



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

Why Indoor Environment Quality matters

Beacon Symposium 2008

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Why are we interested in IEQ?

Health

- Wellington School of Medicine study – less sick days
- Excess winter mortality
- WHO has suggested temperature and humidity's that New Zealand is not meeting

Comfort

- Social aspects

Durability of the building

- Mould and fungi growth

Understand space conditioning energy use

HSS™ for IEQ

Targets

- Average indoor environment temperatures meet WHO minimum standards
- Adequate ventilation without excessive draughts

Temperature benchmarks

- Living room: mean minimum 18⁰c
- Bedroom: mean minimum 16⁰c

Ventilation benchmarks

- New homes: 0.4 – 0.6 air changes/hour
- Existing homes: 0.5 – 0.75 air changes/hour

Humidity benchmarks

- Mean relative humidity: 20-70% in bedrooms and living space

Checklist

- | | |
|---|---|
| <ul style="list-style-type: none"> • Mechanical extract ventilation of kitchen, bathroom and laundry • No unflued gas heaters | <ul style="list-style-type: none"> • Windows with passive venting • Environmental Choice certified paints and finishes • No air conditioning |
|---|---|

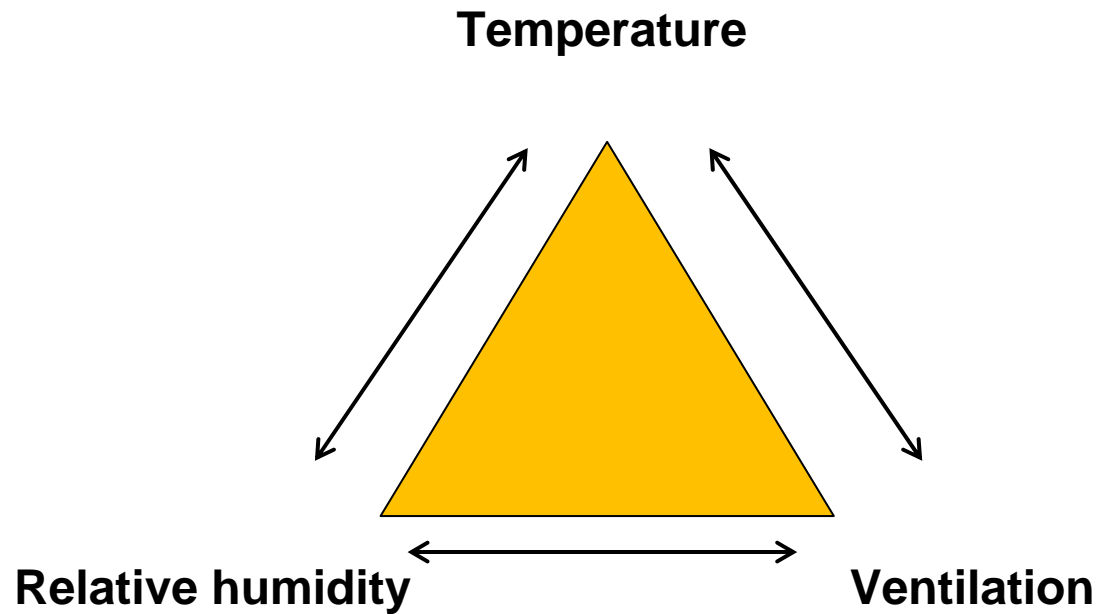
Indoor moisture problems



How we will improve IEQ

- Understand interaction between temperature, ventilation and humidity
- Manage temperature (Energy Stream)
 - Warmer in winter, cooler in summer (?)
- Dry the house out and keep it dry
 - Source control of moisture
- Manage ventilation
- Control pollutants at source

IEQ interactions

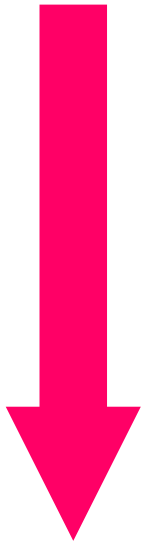


What we know – lack of heating

- Only 5% of homes have central heating
- Most common room and time
 - 91% of living room are heated in the evenings (weekdays)
- 11% of living rooms are heated constantly
- 6% of living rooms are unheated
- 50% of bedrooms are unheated

Heater type is important

Coolest



Fuel	Main heater type	Temp (°C) <small>± 1 SD</small>	Sample
Solid	Open fire	16.0 ± 0.5	12
Electric	Portable Electric	16.9 ± 0.3	83
LPG	Portable LPG	17.1 ± 0.2	54
Electric	Fixed electric	17.8 ± 0.3	19
Oil	Oil fired central	17.9 ± 0.2	2
Gas	Gas	18.0 ± 0.5	26
Electric	Heat pump	18.0 ± 0.4	4
Gas	Central gas	18.3 ± 0.7	7
Solid	Enclosed solid fuel	18.9 ± 0.2	138

Warmest

June, July & August – 5pm to 11pm

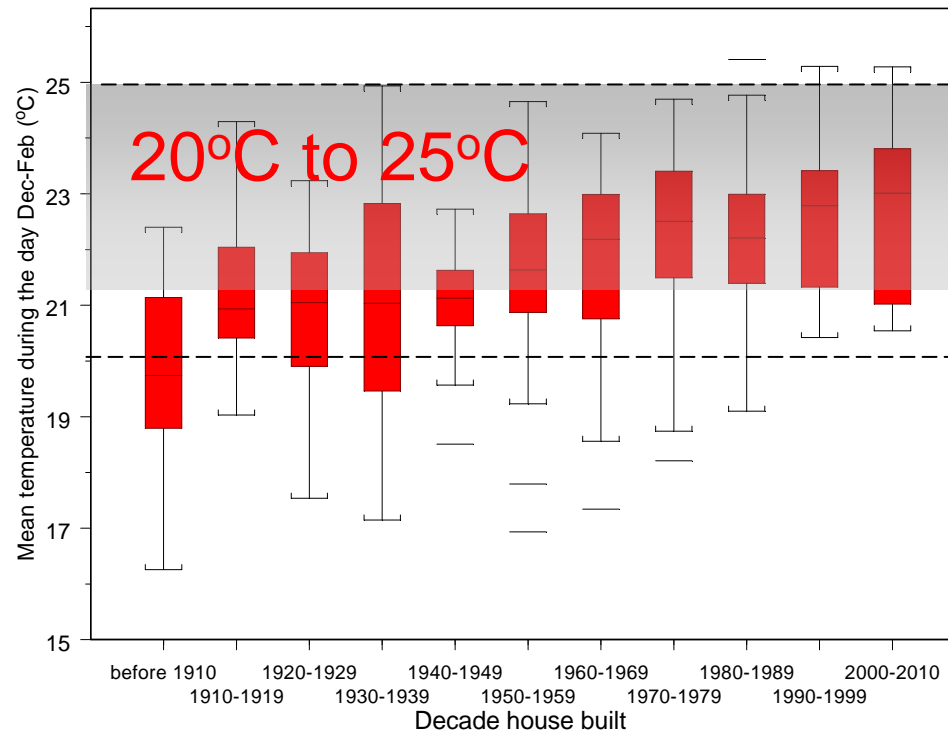
Pre and post 1978 houses

Insulation	Overnight Bedroom	Evening Living Room	Heating Energy (net) (kWh/year)
No requirement (Pre-1978)	13.2°C ± 0.1	17.6°C ± 0.1	3,180
Mandatory (Post-1978)	14.5°C ± 0.2	18.6°C ± 0.2	2,410

- Post 1978 houses have larger floor areas and warmer temperatures₉

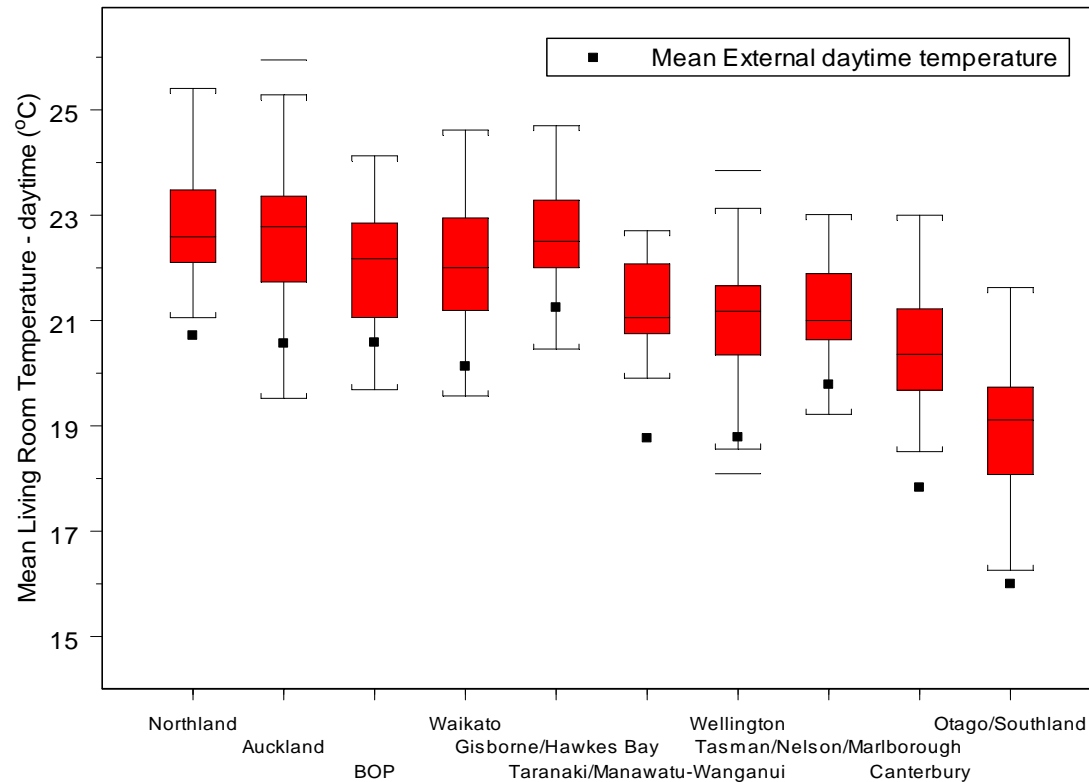
House age - summer

Mean temperatures by house age



- **Newer houses are warmer in summer**
- **0.25°C increase per decade of construction (Linear models)**
- **Climate and age explain 69% of the variance in temperature**

Climate - summer



A 2-3°C external temperature rise will make many houses uncomfortable

December, January & February – 9am to 5pm

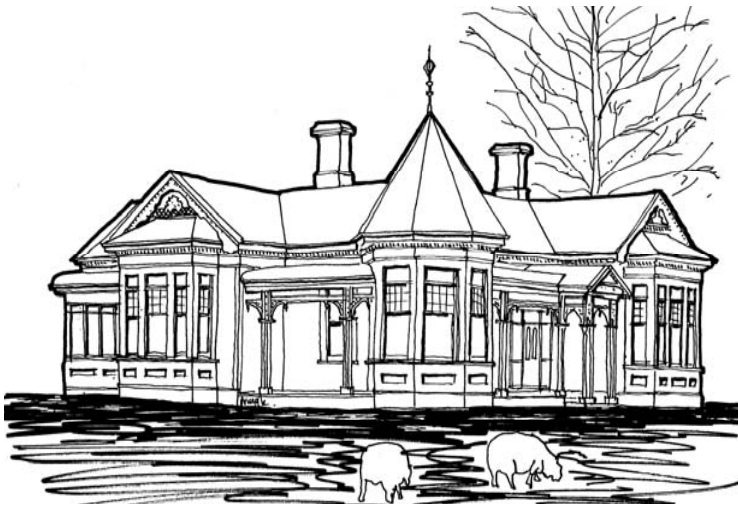
Moisture control strategies

- Eliminate some moisture sources
 - Avoid un-flued gas combustion
 - Minimise indoor clothes drying
 - Minimise ground sourced moisture
- Control moisture at source
 - Bathroom extraction fans
 - Venting dryer outside
 - Kitchen range hood
 - Damp proof membrane under timber floors
- General ventilation and heating
 - Adequate passive or active ventilation
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Importance of ventilation

- Remove moist air
 - Lower humidity
 - Easier to heat, healthier and less mould etc
- Reduce overheating in warmer weather
- Dilute pollutants (source control is still the first step)
- Remove smells
- Provide fresh air (oxygen)

Infiltration and ventilation



Post 1960 typically larger than 120 m² with airtight joinery

Post 1960 simple rectangular designs with airtight joinery

0.9 ac/h

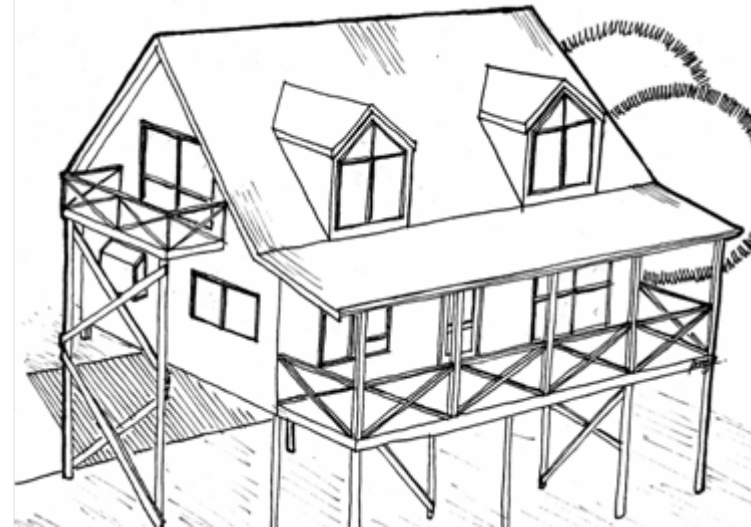
0.7 ac/h

0.5 ac/h

0.3 ac/h

Pre 1960 high stud strip lined

Post 1960 complex shape some internal strip lining



Work in IEQ for Beacon



- 1. Confirming IEQ HSS™ Benchmarks**
- 2. Work with NOW 100 and Renovate 1000 to ensure the houses can reach the HSS™ benchmarks**

Source control, ventilation, information on pollutants

- 3. Active ventilation – increase knowledge of systems**

Monitor forced air systems, heat recovery systems?,
optimise systems

- 4. Value case work**

Why should current practice change to improve IEQ?