

Panasonic
BUSINESS



Panasonic CO₂ Refrigeration Solutions

February, 2022



heating & cooling solutions

AGENDA

1. Legal framework and Regulation

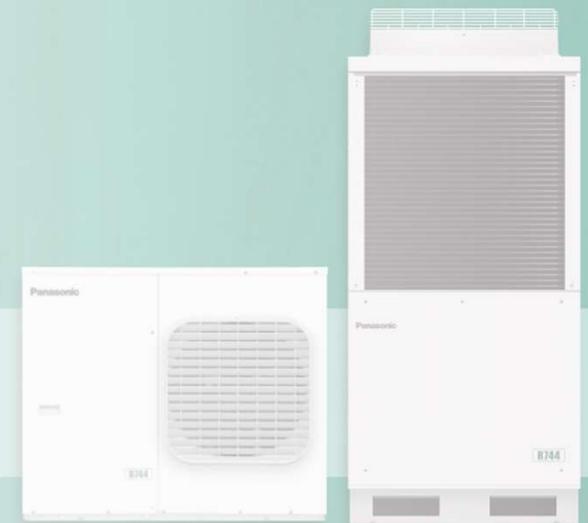
1. F-Gas & Refrigerant classification (reminder)
2. EU framework → Beyond F-Gas
3. National Regulations and Schemes

2. Panasonic CO₂ units in Europe:

1. Condensing units in Europe
2. Key benefits from Panasonic CO₂ solutions
3. Key benefit: sound pressure
4. Online software // Support // Filters
5. Main competitors: snapshot

3. Sales:

1. Panasonic CO₂ installations in Europe
2. Food retail installation <concept>
3. Gas-station installation <concept>
4. QSR installation <concept>
5. Healthcare installation <concept>
6. Storage installation <concept>
7. Challenging conditions: high ambient temperature
8. Challenging conditions: low ambient temperature





1.1. F-GAS REGULATION (EU n°517/2014) & Classification



Reminder

New Installation

01.01.2020

Ban of refrigerants with GWP = 2,500 or more:

- In plug-in units
- In remote installations (with the exception of deep freezing, i.e. -50°C or lower)
- In mobile HVAC systems

01.01.2022

Ban of refrigerants with GWP = 150 or more :

- In plug-in units
- In remote installations with Qo = 40 kW or more
- Exception (remote): Refrigerants with GWP under 1,500 can be commissioned in cascade system at cascade level

01.01.2025

Ban in HVAC of refrigerants with GWP = 750 or more with gas load under 3kg



Maintenance & Retrofitting

01.01.2020

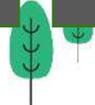
Maintenance and Service forbidden on installations with GWP = 2,500 and over:

- Applicable to gas load of 40 tons eq. CO₂ or more (= 10.4 kg of R404a)
- Exception: Deep freezing (to -50°C and lower)
- Exception: military outputs

01.01.2030

- No recovery of refrigerant with GWP = 2,500 and over
- No more usage of recovered and regenerated refrigerant with GWP = 2,500 or more

>> REMINDER	Non flammable	Midly flammable	Flammable	Highly flammable
Low toxicity	A1	A2L	A2	A3
High toxicity	B1	B2L	B2	B3





1.2. EU Framework → Beyond F-GAS

With possible REACH regulation in Europe



F-Gas is considered as necessary legal framework, but focused on GWP only. National initiatives can be more restrictive.

- Toxicity of refrigerants is not taken into consideration by F-GAS
- Impact of refrigerants on global warming ~5% of total emissions
- (REMINDER = air traffic emission estimated impact ~2.5%)

Refrigerants with GWP < 150:

- Either flammable and toxic
- Or with a higher pressure

15.07.2021 announcement: Germany, the Netherlands, Denmark, Norway and Sweden want to submit by July, 2022 a new regulation to be integrated into REACH in Europe to ban perfluoroalkyls and polyfluoroalkyls PFAS from refrigeration, due to by-products they beget during their entire lifecycle (like TFA and hydrogen fluoride) → To come into force in all Europe (2024? 2025?)



R744 CO₂ is not impacted by any future legal restriction, nor quota, taxes, price increasing, shortage
 → CO₂ is a future-proof solution in refrigeration

Fluids mainly used in Refrigeration (HFCs HFOs Natural Refrigerants)											
Refrigerants	R404a	R410a	R134a	R449a	R448a	R32	1234ze	1234yf	R290	R744	R717
GWP	3,922	1,924	1,430	1,397	1,273	675	6	4	3	1	0
Safety group	A1	A1	A1	A1	A1	A2L	A2L	A2L	A3	A1	B2
F-GAS compliant	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
REACH compliant	NO	No	NO	NO	NO	NO	NO	NO	YES	YES	YES
Content PFAS	yes	yes	yes	yes	yes	yes	yes	yes	NO	NO	NO



1.3. National Regulations and Schemes



Some national initiatives can be duplicated in other EU countries (ex: tax on refrigerants) → **Three categories:**

Category	Examples	Application	Impact
Supportive <i>Subsidies</i>	<ul style="list-style-type: none"> ➤ EIA in the Netherlands ➤ BAFA in Germany 	Subsidies from Government Tax-incentive scheme	CO ₂ installation cost is lowered and becomes more competitive Vs. HFCs
Restrictive	Legal limitation to GWP =5,000 eq. In Denmark	Applicable to refrigeration since 01.07.2021	Kills R449/R448 competition, that moves to GWP < 150 and NatRef,
Financial	<ul style="list-style-type: none"> ➤ Taxes in some countries (ES, DK etc.) ➤ Quotas of refrigerants 	<ul style="list-style-type: none"> ➤ Taxes are based on t.eq. CO₂ 	New HFC installations are becoming more expansive and jeopardized on the mid/long term

Comment on tax scheme in France: Should have applicable 01.01.2022, **but** due to intense lobbying:

- Application postponed to **01.01.2023**
- Starting point = 15 € / t.eq.CO₂, with yearly increasings
- Application: on new HFCs only, not on recycled, nor regenerated ones

>>> Wrap-up:

- Screening existing regulation in countries is mandatory → Also to evaluate (positive or negative) impact of business growth
- Highlighting in local communication (presentation to clients, during training etc.)

Clients do hardly consider regulation (even supportive) in offers, nor mid-term impact of combined EU and national frameworks

2. Panasonic CO₂ units in Europe

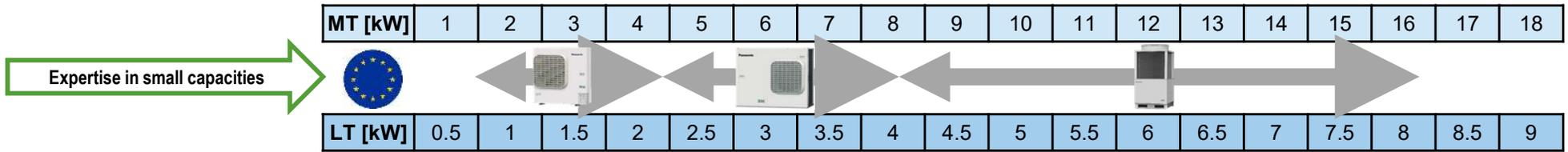




2.1. Condensing units in Europe

Panasonic

➔ Panasonic range of condensing units can address needs from **2 kW to 16 kW**



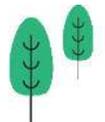
	OCU-CR200VF5			OCU-CR400VF8(A)			OCU-CR1000VF8(A)								
Net Weight	67 kg			136 kg			293 kg								
Ambient T°C	-15°C to +43°C			-20°C to +45°C			-15°C to +43°C								
To	-45°C to -5°C			-45°C to -5°C			-45°C to -5°C								
Qo @ +32°C	4 kW (To -10°C) 2 kW (To -30°C)			7,7 kW (To -10°C) 4 kW (To -30°C)			16 kW (To -10°C) 8 kW (To -30°C)								
Max. length piping (one-way)	25m			50m			100m								
Sound pressure (dBA)	55 dB(A) at 1m			55 dB (A) at 1m			56 dB(A) at 1 m								
Compressor (1 per unit only)	Two-stage rotary			Two-stage rotary			Two-stage rotary								
Heat recovery	No			yes			yes (1000VF8A only)								
Regulation (MODBUS RS485)															

- Compressor:**
- Exclusive Panasonic technology
 - Two-stage rotary compressor
 - 1 compressor / unit



RS485 Connection

Modbus



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2.2. Key benefits from Panasonic CO₂ solutions

Panasonic

Key strengths of PANASONIC condensing units:

- Unparalleled piping length = up to **100m**
- Unparalleled height difference capabilities = up to **20m**
- **One fan** only by all models → Easier to **duct**
- Inner receiver as standard = **up to 12 L**
- Filters delivered with the units
- Compatible with **all regulation** solutions from the market (Modbus)
- Unique **two-stage rotary compressor technology from Panasonic**
- 1 compressor only, **even in LT**
- Unique warranty on compressor = **5 years**
- Possibility to **duct** the units → static pressure: **2HP (17Pa), 4HP (50Pa), 10HP (58Pa)**
- Possibility to **orient air outlet** of the fan in 4 directions.
- Evaporating temperature down to **-45°C** (Deep-freeze + blast-freezing)

- **Energy consumption Vs. HFCs = -15%~-20%** (depending on installation and projects)

Directly monitored by some clients in their installation // Measured by Panasonic on key projects

→ With local expertise, from local people in local languages



Warranty = 2 years on components | **5 years** on compressor



Piping:

- Max. length (one-way): **25m**
- Max. height difference:
 - Unit OVER evaporator: **10m** (with oil trap @ 5m)
 - Unit UNDER evaporator: **5m**



Piping:

- Max. length (one-way): **50m**
- Max. height difference:
 - Unit OVER evaporator: **20m** (oil traps every 5m)
 - Unit UNDER evaporator: **5m**



Piping:

- Max. length (one-way): **100m**
- Max. height difference:
 - Unit OVER evaporator: **20m** (oil traps every 5m)
 - Unit UNDER evaporator: **5m**

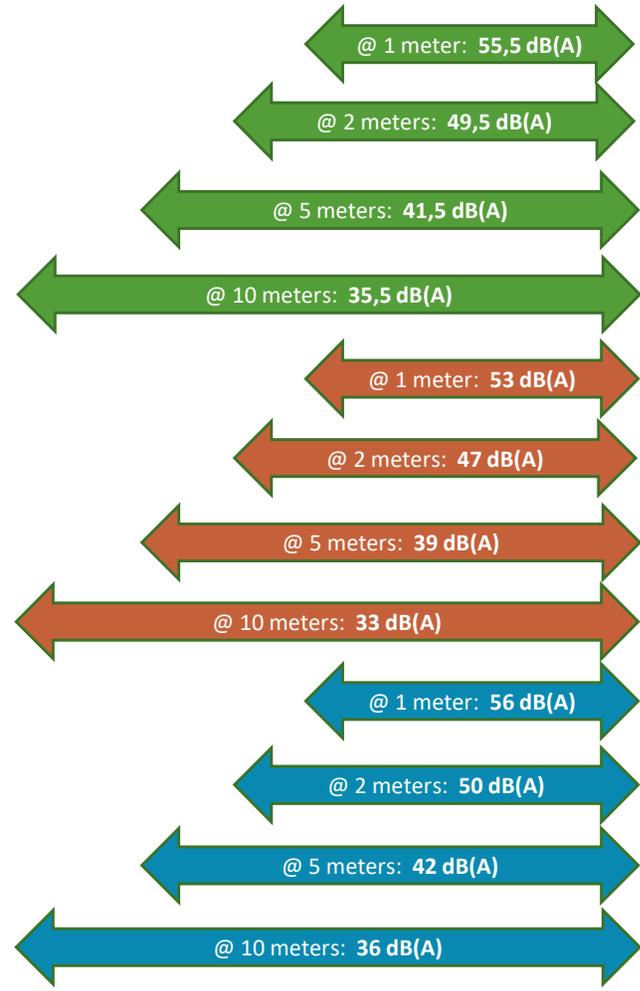
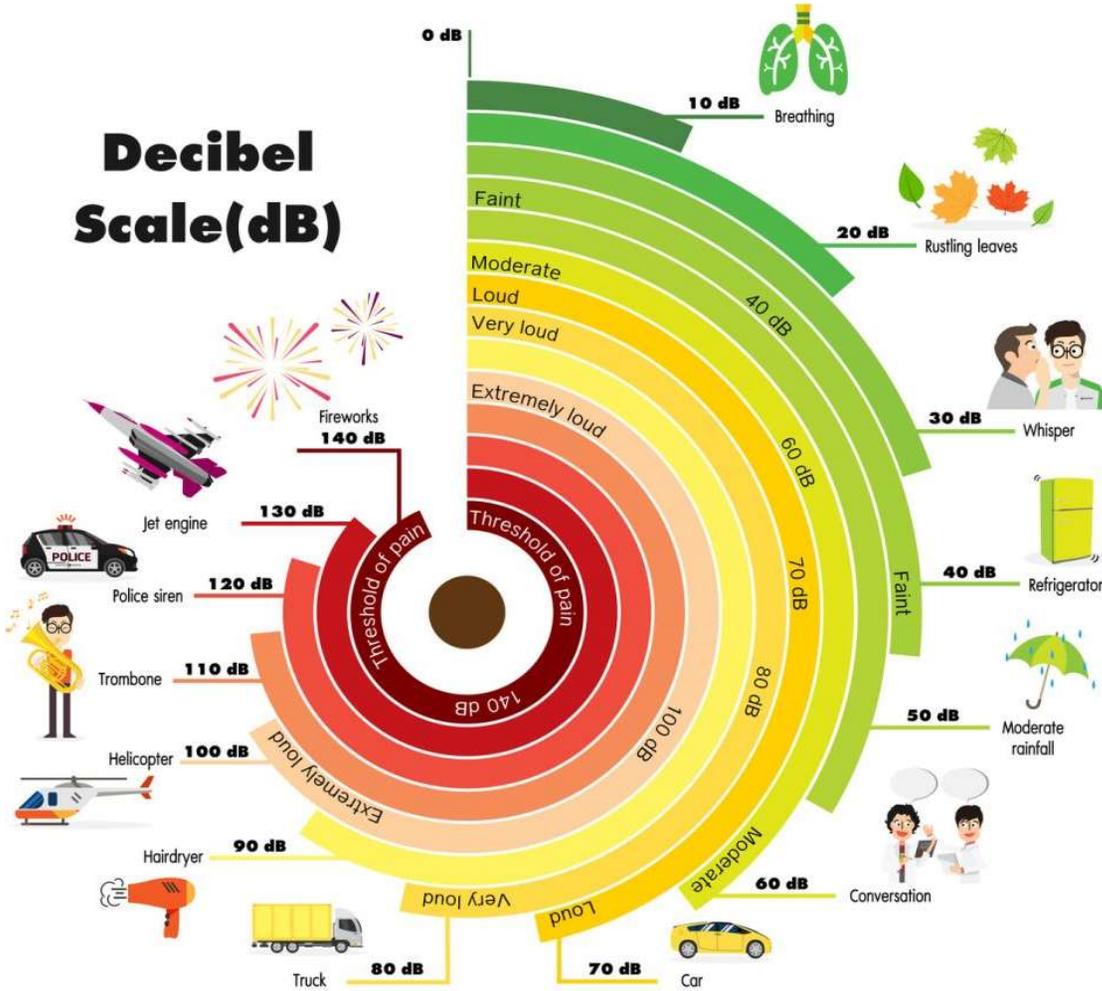


2.3. Key benefits from Panasonic's CO₂ solutions

Very low sound pressure

Panasonic

Decibel Scale (dB)





2.4. Online Software // Support // Filters



Online design software // Data to fill in:

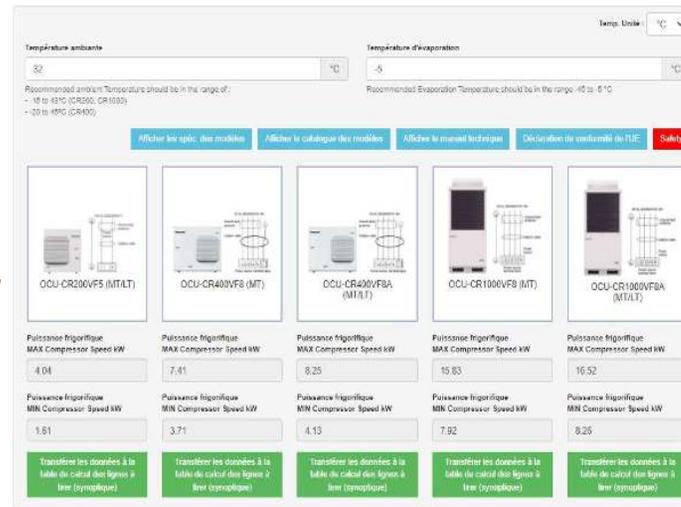
- + Temperatures
- + Cooling needs
- + Piping length
- + Volume(s) of Evaporator(s)

= Piping diameter suggestion

= Suggestion of E2V

= CO₂ load suggestion

➔ free-of-charge from Panasonic PRO CLUB



Support from PANASONIC:
To ensure **plug-and-play** installation

Technical support: 3 levels

1. Local support from local team
 2. Support from HQ team
 3. Support from Factory via HQ team
- ➔ **Remote support / On-site support**

Full set of documents availability:

- Installation manuals
- Online software
- Data sheets
- CE Declaration of conformity
- ➔ And acquisition tools (checkers..)

Information on filters | Included with the units

	OCU-CR200VF5	OCU-CR400VF8	OCU-CR400VF8A	OCU-CR1000VF8	OCU-CR1000VF8A
Liquid line	Included ref. D-152T	Included ref. D-152T	Included ref. D-152T	Included ref. D-155T	Included ref. D-155T
Suction line	<i>No need</i>	Included ref. S-008T	Included ref. S-008T	Included ref. S-008T	Included ref. S-008T

2.5. Main competitors <snapshot>

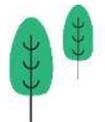
CO₂ condensing units // Boosters are not taken into consideration

Panasonic



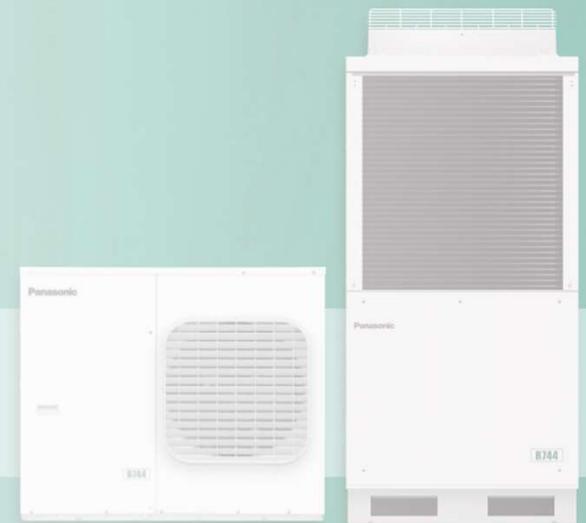
	AREA Cooling	BEUER REF SCM Frigo	CARRIER Profroid / G&C	DAIKIN Hubbard	MITSUBISHI Electric	MITSUBISHI Heavy	RIVACOLD	SANDEN
	iCOOL	UMT	MT... / LT...	GCU	ECOV	HCCV1001E	CN	CDU
Design [impression]								
Compressor	PANASONIC Two-stage rotary 1 per unit	TOSHIBA One-stage rotary 1~2 (LT)	TOSHIBA One-stage rotary 1~2 (LT)	PANASONIC Two-stage rotary Up to 2 (25 kW unit)	MEC Scroll 1 per unit	MHI Two-stage (scroll + rotary) 1 per unit	TOSHIBA One-stage rotary 1~2 (LT)	PANASONIC Scroll Up to 3
Capacities (max. in MT) [portfolio]	Up to 15 kW Multiple unit offer	Up to 10 kW Multiple unit offer	Up to 10 kW Multiple unit offer	Up to 25 kW Multiple offer	Up to 16 kW Two units only	16 kW only One unit only (test)	Up to 9.5 kW Multiple unit offer	Up to 8.5 kW 3 units
Strengths	+ Compressors + Flexibility + Production in PL + Low price / Low margin	+ Cheaper/axed prices + Production in IT + Support from Beijer + Extended network	+ Cheaper/axed prices + Production in FR + Full cc portfolio + Extended network	+ Compressors + A 25 kW unit + Production in UK / IT + Extended network	+ Own compressor + Aggressive mindset + Extended network	+ Own compressor + Strong home market + Piping up to 100m + Extended network	+ Cheaper/axed prices + Production in IT + Full cc portfolio + Extended network	+ Cheap prices + Production in IT + Pre-expansion (...) + Small footprint
Weaknesses	- Max piping length: 40m - Multiple fan (no ducting) - Noise - Long-run reliability - Size > Panasonic - Capacity < Panasonic	- Max piping length: 35m - Big units = multiple fans (no ducting) - Noise - Oil management - Size > Panasonic - LT @ 2 compressors	- Max piping length: 35m - Big units = multiple fans (no ducting) - Noise - Oil management - Size > Panasonic - LT @ 2 compressors	- Max piping length: 45m - Big units = multiple fans (no ducting) - "Must be improved" (client's voice) = poor oil management ? - 25 @ 2 compressors	- Max piping length: 50m - Big units = multiple fans (no ducting) - No cc expert - Teasing only today	- Teasing only today - Two fans = no ducting - Only 1 unit - No feedback in EU	- Max piping length: 30m - Big units = multiple fans (no ducting) - Multiple issues on field → R448~9 - LT @ 2 compressors	- Max piping length: 25m - Big units = multiple fans (no ducting) - Gas load = complex - Pre-expansion = Issues with multiple evap' installations - Very small team - Up to 3 compressors

>>> Color code // Explanations :
 ➤ In Green: competitors that already install Panasonic two-stage rotary compressors
 ➤ In Orange: competitors that claim to install Panasonic two-stage rotary compressors in (near) future



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3. Sales



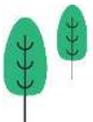


3.1. Panasonic CO₂ installations in Europe

Over 1,100 units installed in 3 years !

Panasonic

<p>C-store</p>	<p>BIO</p>	<p>Gas-station</p>	<p>Hotel / Restaurant</p>
<p>School</p>	<p>Bakery</p>	<p>Meat store</p>	<p>Alcohol store</p>
<p>Healthcare</p>	<p>Storage</p>	<p>Factory / Processing</p>	<p>Data center</p>



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3.2. Food retail installation <concept>



Commissioning made easy
 → Outdoor installation
 → Ducting possibilities (tech. room)

< Examples of food retail clients in Europe >

	France	Installed
	Belgium	Installed
	Denmark	Installed
	Portugal	Installed
	Ireland	Installed

Standard installation in shops is medium temperature, with medium and/or low temperature in cold rooms

- **Application:** cold rooms (storage) and showcases
- **C-Store as preferred format:** LT units are mainly plugins // Full concept store with Panasonic units
- **Bigger stores (supermarkets/hypermarkets):** additional cold rooms / store extension / Click&Collect
- Technical requirements:

➤ Cold room:

- **CO₂ condensing unit → From Panasonic**
- Evaporator → Recommendation = 80 bar // from evaporator manufacturers
- Piping → Recommendation = K65 (CuFe2P)
- Master control + Terminal
- Sensors (4 per room)
- Cable & Wiring
- Expansion valve + wiring

Can also be delivered as packaged offer from PAW-CO2-PANEL(-C) from Panasonic

➤ Showcase: when not plug-in cabinets:

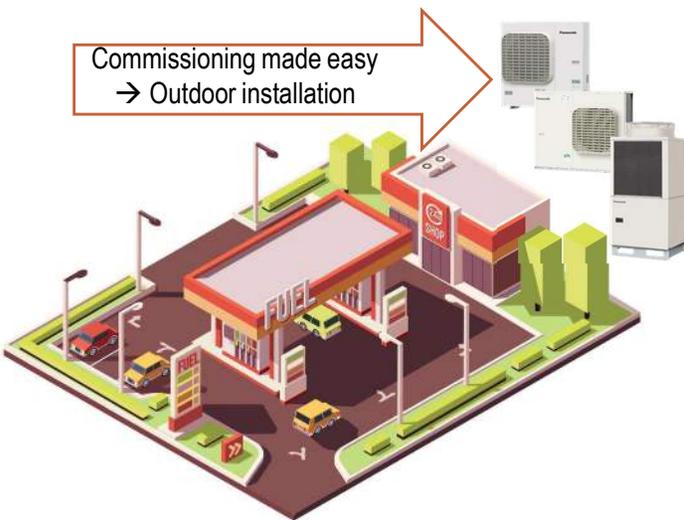
- **CO₂ condensing unit → From Panasonic**
- Piping → Recommendation = K65 (CuFe2P)
- Evaporator of showcase (60 bar min)
- Terminal + Control
- Expansion valve + Wiring

From showcase manufacturer (included in showcase)

- CO₂ is non-explosive / non-flammable / non-toxic → **Safe** to all business environments and food
- CO₂ with GWP = 1 → Ideal solution to **curb carbon footprint** and perfect fit to **BIO** stores
- CO₂ brings energy-savings → **Eq. 15%~20%** from Panasonic units
- CO₂ units with low sound pressure → Ideal unit for **C-Store** and **city-center** concepts // Possible to duct the units
- CO₂ is very stable molecule, available and affordable refrigerant → **No price fluctuation**
- CO₂ units have a small footprint → **No installation constraints**
- CO₂ units can be installed **outdoor** → **No need** for specific technical room and extension of store made easy



3.3. Gas-station installation <concept>



< Examples of gas-station clients in Europe >

	Denmark	Installed
	Sweden	Installed
	Switzerland	Installed
	Croatia	To be Installed
	Serbia	Under review

Standard installation in shops is medium temperature [Restaurants (if any) are often operated by third-part companies]

- **Application:** cold rooms and showcases
- **Standard needs with Panasonic:** 400VF8(A) + another unit → Depends on size/concept (highway..)
- **Technical requirements:**
 - **Cold room:**
 - **CO₂ condensing unit → From Panasonic**
 - Evaporator → Recommendation = 80 bar // from evaporator manufacturers
 - Piping → Recommendation = K65 (CuFe2P)
 - Master control + Terminal
 - Sensors (4 per room)
 - Cable & Wiring
 - Expansion valve + wiring
 - **Showcase:** when not plug-in cabinets:
 - **CO₂ condensing unit → From Panasonic**
 - Piping → Recommendation = K65 (CuFe2P)
 - Evaporator of showcase (60 bar min)
 - Terminal + Control
 - Expansion valve + Wiring

Can also be delivered as packaged offer from PAW-CO2-PANEL(-C) from Panasonic

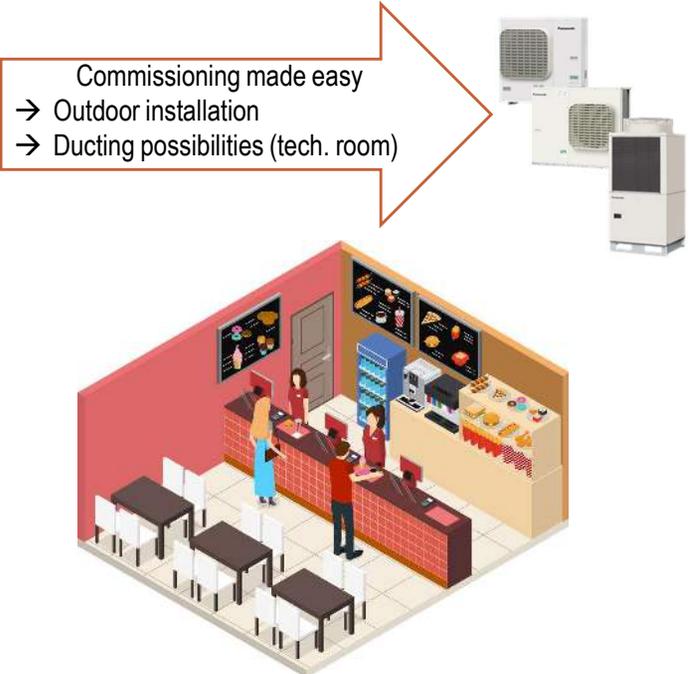
From showcase manufacturer (included in showcase)

- CO₂ is non-explosive / non-flammable / non-toxic → **Safe** to all business environments and food
- CO₂ with GWP = 1 → Ideal solution to **curb carbon footprint**
- CO₂ brings energy-savings → **Eq. 15%~20%** from Panasonic units
- CO₂ is very stable molecule, available and affordable refrigerant → **No price fluctuation**
- CO₂ units have a small footprint → **No installation constraints**
- CO₂ units can be installed outdoor → **No need** for specific technical room and change in design of gas-station



3.4. QSR installation <concept>

Panasonic



Standard installation in QSR is both medium and Low temperature cold rooms.

- **Application:** Average needs are 1 cold rooms: 1 in MT (fresh food) and 1 LT (frozen food)
- **Standard needs with Panasonic:** MT = **200VF5** (~3,5 kW) | LT = **400VF8A** (3.2~3.5 kW)
- Technical requirements:
 - **Showcase:** Mainly plugin units, with R290 as preferred refrigerant
 - **Cold rooms: either in MT or LT**
 - **CO₂ condensing unit** → From Panasonic
 - Evaporator → Recommendation = 80 bar // from evaporator manufacturers
 - Piping → Recommendation = K65 (CuFe2P)
 - Master control + Terminal
 - Sensors (4 per room)
 - Cable & Wiring
 - Expansion valve + wiring

Can also be delivered as packaged offer from PAW-CO2-PANEL(-C) from Panasonic

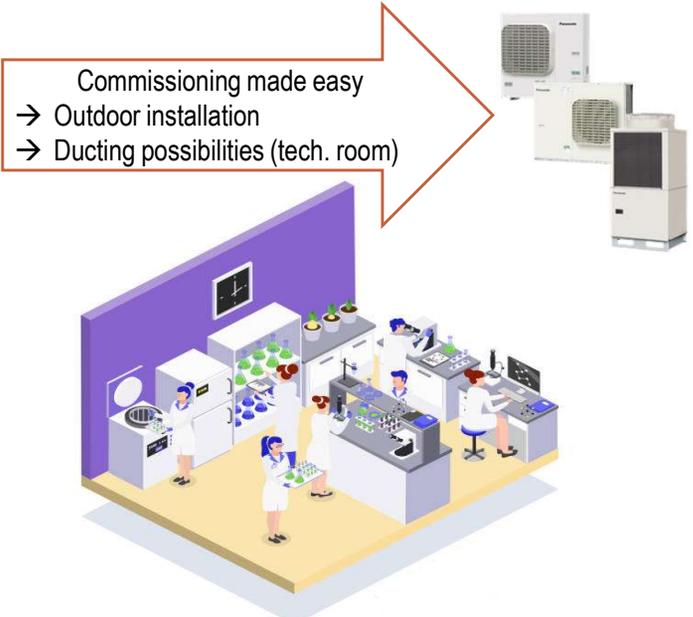
< Examples of QSR clients in Europe >

	Poland	Installed
	Spain	To be installed
	Sweden	Under review

- CO₂ is non-explosive / non-flammable / non-toxic → **Safe** to all business environments and food
- CO₂ with GWP = 1 → Ideal solution to **curb carbon footprint**
- CO₂ brings energy-savings → **Eq. 15%~20%** from Panasonic units
- CO₂ is very stable molecule, available and affordable refrigerant → **No price fluctuation**
- CO₂ units have a small footprint → **No installation constraints**
- CO₂ units can be installed **outdoor** → **No need** for specific technical room and change in design of stand-alone QSR
- CO₂ units connected independently to one cold room → **Resilient** installation and **easier** maintenance process



3.5. Healthcare installation <concept>



- Standard application is cold room, either medium or low temperature
- **Application:** cold rooms → **Reliability** of the installation is the **first** and **paramount** request
 - **Standard needs with Panasonic:** **All units + Backup**
 - Technical requirements:
 - **Cold room only:**
 - **CO₂ condensing unit** → **From Panasonic**
 - Evaporator → Recommendation = 80 bar // from evaporator manufacturers
 - Piping → Recommendation = K65 (CuFe2P)
 - Master control + Terminal
 - Sensors (4 per room)
 - Cable & Wiring
 - Expansion valve + wiring
- } Can also be delivered as packaged offer from PAW-CO2-PANEL(-C) from Panasonic

Risk management is a TOP priority for healthcare business
 CO₂ is non-flammable and non-toxic refrigerant. It's the ideal refrigerant in risk-management approach to healthcare applications, with no contamination in case of leakage (Vs. any other refrigerant)

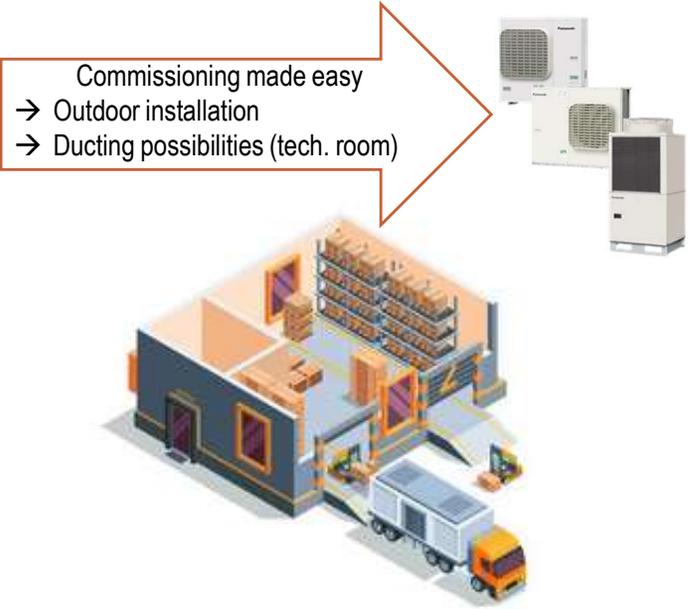
- CO₂ is non-explosive / non-flammable / non-toxic → **Safe** to all business environments and health products
- CO₂ with GWP = 1 → Ideal solution to **curb carbon footprint**
- CO₂ brings energy-savings → **Eq. 15%~20%** from Panasonic units
- CO₂ is very stable molecule, available and affordable refrigerant → **No price fluctuation**
- CO₂ units have a small footprint → **No installation constraints**
- CO₂ units can be installed outdoor → **No need** for specific technical room and change in design of gas-station

< Examples of healthcare clients in Europe >

	France	Installed
	Hungary	Installed
	Germany	Installed
	Denmark	Installed
	France	Installed



3.6. Storage installation <concept>



Standard installation in warehousing is both medium and low temperature cold rooms. Storage capability can be delivered either from a dedicated warehouse or from a production facility.

- **Application:** Cold room: average needs are to be adapted upon needs, from 2HP to 10HP (in MT or LT)
- **Standard needs with Panasonic:** From all units: 200VF5 | 400VF8(A) | 1000VF8(A)
- Technical requirements:
 - **Cold rooms: either in MT or LT**
 - **CO₂ condensing unit** → From Panasonic
 - Evaporator → Recommendation = 80 bar // from evaporator manufacturers
 - Piping → Recommendation = K65 (CuFe2P)
 - Master control + Terminal
 - Sensors (4 per room)
 - Cable & Wiring
 - Expansion valve + wiring

} Can also be delivered as packaged offer from PAW-CO2-PANEL(-C) from Panasonic

< Examples of clients in Europe >

	France	Installed
	France	Installed
	FR / DE	Installed
	United Kingdom	Installed
	United Kingdom	Installed

- CO₂ is non-explosive / non-flammable / non-toxic → **Safe** to all business environments and food
- CO₂ with GWP = 1 → Ideal solution to **curb carbon footprint**
- CO₂ brings energy-savings → **Eq. 15%~20%** from Panasonic units
- CO₂ is very stable molecule, available and affordable refrigerant → **No price fluctuation**
- CO₂ units have a small footprint → **No installation constraints**
- CO₂ units can be installed outdoor → **No need** for specific technical room and change in design of stand-alone QSR
- CO₂ units connected independently to one cold room → **Resilient** installation and **easier** maintenance process



3.7. Challenging conditions <High ambient>



Project: Ice-cream shop in Spain → Very high ambient temperature is no limitation to expansion of CO₂

Challenge:

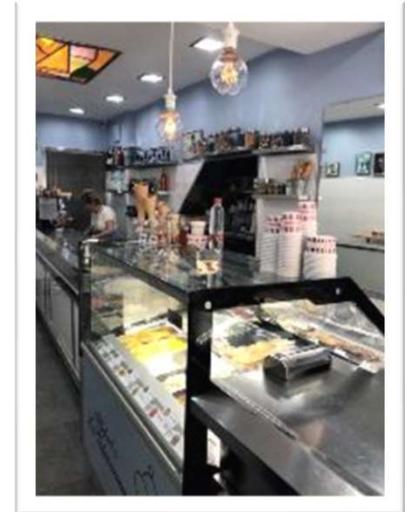
- Very high ambient temperature: Andalusia, the hottest region in Europe
- Seasonal activity: installation must remain loaded with CO₂, without gas releasing, nor leakage, when unit is stopped
- Footprint and sound level: very narrow space, in city center
- Highly sensitive food products: ice-cream (low-temperature LT)

Solutions:

- Installation of 2HP unit: limited footprint, with very low sound level (one compressor only, even in LT)
- Panasonic technology: CO₂ kept in unit, even if shut down (pressure management solutions embedded)
- Resistant to high temperature conditions: no issue, nor failure, even when temperature measured at +52°C !

Success factors:

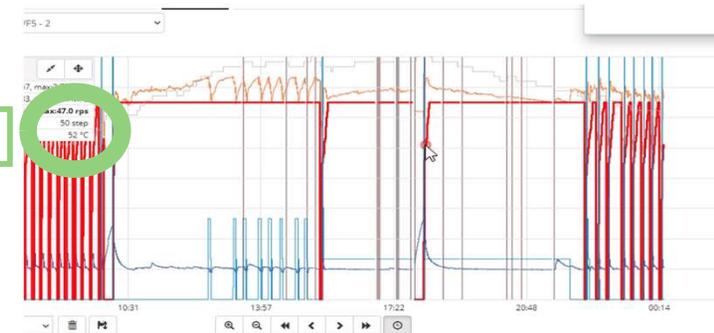
- **Sensitive project** → Monitoring access to Panasonic in Europe)
- **Panasonic technology** → two-stage rotary compressor | Pressure management | Oil-return management
- **Local expertise** → Training to savvy installer, with support from local Panasonic Spain experts
- **Selection & Design** → the right components, along with installer, with specific installation design



➔ LINK to Video: <https://vimeo.com/639908116/eed399b334>



52 °C





3.8. Challenging conditions <Low ambient>



Panasonic

Project: Supermarket in Sweden → Very low ambient temperature is no limitation to expansion of CO₂ refrigeration

Challenge:

- Very low **ambient temperature**: Northern part of Sweden (close to Finland)
- Supermarket must run **constantly**, even in **Winter**
- Extended piping length is needed (over 50m) to LT cold room
- Installation of CO₂ unit, without stopping already-running installation

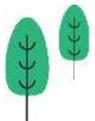
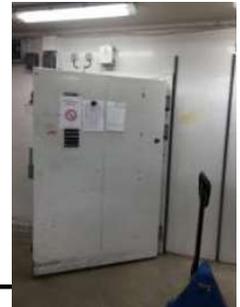


Solutions:

- Installation of **10HP** unit (extended piping length **up to 100m**, one-way)
- **Panasonic technology**: algorithm + pressure management + oil-return management
- Resistant to **low temperature** conditions: **no** issue, **nor** failure, even when temperature measured at **-36°C** !

Success factor:

- Relying on **independent condensing units** allows **step-by-step** installation, without shutting down the entire store
- **Panasonic technology**, with sound background and successful installation in home market of Japan, under various weather conditions
- Local expertise: Training to savvy **installer**, with **support from local** Panasonic Sweden experts
- Selection of the right **components**, with installation **design** adapted to local conditions



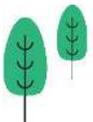
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Thank you

Questions?



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