Are we Cooking the Planet with Gas?

An Analysis of the Impact of Gas v Efficient Electric Residential Appliance Choices on C02e Emissions

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Executive Summary

The Alternative Technology Association (ATA) was funded by the Consumer Advocacy Panel (CAP) in 2014 to conduct a research project on the effect of the rising cost of natural gas on residential consumers in the National Electricity Market (NEM).

The project report (Are we still Cooking with Gas?) focused on determining the relative cost of electric and gas appliances used for space heating, water heating, and cooking. Six hypothetical housing scenarios were created to model the costs of each option and these were then applied to 26 locations within the NEM.

Using the energy loads established as part of ATA's economic analysis, this analysis has applied location-specific CO2-e emissions factors and calculated the relative environmental benefits (or impacts) of switching from gas to efficient electric appliances.

These calculations form the basis of a set of key observations and recommendations, as per below.

Key Observations

- The overriding observation is that CO2-e emissions, when switching all three end-uses traditionally fuelled by gas in combination to efficient electric appliances, are lower. This outcomes was consistent across household scenarios and across all gas zones/locations apart from one (Mildura, Victoria – where a small increase [4%] occurred as a result of the switch).

- When considered one a single appliance replacement basis:
  - space heating was consistently found to be less emissions intensive when being delivered by efficient electric appliances as opposed to gas;
  - the emissions impact of switching water heating varied by location – with all Victorian and some NSW/ACT gas zones/locations experiencing a modest increase in emissions with a switch to efficient electric; whilst SA, QLD and other parts of NSW experienced a reduction;
  - emissions associated with cooking experienced a modest increase across all gas zones/locations modelled;
  - where they occurred, the emissions increases were of a magnitude however that could be offset by purchasing accredited GreenPower at a maximum per household cost of approximately $10-$11 per year.

- The location of the town/gas zone has a strong correlation to the overall emissions total. Locations with colder climates and therefore a greater need for space heating have proportionately higher emissions for both gas and efficient electric appliances.

- The household's State is a key determinant of the difference in emissions when switching from gas to efficient electric appliances. Households in Tasmania (86% annual CO2-e reduction) and South Australia (44% annual CO2-e reduction) have the clearest emissions benefit for switching from gas to efficient electric appliances.

- Victoria has the lowest net emissions benefit in the NEM if switching from gas to efficient electric appliances. This can be attributed to Victoria's electricity generation resources which have the NEM's highest percentage of brown coal (Environment, 2014). Despite this, the benefit of switching from gas to efficient electric in Victoria is still clear (26% reduction).

- All household scenarios showed a net emissions benefit if switching from gas to efficient electric appliances, regardless of state/location. The largest benefit is under the 'Small House' scenario (43%) and the smallest benefit is 'LPG House' (26%).

- The largest single impact for Victorian houses can be made by switching from gas heating to reverse cycle air conditioning (RCAC). On average, across all housing scenarios, switching from gas to RCAC will result in a saving of 1.5 tonnes of CO2-e emissions (27% of the household total) per year.

Key Recommendations

1. The majority of households in the jurisdictions modelled can be confident of a net benefit to their annual CO2-emissions when switching all three gas end uses (space heating, water heating, cooking) in combination to efficient electric appliances. In some parts of Victoria (particularly the north west), householders may want to pay closer attention to their specific results and be prepared to make a small purchase of accredited GreenPower (or a similar offset product) to offset any minor increase.

2. If considering switching individual appliances and in particular water heating (in Victoria, ACT and parts of NSW) and cooking (all jurisdictions), householders should pay closer attention to their specific results and be prepared to make a small purchase of accredited GreenPower (or a similar offset product) to offset any minor increase.

1.0 Introduction

The Alternative Technology Association (ATA) was funded by the Consumer Advocacy Panel (CAP) in 2014 to conduct a research project on the effect of the rising cost of natural gas on residential consumers in the National Electricity Market (NEM).

The stated aim of this research was to:

> *"…understand in detail the impact of projected retail gas price rises on energy consumers – particularly, low income and vulnerable consumers - across the National Energy Market (NEM), and identify cost effective alternatives for household energy management, where they may exist." (ATA, 2014)*

ATA's project (Are we still Cooking with Gas?) focused on determining the relative cost of electric and gas appliances used for space heating, water heating, and cooking. Six hypothetical housing scenarios were created to model the costs of each option and these were then applied to 26 locations within the NEM.

As a volunteer on this project, this researcher was tasked with researching the capital and operational costs of various heating and cooking technologies. At the conclusion of this research, ATA's project team requested an analysis of the CO2 equivalent (CO2-e) emissions for the housing and location scenarios modelled in their research.

Using the energy loads established as part of ATA's economic analysis, this analysis has applied location-specific CO2-e emissions factors and calculated the relative environmental benefits (or impacts) of switching from gas to efficient electric appliances.

These calculations form the basis of a set of key observations and recommendations.

2.0 Methodology

Emissions factors associated with gas and electricity were calculated for three separate levels of analysis:

1. 26 town locations/gas zones across the NEM;
2. Average emissions per household by State; and
3. Average emissions per household by Household Scenario.

The calculation of CO2-e emissions for natural gas includes indirect emissions from extracting and transporting gas (Scope 2 emissions) as well as emissions from point of gas use within a home (Scope 3 emissions).

CO2-e emissions for natural gas are *location agnostic*. The ratio of CO2-e emitted per joule of energy does not vary with the household's location. Conversely, emissions for electricity are dependent on the mix of resources used for electricity generation in each state.

Gas and electricity emissions factors were sourced from the Australian Government's *National Greenhouse Accounts Factors* (2014).

Emissions for reverse cycle air conditioner (RCAC) units only include the electricity used for heating. Space cooling is not included as it cannot be compared with an equivalent natural gas service.

ATA's original report focused on the economics of switching from gas to electric appliances. The electric appliances chosen for their analysis were calculated to be the most economic units available over 10 years.

The choice of only efficient electric technologies is a key determinant in the outcome of both ATA's original analysis and the results of this CO2-e analysis. Simply switching from gas to less efficient electric appliances (e.g. resistance electric hot water) would alter the outcomes in this analysis.

Relevant emissions factors are listed in **Appendix A** in this report. Relevant inputs for calculating specific energy loads by appliance type, household type and household location have been derived directly from ATA's original report and are listed in **Appendix B**.

2.1 Fugitive Emissions

The inclusion of so-called 'fugitive emissions' associated with the extraction and transportation of natural gas provides a more complete picture of the emissions levels associated with natural gas appliances.

Methane released into the atmosphere in its raw form is a much more potent greenhouse gas than CO2. Some estimates state that methane is more than 20 times more potent than CO2 at trapping heat in the atmosphere (Howarth, 2014).

Including an accurate measure of fugitive emissions from natural gas extraction is essential for a comprehensive lifecycle analysis of CO2-e emissions of natural gas.

The latest peer-reviewed estimates of fugitive methane emissions from the US indicate that CO2-e emissions from natural gas extraction could be double the total lifecycle emissions previously calculated for natural gas (Howarth, 2014).

If this estimate is correct, then natural gas will have a higher GHG profile than oil or coal production.

Unlike the US, information about fugitive methane emissions in Australia is severely limited. Using US figures in Australia becomes problematic because the profile of the US natural gas industry is substantially different from Australia: the US industry is based on extracting methane from both shale and conventional gas wells, whereas in Australia natural gas is mined from coal seams and conventional gas wells (Manning, 2014).

Howarth (2014) estimates that fugitive emissions from shale gas extraction are almost twice that of conventional gas extraction. Fugitive emissions from coal seam gas extraction have not yet been sufficiently researched and there is currently limited information available.

2.1.1 AEMO Analysis

A report published by the Australian Energy Market Operator (AEMO) (2014) proposes figures for ‘downstream fugitive emissions’ (methane leakage from transportation and distribution) as well as ‘under-metering’ at the point of end-use. This report proposes between 2.4% and 4% across the eastern states of Australia.

These figures do not include emissions vented directly from the mining site, also known as ‘upstream emissions’. Upstream emissions can be the result of either deliberate venting as part of regular mining operations or potentially as inadvertent seepage through local soil/water in coal seam gas extraction (Day et al., 2014).

2.1.2 CSIRO Analysis

Research undertaken by the CSIRO (Day et al., 2014) of 43 coal seam gas (CSG) wells across New South Wales and Queensland estimates that fugitive emission levels are approximately 0.02% of the lifetime production of the wells.

This is substantially below the levels of ‘upstream’ emissions measured in recent US studies (1.4 – 3.3% by Howarth (2014)).

The CSIRO report notes three key caveats to their results. Firstly, the wells sampled by the CSIRO represent only 1% of Australia’s total CSG mining industry. Secondly, the wells surveyed were chosen by the CSG industry and cannot be taken as a representative sample of the industry overall.

Lastly, the CSIRO study only measured emissions from the well-head. It did not account for inadvertent emissions through mining equipment or via soil and water. The CSIRO study acknowledges the need for much greater research in this area.

2.1.3 Chosen Inputs

Given the dearth of quantitative data on fugitive gas emissions in Australia, this report has chosen to utilise a combination of two measures:

1. The median "downstream" emissions calculated by AEMO (2014) across eastern Australian states: **2.63%** of lifetime production; and

2. The midpoint estimate of "upstream" conventional gas extraction in the United States from Howarth (2014): **1.4%** of lifetime production. This assumes that the fugitive emission levels from conventional mining methods between Australia and US are equivalent.

This equates to a total fugitive emission level of **4.03%** of lifetime production of natural gas wells. It should be noted that this is a *conservative* estimate given that it does not account for the proportion of unconventional gas extraction in Australia.

As previously stated, US studies estimate that fugitive upstream emissions from unconventional extraction are almost twice those of conventional extraction (Howarth, 2014). The unconventional extraction proportion has not been included because there is simply not enough data available to assess its impact or to compare Australia's emissions levels for unconventional gas extraction with those in the US.

2.1.4 Conversion to CO2-e

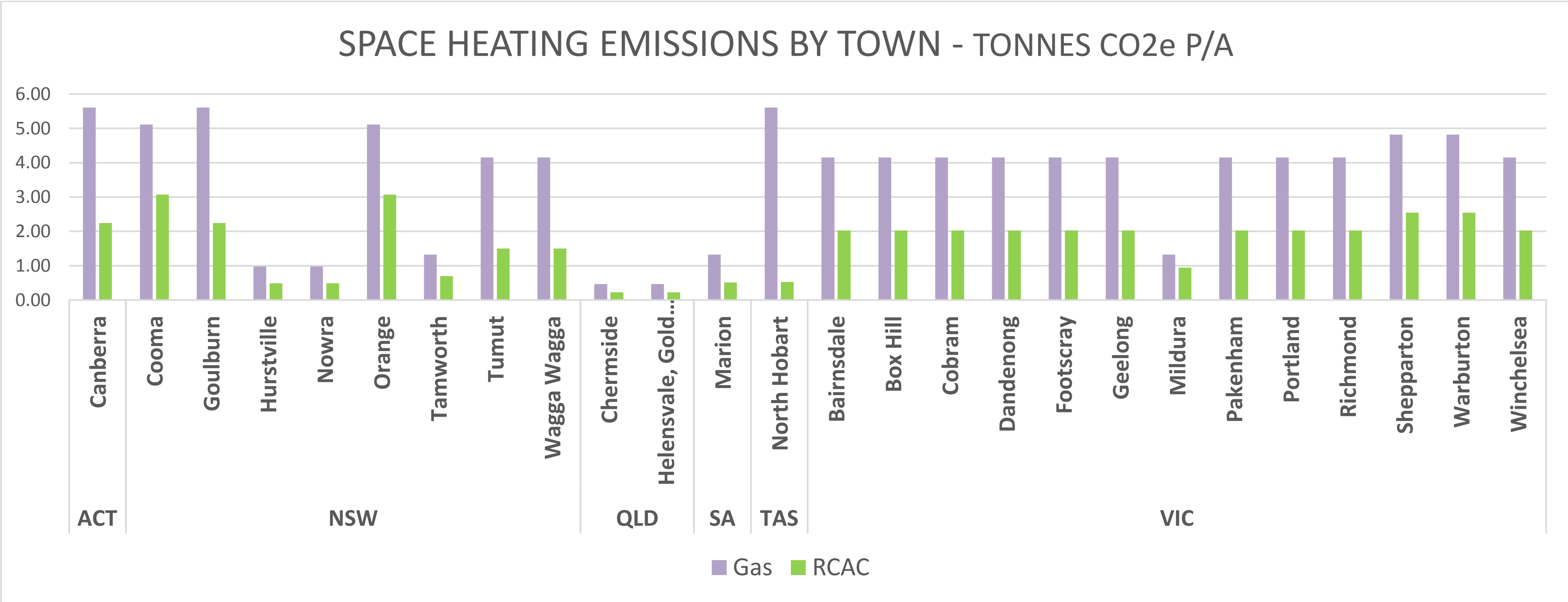
AEMO's (2014) report provides a conversion for raw methane to CO2 equivalent emissions: **0.8 kg CO2-e/MJ**. Applying this conversion rate to the fugitive emissions percentage of 4.03% has resulted in a total fugitive emissions factor of **0.03224 kg CO2-e/MJ**.

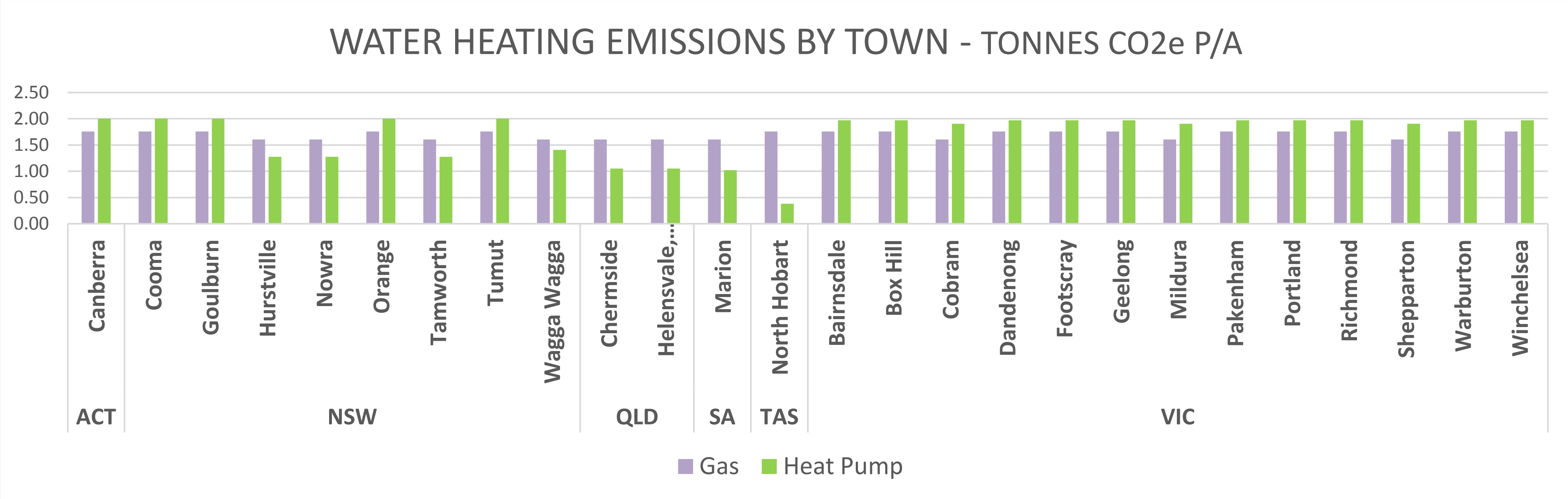
This factor has been combined with the point-of-use combustion factor listed in **Appendix A**.

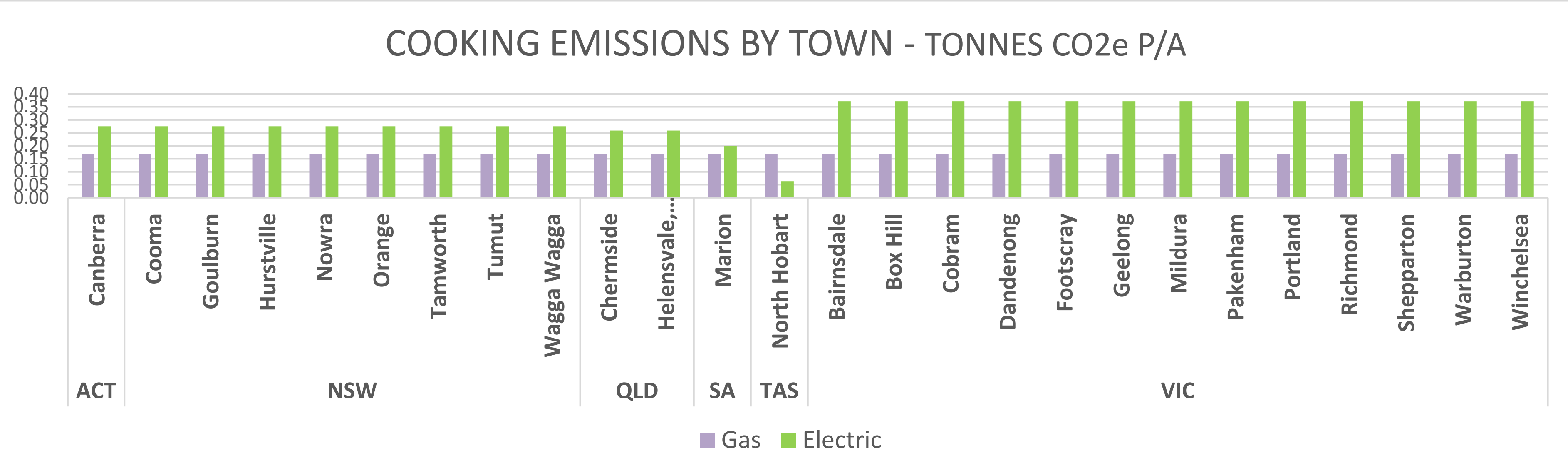
3.0 Results

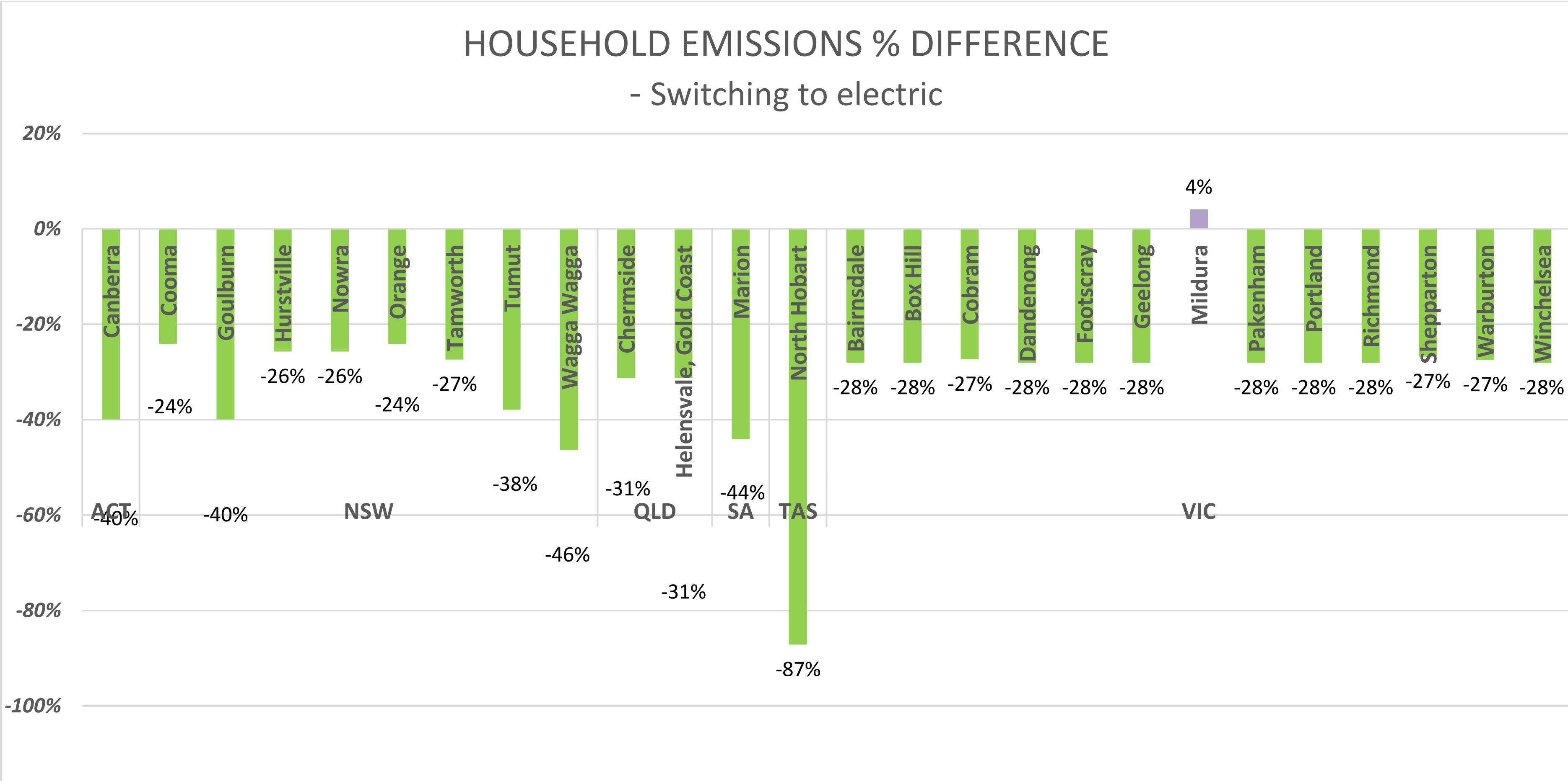
3.1 Emissions by Location/Gas Zone

Emissions were calculated for both gas and electric appliances for each of the three end uses (space heating, water heating and cooking) in all 26 gas zones. The below series of graphs illustrates the differences in CO2-e emissions between gas and electric appliances for each location for *Household Scenario 1: Reference Home*. The towns are organised by State to provide some geographical context.




WATER HEATING EMISSIONS BY TOWN - TONNES CO2e P/A
2.50
2.00
1.50
1.00
0.50
0.00
Canberra
Cooma
Goulburn
Hurstville
Nowra
Orange
Tamworth
Tumut
Wagga Wagga
Chermside
Helensvale,...
Marion
North Hobart
Bairnsdale
Box Hill
Cobram
Dandenong
Footscray
Geelong
Mildura
Pakenham
Portland
Richmond
Shepparton
Warburton
Winchelsea
ACT
NSW
QLD
SA
TAS
VIC
Gas
Heat Pump


COOKING EMISSIONS BY TOWN - TONNES CO2e P/A
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Canberra
Cooma
Goulburn
Hurstville
Nowra
Orange
Tamworth
Tumut
Wagga Wagga
Chermside
Helensvale,...
Marion
North Hobart
Bairnsdale
Box Hill
Cobram
Dandenong
Footscray
Geelong
Mildura
Pakenham
Portland
Richmond
Shepparton
Warburton
Winchelsea
ACT
NSW
QLD
SA
TAS
VIC
Gas
Electric


HOUSEHOLD EMISSIONS % DIFFERENCE
- Switching to electric
20%
0%
-20%
-40%
-60%
-80%
-100%
Canberra -40%
Cooma -24%
Goulburn -40%
Hurstville -26%
Nowra -26%
Orange -24%
Tamworth -27%
Tumut -38%
Wagga Wagga -46%
Chermside -31%
Helensvale, Gold Coast -31%
Marion -44%
North Hobart -87%
Bairnsdale -28%
Box Hill -28%
Cobram -27%
Dandenong -28%
Footscray -28%
Geelong -28%
Mildura 4%
Pakenham -28%
Portland -28%
Richmond -28%
Shepparton -27%
Warburton -27%
Winchelsea -28%
ACT
NSW
QLD
SA
TAS
VIC

The previous charts illustrate the following:

- There is a consistent reduction in emissions associated with space heating when switching from gas to efficient electric appliances across all gas zones – even in Victoria. This is largely due to the significant reduction of energy input required by efficient RC air conditioners as compared with their gas counterparts;
- In all Victorian and some NSW and ACT locations, emissions associated with water heating slightly increase when switching from gas to efficient electric appliances;
- In all gas zones with the exception of Tasmania, emissions associated with cooking increase when switching from gas to efficient electric appliances. This increase is significant in Victoria; whilst being more moderate in other states/jurisdictions;
- When all three end uses are combined as one complete switch away from gas to efficient electric, the emissions associated with all three end uses reduce in all gas zones with the exception of Mildura in Victoria (with a modest 4% increase).

There also exists a strong link between higher heating requirements and emissions levels. Locations in the ACT, Tasmania, most of Victoria and some parts of NSW (e.g. Orange, Cooma), classified as 'heating dominated' locations (ATA, 2014), have the highest emissions results across both gas and electric appliances. The one exception to this is the emission level for electric appliances in North Hobart which have annual CO2-e emissions 87% below gas appliances.

A correlation also appears to exist between state/jurisdiction and emissions difference between gas and efficient electric appliances. The chart above illustrates how Victorian gas zones have the lowest average difference in favour of electric appliances. This implies that the resource used for electricity generation within each state has a significant effect on emissions levels. Victoria's emissions-intensive electricity generation results in the closest result for gas appliance emissions as compared with electric. However even in Victoria, taking into account all three end uses, the emissions difference is still firmly in favour of efficient electric appliances.

At a broad level, the results above point to a potential emissions benefit in a majority of locations when switching from gas to efficient electric for all three end uses. For those households wanting to contain their carbon footprint with only one or two of the above end uses on gas (specifically water heating and/or cooking), the emissions increases associated with switching to efficient electric (where they occur) are of a magnitude that a small amount of GreenPower or similar carbon offset product could be purchased to compensate.

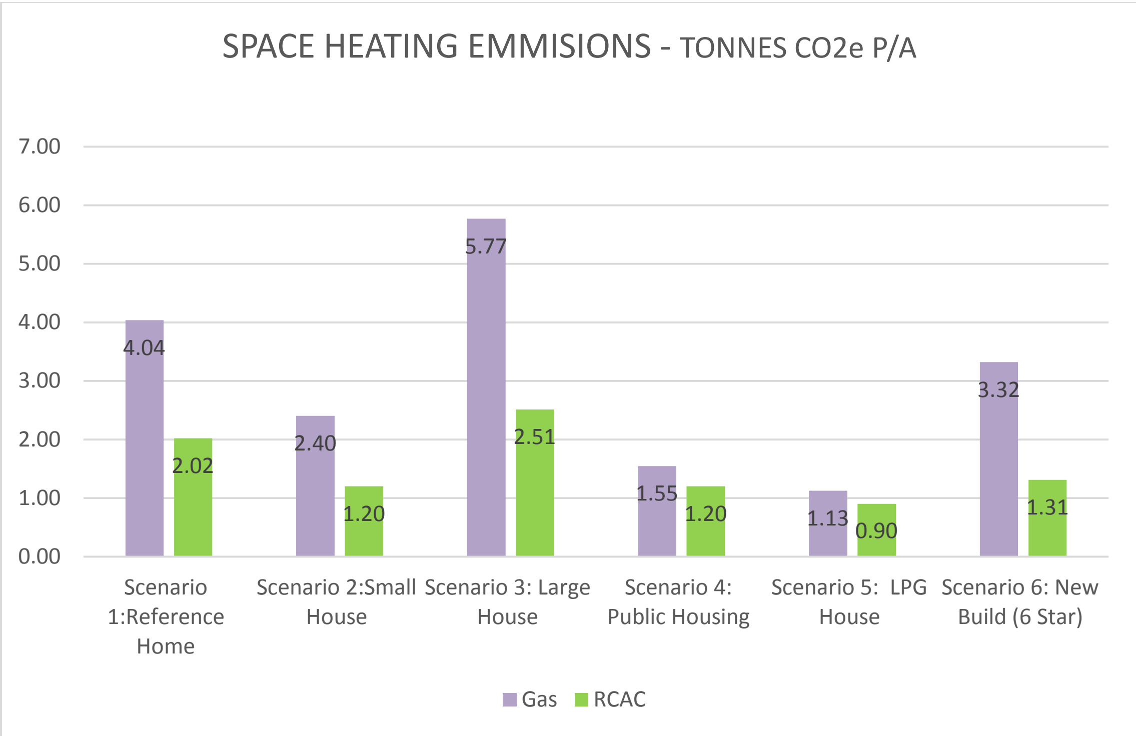
A worst case example of this would be the emissions increase associated with switching water heating in Mildura, Victoria (i.e. 0.3 tonnes per annum increase). At current prices[1], this equates to an equivalent GreenPower purchase cost of $11 per year.

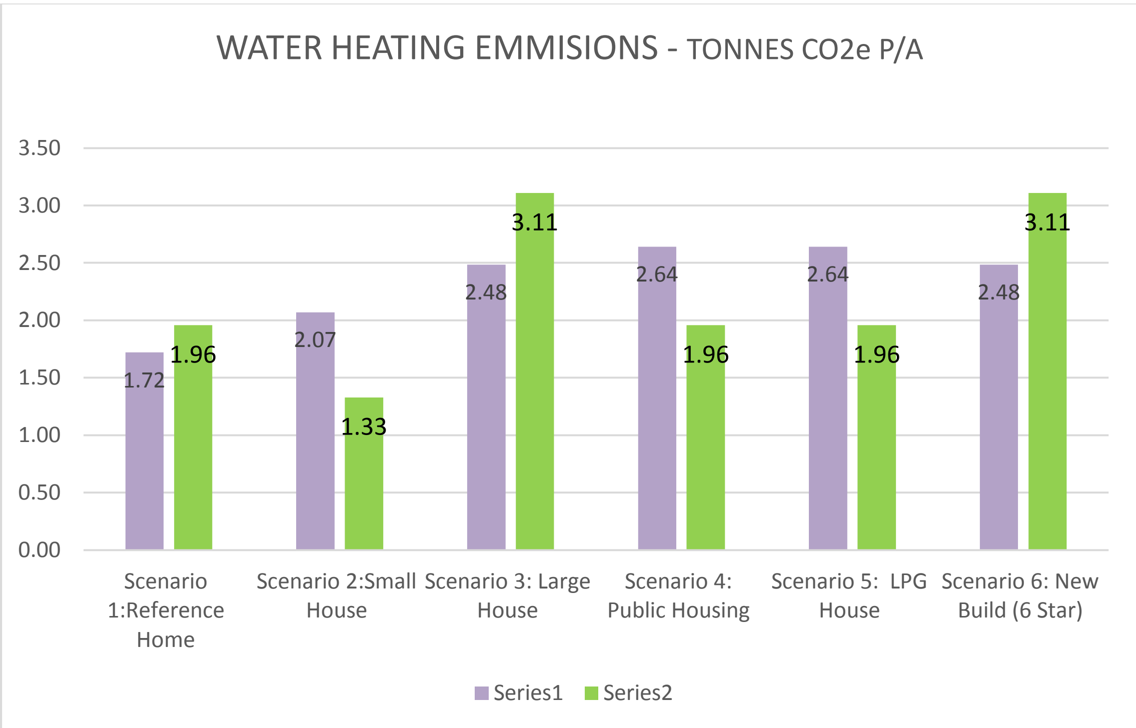
[1] Available through: https://www.climatechest.org.au/host/ata

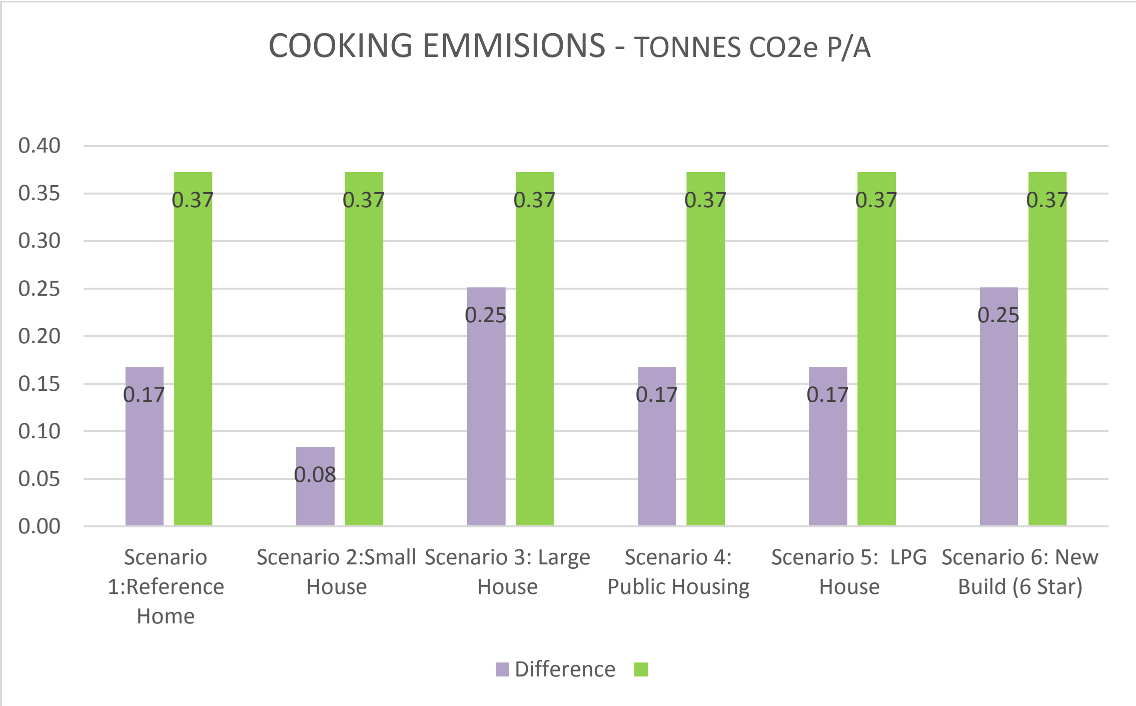
3.2 Emissions by Household Scenario

Emissions were also calculated for both gas and electric appliances by each of the six Household Scenarios and across all 26 gas zones.

A Household Scenario 'average' was then derived from the calculated gas zone emissions data for all states within the NEM. The below series of charts presents the results for Victoria (as the likely worst geographic location given the emissions intensity of its electricity supply) and illustrates the differences in CO2-e emissions between gas and electric appliances for each end use.







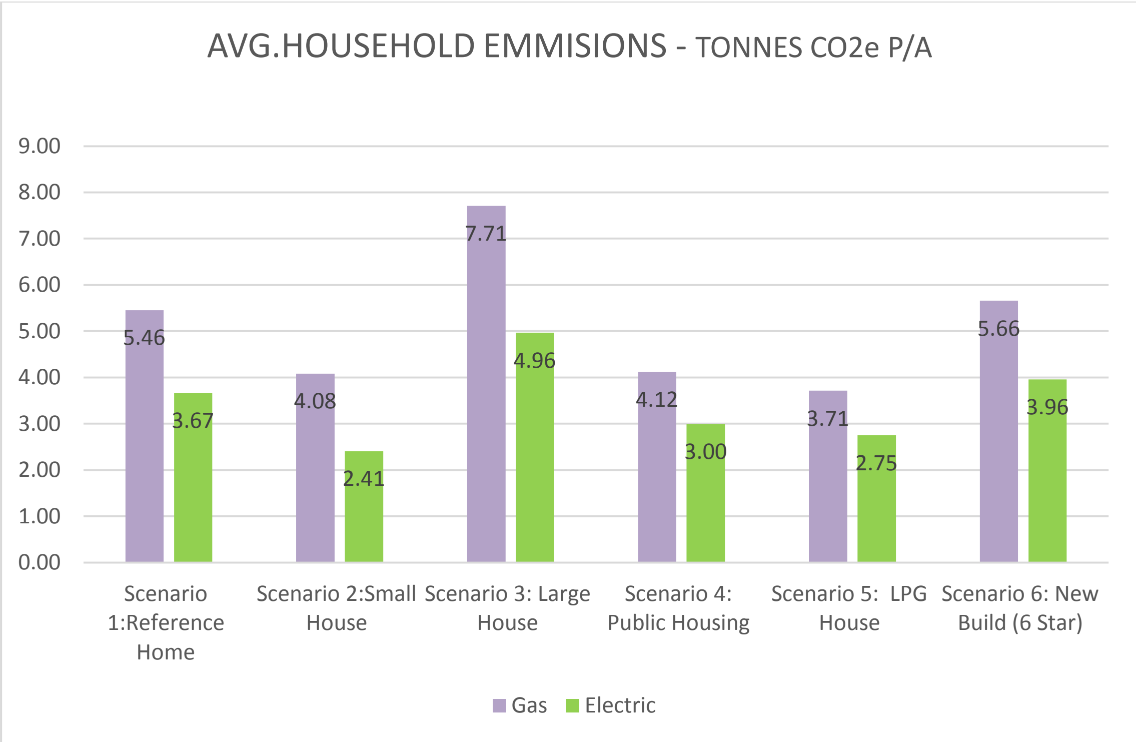
As can be seen, switching from gas to electric leads to a reduction in emissions in Victoria for:

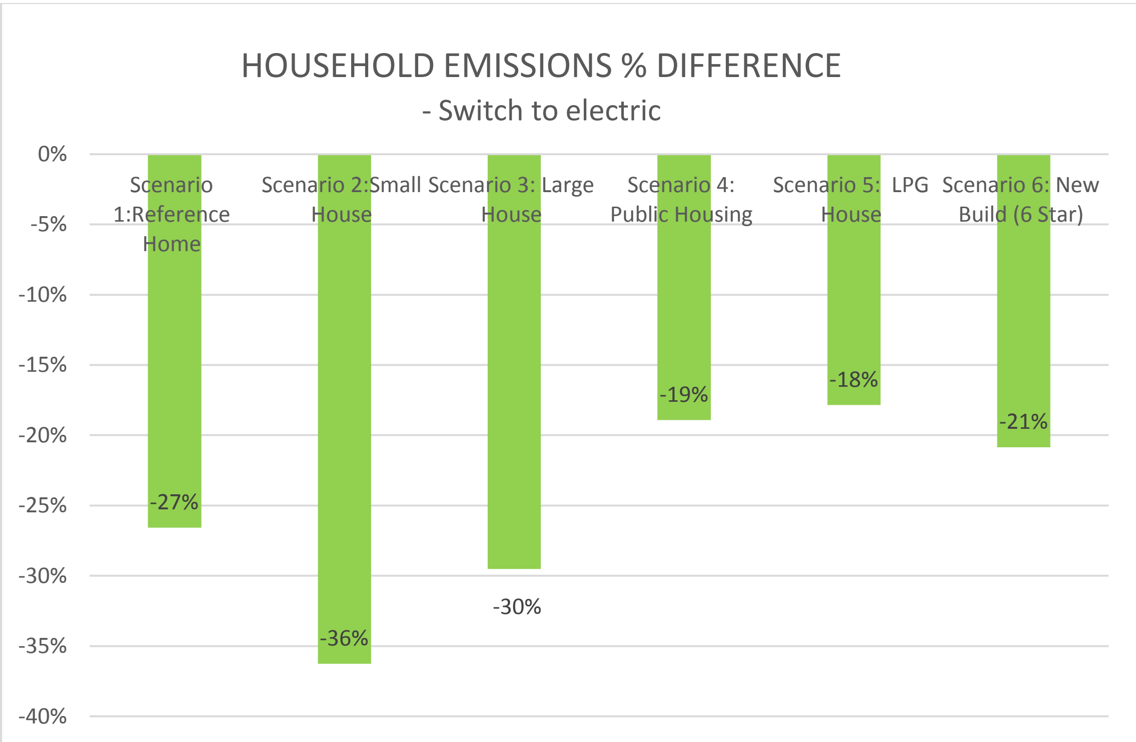
- all household types for space heating; and
- three of the six household types for water heating (with the *Reference*, *Large* and *New Build* homes all increasing modestly).

Switching cooking from gas to electricity in Victoria however leads to an increase in C02e emissions of between 0.12 and 0.29 tonnes per annum, dependent upon household type. To again place these emissions increases in context, at a currently available price of $35/tonne[2], accredited GreenPower can be purchased to offset this greenhouse impact for an annual fee of between $4.20 and $10.15.

When considered together, the combination of a switch from gas to electric for all three end uses leads to a decrease in emissions in Victoria for all household types, as demonstrated in the charts below:

[2] Available through: https://www.climatechest.org.au/host/ata





As mentioned, these results (by Household Scenario, for Victoria) can be considered a worst case scenario in the context of all of the states/jurisdictions modelled. In the small number of instances where emissions increases still occur in the other states/jurisdictions, they will be of an even smaller magnitude that the GreenPower cost impact outlined above.

4.0 Conclusions

This analysis indicates an overall CO2-e emissions benefit in using efficient electric appliances instead of gas across almost all gas zones modelled in the original ATA project.

Where they occur, emissions increases associated with specific locations or due to individual appliance switches are of a magnitude that can be offset by only a tiny amount of a relevant (and high quality) offset product, purchased annually.

In addition, the modelling did not take into account the potential of any existing solar photovoltaic (PV) system to serve part of the new efficient electric appliance load at any individual home. With over 1.5 million Australian households now having rooftop PV, this would serve to further reduce the number and magnitude of scenarios where small emissions increases where found with the switch to electric.

It can also be argued that in the future, the modelled emissions impacts of switching to efficient electric will likely improve, given:

- Australia's electricity supply is getting cleaner as more renewables are installed; and
- efficient electric appliances continue to increase in efficiency.

The inclusion of a fugitive emissions factor in the analysis proves to be a key determinant of the overall result across all scenarios and locations. As previously stated, the inclusion of a fugitive emissions factor (even as conservative an estimate as the one used in this analysis) is essential in determining the true impact of switching between gas and efficient electric appliances.

In addition, this analysis also reveals a strong correlation between household location and annual CO2-e emission levels. The location determines the two strongest contributing factors for emission levels: namely, the required energy for space heating and the type of energy resources used in the generation of electricity for that state.

The variation of emission levels for the different housing scenarios need to be considered in combination with a household's location. This analysis indicates that there is no significant correlation between housing scenarios and average annual emission levels, other than a loose correlation between house size and emissions level.

4.1 Suggested Future Research

Suggestions for further research include a deeper investigation of the source of electricity (e.g. coal, nuclear, renewable energy) in each location. This would entail sourcing the 'energy mix' for each location's electricity retailers and distributors. Obtaining location-specific, rather than State-specific, emissions information will improve the reliability of the emissions results.

The rate of fugitive emissions level from natural gas extraction will need to be refined once more Australia-specific information becomes available on conventional and unconventional extraction. The CSIRO is currently undertaking further research into fugitive emissions leakage but this is not expected to be ready for several years (Manning, 2014).

Another area of further research is to combine the results of ATA's original paper and the results of this emissions analysis. Combining both sets of data would allow:

1. A study of the correlation between emissions levels and the cost-benefit of switching from gas to electric in each location.
2. Combining both sets of analysis to provide recommendations to address both the economic and environmental impact of switching from gas to electric. This could be of use to not-for-profits, local councils, and state governments who are interested in providing a more holistic approach to promoting efficient energy use in residential housing.
3. An estimate of the economic cost/benefit of reducing household CO2-e emissions. Governments wishing to focus on households as part of a national or state emissions reduction scheme can accurately assess the economic impact for each household of switching to less emission intensive appliances.

Appendix A: Emissions Factors

Table 1: Scope 3 Emission Factors – Natural Gas for a product that is not ethane (inc Coal Seam Gas)

State or Territory	Natural Gas EF for including scope 1 & fugitive emissions	Natural Gas EF for scope 1 - Point of use	Natural Gas EF - Fugitive emissions
	kg CO2-e /MJ	kg CO2-e /MJ	kg CO2-e /MJ
ALL STATES AND TERRITORIES	0.08372	0.05148	0.03224

(Environment, 2014)

Table 2: Scope 2 & 3 Emissions Factors – Consumption of Purchased Electricity by End Users

State	EF for Scope 2		EF for Scope 3		Full Fuel Cycle EF (EF for Scope 2 + EF for Scope 3)	
	A	B	C	D	E	F
	kg CO2-e/kWh	kg CO2-e/GJ	kg CO2-e/kWh	kg CO2-e/GJ	kg CO2-e/kWh	kg CO2-e/GJ
NSW	0.86	238	0.13	37	0.99	275
ACT	0.86	238	0.13	37	0.99	275
VIC	1.18	329	0.15	42	1.34	371
QLD	0.81	224	0.13	35	0.93	260
SA	0.61	169	0.11	30	0.72	199
WA	0.76	211	0.07	18	0.83	230
TAS	0.2	56	0.03	7	0.23	63
NT	0.68	189	0.1	28	0.78	216
AUSTRALIA	0.85	237	0.12	33	0.97	270

(Environment, 2014)

Appendix B: Relevant ATA Report Inputs

Table 3: No. of Rooms & Total Heated Area, per Household Scenario

	Scenario 1: Reference Home	Scenario 2: Small House	Scenario 3: Large House	Scenario 4: Public Housing	Scenario 5: LPG House	Scenario 6: New Build (6 Star)
No. Rooms to be Heated	Up to 6	Up to 4	Up to 8	Up to 4	Up to 2	Up to 8
Total Heated Area (m^2)	**120**	**70**	**160**	**70**	**40**	**160**

(ATA, 2014)

Table 4: Annual RC Air Con Energy Use by Climate Location & Household Scenario, kWh

Climate	Location	Scenario 1: Reference Home	Scenario 2: Small House	Scenario 3: Large House	Scenario 4: Public Housing	Scenario 5: LPG House	Scenario 6: New Build (6 Star)
Balanced Moderate Demand	Adelaide	703	418	873	418	313	440
Balanced Moderate Demand	Sydney	488	290	607	290	218	278
Heating Dominated	Melbourne	1,429	849	1,776	849	637	1,429
Heating Dominated	Tullamarine	1,899	1,133	2,368	1,133	853	1,735
Heating dominated High Demand	Canberra	2,267	1,353	2,828	1,353	1,019	1,454
Heating dominated High Demand	Orange	3,096	1,848	3,862	1,848	1,392	1,929
Low Demand	Brisbane	242	144	301	144	108	117

(ATA, 2014)

Table 5: Annual Gas Appliance Energy Use by Climate Location & Household Scenario

Climate	Location		Scenario 1: Reference Home	Scenario 2: Small House	Scenario 3: Large House	Scenario 4: Public Housing	Scenario 5: LPG House	Scenario 6: New Build (6 Star)
Balanced Moderate Demand	Adelaide	MJ pa	15,497	8,893	18,784	8,906	6,477	9,404
		kWh pa	38	24	46	24	16	46
Balanced Moderate Demand	Sydney	MJ pa	10,767	6,179	13,050	6,187	4,500	5,946
		kWh pa	69	43	84	43	29	84
Heating Dominated	Melbourne	MJ pa	45,853	26,748	65,505	18,110	13,171	32,571
		kWh pa	235	176	353	44	29	353
Heating Dominated	Tullamarine	MJ pa	53,760	31,360	76,800	21,232	15,442	56,286
		kWh pa	235	176	353	44	29	353
Heating dominated High Demand	Canberra	MJ pa	64,193	37,446	91,705	25,353	18,438	47,143
		kWh pa	230	173	346	43	29	346
Heating dominated High Demand	Orange	MJ pa	60,252	34,576	73,030	34,626	25,183	36,291
		kWh pa	69	43	84	43	29	84
Low Demand	Brisbane	MJ pa	5,340	3,064	6,472	3,069	2,232	2,511
		kWh pa	16	10	19	10	7	19
Heating Dominated	Melbourne (Gas wall units)	MJ pa	31,609	18,110	38,195	18,110	13,171	18,992
		kWh pa	71	44	85	44	29	85
Heating dominated High Demand	Canberra (Gas wall units)	MJ pa	44,252	25,353	53,471	25,353	18,438	27,488
		kWh pa	69	43	84	43	29	84

(ATA, 2014)

Table 6: Annual Gas & Electricity Consumption, ATA Modelled Hot Water Systems

City	Household Size	Hot Water Load	Gas Storage (5 stars)	Gas Instantaneous (5 stars)		Heat Pump
		L/day	MJ pa	kWh pa	MJ pa	kWh pa
Brisbane	Small	136	N/A	68	12716	792
Brisbane	Medium	200	19170	71	18700	1131
Brisbane	Large	384	27788	N/A	N/A	1815
Sydney	Small	136	N/A	68	12716	887
Sydney	Medium	200	19170	71	18700	1291
Sydney	Large	384	27788	N/A	N/A	2057
Canberra	Small	136	N/A	68	14189	1139
Canberra	Medium	200	20980	71	20620	2022
Canberra	Large	384	30249	N/A	N/A	2636
Adelaide	Small	136	N/A	68	12716	963
Adelaide	Medium	200	19170	71	18700	1423
Adelaide	Large	384	27788	N/A	N/A	2269
Melbourne	Small	136	N/A	68	14189	1001
Melbourne	Medium	200	20980	71	20620	1472
Melbourne	Large	384	30249	N/A	N/A	2335
Hobart	Small	136	N/A	68	14189	1098
Hobart	Medium	200	20980	71	20620	1655
Hobart	Large	384	30249	N/A	N/A	2633

(ATA, 2014)

Table 7: Energy Use & Efficiency of Gas and Electric Cooking Appliances

Type	Energy input	Energy input	Efficiency at point of use	Energy Output
Cook top	*MJ/pa*	*kWh/pa*	*%*	*MJ/pa*
Natural Gas	1,200	333	40%	480
Induction	600	167	80%	480
Ceramic	667	185	72%	480
LPG	691	192	70%	480
Oven				
Natural Gas	800	222	7%	56
Electric	400	111	14%	56
LPG	560	156	10%	56
Total				
Natural Gas	2,000	556		
Electric Induction	1,000	278		
Electric Ceramic	1,067	296		

(ATA, 2014)