

The five principles of the Passivhaus standard: a stable temperature all year with minimal energy consumption

Five technical pillars allow a passive house to hold a stable temperature all year with minimal energy use. At PAPIK Group we apply them at every stage of the project.

A home that minimises energy use and guarantees high comfort is not the result of a single building gesture, but of five principles working together. The Passivhaus standard defines them precisely, and they are the foundations that let a passive house keep a pleasant temperature all year with minimal consumption. At PAPIK Group we build them in from the design phase through to the execution of every Eskimohaus home.

1. High-quality thermal insulation

Insulation is one of the most decisive aspects of a Passivhaus home. A poorly insulated dwelling loses much of the energy it generates, which drives up heating and cooling demand. In a passive house the insulation is far more efficient than in a conventional build, and it is applied continuously across walls, roofs and floors. The result is an envelope that retains heat in winter and keeps the house cool in summer.

How it is achieved

- Use of high-quality insulating materials such as mineral wool, cork or cellulose.
- Continuous insulation across every exterior surface of the envelope: walls, roofs and floors.

2. High-performance windows and doors

Windows and doors are critical points in any construction. In a conventional home they can account for up to 25% of heat losses. In a Passivhaus build, high-performance windows and doors are installed to minimise that loss while still bringing natural light into the interior.

Key features

- Double or triple glazing with low emissivity, depending on the climate.
- Frames with thermal-break construction to prevent energy leaks.
- Excellent airtightness.

3. Airtightness

A passive house must be sealed so that no unwanted air leaks occur. Airtightness means that warm or cold air does not escape from the interior or enter from outside, except through the controlled ventilation system. Controlling air infiltration in a traditional building system is very difficult and forces the installation of membranes and add-ons to reach the required tightness. With the building systems we use at PAPIK Group, whether the structure is light timber frame or cross-laminated timber, the assembly is highly airtight and additional sealing layers are avoided.

The image of a lit candle helps make sense of it: the heat it gives off would stay inside rather than escape outward. The same happens with climate control, which drops the required power and consumption to a minimum, because none of what is generated is lost through leaks.

Why it matters

- Minimises heat loss through infiltration.
- Ensures the ventilation system works optimally.
- Enables low-consumption climate control systems.

4. No thermal bridges

A thermal bridge is an area of a building's envelope with lower thermal resistance, which causes heat losses. They are common at windows, doors or wall junctions. In a Passivhaus home these critical points are carefully eliminated to preserve the thermal efficiency of the whole.

This requirement has to be kept in mind both in the design phase of the house and during execution, using building systems and materials that avoid the creation of thermal bridges.

Solutions

- Designs and building techniques that eliminate thermal bridges.
- Use of low-conductivity materials to prevent energy leaks.

5. Mechanical ventilation with heat recovery

The airtightness described in the third principle creates a new need: renewing the indoor air. This renewal is essential to guarantee high comfort, but it is also a matter of health and of law. Indoor air becomes stale simply through our presence and must be renewed to keep a healthy environment. Mechanical ventilation with heat recovery is one of the great Passivhaus innovations: it exchanges stale indoor air for fresh outdoor air without losing the heat generated inside. Through a set of membranes, the outgoing air transfers its temperature to the incoming air, so air quality and a constant temperature are maintained without raising energy use. The unit also includes filters that keep out pollen, insects and pollution.

Benefits

- Improves indoor air quality by removing CO₂ and pollutants.

— Reduces the need for additional heating by recovering up to 90% of the heat from the outgoing air.

A sixth point: solar protection

There is a sixth aspect that is not part of the five official principles, but which our experience lets us highlight with equal importance. It is solar protection. In climates like ours, reaching indoor comfort in summer is far harder than in winter, because the impact of the sun inside the home acts as a passive climate-control system that works against us in summer. One of the solutions is stackable, adjustable shutters, which allow the enjoyment of natural light while avoiding direct solar impact and interior overheating. Combined with shadow studies, design and overhangs, they help optimise every project.

In summary

The five Passivhaus principles work together to maximise a home's energy efficiency. From good insulation to an advanced ventilation system, each pillar is essential for a passive house to reach optimal comfort with reduced consumption. Anyone wishing to build a Passivhaus home should make sure these five principles are present at every stage of the project. To go deeper into how we put them into practice, you can look at our [construction service](#) or read how [energy retrofit](#) works when starting from an existing building.

None of these five principles works in isolation: the efficiency of a passive house comes from how insulation, airtightness and ventilation are coordinated from the very first drawing.