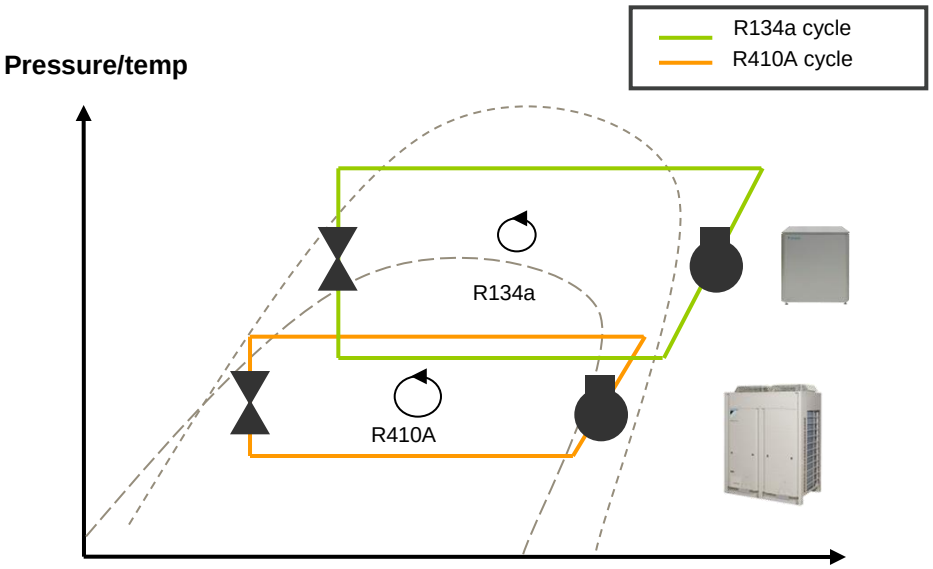



Cascade technology

SANITARY HOT WATER HEATING

High volumes of hot water

- NO electrical heater
- High efficiencies
- Quick heat-up times



MODULAR SYSTEM

Optimised dimensioning

Several classes of I/U + O/U lead to dimensioning acc. to exact needs

Unlimited capacity

Add-on outdoor units to reach higher capacities

Cooling possibility

Reversible indoor units

Efficient solutions

- **Heat recovery when combining cooling and DHW heating**
- **Possibility to connect solar panels**
- **Possibility to use thermal storage (heating / cooling)**

All Seasons

CLIMATE COMFORT

Heating

Air Conditioning

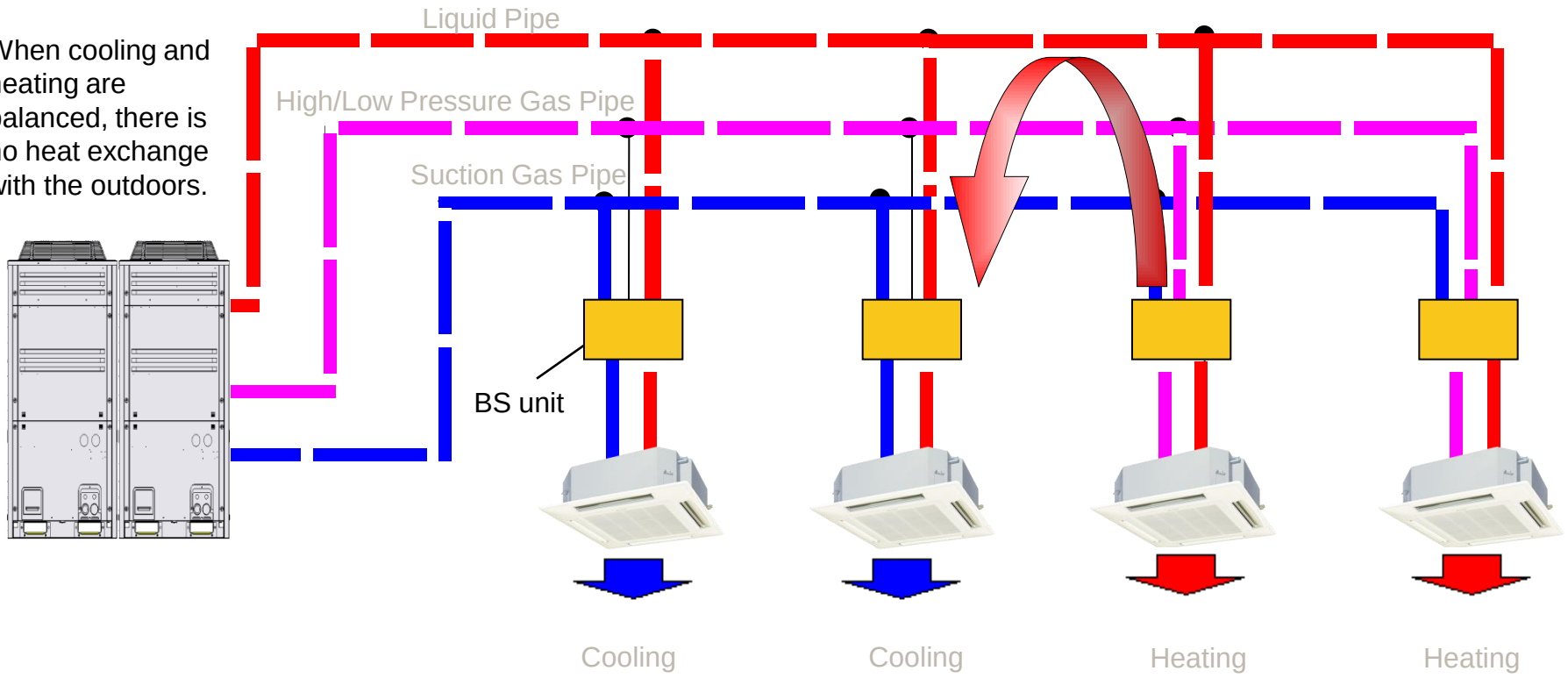
Applied Systems

Refrigeration

Heat Recovery

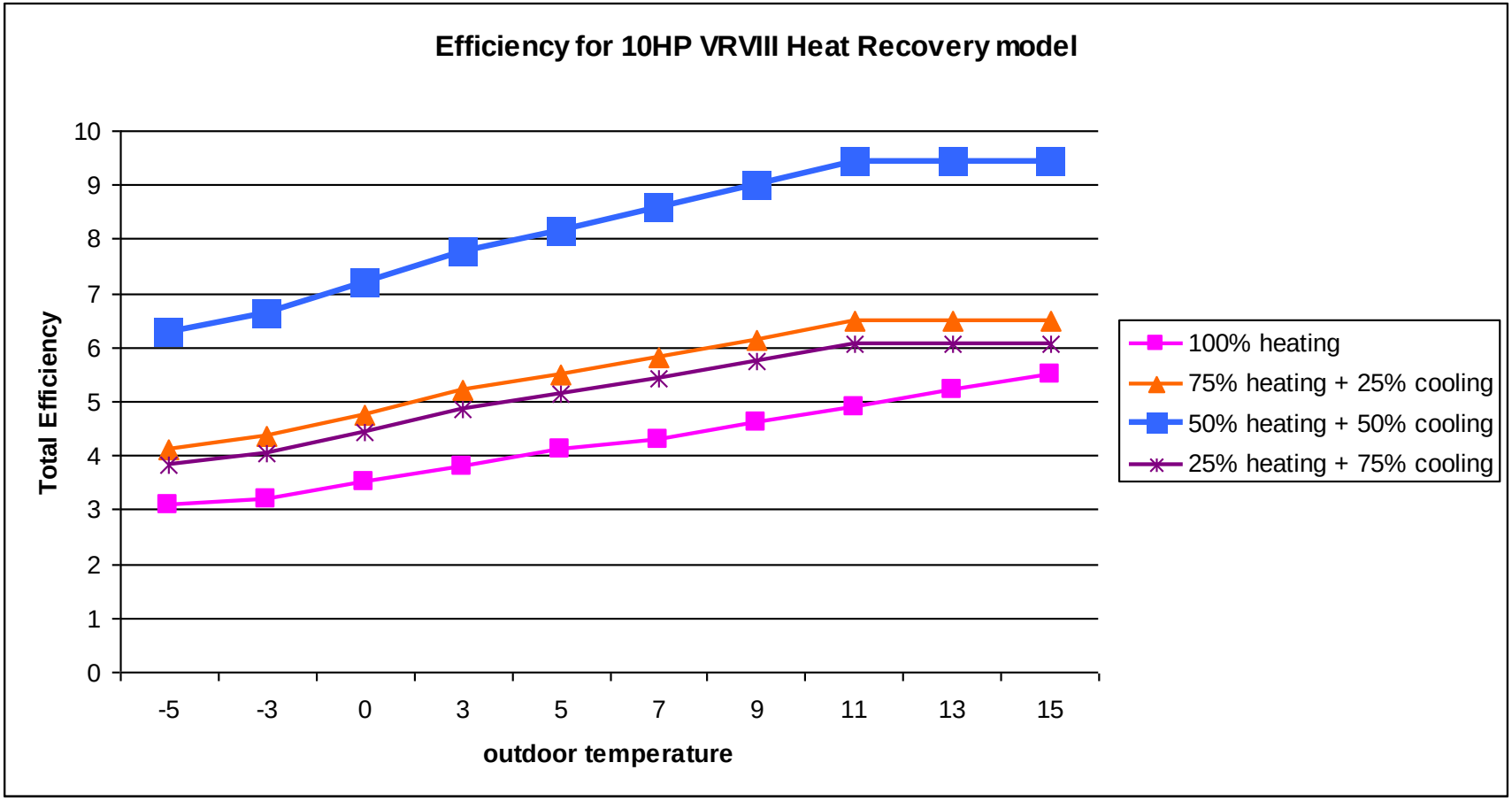
VRV – Heat Recovery system

When cooling and heating are balanced, there is no heat exchange with the outdoors.

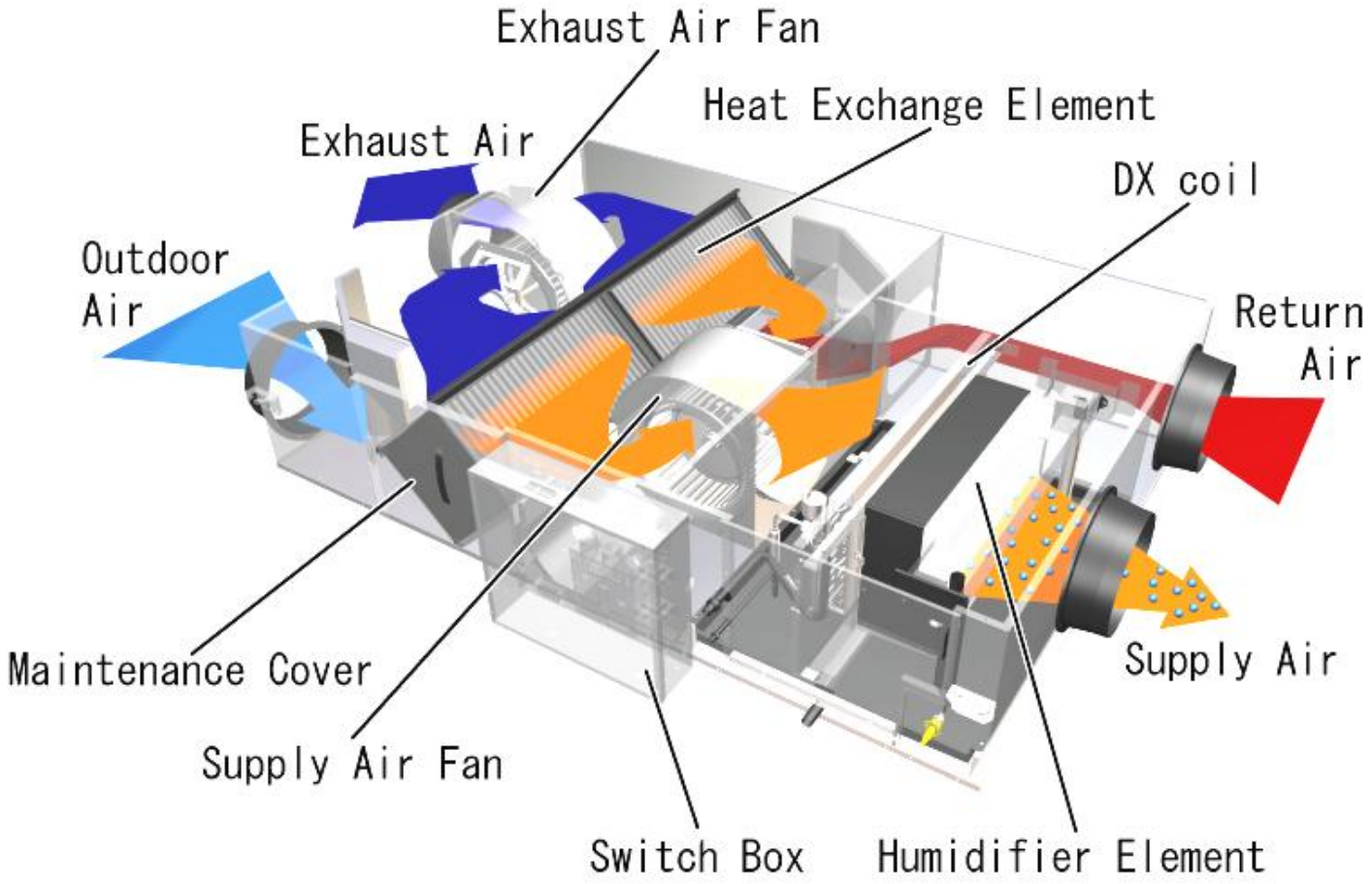


The heat pump unit has two refrigerant pipes (liquid and gas).
=> The heat recovery unit has three pipes (liquid, high/low pressure gas, and suction gas). Cooling and heating are switched by the BS unit, which chooses either high/low pressure gas or suction gas out of these three refrigerant pipes, depending on room temperature and the preset temperature.

Heat recovery & Energy Efficiency



VAM – Heat Reclaim Ventilation



All Seasons

CLIMATE COMFORT

Heating

Air Conditioning

Applied Systems

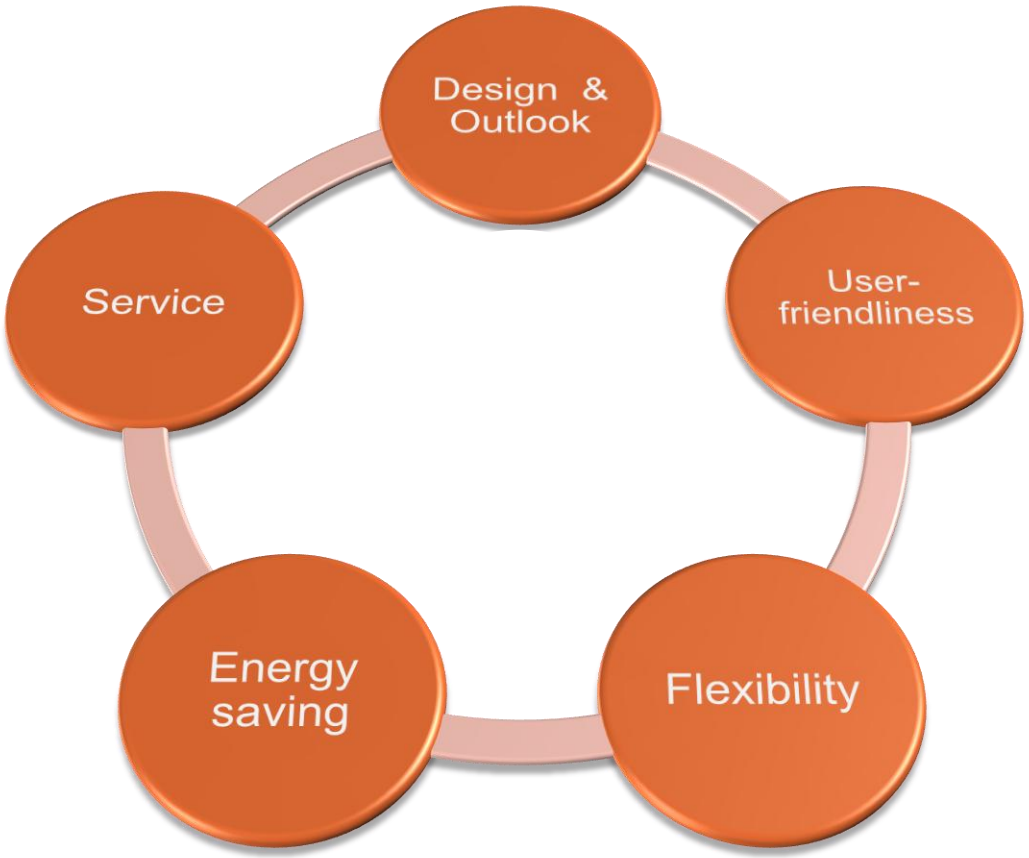
Refrigeration

Control Systems

New and Improved options

Controls

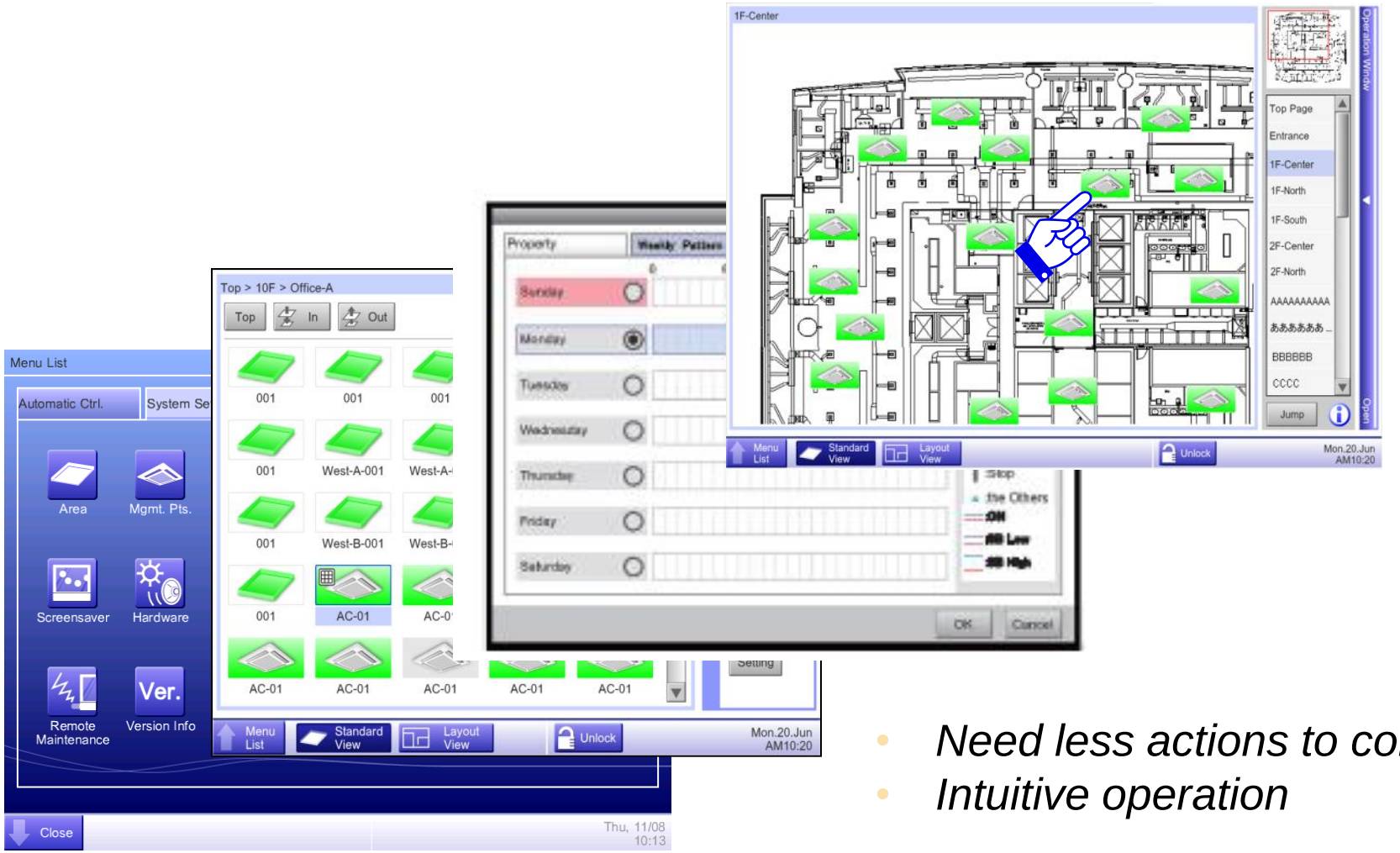
ITOUCH MANAGER



ITOUCH MANAGER

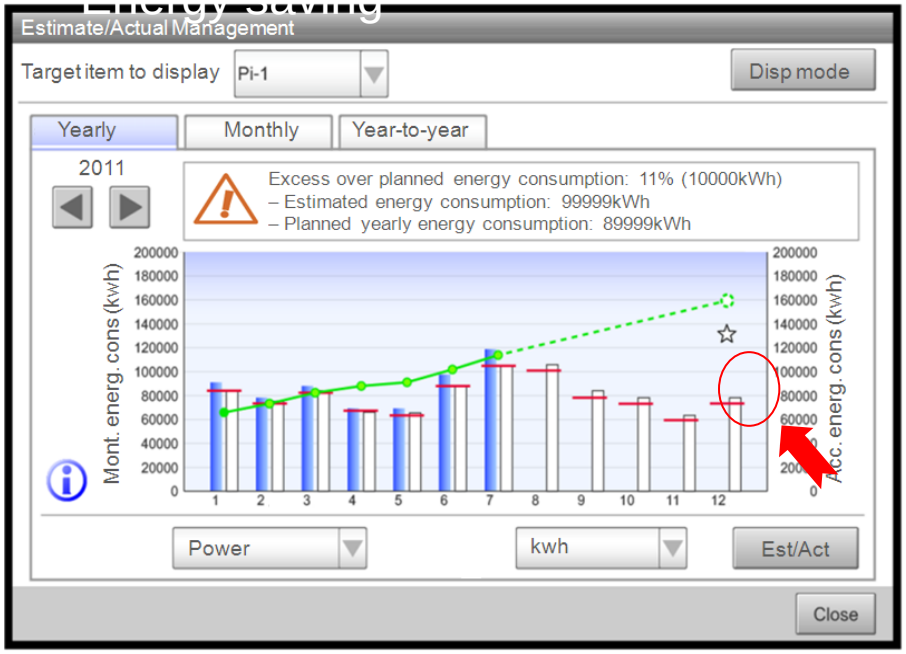
- *Slim outlook enabling easier integration to/in the wall*
- *Large screen for easy interaction*

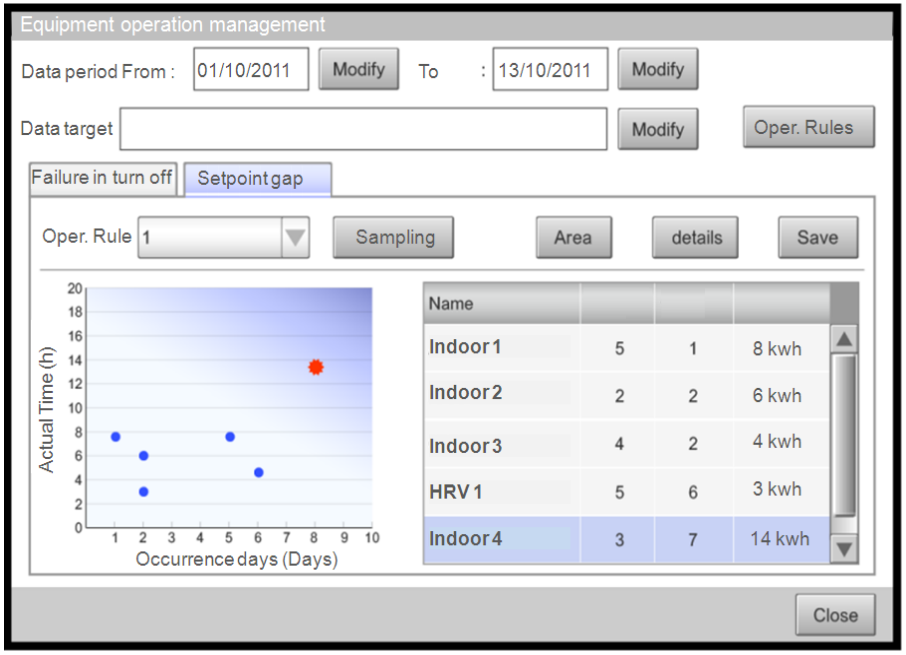
ITOUCH MANAGER



- *Need less actions to control*
- *Intuitive operation*

ITOUCH MANAGER



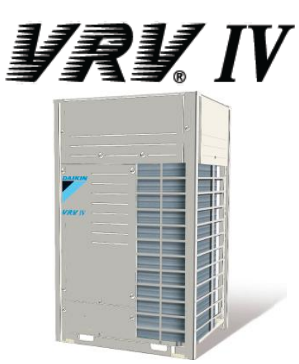


- *Energy management:*
  1. *monitor of energy consumption according to the plan*
  2. *point out the indoor which is the origin of energy waste*

VRV IV - BEYOND THE ORDINARY

- **Optimized seasonal efficiency**
- **Continuous heating** during defrost
- Optimal heating comfort with new Round flow cassette

Combine VRV IV with **standard & comfort Biddle air curtains**



Simplify maintenance and commissioning
- Remote leak check through new ITM
- USB connection

Hot water production
on standard VRV IV

Perfect fresh air comfort
continuous heating feature on new ERQ

THANKS FOR YOUR ATTENTION

Paul Dergeloo
Daikin Air conditioning South Africa
+27 (0)71 685 94 20
Dergeloo.P@daikin.co.za