

Schools and Education

Air exchange in school facilities



Managing air inside schools to
improve the health and performance
of students and teachers



NIBE GROUP MEMBER

Why mechanical ventilation is important

It is estimated that each day, 15% of the population, equal to approximately **10,000,000 people**, including students and teachers, study or work in approximately 45,000 public buildings throughout the country. Italian students spend 4 to 8 hours a day in school buildings for at least 10 years. Mechanical ventilation systems represent an opportunity to better **manage their health and safety**.



What must **always** be ensured in indoor spaces?



Indoor design
temperature



No drafts



No disturbing
noises



Air
purity

Respiratory health and school work performance are at risk

In Italy, asthma and allergic rhinitis are some of the most common diseases in children and teenagers. Studies show that **respiratory health** is directly correlated with several factors found in school environments, including **humidity**, **mould**, volatile organic compounds (**VOCs**), **formaldehyde**, **allergens** and **bacteria**.

Classroom sizes are often insufficient and not suitable for the average number of students. Studies confirm that overcrowding and poor and uncontrolled ventilation lead to **high levels of CO₂ and PM10** which negatively affect student and teacher **performance**.

Improving everyone's **quality of life**

The air quality guaranteed by Rhoss solutions is the first means of protection for the safety and health of children, students and teachers.



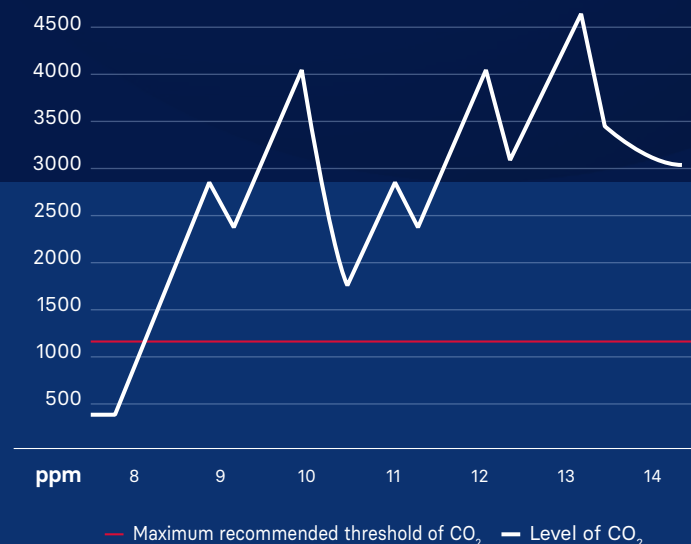
Mechanical ventilation is more effective

"The new social perception of indoor environments cannot be ignored. The ventilation of indoor environments is of utmost importance. Where natural ventilation is not possible or sufficient, ventilation appliances must be installed. Mechanical ventilation systems are more effective than simply opening windows, and they also improve air quality through filtration."

**Source: Istituto Superiore di Sanità
Reports no. 55 and no. 9 of 2020.**

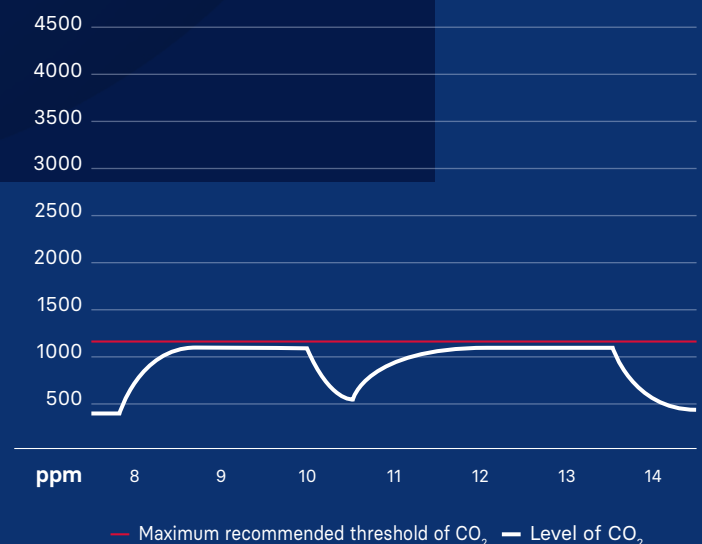
Opening doors and windows is not enough

Even when opening doors and windows, ventilation is often not enough to ensure good levels of CO₂. The heat produced by heating systems is also lost during the winter, resulting in significant economic waste.



Mechanical ventilation brings everything back under control

Flows are regulated and filtered by means of controlled mechanical ventilation systems, allowing the maintenance of optimal saturation levels of CO₂, fine dust and pathogens.





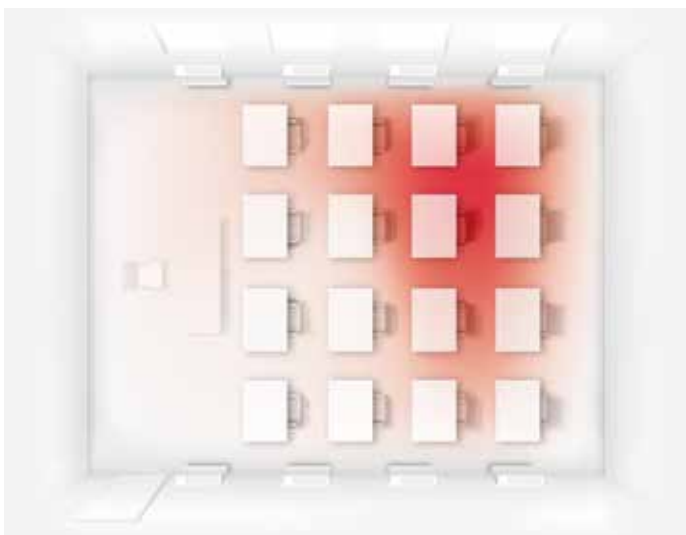
Up to 99% pollutants are removed through ventilation for air exchange

"The impact of ventilation air exchange on the dilution of the viral infectious load removes suspended particles (aerosols) and gaseous pollutants up to 99.9%".

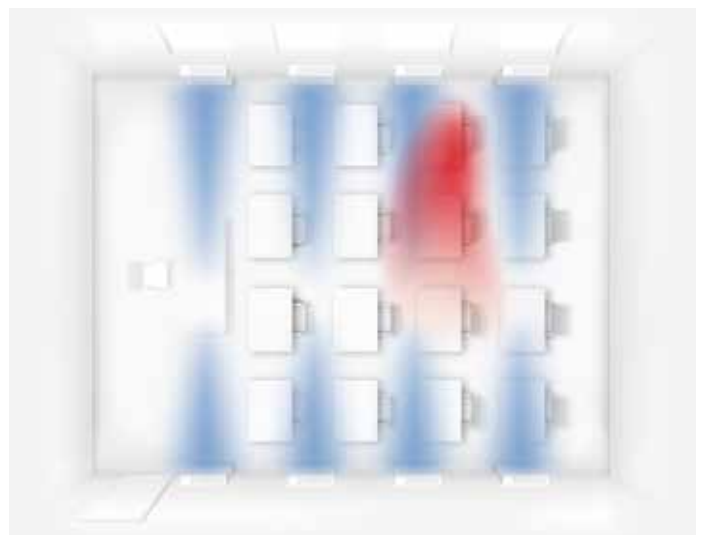
Source: Istituto Superiore di Sanità
Covid-19 Report no. 33 of 25 May 2020.

The continuous dilution effect of ventilation

Proper mechanical ventilation of the rooms causes the continuous dilution effect of the concentration of each polluting element resulting in increased air quality, both in terms of CO₂ concentration and pathogen concentration.



Dynamics of contamination in the presence of an infectious subject without ventilation



Dynamics of contamination in the presence of an infectious subject with ventilation

The current regulatory framework

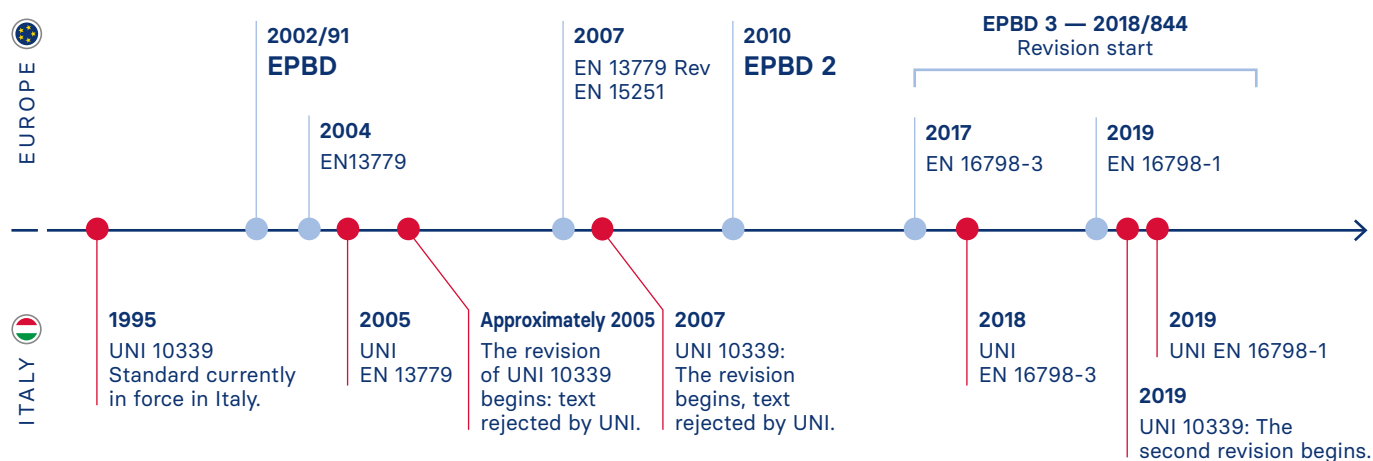


2022 Budget Law

Inclusion of Controlled Mechanical Ventilation amongst the urgent measures for schools

The 2022 Budget Law approved and published on December 31, 2021 includes Controlled Mechanical Ventilation with heat recovery amongst the interventions covered by the "Fund for the COVID-19 epidemiological emergency for the 2021/2022 school year", established with Article 58, paragraph 4, of the Decree-Law of 25 May 2021, no. 73 (converted into law and modified by the provision of 23 July 2021, no. 106).

The standards in Europe and Italy



Limiting the most severe forms of diseases

There is no legislation that regulates the flow of fresh air with the health risk and consequent dilution of the virus, however studies show that an increased fresh air flow results in a lower risk of contagion. It is therefore recommended to size the system according to the maximum air flow recommended by regulations (16798-1 category I).



How to size the **air flow** during the design

The regulatory framework is constantly evolving. On a national level, various solutions can be referenced to calculate fresh air flow rates.

UNI EN 16798-1 of 2019 (in force in Europe and adopted in Italy) is the most versatile: the result depends on the air quality to be obtained and

on the level of indoor pollution of buildings, emitted by the enclosure and furnishings, while in 2019 the second revision of **UNI 10339** began, which defines the renewal percentages according to the type of environments and number of occupants.

Calculating the **air flow rate**

Example classroom

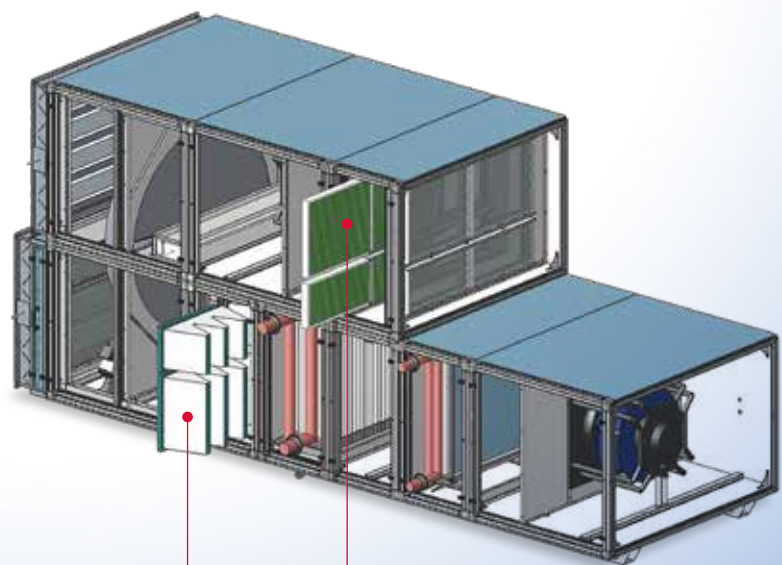
Middle school
Volume: 120m³
Area: 40m²
People: 25

Standard	Fresh air flow		
Ministerial Decree 18/12/1975	420 m ³ /h		
UNI 10339 – 1995	540 m ³ /h		
Ministerial Decree 11 October 2017 (CAM)	730 m ³ /h		
UNI EN 16798-1	Very Low Polluting Buildings	Low Polluting Buildings	Non Low Polluting Buildings
Category I	972 m ³ /h	1,044 m ³ /h	1,188 m ³ /h
Category II	680 m ³ /h	731 m ³ /h	832 m ³ /h
Category III	389 m ³ /h	418 m ³ /h	475 m ³ /h

Exceptional purity levels with **ADV Custom** and **Next Air ADV**



The application of the **Photocatalytic filter** in combination with the **Air'Suite®** bactericidal filter in the Rhoss air handling units allows indoor air quality to reach exceptional purity levels.



AIR'SUITE®

PHOTOCATALYTIC FILTER

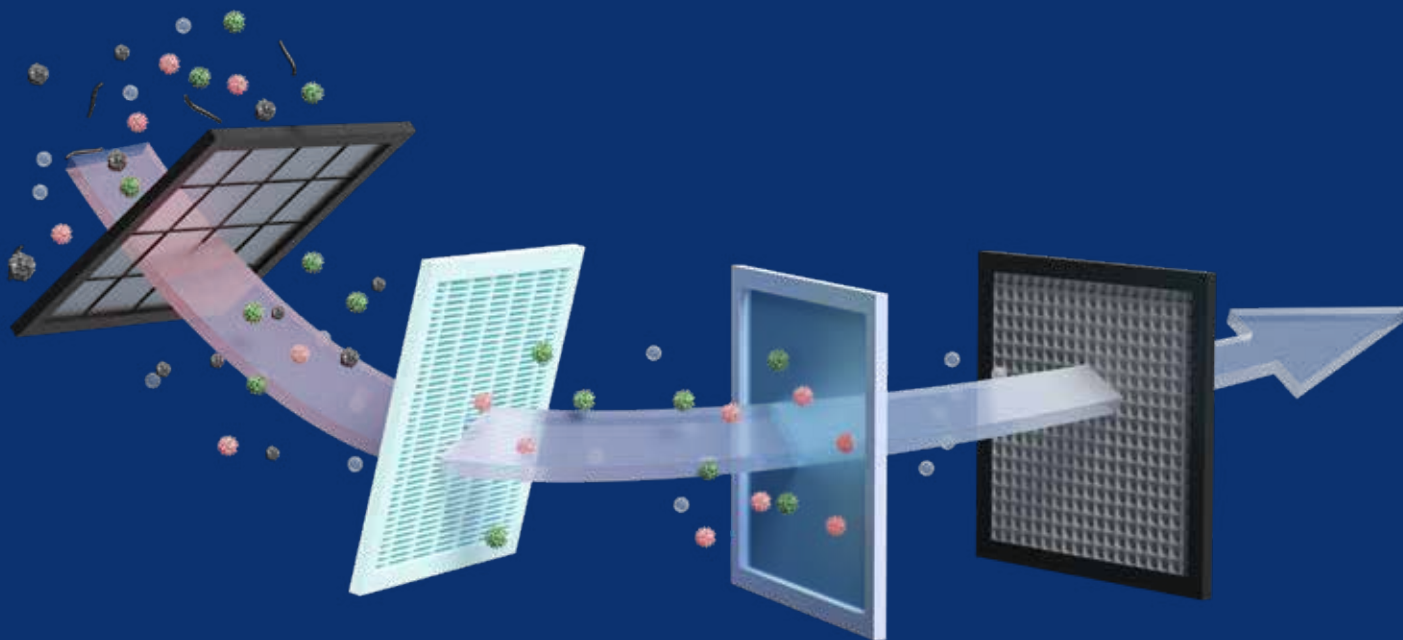
ADV Custom



ADV Next Air



Perfect integration



Photocatalytic filter

is an innovative device for sanitisation and purification based on photocatalysis



Effective against Covid-19

100% inactivation of the SARS-Cov-2 viral load in 30 minutes. Eliminates bacteria, fungi, odours. Reduces the levels of CO₂.



Quick and automatic

Sanitising the air in the room in a few minutes with automatic activation.



Totally safe

100% safe for humans. Inhalation safe, ozone free, UV light free.

air'suite

Bactericidal filtration and mechanical filtration ePM1 50-70-85%



Decontamination in 24h

100% decontamination in 24h of microbiological agents in the air and on the device.



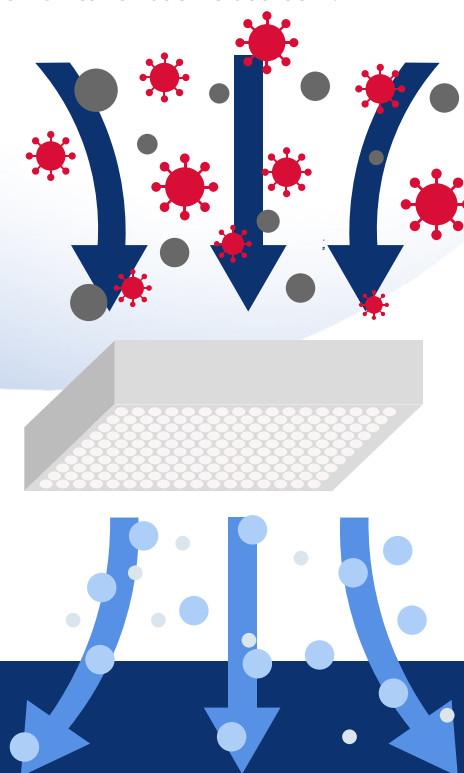
Auto-decontamination of the filtering surface

No risk during maintenance operations.



Heat comfort and air quality with Rhoss **heat recovery units**

The **UTNR-A**, **UTNR-T FRESH**, **UTNR-HE** and **VMC-E** heat recovery units represent the ideal solution in case of existing buildings, small renovations, systems with individual ventilation units for each classroom.



Heat recovery units **UTNR-A / UTNR-T FRESH / UTNR-HE / VMC-E**

Versatile and flexible installation to adapt to any situation

Installation can be exposed and in false ceilings, with both vertical and horizontal execution, in order to flexibly adapt to all installation conditions.

Improve air distribution and prevent flow contamination

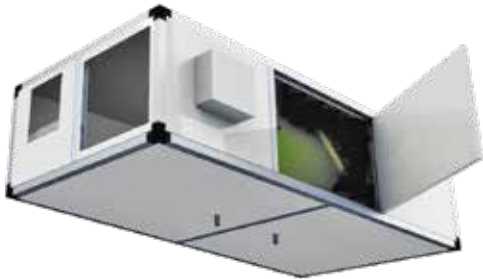
As per the standard (UNI EN 16798) the external air intake and the exhaust must be suitably spaced to prevent contamination between the flows. Rhoss also recommends correctly distributing air inside the classroom, obtaining a complete purification of the classrooms with the greatest dilution of any pollutants and viruses present.

Health and comfort

Additional modules with the Photocatalytic filter and Air'Suite® are available as accessories, which contribute to purify outdoor air, ensuring the healthiness of the rooms in a shorter amount of time.

UTNR-A Platinum

Fresh air terminal units with counterflow opposing flow static heat recovery.



Typical / recommended sizing: from 700 to 1000 m³/h

Considering UNI EN 16798 Classroom: 120m³ / 40m² / 25 people / primary school)

Unit installed	UTNR-A 75 / UTNR-A 100
Horizontal version dimensions (WxDxH)	1940 x 990 x 480 mm
Vertical version dimensions (WxDxH)	1940 x 520 x 1150 mm

Advantages



Easy installation and maintenance



Guaranteed thermal comfort



Low noise impact



Increase of IAQ values thanks to fresh air and filtration



Simple and intuitive management through integrated control



Scheduled installation with classroom-by-classroom advancement steps

Analysis of the costs/benefits ratio



Politecnico
di Torino



Lower costs and improved performance

A study by the Polytechnic Institute of Turin analysed the costs and benefits of systems inside school buildings, in terms of installation and configuration, health and performance of students and teachers.

Clear advantages were discovered in terms of improving the healthiness of environments and the productivity of those who study and work in schools each day.

Costs

Costs related to the configuration of the Air Handling Unit.



Configuring
the AHU

Benefits

Increased focus and concentration, fewer absences due to illness or distance learning, mean greater productivity of the whole class.



Student and
teacher health

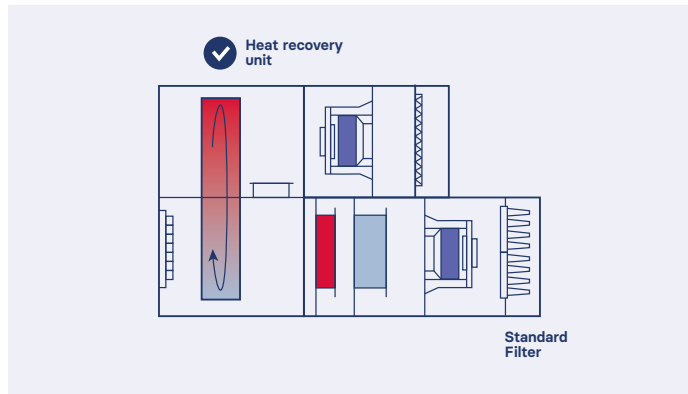


Student
performance

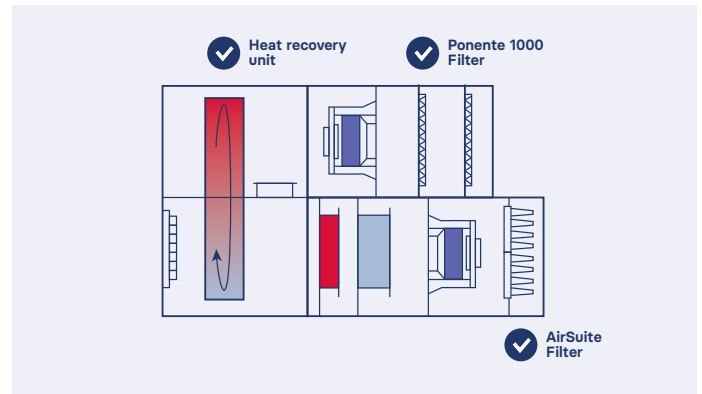
Health and productivity

Comparison with pre-Covid configuration.

Photocatalytic filter + Air'Suite® filter compared to a market filter.



Air management before the pandemic.



Air management after the pandemic.

	Δ Costs	Δ Benefits	$\Delta B / \Delta C$
Kindergarten (2-3 years)	5,646.2	4,126.3	0.73
Primary School (6-10 years)	5,610.4	46,030.4	8.20
Lower Secondary School (11-13 years)	5,643.6	48,038.5	8.53
Upper Secondary School (14-19 years)	5,634.6	48,375.8	8.59

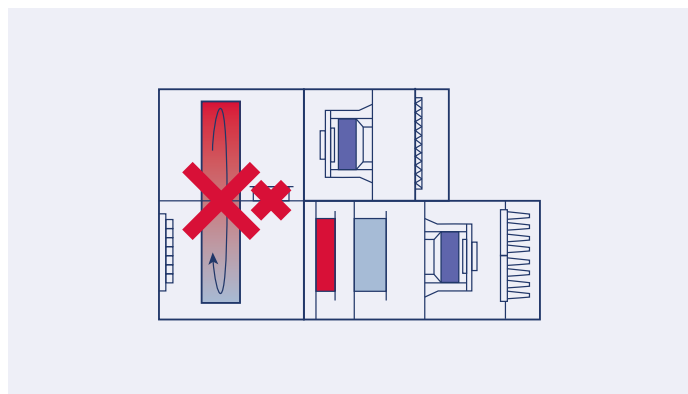
Energy savings

The cost of Covid in terms of energy

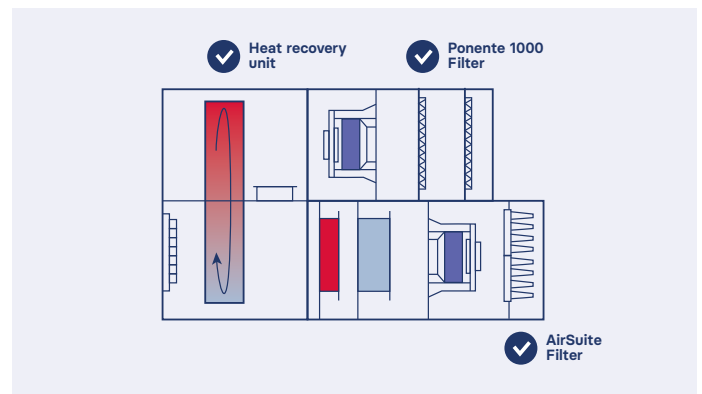
The analysis underlines the unsustainability of energy-intensive HVAC system countermeasures undertaken during the pandemic emergency and supports the need to identify solutions able to provide healthy interior spaces, whilst reducing the air handling energy impact.

Comparison with configuration during and after the Covid 19 pandemic.

Air'Suite® and Photocatalytic filter ensure the healthiness of the air and enable reactivation of the heat recovery and recirculation.



Air management during the pandemic.



Air management after the pandemic.

	Δ Costs	Δ Benefits	$\Delta B / \Delta C$
Primary School (6-10 years)	5,524.9	184,427.8	33.38
Upper Secondary School (14-19 years)	5,524.9	181,953.4	32.93

Educational and work spaces

Managing the air in common areas to improve the health and performance of workers, students and teachers



Lower Secondary School "Antonio Brancati" – NZEB Building
(PESARO) - ITALY

Total air flow rate:

15,000 m³/h

Machines installed:

ADV Custom



University Campus Padua - Former Geriatric Hospital
(PADUA) - ITALY

Total air flow rate:

103,000 m³/h

Machines installed:

ADV Next Air



University of Naples
(NAPLES) - ITALY

Total air flow rate:

74,000 m³/h

Machines installed:

ADV-R Custom



University of Milan
Via Celoria 18
(MILAN) - ITALY

Total air flow rate:

86,700 m³/h

Machines installed:

ADV Custom



New Italo Calvino School
Via di Santa Maria a Cintoia, 8
(FLORENCE) - ITALY

Total air flow rate:

12,000 m³/h

Machines installed:

ADV Custom



University of Naples Federico II
Cupa Nuova Cintia
(NAPLES) - ITALY

Total air flow rate:

40,000 m³/h

Machines installed:

ADV Custom and ADV-R Custom



ADV Custom



ADV Next Air
ADV Modular Units



UTNR-A Platinum
Heat recovery unit



UTNR-HE Platinum
Heat recovery unit



UTNR-T FRESH
Heat recovery unit



VMC-E
Heat recovery unit



Kindergarten Benedetto Costa di Sarnano
(MACERATA) - ITALY

Total air flow rate:
10,100 m³/h

Machines installed:
ADV-R Custom



Regional Library Hub
Former Rossani Barracks
(BARI) - ITALY

Total air flow rate:
48,500 m³/h

Machines installed:
ADV Next Air



University of Salento
(LECCE) - ITALY

Total air flow rate:
77,550 m³/h

Machines installed:
ADV Next Air



University of Chieti and Pescara
(PESCARA) - ITALY

Total air flow rate:
125,000 m³/h

Machines installed:
ADV Next Air and heat recovery units



University of Bologna
(BOLOGNA) - ITALY

Total air flow rate:
420,000 m³/h

Machines installed:
ADV Next Air and heat recovery units



Free Mediterranean University
(BARI) - ITALY

Total air flow rate:
107,000 m³/h

Machines installed:
ADV Next Air



New air for the future.

RHOSS S.P.A.

Via Oltre Ferrovia, 32
33033 Codroipo (UD) - Italy
tel. +39 0432 911611
rhoss@rhoss.com

RHOSS Deutschland GmbH

Hölzlestraße 23, D
72336 Balingen, OT Engstlatt - Germany
tel. +49 (0)7433 260270
rhossde@rhoss.com

RHOSS S.P.A. - France

39 Chemin Des Peupliers
69570 Dardilly - France
tel. +33 (0)4 81 65 14 06
rhossfr@rhoss.com

RHOSS Iberica Climatizacion, S.L.

Frederic Mompou, 3 - Plta. 6ª Dpcho. B 1
08960 Sant Just Desvern - Barcelona
tel. +34 691 498 827
rhossiberica@rhossiberica.com

rhoss.com

