

Fresh Air. Fresh Mind.

*Keeping
homes
cool*



Natural cooling, like opening windows at night, is no longer enough because "thermal loads" are rising, so support from a heat pump is needed.

10

Giuseppe Dalpasso · Business Developer Ventilation

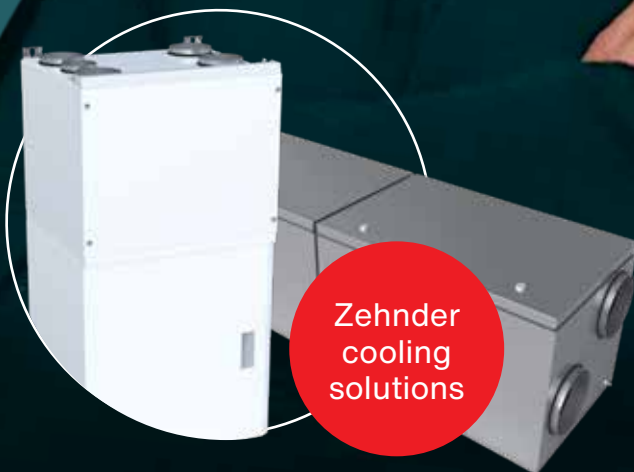
Ventilative cooling **vs.** air conditioning

10

Overheating FAQ

Practical answers from our experts

18



Zehnder
cooling
solutions

Comfort is not a number on a thermostat

YOU'LL ONLY UNDERSTAND IT, WHEN YOU FEEL IT.



Comfort is not a number on a thermostat or a line in a technical specification. It is a feeling.

The moment you walk into a home and instantly sense that the air is fresh, the temperature feels right and the atmosphere simply works. You may not see the technology behind it, but you feel the difference. And today, that feeling of comfort is under pressure.

Summers are hotter and longer, energy is more expensive, and people are increasingly aware of how indoor climate affects their health and wellbeing. These changes are also transforming the way we build our homes.

In the past, the focus was on adding more heating or cooling power. But modern buildings are better insulated and more energy-efficient. The real challenge today is not just heating or cooling a home, but preventing it from overheating in the first place.

At Zehnder, this is a key priority. By using ventilation and smart climate solutions in an integrated way, we can create homes that stay comfortable, even as temperatures rise. In this magazine, we share insights, ideas and research including perspectives from experts in Northern Italy on how we can design healthier, more comfortable homes for the future.

Our goal is simple: *to move from reacting to overheating to preventing it.*



FRESH CONTENT

After reading this magazine you'll:



Understand overheating

Recognise the risks,
causes and impact
of rising indoor
temperatures.



Rethink summer comfort

Shift from fighting heat
to preventing it through
smart design.



Act on ventilation

Consider ventilative
cooling as your first step
towards a cooler home.

The situation 4

How it
works 6

Facts and
figures 8

True
stories 12

FAQ 18

Expert
column 20

Zehnder
cooling
solutions 23

*Get your fresh
Takeaways!*
• check the back •

THE SITUATION

Living in rising temperatures

HOMES ARE GETTING WARMER, AND NOT JUST DURING HEATWAVES. OVERHEATING AFFECTS OUR HEALTH AND COMFORT.

Overheating is no longer a rare summer issue. Heatwaves have increased by around 30% since the 1980s, and between 9 and 20% of Europeans already experience overheating in their homes. The impact goes beyond discomfort. High indoor temperatures disturb sleep, reduce productivity and can cause physical and mental health complaints. In vulnerable groups, prolonged exposure can even become dangerous.

Ironically, many of the improvements that make homes energy efficient in winter, also increase the risk of overheating in summer. Better insulation, airtight construction and large glazed façades trap heat indoors. Add the growing Urban Heat Island effect and the result is clear: heat lingers longer inside our homes.



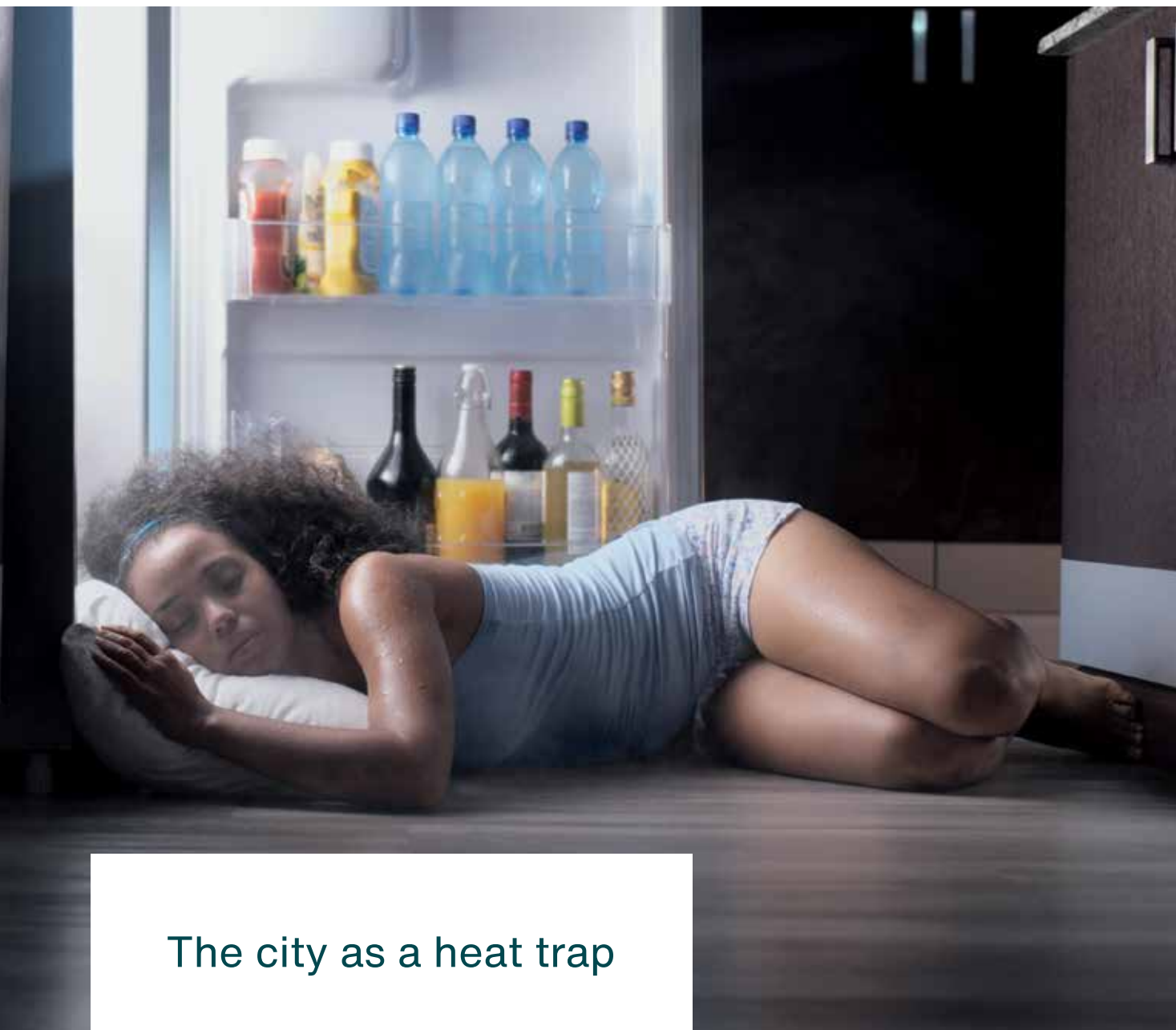
30%

more heat waves
since the 1980s

9-20%

of Europeans experience
overheating

■ **Source**
• IPCC Sixth Assessment
• European Environment
Agency (EEA)



The city as a heat trap

Urban areas can be significantly warmer than their rural surroundings.

The Urban Heat Island effect means cities can be warmer than nearby countryside (4–6 °C hotter, and with peaks up to 10 °C¹). Dense building clusters, dark materials such as asphalt and concrete, and limited greenery absorb heat during the day and release it slowly at night. Surface temperatures in urban areas, such as roads, pavements and rooftops, can be much higher, with studies reporting local surface heat extremes of up to about 10 °C compared to surrounding rural areas during heat events.² As a result, buildings have little chance to cool down.

When buildings are actively cooled with conventional air conditioning, the extracted heat is released outdoors, where it lingers between buildings and is absorbed again by streets and façades, further increasing local temperatures.



1. *Urban heat islands: managing extreme heat to keep cities cool.* (2024, 22 juli). Joint Research Centre. <https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/urban-heat-islands-managing-extreme-heat-keep-cities-cool-2024-07-22>.

2: Mentaschi, L., Duveiller, G., Zulfan, G., Corbane, C., Pesaresi, M., Maes, J., Stocchino, A., & Feyen, L. (2021). Global long-term mapping of surface temperature shows intensified intra-city urban heat island extremes. *Global Environmental Change*, 72, 102441. <https://doi.org/10.1016/j.gloenvcha.2021.102441>

HOW IT WORKS

Build with balance: the Cooling Ladder

KEEPING HOMES COOL DOES NOT START WITH COOLING. IT STARTS WITH REDUCING THE NEED FOR IT.

The Cooling Ladder shows how a balanced indoor climate begins outside the building and only moves to active systems when passive potential has been fully used.

1. Shape the microclimate

Cooling begins outdoors. Trees, water and green spaces help reduce surrounding temperatures and mitigate the Urban Heat Island effect. Materials matter too: light or reflective surfaces absorb less heat than dark stone or asphalt. Good spatial design and natural airflow around buildings help prevent heat from building up in the first place.

2. Keep heat out

The most effective cooling strategy is to prevent heat from entering. Orientation, external shading and screens significantly reduce summer solar gains. A well-designed roof overhang allows low winter, autumn and spring sun to enter, providing useful warmth, while blocking high summer sun when overheating is a risk. Reducing heat gains at this stage limits the need for technical cooling later.

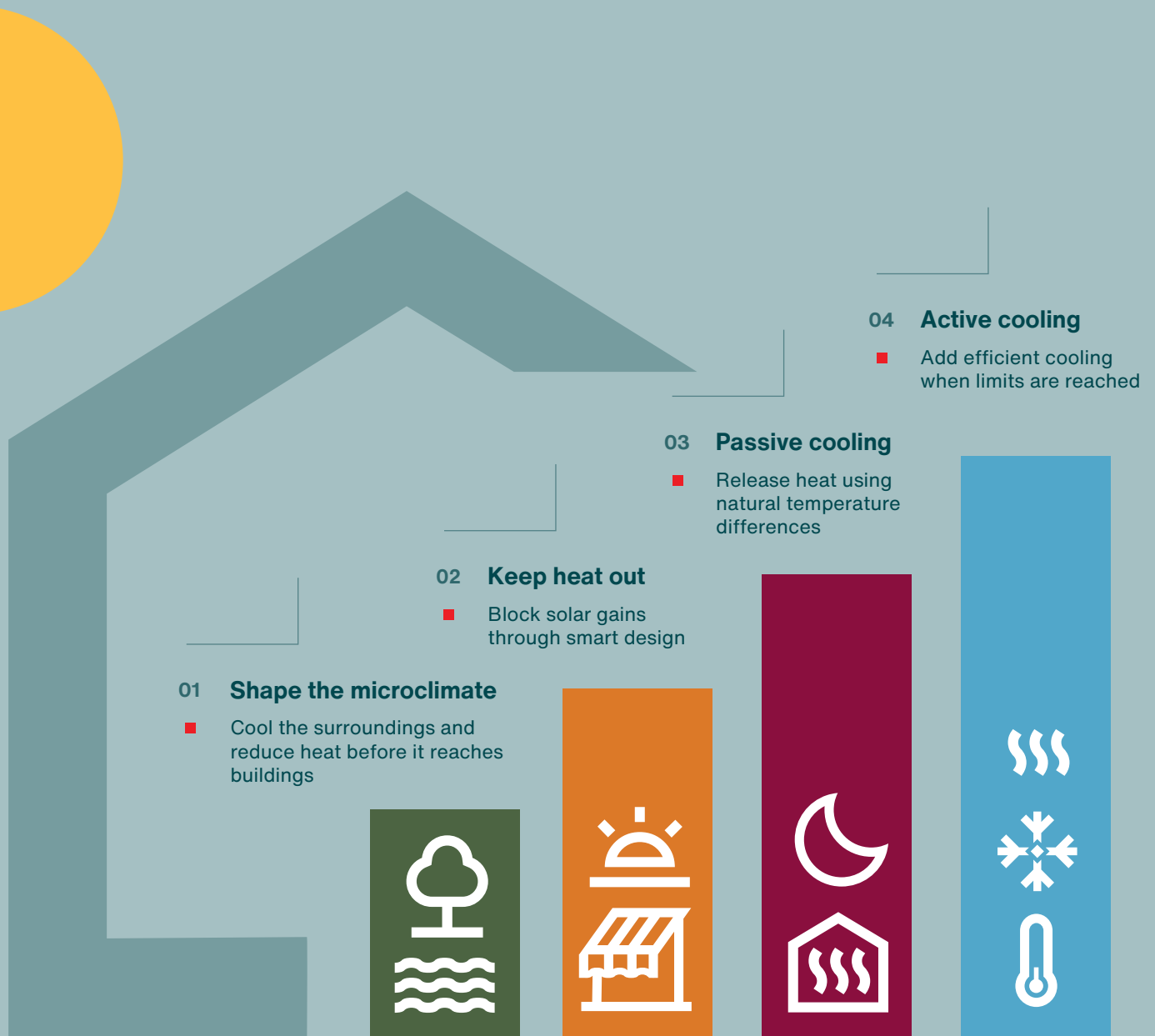
3. Use passive cooling

When outdoor air becomes cooler than indoor air, accumulated heat can be released naturally. Night-time ventilation and controlled airflow help flush excess heat without additional energy use. Ventilation systems with cold recovery can also help retain cooler indoor air during warm periods, reducing unwanted heat gains while maintaining fresh air.

4. Apply active cooling

When passive strategies are no longer sufficient, efficient active systems can provide additional support. Even well-designed homes can experience extreme conditions during prolonged heatwaves. Modern solutions, such as an air-to-air heat pump integrated into a ventilation system, deliver controlled cooling with lower energy use and environmentally responsible refrigerants.

Active cooling should therefore be the final step. Used only when simpler measures are no longer enough.



FACTS AND FIGURES

FRESH
FACTS

1

**More than
heat recovery**
For nearly half
of the year, the
unit operates in
modes other than
heat recovery



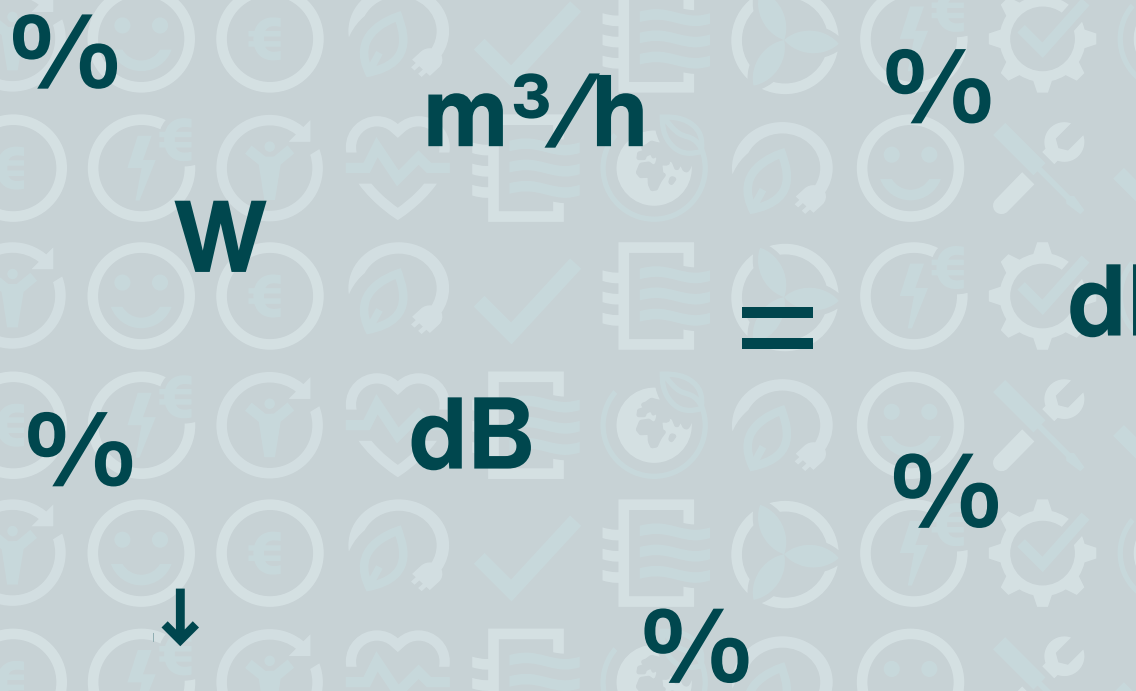
2

**Cooling with
fresh air**
Ventilative cooling
runs about one
third of the year



3

**Balanced ventilation
is a year-round
climate system**



A year in four modes

KNOWLEDGE CONSULTANT BART CREMERS MONITORED 60 ZEHNDER COMFOAIR Q UNITS ACROSS WESTERN EUROPE FOR ONE FULL YEAR. HE ANALYSED HOW MANY HOURS EACH AUTOMATIC MODE WAS ACTIVE.

We tend to call balanced ventilation systems heat recovery units (HRV), but the data tells a broader story. For almost half of the year, the unit is doing something other than recovering heat.

What do these modes actually do?

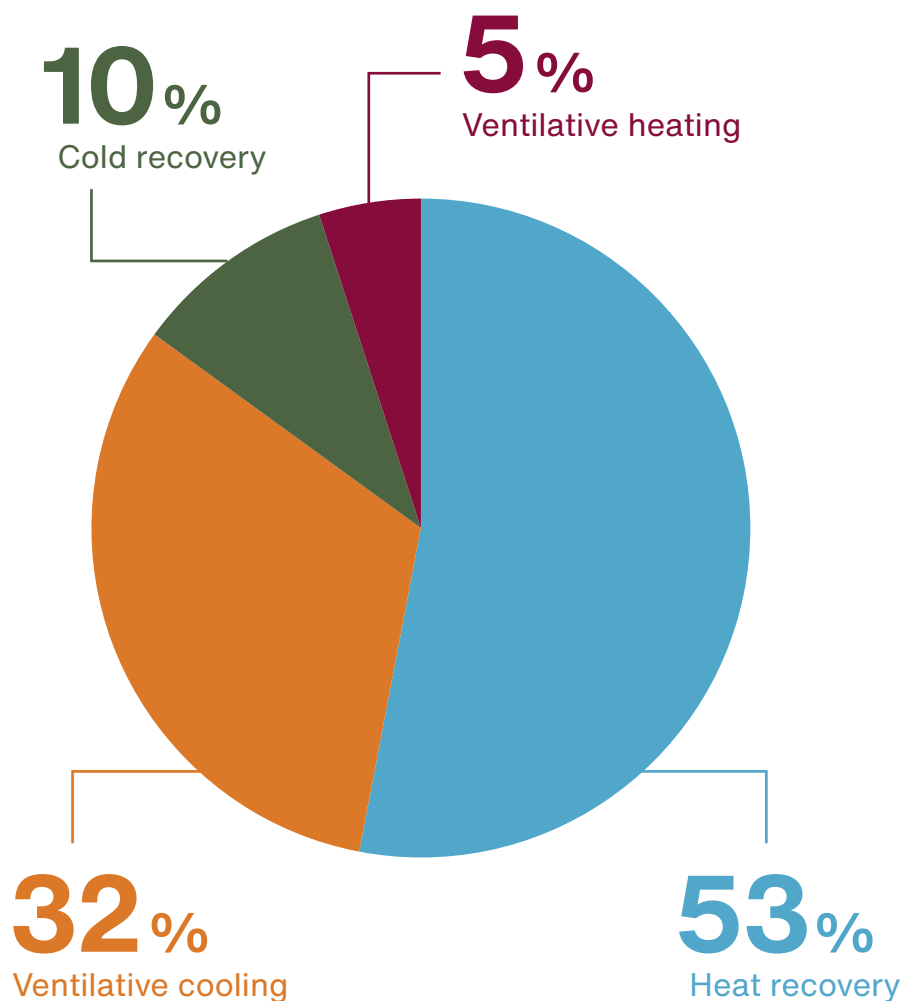
- **Heat recovery (53% of the year)**
Transfers warmth from outgoing air to incoming fresh air. Typical in winter.
- **Ventilative cooling (32% of the year)**
Brings in cooler outdoor air, mainly during summer nights, to reduce indoor temperature.
- **Cold recovery (10% of the year)**
Keeps excess heat outside when it is warmer outdoors than indoors.
- **Ventilative heating (5% of the year)**
Uses warmer outdoor air in spring and autumn to gently raise indoor temperature.



To cool a house properly, you typically need **three times** the airflow required for basic healthy ventilation. Fresh air is the priority. Temperature control is an added benefit.

Bart Cremers • Knowledge Consultant

Balanced ventilation systems automatically alternate between four modes to maintain comfort with minimal energy use. In winter, they recover warmth from the outgoing air. In summer, they prevent heat from entering the home. And when conditions allow, they use free cooling, for example by bringing in cool night air through the bypass. In spring and autumn, slightly warmer outdoor air can even help to gently lift the indoor temperature.



FACTS AND FIGURES

Ventilative cooling vs air conditioning

NOT EVERY FORM OF COOLING WORKS IN THE SAME WAY.

This comparison shows how ventilative cooling and conventional air conditioning differ in terms of health, energy consumption, comfort and sustainability.



Ventilative cooling using balanced ventilation

Air source

100% fresh outdoor air.

Indoor air quality

Removes CO₂, humidity and pollutants. Brings in filtered fresh air.

Cooling principle

Uses outdoor coolness when available. Night cooling via bypass. Optional active cooling through add-on, integrated air-to-air heat pump.

Cooling capacity

Moderate cooling. Maintains comfort and limits peak temperatures.

Electricity use

Uses natural night cooling first. Active cooling only when needed. Lower peak demand.

Sound & unit

No outdoor unit. Lower airflow rates, typically quieter.

Coverage in the home

Supplies fresh air to all connected rooms through a ducted system.



Air conditioning conventional split system

Mainly recirculates indoor air. Limited fresh air supply.

Cools existing air. CO₂ and other pollutants remain in circulation.

Actively cools indoor air via refrigeration cycle. Independent of outdoor conditions.

High cooling power. Rapid cooling, but airflow can feel uncomfortably cold.

High electricity use. Peak demand during hot afternoons when grid load is already high.

Requires outdoor unit. Higher indoor airflow. More potential for noise.

Usually cools one room or zone per unit.



You cannot keep recirculating the same air forever. At some point, you compromise health. Fresh air renewal remains essential

Bart Cremers

Knowledge Consultant

What are we talking about when we think of good indoor climate?

A good indoor climate is always a balance between 'health', 'comfort', and 'energy-efficiency':

- **A healthy indoor climate:** e.g., low CO₂ level, rapid reduction of (virus) particles, prevention of dust mites and moulds, less fine dust, and pollen.
- **A comfortable indoor climate:** e.g., proper temperature, rapid removal of odours, the right level of humidity, acceptable sound levels and no draughts.
- **An energy-efficient indoor climate:** e.g., optimal (re)use of energy to reduce the amount of electricity and/or fossil fuel that is needed to make a home healthy and comfortable.



TRUE STORIES



1 Project 3 Perspectives

A PASSIVE HOUSE NEAR MODENA,
NORTHERN ITALY

In the surroundings of Modena, in the North-East of Italy, a highly insulated, airtight family home became the setting for an integrated ventilation and climate concept. Built in a region known for hot and humid summers, the house combines balanced ventilation with active heating and cooling. The result is a home designed to prevent overheating, reduce energy use and provide stable comfort throughout the year.

In this article, three people look at the same house from three very different angles.

From left to right:

Vitaliano Scardigno

Builder

Giuseppe Dalpasso

Technical Consultant

Stefano Cerchiari

Homeowner





Comfortable homes
start with fresh,
well-conditioned
air.





Stefano Cerchiari

Homeowner

Stefano Cerchiari is the resident and client behind the project. While not a building professional, he approached the design of his 270 to 300 m² home with a clear ambition: long-term comfort without complexity.

For Stefano, comfort was the driving factor.

“We wanted comfort on all three floors, in every season.”

Originally, the plan included balanced ventilation with a post heating/cooling coil. After learning about ComfoClima, he chose one integrated system instead of combining separate technologies. Stefano explains the impact on daily living:

- Indoor temperatures stay around 24.5–25°C in summer and 23°C in winter, regardless of outside conditions.
- Humidity stays between 50–65 percent, consistent all year.

“There are no draughts, it’s very quiet, and there is always fresh air in the house. With one system we control temperature and humidity, and we don’t need radiators or gas. Everything is easy to manage through the app, and the electricity costs are very low.”

“Even in summer, when it is very hot outside, inside it is always comfortable. We prefer staying inside exiting only for a quick swim!”





Giuseppe Dalpasso

Technical Consultant

Giuseppe Dalpasso, civil engineer and technical consultant at Zehnder, supported the project from a climate and energy perspective.

Why Zehnder ComfoClima?

- Desire for stable comfort
- Need to control humidity, temperature, and air quality in an airtight home
- Avoid multiple systems by using just one integrated solution

“Nowadays free, passive cooling, like opening a window at night, is not enough anymore because the thermal loads are increasing. It becomes necessary to have the support of something more, like a heat pump.”

He monitored the system remotely for years to see how it performs.

“The indoor temperature closely follows the target temperature. In addition, the electrical consumption is lower than we initially expected.”



Vitaliano Scardigno

Builder

Vitaliano Scardigno, owner of Unica Costruzioni, is the builder behind the project. His company specialises in high-performance construction methods with strong attention to airtightness and structural integration.

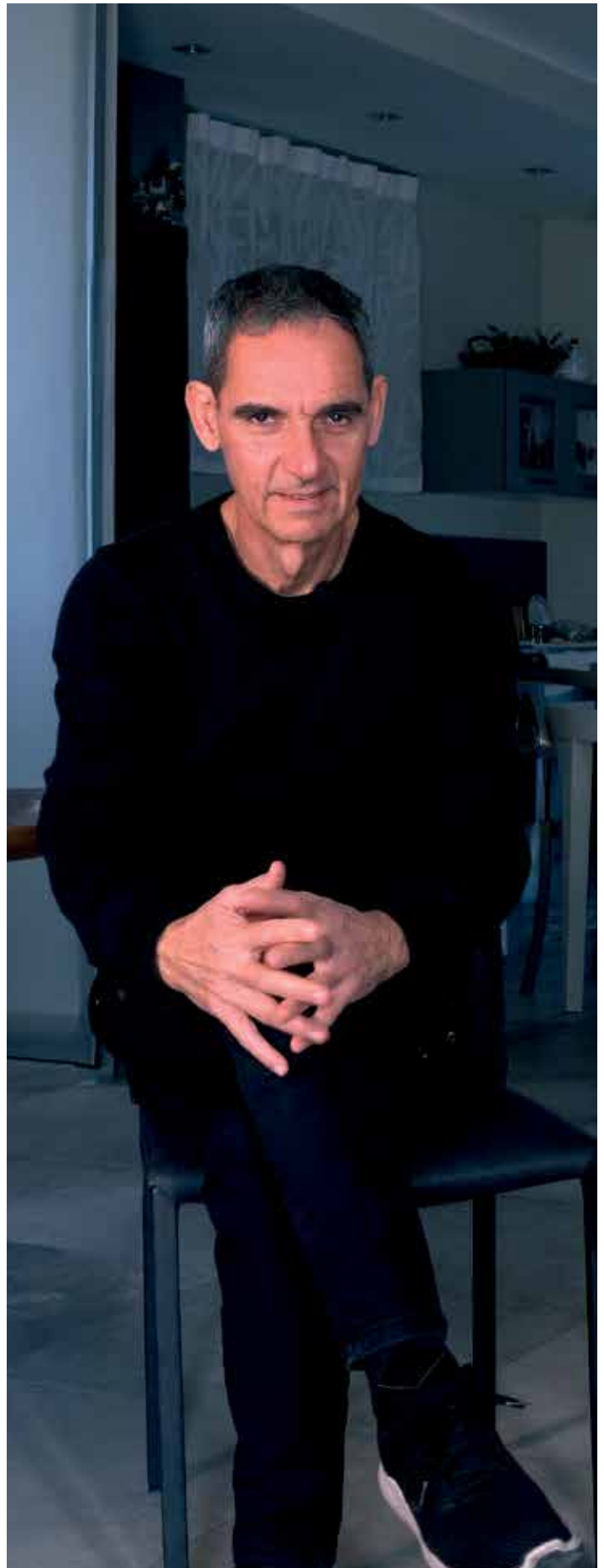
Scardigno's construction method uses:

- Concrete walls with 30 cm EPS insulation
- Full airtightness
- Integration of the air distribution system into the structure before concrete is poured

“Initially I considered a steel frame house but switched after understanding the benefits of using concrete walls combined with approximately 30 cm of EPS insulation. All ventilation and climate ducts were integrated into the structure before pouring concrete. This avoided demolition and reduced duct length and bends. Airtightness was a priority and this created ideal conditions for a ventilation based climate system:

Short duct runs, few bends, cleaner installation, and higher performance.

This phase was complex, but it resulted in faster construction timelines.”



THE SPEAKERS AGREE ON SEVERAL KEY POINTS:

- 1 Success lies in **the integration** of building design and mechanical systems
- 2 Airtight, high-insulated buildings provide the ideal foundation for **ventilation-based climate systems**
- 3 ComfoClima delivers year-round comfort with low energy consumption
- 4 This approach helps prevent issues such as overheating, condensation and mould
- 5 The user experience is simple and intuitive
- 6 The system is suitable for future energy legislation and for homes without gas supply

■
The data from this project has contributed to scientific research.

Would you like to learn more? Read “Energy Analysis of Balanced Ventilation Units with Exhaust Air Heat Pumps”.

▪ Adam O'Donovan
▪ Paul D. O'Sullivan
▪ Bart Cremers,
2025



FAQ



Giovanna Amista

Solution Manager & Head of Zehnder Academy Italy

FAQ

Overheating, ventilation and summer comfort

Overheating raises practical questions for both installers and homeowners. What really causes it? When does ventilation help? And when is additional cooling needed?

We asked Alexandru Ailiesei, Trainer and technical expert at the Zehnder Academy in Germany, and Giovanna Amista, Solution Manager and responsible for the Zehnder Academy in Italy, to share their experience from projects and training sessions across Europe.

What causes overheating?

- **Is overheating mainly caused by climate change or building design?**

Both. Rising temperatures and longer heat waves play a role. At the same time, modern buildings are more airtight and better insulated, which improves winter performance, but can trap heat in summer. We also see larger glazing areas and lighter construction methods. Planning is crucial. Large glass surfaces without proper shading inevitably lead to high solar gains.

- **Do large windows make overheating worse?**

Yes, especially without proper shading. Large glazing areas allow significant solar gains. Orientation and external shading are crucial.

- **Is overheating more common in airtight or passive houses?**

Not necessarily. Well-designed passive houses perform well year-round. However, once heat enters, it is harder to release, making user behaviour and shading essential.



Overheating has multiple causes. It's the result of design, climate and usage combined.

Why does it feel uncomfortable?

- **Why can the air feel heavy or humid even when the temperature seems fine?**

Because temperature alone doesn't define comfort. High humidity reduces the body's ability to cool itself, making air feel heavier and more oppressive.

What can ventilation do?

- **Can ventilation help prevent overheating?**

Definitely. Ventilation systems can reduce overheating risk by using cooler outside air, especially during night-time or cooler periods.

▪ **Does ventilative cooling only work at night?**

No, but it's most effective when outdoor temperatures are lower than indoors, which is often at night.

▪ **How do you prevent warm air from entering during hot days?**

By controlling airflow. Reduce ventilation during the hottest hours and increase it when outside air is cooler. Enthalpy recovery helps limit incoming humidity. With an additional cooling module, the supply air can be actively cooled and dehumidified for extra comfort.



Ventilation is not just air exchange. It's climate control.

When is additional cooling needed?

▪ **Why do some homes still need extra cooling?**

Because ventilation alone has limits. When nights stay warm and solar gains remain high, there is not enough temperature difference to cool the building naturally.



When passive strategies reach their limits, active cooling ensures stable comfort.



Alexandru Ailiesei

Trainer and technical expert •
the Zehnder Academy Germany

EXPERT COLUMN

Erwin Plessers • system engineer Infra Vitaal and Jérôme Corba • advisor HVAC solutions Zehnder

Keeping Young Minds Cool on Hot Days

A healthy indoor climate is essential in a nursery, especially as summers grow longer and hotter. In Zalk, the Netherlands, an automated climate system ensures comfort, fresh air and stable temperatures for children and staff alike.

Jerôme:

Overheating is no longer limited to a few summer weeks. “Due to change of climate, we get longer and more intense summers,” he explains. Buildings, both existing and new, increasingly struggle with high indoor temperatures. The consequences go beyond discomfort. Poor sleep, reduced efficiency and physical complaints are common symptoms. In a nursery, that impact is even greater. Children need stable temperatures, good air quality and low noise levels to feel safe and comfortable.

Balanced ventilation plays a key role here. According to Jérôme, a common misconception is that ventilation is only relevant in winter. In reality, it also supports summer comfort through cold recovery and an integrated bypass, helping to lower cooling demand. Fresh air remains essential, even when temperatures rise.

Erwin:

“In this building we control temperature, humidity and CO₂,” he explains. The nursery in Zalk uses ComfoAir Q in combination with ComfoClima. Night cooling is activated automatically when outdoor conditions allow it. During the day, the system continuously monitors indoor and outdoor temperatures and adjusts accordingly.

On sunny days, heat gain is unavoidable, but choosing the right building system limits its impact. Automation ensures that staff do not have to intervene manually.

The result is a stable indoor climate with controlled humidity levels and fresh air in every room. For young children who cannot regulate their own comfort, that reliability makes all the difference.



The right system keeps comfort under control.



Erwin Plessers





We must ventilate with climatic solutions to remove heat effectively.

Jerôme Corba



PRODUCT

Zehnder HP Cooling Solutions

Smart cooling,
heating and
ventilation in one
integrated solution

Zehnder ventilation units with an integrated exhaust air heat pump combine ventilation, heating, cooling, dehumidification and humidification into one energy-efficient solution.

- 100% fresh outdoor air - no recirculation
- No external unit required
- Heating and cooling with an integrated exhaust air heat pump
- Replaces two separate units with one integrated solution

PRODUCT

Zehnder Cooler Units

Fresh air and
effective cooling
in one integrated
solution

An efficient compressor-based cooling solution integrated into the ventilation unit, delivering cool, dehumidified fresh air for greater comfort and healthier indoor living.

- 100% fresh outdoor air - no recirculation
- No external unit required
- Integrated compressor-based cooling module
- Energy efficient, draught-free cooling

PRODUCT

Zehnder ComfoClima

Smarter,
future-ready
climate
integration

The Zehnder ComfoClima integrates heating, cooling and ventilation into one compact system - delivering fresh air comfort without compromise. It sets a new benchmark for integrated residential climate solutions.

- 100% fresh outdoor air - no recirculation
- No external unit required
- Integrated heat pump technology
- Enhanced efficiency and performance with reduced environmental impact



A close-up, low-angle shot of a fluffy brown dog, possibly a Shetland Sheepdog or Rough Collie, lying down on a light-colored wooden floor. The dog's head is in the foreground, resting on the floor, with its eyes closed. Its fur is thick and wavy, with a mix of light and dark brown tones. The background is out of focus, showing a window with a white frame and some greenery outside. The lighting is warm and soft, suggesting a sunny day.

*Keeping
homes
cool*

Fresh takeaways

Keeping homes cool starts before cooling begins.

- Prevent overheating instead of fighting it later with more power.
- Use the Cooling Ladder: shape the microclimate, keep heat out, ventilate smartly, add active cooling only when needed.
- Fresh air and temperature control should work together, not separately.
- Ventilative cooling reduces peak demand and improves indoor air quality.
- Automation and smart control systems make comfort simple and reliable.
- A well-designed system protects health, lowers energy use and increases long-term comfort.