

Reducing fuel poverty by improving housing

Evaluating the co-benefits of low-income
weatherisation programmes

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www.sustainablecities.org.nz



Outline of talk

- Importance of reducing inequalities
- Market-solutions inadequate
- Structural problems of cold, damp houses
- Establishing causation of interventions
- Insulating houses has multiple benefits
- Installing sustainable heating gives multiple gains
- Multiple outcomes important for population health interventions
- Research-based public policy

Inequalities & the population approach

- Social gradient in the underlying structural determinants of disease, e.g. housing
- Social gradient in determinants leads to social gradient in health
- Underpinned by Rose (1985)

A large number of people at a small risk may give rise to more cases of disease than the small number who are at high risk

Approach to reducing inequalities

- Structural inequalities shape health
- Housing a practical approach
- Framing of solution-focused research
- Process as important as outcomes
- Involved communities and policy people from beginning
- Researchers can facilitate translation to policy

Market-solutions inadequate

New Zealand's electricity market
is one of the least regulated
electricity markets in the OECD

Real electricity prices March years 1974-2007

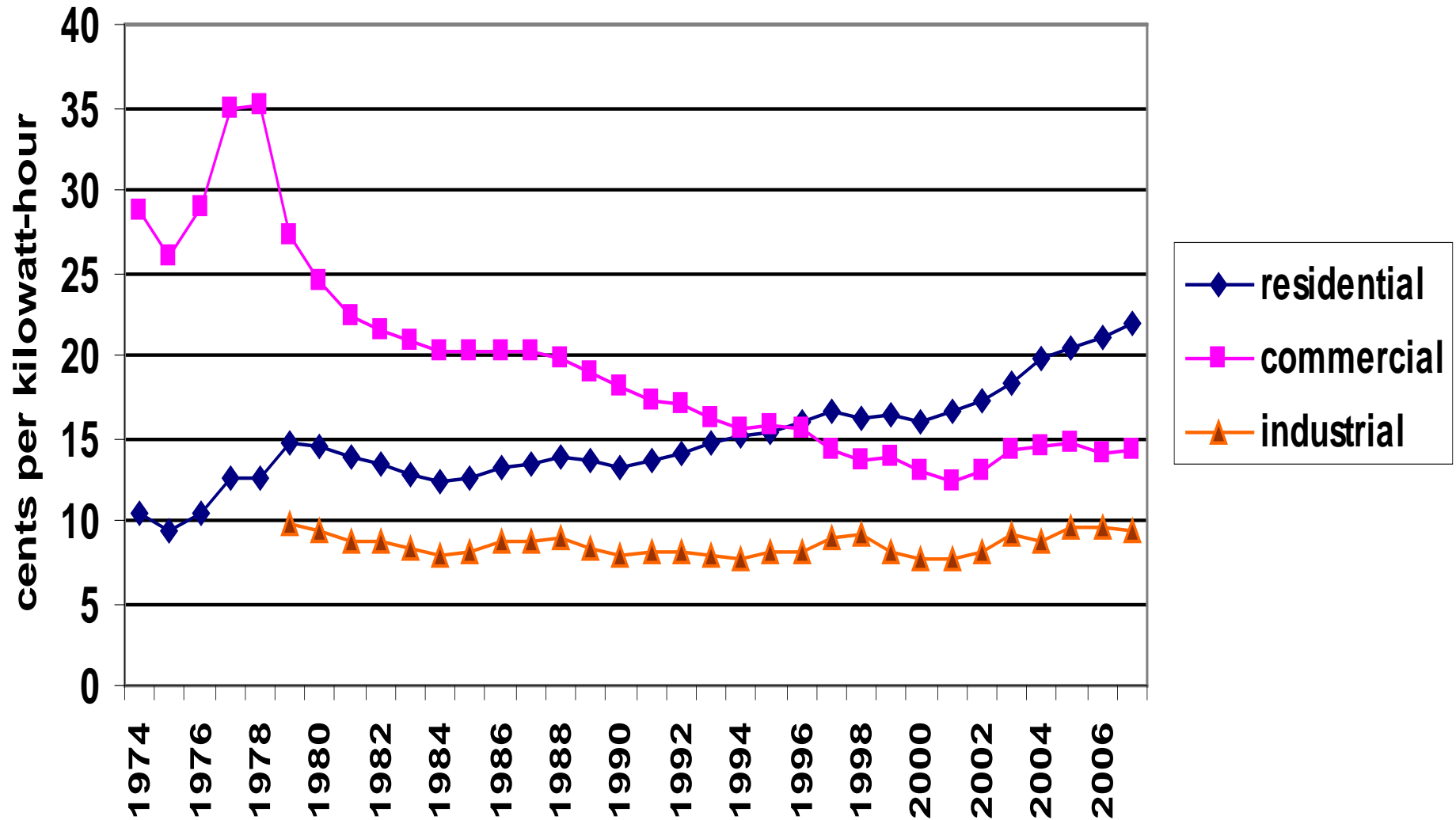
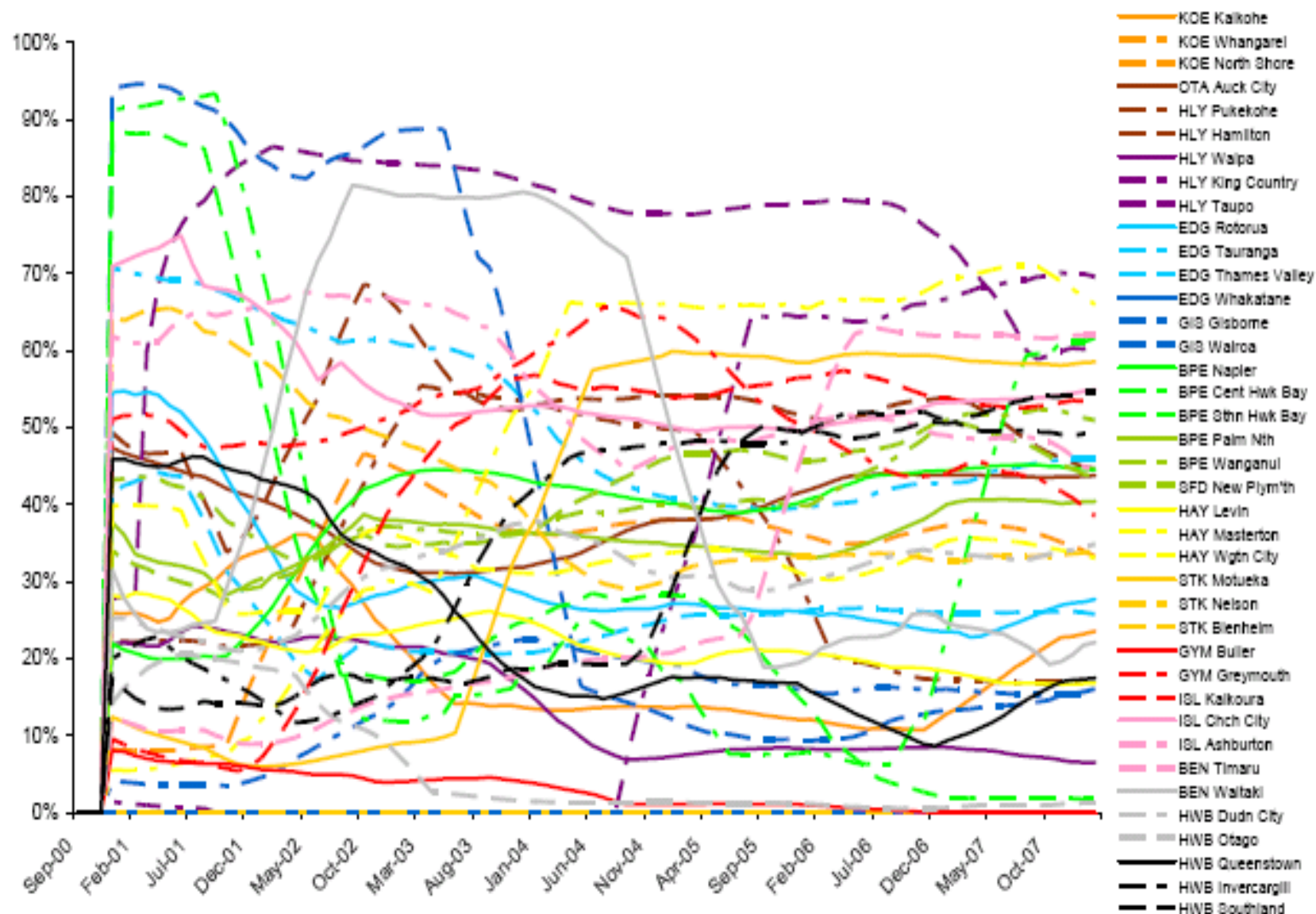


Figure 22: Change in incumbent retailer market TOU share in each network



**Old New Zealand houses have an
average 90 year lifetime**



Cold

- NZ houses are mostly old, cold and damp
- 90% of time indoors, 75% in homes
- Average winter temperature is 16°C (WHO recommends 18 – 21°C)



Kiwis pay for their cold comfort

By REBECCA TODD

PEOPLE ARE turning off heaters and jumping into bed to escape rising power bills after the coldest June in more than 30 years.

The average national temperature last month was a nippy 7.3°C, the lowest since 1972.

As the chill set in, Kiwis cranked up their heating and snuggled up indoors. Power usage was pushed to record highs – and power bills are now following suit.

Elaine and Fred Baker of Rotorua were forced to turn off their heater and stay in bed after receiving a bill for \$147 when they usually pay about \$80 to \$90.

"We can't afford to have another power bill like that," Elaine said.

Millie Mitchell, 78, of Dunedin has been turning off her heating and going out during the day after receiving her biggest power bill ever of \$240 for last month.

A brisk walk, trip to the gym or lunch in the warmth of the senior citizens' club is her tip for beating the chills and the bills.

Age Concern chief executive Ann Martin said: "We don't recommend staying in bed to save money. Activity is the key to keeping warm and healthy throughout winter."

Although Christchurch was the coldest main centre last month, Cantabrians Steve and Diane Garside say they're reaping the benefits of their decision last winter to convert to coal because of rising power bills. They have three children and estimate that if they had stayed with electric heating their June power bill would have been \$330, instead of \$180.

Temperatures in Omarama, North Otago, plummeted to a glacial all time low of -14°C last month. Locals Sue and Jim Harkin used a log burner with a wetback to combat the cold but even so were surprised to find their power bill jumped \$40.

Even people in milder climates like Tauranga felt the pinch. Dawn Barber is in her seventies and lives alone in Bureta. Her June power bill was up \$36 from the usual \$100.

"It was quite a jump. It's probably the heaviest one I've ever had."

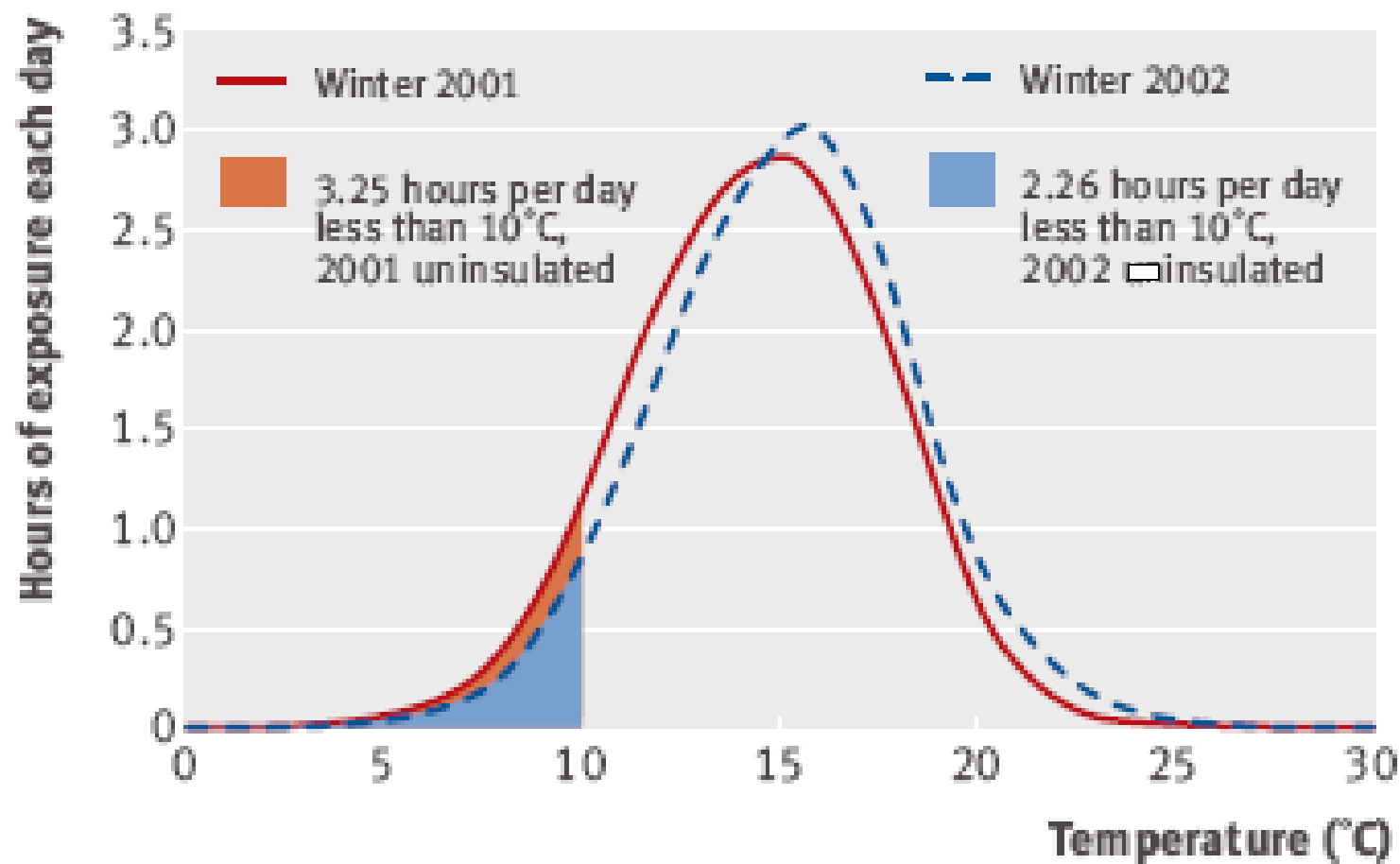
The warmest place to be in June was Kaitiaki – where they had a relatively balmy average temperature of 11.3°C.

As the cold snap continues, July's bills could follow a similar pattern, but National Climate Centre principal scientist Dr Jim Salinger said the country should be thawing by the end of the month.

"We are expecting a cool July, frostier than usual, but a warm start to spring with average to above average temperatures for August and September."

The World Health Organisation recommends living areas are heated to 20°C. Less than 16°C puts people at higher risk of respiratory problems and under 12°C increases the danger of a heart attack or stroke.

■ For information on how to keep your home warm and dry go to <http://www.eeca.govt.nz>.



Excess winter mortality

- 1600 excess winter deaths in NZ each year from respiratory and circulatory problems (16%) vs 900 deaths from air pollution
400 direct road toll
- EWM unchanged for last 20 years in NZ
- Census-mortality linkage study,
higher EWM among low-income people,
living in rented accommodation
& urban areas.

Excess winter hospitalisation (EWH)

A 2000-2006 study of EWH + housing factors found small significant effects:

- EWH was higher in villas and pre-war bungalows than in post-war bungalows, and lower in “quality” bungalows;
- EWH was higher in urban areas than in rural areas; and
- EWH increased with increasing SE deprivation

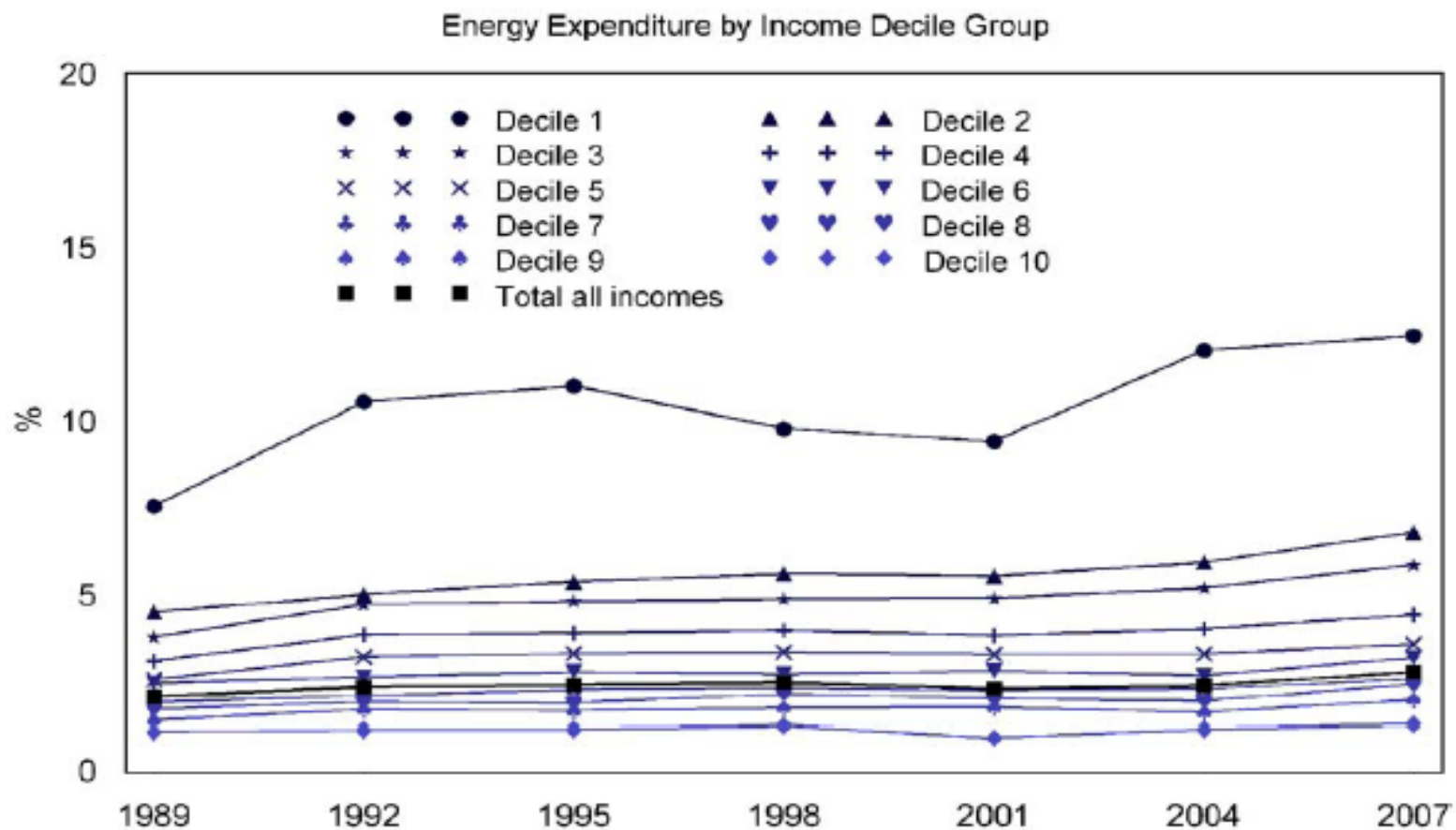
The poorer the condition of a dwelling (on a 3 point scale), the higher the proportion of rentals in the area.

For more information contact: lucy.telfar-barnard@otago.ac.nz

Fuel poverty in NZ

- Reluctant use of Boardman definition
- Social gradient in energy expenditure
- 2001 10-14% of households
- 2006 23% of households in fuel poverty
- Light regulation
 - Govt requires low user tariff (1/3 regular fixed daily charges) for those under 8000kWh/a annum or 9000kWh/annum in south of the South Island
- High disconnection (2%) & self-disconnection
- Pre-payment offered as a budgeting tool





Source: Statistics New Zealand

After figure 34, "Market Design Review - Options Paper" Electricity Commission

Fig. 4. Energy expenditure by income decile group.

Howden-Chapman P, Viggers H, Chapman R, O'Dea D, Free S, O'Sullivan K. Warm homes: drivers of the demand for heating in the residential sector in New Zealand. *Energy Policy* 2009;37(9):3387-3399.

Does insulation make a difference to health?

- Survey
 - Self-report, bias
 - Cross-sectional can't show cause and effect
- Community trial
 - Gold standard design (Wanless, NICE)
 - Can show cause (“something that makes a difference” Susser) and effect
 - Independent measures
 - Staggered interventions possible & preferable
 - Can generalise from the results

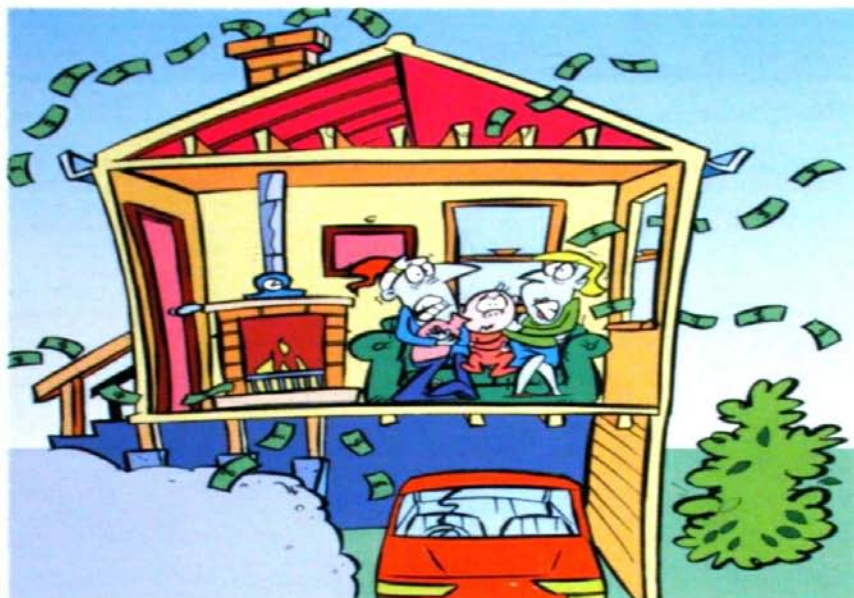
Where does the heat go?

12%

through
unblocked
chimneys and
draughts
around doors
and windows

10%

through
the floor



42%

through the
ceiling

12%

through
windows

24%

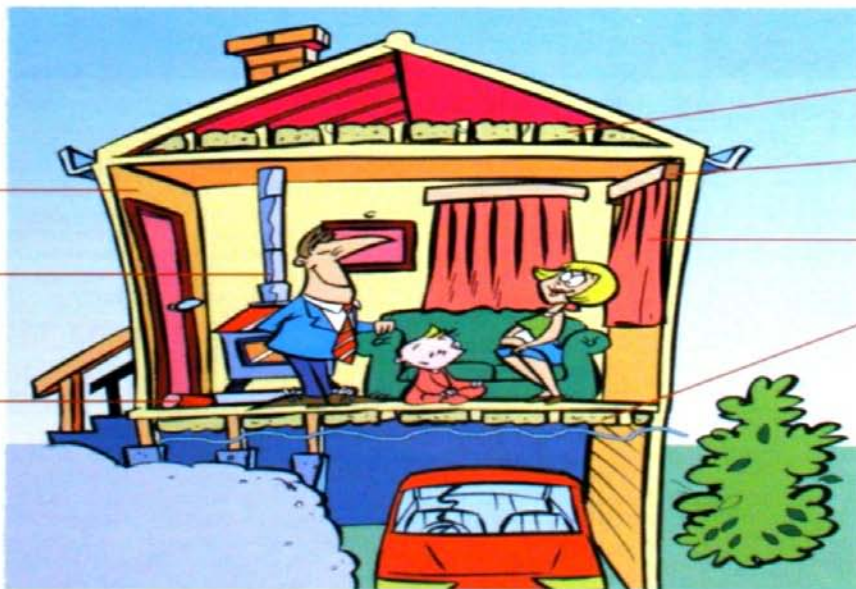
through
walls

Winter heat savers

Wall
insulation

Enclosed
energy-
efficient
burner

Draught-
stopper



Ceiling
insulation

Pelmet

Well-fitting
curtains

Underfloor
insulation

Insulation also
keeps the
house cool in
summer

Housing, Insulation and Health Study

- 1400 households where one member had chronic respiratory symptoms
- Occupants of insulated houses exposed to significantly warmer and less damp houses
- Key energy result: Occupants in insulated houses used 23% less energy

Howden-Chapman, P., J. Crane, et al. Retrofitting houses with insulation to reduce health inequalities: aims and methods of a clustered, randomised trial in community settings." *Social Science and Medicine*, 2005, 61: 2600-2610.

Howden-Chapman P et al. Retrofitting houses with insulation to reduce health inequalities: results of a clustered, randomised trial in a community setting. *British Medical Journal* 2007;334:460-464.



Insulation study results

- Significant improvement in self-reported housing conditions (less cold and dampness)
- Significantly fewer days off school and work
- Significantly fewer symptoms of wheeze and colds
- Fewer hospital admissions
- Positive benefit to cost ratio almost 2:1



House call: Energy Doctor Lloyd McGinty checks the insulation in the roof of John Herps and Colleen Niwa's home in Titahi Bay. He says there are simple steps householders can take to reduce their winter misery.

Picture: PHIL REID

Simple steps toward a warmer, healthier home

The shivering season is here but help is at hand. **Paul Easton** reports.

LLOYD MCGINTY is scrambling around in the roof space of the Titahi Bay home of John Herps and Colleen Niwa.

But it's okay, he's been invited.

He is the Energy Doctor, and he is performing an energy audit, seeking ways to make the house more energy-efficient.

It's part of the Warm Homes Porirua project, run through the Energy Efficiency and Conservation Authority's EnergyWise home grants programme and managed by Sustainability Trust, a Wellington-based charitable trust.

Homes qualifying for the project are given an "insulation retrofit" for \$300, something that would usually cost about \$2100. They receive ceiling and under-floor insulation, hot-water cylinder wraps and pipe lagging, energy-efficient lightbulbs, low-flow showerheads, underfloor polythene, and draught-proofing of doors.

In the roof Mr McGinty finds some tatty looking Pink Batts, "probably from the

1970s", which are providing about as much insulation as wet cardboard, and some piping that is only partly lagged. The old batts will be swathed in new insulation, which lies like a layer of marshmallow over the existing Pink Batts.

Warm Homes Porirua has warmed up more than 700 homes in the Porirua area since February 2005.

"People that previously suffered from bad health and sick days off work and school have now seen the real benefits of what can be achieved in a warm, energy-efficient home," says ECCA marketing advisor Paul Halford.

Over the past three years, Warm Homes Porirua has received funding from EECA, Hutt Mana Charitable Trust, the Social Development Ministry, Capital and Coast District Health Board, Mana Community Grants Foundation, Porirua PHO and



Tumai mo te iwi PHO.

Down from the roof and clipboard in hand, Mr McGinty asks Mr Herps and Ms Niwa about their energy use habits, compiling a checklist of energy use and misuse.

How many times do they wash their clothes? Do they switch appliances off at the wall?

He shows them a simple trick to stop a chilly draft which whistles down their chimney — stuffing it with shopping bags full of crumpled newspapers.

"There are some really easy things you can do."

Mr Herps and Ms Niwa will reap the benefits of a warmer home — both have respiratory conditions.

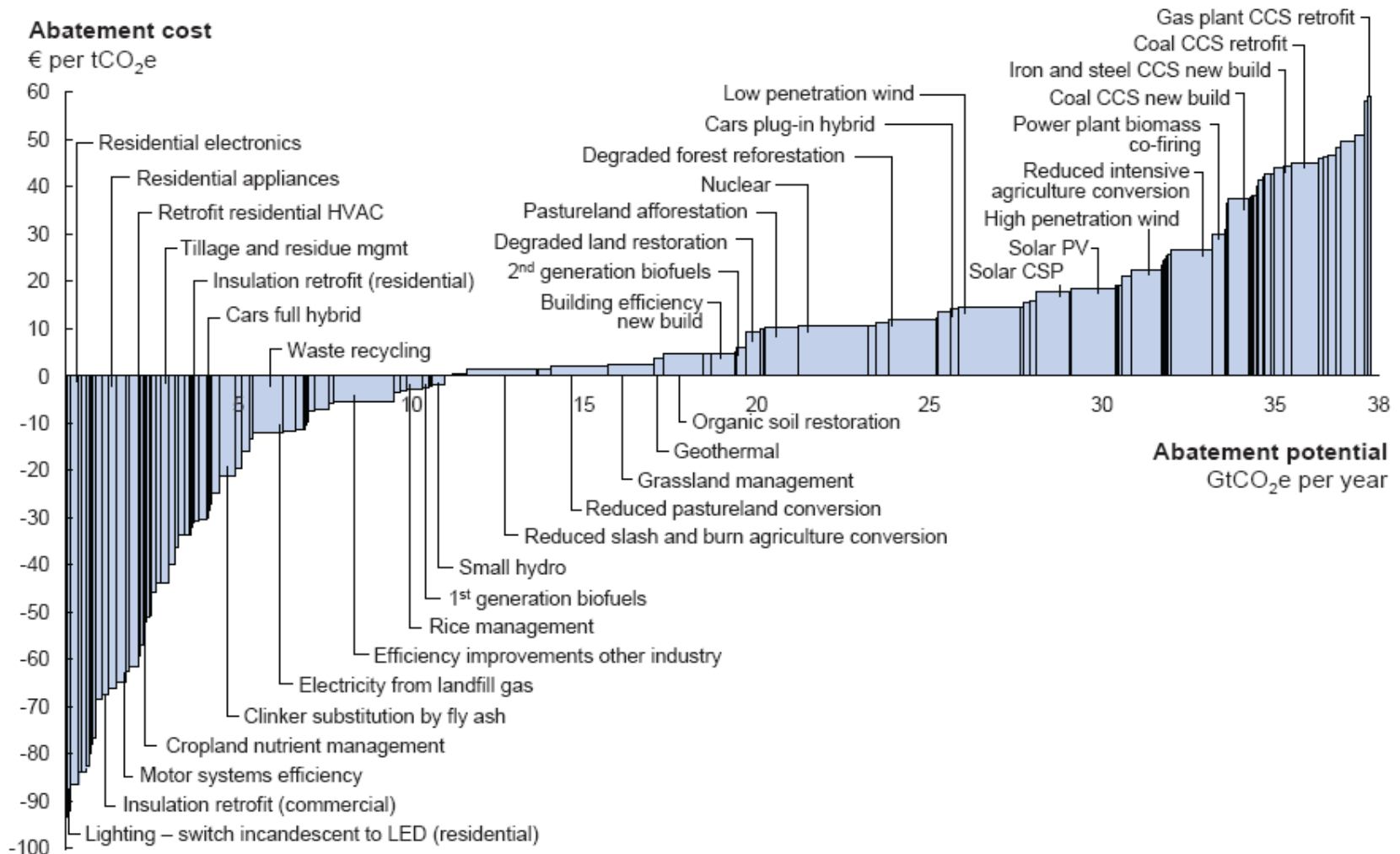
Mr McGinty, a former plumber, will also suggest heating options to replace the couple's rather inefficient fan heater.

Mr Herps says he's keen to sign up. "It's been a lot more thorough than expected."

■ To find out about the EnergyWise home grants programme visit www.eeca.govt.nz or call 0800 358676.

Big gains: actions below the line save money

Global GHG abatement cost curve beyond business-as-usual – 2030



CO₂ savings - every bit helps

- Average 217 kilograms CO₂ per household per year
- Measured for electricity and mains gas savings
- Valued at \$30 per tonne of CO₂
- Present value of savings: \$100 per household – every bit helps
- UK residential sector generates 10-13% CO₂

Cost-Benefit Analysis

Cost of insulation **\$1,800** per dwelling

Total estimated tangible **benefit** comprises health, energy and carbon savings: **\$3,374** per dwelling (present value, at 5% real discount rate, over 30 years) **Net benefits ~ 2:1**

Conservative assumptions: no energy price increases, no wood and coal counted, mortality gain not counted

Housing, Heating & Health

- Even insulated houses colder than ideal
- NZ has Scottish pattern of spot heating one room
- Third of NZ households use unflued gas heaters (1 kg LPG = 1.6 kg H₂O)
- 30 NZ cities exceed air quality standards

Leith

LIQUORLAND

Use fanbake, it heats
the room quicker.

Yeah right.


Tui

Housing, Heating and Health Study

- 409 households in community trial
- Does non-polluting, more effective, home heating reduced children's asthma symptoms over winter?
- Households had choice of sustainable heaters

Howden-Chapman P, Pierse N, Nicholls S, Gillespie-Bennett J, Viggers H, Cunningham M, et al. Effects of improved home heating on asthma in community dwelling children: randomised community study. *British Medical Journal* 2008;337(a1411doi:10.1136.a1411).



Intervention

Previous:

- X electric heaters (2kW)
- X unflued gas heaters (4kW)

Replaced with:

- ✓ 320 heat pumps (4-7kW)
- ✓ 55 wood pellet burners (10kW)
- ✓ 11 flued gas heaters



Heating

Average living rooms 1.1°C warmer

People felt warmer

Condensation reduced

Less mould and mouldy smells reported

Levels of nitrogen dioxide halved

Levels of wheezing & coughing halved

Effects more marked in low-income families

Two more days at school during winter

Free, S., P. Howden-Chapman, et al. (2009). "Does More Effective Home Heating Reduce School Absences for Children with Asthma?" *Journal of Epidemiology and Community*, doi:10.1136/jech.2008.086520.

Gillespie-Bennett, J., N. Pierse, et al. (2008). "Sources of nitrogen dioxide (NO₂) in New Zealand homes: Findings from a community randomised controlled trial of heater substitution." *Indoor Air* **18**(6): 521-528.

Gillespie-Bennett J, Pierse N, Wickens K, Crane J, Howden-Chapman P, Housing Heating and Health Team. The respiratory health effects of nitrogen dioxide exposure. *European Respiratory Journal* in press.

Cost-benefit of improving heating

Cost and installation cost of heaters over conservative
12 year life-span

Benefits

no visits to health professionals, time off work/school,
care-giving, pharmaceutical use, changes in total
household energy use and carbon emissions

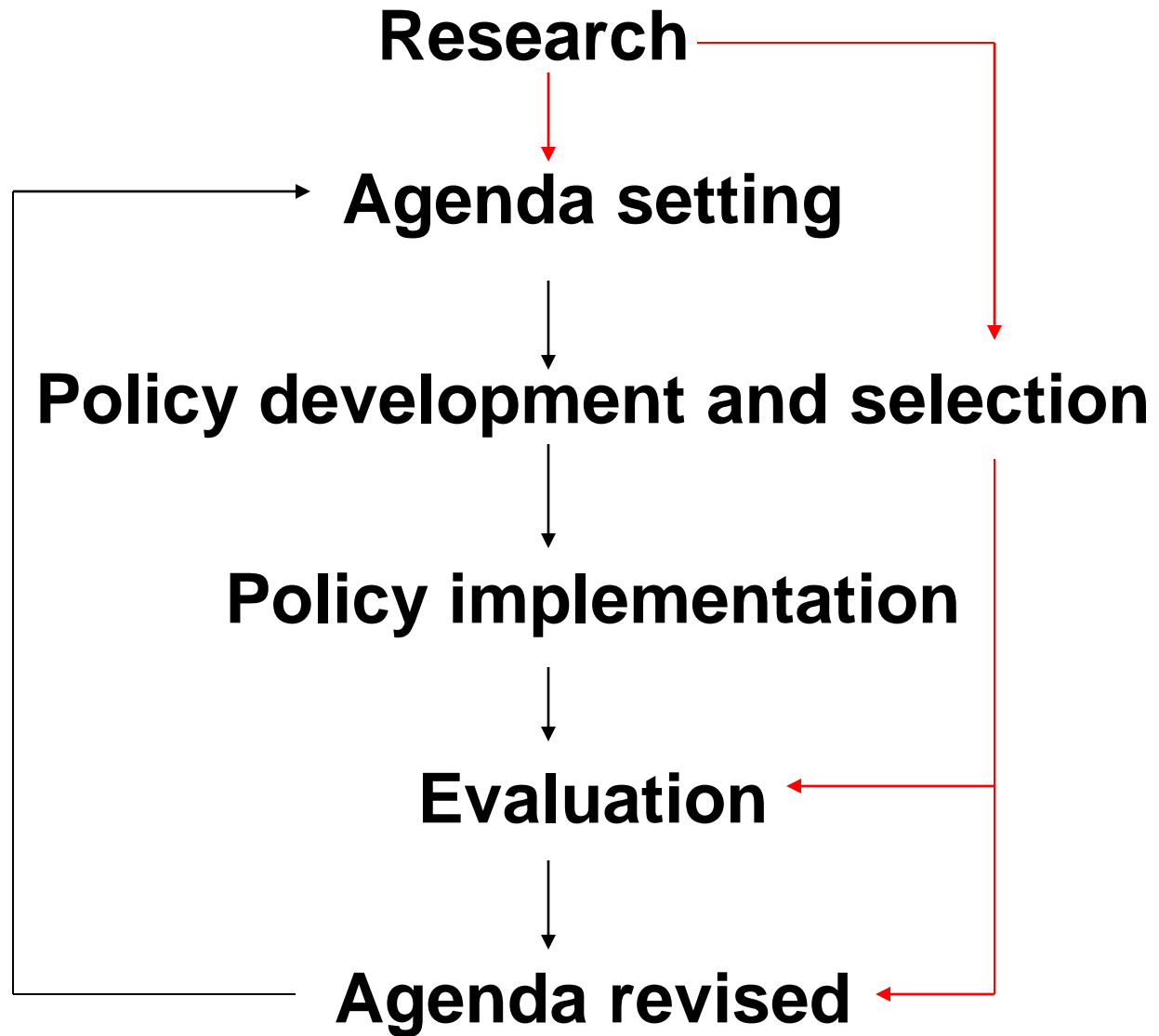
Sensitivity analysis

Targeted approach (high rates of household asthma)
benefit:cost ratio 1.09: 1

Untargeted approach (typical NZ asthma rates)
benefit:cost ratio 0.31: 1

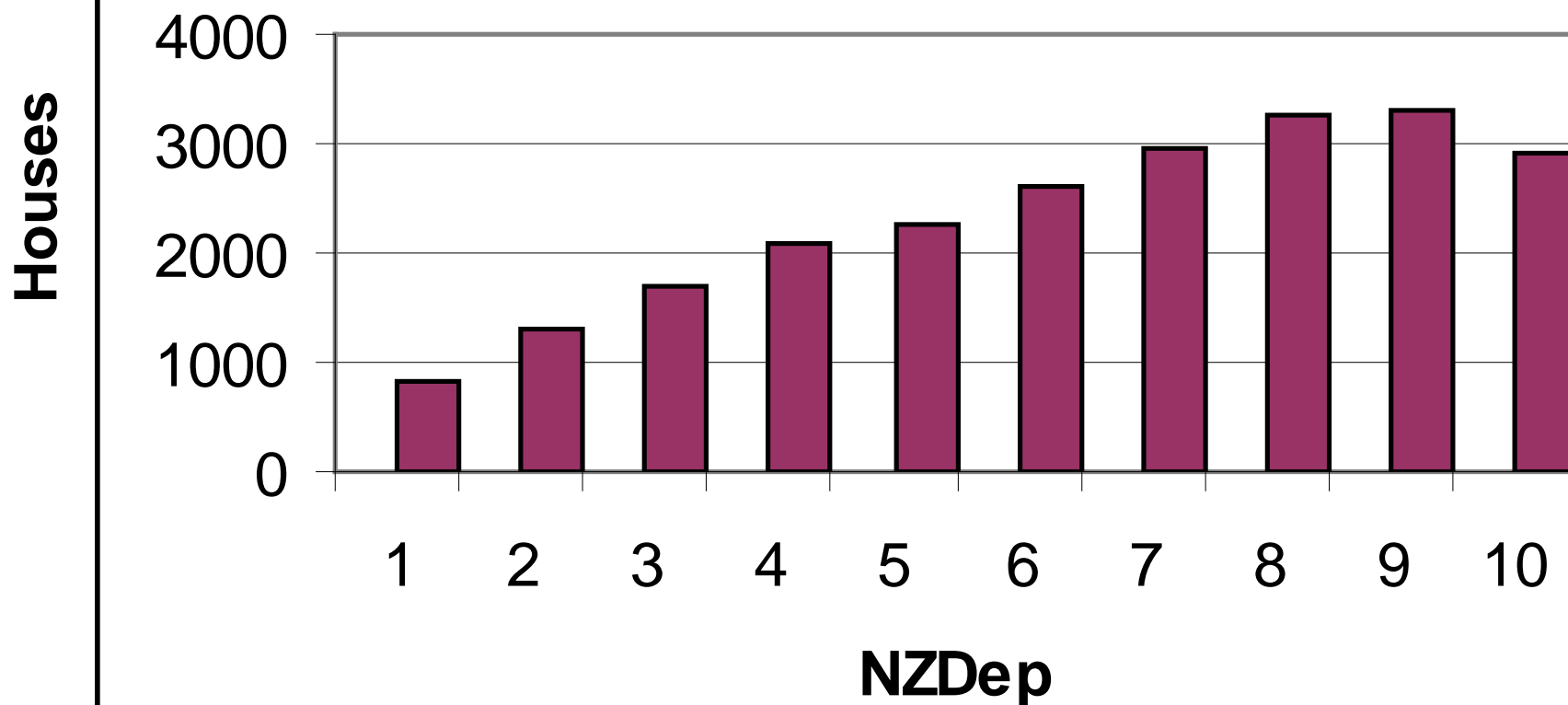
Influence of research on policy

- Framing of problem around co-benefits
 - Housing & health
 - Energy efficiency
 - Climate change
 - Employment creation
 - Regional development
 - Social capital
 - Fuel poverty



Reducing inequalities?

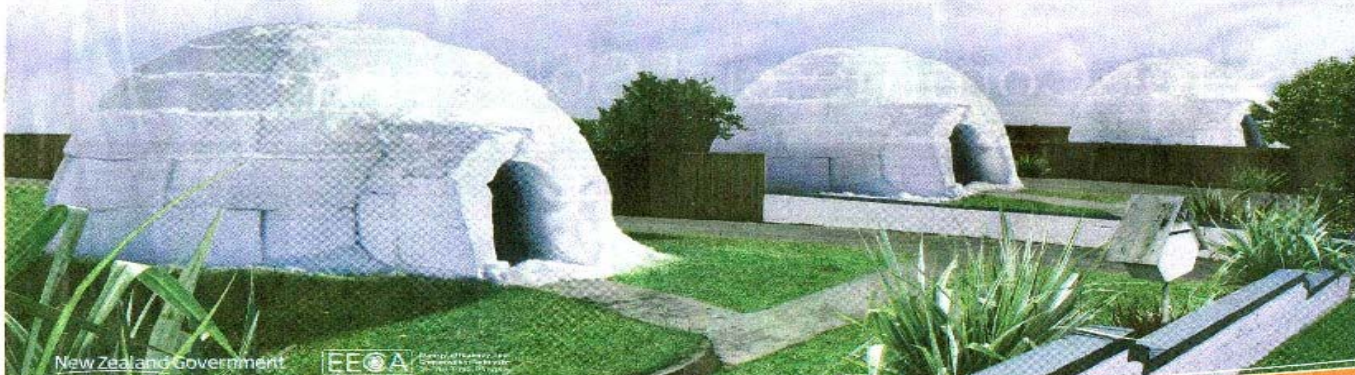
Number of Dwellings insulated using EECA



Policy Impact

- Policy piloted locally before implemented nationally
- Products regulated, process audited
- Previous labour Govt allocated 1 billion dollars Household Fund
- Current National Govt \$383m
 - research evaluation of roll-out to 70,000 houses
 - E savings, hospitalisation, drugs & employment
- Inter-sectoral policy with major impact on central, regional and local government, NGOs

Is your home one of the 900,000 houses
with sub-standard insulation?
You could get 1/3 off the cost to upgrade.



THE POLITICIAN

I WANT EVERY HOUSE
IN THE COUNTRY FULLY
INSULATED!



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THEN I WON'T BE ABLE TO HEAR THE
PEOPLE COMPLAINING ABOUT THE
WAY I'M HANDLING THE FINANCIAL
CRISIS!!!



Contrast with policy development & implementation in Australia

- Lack of piloting
- Lack of development of infrastructure
- Federal policy lacking state operational planning
- Large injection of \$\$
- Lack of regulation re standards
- Lack of policy development
- No risk management strategy
- Major political implications
- Fall of PM Rudd

Warm Homes for Elder NZers

- 600 people over 55 with COPD
- Intervention \$500 electricity voucher
- Framed as “Heat as medicine”
- Whanganui, Palmerston North, Wellington & Christchurch
- Community partnerships with asthma societies, outpatient respiratory clinics
- Enrolments underway

Qualitative pilot study of pre-payment meters

“I’ve done it 3 times now... turning it off on a Tuesday morning... because I’ve only had say four or five dollars in there, and I turn it on at four o’clock... do a barbeque for the kids when I come home, so they got dinner, and then turn it on at night... we had a dollar fifty left in the morning, it would last until nine o’clock and I’d go down and buy some.” [Howard]

O'Sullivan K, Howden-Chapman P, Geoff F. Making the connection: the relationship between fuel poverty, electricity disconnection, and prepayment metering. *Energy Policy* 2011;39:733-741.

O'Sullivan K, Howden-Chapman, P. Fougere, G. Death by disconnection: the missing public health voice in newspaper coverage of a fuel poverty-related death, *Submitted for publication*.

Housing Outcome Mould Study (HOME)

- Third of NZ houses have mould
- Leaky buildings major problem (~80,000 houses); estimated health costs \$474m
- Case-control study linking public health and mycology
- Replicating Finnish study, first and only study to show asthma caused by mould

•Howden-Chapman P, Saville-Smith K, Crane J, Wilson N. Risk factors for mould. *Indoor Air* 2005;15:469-476.

•Howden-Chapman P, Bennett J, Siebers R, editors. *Do Damp and Mould Matter? Health impacts of leaky homes*. Wellington: Steele Roberts Publishers, 2010.

Social Housing Outcome Worth (SHOW)

- Social housing in NZ ~5% of population (1/4m people)
- **Cohort study** of health impacts of moving people from waiting list to HNZC tenancies
- Applicant & tenant data linked to hospital records via encrypted National Health Index number.
- Housing Sensitive Health Outcomes
Hospitalisation

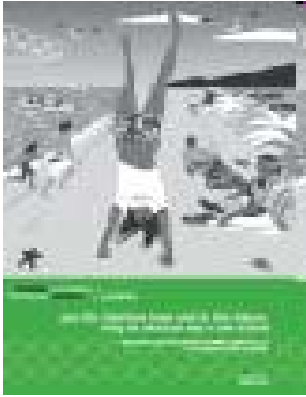
Social Housing Outcome Worth (SHOW)

- Rates significantly lower in HNZC tenants compared with housing applicants and pre-tenant applicants
- Decline in hospitalisations increases with duration of tenancy + plateaus after about 4 years, particularly for respiratory diseases; injuries and poisonings; and infectious diseases
- Can cohort study demonstrate causality?
- Is social housing an effective intervention for reducing health inequalities?

Further applied research

- Developed Housing Quality Index
- Built prototype energy-efficient extended family Pacific house for HNZC

Keall M, Baker M, Howden-Chapman P, Cunningham M, Ormandy D. Assessing health-related aspects of housing quality. *Journal of Epidemiology and Community Health* 2010;64(9):765-71.



Pene G, Howden-Chapman PL, Peita M, Viggers H, Gray J. Living the Tokelauan Way in New Zealand: Teenager's perspectives on extended-family living and the evaluation of a purpose-built, extended family house. Wellington: Families Commission, 2009.

Summary (1)

- Different research methods for different purposes
- Community RCTs possible & policy influential
- RCTs expensive & complex to manage
- Trials deliberately framed positively as housing & health research **not** low-income & health research **or** fuel poverty
- Solution-focused research makes policy engagement easier
- Research targeted to providing material benefits to low-income communities
- Results generalisable to “NZ Inc”

Summary (2)

- Important to insulate **and** heat our homes where we spend most of our time
- Good for health, energy efficiency, climate change **and** employment
- Buffers households from residential electricity price increases and flow-on from ETS & necessary carbon charges

Summary (3)

- Research has led to important policies that survived change of government
- National policy being evaluated
- Healthy Housing Initiative addressing demand-side energy problems
- Multiple benefits add up to significant population approach
- Demonstrated important private and public benefits