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# HEALTHY INDOOR CLIMATES

Warmer summers jeopardise comfort at home due to overheating  
What are the solutions?



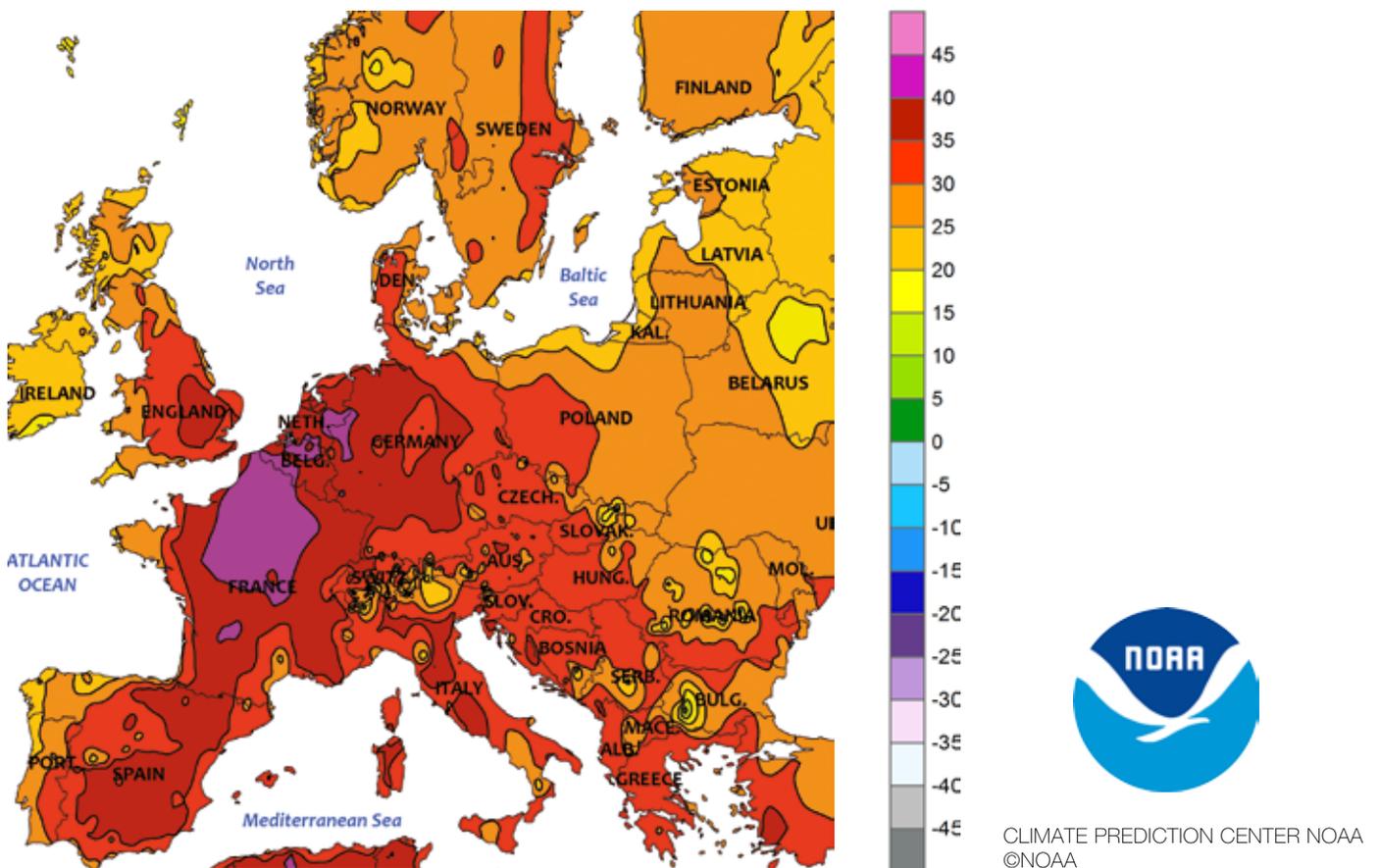
## The causes of overheating

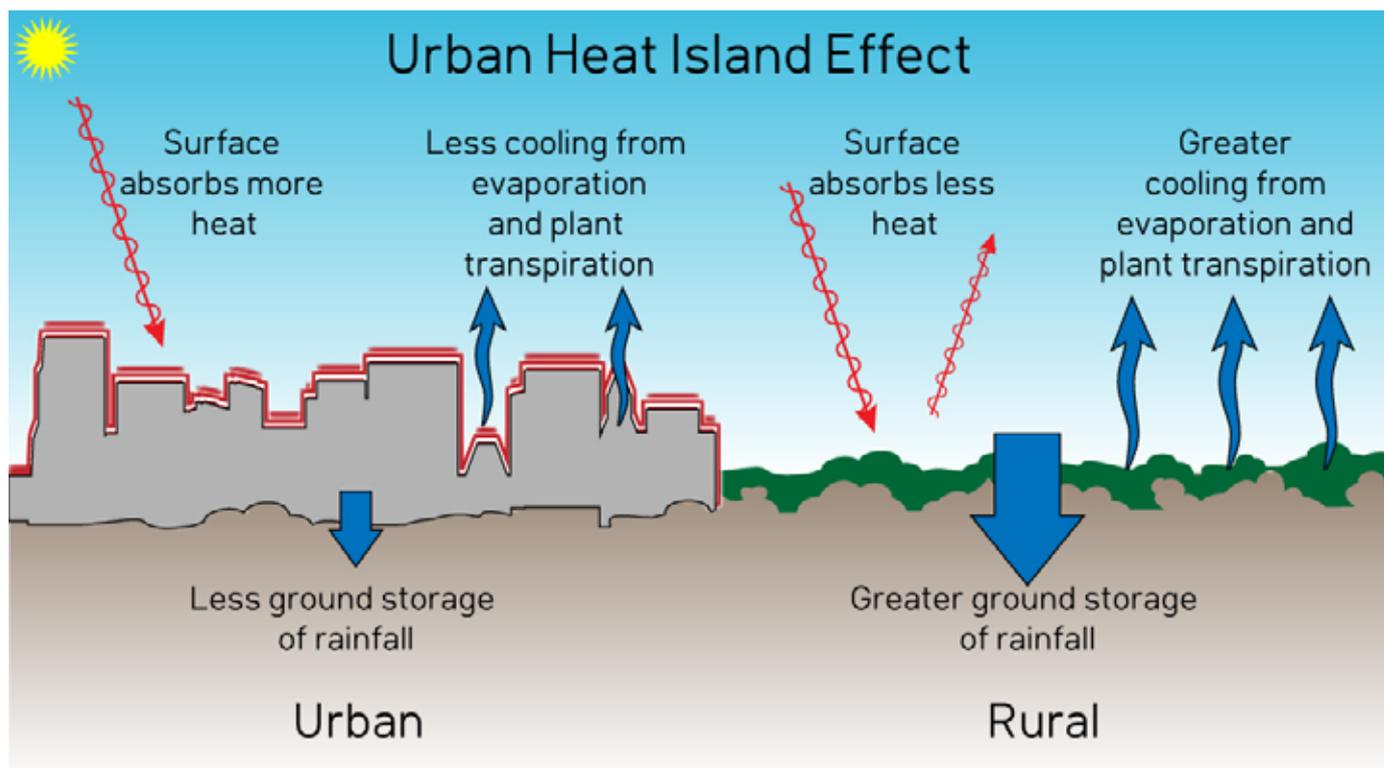
Nowadays, it is easier to keep your house warm in the winter than cool in the summer. And, if many of the national climate institutes in Europe are correct, next summer will most likely be even warmer. The summers that follow may not only continue to get hotter each year, but they may also stay hot for a longer period of time. There is a growing awareness that this causes indoor conditions to become uncomfortable and even unhealthy. The quality of our indoor climate is in jeopardy, not only inside our homes, but also in our offices and factories. Installers are being asked more and more frequently for their help in keeping spaces liveable during the near-tropical summer months.

### Why is it getting warmer and warmer indoors?

The main culprit is the climate issue. Until last summer, many Western European countries have overpassed heat records. Even in historically colder climates like the Netherlands for example, the highest temperature on record in was 38.6 degrees. That had been the record for 75 years and was set in the town of Warnsveld in Gelderland province. It was only surpassed last year when Eindhoven hit 39.3 degrees Celsius. Warmer periods will occur more frequently here and will linger for longer. That is why the Dutch meteorological institute does not expect the Eindhoven record to last very long.

**EUROPE Extreme Maximum Temperature (C) July 25, 2019**





### The Urban Heat Island effect

In urban areas, the Urban Heat Island effect appears to cause temperature increases of up to 8 degrees. Large glass surfaces, conservatories or verandas on the south or west sides of a house can make living spaces feel like greenhouses that are barely accessible at times due to the heat. The stone, concrete and asphalt in a city absorb a lot of solar heat during the day, while hardly any cooling can occur at night via moisture evaporation from the soil, ponds or other bodies of surface water. The design of residential areas and new buildings does not yet adequately address this issue. Green areas, to the degree that they are present, are often too small to be able to effectively cool the growing levels of heat.

A lot of research is being conducted into new materials and technologies that may be able to transmit less heat to the indoor climate, but any practical application is still in its infancy. For more information on the Urban Heat Island effect

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In addition, a number of unfavourable factors help push temperature and humidity levels in homes to uncomfortable and unhealthy heights. These factors include limited ventilation options, increasingly effective insulation, community district heating, as well as electric sources of heat such as computers, TVs, lighting and human activities.

## Uncomfortably hot

That means it can get quite toasty in the house during summer, something that will only continue to get worse if we do nothing. After an extremely hot summer day, it is not inconceivable for it to be warmer inside than it is outside at night. People have trouble sleeping in temperatures that exceed 24 degrees.

The demand for cooling, and air conditioning in particular, is generating a much larger demand for electricity, which further intensifies the greenhouse effect. Overheating should not be underestimated. It requires a real and more fundamental solution. And this solution should preferably be as climate neutral as possible.



## Research

A great deal of scientific research has already been conducted on the impact of the changing summer weather on the indoor climate in homes, which can differ greatly in their thermal conductivity, ventilation and heat insulation. These studies were conducted in houses that were occupied as well as in computer simulations. There is also a great deal of information on the effects produced by different kinds of measures. This has already led to standardised norms as to what can be considered too hot for different rooms in a home, using important parameters such as activities, numbers of users and surface area.

Examples of these standards can be found in national directives or agreements, like in the Spring Agreement of the Netherlands for example.

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Ventilation is often an effective solution for combating overheating. This is certainly true in combination with awnings and structural features such as external wall insulation and roof overhangs.

## How to prevent overheating

### Spotlight on installers

Occupants and/or owners, architects, contractors and housing associations should consult an installer about these issues, keeping a close eye on the increasing number of new laws and regulations from the government. One example includes the requirements for nearly Energy Neutral Buildings EU countries had to draw up and submit nearly zero-energy buildings national plans, describing how they intended to increase the number of NZEBs in their respective country to comply with the directive.

### What advice can installers provide on cooling?

The ideal approach is to take methods of reducing overheating into consideration during the design and construction phases of a home.

This includes the orientation of the house toward the sun, planting trees, building roof overhangs and including sun protection (structural, natural or blinds), less glass on the façade and ventilation for summer nights (structural). The non-profit interest group Stroomversnelling (editorial note: Dutch NGO), based on their *isso/sv assessment method Zomercomfort Woningen* (Summer Comfort Living, editorial note), estimates that a number of issues can be effectively managed using these measures. Municipalities, housing associations, builders and suppliers are all working together on this. That is why it is vital to make a realistic assessment of the indoor climate in the summer during the design phase of new buildings and large-scale renovation projects using these standards or other generally accepted standards and calculation methods.



## But what are the options?

**We will discuss three frequently applied measures: opening windows, installing air conditioners and balanced ventilation systems.**

### 1. Opening windows not always effective

Opening a window is the oldest and best known ventilation solution using the cool night air. But if there is no wind, no cool air will enter through the open window at all, even if you open two opposite each other. Airflow is required in this case. Even opening the windows briefly in the morning to air out the home does not work well or quickly enough to dissipate the large amount of CO<sub>2</sub> that has built up overnight. And what do you do if it warms up more quickly outside than it does inside? Keeping the window open is then counterproductive. In other words, opening a window does not always help to combat overheating and improve the indoor climate. Not to mention that this method does nothing to stop fine particulate matter, pollen, traffic noise or unwanted intruders from entering your home. Taking a different, pro-active approach to cooling and refreshing the air inside the house is absolutely necessary.

### 2. What about air conditioning?

About 38 million air conditioners are currently in use in the EU with an expected annual growth of 4 percent until 2030. Air conditioning eliminates many of the disadvantages of leaving a window open, but it also involves a number of new disadvantages, both for individual users and for society as a whole. It is an energy-consuming and expensive alternative that causes additional CO<sub>2</sub> emissions due to its high energy consumption. Air conditioners do not refresh the indoor air either, as only the indoor air is circulated. But the health factors are even more important to consider here. Dry air quickly causes discomfort such as dry eyes, dry skin and other irritations. Occupants can easily catch a cold if the temperature difference between the indoor climate and the outside air is too great. If there is inadequate maintenance, air conditioning can also cause problems such as bad smells and respiratory diseases, as it circulates insufficiently filtered air throughout the house.

### 3. Balanced ventilation as an alternative

A much healthier alternative to air conditioning is balanced ventilation. This air exchange system supplies fresh outdoor air, filters it and adjusts it to the right temperature and humidity for use in the home. The quantities of actively supplied fresh outdoor air and actively extracted used indoor air are exactly the same, or in other words, balanced. The outgoing air usually comes from the kitchen, bathroom or lavatory.

The incoming fresh air usually goes to living rooms and bedrooms. The system consists of two fans, a number of ventilation ducts and a heat recovery unit that recovers heat from the desired airflow. This creates a healthy and comfortable indoor climate in every room as well as a pleasant temperature, possibly with limited additional support from a central heating and/or cooling system. Air filters help keep unhealthy air borne particles out.



### Cold recovery in hot summers

During a hot summer, the heat recovery unit works the other way around. The relatively cool air from indoors is transferred to the warmer, extracted outdoor air. This helps the house maintain a cooler room temperature for longer. In other words, the system has now become a cold recovery unit. Balanced ventilation is proven to be an effective, climate-friendly method for keeping the indoor climate liveable and healthy.

**This is situation 3, see below**

### Indoor climate in autumn and spring

In these seasons, heat recovery from indoors to outdoors (in the winter) or from outdoors to indoors (in the summer) may be temporarily unnecessary, for example if the indoor temperature is likely to exceed a preferred value. In this case, the main task of balanced ventilation is then to refresh the indoor air and filter the outdoor air. The system makes an automatic selection via its fully integrated automatic control unit based on measured indoor and outdoor conditions.

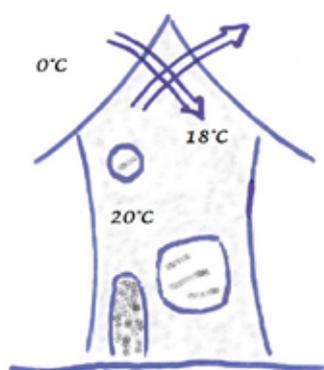
Occupants can choose a temperature profile themselves to achieve generally warmer or cooler supply temperatures. This is also possible in warm summers when the outside temperature drops significantly at night and the cool air can flow in directly but still filtered.

**This is situation 2, see below**

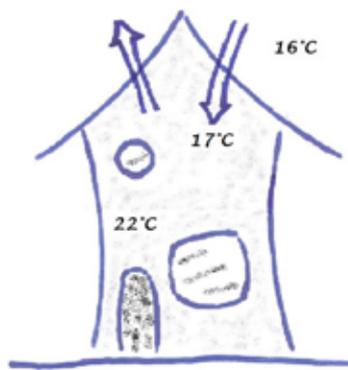
### Heat recovery in cool winters

Balanced ventilation offers also in winter a comfortable indoor climate. The airflow for supplying clean air and the airflow for removing used air are separated, but pass each other closely in a heat recovery unit. During the winter months, the fresh outdoor air absorbs valuable heat from the outgoing air from the home. This means that much less heat is lost from the home, making a significant difference in heating costs and therefore in CO<sub>2</sub> emissions. The system is particularly effective in new buildings and in renovated houses designed for this purpose.

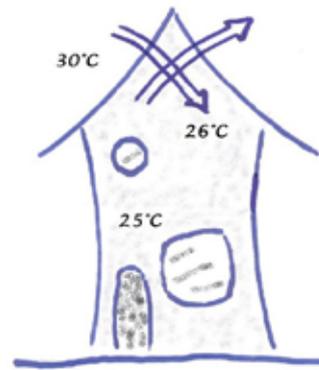
**This is situation 1, see below**



**1. Heat recovery (winter months)**



**2. Passive cooling with outdoor air (mid-season; autumn, spring)**



**3. Cold recovery (summer months)**

## Conclusions

Balanced ventilation is an investment during the construction phase, but is an advantage when it comes to revenue during operation. It increases comfort and health and the “liveability” of the home because it helps prevent overheating and reduces energy waste. The case is the same with renovations by using air-conditioning systems. Balanced ventilation holds a number of advantages over alternatives such as open windows and air conditioning. If other options such as reducing glass surfaces in the façade, correct orientation to the sun, roof overhangs and similar measures are taken into account for renovations or new buildings, the efficiency of balanced ventilation will increase even further.



## What does Zehnder do?

Zehnder has a long history of contributing to people's health by providing ventilation systems for a healthy and comfortable indoor climate. Energy-efficient with a high heat recovery rate for new builds and renovations of single family homes, apartment buildings and commercial buildings in the public and commercial sector.

The Zehnder brand is represented in over 20 countries worldwide.

**For more information, please visit:**

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