GAS OR ELECTRICITY?

The economics of fuel choice for households

People don't generally realise, but every time they replace a fixed appliance (heater, cooker, hot water system) they are also making a fuel choice decision: gas or electricity? Among the many reasons for choosing one way or the other, the economics of the choice is largely mysterious to most people. Which fuel is cheaper for the same output?

Gas was historically cheaper, but this is not necessarily still true. Gas and electricity prices have both risen spectacularly in recent years, and tariff structures – with higher daily charges and relatively lower unit charges – have changed the relationship between consumption and cost. Appliances have also become more efficient, especially electric ones – heat pumps, which output *more* energy than the electricity they consume, have become more widespread in space heating and hot water systems; and induction stove-tops offer greater temperature control and more efficient thermal conversion than their resistive and ceramic forebears. Consequently, even if gas is cheaper than electricity on a per-unit basis (when converted to the same units, such as kilowatt–hours) it's not necessarily cheaper at doing the same work (because a gas heater might need five to ten times as many kilowatt–hours to produce the same heat as a reverse cycle air conditioner).

In 2014, with the prospect of sharp increases in gas prices on the horizon, the ATA did some analysis of the comparative economics of gas and electricity for a household faced with a fuel choice decision. (This project was generously funded by the Consumer Advocacy Panel.) We found that in many situations (especially new builds and existing all-electric homes), choosing the all-electric option was cheaper – even if gas prices *don't* skyrocket. In 2017, after a few more years of energy prices rises and improvements in appliance efficiency, we revisited this analysis.

A new approach

2017 was a good time to redo the analysis, since energy market and technological changes have changed the relative cost of the two fuels. We also wanted to see the extent to which home solar generation – increasingly common – favours the switch to electricity. Thanks to funding from Energy Consumers Australia, we have been able to do so.

We chose five archetypal households to understand how fuel choices worked for different common household types:

- Two people, frugal energy users, in a small house.

- Four people (two adults, two kids) with a ‘stay-at-home’ profile (i.e. high weekday daytime usage) in a medium-sized house.
- The same as the above but with a ‘working’ profile (i.e. low weekday daytime usage).
- Five people in a large house.
- The same as the above but in a newly-built large house.

We have made significant improvements to the modelling and approach of the original project to overcome its shortcomings – some in response to our own evaluation, and others in response to independent analysis by Frontier Economics:

- Building a consolidated model to determine hot water, heating, and cooling requirements on a half-hourly basis – and the resultant hot water, heating, and cooling appliance energy usage – for each of the household types.
- Building a dedicated model to accurately calculate gas bills, given daily gas usage.
- Selected appropriate electricity interval datasets (records of half-hourly usage) from our library of smart meter data to use as the underlying consumption for each household, in order to properly calculate electricity bills (and to use in *Sunulator*, our solar generation model, to calculate how much solar is able to offset electricity usage of heaters, air conditioners, and hot water systems).
- Building an integrated Fuel Cost Comparison Model that calculates cooking energy requirements, imports relevant cost data from the other models, and incorporates maintenance and capital costs when making the final calculations.

Energy usage modelling outcomes were extensively tested against benchmark and survey data. A reference group, comprising energy experts, representatives of energy companies and energy consumer advocates, guided and informed us during project development. In particular, this group helped us ensure that appliance options were locationally appropriate.

We have made the following assumptions about appliance choice:

- Gas heating is ducted in Victoria, ACT and all new built homes (regardless of location), and a wall furnace with supplementary portable heaters (one to three, depending on dwelling size) in existing homes in Tasmania, South Australia, New South Wales and Queensland.
- Electric heating is reverse cycle air conditioner with a large unit in the main living areas and smaller units elsewhere (one to three, depending on dwelling size).
- Gas hot water is instantaneous for small and medium dwellings and storage for large ones.
- Electric hot water is heat pump storage for all dwellings, timed to heat during the morning when solar generation is available.

- Gas cookers comprise gas cooktop and gas oven.
- Electric cookers comprise induction cooktop and resistive electric oven.

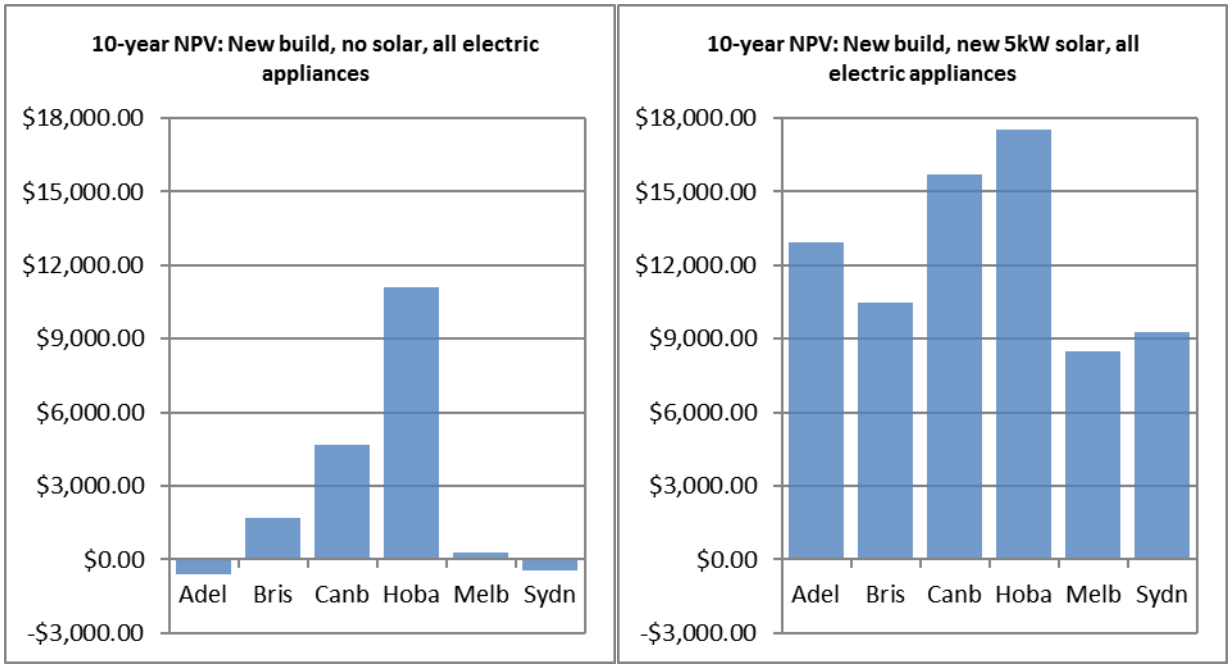
Findings

Some of our results were quite different this time than in 2014. Others were the same. Some of the differences were sue to the improvements we made to the modelling and approach; others were due to changes in tariff rates and structures. In particular, increased electricity prices and different gas tariff structures that reward high usage have made a big difference in South Australia.

Nevertheless there are a handful of key principles that can guide fuel choice decisions, in terms of the total cost of ownership (purchase, installation, and running cost) over ten years:

For new homes:

- If you're putting solar PV on, it's always better to go all-electric
- If you're not putting solar PV on, all-electric is still the best choice (except in Adelaide, Melbourne, and Sydney, where the overall cost is pretty much the same whether you go dual fuel or all-electric)

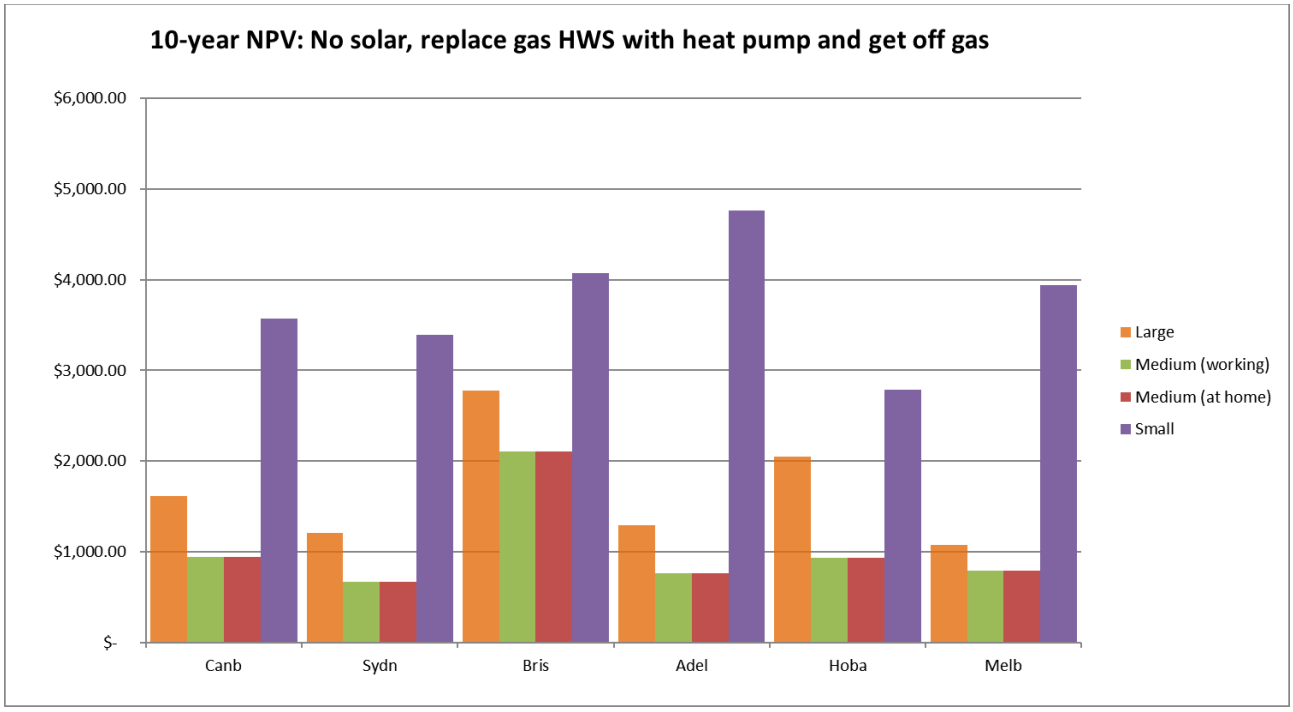


- If you really love gas cooking, you may as well put hot water on gas as well to get better value form the gas connection (except in Sydney, Adelaide and Brisbane, where you only come out ahead if you have all three appliances on gas). However you'll do even better if you run your gas stove from a gas bottle and avoid a mains gas connection, as the additional cost for just a

cooktop is marginal and far outweighed by the benefit of avoiding other fixed charge on a gas connection.

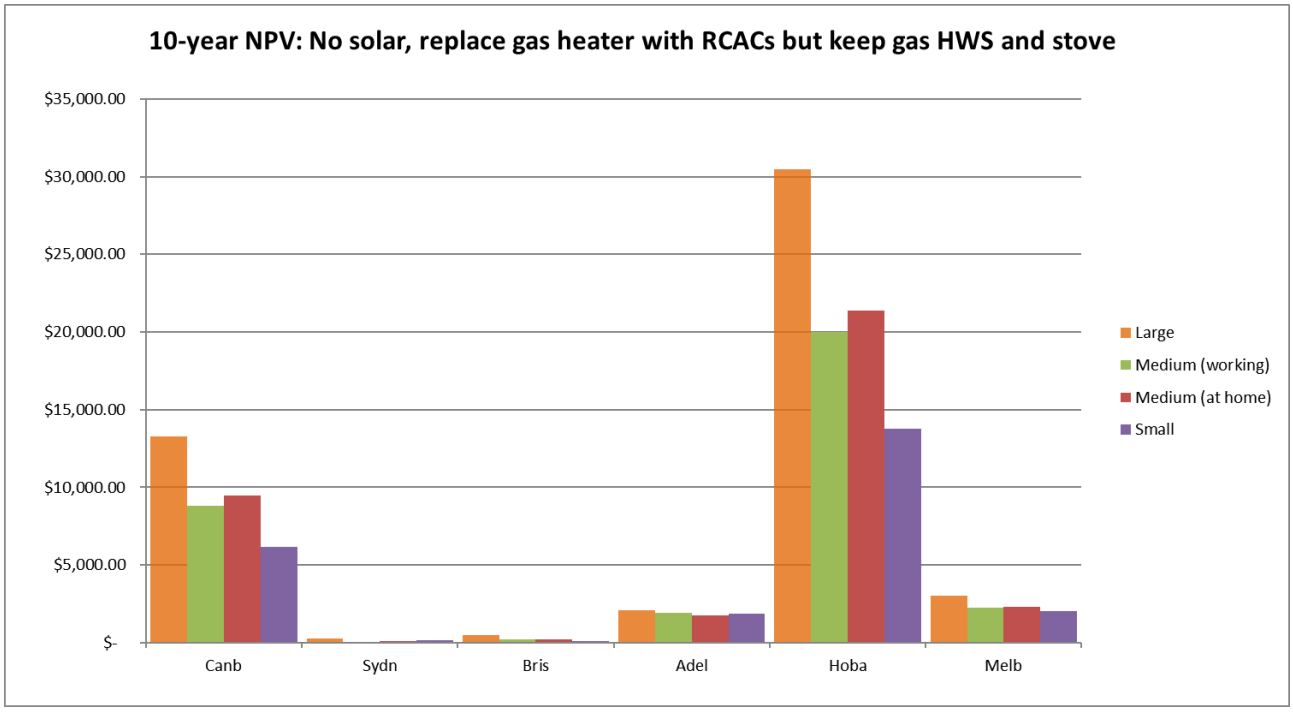
If you have only one gas appliance:

- Replace it with an electric one. It's almost always a better choice, as even in places where the running costs of gas are lower than for electric appliances, abolishing the fixed charge of the gas connection outweighs it.
- However if it's hot water, the benefit is fairly small for medium households in Adelaide, Sydney, and Melbourne. (At between +$600 and +$800 over ten years, for these locations it's in the 'marginal' zone where small changes in installation cost or household behaviour could make the cost benefit of switching to electricity closer to zero or even a few hundred dollars more expensive. This makes it an 'either/or' case where the economics are so marginal, it doesn't make much difference which fuel you choose.)

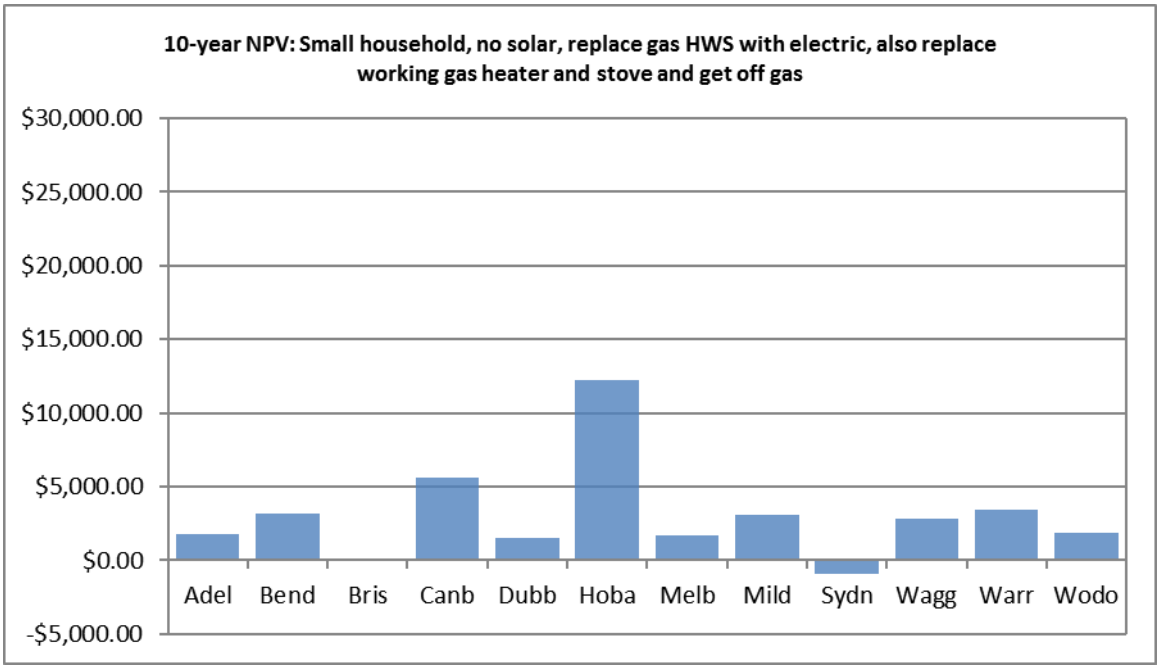


If you have more than one gas appliance:

- If a heater fails, replace it with an electrically-powered reverse cycle air conditioner (RCAC). It's cheaper overall everywhere except Sydney and Brisbane, where it's about the same as sticking with gas. If you change your other gas appliances over to electric at the same time, it's better in most places and marginal in a few – except for medium and large households in Sydney, where gas is better.



- If a hot water system fails and it's not your only gas appliance, you're always better off replacing it with another gas one – unless you also replace your other gas appliances too, to abolish the fixed price of the gas connection (except for medium and large households in a few locations: in Adelaide, Dubbo, Melbourne, and Sydney, sticking with gas gives better value; and in Bendigo, Mildura, Wagga, Warrnambool, and Wodonga it's marginal. For small households, Sydney is marginal and everywhere else is positive.)



The more (or less) you use, the more you save

The 2014 study showed that in general, the higher the consumption, the quicker the payback time. This was because in most cases (with the main exception being cold climates with low gas prices) the running costs of efficient electric appliances were lower, while the capital costs are higher. Once the lower running cost offset the higher purchase and installation cost, the savings grew.

The current study has found that this situation has changed a bit. While still mostly true, in some areas electricity prices have outpaced gas prices, diminishing this volume benefit. In a few places, gas tariffs have very steep declining blocks, which make high gas usage relatively cheaper (South Australia is the best example), making gas still the fuel of choice for high volume users. Conversely, much higher fixed charges in many (not all) areas have amplified the benefits for small households cutting the gas connection, because fixed charges make up a higher proportion of their fuel bill.

Next up...

These results are just a high level overview of our findings. While these key principles give good general guidance, the full summary report (coming in the next month or so) break down the results across the 16 different locations; while the full report (due a month later) will give detailed results for every scenario and household type in all locations. Keep your eye on our website, Facebook page, and eBulletin to see it when it's ready.