Household fuel choice analysis

NSW and ACT

Assumptions

- Houses are 3-star
- Gas heating is ducted (Vic, ACT, new homes) or wall furnace plus portables; electric heating is multiple RCACs
- Gas HWS is instantaneous except storage for large; electric HWS is heat pump storage
- Gas stove is all gas; electric stove is induction cooktop and electric oven

Main findings

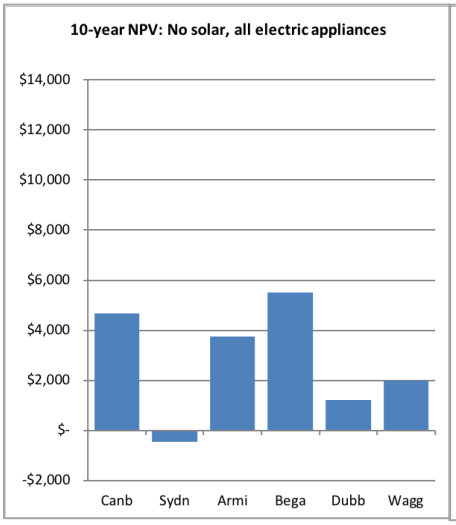
- All-electric is the best choice for large new homes (marginal in Sydney)
- With only one gas appliance it's always valuable to replace with electric
- Heat pump heating (RCACs) is always better value, and hot water never
- Cooking doesn't matter unless it's the only gas appliance
- Dual fuel is consistently good value in Sydney

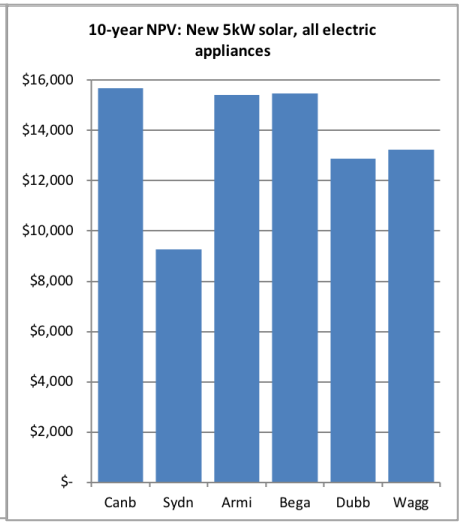
New homes

1A. Going all electric

Do it

This is a strong choice anywhere in NSW and ACT, with the caveat that in Sydney it's marginal enough to be an either/or. The charts show the money saved over ten years compared to having all appliances on gas.



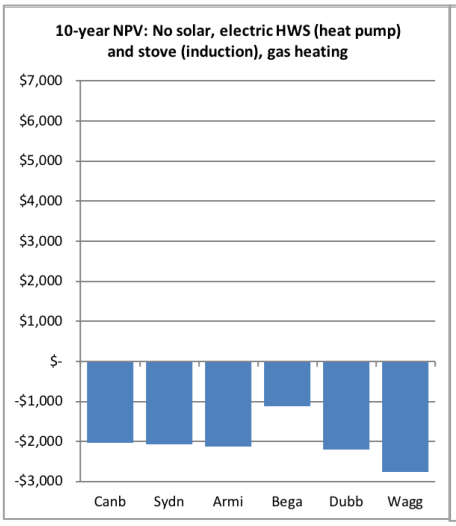


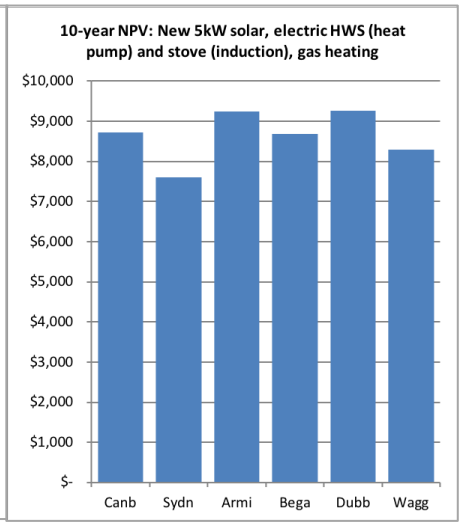
With new 5 kW solar PV it's even stronger. This mostly reflects the high value for solar, but is helped by the additional value gained from using solar generation to fuel electric appliances – hot water in particular.

1B. Just gas heating

Don't do it

Some people prefer gas heating. Keeping the gas connection keeps the fixed charge, and with heating being the strongest case for fuel switching to electric, keeping it on gas makes no sense. All these households would be better off having all appliances on gas than just heating.



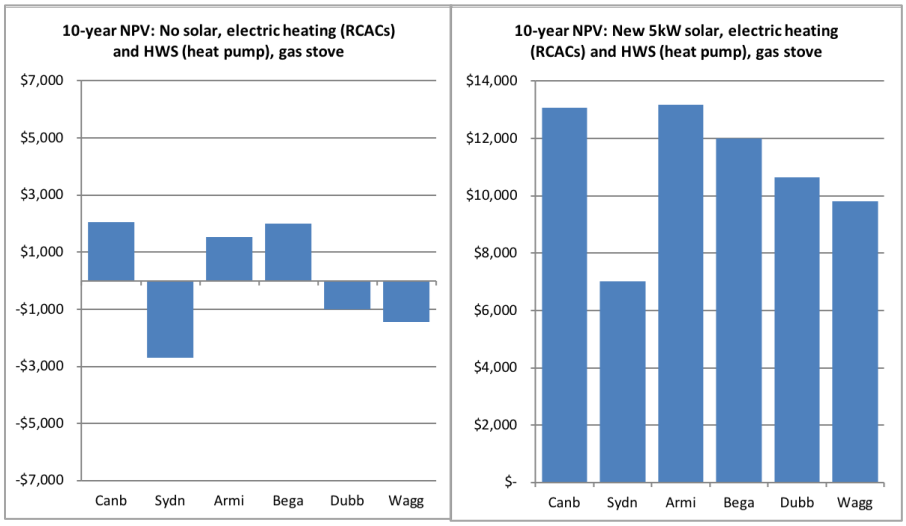


With solar, there's an overall benefit but it's significantly less.

1C: Just gas stove

Depends *WHERE* you are

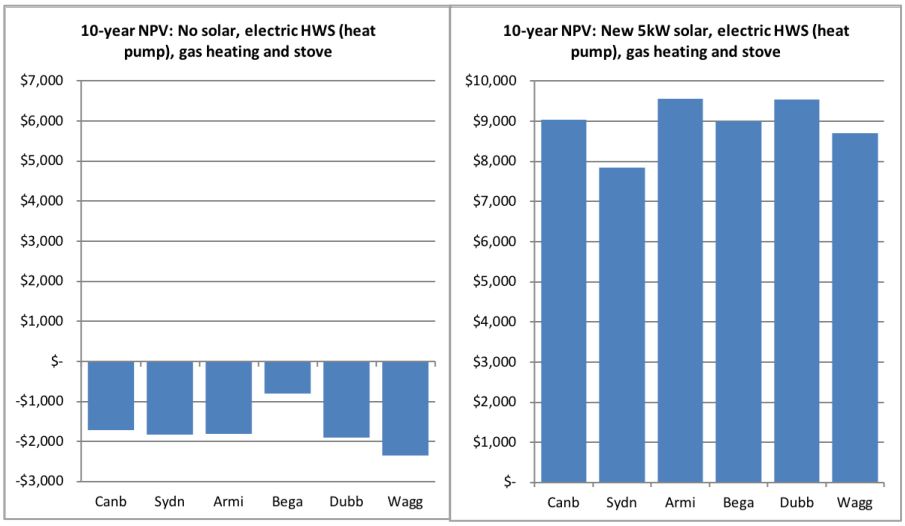
Many people prefer gas cooking. Going all electric with just a gas stove is still better value overall than having more appliances on gas in cooler climates. This choice gives good value everywhere except Dubbo, where it's marginal though tending toward negative, and Sydney and Wagga, where you're better off having everything on gas than just the stove. *Having solar with this choice brings a solid benefit.*



1D: Gas cooking and heating

Don't do it

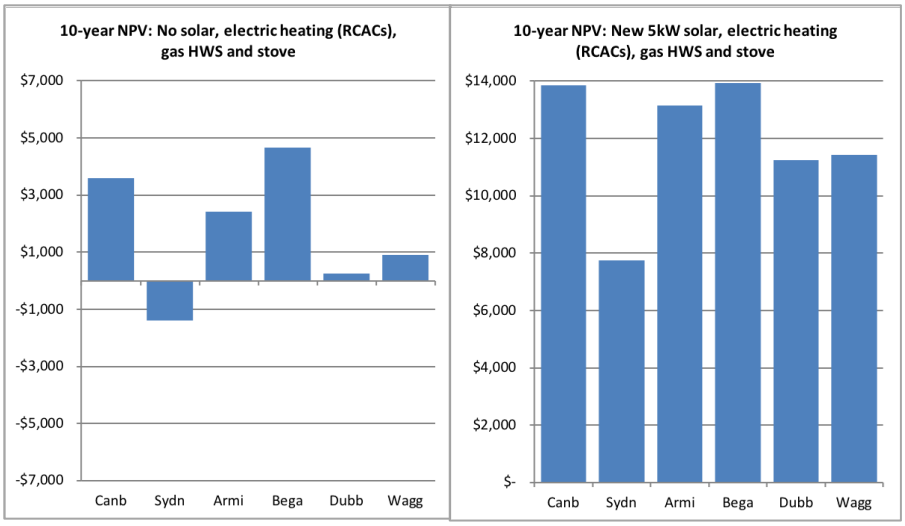
Since many people prefer gas for heating and cooking, how does that work out in a new large dwelling? Not so good. Since heat pump hot water doesn't compete well with gas in NSW climates, only having hot water on electricity doesn't produce enough value to make the fixed gas charge worthwhile. In Bega this is marginal – everywhere else sticking with gas for everything is a better choice.



1E: Gas hot water and cooking

Do it, but not in Sydney

Since many people prefer gas cooking and electrically-powered RCACs are generally more cost-effective than gas heating, what happens if you put hot water and cooking on gas but use RCACs for heating? Turns out this is a good choice for most places. High value in cooler places, marginal but tending toward positive elsewhere apart from Sydney. This really aligns with the underlying theme that dual fuel is good value in Sydney. *Note that bneefits with solar are very strong.*



Existing homes

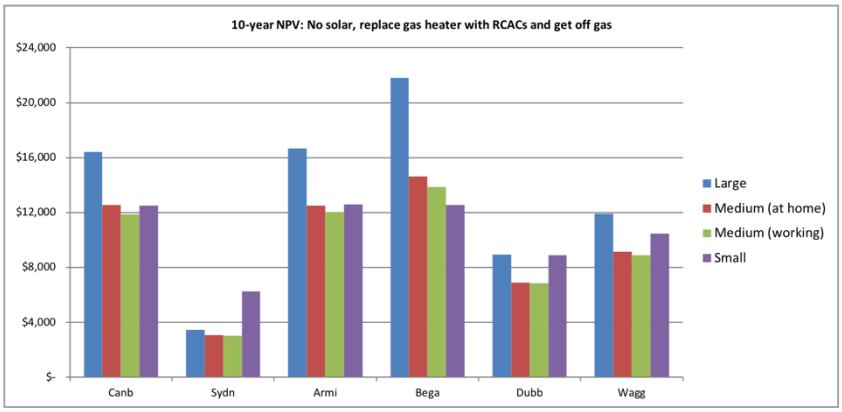
This section shows the economic outcomes of a range of different fuel-choice scenarios for four household types in five NSW locations – Sydney, Armidale, Bega, Dubbo, and Wagga Wagga – and Canberra, ACT.

2: If you only have one gas appliance

2A: Heater fails, replace with RCACs and get off gas

Go electric

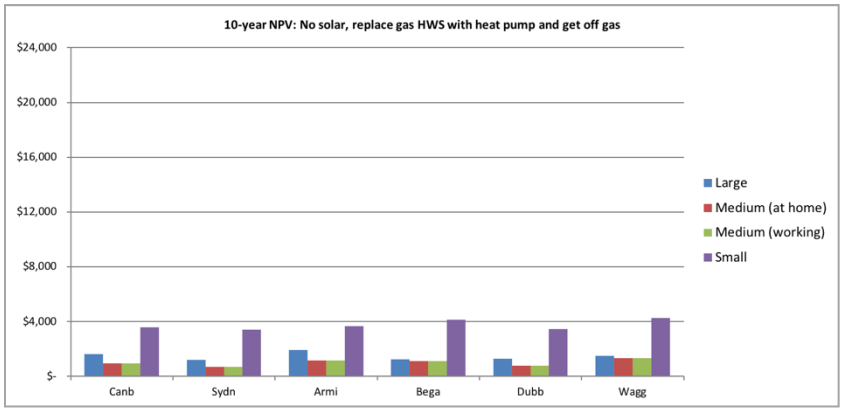
This is a solid choice, and is so for every location around Australia that we modelled. Heating is always cheaper overall with RCACs than with gas space heaters or ducted heating, even with the higher capital cost. When a heater is the only gas appliance, the value of getting rid of a fixed charge by cutting the gas connection is not offset by the extra capital cost of replacing appliances before the end of their lives.



2B: Hot water system fails, replace with heat pump and get off gas

Go electric:

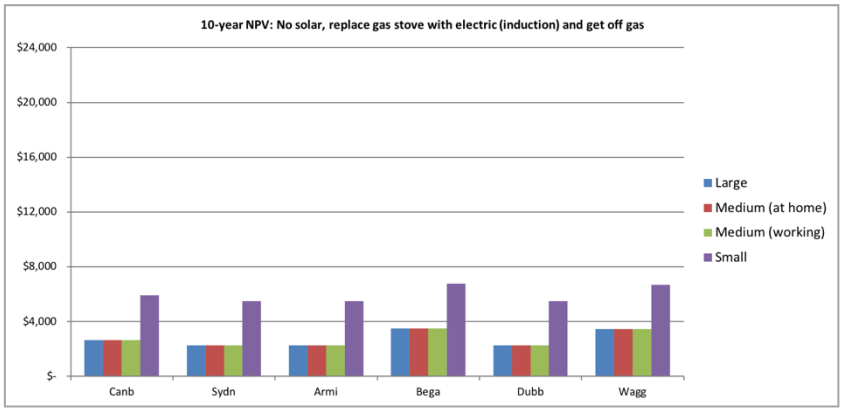
Heat pumps don't compete very well against modern gas hot water in NSW climates. When it's the only gas appliance, abolishing the fixed charge of the gas connection helps the economics. This is a strong choice for all small households and still a good one for medium and large ones. Only in Sydney and Dubbo does the value of less than $100/per year make it a marginal benefit. *Existing 2.5 kW solar PV increases value across the board and takes it above the $100 p.a. threshold for all but the at-home medium household in Sydney (which is just below it at $96).*



2C: Stove fails, replace with induction cooktop/electric oven and get off gas

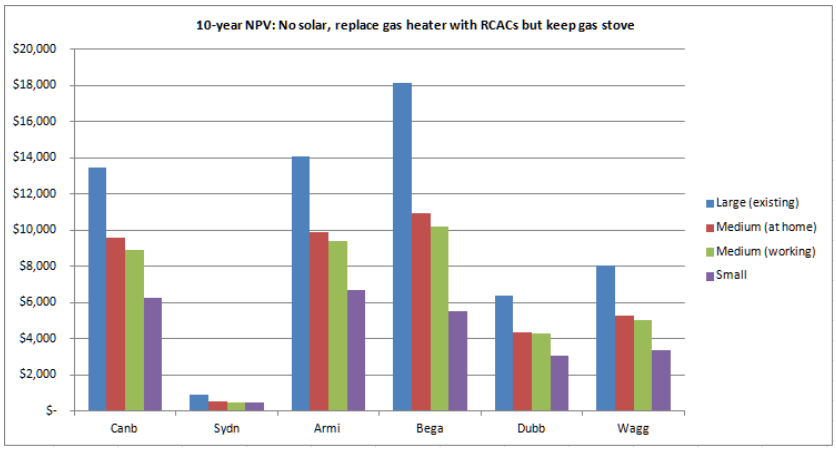
Go electric

Fuel switching cooking is only of economic value when it is the only gas appliance, and this gets the bonus of abolishing a fixed charge. This is mainly because the energy used by cooking is, on a household level, immaterial. The values shown in this chart are overwhelmingly the saving on the fixed charge.



3: If you have heating and cooking on gas

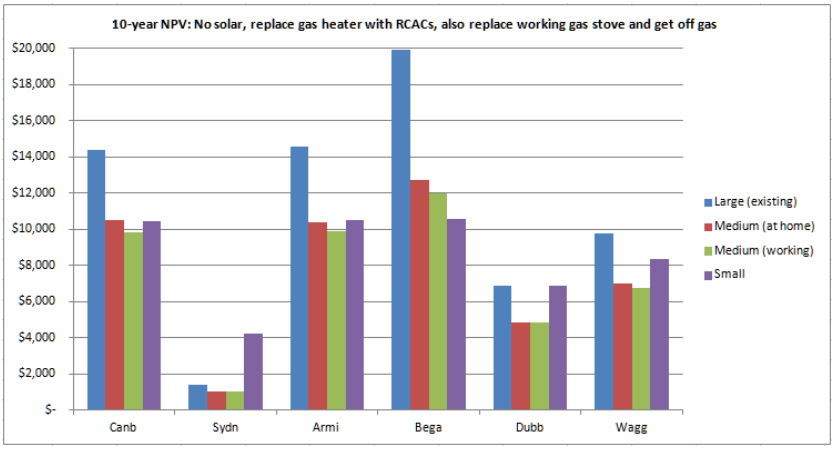
3A: Heater fails, replace with RCACs but retain gas stove



Go electric except in Sydney

The economic benefit of switching heating to RCACs is proportional to volume: larger households get greater value, and the at-home medium household gets marginally better value than the working one. Overall, there is clear value in all locations but Sydney. In Sydney, there is marginal value ($90 p.a. for a large house and around $50 p.a. for the others), but this is small enough to be outweighed by above average installation costs, or modest changes in behaviour higher-than-expected variations in fuel prices. Thus we consider Sydney an either/or case: both fuel choices have similar economic outcomes. This explanation should be moved to section 1 where the concept is first mentioned

3B: Heater fails, replace with RCACs and also replace working gas stove with induction, get off gas



Go electric

Fuel switching a working gas stove at the same time as a failed heater brings greater benefit than just replacing the heater. Even with the additional capital cost of replacing a second appliance that is not yet at end-of-life,[1] there is greater value in doing so with a gas stove if it allows you to remove the gas connection (and its unavoidable fixed charge). The value of this choice is proportionately larger for lower-consumption households because the fixed cost is more material when usage is low. The interaction between the fixed and variable costs mean that lower volume users pay an effectively higher rate per unit. This effect is exacerbated by declining block gas tariffs which make the variable cost alone cheaper for high-volume users and more expensive for low-volume users. Note that while for most Sydney household the benefit is modest (but still material), for small households it is significant. This is due to the greater value in avoiding the fixed charge for these households.

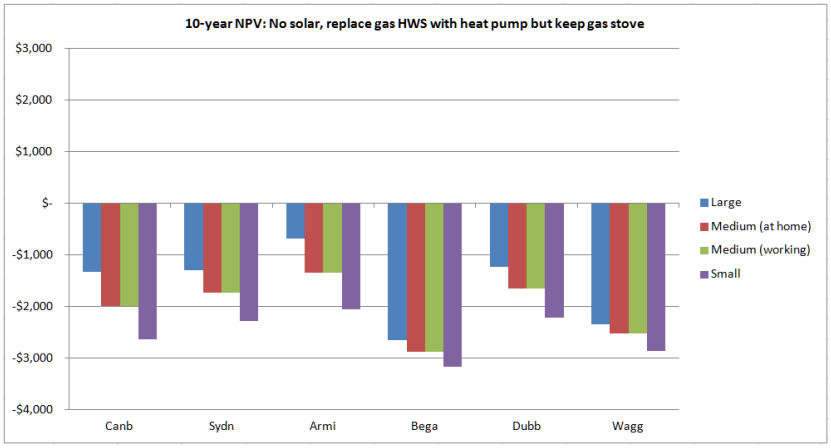
[1] This modelling assumes the full replacement cost of the induction stove as an additional capital expenditure. If the existing gas stove would have required replacement sometime over the ten-year period, this cost should be discounted by the capital cost otherwise incurred by replacing it with another gas stove. This would improve value in all scenarios by $1,000 or more, and in particular improve the Sydney value from marginal to significant.

4: If you have hot water and cooking on gas

4A: Hot water system fails, replace with heat pump but retain gas stove

Stick with gas

The relatively low energy use of efficient gas hot water systems means that heat pumps can't really compete when the gas connection and its fixed charge remain. The different outcomes in these locations reflect differences in relative price more than anything else. Note that in Armidale, the difference for a large household is marginal – this means that either fuel will have a close enough economic outcome as to not matter.

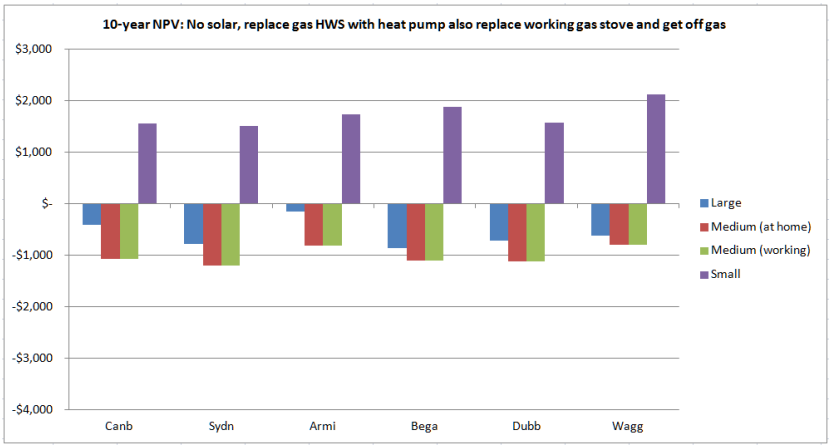


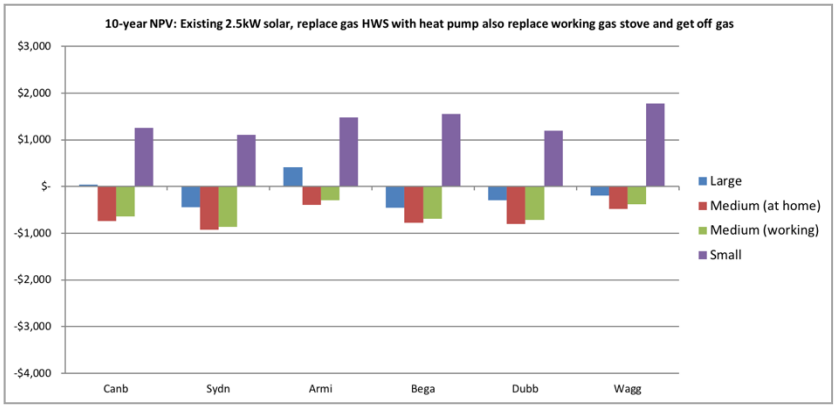
If these households had existing 2.5 kW solar PV, the value would still be negative but less so, due to the ability to use solar generation for some of the water heating. This would make all but the small household in Armidale marginal, along with the large household in Canberra, Sydney, and Dubbo.

4B: Hot water system fails, replace with heat pump and also replace working gas stove with induction and get off gas

Depends *WHO* you are (great for small households)…

This example really shows the marginal nature of fuel switching hot water in NSW. Small households should go electric – they benefit from losing the fixed charge for gas. For most other households it's close to marginal. Going electric is fairly neutral for large households in Armidale and Canberra, while sticking with gas is more likely to be a lower-cost choice for other large households and all medium ones.





If these households had existing 2.5 kW solar PV, the value is a little less (but still positive) for the small households (because additional electricity consumption is effectively more expensive per unit due to the greater impact of the fixed charge on lower consumption), but more positive for all other households, making it neutral for large households in all locations – as well as medium households in Armidale and Wagga Wagga – and marginal for medium households elsewhere.

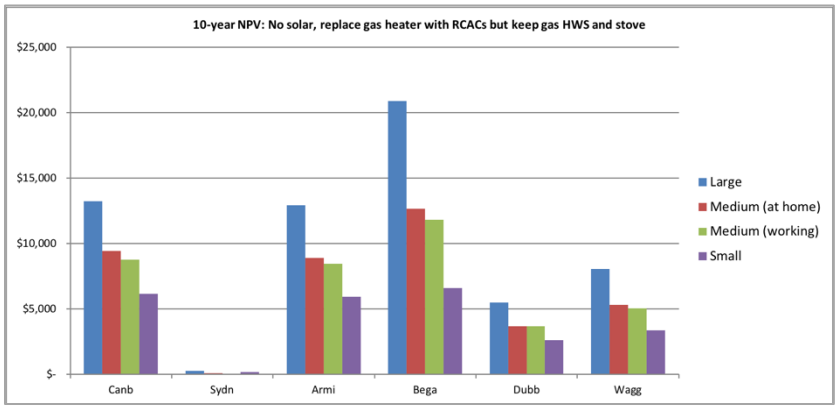
5: If you have heating, hot water, and cooking on gas

5A: Heater fails, replace with RCACs but keep hot water and stove on gas

Go electric (doesn't matter in Sydney…)

Replacement of gas heating with RCACs, even when keeping other appliances on gas, has significant value for all household types in all locations except Sydney, where it is a neutral choice.

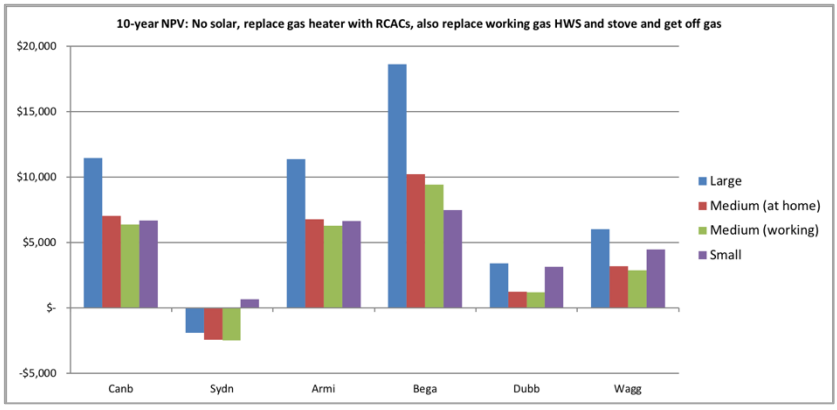
Existing 2.5 kW solar PV makes little difference, due to the low co-incidence of heating and solar generation times.



5B: Heater fails, replace with RCACs; also replace working gas hot water system with heat pump and gas stove with induction and get off gas

Go electric (except Sydney …)

Taking other appliances off gas at the same time brings lower value due to the additional capital cost[2], but still brings positive value outside of Sydney. In Sydney, small households get marginal value (making it an either/or case) due to the greater value of losing the second fixed charge. For larger Sydney households, gas is a better bet.



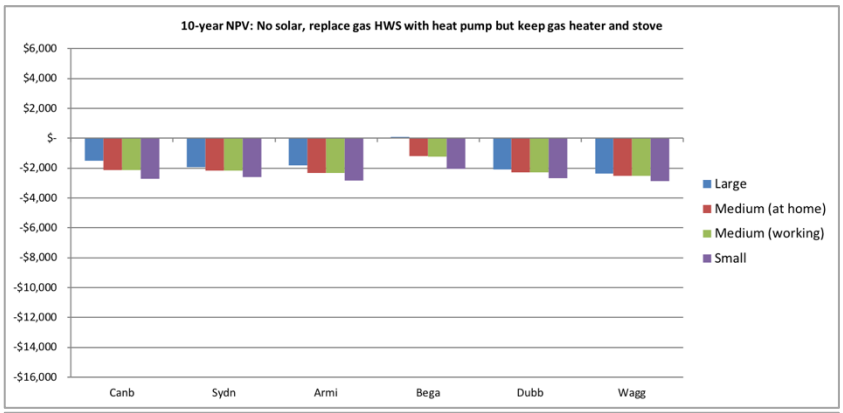
Existing 2.5 kW solar PV adds a little value in cooler climates, mainly for medium households.

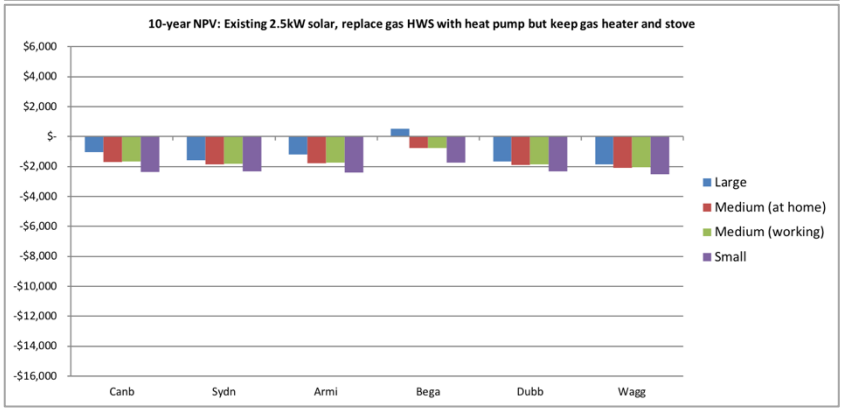
[2] This modelling assumes the full replacement cost of the heat pump HWS and induction stove as additional capital expenditure. If the existing appliances would have required replacement sometime over the ten-year period (fairly likely for the HWS), this cost should be discounted by the capital cost otherwise incurred by replacing it with another gas unit. This would improve value in all scenarios by $1,000 or more, but probably not enough to provide positive value for medium and large households in Sydney.

5C: Hot water system fails, replace with heat pump but keep heater and stove on gas

Stick with gas

These results are similar to *4A* above (the chart is scaled differently to better compare with *5D*). The relatively low energy use of efficient gas hot water systems means that heat pumps can't really compete when the gas connection and its fixed charge remain. The different outcomes in these locations reflect differences in relative price more than anything else. Interesting results in Bega – this fuel switch is neutral (i.e. either/or) for large households and close to marginal for medium ones. *Existing 2.5 kW solar PV adds a little value in all locations and for all households, making the switch more likely to be positive for large and medium households in Bega.*





5D: Hot water system fails, replace with heat pump; also replace working heater with RCACs and gas stove with induction and get off gas

Depends *WHERE* you are (great for cool climates)…

This switch is positive for all households in some places (cooler climates), with more mixed results in others. Sticking with gas is most valuable in Sydney – this is probably mostly due to cheaper gas prices and low heating loads. Value is marginal for medium homes in Wagga (while positive for others) and large homes in Dubbo (while positive for small). *Existing 2.5 kW solar PV improves value everywhere (due to handling hot water loads), making the switch marginal for medium homes in Dubbo and positive for them in Wagga. Sydney remains negative.*