

IP4 Updates



Foundations

Wood Heater

Workshop Dec 2022

- 140 participants
- 96 organisations
- Shared knowledge and ideas and heard successful stories from NZ
- **Interventions need to be multifaceted!**

Leverage

New collaborative grants 2022-3

- Asthma Australia
- HEAL
- Centre for Safe Air
- University/CSIRO in kind

Currently 7 active projects

- **Lets talk about smoke** – community levers
- **Making the Switch** – community levers
- **Discrete choice experiments X2** - community/policy levers
- **Wood heater design and testing** - regulatory levers
- **Economic impacts** - burden of disease and benefits of interventions -policy levers
- **Communication** – online tool

1. Let's Talk about Smoke – Co-designing a wood heater intervention in Mt Barker

NESP funded PhD / Additional HEAL seed funding – Led by Dr P Jones

Our Aim: To create, pilot and evaluate **new approaches** to wood heater communication by bringing together researchers, communication experts, local council and the community.



Let's Talk about Smoke – Co-designing a wood heater intervention in Mt Barker

We have:

- **Held workshops with Mt Barker community members** to understand their perspectives on wood heaters and wood heater use
- **Held focus groups** to get feedback on innovative approaches to intervention delivery and messaging.
- **Worked with Council and SA EPA** to map out the options, costs and benefits of various ways to deliver wood heater behaviour change programs.
- **Pilot** communication intervention in progress.
- **Share our findings** with governments, communities and researchers.



2. Making the Switch – Trialling a wood-heater replacement scheme in Armidale

National Environmental Science Program

NESP / PhD student and Asthma Australia funding Led by P Jones

Our Aim: To co-design and pilot a wood heater replacement scheme to gain new knowledge on feasibility, acceptability, resident experience, and impacts on home temperatures and budgets.

Making the Switch – Trialling a wood-heater replacement scheme in Armidale

We are:

- **Working with Armidale Council** to design a wood heater replacement scheme.
(budget - \$3000/home plus free energy audit)
- **Piloting** the scheme in **25 homes** (2025).
- **Collect data** on the residents' experience, home temperatures and energy bills.
- **Evaluate** the lessons for feasibility and acceptability in replacement trial design.
- **Share findings** with governments, communities and researchers.



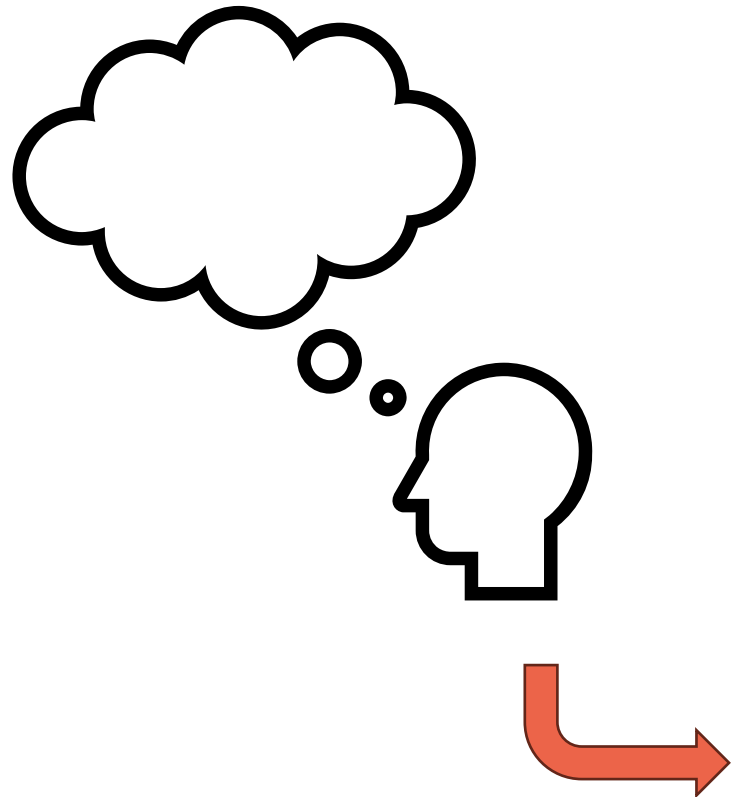
3. Discrete Choice Experiments to Inform policy



- Originally used in marketing and economics to understand market drivers
- Now expanded to other fields including medicine and environmental health
- Participants are given with real or hypothetical choices/scenarios to see what factors they consider.
- It helps understand trade-offs (motivations and concerns) when making decisions.
- Understanding choice patterns and drivers is useful for designing policies and interventions.

DCE 1 (NESP) - wood heater users and non-users

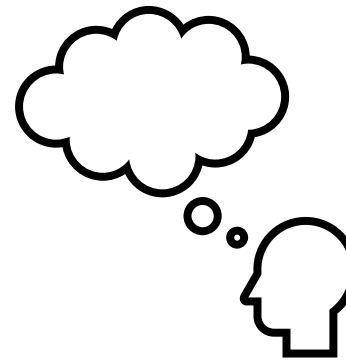
... analysis in progress









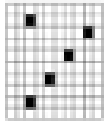
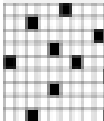
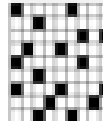
	Program A	Program B
Cost to the household participating in the scheme	Free	\$1000 for all
Cost to the average taxpayer/rate payer	\$20 extra per year for 5 years	No additional tax
Wood heater removal and replacement with lower pollution options	Compulsory	Voluntary
Impact on carbon emissions in participating households	The same	Decreased by 80%
Household energy costs per year in participating households	The same	Decreased by 30%
Health benefit due to reduced smoke – Australia wide, every year into the future	This saves 5 lives This prevents 50 people from needing an ambulance or an admission to hospital and 500 people from missing an average of 2 school or workdays.	This saves 500 lives, prevents 5000 people from needing an ambulance callout or hospital admission, and saves 50,000 people from missing an average of 2 work or school days each year.
I would support	<input type="checkbox"/> Option A	<input type="checkbox"/> Option B

DCE 2. (NESP/AA) Wood heater owners and replacement schemes

- soon to commence!



- Replacement schemes are an effective method for reducing pollution
- But - expensive and requires significant buy-in from the community. Many have had poor uptake
- Aimed at understanding the characteristics of a scheme that will make it more acceptable
- Includes components of the scheme (incentives) and environmental and health impact of the alternatives compared to the wood heaters

	Option A	Option B	Option C
Price (AUD)	 500	 1000	 3000 (full cost)
Household Carbon emissions	 Decreased by 30%	 Decreased by 30%	 Decreased by 30%
Lifetime cancer risk	 Reduced by 5%	 Reduced by 10%	 Reduced by 20%

4. Emerging Priority Funding: to support reform of Wood heater testing in Australia



Why? - The current regulatory standard is not fit-for-purpose (and not enforced)

AS/NZS 4013 Domestic solid fuel burning appliances - Method for determination of flue gas emission

The testing protocol does not reflect real-life emissions.

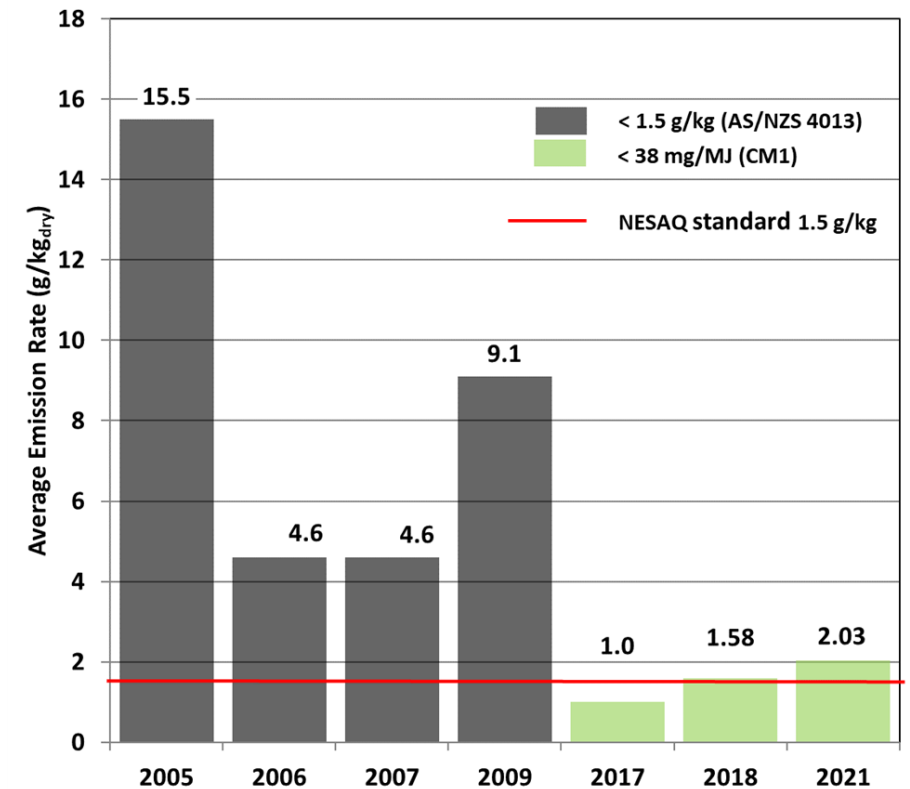
- *It excludes the start-up of the fire. This is the stage that produces the most pollution.*
- *It cannot tell us how much pollution each heater adds to the air during routine use in the community*

This limits its usefulness as a tool for reducing air pollution



Potential solutions - Ultra-low emission burners (ULEBs)

- A ULEB meets strict performance criteria when tested to the Canterbury Method (CM1) developed by Environment Canterbury NZ
- CM1 is intended to simulate typical home usage and includes the heater's start-up stage
- Real world emissions are substantially lower in ULEBs compared with heaters that meet the latest A/NZ standard
- Regulation has driven innovation in NZ



ULEBs (green) compared with ANZ 4013 (grey) in real-life emissions testing
(data from Environment Canterbury 2022)

ULEBs – the issue for Australia is our eucalypts

The CM1 protocol was not designed for hardwoods

- Hardwoods (eg eucalypts) burn differently to softwoods (eg pine)
 - More dense
 - Slower burning
- Softwood fuel loads and testing cycles will not work for hardwoods
- If the CM1 protocol could be adapted for Australia we would have a robust tool to improve our air quality



Preliminary Tasmanian research showed that there is good potential for developing Australian hardwood ULEBs

- Designed a prototype 'Tasmania Protocol' based on the CM1 for testing appliances burning Australian hardwoods.
- Evaluated the performance of four contrasting designs of existing (softwood) ULEBs fuelled with hardwoods.
- Potential to reduce pollution by 80 to 90% compared with current Australian stock



Pilot work (Johnston et al 2023)

Emerging Priority funding approved by NESP and supported by UTAS PhD

Work requested by Standards Australia

2024-2025 - refine and develop the
Tasmania Protocol as a tool to
support:

- appropriate quantification of emissions
- sustained improvement in air quality
- sustained improvement in population health
- sustained reduction in carbon emissions



5. Burden of disease and benefits of interventions



> [Sci Total Environ.](#) 2024 Apr 15:921:171069. doi: 10.1016/j.scitotenv.2024.171069. Epub 2024 Feb 21.

The mortality burden attributable to wood heater smoke particulate matter (PM_{2.5}) in Australia

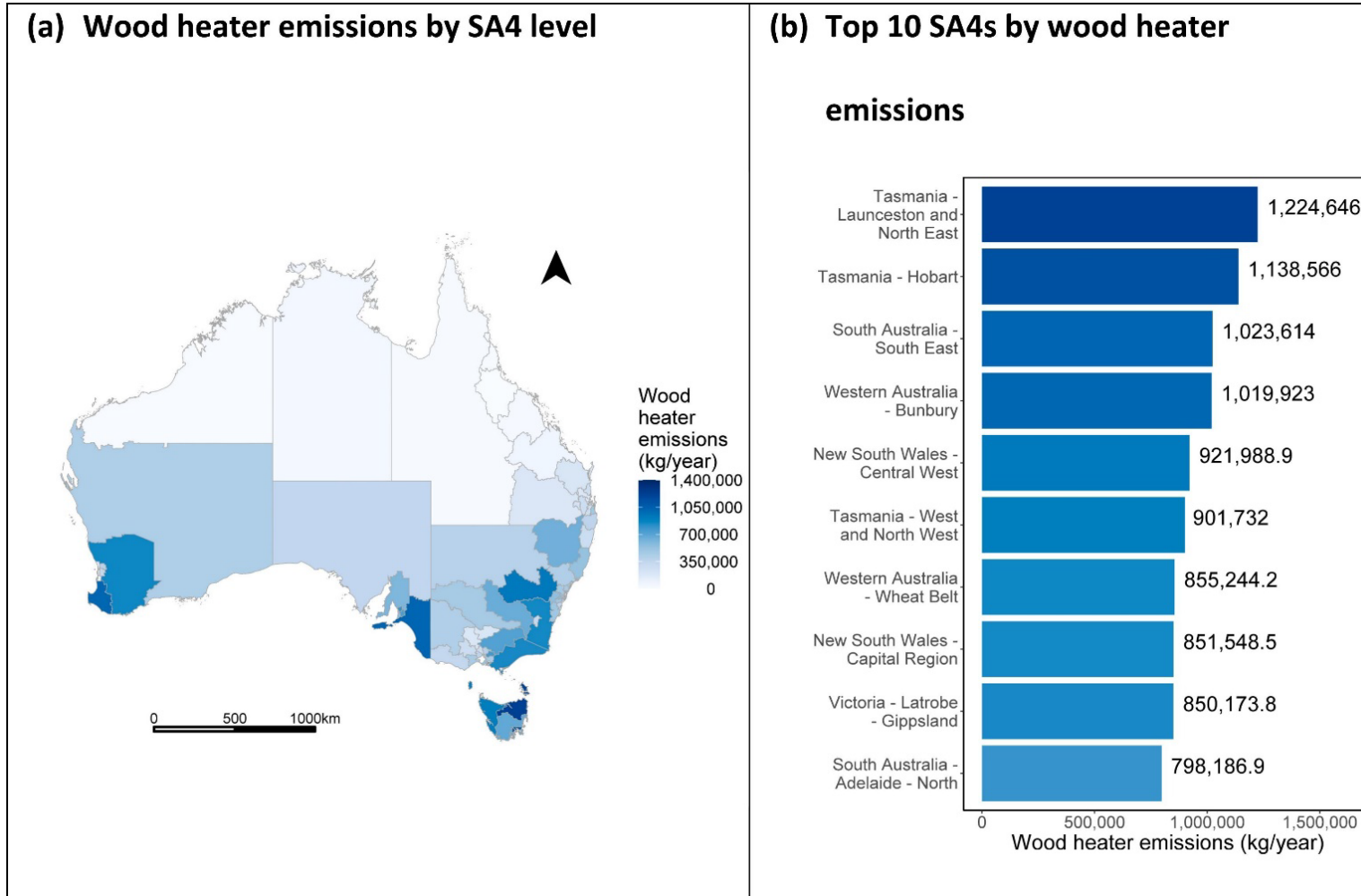
Nicolas Borchers-Arriagada¹, Stephen Vander Hoorn², Martin Cope³, Geoffrey Morgan⁴, Ivan Hanigan⁵, Grant Williamson⁶, Fay H Johnston⁷

~ 1.35 million households in Australia use firewood (wood heaters) as their main source/technology for space heating.

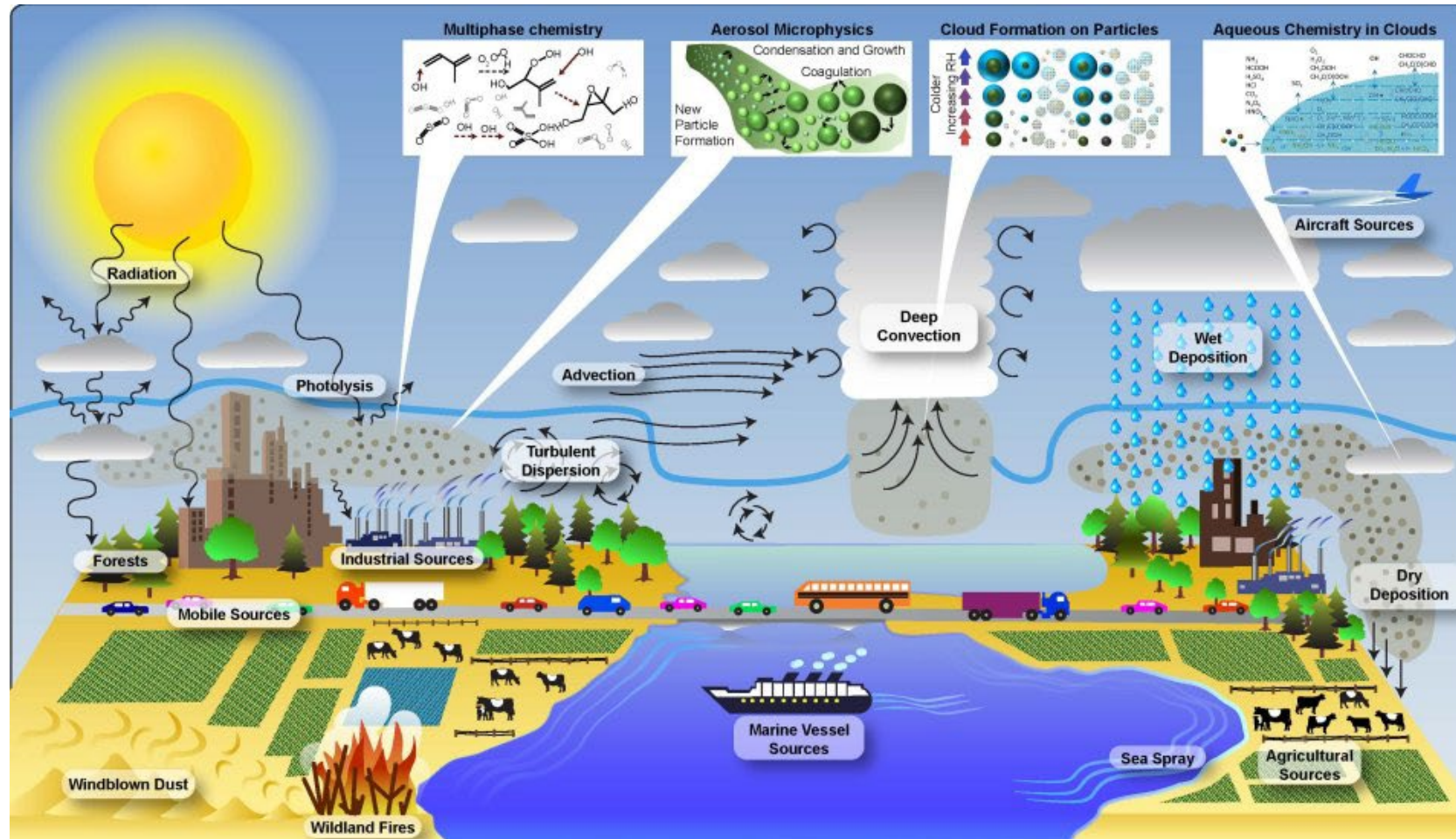
Romanach and Frederiks 2021



Wood heater emissions by SA4 (kg/year)



Air quality modelling



Pollution modelling

State/Territory	Annual PM_{2.5} (µg/m³)	WHE-related PM_{2.5} (µg/m³)	%
New South Wales	6.8	1.3	19.1%
Victoria	6.7	0.74	11.0%
Queensland	5.8	0.35	6.0%
South Australia	5.9	0.9	15.3%
Western Australia	8.1	0.33	4.1%
Tasmania	4.2	0.81	19.3%
Australian Capital Territory	6.6	0.82	12.4%

Estimated mortality burden - 2015

State/Territory	Attributable number of deaths		Attributable number of deaths per 100,000	
	N	(95 % CI)	N	(95 % CI)
Australian Capital Territory	9	(6–12)	2.2	(1.4–2.9)
New South Wales	382	(250–506)	5.0	(3.3–6.6)
Queensland	58	(38–77)	1.2	(0.8–1.6)
South Australia	69	(45–92)	4.1	(2.7–5.4)
Tasmania	21	(14–27)	4.0	(2.6–5.3)
Victoria	163	(106–215)	2.7	(1.8–3.6)
Western Australia	27	(17–35)	1.0	(0.7–1.4)
National	728	(476–964)	3.1	(2–4)

What if we change something???

Relative benefits of using cleaner heating technologies



Electric heaters

No emissions (electricity generated from non-combustible sources)

Modelled benefit of randomly replacing 50% of the existing heaters with lower pollution alternatives

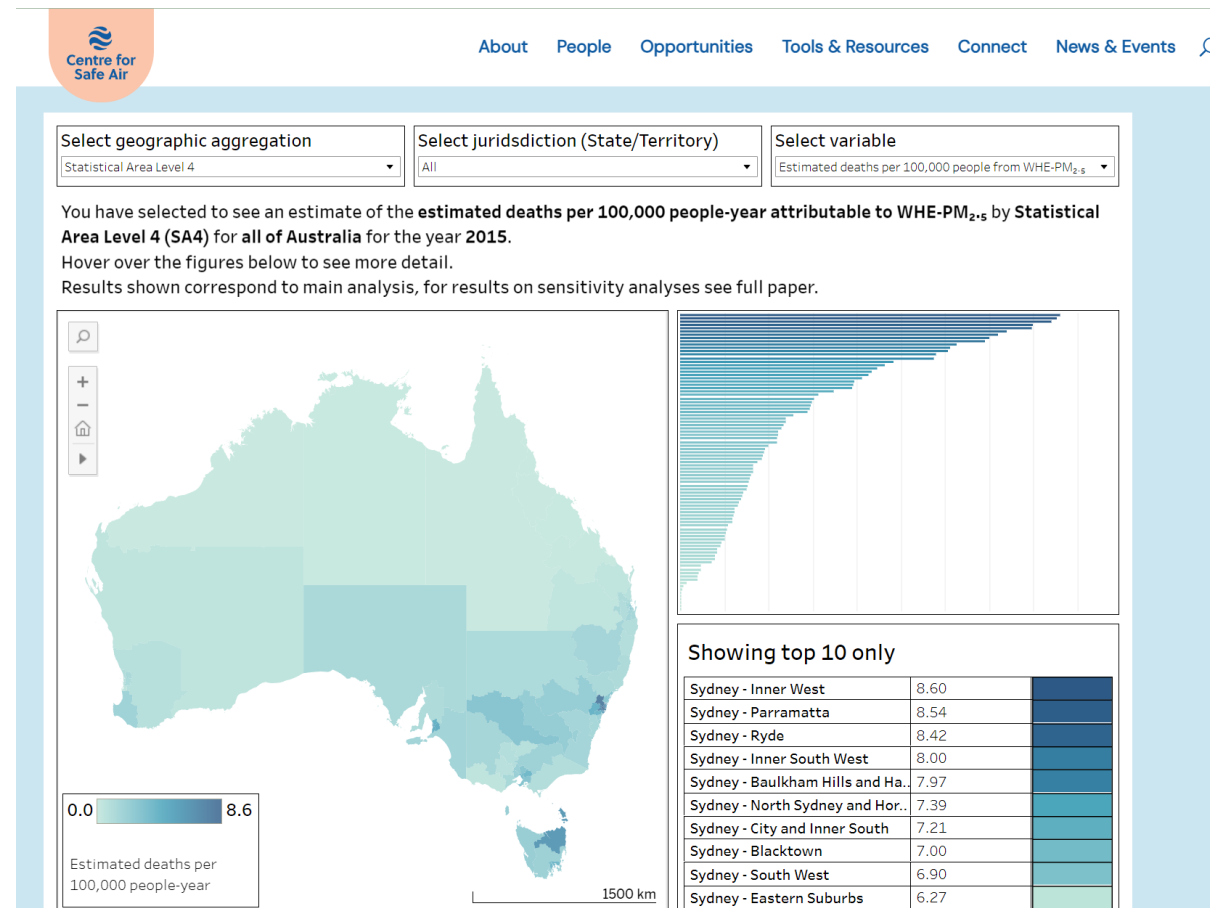
Estimated benefits (per year) of using alternative heating technologies.

Intervention Scenario	State/Territory	PM _{2.5} Reduction	Estimated reduced mortality		Estimated health benefits	
		(µg/m ³)	N (95 % CI)		\$AUD (95 % CI) million	
Electric heater with electricity from non-combustible renewable source	Australian Capital Territory	0.41	4	(3–6)	23.1	(15.1–30.6)
	New South Wales	0.65	191	(125–253)	1012.5	(661.4–1339.8)
	Northern Territory	0.00	0	(0–0)	0.1	(0.1–0.2)
	Queensland	0.18	29	(19–39)	154.8	(101–205.1)
	South Australia	0.45	35	(23–46)	183.5	(119.8–243)
	Tasmania	0.41	10	(7–14)	55.0	(35.9–72.8)
	Victoria	0.37	81	(53–108)	431.1	(281.4–570.9)
	Western Australia	0.16	13	(9–18)	70.3	(45.8–93.1)
	National	0.40	364	(238–482)	1930.5	(1260.4–2555.6)
High technology wood heater	Australian Capital Territory	0.34	4	(2–5)	19.2	(12.5–25.4)
	New South Wales	0.54	159	(104–210)	842.0	(550–1114.2)
	Northern Territory	0.00	0	(0–0)	0.1	(0.1–0.2)
	Queensland	0.15	24	(16–32)	128.8	(84–170.6)
	South Australia	0.38	29	(19–38)	152.6	(99.6–202.1)
	Tasmania	0.34	9	(6–11)	45.8	(29.9–60.6)
	Victoria	0.31	68	(44–90)	358.5	(234–474.8)
	Western Australia	0.14	11	(7–15)	58.4	(38.1–77.4)
	National	0.33	303	(198–401)	1605.4	(1048.2–2125.3)

Electric heating avoids 364/728 (50%) deaths: \$1,930.5M/yr
 ULEB heating avoids 303/728 (42%) deaths: \$1,605.4M/yr

Centre for Safe Air - Data visualisation tool demonstration

- https://safeair.org.au/data-visualisation-wood-heater-pollution-mortality-in-australia/?mc_cid=e611a58d9a&mc_eid=2405e30e8b





Sustainable Communities and Waste

National Environmental Science Program

Thank you

Amanda.Wheeler@csiro.au

Fay.Johnston@utas.edu.au

