Ventilation options

Sufficient ventilation is crucial as our homes become more airtight. A mix of passive and mechanical options can work well, but all designs should start by getting the source extraction measures right.

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VENTILATION IS CENTRAL to providing a healthy indoor environment. We constantly produce contaminants such as volatile organic compounds (VOCs), carbon dioxide (CO_2), moisture, combustion products and cooking odours. Ventilation is the main means available to remove and dilute contaminants in the indoor air.

Airtightness trend

The ventilation stream of BRANZ's WAVE (Weathertightness, Air quality and Ventilation Engineering) programme identified a consistent trend to increasing airtightness of homes. This demonstrated a steadily decreasing amount of background infiltration. In some cases, though, this background infiltration provided a useful dilution of contaminants.

Although this trend is positive from the energy point of view, it is crucial that sufficient ventilation is provided as adventitious openings are closed down by changing building materials and techniques.

Fieldwork has shown the negative consequences of not providing enough ventilation (see *Build* 151, *New homes dripping*). The key issues identified in this work were substitution and poor design and installation.

What does the Building Code say?

The typical method of compliance with clause G4 of the New Zealand Building Code is to provide an opening window area equivalent to 5% of the floor area of a building. There are also elements in clause G4 to demonstrate compliance using active ventilation in polluting spaces like kitchens, laundries etc.

Clause G4 assumes that windows will be opened during normal operation of a home. However, evidence from WAVE suggests this may not be happening as much as is necessary (see *Build* 127, *Changing the air indoors*).

The BRANZ occupant behaviour project (see pages 46–47) is looking into this in more detail and will provide information on how often and how far people are opening their windows.

Ventilation strategy should start passive

In general, the most cost-effective way to add ventilation to a home is to get the passive measures right. Passive ventilation alone cannot usually capture the majority of moisture produced during cooking and bathing so needs to be combined with source extracts. This strategy works well particularly for older homes or where there has been an effort made for passive design.

Mechanical ventilation is seen as a quick fix, but care must be taken with the design of the system as it is easy to overventilate. Control of any active system is going to be crucial to its performance.

The main options for mechanical ventilation include exhaust, supply-only and balanced ventilation – usually with heat recovery.

Passive options

Passive ventilation options include trickle vents, passive stack ventilators and windows:


Trickle ventilators are a good passive option.


Poor installation is often the cause of high moisture levels.

- Pros - typically cheap, easy to fit and with good control for diligent occupiers.
- Cons - ventilation performance is dependent on wind and stack pressures and energy impact, and they require a degree of occupier involvement and education. Extract ventilation is usually required to remove pollutants at source.

Mechanical options

These include extract ventilation, supply ventilation and balanced ventilation with heat recovery.

Extract ventilation

Typical examples include bathroom extract fans and rangehoods. Extract ventilation is an effective way of dealing with moisture at its source and can simply be left on after a polluting event for a few minutes to help remove contaminants.

Care is needed to locate intakes in the optimal position to capture the contaminant source effectively. Where the make-up air is coming from also needs to be considered, for example, an open window or internal door.

- Pros - very effective at source capture, easy to install and cheap.
- Cons - can have an energy impact, though this is minimal as they are run intermittently. They require user intervention.

Supply ventilation

A supply-only system takes roof space air and ducts it to several rooms in the home through ceiling-mounted diffusers. Examples of this style of ventilation system commonly include a bypass where intake air is taken from the eaves of the building in the warmer months.

Drawing air from the roof space doesn't comply with clause G4 which requires ventilation with outdoor air.

- Pros - relatively inexpensive, simple to install. Roof space air can have some energy benefit in the shoulder seasons.
- Cons - roof space air is not the cleanest air source, but filters will help with this. Controlling system flow based on temperature difference alone can lead to additional moisture in the home, although some manufacturers are now incorporating humidity measurement in their controllers.

Balanced ventilation with heat recovery

Balanced ventilation offers a great solution for ventilating your home efficiently. However, it is not well suited to retrofitting. A balanced system requires a very airtight building to be cost effective.

Balanced systems extract air from the building and pass it through a heat exchanger. Intake air is drawn through the other side of the heat exchanger, pre-warming the building's replacement air.

Heat exchanger cores can be very efficient - over 90% in some cases - however, systems require two fans to work. Given the temperate climate in New Zealand, it is possible that the energy recovered can be less than the cost to run the fans driving the system.

Given they are trying to get the absolute maximum energy efficiency possible, running ductwork inside the building insulation is an important consideration.

- Pros - very efficient, good track record of use overseas.
- Cons - most expensive option, difficult to retrofit. Requires an airtight building for maximum efficiency. Requires careful commissioning and regular maintenance.

What's next?

With the completion of WAVE, the energy-efficient ventilation project has recently begun. It seeks to answer a raft of questions about getting the right ventilation option into a home to minimise the energy impact while maximising pollutant removal.

Part of this involves investigating just how much of an impact infiltration air is having and what the right ventilation option is given the airtightness of a building.

Although increasing airtightness - by decreasing infiltration - will result in energy saving, there is evidence the relationship is not completely linear. The first part of the energy-efficient ventilation project will investigate this in more detail in the context of our lightweight construction.