

Study: gas hot water not the answer

1 October 2013

By Cameron Jewell

1 October 2013 — [UPDATED 2 October 2013] Gas hot water isn't as sustainable as point-of-use instant electric systems under many circumstances, according to a new study out of RMIT University.



Alan Pears

The study authors of the investigation into the environmental impacts of hot water systems said that current policies favouring gas and gas-solar hot water were “short-sighted”, and reflected a lack of a “whole-system” approach to measuring environmental impacts.

They said more flexibility was needed in Australian building policies to support innovation and future-proof technology relating to hot water systems.

The researchers from RMIT's Centre for Design compared the life cycle impacts of gas centralised hot water with point-of-use instant electric systems in medium and high-density apartment buildings.

The buildings were:

- an existing high-density apartment complex, La Banque building, located in the Melbourne CBD at 380 Little Lonsdale Street, consisting of 257 apartments on 35 levels.
- a proposed medium-density apartment complex, the Brahe Place building, located in East Melbourne at 18 Brahe Place, consisting of eight apartments on three levels.

Table 1: Hot water systems under study (base case scenario)

Building	Type of hot water system		Household size profiles (people)**	Annual hot water per resident (kL)***	Temp. rise for 50°C water (°C)	Number of residences
La Banque	HWS 1	Gas plant ring main	257 (low) 382 (avg.) 643 (high)	20.1 (low) 26.8 (avg.) 40.2 (high)	59* winter 52* summer	257
	HWS 2	Continuous flow electric water heater (CFEWH)			39 winter 32 summer	257
Brahe Place	HWS 3	Gas plant ring main	8 (avg.) 16 (high)	20.1 (avg.) 33.6 (high)	59* winter 52* summer	8
	HWS 4	Gas plant ring main with solar			59* winter 52* summer	8
	HWS 5	Continuous flow electric water heater (CFEWH)			39 winter 32 summer	8

* Heated to 70°C, then tempered to 50 °C with cold water

** Determined with ABS data extrapolations (Australian Bureau of Statistics 2007)

*** Determined with ABS and Federal Government data extrapolations (Australian Bureau of Statistics 2007; Department of the Environment Water Heritage and the Arts 2008)

Alan Pears, senior lecturer in environment and planning at RMIT, said the results showed that electric systems could be the more sustainable option into the future in many cases.

“Our findings show there are significant opportunities today, and in coming years, for point-of-use electric systems to perform better than gas and solar-boosted gas, in greenhouse gas emissions and energy demand,” Mr Pears said.

“Context is the key to choosing environmentally friendlier hot water systems, and this research demonstrates why policymakers should consider a systems approach in regulation, rather than following product-specific rules of thumb.

“Because of their strong energy efficiency, point-of-use electric hot water systems could also be the choice to ensure future-proofing of developments, as future grid emission reductions combine with efficiency for strong environmental outcomes.”



The 257-unit La Banque building in Melbourne's CBD.

Comparing the two systems over the life cycle in the 257-apartment building and the eight-apartment block, the study found:

- point-of-use electric was up to 3.1 times more energy efficient than gas in the medium-density block (up to 1.6 times compared with solar-boosted gas)
- point-of-use electric was up to 2.3 times more energy efficient than gas in the high-density building

“The apartment buildings had pumped ring main hot water systems, which have very large heat losses,” Mr Pears told *The Fifth Estate*. “Also, apartments typically have fewer people and lower hot water usage. So a precise electric water heating option near the point of use, such as the Microheat unit evaluated, can do quite a good job.”



The proposed eight-apartment Brahe Place in East Melbourne.

As to why dedicated solar systems weren't part of the study, Mr Pears said:

“Individual solar hot water systems would not be particularly straightforward because of limited roof space and long distances from the roof, and capital costs would be very high.

“So use of solar would still require a ring main, with its associated large losses. It would be feasible to consider an unboosted central solar system with a ring main – preferably much better insulated than standard Australian practice – and the point of use electric boosters. That would involve significantly higher capital costs, though.”

Responding to possible issues associated with increased peak demand from electric systems, Mr Pears said: “With regard to the peak demand issue, the cost of higher capacity wiring was included in the analysis. With regard to actual peak impact, it’s difficult to take a definitive position. Apartments typically have only one shower and fewer people. With a water-efficient shower head, the instantaneous electricity demand is not enormous, and the diversity of timing of usage reduces the impact of the overall building on the peak.

“There is certainly a broader issue in managing peaks, especially now that many people are installing induction cooktops with very high peak demand – although it is usually for short periods.”

Mr Pears said that the study did not claim electric hot water was the solution in all situations.

“However, where the distribution losses are high and hot water usage is low, such as in many apartment buildings, they can be very useful. That’s why the case studies analysed were apartment buildings.”

While the study found gas currently scored better on greenhouse gas emissions in coal-reliant Victoria, it said the electric system could perform better into the future as our energy mix changes.

The independent research, which assessed greenhouse gas emissions, water use, solid waste and cumulative energy demand – and included the use of dynamic thermal modelling software – was commissioned by Australian-owned MicroHeat Technologies, developers of an electric hot water system that does not use heat exchangers such as those tested in the study.

Read the full report: <http://bit.ly/15wAUwE>

Comments

9 Responses to “Study: gas hot water not the answer”

Nick says:

4 October 2013 at 4:26 pm

“ Three-phase power into an apartment seems really darn’ crazy to me, does anyone know what electricity companies charge apartments with these hookups in service fees etc?

Also comparing energy efficiency of gas to electricity is obviously not apples for apples, if we were going there, shouldn’t we compare primary energy of the coal-sourced electricity (which it appears they haven’t)...

Cedric Israelsohn says:

4 October 2013 at 2:58 pm

“ Dear FithEstate,

Thank you for presenting the article and at least creating some debate around the issue. All responses are valid, but some comments:

1) The representative of the Electrical Instantaneous Manufacturing Company should recognise that this debate behooves them as well, and I would be glad to introduce him to those, at the top of tree, who support this reality “for free”.

2) On the issue of peak demand - AS/NZS 3000 supports the "incidence of co-incidence" in its Section C on Maximum Demand and Diversity Factor.

Regards,

Ced Israelsohn
Technical Director
MicroHeat Technologies Pty Ltd

Andrew Thompson says:
4 October 2013 at 10:08 am

“ While the study raises key issues and intuitively, where demand really is low and infrequent and ring mains are large and poorly insulated, the findings make sense, I think the key thing to bear in mind is that the study was paid for by MicroHeat Technologies. Who make instantaneous electric water heating units. And the study found these units are sometimes better than gas systems. Not terribly surprising.

Also interesting to note that instantaneous water heating is dismissed as no big issue for peak demand, but induction cook tops apparently are?

Still, a useful contribution to the debate despite the caveats.

Darren Fletcher says:
4 October 2013 at 7:18 am

“ I declare that I represent a company that manufactures electric instant water heaters, Andrew I am yet to find a consultant that will produce a report fee free? Someone always has to commission reports, when you find the fee free consultant let me know I will engage him immediately.

Klaas Visser says:
3 October 2013 at 9:36 pm

“ EcoCute electrically driven CO2 heat pump water heaters started in Japan about 10 years ago and now more than 5 million of these units are operating in Japan with COPs exceeding 4. They are increasingly being used in China and Europe, There have been a number of independent developments. As far as I am aware there are a number of significant installations in Darwin carried out by Mr Geoff Little, who used Mycom technology. The Mycom systems come in all shapes and sizes from small to large systems for hospitals. I have no doubt that these systems would perform better than either of the systems examined by Mr Pears. Point of use electric systems are very popular in countries like Thailand and to me it makes a lot of sense to only heat water when it is needed. To that extent I would support Mr Pears' findings. I am also grateful for his estimates of annual per resident hot water consumption but am somewhat miffed by the increasing per capita consumption although it could well be that higher occupancy includes a lot more children which would likely increase hot water consumption.

With best wishes and kind regards

Yours sincerely

Klaas Visser.

Jonathan Prendergast, Director, Prendergast Projects says:

2 October 2013 at 4:02 pm

“ It sounds like a key finding that due to the infrequent use hot water by residential dwellings, storage of hot water can undermine efficiency as there are losses through the day while hot water is not being used, and more energy required to keep the temperature up.

A combination of electric instantaneous, and solar boosted storage would be interesting. With the stored hot water being allowed to drop in temperature when no solar energy is available.

This would see solar energy captured, some lost, but no wasted electricity or gas through thermal losses.

Sam says:

2 October 2013 at 1:24 pm

“ @Andrew Pettifer

Without knowing what the floor plate is I don't think full solar would be viable for a 257 unit block although they do mention the scope for solar boosting. Centralised heat pump would viable and potentially the most efficient option.

Andrew Pettifer says:

1 October 2013 at 10:07 pm

“ Why would you not include a full solar option in the study? Perhaps because the headline “Study: Solar hot water the answer” is not what the company who commissioned the report would want to see?

Jonathan Prendergast, Director, Prendergast Projects says:

1 October 2013 at 7:11 pm

“ Interesting.

I wonder what if the study considered the effect of peak demand of using instantaneous electric hot water?

It would certainly require greater electric capacity for each dwelling, although this is normally over designed anyway.

Comments are closed.