Insulation, ventilation, space heating and water heating

For the Pilot Housing Survey, trained assessors visited 832 houses, recording information on physical characteristics such as insulation, space heating and water heating, the presence of mould and general condition. The findings point to specific areas where New Zealand's housing stock can be targeted for improvement.

Collecting robust data on New Zealand's houses is a crucial first step in developing policies and programmes across a wide area of government, from energy efficiency and carbon reduction to public and child health.

This Research Now covers the survey's findings around thermal insulation, ventilation, space heating and water heating and the presence of smoke alarms. For findings around house condition, see BRANZ Research Now: *Pilot Housing Survey #2 House condition*. For more about the survey design, see BRANZ *Research Now: Pilot Housing Survey #1 Survey methodology*.

Insulation

Thermal insulation became mandatory in all new houses in New Zealand from 1978. Houses built before then are unlikely to have insulation unless it has been retrofitted.

The Pilot Housing Survey (PHS) recorded the type, depth and coverage of insulation materials in the roof space, where there was an accessible roof cavity (3% of houses surveyed had another dwelling above, and 9% had no accessible roof cavity). The insulation assessment was done from the access hatch, and in 5% of houses with a roof cavity, it was not possible to make a proper assessment.

The results suggest 45% of houses with a roof cavity had at least 120 mm insulation (Figure 1), while 49% had less than 120 mm. (EECA recommends bulk roof space insulation of at least 120 mm thick, and this figure is one measure in the healthy homes standards for rental housing.) There was no significant difference between owned and rental stock. Of the houses with less than 70 mm insulation and an accessible roof cavity, only around 1% had no insulation at all.

The condition of insulation can impact its thermal performance. The PHS recorded the presence of a range of defects including rips/tears/gaps/tucks/folds, signs of vermin, gaps due to downlights, signs of damp or mould and inappropriate/improvised/unsuitable material. The results show that, of those houses with insulation, 52% had defects that could compromise effectiveness.

For houses with an accessible subfloor, the PHS recorded the type and coverage but not thickness of insulation (Figure 2). The assessment was done from the access hatch.

Over a third of houses (36%) had a concrete slab foundation, more common amongst owner-occupied houses (40%) than rental dwellings (28%). In 6% of cases, the subfloor was not accessible.

Of those with an accessible subfloor (55%):

- 61% had at least 80% coverage - most of these had bulk insulation (80%), 16% had foil
- 23% had less than 80% coverage - most of these had no insulation at all
- in 16%, the extent of insulation could not be determined.

There was no significant difference between the proportion of owned and rented houses lacking subfloor insulation.

The healthy homes standards that come into force on 1 July 2021 for privately owned rental homes and boarding houses have a required standard for insulation:

"The minimum level of ceiling and underfloor insulation must either meet the 2008 Building Code, or (for existing ceiling insulation) have a minimum thickness of 120 mm."

The thermal performance of a dwelling can also be affected by draughts from gaps in the building envelope - see BRANZ Research Now: Pilot Housing Survey #2 House condition for more on this.

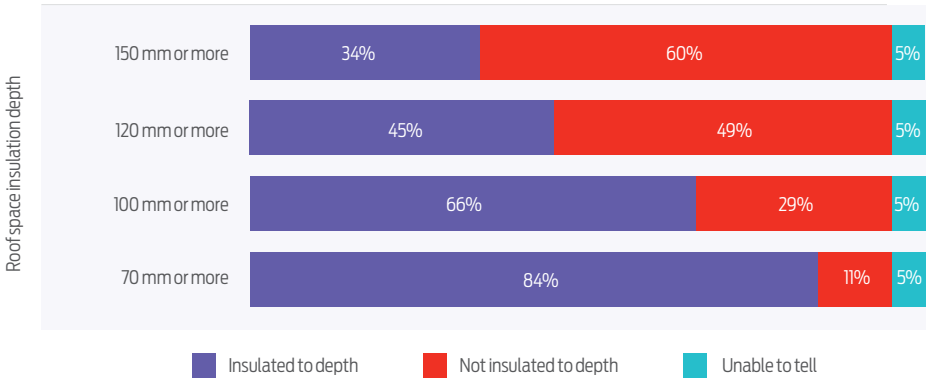

Figure 1 Depth of roof space insulation in surveyed houses

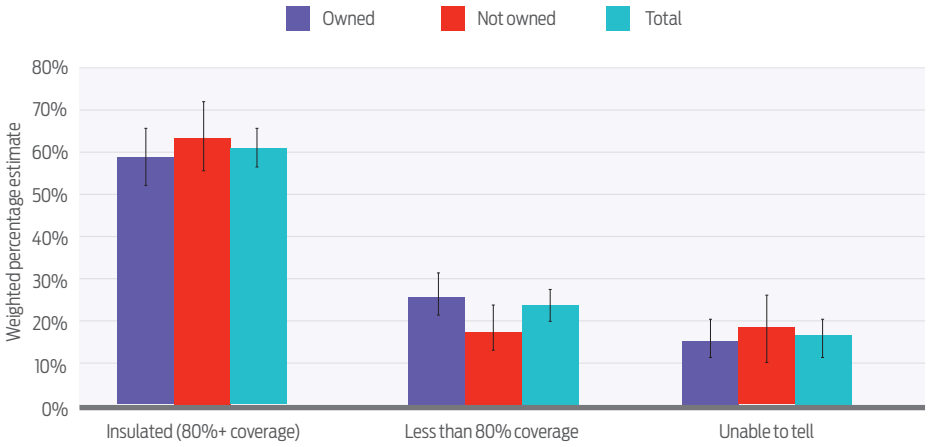

Figure 2 Subfloor insulation coverage in houses with a subfloor cavity

Ventilation

Ventilation is crucial for a healthy indoor environment, bringing fresh air into the house, removing pollutants and helping to manage moisture. The PHS recorded the presence of mechanical ventilation (Figure 3) and openable windows. When considering extract ventilation, the survey only counted appliances vented to the outside and in working order.

There was extract ventilation in all bathrooms of 51% of houses, with no significant difference between owned and rented. For kitchens, 55% had extract ventilation, but with a gap between owner-occupied dwellings (64%) and rental houses (37%).

Whole-house ventilation systems were found in 23% of all houses - 28% of owner-occupied houses and 13% of rental homes:

- 18% of houses had a positive-pressure ventilation system (which takes air from outside or the roof space and ducts it into living spaces through ceiling vents).

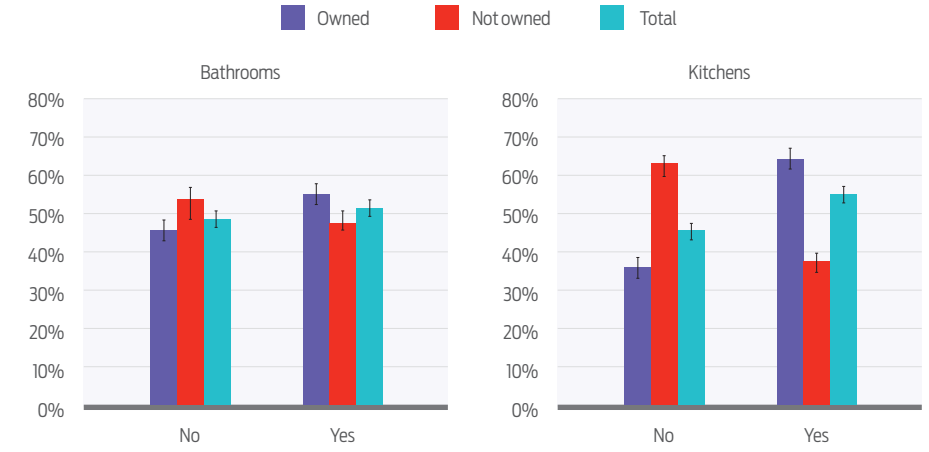

Figure 3 Presence of working and vented mechanical extract ventilation in bathroom and kitchens

- 5% had a balanced-pressure system (which includes both an intake fan supplying fresh air from the outside and an exhaust fan removing stale air and discharging it to the outside).

The healthy homes standards also have a required standard for ventilation in rental homes:

"Ventilation must include openable windows in the living room, dining room, kitchen and bedrooms. Also an appropriately sized extractor fan(s) in rooms with a bath or shower or indoor cooktop."

Space heating

The PHS recorded information on the presence of heating appliances in all rooms of the house separately, based on what the assessor could ascertain at the time of the survey. The timing of the survey could have implications for the results on portable devices, which may be less evident in warm weather.

Heat pumps and enclosed wood burners were the most common heating type in living areas, with 44% and 31% of houses surveyed having these heating appliances (Figure 4). Heat pumps were the most common heaters in living areas in both owned and rental homes.

Overall, 78% of houses had a fixed heater in the main living area (not counting open fires or unflued gas heaters). The proportion was higher for owned houses (83%) than rental homes (69%). Non-owner-occupied houses were more likely to have no heating in living areas (15%) compared to 6% in owner-occupied houses.

Over half of all houses (54%) had no heating in any bedrooms, and only 12% had heating in all bedrooms. Portable electric was the most common type (21%) then fixed electric (10%).

Counting heaters present anywhere in the house (but excluding bathrooms and laundry), just under half of houses surveyed (49%) had at least one heat pump (Figure 5). Heat pumps were more common in owner-occupied dwellings (54%), but they are increasing in prevalence in rental homes. In the 2015/16 BRANZ House Condition Survey (HCS), heat pumps were observed in 27% of rentals compared to 39% in the PHS.

One-third of houses (32%) had a wood burner.

Consistent with the previous BRANZ HCS, rentals were still more likely to have portable heating only compared to owner-occupied dwellings (17% versus 4%).

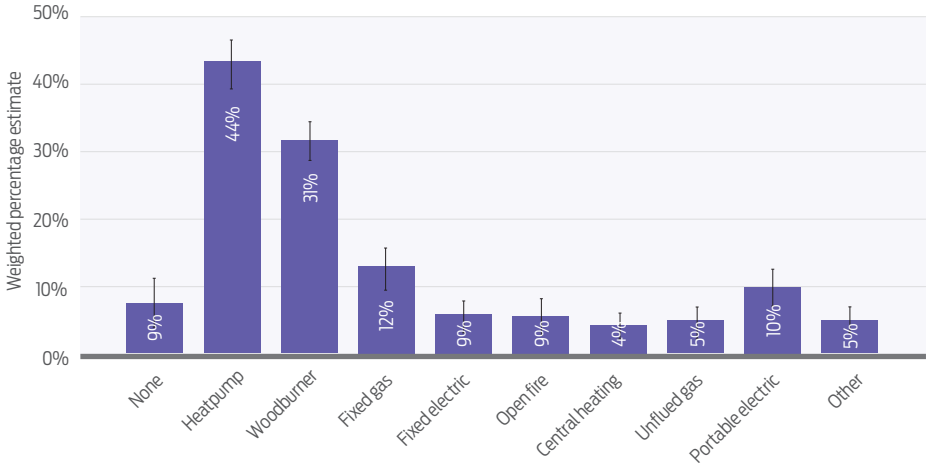

Figure 4 Heating appliances found in living areas

The healthy homes standards have a required standard for space heating:

"There must be fixed heating devices, capable of achieving a minimum temperature of at least 18°C in the living room only. Some heating devices are inefficient, unaffordable or unhealthy and will not meet the requirements under the heating standard."

The survey results also hint at a decrease in the presence of unflued gas heaters, which is a positive finding. These heaters release noxious gases and moisture into the home, are comparatively expensive to operate and are not recommended. In the 2015 BRANZ HCS, unflued gas heaters (fixed or portable) were recorded in 15% of houses surveyed. The PHS recorded them in only 5% of houses.

Water heating

As with space heating, hot water system type has implications for efficiency and running costs. Most New Zealand homes have an electric hot water cylinder. Older cylinders tend to be low pressure, whereas modern electric hot water cylinders tend to be high pressure/mains pressure.

The survey finds a difference in hot water system types in owned and rented dwellings. In the latter, low-pressure electric cylinders were the most common type of water heating, found in 58% of rentals (Figure 6). In owner-occupied dwellings, low-pressure and mains-pressure cylinders were seen in similar proportions (34% and 32%).

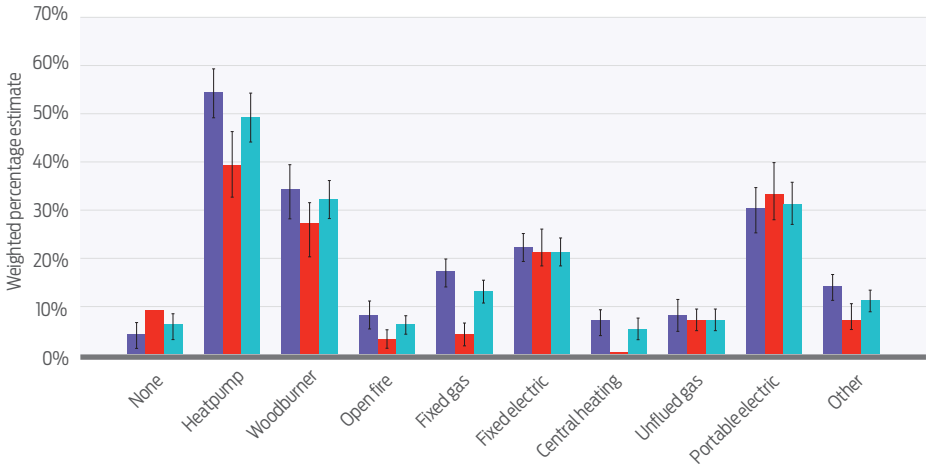

Figure 5 Heating types in all houses

While instant gas water heating was less common than electric cylinders, the survey results suggest an increase since the previous BRANZ HCS, from 11% in 2015/16 to 21%. This appears mainly driven by uptake in the owner-occupied stock.

The temperature of hot water at the tap should be in a safe range to avoid scalding, but where a cylinder is present, water must be stored at a sufficient temperature (reaching 60°C daily) to prevent Legionella bacteria growth.

Under the Building Code, the maximum water temperature at the tap for showers, baths and hand basins is 55°C. The PHS recorded the temperature at the hot water tap in all bathrooms. The results suggest around one-third of houses surveyed (33%) had hot water exceeding 55°C in a bathroom. Hot water tap temperatures exceeding this threshold were more commonly observed in rental houses.

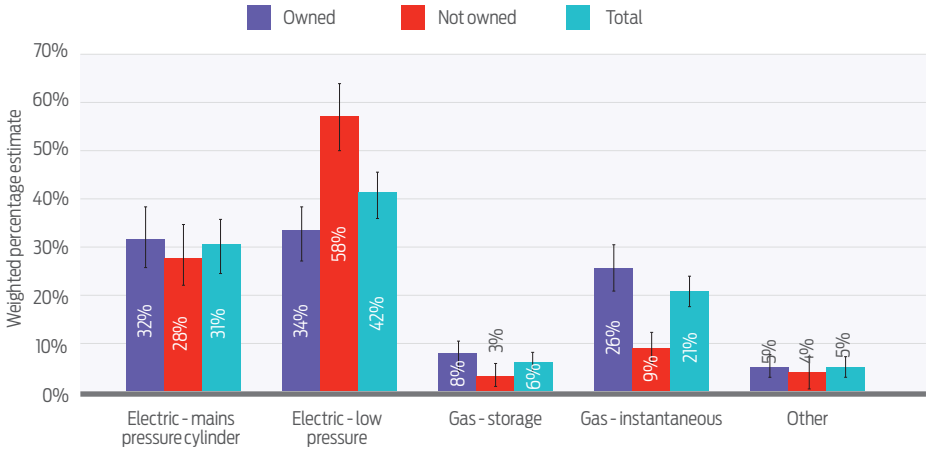

Figure 6 Water heating types in all houses

Smoke alarms

The Building Code requires smoke alarms in all new homes and in all existing homes undergoing building work. The Residential Tenancies (Smoke Alarms and Insulation) Regulations 2016 requires smoke alarms in all rental homes. The requirements are that:

- on floors with bedrooms, the smoke alarms must be located either in every sleeping space or within 3.0 m of every sleeping space door
- in multi-storey homes, there must be at least one smoke alarm on each level.

The PHS assessed the presence of smoke alarms against these criteria.

In around three-quarters of houses (72%), all smoke alarms were working at the time of the survey, with no difference between owned and rental dwellings. However, in around one-quarter of houses (25%), the alarms were not within 3 m of all bedrooms.

One in 10 houses surveyed had no smoke alarms at all, and in a further 7%, none were working at the time of the survey. Combined, these figures suggest 17% of dwellings had no working smoke alarms at the time of the survey.

Looking at rental homes, where working smoke alarms are a legal requirement, 9% had no smoke alarms at all, 19% did not have alarms within 3 m of all bedrooms, 6% had none in working order and 5% had some in working order.

Opportunities for improvement

The survey has thrown a spotlight on areas that clearly need improvement. For example:

- 49% of houses need more ceiling insulation
- 49% of houses need mechanical extract ventilation ducted to the outside in their bathroom(s)
- 44% of houses need mechanical extract ventilation ducted to the outside in their kitchen
- 22% of houses have no fixed heating in the living area.

Full details are available in the BRANZ study report.

More information

Pilot Housing Survey #1 *Survey Methodology*
Pilot Housing Survey #2 *House condition*

BRANZ study reports
These can be downloaded from www.branz.co.nz
SR456 *Assessing the condition of New Zealand housing: Survey methods and findings* (2020)
SR370 *BRANZ 2015 House Condition Survey: Comparison of house condition by tenure* (2017)
SR372 *Warm, dry, healthy? Insights from the 2015 House Condition Survey* (2017)

BRANZ websites
www.branz.co.nz/healthy-homes-research/hcs/
www.level.org.nz
www.renovate.org.nz

Stats NZ website
www.stats.govt.nz/integrated-data/apply-to-use-microdata-for-research/
www.stats.govt.nz/reports/housing-in-aotearoa-2020

Healthy homes standards
www.hud.govt.nz/residential-housing/healthy-rental-homes/healthy-homes-standards/