CHILLVENTA

Chillventa Specialist Forums 2024
Chillventa Fachforen 2024

CONNECTING EXPERTS.

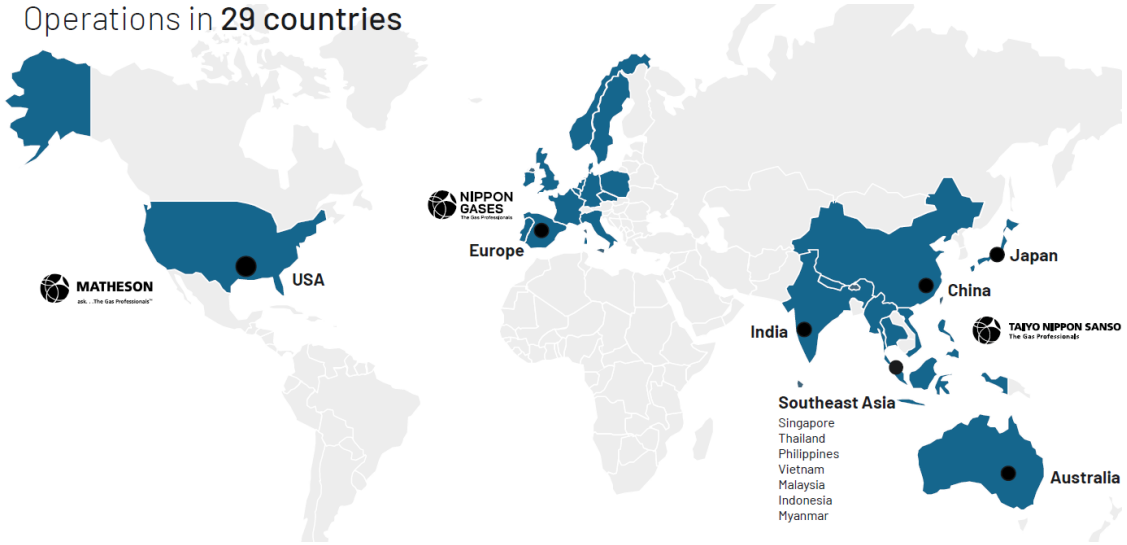
Innovative solutions for energy efficiency of HVAC-R systems

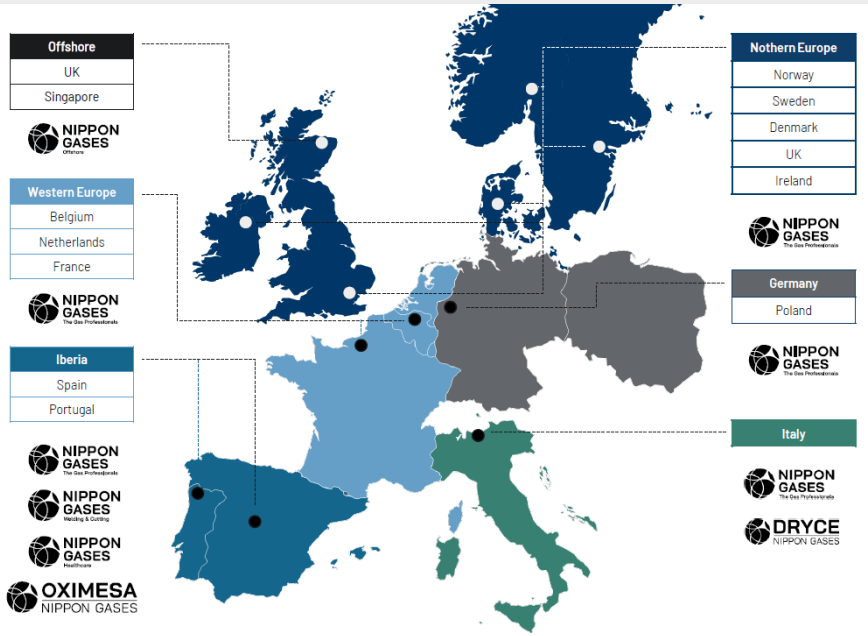
Carmelo Di Pasquale – Refrigerants Product Manager

NIPPON GASES

Nippon Gases Group

Nippon Gases is part of **Nippon Sanso Holdings Corporation** - the parent company to the **Taiyo Nippon Sanso** industrial gas business in Japan, the US **Matheson Tri-Gas Group**, the **European Nippon Gases**, the **Asia/Oceania Regional Group** and **Thermos Business Group.** Our group has over 100 years of experience and boasts a major presence in Japan, Southeast Asia, Australia, the United States, Canada and in Europe. **Nippon Gases Italia** produces and distributes cryogenic, technical, medical, refrigerant, pure and specialty gases. In addition to its core business products, the Nippon Gases Italia Group provides gas services, materials, equipment and facilities.





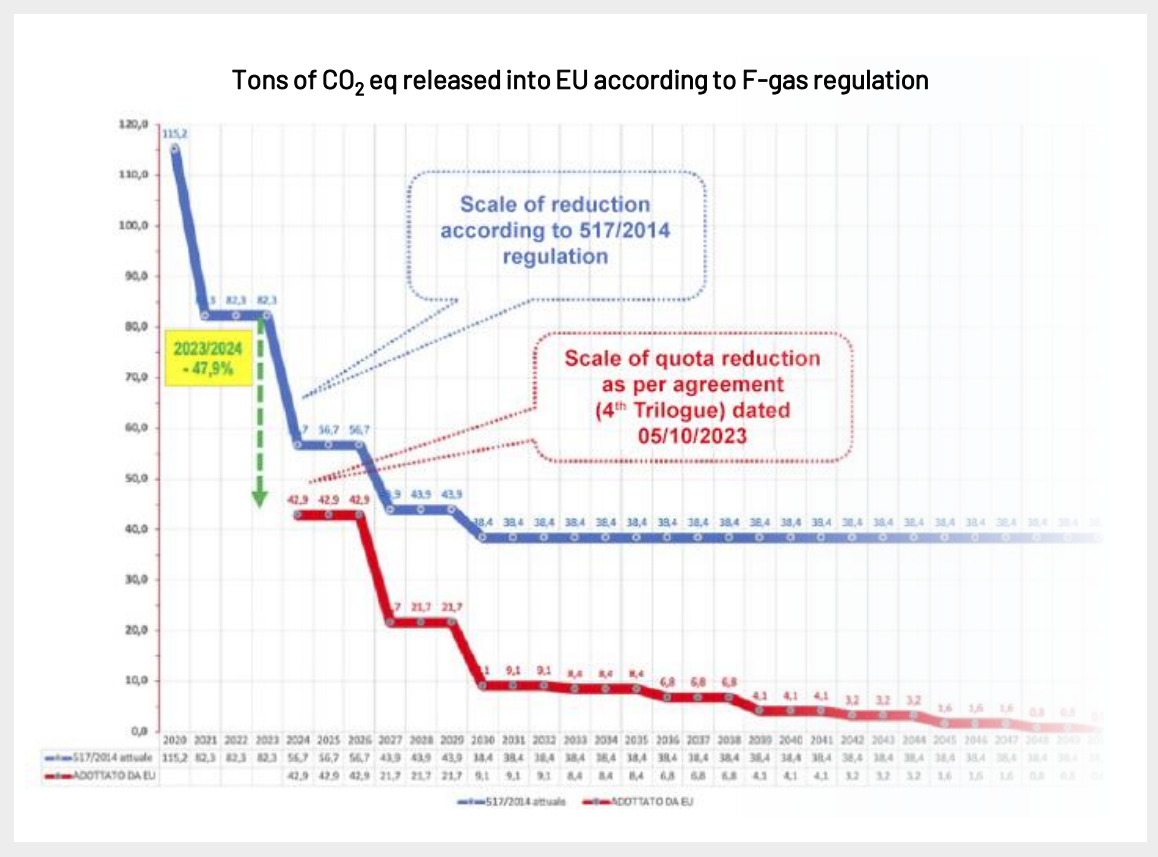
Nippon Gases Refrigerants business

For **over 70 years** Nippon Gases has always been at the forefront of the Refrigerants world with the most efficient technological solutions and products with the lowest environmental impact.

Today, as then, the extensive and widespread sales network allows Nippon Gases to operate quickly and efficiently throughout the Italian territory, offering a full range of products and solutions in accordance with the latest environmental protection regulations.

Our filling station

Key points of new F-gas regulation 573/2024



- More stringent quota reduction than previous F gas 517/2014.
- Stricter GWP limits in some sectors in refrigeration and air conditioning.
- No more use of virgin R-404 in maintenance from 2025.
- GWP limit = 150 in commercial refrigeration.
- F gas Ban in heat pump < 12 kw since 2035.
- Payment of an additional fee worth € 3.00/ton CO_2 equivalent.
- New law enforcement measures to prevent illegal imports of HFCs.
- The importance of the EN378 standard for the development of new flammable gases to meet safety requirements.

Refrigerant overview

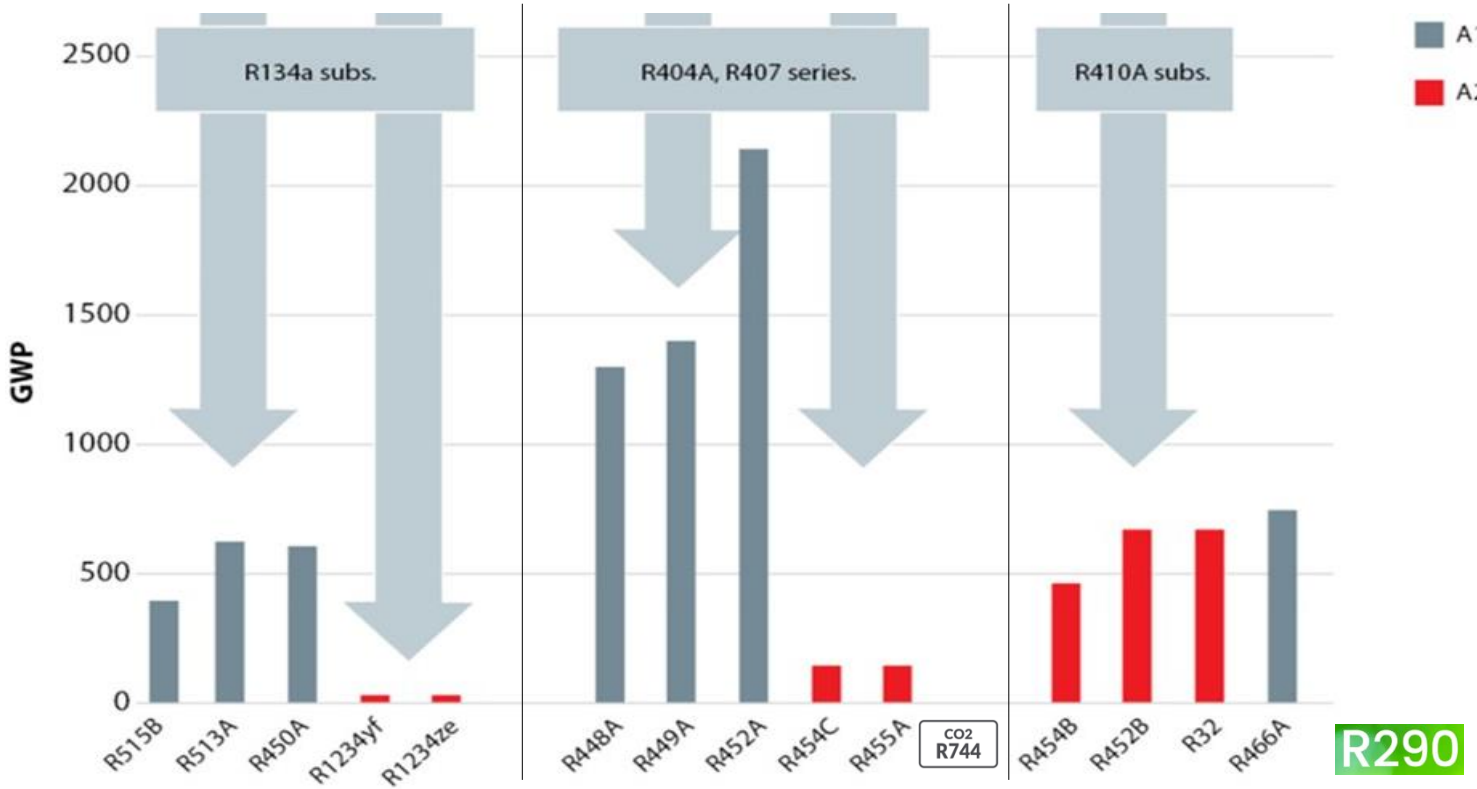
HFC Phase down: the transition to low-GWP refrigerants must accelerate to follow the quota cut.

SOLSTICE® ZE

SOLSTICE® L40X (R-455A)

Opteon™ XL20
Refrigerant (R-454C)

Opteon™ XL41
Refrigerant (R-454B)



GWP

↓

CAPEX

↓

OPEX

↓

TEWI

The best **refrigerant** is the one that delivers **sustainability** with the best balance of cost and **performance**.

New F gas 573/2024: GWP limits schedule in HVAC/R segment

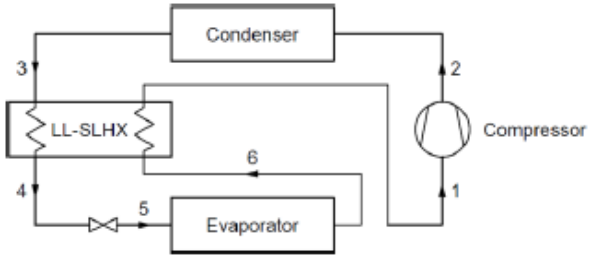
NEW EQUIPMENT	GWP Limit by year										
	2015	2020	2022	2025	2026	2027	2029	2030	2030	2033	2035
Chillers <12kW						150			No F-gases*		
Chillers >12kW						750					
AC and HP Portable Plug-in monoblock		150									
AC and HP Stat. monoblock < 12 kW						150			No F-gases*		
AC and HP Stat. monoblock > 12 kW and < 50 kW						150					
AC and HP Stat. monoblock > 50 kW								150			
AC and HP Monosplit (< 3 kg of HFC charge)				750							No F-gases*
AC and HP Multisplit air-to-water < 12 kW						150					No F-gases*
AC and HP Multisplit air-to-air < 12 kW							150				No F-gases*
AC and HP Multisplit (any kind) > 12 kW							750			150	
Domestic refrigeration	150				No F-gases*						
Commercial refrigerators and freezers (HFC)			150								
Commercial refrigerators and freezers (All F-gases)				150							
Multi-pack centralized > 40 kW**			150								
Self-contained refrigeration equipment				150							
All other refrigeration equipment***				2500					150		

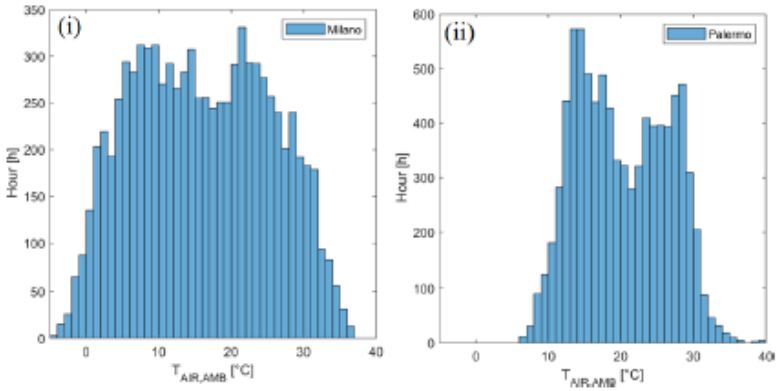
* Restrictions subject to Safety Clause and Revision Clause
** Except cascade systems: 1,500GWP
*** Except ultra-low temp equipment (below -50C)

NIPPON GASES

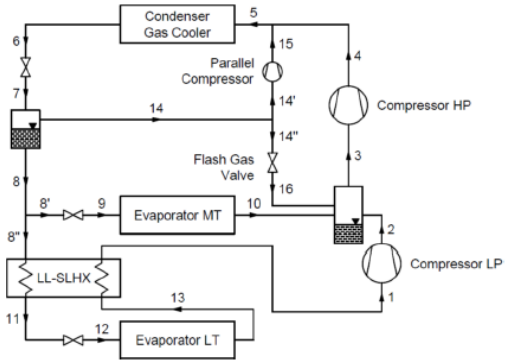
Commercial refrigeration: Case study on 1000 sqm supermarket

Performance analysis: direct expansion HFO systems vs CO_2 transcritical booster





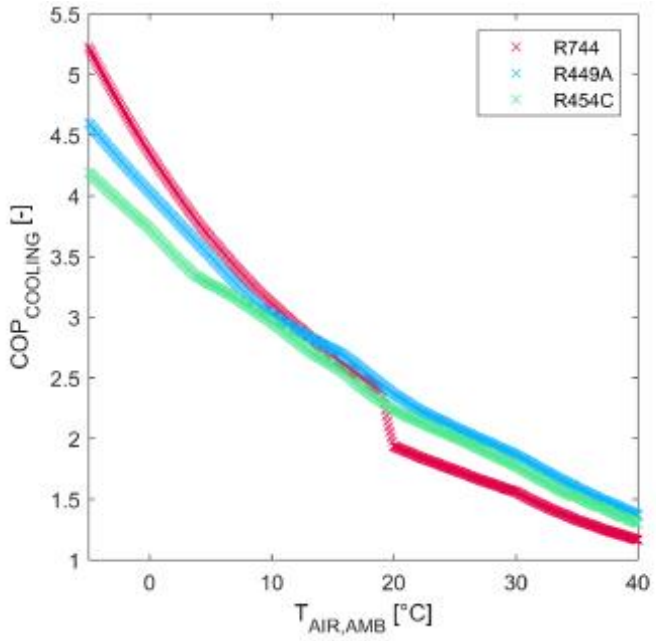
Air temperature distribution in Milano (i) and Palermo (ii)



Layout for R744

Performance comparison results (Milan, North Italy)			
Fluid	R-449	R454C	CO_2
Annual Consumption [MWh]	302,81	318,22	335,99
sCOP	2,65	2,52	2,39

Performance comparison results (Palermo, Soth Italy)			
Fluid	R-449	R454C	CO_2
Annual Consumption [MWh]	331,21	347,13	375,97
sCOP	2,42	2,31	2,13



COP behaviour of the three refrigerants as function of ambient air temperature

HFO A2L references in Italy: MD Discount supermarket chain

The famous MD chain is the first in Italy to use this new HFO technology from Honeywell (Solstice® L40X _R-455A) with very low GWP (146):

- Estimated operating cost savings of €260,000 over the life cycle of the plant compared to a trans-critical CO_2 plant.
- Estimated 25% lower indirect emissions.

Honeywell's energy-efficient Solstice® L40X refrigerant is ready to meet the refrigeration needs of small and medium-sized supermarkets while meeting regulatory requirements.

SOLSTICE® L40X (R-455A)

Technical details

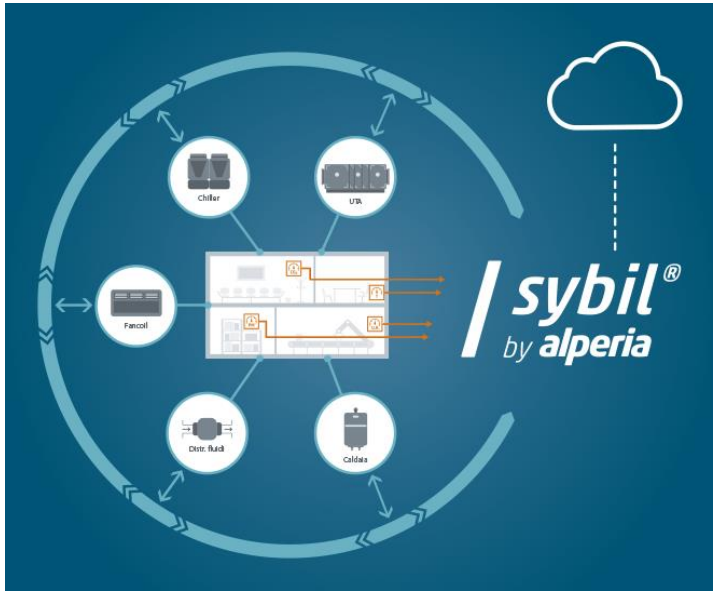
arneg

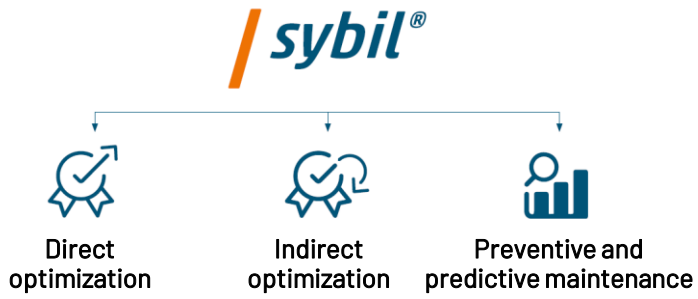
Honeywell

- **Contractor:** Arneg S.p.A.
- **Surface:** 1500 mq
- **Refrigerant gas:** R455 A
- **4 circuits in MT (cold room + cabinet) + 1 cold room in LT**
- **Power:** 80 KW
- **Refrigerant charge:** ca 50 kg / circuit
- **Total refrigerant charge :** 200 kg
- **LT systems:** R-290 plug-in

Optimization of HVAC-R systems

Nippon Gases's energy effiency services in partnership with Alperia





Simply modernizing machinery isn't enough. To increase savings and reduce maintenance costs, it's essential to install an advanced control system with **machine learning algorithms** capable of predicting cooling/heating demands and/or machine inefficiencies.

Features of the Sybil® system

EFFICIENT: It significantly reduces fluctuations in all controlled variables of the system. Increased stability allows closer adherence to user-set constraints, resulting in energy savings while maintaining desired comfort levels.

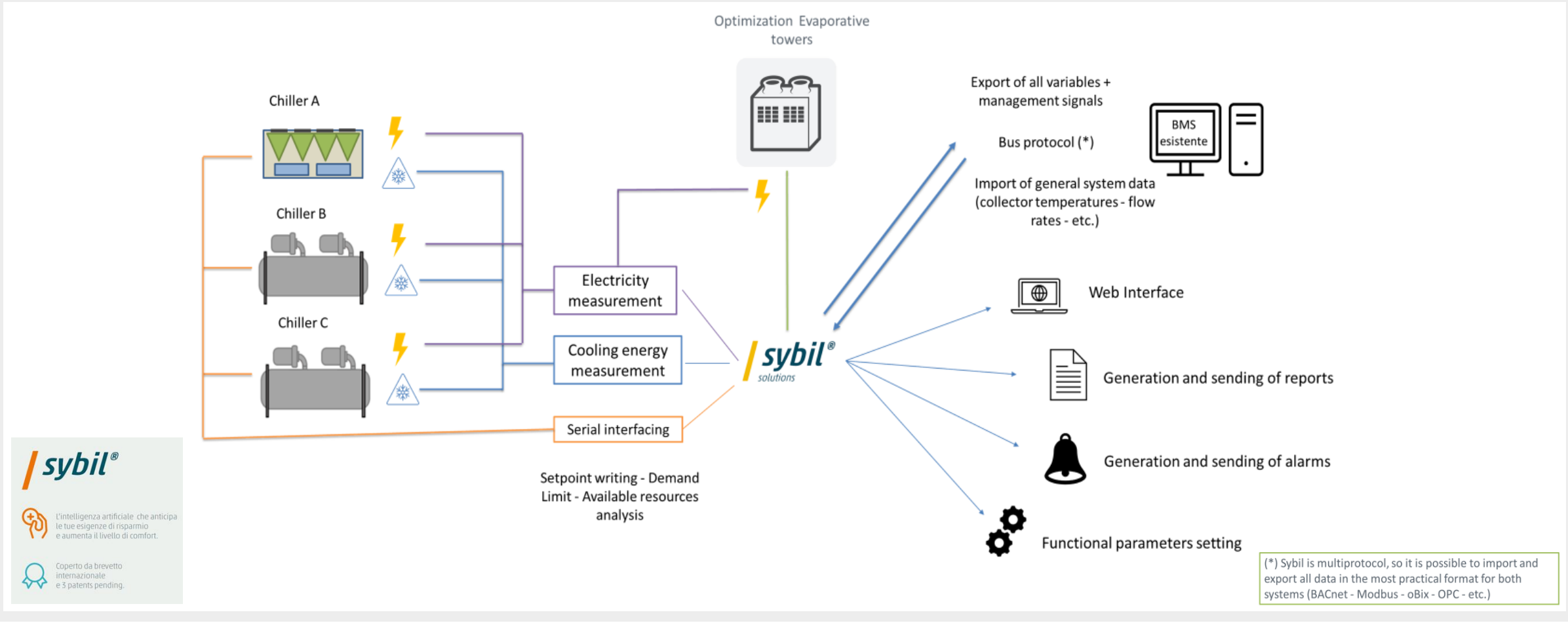
FLEXIBLE: It can acquire data by interfacing directly with equipment in heating, cooling, air handling, and refrigeration systems, using protocols such as Modbus, BACnet, 0-10 V signals, 4-20 mA signals, or by interfacing directly with the existing BMS, collaborating synergistically.

PROACTIVE: It enables proactive diagnostic activities, preventing breakdowns and emergency interventions, thereby reducing maintenance costs.

ON TIME: It learns real-time operation of the system and external variables, acting promptly to mitigate their effects.

Savings achievable from 5% to 30% in energy consumption of systems, depending on the system type and applicable strategies.

Sybil's system architecture



Case studies

sybil®

Shopping Center

A two-level shopping center with 36 shops of various sizes and 3 common areas: HVAC system consumption reduced by approximately 30%

Business Center

A 10 floors building with LEED® GOLD certification: HVAC system consumption reduced by approximately 35%

Airport

One of the largest airports in Italy with 40 air handling units: AHU (Air Handling Unit) consumption reduced by over 40%

Case study: Shopping Center

A two-level shopping center with 36 shops of various sizes and 3 common areas.

HVAC system consisting of:

- 3 air handling units (AHUs) for common areas
- 10 primary air handling units (AHUs) for shops
- 3 air-cooled chillers, each 266 kW2 boilers, each 528 kW
- Existing Emerson Building Management System (BMS)

Results in one year

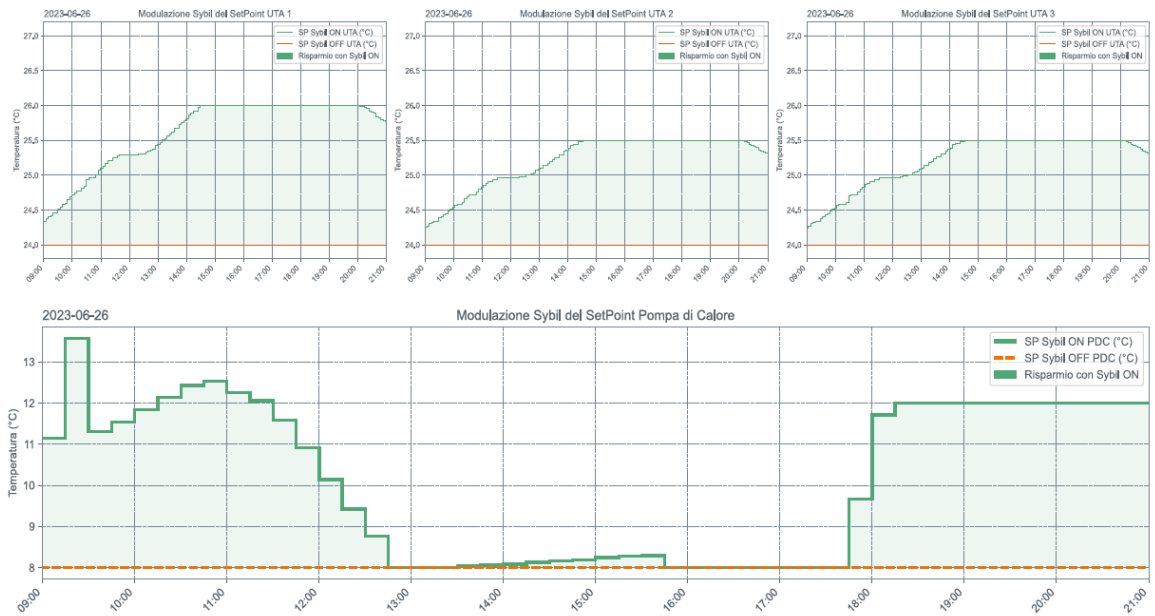
11.657 Smc (34%)
Gas savings

93.609 kWh (20%)
Electrical energy savings

83,4
Trees planted

47,3 t
CO_2 emissions avoided

Examples of sybil® actions



Adjustment of the supply temperature of the 3 heat pumps

Case study: Business Center

Office building of 15,500 square meters divided over 10 floors, renovated in 2021.

HVAC system consisting of:

- 3 Multifunctional machines
- 7 Boilers
- 223 Fan coil units
- 20 Heat recovery units
- Existing Siemens Desigo BMS

Results in one year

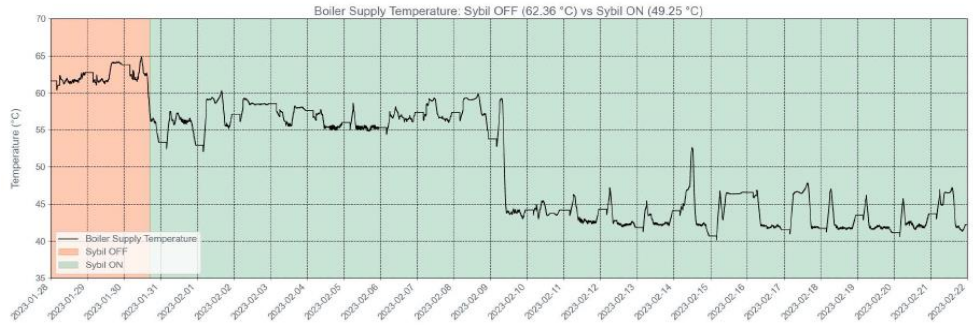
1.004 Smc (34%)
Gas savings

17.819 kWh (39%)
Electrical energy savings

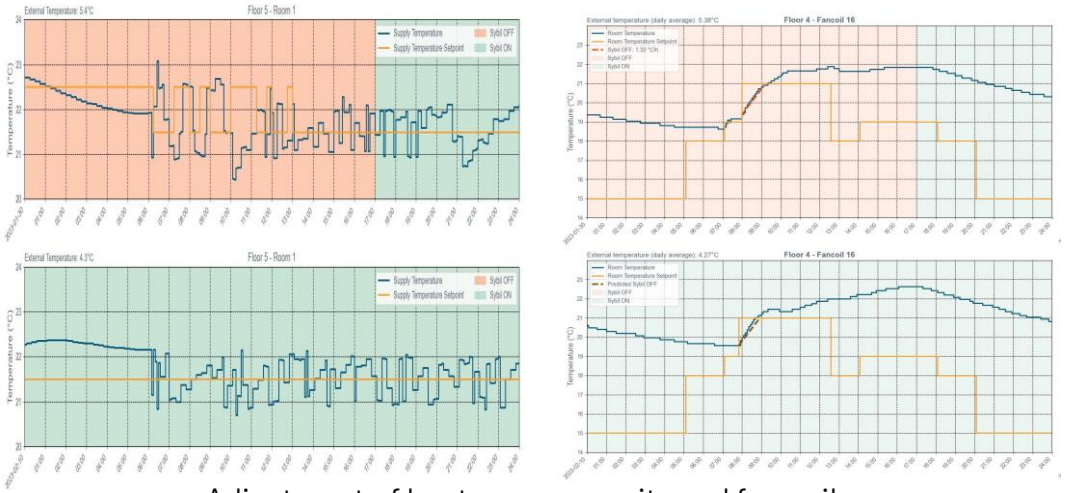
11,64
Trees planted

6,6 t
CO_2 emissions avoided

Examples of sybil® actions



Adjustment of the supply temperature of the boilers



Adjustment of heat recovery units and fan coils

Case study: Airport

One of the most important airports in Italy, with 14 million passengers transported.

HVAC system consisting of:

- 40 air handling units of various types (All-air, primary air, with VAV, etc.)
- Existing Schneider BM

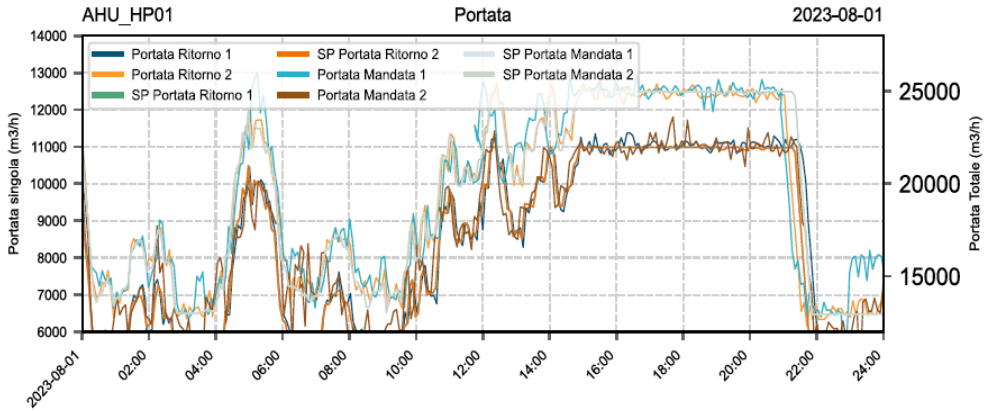
Results in one year

146,2 kWh (44%)
Electrical energy savings

66,5
Trees planted

37,8 t
CO_2 emissions avoided

Examples of sybil® actions



Adjustment of supply and return airflow

alperia In partnership with NIPPON GASES

Conclusions

- Training on use, transportation and storage of flammable gases to installers and refrigeration technicians is critical to the transition to low GWP refrigerants for the HVAC/R sector.
- The transition to low GWP < 750 A2L refrigerants or natural gases must accelerate!→Risk of HFC shortage after 2027.
- Low-GWP HFO A2L gases are a candidate as the best solution in terms of energy efficiency for commercial refrigeration systems for small and medium-sized retail trade.
- There is no single refrigerant (either natural or synthetic) suitable for every application.
- Refrigerant gas regeneration is an essential procedure to secure market volumes as a result of the large share cut expected in the coming years and at the same time push the circular economy of refrigerant gases.
- With its new energy efficiency services, Nippon Gases in collaboration with Alperia gives the opportunity to make plants more efficient by leveraging advanced artificial intelligence software that can maximize plant performance.

NIPPON GASES
The Gas Professionals

Thanks for your attention

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