Knowledge Base

Unflued Gas Heater Fact Bank

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Document number	PUB/7

Purpose

This document is the repository of Beacon's core facts and knowledge about unflued gas heaters drawn from a range of publications and research. It was developed by Vicki Cowan, Verney Ryan and Lisa Burrough as part of the preparatory work to develop value cases to remove unflued gas heaters from New Zealand homes.

The problem

Unflued gas heaters burn gas to produce heat but they have no flue or chimney to transfer combustion products outside. These combustion products include: water, nitrogen dioxide, sulphur dioxide, carbon dioxide, carbon monoxide, benzene, butadiene, fine particulates and formaldehyde. These significantly reduce the indoor environment quality of New Zealand homes, harming occupants and reducing the durability of the building. HEEP[1] estimated 500,000[2] New Zealand homes had portable LPG (i.e. unflued) gas heaters (39% of their sample). This is higher than the number recorded for bottled gas in the 2006 Census which was 388,000[3] homes. The difference is thought to be due to HEEP picking up all heaters (used or unused), whereas the census may not pick up all unused heaters.

[1] Isaacs, N.P., Amitrano, L., Camilleri, M., French, L. Pollard, A., Saville-Smith, K., Fraser, R. and Rossouw, P. 2004. Energy Use in New Zealand Households: Report on the Year 8 Analysis for the Household Energy End-use Project (HEEP). BRANZ: Judgeford, Porirua. (Study Report SR 133)

[2] Beacon notes that as rental properties were under represented in the HEEP survey, 500,000 is a conservative estimate.

3 www.stats.govt.nz 2006 Census data on Fuel Type(s) Used to Heat Dwellings – assessed June 2010

The solution

Beacon's interpretation of this knowledge base is that New Zealanders would be a lot better off without unflued gas heaters.

Significance of the problem

Indoor air quality needs to be a priority because:

- Indoor air is usually more polluted than outdoor air due to long periods of exposure and higher concentrations[4].
- Indoor pollutants have multiple pathways into humans – inhalation, ingestion, and contact with skin/eyes (so infants very vulnerable). Pollutants indoors can be 1000 times more likely to reach a person's lungs than outdoors[5].
- New Zealanders spend more than 75% of our lives at home, mostly indoors[6].
- Populations with vulnerable health, such as the infirm, infants, children, elderly and disabled persons, spend more time in the home.
- 45% of New Zealand homes have mould. High moisture levels leads to damp building materials and mould. This not only means higher maintenance of the building materials is required to prevent deterioration, but it leads to an environment that is less healthy than its potential.

4 Spengler, J. Indoor air quality issues in buildings. In Proceedings of the 10th Annual AIOH Conference. 1991. Bendigo
SEPA Consumer Product Safety Commission: What You Should Know About Combustion Appliances and Indoor Air Pollution CPSC Document #452
http://www.cpsc.gov/cpscpub/pubs/452.html
5 Bennet, D., McKone, TE, Evans, JS, et al., Defining intake fraction. Environmental Science and Technology, 2002: p. 207A-211A.
Smith, K., Air pollution: assessing total exposure in the United States. Environment International, 1988. 30(8): p. 10-38.
Lai, A., Thatcher, TL, Nazaroff, WW., Inhalation transfer factors for air pollution health risk assessment. J Air Waste Management Association, 2000(50): p. 1688-1699.
6 Keall, M.D., Povey, L.J., New Zealand Travel Survey Highlights 1997/98. 2000, Land Transport Safety Authority: Wellington New Zealand.

Unflued gas heaters produce dangerous indoor conditions, because they emit:

- **Nitrogen dioxide,** a colourless and odourless gas that causes shortness of breath after exposure to high concentrations, especially in children and people with asthma.
- **Carbon dioxide**, which is produced by combustion and can affect breathing at high levels.
- **Carbon monoxide,** hard to detect, and very toxic: 800 ppm causes unconsciousness in about 2 hours. Early symptoms include coughing, wheezing and shortness of breath, chest pains or angina, headaches, dizziness and nausea.
- **Water**, which condenses in homes which are already characterized as damp and cold. This moisture increases the spread of mould and dust mites.

Portable LPG heaters are a greater fire risk than electric heaters

- Beacon's analysis of Fire Service data shows that the number of incidences per 100,000 portable LPG heaters is 6.2, and, for electric heaters, is 2.3 on average for the period 2001 to 2009. The difference is statistically significant (p-value =0.00066).
- In November 2009, the Ministry of Economic Development reminded people that dehumidifiers require regular maintenance to prevent them from becoming a fire or electrical hazard[7]. HEEP tells us that households with unflued gas heaters are 40% more likely to also own a dehumidifier[8]. Dehumidifiers are also a fire risk so this contributes to the fire risk associated with unflued gas heater use.

Research links unflued gas heaters to health problems

- Children are affected by lower levels of pollutants than adults and chronic damage as lungs develop can put individuals on a pathway of respiratory illness for life[9].
- Research recorded peak NO_2 levels in some homes with unflued gas heaters at five times World Health Organisation recommendations. Records of pollutants synchronised with unflued gas heater use[10]
- The Australian Department of the Environment and Heritage's *Unflued Gas Appliances and Air Quality in Australian Homes Study* found that, when unflued gas heaters are operating, the indoor air has higher levels of nitrogen dioxide, carbon dioxide and carbon monoxide than outside. Air pollutant levels were often significantly above indoor air quality criteria; and well above those associated with causing asthma.

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7 Safety message- Dehumidifiers - the importance of regular maintenance. Accessed 15 February 2010 http://www.energysafety.govt.nz/templates/Page___42199.aspx

8 Isaacs N.P., Amitrano, L., Camilleri, M., French L., Pollard A., Saville-Smith, K., Fraser, R. and Rossouw, P. 2004 Energy Use in New Zealand Households: Report on the Year 8 Analysis for the Household Energy End-use Project (HEEP). BRANZ Study Report SR 133.

9 Gauderman et al, 2007. Effects of exposure to traffic on lung development from 10-18 years of age: a cohort study. The Lancet, 2007.

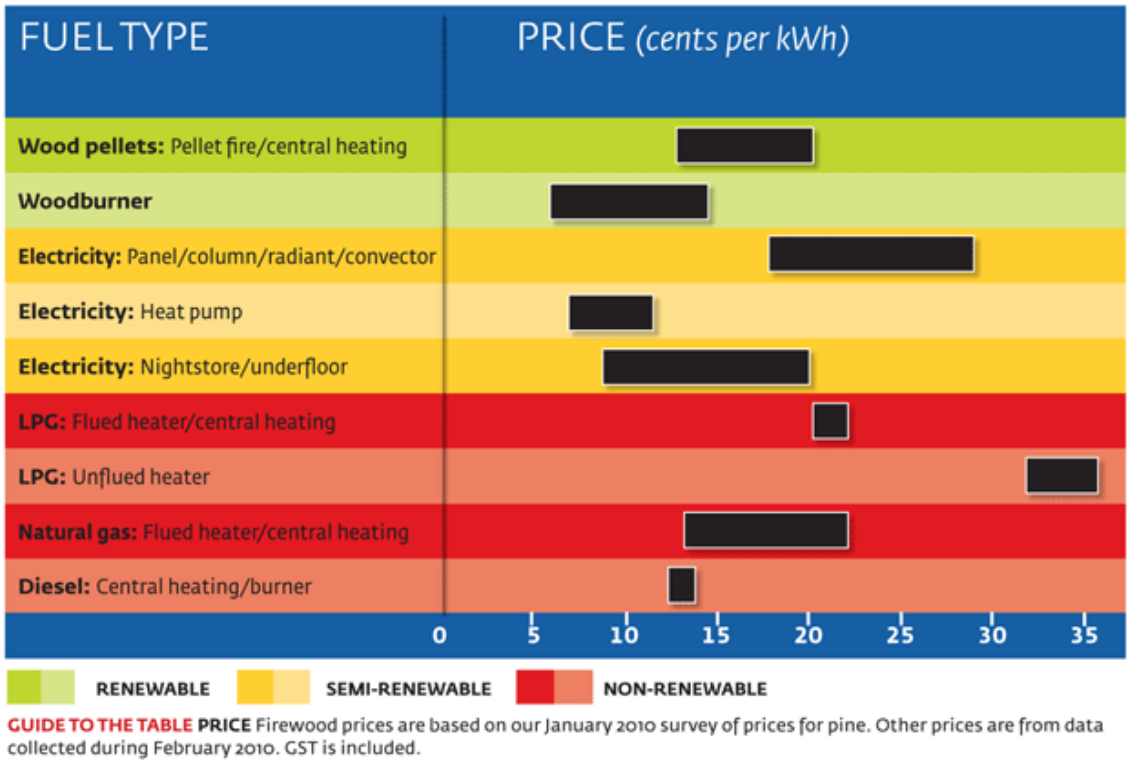
10 Phipps, R. (2007). Indoor Environment Quality. Report TE220 for Beacon Pathway.

- A Flinders University (Melbourne) study found that unflued gas heaters in classrooms emitted up to three times the nitrogen dioxide of flued heaters. Asthma attacks and chest tightness in asthmatic children reduced when the unflued gas heaters were removed.
- New Zealand has one of highest rates of asthma in world; one in four[11]. The Housing, Heating and Health Study, led by University of Otago Wellington researcher Professor Howden-Chapman, found the health of asthmatic children improves significantly when unflued gas heaters are replaced with cleaner, heating sources. Condensation, mould and damp were reduced, and levels of nitrogen dioxide halved.
- Both the UK LPG Association and LPG Australia suggest where occupants have any respiratory problems that flued heaters should be used[12].

Unflued gas heaters bring extra costs

- An unflued 4 kW LPG heater produces 0.5 L hr^{-} of water and a 4 kW natural gas heater produces 0.6 L hr of water. Heating solutions should be addressing New Zealand's cold damp housing – not adding to the problem as recognised by the Australian and UK LPG Associations' inclusion in their fact sheets that unflued gas heaters should not be used in damp homes[13].
- A common response to the dampness within homes is to run a dehumidifier as well. BRANZ's HEEP study shows a statistically significant relationship at the 95 % level that houses with an unflued LPG heater are more likely to have a dehumidifier. Dehumidifiers are expensive to run – they cost $0.14-$0.42 per litre of water removed. This creates a 'hidden' cost of keeping warm to individual homeowners and dehumidifiers only remove the pollutants occupants 'see', i.e. the water.
- Unflued gas heaters are perceived to be a cheap heating solution: however analysis of gas prices over past years indicate replacement with a flued system (to avoid need for dehumidifier) or electric heating would be more price competitive for homeowners (Table from http://www.consumer.org.New Zealand/reports/heating-options/fuel-prices-compared, updated in April 2009)

11 Asher, I., Byrnes, D. (2006) Trying to catch our breathe: the burden of preventable breathing disease in children and young people. Asthma and Respiratory Foundation of NZ.
12 Portable (unflued) gas heaters and your health, September 2004
13 User Information Sheet 001 – January 2008, UKLPG - http://www.uklpg.org/lpg_property/UIS001.pdf accessed 11/12/09



Unflued gas heaters are affecting many New Zealanders

- 27.7% of New Zealand households reported using bottled gas for heating in the 2006 census[14].
- They are relatively cheap to buy (approximately $120 -$150) making them the heater of choice for lower income households.
- Without regular servicing, unflued gas heaters are markedly less efficient and more polluting[15]. New Zealand servicing centre data indicate less than a quarter of heaters are regularly serviced.
- Should only be used in well ventilated spaces, but this is not controlled in any way.

14 www.stats.govt.nz

15 Manufacturer's instructions for use the UKLPG Association and the NZLPG Association. "Unflued gas heaters and your health", brochure from Australian LPG association: www.unfluedheaters.com.au

Current situation in New Zealand

- The Gas Regulations control the safety of gas installations in Part 1 of the New Zealand Gas Installation standard (NZS 5261). Part 2 of the standard prohibits the installation of (fixed) unflued heaters in bedrooms & bathrooms. However, the portable nature of cabinet heating devices does mean that these heaters can and do get used in bedrooms often with lethal outcomes[16].
- The dangers of unflued gas heaters are well recognised and warnings about their use have been issued by government bodies including New Zealand Energy Safety Service, Ministry of Health, EECA, Ministry of Consumer Affairs and regional public health services. The Parliamentary Commissioner for the Environment called for a ban in 2006[17].
- PlaceMakers, the retail arm of Fletcher Building Limited, have a central policy to not stock portable cabinet LPG heaters and their stores have not sold any in the last four years[18]. The original prompt for this policy was related to fire risk to children; however, Jane Cuming identified that extra moisture added by unflued gas heaters to already damp New Zealand homes was also a strong driver.
- MED's Energy Safety Committee has commissioned an independent review of LPG cabinet heaters as a suitable means of heating in New Zealand. The purpose of the review (first quarter 2010) is to consider whether LPG heaters are suitable in New Zealand in light of current knowledge of economic, health, social and environmental factors.
- In one research study, the removal of unflued gas heaters showed improvement of asthma symptoms in excess of expected results from a successful clinical trial of a preventative asthma drug[19] (Otago Medical School). This provides a unique opportunity for health providers (central government agencies/district health boards, primary health organisations) to improve their health outcomes with a relatively simple intervention.
- Review of fire service statistics show that portable LPG heaters have a significantly higher incidence (to 98% confidence level) of structural fires than those due to electric heaters, per

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16 2009 two records of outdoor heater use in bedrooms:
http://www.nzherald.co.nz/taumarunui/news/article.cfm?l_id=302&objectid=10587859&pnum=1
http://www.times-age.co.nz/local/news/tenants-risked-death-with-patio-heaters-inside/3902291/
2008 accident after use in confined space:-
http://www.energysafety.govt.nz/templates/MultipageDocumentTOC____40879.aspx
17 Parliamentary Commissioner for the Environment. 2006. Healthy, wealthy and wise. A health impact assessment of Future currents: Electricity scenarios for New Zealand 2005–2050. Wellington: Parliamentary Commissioner for the Environment.
18 Personal communication, Jane Cuming, Building Standards Manager, Placemakers
19 Howden-Chapman, P.P., N; Nicholls, S.; Cunningham, M.; Phipps, R.; Boulic, M.; Fjallstrom, P.; Bennett, J.;Free, S.; Chapman, R.; Lloyd, B.; Viggers, H.; Shields, D.; Baker, M.; Cunningham, C.; Woodward, A.; Wickens, K.; Bullen, C.; Crane, J., Reducing childhood asthma morbidity through housing intervention: main health results from the Housing, Heating and Health Study. submitted to Lancet, 2007

house. This takes into consideration the number of each heater type in our houses and the number of fires caused by each heater type[20].

- Anecdotally, there is evidence that portable LPG heaters are used as a means of budgeting for those who cannot heat as much as they would like (or is desirable for health and comfort). Swapping to an electric heater provides the user with improved energy efficiency, and lower costs per unit of energy as Consumer NZ research indicates (above). The amenity value of a portable LPG heater is that when the bottle runs out users don't refill until their budget allows. Experience from the Energy Efficiency Community Network indicates while some households would respond to improved information and have capacity to change from unflued gas heaters, other households – and these are the most vulnerable – will not have capacity.

Situation overseas

- Use of unflued gas appliances are not recommended in **Canada**.
- Banned from use in **Western Australia**; emissions regulated in other states.
- Some states in the **United States** ban the use of unflued gas heaters, but most allow their use under restricted circumstances.
- Flue-less gas fires are permitted in the **United Kingdom** subject to regulations for ventilation.

20 Beacon analysis of Fire Service Statistics from 2000/2001 year to 2008/2009 year.

The solution

Beacon's interpretation of this knowledge base is that
New Zealanders would be a lot better off without unflued gas heaters.

Beacon Pathway's perspective on home performance is captured in its definition of the HSS High Standard of Sustainability® (HSS®). A home is viewed as a system where several components need to be optimized in order to achieve high performance: benchmarks are set for reticulated energy and water use and World Health Organisation (WHO) recommended temperature and humidity minimums are adopted. Beacon's strategy for indoor environment quality is to balance temperature, ventilation and relative humidity while controlling pollution at source. Beacon has devoted considerable resources to research and transfer knowledge in this area, increasing New Zealand's awareness of the need for full thermal envelope insulation to a high standard, clean efficient heating and ventilation of kitchen and bathrooms. With regard to source control of pollution, a target to remove unflued gas heaters presents a clear opportunity to significantly improve outcomes for New Zealanders and their homes.

Pathway to change New Zealand's reliance on unflued gas heaters

Action is required on several fronts to achieve this change; there is no clear and easy solution, i.e. no silver bullet. Beacon has identified the organisations with a stake in this issue from across its four main channels: government, industry, infrastructure and consumers.

Government needs to:-

1) Recognise that households relying on unflued gas heaters fall into three groups, each requiring different approaches and levels of support. The first group will have capacity to stop using unflued gas heaters and require only information to make a better heating choice. The second group required information and some support/advice to make better heating choices. The third group is the most vulnerable households in New Zealand, faced with fuel poverty, often living in tenanted accommodation and with very little capacity to move away from unflued gas heating without integrated support (i.e. budgeting, health, employment, housing etc.)
2) Actively discourage use of unflued gas heaters in New Zealand homes, via:
   - Ministry of Social Development which should take into account the full costs (up-front, running and health) of unflued gas heating when providing heating assistance to New Zealand households and exclude support for these types of heaters.
   - Warm Up New Zealand where government is incentivising improved efficiency of heating – use the programme as mechanism to remove unflued gas heaters as part of upgrade
   - Treatment of respiratory illness (e.g. asthma) should include removal of unflued gas heaters based on proven links between health and these sources of indoor pollution.

- Ensure all connections to reticulated and bottled gas in new homes are to flued heaters: bayonet connections offer only portable, unflued heating options to occupants and so should not be an option.

3) Communicate the problems these heating devices cause in New Zealand homes for their occupants.
   a) Regulate for point-of-sale consumer information regarding the dangers and costs of unflued gas heating.
   b) Regulate point-of-sale information regarding the necessity of regular servicing for gas heating and requirement for adequate ventilation during heating.
4) Support community based initiatives that help vulnerable householders to transition away from unflued gas heaters, for example, Home Energy Advice Centre (HEAC), energy trusts.

Local councils need to:

5) Respond to ban and ensure unflued gas heaters enter waste stream and steel is extracted for recycling.
6) Communicate with consumers about what to do with their unflued gas heating units.

Industry needs to:-

7) Stop stocking and selling unflued gas heaters (new and second hand).
8) Supply alternative efficient heating options to consumers which enable fuel budgeting
9) Ensure that all installation of heating options relying on reticulated gas is flued.
10) Where a sale is undertaken, heaters should be clearly marked with conditions of use:-
    - Ideally use as contingency heater only (e.g. during power cuts) and in very cold regions, (e.g. not needed in Auckland, Northland so shouldn't be sold there)
    - Dangerous gases – open a window when using to ensure there is adequate ventilation
    - Service once a year - the less it is serviced, the less efficient the heater is, with permanent labelling to provide transparent record of maintenance
    - Not recommended for use in a damp house
    - The heater will release moisture – a dehumidifier may be needed.
    - Not recommended for elderly or children.
    - Do not use in a small room or bedroom
    - Don't leave unattended while being used as it is a fire hazard
    - Keep 1 metre away from flammable materials.
11) Where a sale is undertaken, industry retailers could develop a servicing scheme, perhaps in partnership with LPG Association, where customers are reminded to service their units and given advice where to go.
12) Develop schemes that facilitate consumers moving away from unflued heating solutions, for example:
    - Gas industry swap schemes – unflued for flued heaters.
    - Energy utilities supporting budgeting schemes to help households transition from unflued heating.

- Community NGO groups running projects ideally as part of a comprehensive programme which includes budgeting support, particularly for most vulnerable households to provide evidence of how best to support households moving away from unflued gas heating.

Consumers need to:-

13) Respond to the evidence by:
    - Not buying new unflued gas heaters;
    - Not giving away or selling second hand unflued gas heaters – recycle the units through council.
    - Not using existing unflued heaters – either recycle the units and use bottles on outdoor barbecues only or service then store (with conditions of use list) as contingency heater only for emergency power cut situations; and,
    - Not fitting unflued gas heaters when on reticulated gas supply (i.e. say "no" to bayonet fittings).
14) Spread the word – unflued gas heaters are not a good solution and all use should be discouraged.

Beacon will support these pathways by:-

15) Providing a robust knowledge base to ensure informed decision making by all players: continuing to target consumers via range of media opportunities (e.g. magazines, newspapers and radio)
16) Researching barriers to change, current focus:
    - Work with community-based agencies, e.g. HEAC, to understand the challenges of providing vulnerable households with improved heating while retaining capacity for people to manage energy budgets and control energy consumption.
17) Working with councils on waste if large scale release of unflued gas heaters into waste stream: cabinets assumed to be of value due to steel.
18) Working with gas industry (LPG and Natural Gas Associations as well as retailers) on potential for schemes to transition New Zealanders towards flued gas and more efficient heating solutions.
19) Working with retailers to explore opportunity to withdraw unflued gas heaters, i.e. following lead taken by PlaceMakers.
20) Advocating at all levels for change