

The Sustainable Energy Forum



P O Box 11 152, Wellington

Email: info@sef.org.nz

Web: <http://www.sef.org.nz>

28 June 2007

Contact for this Submission – see below

Department of Building and Housing
Building Quality and Performance
Level 6, 86 Customhouse Quay
PO Box 10-729
Wellington

comments@dbh.govt.nz

Submission for proposed changes to the Building Code and Compliance Documents on energy efficiency of hot water systems and HVAC (heating, ventilating and air-conditioning) systems

This submission has been prepared by the Sustainable Energy Forum (SEF) and comments on the proposed changes to hot water systems. SEF is a broad organisation. This submission is the result of discussion amongst members and reflects a consensus. However it may not necessarily take into account the views of every member.

SEF supports the concept of applying a standard to a whole design rather than just to individual components, although, in some cases, better component standards are also required.

Mandating Better Water Heating Options

SEF supports the fitting of solar water heaters, heat pumps or other alternatives to electric resistance heating in the default design of hot water systems in all new homes and temporary places of residence (such as motels), where practical. Electric resistance heating should take on the role of merely boosting hot water supplies as a back up when

required. Exemptions can apply to those buildings with insufficient solar access or where other aspects of hot water system or building design renders a solar water heater or heat pump impractical or redundant. The idea is to provide some flexibility in design while expecting that most installations will not be approved unless a solar water heater or heat pump is incorporated.

There is also the expectation that, where possible, house design and orientation will facilitate the fitting of a solar water heater. Note there is a need for local authorities to further address solar access issues, particularly in high density housing areas. There is also a necessity for performance standards to be set for solar heaters, adequate training and certification of installers and a set of best practice guidelines to be promulgated. Australia is in the process of setting up a labelling scheme for solar heaters and heat pumps which could form the basis of a similar scheme in NZ.

Mere encouragement by way of a “credit” for making provision for future fitting of solar heating may lead to compromises in the design of a system. For example, placement of the hot water tank may be less than optimal for a non-solar system, but it may be positioned to gain a “credit” with no intention of ever installing a solar heater. Unless the tank is placed in the roof space, a future solar installation will have to either rely on a pumped system or installation of a second tank. This will increase costs and unless competently set up, may be less efficient than a direct ‘thermosiphon’ arrangement.

The economic benefit to the home owner in relation to the small extra percentage cost of installing solar water heating or a heat pump to a new house (even in lower sunshine regions and particularly if electrical boosting is charged at night-rate) is well documented and will not be further discussed here. Furthermore, it is worth noting that a significant proportion of new houses are built by speculative builders who then sell them to the first occupiers. It is in the builder’s interest to keep costs to an absolute minimum - as a result, the minimum is all the occupier gets. Having just taken on a large mortgage, the new home owner is unlikely to spend any extra upgrading the system, especially if it is planned to resell within, say 5 years. Each subsequent owner will find themselves in the same situation. Without some form of compulsion, uptake of solar heaters on new dwellings is likely to remain low.

Insulation

SEF supports mandatory insulation of all hot water piping, extended to cover retrofits where piping is accessible. It should be emphasised that particular attention should be paid to joints, elbows, junctions and valves. These are areas that take time to get right and some plumbers will be tempted to take short cuts. There needs to be a best-practice procedure for insulating owner-accessible valves on mains pressure systems.

It is noted that fitting a wrap to current A grade tanks is of benefit, especially if the tank is in a cooler area (such as a roof space). This implies that further upgrading of insulation standards is necessary.

Wetbacks*

Recent moves by the Ministry for the Environment to limit urban air pollution has provided a discouragement to install wood stoves with water heating capability. This has arisen due to concern that the presence of a water jacket within the firebox reduces the efficiency of combustion and thus raises smoke emissions. However, newer designs providing either a coil of pipe within the upper chamber of the stove or a water jacket around the flue largely bypass this problem.

Wood stoves have the potential to provide more than “boosting”. A stove with a 3 kW wetback run for 6 hours a day should obviate the need for any other source of water heating in all but the largest households during winter. Thus an ideal set up for most family homes would be solar plus wetback.

There may be a case for mandatory installation of wetbacks of approved design. This needs to be balanced against less than ideal placement of the tank and the possibility that home owners may choose another form of space heating to avoid the extra cost. However, there is also a case for providing a subsidy to cover this cost – in terms of cost effectiveness, it may well provide at least as good an investment of public funds as a solar heater**. SEF suggests the Department liaise with MfE and EECA on these issues.

* The term “wetback” does not correctly describe this design. However the word is in common parlance and is used here as a term for a device that extracts heat from a wood stove to heat water.

** It is noted that, in general, subsidies may be unnecessary if the line company ODV valuation methodology was modified to recognize the national economic benefits that would result from reduced losses and less pressure to invest in network expansion.

User Efficiency and Safety Issues

Maximising the efficacy of solar and wood systems often demands that water in the tank be relatively cool at the start of the heating cycle. It would be desirable that a timer and water temperature gauge be part of a standard solar or wood-fired heating system. A default timer setting may be from 3 – 6 am plus for a period in the late afternoon, although it would probably need to vary by season.

Concerns have been raised over the possibility of microbiological contamination of tanks if the temperature is kept relatively low for extended periods. Current recommendations are to have the water temperature rise to at least 60° at least once a week but there is the possibility that this will be raised to 70° daily. Such a move would have implications for efficacy of solar or wood heating and standing losses from tanks. Unless there is strong evidence of a significant public health risk, the move would seem counter-productive. At this stage, the evidence seems somewhat tenuous.

Proposed Design Rating Tool

SEF supports a whole system approach for design of hot water services related to a standard. The major advantage of the proposed rating tool is simplicity and relative low

cost to comply. However the tool being based on a CO₂ emission factor has a few problems which may be exploited by opponents.

(1) Choosing a CO₂ Emission Factor

The complexity of the NZ electricity generation system combined with a diversity of gas sources makes it extremely difficult to calculate a factor for the entire country that reflects reality.

For example, the Kapuni field supplies the lower North Island domestic gas network. It contains a high proportion of CO₂ (45% at the wellhead) which is stripped out and vented to the atmosphere. Thus gas supplied by Kapuni is approximately as CO₂ intensive as coal. If the objective is to reduce CO₂ emissions, gas consumers south of Taranaki should be penalised by the model.

In contrast, the hydro/thermal electricity mix in the South Island is likely to be quite different from the North – perhaps residents should be credited for having a greater proportion of hydro generated electricity in an “average” year.

Perhaps the main danger in choosing what could be seen as an arbitrary value is the possibility of opposing sides arguing the number up or down resulting in a negotiated agreement that reflects political influence rather than efficient use of energy or environmental impact.

This is not to say the CO₂ approach should be discarded, but merely to point out that the reasons for the chosen emission factor need to be robust and defensible.

(2) The Effect of Ripple Control

Ripple control has the effect of reducing CO₂ emissions referable to electrical water heating. However, installation and operation depends on the retailer. All retailers offer an electricity pricing option that provides water heating 24 hours. The effect on the results of the rating tool if a consumer changes price plans may be quite significant.

Inconsistent ripple control can be counter-productive where a significant proportion of water heating is solar. If timers are relied on to electrically boost at certain times when insolation is low, a sudden change in the timing of ripple control may mean cold water. Domestic friction under such circumstances is likely to lead to the timer being bypassed and consequent reduced efficacy of the solar unit.

(3) Methodology

One effect of the proposal is to disadvantage houses with large numbers of bedrooms which could result in houses being designed with multiple "studies", "workrooms" and the like. Another will be to have low-flow shower heads fitted which may be quickly swapped for higher flow items once the house has been approved.

The proposal does not entirely reflect the HEEP results. It correctly reports that there is a very wide range of consumption rates, but then proceeds to analyse the policy on the

basis of average behaviour. HEEP showed that the number of people in a house was poorly correlated to hot water use, unless they were teenage girls.

There are assumptions about technical energy efficiencies that may be incorrect. For example: "When gas is used to produce electricity, with that electricity then used to heat water, this results in twice as much gas being used than in direct gas water heating systems." This is debatable. If the gas to electricity is from a CCGT (best case scenario) with efficiency of about 50%, minus 10% losses from transmission and distribution (T&D), results in a delivered efficiency of 45%. No gas heater can double that, even when new, and that is before allowing for the T&D losses in the gas system. When at half their life they may not even exceed it.

However, assuming a gas water heater has an efficiency of 75% then a rough comparison for 100 units of water heating (ignoring T&D and standing losses) becomes:

- (a) electric (efficiency of 100%) = 100 units electricity = 200 units of gas
- (b) gas (efficiency of 75%) = 133 units of gas
- (c) solar (50% of demand) = 50 units electricity = 100 units of gas
- (d) heat pump (COP=2) = 50 units electricity = 100 units of gas
- (e) solar (67% of demand) = 33 units electricity = 66 units of gas
- (f) heat pump (COP=3) = 33 units electricity = 66 units of gas

Note this does not take CO2 emissions into account which depend much on gas source (see note on Kapuni above).

Marrying Gas and Supplementary Heating

The proposal states that a significant proportion of new houses in the North Island are opting for gas for heating. This is surprising given the current predatory behaviour of gas retailers in instituting high fixed charges and financial penalties for plan changes. However, it may be desirable to develop a best-practice method of combining solar and gas. Solar water tanks incorporating gas boosting are available in Australia but are quite expensive. A system better suited to NZ may be to use an instantaneous gas heater to boost temperatures when required. This may require some modification to the heaters.

Submission prepared on behalf of the Sustainable Energy Forum by:

Alan Thatcher

Ph (work): 06 350 5328

A.Thatcher@massey.ac.nz

The objective of the Sustainable Energy Forum Inc. is to promote the transition toward sustainable energy in New Zealand. In this context, 'sustainable energy' means the sourcing, transformation, use and management of energy in a manner which improves social well-being, while conserving physical resources, maintaining the integrity of ecosystems, and avoiding the transfer of costs onto future generations.