Case study

Warmth and energy savings in Papakowhai

Full insulation and an efficient heat source led to substantial reticulated energy savings and indoor temperature improvements.

Beacon's Papakowhai Renovation project in Porirua tested various combinations of energy, water and indoor environment retrofits on nine ordinary 1970s homes. The houses were monitored before and after the renovations to determine how well each house performed. Results showed that a fully insulated home boasting an efficient heat source made substantial reticulated energy savings and indoor temperature improvements.

Renovating House 3

House 3 is one of the Papakowhai success stories. Built in the 1970s, it is typical of the split level homes in the hilly suburb, oriented to the view rather than the sun. Additionally, insulation was not required in homes of this era, and the split levels and variety of building materials and systems – from skillion to cavity roofs, and suspended to uninsulated concrete floors – produced homes considered difficult to energy retrofit.

To improve its performance, House 3 underwent a major renovation:

- Double glazing was installed
- Insulation was fitted in the walls (R2.4 batts) and under the floor (R2 foil backed batts and polythene vapour barrier)
- The skillion ceiling was lowered and insulated with R3.6 batts, and the remaining ceiling insulation was re-laid and overtopped with R2.6 blanket
- A variety of heaters were replaced by an NES-compliant wood burner and a ducted heat pump system; a solar hot water system and a newly wrapped 300 litre cylinder were installed
- Flow restrictors on the shower heads and dual-flush toilets reduced water use
- A kitchen rangehood replaced a broken extraction fan.

The results

This family of five reduced their winter power bills by 33%. They saved 62% on space heating costs, despite increasing their heating to bring their house to comfortable and healthy temperatures. The impact of the extra heating was absorbed by the improvement in thermal performance of the dwelling and increased efficiency of heat source.

House 3 Winter Energy Use (May – Sept)			
Period	**Space Heating (kWh)**	**Reticulated Hot Water (kWh)**	**Total Reticulated Energy (kWh)**
Pre-Retrofit	2,120	2,130	7,550
Post-Retrofit	810	970	5,070

The solar water heater provided 55% of the family's hot water – in winter! In summer it would be close to 100%. Again, this is despite the family enjoying longer showers and using 21% more hot water in winter. The water-efficient shower heads also helped to offset greater costs for the family.

Inside the house, the family enjoyed much warmer, healthier living. The average winter temperatures in the family room rose by 1.7°C and in the bedroom by 3.8°C. Even better, the bedroom rarely dipped below 16°C overnight and the family room rarely below 18°C in the evenings. These are the minimum temperatures recommended by the World Health Organisation for healthy living.

Benefits for the family

As for the family, the changes exceeded all their expectations. They appreciated the new warmth of the house, especially being able to use the whole house rather than huddling round the fire. Problems with condensation and mould were eliminated and they noticed improved family health with fewer colds and flu since the renovations. What's more, an asthmatic child needed to use an inhaler less frequently. With their water costing less to heat, they no longer worried about the hot water running out. And an added bonus of the double glazing was reduced noise from both inside and outside the house.

Key findings of the Papakowhai Renovation project:

- It's important to insulate the full thermal envelope, including the walls.
- Efficient heating must accompany a thermal retrofit.
- Hot water cylinder wraps are a great energy efficiency measure and should be widely applied.
- Solar hot water systems can perform well, even in winter.
- Water-efficient showerheads should accompany hot water conversions.

For more information:

- Beacon website www.beaconpathway.co.nz/existing-homes/article/what_is_the_papakowhai_renovation_project