



# Rotorua NOW Home: A collaborative project

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Leader



Creating homes and neighbourhoods that work  
well into the future and don't cost the Earth

# Outline of Presentation

1. Rotorua NOW Home – research questions
2. Waitakere NOW Home vs Rotorua NOW Home – design & construction
3. Key results from monitoring
4. So what does this tell us?

# Rotorua NOW Home – Research Questions

- Can we take what we have learned from the Waitakere NOW Home design & construction, and translate that so that a third party (HNZC) can achieve similar outcomes in a different climate?
- Have we got it right? Are the key features of the Waitakere NOW Home workable in other circumstances?







# Rotorua vs Waitakere – Design & Construction Process

Waitakere NOW Home	Rotorua NOW Home
Climate Zone 1	Climate Zone 2
Designed to meet Beacon requirements	Designed to meet HNZC requirements with NOW Home overlay
Beacon team had control over design	APR independent architect designed, with input from Beacon & HNZC
On-site Beacon project manager	APR project managed
Built by GJ Gardner using a modified GJ Gardner specification	Built by independent builder using APR generated specification



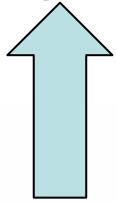
# Similarities Between the Homes

Aspect	Common Attribute
Size	Modest size (141-146m <sup>2</sup> ), 3 bdrm house, with single garage
Floor Plan	North oriented living spaces with optimum eave widths for passive solar gain
Thermal Mass	North facing insulated concrete slab
Hot Water System	Solar hot water system –sub optimal panel orientation
Water System	Low flow taps and fittings
Rainwater reuse	Rainwater supplying laundry and toilet
Waste	Strong focus on reduced construction waste and diversion from landfill with relatively good success
Lighting	Energy efficient bulbs used
Paints, adhesives & finishes	Environmental Choice certified products used wherever available
Lifetime Design	Accessibility design principles used
Landscape treatment	Vegetable garden, composting and outdoor clothes drying

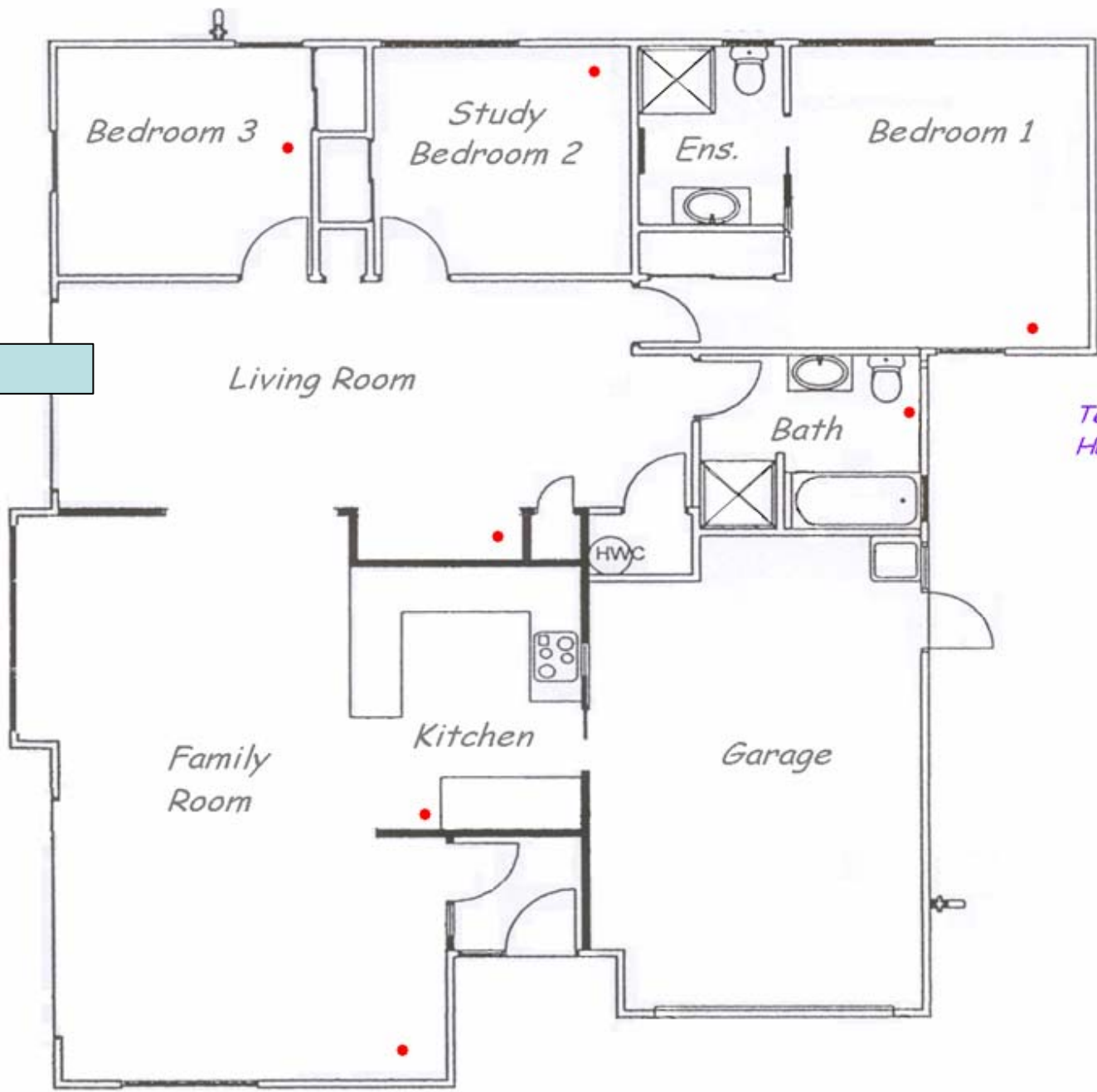
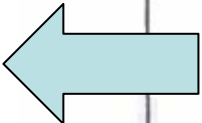
# Differences Between the Homes

Aspect	Waitakere NOW Home	Rotorua NOW Home
House form	Simple form with pitched roof & conventional guttering system.	More complex design, butterfly roof & internal gutter
House Materials	Wooden weatherboard cladding, concrete tiled roof	Shadowclad ply & Colorsteel cladding, Colorsteel roof
Floor Plan	Bedrooms on eastern side	Bedrooms on western side
	1 bathroom – disabled access, laundry in garage	2 bathrooms – one disabled access, separate toilet, separate laundry
	No corridors – bedrooms located off second living area	Bedrooms separate from living areas down corridor which faced onto deck
	Draught lobby included at entrance.	Main entry into living area
Ventilation	Openable windows & rangehood, mechanical bathroom ventilation & passive kitchen ventilation system added later	Mechanical ventilation in kitchen and bathrooms, passive vents in living areas
Heating	No fixed heating system provided	10 kW pellet burner in family room
Costs	\$220,000 + GST	Budget \$180,000 + GST

North



North



Temperature Humidity Sensors



# Differences Between the Homes

Aspect	Waitakere NOW Home	Rotorua NOW Home
Rainwater Tank	Above ground tank - 13,500 litres with manual change-over to/from town supply. Rainwater also supplying hot water system	Below ground rainwater tank, 4000 litres with automated controller to manage switch between town & tank supply
Whiteware	Energy and water efficient whiteware supplied as part of tenancy	Tenants supplied own whiteware - older
Lighting	Suspended lighting system, CFLs throughout	Combination suspended CFLs and halogen downlights,
Tenants	4 person moderate income family	5 person low income family
Monitoring	Intensive monitoring system with every circuit and tap monitored	Cut down monitoring system
Insulation	High insulation levels specified and used throughout	High insulation levels specified -however, lower spec insulation installed
Thermal Mass	Thermal mass contributed significantly to keeping the home warm	Thermal mass covered by carpet and unable to contribute to retaining warmth in the home

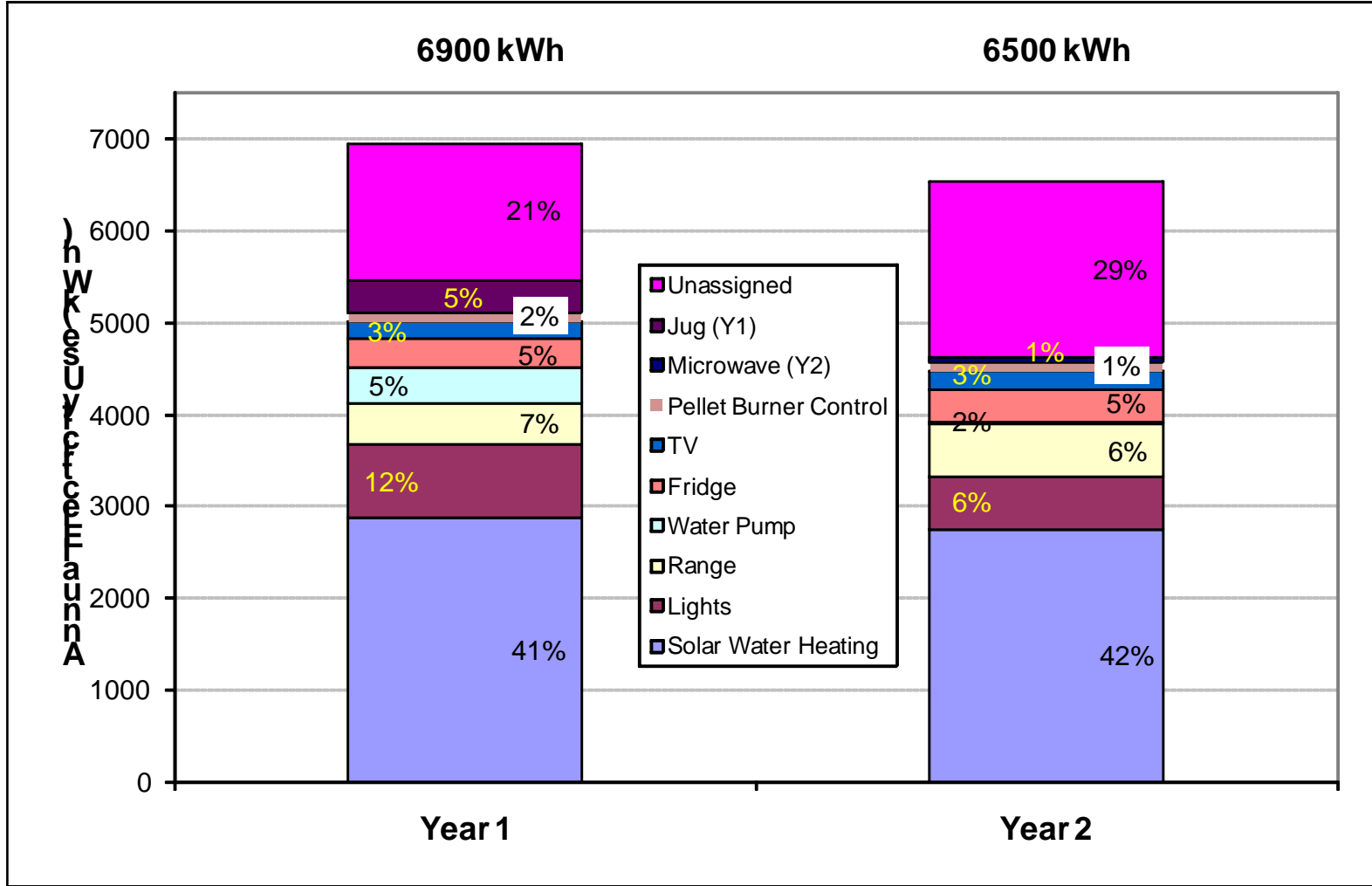




# Monitoring Results - Energy

- Used 6900 kWh in Year 1 and 6500 kWh in Year 2
- Lower than Waitakere NOW Home and met HSS<sup>®</sup>-2008 benchmark – despite being a 5 person household
- Solar water heater was the largest electricity end use – 41% of electricity, and was generally a poor performer with a COP of 1
- Lighting was a high user in Year 1 but dropped back in Year 2
- Water pump was a relatively high user – 5%

# Electricity End Uses



# Monitoring Results - Water

- Rainwater system performed very well in Year 1 – 57 litres/pp/day average use – lower than Waitakere NOW Home & HSS<sup>®</sup>-2008 benchmark
- In Year 2 the Rainbank failed and all water was provided from town supply with average 200 litres/pp/day
- Occupancy dissatisfaction with flow rates of showers – low low flow

# Monitoring Results - IEQ

- Average evening living room temperature of 17.5°C, slightly below the 18°C HSS<sup>®</sup>-2008 benchmark
- Overnight bedroom temperatures were still poor - average winter temperature in the master bedroom was 12.9°C, considerably cooler than the 16°C recommended in Beacon's HSS<sup>®</sup>.
- RH levels were good in the living areas - evening winter humidity levels averaged 58% RH
- RH levels in bedrooms were higher- master bedroom overnight average of 69% RH & bedroom 3 overnight average of 72% RH

# Performance of thermal envelope

- Heating required every day over winter – and pellet burner even used a couple of days in December
- Didn't perform as well thermally as anticipated because of a combination of design, user behaviour and construction error

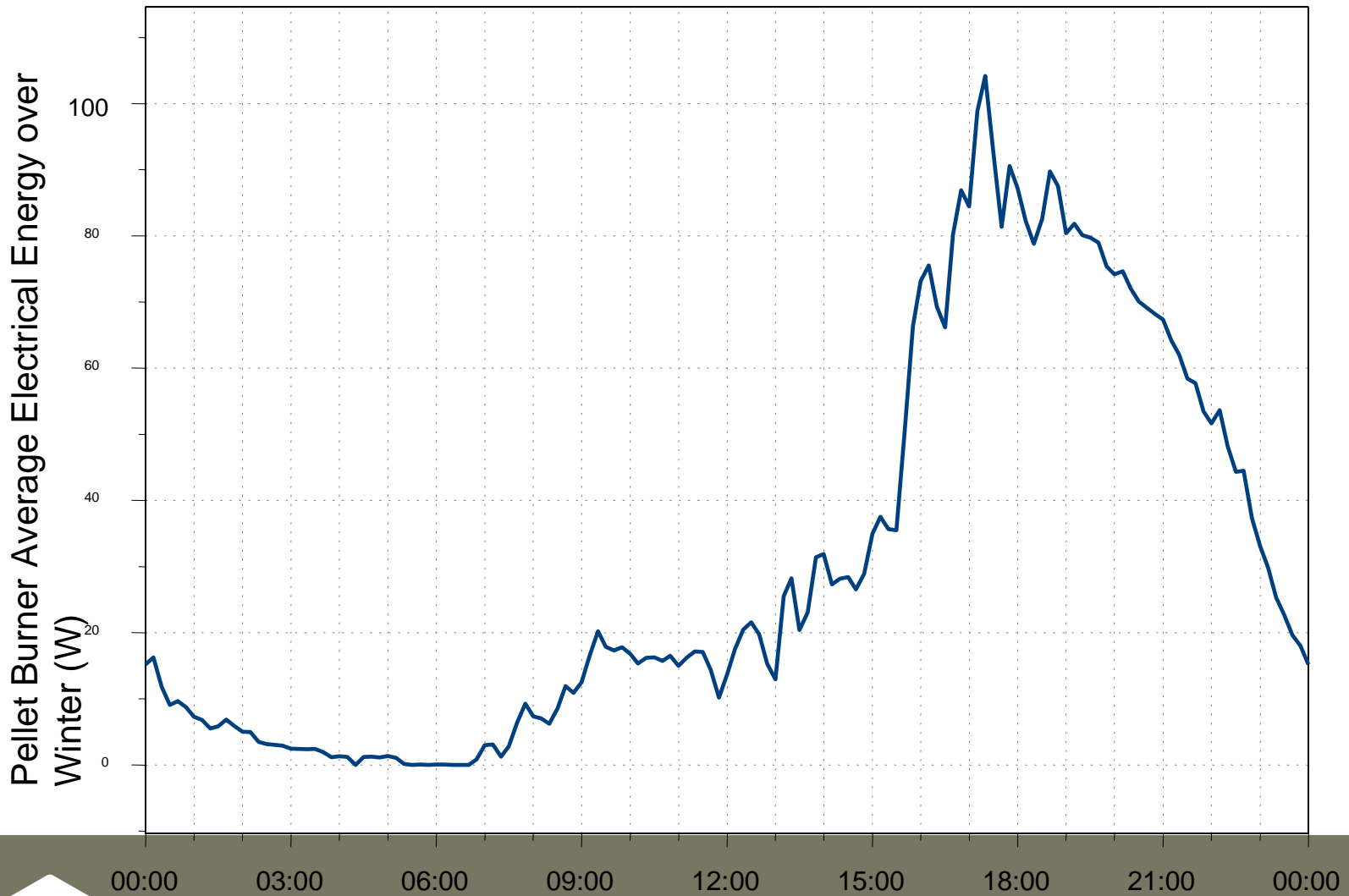
In particular

- Below spec ceiling insulation installed
- HERS rating of 5.5 stars vs 6 for Waitakere NOW Home
- Concrete thermal mass covered by rugs

# Performance of the heating system

- Pellet burner seen as a good way to manage heating costs for fixed low income household
- Was mainly used in afternoon and evening – little morning and overnight use
- Size of pellet burner (10 kW) meant that whole house should have been able to be heated to healthy temperatures. However, distance to the bedrooms and lack of heat transfer meant that bedrooms were effectively unheated.
- Under-heating may also be a factor – cost, user expectations

# Pellet Burner Use



# Dampness and Condensation

- Dampness and condensation weren't problems in the home – and cold temperatures were the cause of the elevated relative humidity in the bedrooms
- Cedar louvres assisted in lowering relative humidity levels in living areas
- Mechanical extract ventilation eliminated any moisture from wet areas



# Performance of the Water System

- Total per person water use was relatively high (200 litres/pp/day *cf* 189 pp/day in Waitakere)
- Rotorua year-round rainfall meant a smaller tank (4000 litres) was able to supply most (72%) of household needs. This compares with 60% of water use provided by a 13,500 litre tank at Waitakere
- When working, the controller was effective at optimising water sources – but had quite a high power demand (5% total electricity)
- Insufficient flow rate meant occupants had a poor level of service



# So what does this tell us?

- Some of the outcomes were better and some were worse than the Waitakere NOW Home
- The biggest issues seem to have arisen as a result of the more complex design, insufficient regard for the colder climate, and occupancy behaviour
- Additional design criteria and specifications are required to ensure these issues don't occur in future homes. These include, for example:
  - Alternative methods to achieve thermal mass
  - Better specification around heating and the need for heat transfer

# What next for New Homes?

- Design criteria and specifications developed for future Home*Smart* Homes, taking into account learnings from both NOW Homes
- Support information – Homeowner Manual, Best Practice Guide also developed
- Information will be published on the Beacon website as well as plans and specifications for the Waitakere NOW Home
- Aim to gain DBH building consent for “national multiple-use” of Waitakere NOW Home design so design can be easily used around NZ

# Project Partners and Suppliers

  
**Housing** New Zealand  
Housing New Zealand Corporation



  
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