LPG AUSTRALIA

SUBMISSION TO THE REGULATION IMPACT STATEMENT: FOR CONSULTATION

PHASING OUT GREENHOUSE-INTENSIVE WATER HEATERS IN AUSTRALIAN HOMES

25 MARCH 2010

The purpose of this Submission is to record the responses of the working group of LPG Australia to the consultation RIS presented by the Federal Government Department of Environment, Water, Heritage and the Arts (DEWHA).

References: A. The National Framework for Energy Efficiency – RIS: Phasing out Greenhouse-Intensive Water Heaters in Australian Homes and Appendices.

See Distribution.

Introduction:

LPG Australia welcomes the opportunity to comment on The National Framework for Energy Efficiency – RIS: Phasing out Greenhouse-Intensive Water Heaters in Australian Homes and Appendices (RIS) which identifies and assesses the impact of phasing out electric storage hot water in existing Australian homes on the national green-house gas emissions.

This submission responds to the RIS in three ways:

a. Responding to all relevant questions raised within the RIS;

b. Offering experience gained from the Australian gas industry, and;

c. Challenging several assumptions and assertions within the RIS particularly in reference to LPG and its role as an appropriate fuel source for domestic hot water.

The three approaches will be amalgamated in the responses to the questions raised on Page 14 of the RIS.

Executive Summary:

Energy consumption per capita in most first world nations has increased rapidly for many years, and Australia is no exception. This is despite improvements in the efficiency of domestic appliances.

In Australia, vast coal reserves have fed a sprawling power generation and distribution system, delivering low-cost electricity to industry and consumers, and launching Australia's increasing living standards to become a major global greenhouse gas (GHG) contributor / polluter.

If GHG reductions are to be achieved in Australia, then clearly;

a. It is essential that any GHG reduction scheme (abatement scheme) operates uniformly and nationally, free of the vagaries of inconsistent and at times conflicting state based regulations. The proposed legislation must be applied nationally.

b. Reduction in domestic GHG emissions is a small but important part of the a bigger national reduction scheme;

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b. The appliance life, energy cost and energy consumption data used in the calculations are at odds with manufacturers' and suppliers' data obtained from real-world installations across Australia, and;

c. The Australian Standard relating to heat pump performance is in need of review in light of the real-world performance data now available, and the current performance data is of questionable validity.

The working group makes the following responses to the questions contained within the RIS.

Responses to Questions (Page 14 of RIS):

1) Do you support the proposal?

The proposal embodies a process by which domestic GHG emissions may be reduced, but not eliminated. Such a proposal must be supported as part of a larger strategy that assesses the GHG impact of coal-fired power stations, large industries and metals refining. Several "carbon reduction schemes" have been developed which build part of the larger strategy. LPG Australia broadly supports proposal S3.

2) Agreement with proposed GHG-intensity criteria?

Although we do not agree with the precise estimates of emission intensity of water heater types shown in Figure 11, we agree with the large difference in emissions intensity between electric resistance water heaters and all other types, as shown there. We agree with the RIS that this large difference provides a robust basis for defining a group of "greenhouse intensive" water heater types, for the purpose of the proposed measure.

The proposed GHG-intensity criteria act as a rough guide to differentiate product types, but some efficiency data in Table 6[1] seems to be inaccurate:

- Electricity – Highest Efficiency at 0.90 is achieved by recent models complying with the latest MEPS levels. Older models, of which most of the population of electric water heaters consist, would be much lower.
- Gas IWH – Highest Efficiency at 0.75 has not considered gas condensing IHWS at 0.90 or over (several manufacturers have a range of condensing gas water heaters in Australia).
- Gas SWH – Highest Efficiency at 0.78 has not considered the 5 Star gas storage units available in Australia with higher ratings up to 0.90.
- Heat Pump – Lowest Efficiency at 2.2 is highly doubtful. The Australian Standards used to make those calculations are under review (amendment in draft stage), and field experience has shown some heat pump units operate largely in "resistive heating mode (boost)" in many cooler climatic regions. With the stored water temperature of 60°C and the ambient at 5°C the COP is around 1.0. Many heat pumps have resistive

heating boosters, and when this required, the COP falls well below 1.0. This does not seem to have been taken into account.

- Some data appears to relate to a nominal hot water off-take of 200 litres per day, and other data at 140 litres per day. Comparison of data sets is therefore erroneous.
- The origin of much of the data in Table 6 is unknown.

However, we wish to further point out that framing discussion of water heater policy in terms of “energy efficiency” is unhelpful, and almost invariably misleading, because “efficiency” can be defined in so many different ways. If, as is commonly the case in many contexts, it is defined in terms of the proportion of energy supplied to a water heater that is converted into hot water, then electric resistance water heaters are amongst the most “efficient” types of water heater. However, the very high emissions intensity of electricity means that these water heaters are highly “inefficient” so far as emissions are concerned.

The proposed measure examined in the RIS is explicitly a greenhouse policy measure, having the intention to phase-out “greenhouse-intensive water heaters”. Discussion around the measure should therefore at all times be framed in terms of emissions intensity and emissions efficiency, and should say nothing about energy efficiency.

3) Significance of market failures?

Research[2] by LPG Australia supports the RIS and agrees that the principal driver in HWS in existing HWS replacement is the tradesperson, and the vast majority of replacements are like-for like.

The purchase of the HWS and the energy source that drives it are “grudge purchases” and while the failure of the existing water heater generates consumer complaints, they do not appear to motivate the consumer sufficiently to act / change their water heater type.

The gas industry, appliance manufacturers and industry associations have developed and delivered extensive “trades information” packages on gas hot water, nationally for many years, aimed at making change over decisions easier.

In addition, some businesses offer a “3 hour turnaround” if any HWS fails. Using a high-efficiency, high flow LPG powered IHWS, hot water is guaranteed available in a household at all outlets in less than three hours after the old electric, gas of other system has failed. The householder then has days or weeks to investigate a long-term replacement, allowing a more rational decision to be reached about the new appliance.

Similarly, several businesses offer a heat-pump installation in less than one day if it is replacing an external electric HWS. While the heat pump replacement attracts huge government-based rebates, any gas HWS installed does not, except for any solar panels incorporated into the gas system. The discrepancy is substantial; it reduces the competitiveness of high efficiency gas in the replacement market. This is particularly inexplicable when in many cases; the high efficiency gas appliance is less greenhouse intensive than a heat pump.

The connection of heat pumps to off-peak power and associated timer is tempting for the installer, however this defeats the effectiveness of the heat pump except in high daytime draw-off scenarios.

4) Agreement in capital cost and running costs?

It is anticipated that energy costs will rise significantly in the next decade for many reasons, including infrastructure refurbishment, increasing demand, "energy supply switching by industry" and carbon reduction schemes.

However, the RIS is deficient in this respect due to its failure:

- To assess the impact of the loss of "off-peak" power at about 5.1 c / kWh when changing to an alternative HWS. (Even a heat pump cannot deliver useful energy at 5.1 c / kWh). Many consumers enjoy off-peak power rates presently. However the average price of natural gas at 1.3 c/MJ is slightly cheaper[3]

- to reasonably demonstrate an average[4] LPG running costs at about $400 per annum. The RIS shows $900[5]. This inaccuracy is consistent with a sustained bias against the traditional LPG industry. For example[6]:

    - Page 41 – Reliable information....is limited to natural gas water heaters only. Incorrect. The standards that apply to natural gas hot water heaters apply to LPG water heaters as well. The information available and labelling requirements are identical, and the performance of the two different fuels (NG and LPG) are near identical.

    - Page 57 – LPG would rarely be competitive in a natural gas area.

      This is incorrect. A standard LPG installation might cost around $300, and a natural gas connection about $220. The cost of the LPG installation is largely independent of site conditions, the natural gas connection is completely dependent on site conditions. The difference in end-cost can be substantial. In addition when natural gas standing charges are taken into account, LPG can be cheaper (annually) for small users. For example $145[7] for natural gas and $50 p.a. for cylinder rental for LPG.

    - Page 58 - ....a risk that households ....will shift to LPG ……and this situation must be monitored. Is this a risk that household might enjoy high efficiency gas hot water and reduce GHG emissions? This background of this statement is not explained in the RIS.

      If this comment is related to running costs, an example of hot water usage using an IHWS powered by LPG would look like:

      140 litres / day (medium user) x 35°C temperature rise x 4.5 c / MJ x 365 days per year = $450 p.a. This being the case, many LPG powered HWS in Queensland would require less than $450 p.a. in operating costs, as the

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The staged process is essential – the availability of trades people will be a limiting, if not disruptive factor.

Electric hot water density may be a better qualifier – the areas in each capital city with the highest population of electric hot water systems (and likely numbers of trades people also) are processed first, and so on. Regional Australia is last to be processed (low populations of both).

The RIS makes little attempt at a population-weighted energy density strata, making target selection (unilateral or staged) very difficult.

6) General Exemptions adequate?

The general exemptions are excessive, but must be seen in context with the different approaches used by different state governments in restricting electric hot water in new dwellings.

Commercial buildings should not be automatically exempt in perpetuity, nor should all existing medium-density and high-density housing and offices.

7) General Exemptions appropriate?

Excepting the comments in 6) above, yes the general exemptions are appropriate.

8) Implications for the LPG industry?

Traditional LPG (that is, LPG supplied to homes) is a small part of the overall industry. Increased demand through increased use of LPG powered HWS would mean a modest increase in customer numbers and Traditional LPG tonnage sold.

9) Opportunities created?

The LPG industry would see a small but sustained growth in business activity during any phase-out program. Gas HWS manufacturers would see a sustained burst of demand.

The availability of trades people in executing any phase-out will be a rate-limiting factor.

However the fact remains that government financial support for efficient gas water heating is, in general, lacking when compared with solar and heat pump.

10) Rapid replacement?

Businesses in Australia already offer rapid change-over of HWS, with Heat Pump and IHWS Gas being the mainstay. This must be promoted in two ways:

- promotion by the industry. This is occurring now, but must be escalated, and;
- support by the Government by advertising the imminent “phase-out” program, and how the transition will take place with minimum impact on the customer.

11) Technical and functional issues related to lower greenhouse-intensive HWS?

Australia has abundant and cheap energy in many forms and off-peak electric hot water at 5.1 c / kWh is a "benchmark" as it was available to hundreds of thousands of households. Any phase-out program may see higher energy costs for HWS operation, and resulting public misgivings. This appears to be happening in any case as an unintended consequence of solar PV installations (many power suppliers [retailers] remove access to off peak power for solar PV owners, leading to large increases in hot water running costs), and the gradual increase in the cost of off peak power in general.

The current arrangements using an almost incomprehensible mix of Federal and State-based rebates as an incentive would not be appropriate in any phase-out program.

Even including gas powered HWS installation, many suburbs in cities, and complete towns in regional Australia will not present a viable proposal to extend existing (natural) gas mains and distribution networks. The demand, although increased, will not be sufficient to justify the work. There may however be the opportunity to reticulate LPG and NG in some cases.

The issue of nuclear powered electricity grids and impact on GHG calculations has not been addressed.

There are no technical issues caused by the proposals in the RIS for LPG appliances or LPG supply networks.

12) Electricity Prices and Network Costs?

Any decrease in electricity usage due to a phase-out program would accelerate the upward price movement of base load electricity. The costs of generation and distribution must be paid for by a smaller number of GWh sold.

This decrease in electricity demand is unlikely, despite the price almost doubling in just over a decade. An abundance of inexpensive white goods, including reverse cycle air conditioners will ensure continued demand growth, but at more modest rates.

13) Agreement with Recommendations (by number)?

1. Yes, a phase – out is required to reduce GHG emissions. An effective GHG reduction program will require a multitude of programs and regulations to be in place, and executed carefully. While domestic HWS is a small contributor to the national GHG load, it is an identifiable target. However, the phase-out must not be arbitrarily restricted Class 1 buildings in perpetuity. It is quite likely some buildings in other classes are good candidates to be included.

   A national approach, or at the very least a state-based consistency based on a national approach for new dwellings would have a positive flow on effect to any phase-out program for existing dwellings. Disparate policies and timing around Australia will cause confusion, expense and uncertainty for all concerned in the process. Manufacturers and gas suppliers in particular cannot plan to meet the GHG goals in an uncertain regulatory climate.

2. The 2010 and 2012 phase-out timetable is very tight. The option of extending this timetable should be considered to avoid stressing the public, appliance and energy industries. LPG Australia considers that Scenario S3 addresses this only in part.

3, 4, 5, and 6 – use a national approach from the start, allow each jurisdiction time to create mirror regulation, allow the appliance industry and the energy industries sufficient time to “tool-up” and the alert the public of the pending program. There is a strong need to avoid the state-to-state variations completely.

7. Agree, provided the method of calculation is sound for each type. At present, it is not sound, and many rebates are granted without considering the GHG impacts and the public is getting a confusing message. Currently, an efficient gas hot water system can be removed and replaced with a heat pump, and attract a rebate, despite the heat pump generating twice the GHG loading as the gas system for the same amount of hot water delivered.

A phase-out program will accentuate this mess if it is not corrected. If GHG reduction is acknowledged and rewarded uniformly, any phase-out program will not be rejected by a sceptical electorate.

The RET scheme is a distortion and prevents GHG reduction being rewarded uniformly. The RIS calculations must be recalculated without any RET impact and the two results compared. This will give a measure of the RET distortion.

8. The general exemptions are too wide. Any phase-out should include more building types, perhaps in a staged process.

9. Agree. Exemptions must be available, but be restricted to nationally recognised and documented situations.

10. Agree.

11. Agree, industry associations must assist here, and the Government must support this with clear and consistent messages on the phase-out in a significant national advertising campaign. The entire “information process” must occur at least one year in advance of the phase-out action, and continue through the phase out process.

12. Agree, as in 11) above, using simple and consistent messages.

Conclusion and Recommendations:

The RIS effectively identifies the issue of GHG emissions from domestic energy-intensive hot water systems, and has investigated many available options. The recommendations made are not complete, due to the impact of market distortions.

LPG Australia supports the phase out of greenhouse intensive water heaters in Australian homes. However in doing this the place of high efficiency gas water heating has to be acknowledged and given greater emphasis than is reflected in the RIS.

High efficiency gas water heating has an important part to play in reduction of greenhouse gas emissions.

For the many reasons described in the appendix, we consider that the RIS under-estimates the operating costs of heat pump water heaters, particularly in most parts of southern Australia. Consequently, it understates the operating and lifetime costs of heat pumps and overstates the greenhouse gas abatement that they can provide, relative to electric resistance water heaters. It may also further understate lifetime costs of heat pumps by not including any allowance for the cost of replacing the sealed unit well before the end of the life of the tank and other components. As a result, where reticulated gas is not available, electric boosted solar and LPG water heaters may be relatively better options, in both economic and environmental terms, that the RIS suggests.

The RIS also appears to use excessively high average household water consumption levels in warmer parts of Australia. This has the effect of making LPG a less economically attractive option that it would be if hot water consumption were smaller. The text consistently bases conclusions on broad average household hot water consumption, and gives almost no regard to the effect of different consumption levels on the relative economics of different types of water heater.

LPG Australia recommends that Scenario S3 is adopted, with a greater emphasis on high efficiency gas water heating, after addressing the deficiencies in the RIS already indentified.

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24 March 2010

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24 March 2010

Annex A: Calculations on Heat Pumps and Gas Hot Water Heating

Distribution: GRRA Committee Members

Annex A Calculations on Heat Pumps and Gas Hot Water Heating

The RIS significantly underestimates the operating cost of heat pump water heaters and over-estimates the operating cost of gas water heaters that would be experienced in most parts of southern Australia. This has arisen from two principal causes.

> Firstly, as stated above, and for reasons which we do not understand, the RIS uses performance parameters for both instantaneous and storage gas water heaters which are well below the measured performance of many models now widely available in the Australian market, and are therefore not representative of the types of gas water heaters likely to be installed to replace electric systems.

> Secondly, and of broader significance, all the simulation modeling undertaken for the RIS and reported in detail in Appendix 3 was undertaken for the four reference locations used by ORER for defining the performance of solar and heat pump waters heaters in each of the four climate zones defined in AS/NZS 4234-2008. These locations are Rockhampton, Alice Springs, Sydney and Melbourne, for Zones 1, 2, 3 and 4 respectively. The four climate zones were originally established for the purpose of standardizing procedures for assessing the performance of solar water heaters. They are completely unsuitable for assessing the performance of heat pump water heaters. The consequence is that the data in the RIS significantly overstates the operating performance, and under-estimates the operating cost of heat pump water heaters in many parts of southern Australia. A more detailed explanation of this statement follows.

Performance of heat pump water heaters at lower ambient air temperatures

The extent to which heat pump water heaters reduce electricity consumption, relative to electric resistance water heaters, is determined by the Coefficient of Performance (COP) of the heat pump system. For all types of heat pump, the COP decreases as the temperature of the ambient heat source (air in the case of water heaters) decreases. The great majority of heat pump water heaters sold in Australia experience a very rapid decrease in COP if air temperatures fall much below 12^{o}C. A new draft standard, DR AS/NZS 5125, has been developed to correctly account for this effect when calculating the energy consumption of heat pump water heaters. It is our understanding that this draft standard was used to model the performance of heat pump water heaters for the RIS. However, by modeling only for the climates of Sydney and Melbourne, both of which, and particularly Sydney, have relatively mild winter temperatures, almost none of the effect of reduced COP has been revealed in the results.

Last year Elgas commissioned **Pitt and Sherry** to model the performance of heat pump water heaters at a number of separate locations around Australia, using the TRNSYS simulation procedures specified in AS/NZS 4234 and DR AS/NZS 5125. The following table compares the **Pitt and Sherry** results with modeling results reported in the RIS (Appendix 3, p. 38). The **Pitt and Sherry** results are for a typical 310 L tank, described as being suitable for a 3-6 person household in a “moderate” climate and a 3-5 person household in a “cool” climate. The RIS results, are for simulations by Thermal Design Pty Ltd of two different, unspecified models, one with a 300 L tank and one with a 340 L tank. The latter was also simulated with off-peak boost, but the former was not.

The **Pitt and Sherry** simulations are for the separate specified locations, using climate data for that location, and therefore are able to allow for the different ambient air temperatures at the various locations. Ambient air temperature affects standing losses for all types of storage water heaters located outdoors and also, most importantly, significantly affects the performance of heat pumps at lower ambient air temperatures, as explained above. The RIS simulations are generic for Zones 3 and 4; the actual locations chosen are not stated but it might be assumed that they are Sydney for Zone 3 and Melbourne for Zone 4, which, as noted above, are the respective reference locations for these Zones. It should also be noted that the RIS contains no simulation results for the newly created Zone 5 in DR AS/NZS 5125, which is intended to overcome, at least in part, the problem created by widely different climates within the current Zone 3.

It can be seen that the **Pitt and Sherry** simulations give COP values which are consistently very much lower than the results in the RIS and that, as might be expected, the differences are greatest for locations with lower winter and overnight temperatures (Canberra, Hobart, Wagga Wagga, Launceston).

Location	**Zone**	**COP continuous**		**COP off-peak**	
		Pitt - Sherry	**RIS**	Pitt - Sherry	**RIS**
Adelaide	3	2.3	2.9, 3.0	2.1	3.5
Brisbane	3	2.6	2.9, 3.0	2.7	3.5
Canberra	3	1.8	2.9, 3.0	1.5	3.5
Perth	3	2.5	2.9, 3.0	2.6	3.5
Sydney	3	2.4	2.9, 3.0	2.3	3.5
Hobart	4	1.9	2.75, 2.9	2.0	3.2
Melbourne	4	2.2	2.75, 2.9	2.3	3.2
Oakey	3	2.4	2.9, 3.0	1.9	3.5
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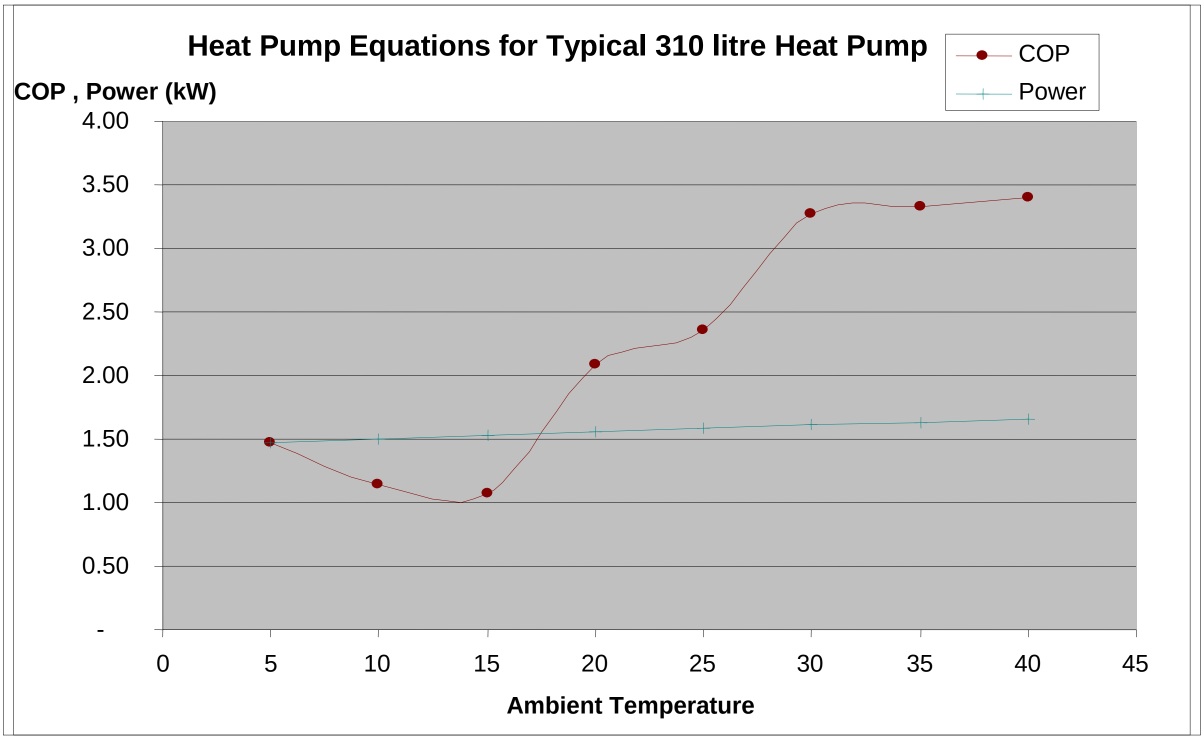
The following graph shows the variation of COP with ambient air temperature for the typical 310 litre model. The graph for the typical 310 litre model was compiled by **Pitt and Sherry**.



The graph shows very low COP at low ambient air temperatures. The higher COP values from the RIS, shown in the table above are for the 340 litre model. This comparison indicates that the variation in efficiency between makes and models is quite large and basing program design on the performance of one or two models only would be unwise and risky.

Use of off-peak tariffs

As a consequence of their lower COP under winter conditions in colder climate areas, heat pump water heaters have difficulty delivering adequate volumes of hot water at all times. This difficulty is much greater if they are operated on off-peak tariffs.

This suggests that heat pumps are most unlikely to be able to provide satisfactory service quality if operated on off-peak tariffs in these areas. The same also applies, possibly to a somewhat lesser extent, to electric boosted solar water heaters.

However, the RIS appears to be have been prepared using an assumption that a proportion of heat pump and solar systems in both Zones 3 and 4 will be connected to off-peak tariffs (see Chapter 4, Figure 26 and Appendix 6, Figures 27 and 30). The note to Appendix 6, Figure 26 states that the assumed proportions of off-peak connected heat pumps are 40% in Victoria, 30% in Tasmania and 40% in the ACT. In the ACT, the default retailer, ActewAGL, which retains a dominant share of the residential electricity market, does not allow solar water heaters to be connected to the off-peak tariff, and independent providers of energy advice strongly recommend householders not to connect heat pump water heaters to off-peak.

We therefore conclude that the RIS has significantly under-estimated the operating cost of heat pump and, to a lesser extent, solar water heaters in Victoria, Tasmania, the ACT, and the colder inland areas of NSW.

Consumption volumes

(RIS p. 78 and Appendix 3, pp. 32-34

Operating costs depend on the volumes of hot water consumed. The RIS correctly identifies that average or typical household hot water consumption levels are considerably less than the levels specified in AS/NZS 4234, which were first defined in the mid-1980s. It addresses this issue by categorizing households as either "small" or "medium" users of hot water (p. 78). The approach is explained in more detail in the Appendix, but is not altogether clear what approach which was taken. If, as seems most likely, modeling assumed one of two consumption levels, 6.6 and 13.2 GJ/a, in each of the four solar water heater climate zones, then volumetric consumption in the warmer climate zones is higher than in the cooler zones, as shown in Table 15. This seems highly improbable. Furthermore, it is stated that the modelled consumption was matched to the EES data, as shown in Figure 15, but it is unclear how that is the case. It is stated that average hot water use lies between the horizontal lines corresponding to the Medium and Small consumption levels in the Figure, but the Figure also shows that EES estimated national average consumption to be almost exactly equal to the Small level in 2009, and continuing to fall. There is no reference in the RIS to assumptions of lower average consumption levels in future years.

Consequently, either the assumed consumption levels for cooler zones are too low, or those in the warmer zones are too high. These relativities have an important consequence for the assessment of the relative economics of different types of water heaters. At lower consumption levels, options with lower capital costs and higher operating costs, such as LPG instantaneous and storage, become relatively more economic. Conversely, at higher consumption levels the more capital intensive options, such as gas boosted solar, are relatively more economic attractive.

We understand that the modeling for the RIS allocated households into the two consumption levels (Small and Medium) and simulated their consequent choice of water heater type. We assume that this is the reason for the significant market share achieved by LPG in Scenarios 2 and 3, as shown in Figures 29 and 30 respectively. (We note that the design of Scenario 4 <u>explicitly operates</u> to exclude LPG from most of the water heating market.)

The difference in water heating economics between Small and Medium households is not reflected in the text of the RIS, which is expressed in terms of averages throughout. In particular, it results in a number of categorical statements about the high cost of LPG in all circumstances. Several examples follow.

> "If electric resistance water heaters are excluded from the market, householders in gas supplied areas will have the choice of gas, solar-electric, solar-gas or heat pump (LPG would rarely be competitive in a natural gas area)." (p. 57)

This may not be correct in areas with reticulated gas but without a significant space heating load, particularly south east Queensland, since the high fixed costs of natural gas supply would have to be covered by a relatively modest consumption volume, significantly increasing the unit cost of natural gas. This effect would apply *a fortiori* for households with low hot water consumption. This effect can actually be seen in Figure 24.

> "Conventional LPG is always more costly because of the high fuel cost" (p. 82)

This statement cannot be true in all cases. As the lowest capital cost option, LPG will become progressively more economic as hot water consumption levels are reduced. The RIS does not present the information which would be required to estimate what this consumption level might be. However, given the likelihood that the range of consumption levels modelled for tropical regions (Zone 1) in particular are almost certainly too high, as explained above, it is likely that LPG will in fact be the most economic water heater choice for smaller households in these areas. The only presentation of relative costs at Low consumption levels is in Figure 24, in Chapter 4. This shows that, while LPG has higher lifetime costs than other technologies, the difference is small. If more accurate performance characteristics were used for heat pumps, there may be little or no cost difference between heat pump and LPG.

In conclusion, the complete absence of reliable data on actual household hot water consumption levels makes it very difficult to draw firm conclusions from the results of modelling based on figures that are little more than guesses, particularly as regards the distribution of consumption levels across the whole population of households. We recommend that the government fund a study which measures actual consumption in a representative sample of households in order to remove this great uncertainty.

Conclusion

For the many reasons described above, we consider that the RIS under-estimates the operating costs of heat pump water heaters, particularly in most parts of southern Australia. Consequently, it understates the operating and lifetime costs of heat pumps and overstates the greenhouse gas abatement that they can provide, relative to electric resistance water heaters. It may also further understate lifetime costs of heat pumps by not including any allowance for the cost of replacing the sealed unit well before the end of the life of the tank and other components. As a result, where reticulated gas is not available, electric boosted solar and LPG water heaters may be relatively better options, in both economic and environmental terms, that the RIS suggests.

The RIS also appears to use excessively high average household water consumption levels in warmer parts of Australia. This has the effect of making LPG a less economically attractive option that it would be if hot water consumption were smaller. The text consistently bases conclusions on broad average household hot water consumption, and gives almost no regard to the effect of different consumption levels on the relative economics of different types of water heater.