Pecan Engineering Pty. Ltd. & Adelaide Heating Technology

Submission

In response to “Consultation RIS for reducing emissions from wood heaters”

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7/12/2013

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Author

Tim Cannon – Hons B.Sc.

I work at Pecan Engineering Pty. Ltd. manufacturing wood heaters among other things. My role is Research & Development manager. I have been performing R&D for a number of years now into reducing the emissions and increasing the efficiency on wood heaters. We have a NATA accredited testing laboratory, complying with the current AS/NZS 4012, 4013, & 2918 standards for testing of domestic solid fuel burning appliances. I have provided technical services to the Australian Home Heating Association, and spent many hours researching papers and undergoing data analysis in the wood heating field.

Introduction

There are many articles and papers that have a particular bias towards wood heaters and their impact on particulate matter levels in the air. Data used to substantiate these articles is often manipulated or presented in a manner that suits the author's particular bias. This can have flow on effects whereby future authors and analysts reference the figures presented in such articles without digging any deeper to determine how the figures were derived. This can result in a misleading perception of wood heaters and their impact to PM levels.

Each of the questions posed in the paper have been addressed in this submission. Please take the time to read this submission in its entirety as it is relevant and represents many hours of research and analysis on the subject of wood heater emissions.

Consultation RIS for reducing emissions from wood heaters – Questions answered

Section 2 – Australian Wood Heaters

1. ***What is your view of the wood heater industry in Australia? Are there specific aspects of the industry that require attention? Please provide details.***

Current wood heaters being sold are much cleaner burning than earlier models, that is, they produce less smoke. They are also more efficient with regards to the amount of heat energy put in to the living space from the heater which previously would have been lost as either unburnt gases (smoke) or lost heat up the flue.

Being able to produce an over-night burn from a current model heater is becoming more difficult as a result of the modifications to produce clean burning appliances.

Tighter control on sales of uncertified and second-hand heaters in Australia would help to reduce the number of "dirty" heaters being installed.

Tighter controls on the quality of the fuel supplied by wood suppliers and merchants would help to reduce overall emissions. It has been proven that the higher the moisture content of the wood, the higher the amount of particulate matter emitted from the heater. In Western Australia, moisture content of wood offered by suppliers is regulated. It is not easy for

owners to store 2 tonnes of firewood at home for 6-12 months so that it can "season" ready for the winter ahead. Not to mention upfront cost as opposed to stocking their firebox or garden shed as required throughout the winter. Seasoning of the wood needs to be done by the wood merchants and regulated.

I personally have experienced buying wet wood from numerous suppliers around Adelaide. Often it is not until one gets home and try to burn it that find out it is wet, the fire won't get hot and smoke exits the flue.

2. Can you provide evidence of new or different operational or marketing paradigms that would affect the stated view?

Prices of some certified wood heaters are coming down as a result of being manufactured in China at a low cost than manufactured in Australia. That does not necessary imply the quality is any less, but the price to the consumer is lower ($1000 a unit or less). This is an attractive alternative to other heating sources for many home owners living on a tight budget but still have to heat their house. Wood is still a far cheaper method of heating the home when compared to electricity, and in areas where reticulated gas is not an option there is little choice to those on a lower income.

The following table from the consultation paper shows estimates of wood consumption in tonnes/year per household.

Table 2.2: Estimated annual cost of heating per household, selected locations

	Price ($/tonne)[a]	Wood use tonnes[b]	Annual heating cost
Tasmania	$150	10.28	$1,540
Sydney	$380	3.43	$1,300
Wagga Wagga	$180	4.08	$730
Melbourne	$300	3.75	$1,130
Perth	$270	3.09	$830

The table below is from a CSIRO paper titled *Impact and use of firewood in Australia* (Driscoll *et al.* 2000). The Australian Government Department of Sustainability, Environment, Water, Population and Communities state this as the most up to date report for wood consumption in Australia. (http://www.environment.gov.au/land/pressures/firewood/facts.html).

Table 2.1.2. Average consumption of firewood per household and total firewood used in capital city and the rest of each state (pooled over states) and for each state separately. 95% confidence intervals are indicated. Northern Territory data are from Bush et al. *(1999).*

Location	*N*	Household firewood use (tonnes per year)	std. error	Lower 95%	Upper 95%	No. of house-holds	Proportion that use firewood	Total firewood used (million tonnes)	Lower 95%	Upper 95%
Cap. city	168	2.25	0.23	1.83	2.75	4 378 700	18.6%	1.82	1.48	2.24
Rest state	250	3.67	0.22	3.28	4.14	2 586 300	34.7%	3.30	2.95	3.71
NSW	91	2.65	0.24	2.21	3.15	2 402 454	22.3%	1.42	1.18	1.68
VIC	103	2.69	0.30	2.13	3.28	1 747 638	25.8%	1.21	0.96	1.48
QLD	41	1.31	0.21	0.92	1.76	1 338 442	18.9%	0.33	0.23	0.45
SA	36	2.64	0.35	2.03	3.39	609 769	25.5%	0.41	0.32	0.53
WA	72	2.70	0.29	2.16	3.29	718 988	29.2%	0.57	0.45	0.69
TAS	63	5.81	0.52	4.87	6.84	186 272	66.8%	0.72	0.61	0.85
ACT	10	1.88	0.34	1.26	2.57	117 290	22.3%	0.05	0.03	0.07
NT						64 687		0.03	0.00	0.00
Australia	418	3.00	0.15	2.71	3.32	7 120 853	23.4%	5.00	4.52	5.54

N is number of respondents

The estimates for wood consumption between the two tables differ significantly.

When modelling the PM contribution from wood heaters, a % reduction or increase in the amount of wood consumed will result in an equivalent % reduction or increase in overall estimated PM levels. For example, PM levels from wood heaters modelled for NSW will be 23% lower if the values from Driscoll et al., 2000 are used rather than the Consultation RIS paper.

This highlights the importance of using valid data in the modelling. Other examples are presented later in this submission.

Section 3 – Statement of the Problem

3. ***Do you consider wood heater emissions to be a significant issue relative to other forms of air pollution?***

Yes and No.

Yes – wood heaters contribute to the overall air quality in built up areas. In certain air-sheds, and due to the topographical location and weather conditions, air pollution can become trapped not being able to disperse in to the atmosphere. The weather conditions that cause this mainly occur in winter. Regardless of whether wood smoke is contributing, particulate matter (PM) levels will go up as a result of a temperature inversion. The fact wood heaters are operated in winter as well, it is easy to attribute the increase in PM levels directly to wood heaters, and not the fact that weather conditions will often trap the particulates.

No – in more rural areas where population density is low, any PM produced by a wood heater is able to disperse before it may cause any health issues from being breathed in. In these areas, I do not consider wood heater emissions to be a significant issue.

Furthermore, research has shown that heating the home by wood can be carbon neutral (Paul et al., 2006, Polglase et al., 2012). Alternative sources of heating the home, such as electricity provided by coal-fired power stations produce enormous amounts of carbon dioxide contributing to global warming (refer to answer to Question 14 for more information), plus the excessively high PM levels where the coal is mined and the power station operates as demonstrated in *Chart 3* below showing PM2.5 levels in the Upper Hunter area.

4. ***Do you agree with the conclusions provided in this section? If not, please provide reasons.***

"Fact versus Fiction"

Rather than agree or disagree, I will attempt to highlight the differences between fact and fiction when it comes to estimating the contribution of wood heaters to poor air quality. The gap between the two can be large.

Fact

The air quality monitoring network in NSW consists of monitoring stations set up to record and report air quality index values, including PM10 and PM2.5. This data is available on the NSW Government Environment & Heritage website (http://www.environment.nsw.gov.au/air/index.htm). The data presented in the tables below was sourced from this website.

This data is fact, there is no mis-representation, or mis-interpretation, it is what it is.

Chart 1 below shows average PM10 levels across Sydney comparing summer to winter since 2000. Average PM10 levels in summer are consistently higher than in winter. This occurs for each monitored region in Sydney and for each year from 2000 until 2012.

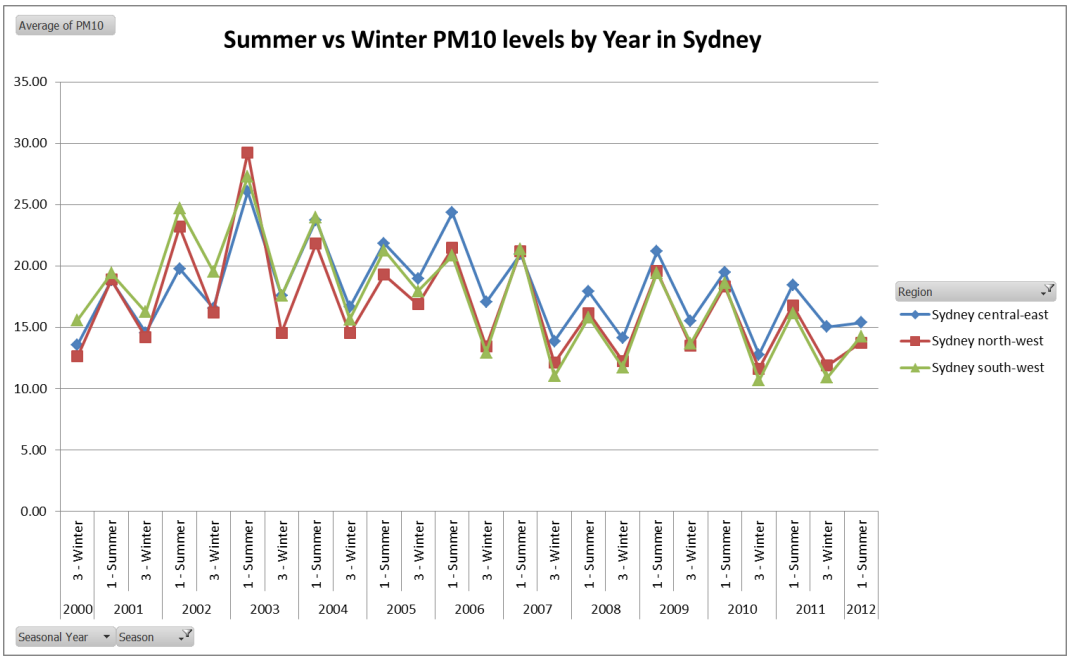


Chart 2 below shows average PM2.5 levels for summer and winter across Sydney since 2000. Overall, there are more instances where the summer average is greater than the winter average. There is no consistent evidence in the data from these monitoring stations that suggests that PM2.5 levels in winter are greater than summer in Sydney.

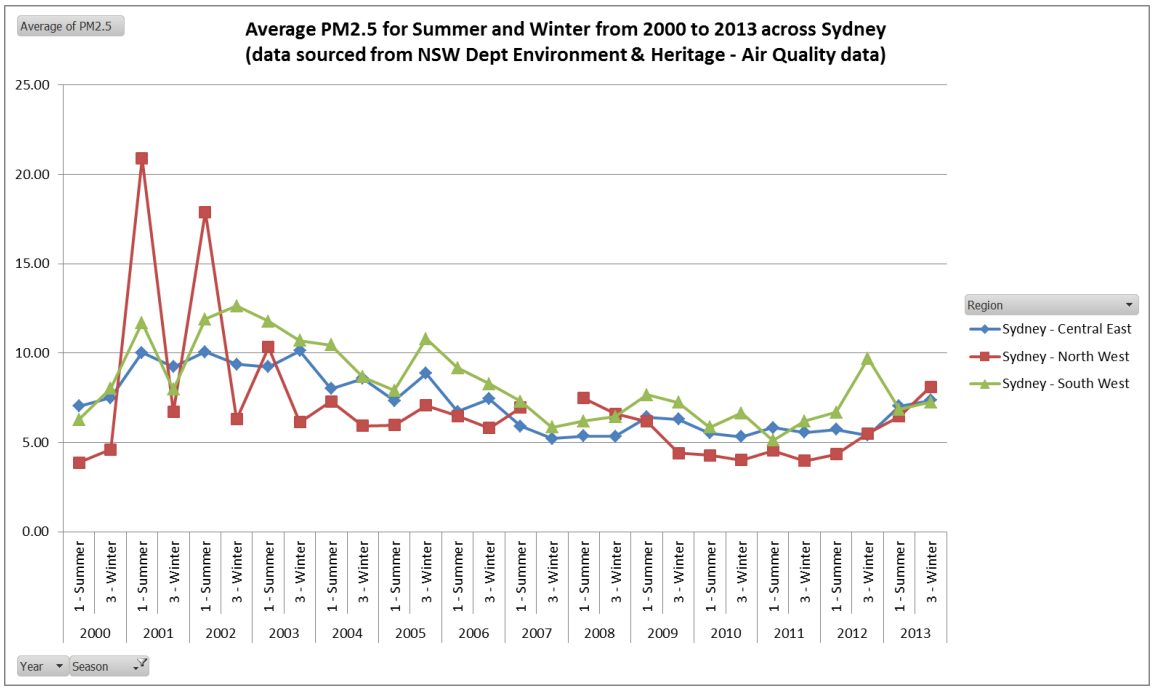
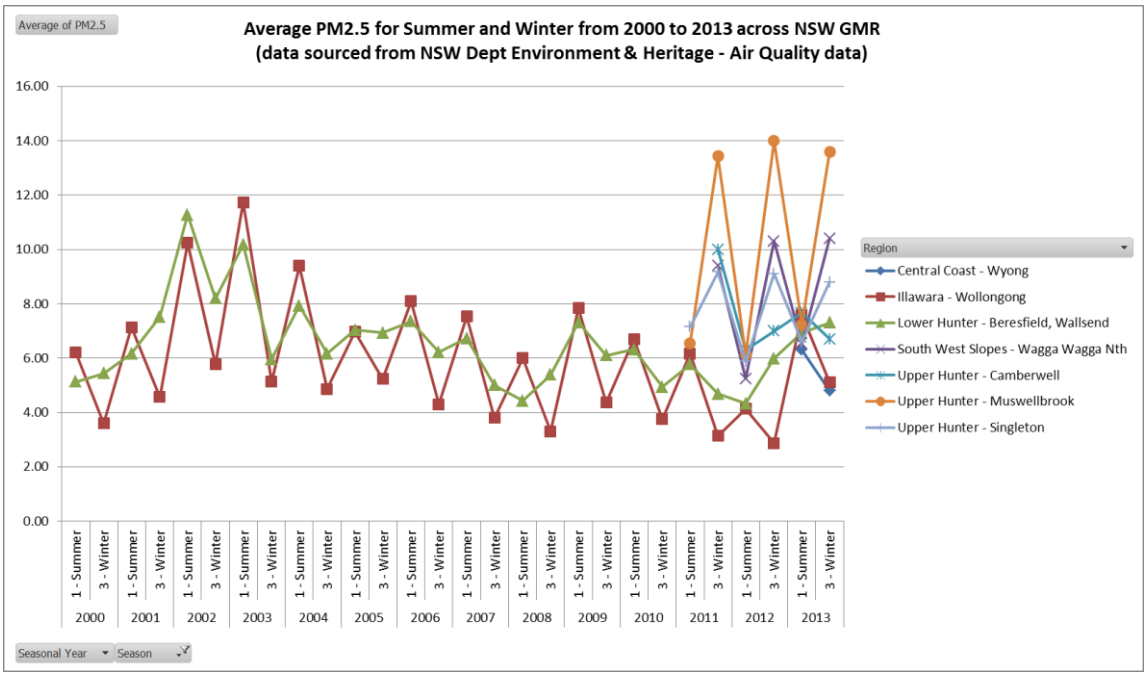


Chart 3 below shows average PM2.5 levels for summer and winter across regional metropolitan NSW since 2000.



- Wollongong – average PM2.5 levels are consistently higher in summer than winter.
- Lower Hunter – average PM2.5 levels were higher in summer 9 out of the 14 years recorded.
- Upper Hunter regions – average PM2.5 levels in winter are much higher than summer. The major contributors to particulate matter in these regions are mining of coal and coal-fired power stations. It would be unreasonable to consider wood heaters as the sole cause for the higher PM levels in winter in these regions, especially when there is no consistent evidence elsewhere that winter PM2.5 levels are higher than in summer. This could be an example where weather conditions and local topography affect the PM levels resulting in the higher readings at the monitoring stations.

With the data from the monitoring stations in NSW, there is no real evidence that PM levels are greater in winter than in summer. This fact needs to be taken in to account when modelling the overall PM contributions from wood heaters. It is not difficult for the modelled values to become over-represented and not consistent with the facts.

The only mention of monitoring stations in the Consultation RIS paper is in relation to the number of exceedences of PM10 National Air Quality Standard. It makes no mention of the data recorded at these and other monitoring stations across Australia.

PM2.5 levels in ACT at Civic and Belcon monitoring stations were higher in summer than in winter for 2007 and 2008 (Bridgman, 2009). The Monash monitoring station showed higher PM2.5 levels in winter than in summer, however. In winter of 2008, there was a significant increase in PM2.5. This can be attributed to the weather conditions in July 2008 when there were 23 days of frost recorded in the month, the highest since 2002. In Tuggeranong, the average minimum temperature for July 2008 was -0.9°C (http://www.bom.gov.au/climate/current/month/act/archive/200807.summary.shtml). When these weather conditions occur, PM levels increase regardless of any contribution from wood heaters.

Fiction

It is difficult determine the true contribution to poor air quality caused by wood heaters. There are many variables that affect the contribution which makes modelling the total estimates difficult and prone to error. The key variables used to model PM contributions from wood heaters are:-

- Number of wood heaters, divided into types
- Emissions factor for each type of heater
- Amount of wood consumed annually per household

A simple example of how the modelled PM contribution can be mis-represented is given in Table 3.1 below. For each of the three variables, individually, the difference between Scenario 1 and Scenario 2 is not significant. For example, when the number of heaters is estimated based on a survey with a small sample set, the difference between 100,000 and 125,000 wood heaters is not much, however, that will result in a 25% variation in calculated PM emissions. A difference in wood consumption of 2.5 and 3.0 tonnes /year from the same survey, again, doesn't appear much difference upon initial inspection but will also result in a 20% variation.

There are a number of papers with studies arguing what a more realistic emissions factor for wood heaters should be in the real-world. 9.0 g/kg or 12.0 g/kg, not much difference upon initial inspection between the two but will result in a further 33% variation.

Combine these three and we get a 100% increase in the calculated PM contribution.

Table 3.1 – Examples for modelling PM contribution

Variables	Scenario 1	Scenario 2
Number of wood heaters	100,000	125,000
Emissions factor (g/kg)	9.0	12.0
Annual wood consumption (tonnes)	2.5	3.0
Total PM contribution (tonnes)	2,250	4,500

This example is exaggerated, however, it highlights how an over-representation on the number and type of wood heaters or annual wood consumption can have such a large impact on the total calculated PM contribution from wood heaters.

Examples of modelled PM contributions from wood heaters from various sources:

NSW Environment Protection Agency

In the NSW air emissions inventory report for 2008 (NSW EPA_1, 2012), the total estimated annual emissions for PM2.5 in Sydney was 11,728 tonnes/year. In the technical report, solid fuel combustion was responsible for 5,457 tonnes/year in Sydney (NSW EPA_2, 2012).

This translates as 46.5% of all PM2.5 in Sydney in 2008 was from solid fuel combustion (wood heaters).

Assuming solid fuel combustion appliances are operated in winter, there is no obvious correlation between this modelled contribution from solid fuel combustion and the PM2.5 levels recorded at the monitoring stations shown in the charts above. If wood heaters represented 46.5% of all PM2.5, would one expect a consistent increase in PM2.5 in winter compared to summer recorded at the monitoring stations?

The methods for determining these figures are described in Technical Report 4 (NSW EPA_2). The data was based on a domestic survey of solid fuel combustion randomly sampling 801 households from a total number of 1,901,680 households across the Greater Metropolitan Region (GMR). From the survey it was determined that 13.38% of dwellings in GMR had some form of wood-fired space heater. This means that of the 801 households surveyed, 107 households responded with some form of wood heater. The number of heaters as a percentage of total dwellings was reported in Table 3-277 on the next page.

Table 3-227: Wood fuel fired residential space heater ownership by region

Region	2008 proportion of total dwellings (%)				
	Slow combustion heater with compliance plate	Slow combustion heater without compliance plate	Open fireplace	Potbelly stove	Grand Total
Newcastle	6.10	2.66	5.50	1.16	15.42
Non Urban	6.44	2.81	5.80	1.22	16.28
Sydney	5.04	2.20	4.54	0.96	12.73
Wollongong	5.57	2.44	5.02	1.06	14.09
Grand Total	5.29	2.31	4.77	1.00	13.38

This translated into the following number of wood heaters:-

Table 3-219: Wood fuel fired residential space heater population by heater type in the GMR

Dwelling type	Slow combustion heater with compliance plate	Slow combustion heater without compliance plate	Open fireplace	Potbelly stove	Grand Total
Flat, unit or apartment	-	-	-	-	-
Semi detached, terrace house or townhouse	6,120	1,113	3,616	3,616	14,466
Separate house	94,533	42,875	87,089	15,483	239,979
Other dwelling	-	-	-	-	
Grand Total	100,653	43,987	90,706	19,099	254,445

The annual wood consumption by heater type was determined:-

Table 3-221: Wood fuel fired residential space heater average age and wood consumption in the GMR

Heater type	2008 statistics	
	Average age (year)	Average wood consumption (tonne/heater/year)
Slow combustion heater with compliance plate	12	2.9
Slow combustion heater without compliance plate	17	2.9
Open fireplace	22	2.0
Potbelly stove	14	2.3
Grand Total	16	2.5

This data allowed overall solid fuel combustion particulate emissions to be calculated:-

Table 3-232: Solid fuel combustion emissions by activity

Activity	Substance	Emissions (kg/year)				
		Newcastle	Non Urban	Sydney	Wollongong	GMR
Solid Fuel Combustion	PARTICULATE MATTER ≤ 10 µm	473,730	1,188,991	5,669,095	312,844	7,644,661
	PARTICULATE MATTER ≤ 2.5 µm	456,048	1,144,611	5,457,489	301,167	7,359,314

This was then broken down by heater type:-

Table 3-233: Solid fuel combustion emissions by source type

Source type	Substance	Emissions (kg/year)				
		Newcastle	Non Urban	Sydney	Wollongong	GMR
Slow Combustion Heater with AS[70]	PARTICULATE MATTER ≤ 10 µm	177,594	445,735	2,125,257	117,280	2,865,866
	PARTICULATE MATTER ≤ 2.5 µm	170,965	429,097	2,045,929	112,903	2,758,894
Slow Combustion Heater without AS	PARTICULATE MATTER ≤ 10 µm	120,709	302,962	1,444,517	79,714	1,947,902
	PARTICULATE MATTER ≤ 2.5 µm	116,204	291,653	1,390,598	76,739	1,875,194
Open Fire Place	PARTICULATE MATTER ≤ 10 µm	133,429	334,885	1,596,729	88,114	2,153,157
	PARTICULATE MATTER ≤ 2.5 µm	128,448	322,385	1,537,130	84,825	2,072,788
Pot Belly Stove	PARTICULATE MATTER ≤ 10 µm	41,998	105,410	502,592	27,735	677,736
	PARTICULATE MATTER ≤ 2.5 µm	40,431	101,475	483,832	26,700	652,438

Going back to the earlier statement that 46.5% of all PM2.5 in Sydney in 2008 was from wood heaters according to this study, 29% of that from wood heaters is produced in Open fireplaces.

According to the survey results and modelling performed in this study, 4.5% of all dwellings in Sydney (1 in every 22 dwellings) each burn 2 tonnes of firewood per year. 2 tonnes of firewood is a minimum of 5-6 standard trailer loads. Do 67,000 households in Sydney burn that much wood to heat their house?

Using such a small sample set from the survey to extrapolate such large numbers could be risky when the stakes are so high including the impact on health and determining the most appropriate option for reducing particulate emissions from wood heaters.

Australian Bureau of Statistics

The data from the Australian Bureau of Statistics in the table below shows quite different numbers for wood heater types as a % of all dwellings as compared to that reported by the NSW EPA in the 2008 study.

The relative consistency and moderate decline from 2005 to 2011 supports the validity in the numbers reported by ABS.

TYPE OF HEATER USED MOST OFTEN, Households with at least one heater in use, 2005, 2008, 2011

Proportion (%)	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT	Aust.
MARCH 2011									
Wood									
Combustion	11.3	5.3	7.4	12.9	10.9	13.4	12.4	1.9	9.0
Fire–open	0.8		2.3	0.3	0.5			0.0	0.8
Pot-belly	0.2		0.2		0.7	0.0		0.0	0.2
Other	1.8	3.4	2.5	1.3	1.9	14.2			2.7
Total (%)	14.1	8.7	12.4	14.5	14.0	27.6	12.4	1.9	12.7
MARCH 2008									
Wood									
Combustion	12.1	8.5	9.1	10.9	13.3	22.8	9.8	3.8	10.8
Fire–open	1.2	0.5	1.9	1.2	1.3	2.5	0.0	0.0	1.1
Pot-belly	0.4	0.3	1.8	0.9	2.3	1.6			0.8
Total (%)	13.7	9.3	12.8	13.0	16.9	26.9	9.8	3.8	12.7
MARCH 2005									
Wood									
Combustion	12.1	10.4	13.1	13.6	15.1	35.9	6.7	2.8	12.7
Fire–open	1.3	0.9	2.0	1.1	0.9	1.5	4.9	0.2	1.2
Pot-belly	0.7	0.3	3.0	0.7	2.8	0.5	0.0	0.0	1.1
Total (%)	14.1	11.6	18.1	15.4	18.8	37.9	11.6	3.0	15.0

Consultation RIS for reducing emissions from wood heaters

The following dialogue is not a criticism of the figures presented in paper but is intended to highlight the impact different sources can have on the modelled PM contribution from wood heaters. Which source of data is most credible is the question.

The reported 1.1 million dwellings using wood heaters throughout Australia is consistent with ABS 2011 (1,145,536 dwellings in fact).

Emission factors presented are not unrealistic and justified.

Estimated annual wood consumption presented differs significantly from that reported by the Australian Government Department of Sustainability, Environment, Water, Population and Communities for wood consumption in Australia (Driscoll et al, 2000).

This is equivalent to a 23% reduction for NSW, 28% reduction for Victoria, and 43% reduction for Tasmania in annual wood consumption.

If the annual wood consumption figures from Driscoll et al., 2000 are used, the 40,000 tonnes of particulate emissions from wood heaters in Australia reported in the Consultation RIS paper would be reduced by 25% immediately. Costs on health impacted by wood heater emissions would also be reduced by 25%.

Alternative model for annual particulate emissions from domestic solid fuel combustion

This data model uses the following and justifiable data sources:-

- Number of heaters by type - ABS 2011 for % of wood heater types and number of dwellings by state
- Emission factors – those reported in the Consultation RIS paper
- Annual wood consumption – Driscoll et al., 2000

Calculations are based on the methods detailed in "*Emission Estimation Technique Manual for Aggregated Emissions from Domestic Solid Fuel Burning*, November 1999".

	NSW	Vic.	Qld	SA	WA	Tas.	NT	ACT
Type of wood heater as % of all dwellings								
Combustion	11.3	5.3	7.4	12.9	10.9	13.4	12.4	1.9
Fire–open	0.8		2.3	0.3	0.5			0
Pot-belly	0.2		0.2		0.7	0		0
Other	1.8	3.4	2.5	1.3	1.9	14.2		
2011 ABS Census - number of dwellings by state								
	2,864,531	2,277,967	1,826,449	727,676	960,717	232,370	81,190	145,229
Calculated number of heaters by type and state								
Combustion	323,692	120,732	135,157	93,870	104,718	31,138	10,068	2,759
Fire–open	22,916	0	42,008	2,183	4,804	0	0	0
Pot-belly	5,729	0	3,653	0	6,725	0	0	0
Other	51,562	77,451	45,661	9,460	18,254	32,997	0	0
Calculated emissions by heater type and state								
Combustion	7,762,943	2,939,166	1,602,356	2,242,747	2,558,788	1,637,230	NA	46,948
Fire–open	1,032,377	0	935,525	97,974	220,485	0	NA	0
Pot-belly	180,666	0	56,945	0	216,075	0	NA	0
Other	1,236,575	1,885,503	541,337	226,013	446,027	1,734,975	NA	0
Total	10,212,561	4,824,669	3,136,164	2,566,734	3,441,375	3,372,204	0	46,948

Grand total for all states =	**27,601**	**tonnes**

Using these valid data sources, overall particulate emissions from wood heaters across Australia can be represented as 27,600 tonnes, 31% less than the figure reported in the Consultation RIS paper.

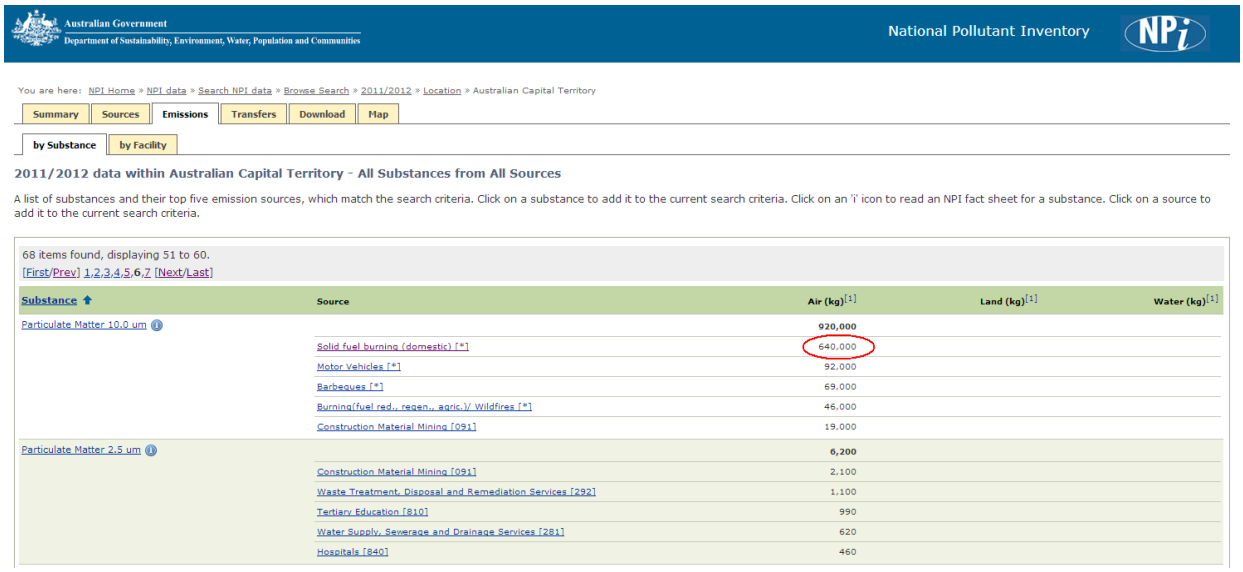
Australian Government National Pollutant Inventory

The National Pollutant Inventory (NPI) (http://www.npi.gov.au) lists emission sources and their contribution across Australia. It was confirmed with a representative who maintains the data on the website that they only present the data that is made available to them from the various state EPAs and that the list of emission sources is not exhaustive. In some cases, the figures are modelled and adjusted mathematically as is the case for wood heaters described as "solid fuel burning (domestic)".

According to the NPI, domestic solid fuel burning in ACT represents 640,000 kg of PM10 out of a total of 920,000 kg. On face value, it is easy to interpret this information as wood heaters being responsible for 70% of PM10 in ACT. This figure has been quoted in draft legislations (ACT Greens, 2012), in submissions to the senate inquiry into impacts on health

of air quality in Australia (D. Johnston, Secretary, Tuggeranong Council, May 2013), and in the Consultation RIS paper, to name a few.

I suspect a) this list is not exhaustive, and b) domestic solid fuel burning has been over represented.



Australian Government
Department of Sustainability, Environment, Water, Population and Communities

National Pollutant Inventory

You are here: NPI Home » NPI data » Search NPI data » Browse Search » 2011/2012 » Location » Australian Capital Territory

Summary | Sources | Emissions | Transfers | Download | Map

by Substance | by Facility

2011/2012 data within Australian Capital Territory - All Substances from All Sources

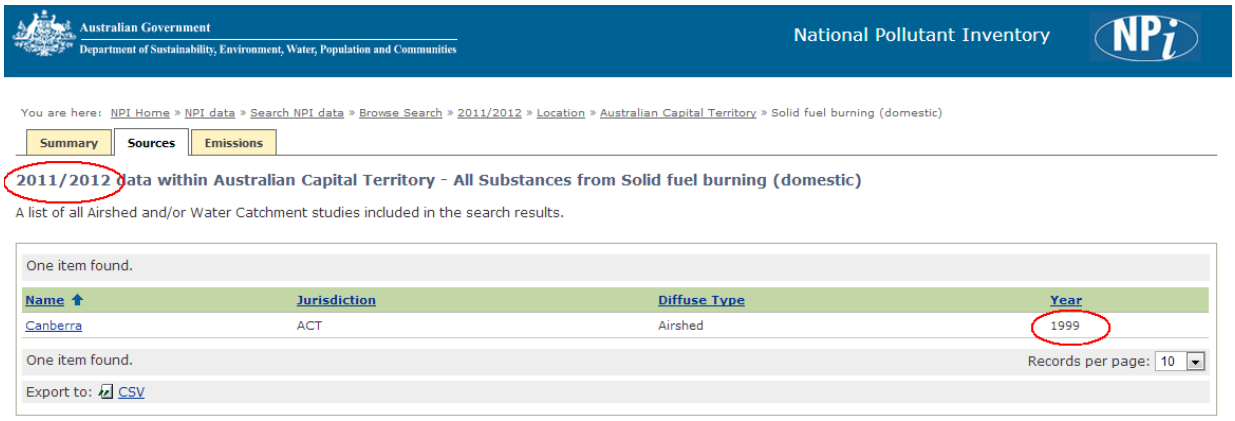
A list of substances and their top five emission sources, which match the search criteria. Click on a substance to add it to the current search criteria. Click on an 'i' icon to read an NPI fact sheet for a substance. Click on a source to add it to the current search criteria.

68 items found, displaying 51 to 60.
[First/Prev] 1,2,3,4,5,6,7 [Next/Last]

Substance	Source	Air (kg)[1]	Land (kg)[1]	Water (kg)[1]
Particulate Matter 10.0 um		920,000		
	Solid fuel burning (domestic) [*]	640,000		
	Motor Vehicles [*]	92,000		
	Barbeques [*]	69,000		
	Burning(fuel red., regen., agric.)/ Wildfires [*]	46,000		
	Construction Material Mining [091]	19,000		
Particulate Matter 2.5 um		6,200		
	Construction Material Mining [091]	2,100		
	Waste Treatment, Disposal and Remediation Services [292]	1,100		
	Tertiary Education [810]	990		
	Water Supply, Sewerage and Drainage Services [281]	620		
	Hospitals [840]	460		

If this 70% were correct, then why:-

- Barbeques represent 7.5% of all PM10 in ACT (69,000 kg)?
- Total PM2.5 in ACT is only 6,200 kg, or 0.67% of the reported PM10?
- Domestic solid fuel burning is not listed as an emission source for PM2.5?
- ABS 2011, number of wood heaters in ACT = 2,759. 640,000 kg equates to 232 kg of PM10 per heater. Even with a generous emissions factor of 12.0 g/kg, this translates to an annual consumption of 19 tonnes of wood per heater. Another example of the figures presented as questionable.
- The data used to model PM10 from domestic solid fuel burning for the year 2011/2012 is based on data from a study conducted in 1999? Opportunity for error?



Australian Government
Department of Sustainability, Environment, Water, Population and Communities

National Pollutant Inventory

You are here: NPI Home » NPI data » Search NPI data » Browse Search » 2011/2012 » Location » Australian Capital Territory » Solid fuel burning (domestic)

Summary | Sources | Emissions

2011/2012 data within Australian Capital Territory - All Substances from Solid fuel burning (domestic)

A list of all Airshed and/or Water Catchment studies included in the search results.

One item found.

Name	Jurisdiction	Diffuse Type	Year
Canberra	ACT	Airshed	1999

One item found. Records per page: 10

Export to: CSV

These examples demonstrate the importance of sourcing the most accurate and current data available.

5. ***Are there other variables that have not been considered or not been attributed sufficient weight in the discussion?***

Two variables that have not been discussed are:-

- Weather conditions
  - In winter, certain weather conditions often in conjunction with the local topography can result in temperature inversions which will trap any particulate matter from escaping and dispersing into the atmosphere.
  - Exceedences of the PM2.5 NEPM standard in winter can often be attributed to temperature inversions.
  - If wood heaters were the main cause for such exceedences then why do the exceedences occur only periodically during winter not consistently as would expect if they were due to wood smoke?
- Topographical Location
  - The topographical terrain can have a large impact on particulate matter emission levels.
  - This could be considered as part of regulation of wood heaters and their emissions. For example, districts located in a depression or valley may require tighter emissions controls than those that are in flat terrain or on a hill.
  - The Molonglo Valley in ACT designated for future residential development is an example where the nature of the surrounding topography is likely to be susceptible to regular temperature inversions and increased particulate emission levels (AECOM, 2011).

Section 4 – Rationale for Government Intervention

6. ***Do you agree that the current policy measures for the abatement of wood heater emissions are not successful in realising the policy objectives? Can you provide other evidence to support this?***

Yes. Regulation of certified wood heaters is on a state level. In South Australia there is no regulation on wood heaters sold. Dirty polluting wood heaters imported from overseas can be sold in South Australia with no consequence.

At the other extreme, Camden Council in NSW have adopted an emission standard of 1.0 g/kg or less and 65% efficiency. This regulation is unrealistic for Australian wood heaters that burn hardwood. Many wood heaters in New Zealand that have been tested on Softwood comply with this standard. However, if one of these is installed in Camden and the homeowner burns hardwood (predominant fuel type in Australia), the heater will perform worse with higher emissions than if they had installed an Australian wood heater with a certified overall emissions of 2.5 g/kg.

A heater designed to burn softwood will produce high emissions if fuelled with hardwood, and vice versa where a heater designed to burn hardwood will produce much higher emissions if fuelled with softwood. The design of the heater determines the way in which the fuel burns and softwood burns differently to hardwood.

7. ***Which policy delivery method do you believe should be adopted by government and why?***

Commonwealth legislation of policy.

Section 5 – Identification of Feasible Policy Measures

8. ***Do you agree that the policy measures listed for the abatement of wood heater emissions will be successful in realising the objectives? If not, please provide your reasons including supporting evidence.***

Yes. Tighter regulation on nuisance operators – allowing complaints by neighbours to be followed up and acted upon as a result of better local council services.

9. ***Do you believe that the "nudge" programs will be helpful in reducing wood heater emissions?***

10. ***Are there other measures that are not listed in the document that should be considered?***

Wood heaters sold in Australia that have to comply with the specified emissions and efficiency standards need to have been tested burning Hardwood. Those that comply when only tested burning Softwood should not be allowed to be sold in Australia. Wood suppliers offer Hardwood, not Softwood in Australia, and therefore only those complying on Hardwood should be allowed in the country.

In New Zealand, the Environment Canterbury Regional Council and Nelson City Council will only accept an application if the wood heater has been tested burning Softwood. This regulation should be reciprocated in Australia.

More strict regulation on wood suppliers offering green (wet) wood for sale. It is easier for the wood supplier or merchant to store large quantities of wood allowing it to dry for the following season than it is for the individuals who operate a wood heater to store 2 tonnes of firewood on their property for 6-12 months in advance of the winter season ahead.

Section 6 – Identification of Feasible Policy Combinations

11. ***Which of the listed policy combinations do you favour in addressing a reduction in wood heater emissions? Why do you favour these measures?***

Any. That which is most cost effective for maximum gain, i.e. reduction in overall emissions.

12. ***Are there policy combinations that you would not support? Please provide reasons.***

No.

Section 7 – Impact Analysis of Feasible Policy Options

13. Do you believe the base case has been correctly identified, or are there other variables that need to be considered?

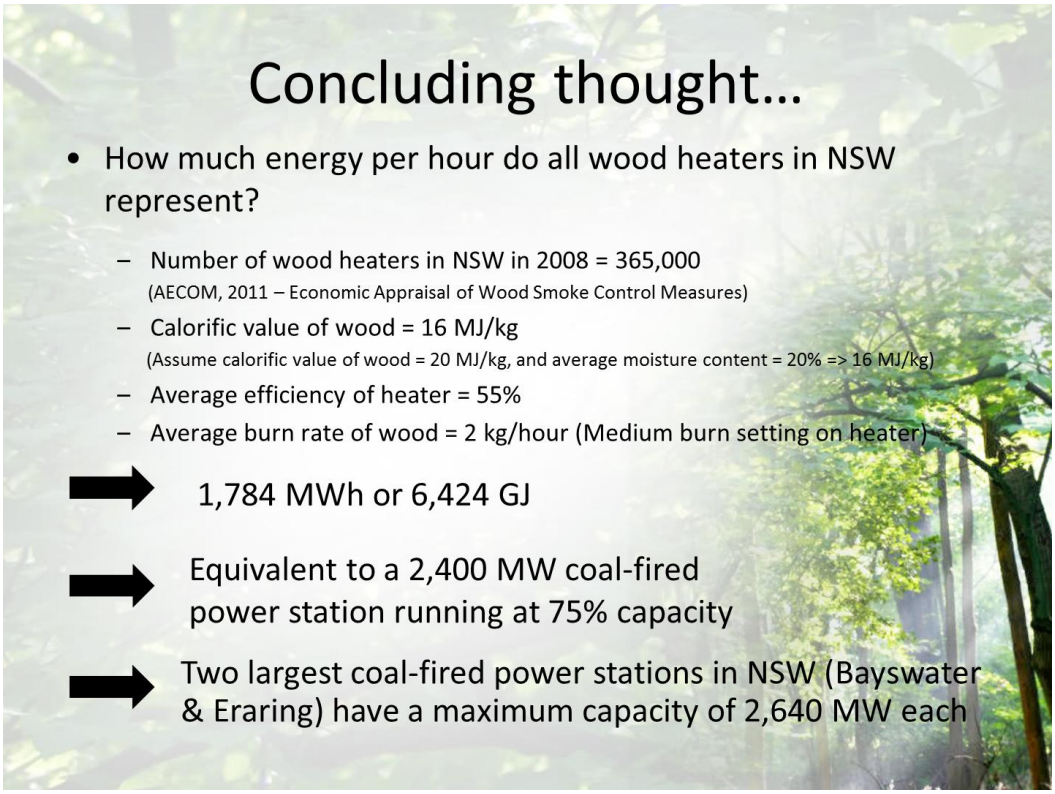
Yes overall, however, the modelled figure of 40,000 tonnes could be argued to be over-stated.

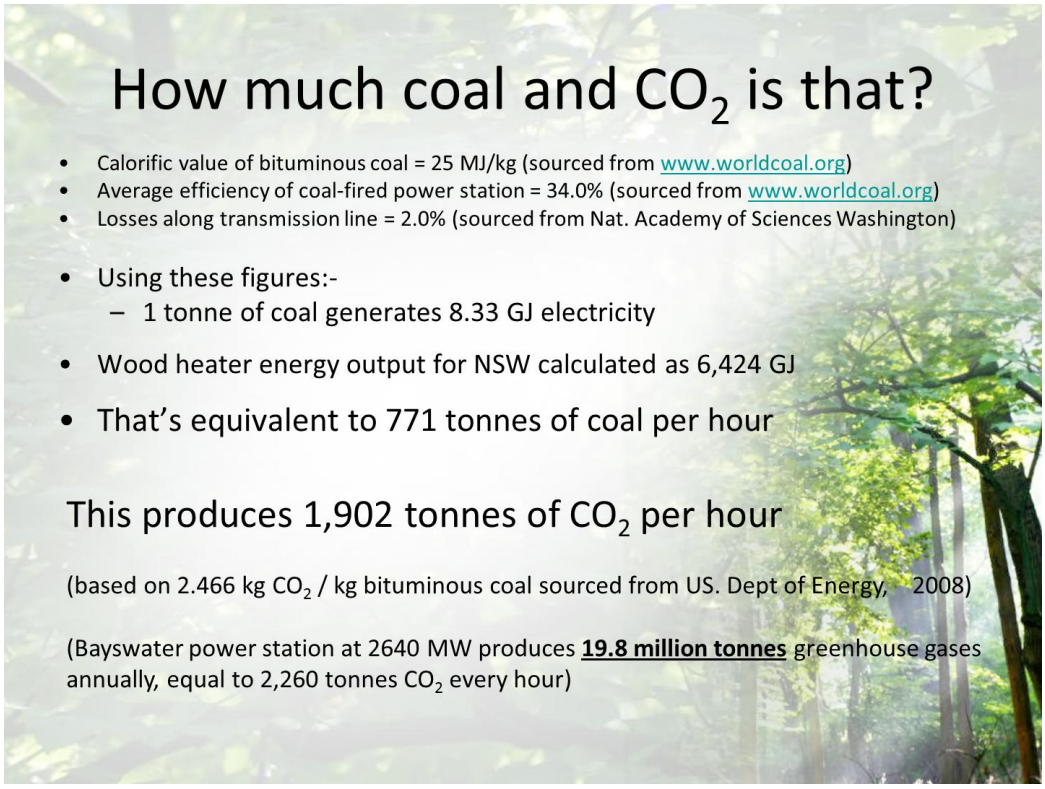
14. Have all health, environmental, economic and social impacts been identified? If not, please suggest others that need to be included. Has sufficient weight been given to these impacts within their relationship to the policy options being proposed?

Greenhouse gas emissions have not been considered. In many parts of Australia, reticulated gas is not an option, so the only alternative to heating the home with wood is by electricity.

The following two slides are from a presentation I gave for the Clean Air Society of Australia and New Zealand. It demonstrates that the total amount of heat energy generated by wood heaters in NSW is equivalent to the largest coal-fired power station in NSW. The amount of coal required to produce the same amount of energy per hour is 771 tonnes producing 1,902 tonnes of CO_2 per hour.

If Australia wants to earn carbon credits, although hypothetical, it is worth considering the impacts.





The demographic of people who use a wood heater to heat their home needs to be considered when determining appropriate regulations. Possibly the largest demographic of people would be middle to lower incoming earning families. For these people, wood heaters are the cheapest form of heating both in cost of fuel as well as cost of appliance. This demographic will live in areas where house prices and rental rates are lower and often these areas will be regional towns or outer limits of the capital city. In either case, reticulated gas, as an alternative form of heating, may not be an option due to availability and electricity will not be an option due to ever increasing electricity rates.

15. Have all key assumptions been correctly identified and included in the analysis? If not, please suggest others that need to be included.

Health costs attributed to wood heaters

Costs to health services per tonne of particulate emissions contributed from wood heaters are primarily based on the estimated total particulate emissions produced. The assumptions used to extrapolate the total emissions figure could be better represented. When 40,000 tonnes is quoted, the reader assumes that figure must be valid, which it may, however the assumptions used to calculate that figure are not provided.

What is concerning is the estimate for the annual consumption of wood per household used in the data modelling. These figures will be based on survey results. The variation in results

from different surveys on household consumption of wood by state is significant enough to question the validity and accuracy of the values presented.

Firstly, the size of the sample set in the survey used to represent all households with a wood heater in each state is questionable.

Secondly, the estimated annual wood consumption given by respondents in the survey is likely to be inflated. Consider the following scenario.

Scenario

Survey question "How much firewood do you typically use in a year?"

Respondent ponders thinking about how many trailer loads (or car boot loads) of wood they use in a year, thinking 3 maybe 4 trailer loads, "Ok, 4 trailer loads, that's 2 tonnes I use in a year".

Firstly, "3 maybe 4 trailer loads", naturally the respondent will round up. In this case it could be as much as 25-30% exaggerated.

Secondly, a standard trailer is 6" x 4", when the wood is packed tightly it will weigh 300 - 400 kg (using Red gum). If the trailer is packed loosely, 200-300 kg, and if loaded loosely from a front-end loader 200kg. (These figures were sourced from wood suppliers).

Therefore, the estimate given in the survey of 2 tonnes based on 4 trailer loads could be as much as 65% exaggerated (4 trailer loads @ 300kg each = 1200 kg versus estimated 2000 kg).

In reality, this respondent may have consumed only 3 trailer loads, and at 300 kg each (900 kg total), that is less than 1 tonne consumed as compared to the survey result of 2 tonnes.

The assumptions made, particularly regarding annual wood consumption, when modelling the total particulate emission contribution from wood heaters need to be taken in to account and stated so. If estimates on annual wood consumption were out by 30%, that translates into an immediate reduction in costs to health services by 30%. This is very significant considering the accuracy and validity of the data used.

Section 8 – Conclusions

16. Do you agree with the conclusions? If not, please provide reasons.

"Wood heaters are the main source of increased particulate emissions in winter"

Agreed wood heaters produce smoke, some much more than others. When someone in the neighbourhood is operating their wood heater incorrectly and producing excessive amounts of smoke from their flue/chimney, agreed when standing outside the smoke can be smelt and may not even be visible. Does this mean that one is breathing particulate-laden air in to their lungs because they can smell smoke? Humans do not carry much in the way of smell senses, however, when there is smoke, whether visible or not, the human nose will pick it up. Does that mean then that the air must be laden with particulate emissions and one should run for the hills?

One cannot deny that poor air quality affects people's health. Old saying "those who grow up in the country live for longer", particulate emissions likely have a large part to play in that.

There are many individual case studies where a resident will be susceptible to respiratory illness. Their neighbour either cannot operate their wood heater correctly, or has an open fireplace or non-certified heater and produces excessive smoke as a result. Definitely, these types of cases should be resolved. However, these individual cases do not represent the majority of Australia. If wood heaters were as filthy as some make them out to be, then with 1.1 million across Australia why aren't there more people complaining.

NSW EPA modelled figure of 46.5% of PM2.5 in Sydney attributed to wood heaters – imagine walking down a street in Sydney in winter, according to these figures almost 50% of the particle matter in the air is smoke. Hard to imagine, especially when monitoring stations suggest otherwise.

There is no consistent evidence from monitoring stations that winter PM2.5 levels are greater than in summer. Those monitoring stations that do show an increase in winter will be in a location susceptible to temperature inversions where all particulate emissions are trapped and monitor readings increase.

Wood heaters do contribute to the poor air quality in built up areas in winter. However, what percentage they contribute is questionable. Current data modelling is insufficient to represent the true impact of wood heaters to people's health.

Other Considerations

More analysis from monitoring stations

More data analysis of PM2.5 from monitoring stations should be conducted to get a clearer picture of what influence wood heaters have on overall air quality rather than based solely on data modelling.

The USA EPA website allows data from monitoring stations to be downloaded for analysis (http://www.epa.gov/airquality/airdata/). A much larger set of data from many more monitoring stations is available than that in Australia.

For example, the state of Washington, USA, emission limits of certified EPA wood heaters is 4.5 g/hr as compared to the rest of the country at 7.5 g/hr.

For the year 2012 in the state of Washington, the PM2.5 daily average in Winter (Dec 21 – Mar 20) was 7.2 ug/m3 while the daily average in Summer (Jun 21 – Sep 20) was 7.3 ug/m3. Daily averages from 59 monitoring stations across the state have been used to give these figures.

Even in the most strictly regulated state of USA for wood heater emissions, average daily PM2.5 levels in winter are the same as those in summer. This is another example that makes one question the accuracy of the variables used in data modelling to determine how much wood heaters contribute to particulate emissions.

Testing costs to certify a heater model

Appendix 7, page 142, the cost for testing a heater model for certification is quoted at $10,000. Our company was quoted $12980 to test a heater in 2010. It is likely that this has since increased.

Often a heater may require several iterations in testing with modifications in between to get the emission results below the regulated standard. Therefore, it is unreasonable to assume that overall costs to manufacturers would be the number of heater models to be tested multiplied by the cost of the test since a heater may require several tests.

Star Rating on wood heaters

Appendix 8 discusses various labelling schemes. Introduction of a suitable star rating for wood heaters would make it much easier for the buyer to compare the performance of one heater to the next. A heaters performance is based on two factors, emissions and efficiency. A wood heater with low emissions will not necessarily have a high efficiency, typically it will be the reverse. Similarly, a heater with very high efficiency is likely to have a higher emissions output than one with a lower efficiency.

A suitable star rating would combine emissions with efficiency represented as grams of particulate emissions per unit of energy produced. The unit of measure would be either g/kW. The number of stars would applied based on this unit of measure.

The following table gives examples showing heater models with different emissions and efficiency can have the same star rating.

The formula is:-

g/kW = Emissions (g/kg) / (Efficiency (%) x Calorific value of wood (MJ/kg))/3.6

(Assuming average calorific value of hardwood is 20MJ/kg, and average moisture content is 20%, therefore wet-base calorific value will be 16 MJ/kg)

Model	Emissions (g/kg)	Efficiency (%)	g/kW
1	1.3	52%	0.56
2	1.5	60%	0.56
3	1.7	68%	0.56

For example, a room in a house requires 6kW to heat it:-

- Model 1 will consume 2.6 kg wood and emit 3.375 g of particulate emissions.
    - 2.6 kg = 6kW / (16MJ/kg / 3.6 x 52% efficiency)
    - 3.375 g = 2.6 kg x 1.3 g/kg emissions
- Model 2 will consume 2.25 kg wood and emit 3.375 g of particulates
- Model 3 will consume 1.99 kg wood and emit 3.375 g of particulates

In this example, each of these models, although have different emissions and efficiency values, would have the same star rating. This is because they will each produce the same amount of particulate emissions to generate 6 kW of energy.

Typically, a smaller heater will have low emissions and a low efficiency (Model 1), while a larger heater will have higher emissions and a higher efficiency (Model 3). A star rating based on this type of calculation allows performance of a small heater to be compared to that of a large heater.

When a heater is tested, the emissions and efficiency are reported. This type of calculation can be performed on all currently certified heaters in Australia. Data analysis would be required to determine the allocation of stars to different g/kW ranges.

I have attempted this using data sourced from the Australian Home Heating Association website. Two currently certified heaters in Australia, one at 1.1 g/kg and 65%, and the other 1.35 g/kg and 77%, would both be 6 Star Rating as they both have the same g/kW value.

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