

6 November 2019 Hearing of Inquiry into Coal Fired Power Funding Prohibition Bill - Public Health Association of Australia – Responses to questions on notice

1. Health impacts at different levels of global warming

Smith KR, Woodward A, Campbell-Lendrum D, Chadee DD, Honda Y, Liu Q, et al. Human health: impacts, adaptation and co-benefits. In: Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, et al., editors. Climate Change 2014: Impacts, Adaptation, and Vulnerability Part A: Global and Sectoral Aspects Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press; 2014. p. 709-54.

- 3 types of effects on human health –
 - direct (from changes in frequency of extreme weather events including heat, drought and heavy rain);
 - indirect effects mediated through natural systems (from disease vectors, water-borne diseases, air pollution)
 - economic and social effects mediated through human systems (from occupational impacts, undernutrition, mental stress)
- Limits to human adaptation exist.
- Impacts will be greater than simple linear increments in areas such as mortality response to extreme heat, agricultural crop yields, child nutrition and development, infectious diseases
- Physiological limits to human heat tolerance:
 - Warming of 7° would create areas where it is impossible to live because metabolic heat dissipation would become impossible. Warming of 11° would see these areas increase to encompass most of the areas occupied by humans today.
 - Warming 3.4° by 2100 would reduce global labour productivity to 60%, particularly in India, northern Australia and south eastern USA.
- Limits to food production and human nutrition
 - Some crops can't grow at temperatures higher than 40° eg maize, rice, wheat, soybean
 - Warming of 4° leads to very severe global risk to food security
- Displacement and migration
 - 4° (relative to 2°) of warming, would remove many people's ability to choose whether to stay or leave when confronted with environmental changes, and forced migration leads to more significant adverse health impacts including undernutrition, food and water borne illnesses, acute respiratory infections, sexually transmitted infections, increased maternal mortality and mental health disorders

Masson-Delmotte V, Zhai P, Pörtner H-O, Roberts D, Skea J, Shukla PR, et al., editors. Global Warming of 1.5° C: An IPCC Special Report on the impacts of global warming of 1.5° C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. <https://www.ipcc.ch/sr15/download/#full>: IPCC; 2018.

- 2 vs 1.5 degrees of warming:
 - Increased risk of heat related morbidity and mortality
 - Increased risk of vector-borne diseases such as malaria and dengue fever including potential shifts in their geographic range
 - Higher net reductions in yields of maize, rice, wheat and potentially other cereal crops, and in the CO₂ dependent nutritional quality of rice and wheat
 - Larger reductions in food security due to impacts on yields, crop nutrient content, livestock, fisheries and aquaculture and land use.
 - Increased risk of undernutrition

- Adverse effects on livestock related to changes in feed quality, spread of diseases, water resource availability.
- Increased mortality due to reductions in food availability and consumption of fruit, vegetables and red meat.
- 50% increase in proportion of world population exposed to water stress
- Increased risk to global aggregated economic growth

2. Broader community health impacts of living in vicinity of power stations

Armstrong F. Coal and health in the Hunter: Lessons from one valley for the world. Clifton Hill, Victoria: Climate and Health Alliance; 2015.

- NSW Health report (2010): Hunter regions most affected by open cut coal mining and coal-fired power generation have higher rates of emergency visits and hospital admissions for asthma and respiratory disease and cardiovascular disease compared with the rest of the state
- 1990s report – self reported asthma more common among children living in a town near 2 coal fired power stations compared with another similar control town
- 2010 survey – Hunter region had the highest proportion of children diagnosed with asthma in NSW
- No comprehensive epidemiological or toxicological studies of the health impacts of the long term effects of coal on the Hunter Valley community (as at 2015)

Kravchenko J, Lyerly HK. The impact of coal-powered electrical plants and coal ash impoundments on the health of residential communities. North Carolina Medical Journal. 2018;79(5):289-300

- Literature review over 30 years
- Higher rates of all-cause and premature mortality, increased risk of respiratory disease and lung cancer, cardiovascular disease, poorer child health, higher infant mortality – in people living in close proximity to coal-fired plants vs elsewhere

Hendryx M, Entwistle J. Association between residence near surface coal mining and blood inflammation. The Extractive Industries and Society. 2015;2(2):246-51.

- Controlled study – persons living close to active surface coal mining show significantly elevated blood inflammation

<https://www.cancer.gov/about-cancer/causes-prevention/risk/chronic-inflammation>

- Over time, chronic inflammation can cause DNA damage and lead to cancer

Hendryx M, Holland B. Unintended consequences of the Clean Air Act: Mortality rates in Appalachian coal mining communities. Environmental Science & Policy. 2016;63:1-6.

- Mortality rates for all cause, respiratory cancer and non-cancer respiratory disease all significantly higher in local communities after increase in coal mining – controlled for time, age, smoking, poverty, obesity, GP access

Mactaggart F, McDermott L, Tynan A, Gericke C. Examining health and well-being outcomes associated with mining activity in rural communities of high-income countries: A systematic review. Australian Journal of Rural Health. 2016;24(4):230-7.

- Evidence of increased prevalence of chronic diseases and poor self-reported health status was reported in the mining communities.

Cortes-Ramirez J, Naish S, Sly PD, Jagals P. Mortality and morbidity in populations in the vicinity of coal mining: a systematic review. BMC Public Health. 2018;18(1):721.

- Epidemiological studies 1990-2016 from USA, Europe, China – exposed populations had increased risk of mortality and/or morbidity by 78 ICD diagnosis categories including neoplasms (usually cancers); diseases of the circulatory, respiratory and genitourinary systems; metabolic diseases; diseases of the eye and the skin; perinatal conditions; congenital and chromosomal abnormalities; external causes of morbidity.
- 2/3 of the studies in this review found increased risk of cancers, particularly lung and colon.

Lin CK, Lin RT, Chen T, Zigler C, Wei Y, Christiani DC. A global perspective on coal-fired power plants and burden of lung cancer. *Environ Health*. 2019;18(1):9.

- Epidemiological study of every country with coal fired power plants globally. Every 1KW increase of coal capacity per person increases relative lung cancer risk by 59% of males and 85% for females.

Ewald B. The health burden of fine particle pollution from electricity generation in NSW.

https://www.envirojustice.org.au/wpcontent/uploads/2018/11/Ewald_B_2018_The_health_burden_of_fine_particle_pollution_from_electricity_generation_in_NSW.pdf: Environmental Justice Australia; 2018.

- Health burden from premature death, incidence of low birth weight babies and new cases of type 2 diabetes attributable to PM_{2.5} air pollution exposure from 5 NSW power stations – Bayswater, Liddell, Eraring, Vales Point, Mount Piper
- 297 deaths, 233 low birth weight babies, 361 people to develop type 2 diabetes – annually
- Eraring and Vales Point make the largest contribution to the health burden from power generation since prevailing weather patterns are most likely to carry pollutants from these sources into the Sydney basin.
- No similar study is available elsewhere in Australia

3. Which of current power stations are the most damaging to public health

Ewald B. The health burden of fine particle pollution from electricity generation in NSW.

https://www.envirojustice.org.au/wpcontent/uploads/2018/11/Ewald_B_2018_The_health_burden_of_fine_particle_pollution_from_electricity_generation_in_NSW.pdf: Environmental Justice Australia; 2018.

- Eraring and Vales Point make the largest contribution to the health burden from power generation since prevailing weather patterns are most likely to carry pollutants from these sources into the Sydney basin.
- No similar study is available elsewhere in Australia.
- Table 2 – Adverse health outcomes attributable to power stations during their remaining years of operation (3 health outcomes only, attributable to PM_{2.5} only so an underestimation of total health burden)

| Power Station | Planned year of closure | Remaining operation years | Number of expected deaths | Number of low birth weight babies | Number of new onset diabetes |
|---------------|-------------------------|---------------------------|---------------------------|-----------------------------------|------------------------------|
| Bayswater | 2035 | 17 | 685 | 571 | 857 |
| Liddell | 2022 | 4 | 107 | 89 | 134 |
| Eraring | 2032 | 14 | 1219 | 1058 | 1579 |
| Vales Point | 2030 | 12 | 547 | 475 | 709 |
| Mount Piper | 2042 | 24 | 871 | 835 | 1133 |
| TOTAL | | | 3429 | 3029 | 4412 |

- Table 19 – Percentage of regional health burden attributable to each power station

| Power station | Sydney (%) | Central Coast (%) | Lower Hunter (%) | Upper Hunter (%) |
|---------------|------------|-------------------|------------------|------------------|
| Bayswater | 10.7 | 0 | 38.6 | 60 |
| Liddell | 7.1 | 0 | 25.7 | 40 |
| Eraring | 38.4 | 65.6 | 23.4 | 0 |
| Vales Point | 20.1 | 34.4 | 12.3 | 0 |
| Mount Piper | 23.7 | 0 | 0 | 0 |
| TOTAL | 100 | 100 | 100 | 100 |

- Table 20 – Mortality, annual death

| Power station | Sydney | Central Coast | Lower Hunter | Upper Hunter | Total |
|---------------|--------|---------------|--------------|--------------|-------|
| Bayswater | 16 | 0 | 20 | 4 | 40 |
| Liddell | 11 | 0 | 13 | 3 | 27 |
| Eraring | 59 | 16 | 12 | 0 | 87 |
| Vales Point | 31 | 9 | 6 | 0 | 46 |
| Mount Piper | 36 | 0 | 0 | 0 | 36 |

4. Health impacts burning coal vs wood

World Health Organization. Residential heating with wood and coal: health impacts and policy options in Europe and North America.

http://www.euro.who.int/__data/assets/pdf_file/0009/271836/ResidentialHeatingWoodCoalHealthImpacts.pdf: WHO; 2016.

- Both coal and wood heating emissions linked with serious health effects such as respiratory and cardiovascular mortality and morbidity