Tackling short-lived-climate pollutants is at least as important as CO₂

A team of 50 experts from the UN Environment Program and the World Meteorological Organization (UNEP/WMO) modelled the rise in global temperatures and recommended a package of 16 measures, without which, as shown in the graph below, global temperatures are likely to rise by more than 1.5 °C within 15 years and 2 °C within 35 years (2). The package was designed to reduce short-lived climate pollutants (SLCP), also called super-pollutants. Three experts - a Nobel prizewinner, a renowned climate scientist and sustainability guru explain: “The best and fastest way to prevent immediate climate destabilization lies in cutting back on emissions of super pollutants (black carbon, methane, ozone precursors and HCFC) that make outsize contributions” (4).

SLCP are responsible for about half of current warming, but stay in the atmosphere for much shorter periods of time than CO₂. Tackling SLCP is the fastest way to slow the global temperature increase and give the world a fighting chance of meeting the target set at Paris. Reducing SLCP slows current warming and prevents future warming by slowing the melting of glaciers (so that they continue to reflect radiation back into space) and preventing the release of the super-pollutant methane from melting permafrost and under-sea ice. The three experts warned: “Cutting CO₂ emissions remains imperative, and cannot be delayed ...the parallel strategy of reducing super pollutants is perhaps even more important to avert disastrous consequences in the near-term.” (4).
The UNEP/WMO package includes measures to replace traditional brick kilns with less polluting designs, prevent methane leaks from mines, pipelines, and landfills, clean up diesel emissions, use cleaner heating and cooking stoves in developing countries, ban open burning of agricultural waste and phase out log-burning stoves in developed countries. Implementing these measures is a win-win situation – good for the climate and good for our health (2).

California is tackling SCLP

The California Air Resources Board is developing a strategy to reduce SLCP because: “Deploying existing technologies and resource management strategies globally to reduce SLCP emissions can cut the expected rate of global warming in half and keep average warming below the dangerous 2°C threshold at least through 2050. We can slow sea level rise significantly, reduce disruption of historic rainfall patterns, and boost agricultural productivity by reducing crop losses to air pollution. Cutting global SLCP emissions immediately will slow climate feedback mechanisms in the Arctic and elsewhere that would otherwise further accelerate global warming and make climate change far more difficult to solve and far more costly to live with—as more resources would be required for disaster relief, conflict management, and adaptation” (3).

Fugitive methane

California’s SLCP strategy aims to reduce fugitive methane emissions from oil and gas by 40% in 2025 and at least 45% in 2030, and also aims to reduce methane from all other sources by 40% in 2030.

In Australia, a recent report by the Melbourne Energy Institute (MEI) (6) found that:

- there is significant uncertainty about methane-emission estimates reported by oil and gas producers to the Australian government, and by the Australian government to the United Nations. The United Nations has requested that Australia improve its methodologies.
- Australian methane-emission reporting methodologies rely to a significant extent on assumed emissions factors rather than direct measurement
- the assumptions used to estimate methane emissions include some that are out-dated, and some that lack demonstrated relevance to the Australian unconventional oil and gas industry

The MEI report also notes that: “If Australia’s methane emissions from unconventional gas production are higher than reported, this represents an opportunity cost in terms of lost gas sales and a liability to future carbon pricing.”

**NSW Climate Strategy: Recommendation 1**

NSW should work with interested parties to develop improved estimates of methane emissions from the Australian oil and gas industry that accurately reflect the impact on the climate and ensure that steps are taken to remedy any disproportionate sources of emissions.
Wood stoves

California’s SLCP strategy also aims to drastically reduce SLCP emissions from wood stoves, noting that: “To protect public health and use incentive dollars efficiently, non-wood burning devices should be prioritized where possible.”

Efforts are being made to educate Californians about the health hazards of wood smoke. For example, a 30-second advert shows smoke, seemingly from a cigarette, rising in a slow stream. “We all know it’s bad for you. It makes you cough, and it damages your lungs.” The camera pans down to reveal the roof of a house with a cigarette replacing the chimney: “This winter, rethink your wood fire and protect the air inside and outside your home. If your home is smoking, it’s time to quit. It’s your air. Protect it. Visit SpareTheAir.org”(7).

Use is made of billboards (e.g. the poster shown above, explaining the health damage to children), videos and print media (e.g. the ‘Spare the Air’ notice attached to the front page of a newspaper). All convey the message that, just like cigarette smoke, wood smoke is hazardous to health. This information is reinforced by the fact that wood heating is illegal on days when high PM2.5 pollution is forecast, and wood stoves are not permitted in new buildings.
The most health-hazardous pollutant in our air (responsible for more premature deaths than any other pollutant) is PM2.5 pollution - fine particles less than 2.5 millionth of a meter that penetrate the deepest recesses of our lungs where they can enter the bloodstream and transport toxins to every organ of the body. Figure 6 (below) from the ‘Clean Air for NSW’ consultation paper shows that PM2.5 emissions from residential wood stoves dominate all other sources of PM2.5 emissions in Sydney. The fact that that wood stoves contribute disproportionately to climate change should also be recognized, as well as what is being done elsewhere (e.g. California) to clean up wood stove pollution.

![Figure 6: Top Direct Human-Made and Natural Sources of PM2.5 Emissions (Tonnes/Year) for Sydney Region (EPA 2012)](image)

Measured emissions from wood stoves in Australia and New Zealand show that real-life pollution is much higher than suggested by current ‘standards’ (which are based on laboratory tests of perfectly-operated stoves). For example, when 4 wood burners with ratings less than 1.0 g/kg were measured in homes in Christchurch, real-life emissions averaged 9.5 g/kg. Two wood burners with emissions ratings less than 1.5 g/kg, had real-life emissions of 4.5 and 1.5 g/kg (8).

One little-recognized fact is the disproportionate contribution to global warming from methane, black carbon and CO emitted by domestic wood stoves. In Australia, real-life emissions were measured from 18 AS4013 heaters operated by householders in Launceston (9), where the public had been alerted to the serious health problems caused by breathing wood-smoke by education programs, including a $2 million federally-funded wood-smoke reduction program. The education programs persuaded 70% of wood-heated households switching to non-polluting heating (10, 9). Knowing the health effects of wood-smoke and that their emissions were being measured, the volunteers for this study would have been keen to take the time and trouble to operate their heaters correctly. There was no evidence that heaters were allowed to smoulder overnight; in contrast they appeared to be re-fuelled periodically throughout. Nonetheless, about 15% of fuel carbon was emitted as CO, indicating that the dampers were usually partly or fully closed.
Climate policy in NSW suffers from the fact that regulation of wood heaters is currently left to local councils who have neither the expertise nor the resources to manage the problem. Most people would expect a heater satisfying the current Australian/NZ standard (4013) to have a ‘safe’ level of pollution. However, as shown by the photo below of new heaters installed in Armidale, NSW, nothing could be further from the truth. All except possibly the top left heater are known to satisfy the current ‘standard’, implying that real-life emissions are totally unsatisfactory and likely to be much higher than those measured in Launceston, and somewhere between 10 to 15 g/kg PM2.5 per kg of hardwood burned.

Table 1 was compiled from laboratory measurements by CSIRO of methane, black, carbon and CO emissions from a correctly-operated Australian wood heater burning softwood (1), laboratory measurements of black carbon emissions from Australian wood heaters burning hardwood (6), CO measurements from the study of real-life emissions in Launceston (9), and the most plausible estimate of real-life methane emissions (based on the relationship between PM2.5 and methane emissions observed in the CSIRO study plus the estimate of average real-life PM2.5 emissions of 12.5 g/kg discussed above) to allow for the fact that (unlike the volunteers in the study of real-life emissions in Launceston) most Australian wood heaters users would be unlikely to attempt to minimize emissions by getting

<table>
<thead>
<tr>
<th>Emissions/tonne of wood burned</th>
<th>PM2.5, kg</th>
<th>BC, kg</th>
<th>CH₄, kg</th>
<th>CO, kg</th>
<th>CO₂, kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softwood</td>
<td>15.8</td>
<td>3.20²</td>
<td>30³</td>
<td>220⁴</td>
<td>1900⁵</td>
</tr>
<tr>
<td>Hardwood</td>
<td>12.5</td>
<td>0.63⁴</td>
<td>18.7⁵</td>
<td>209⁶</td>
<td>1860⁷</td>
</tr>
<tr>
<td>20-year GWP</td>
<td>3203⁸</td>
<td>88⁹</td>
<td>18.6⁹</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Climate impact (tonnes CO₂-eq per tonne wood burned)</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Softwood</td>
<td>10.25</td>
<td>2.64</td>
<td>4.09</td>
<td>1.90</td>
<td>18.88</td>
</tr>
<tr>
<td>Hardwood</td>
<td>2.02</td>
<td>1.65</td>
<td>3.89</td>
<td>1.86</td>
<td>9.41</td>
</tr>
</tbody>
</table>

a Measurements from CSIRO laboratory study of Australian wood heaters (1).
b Calculation based on the relationship between PM2.5 and methane emissions observed in the CSIRO study and a slightly higher estimate of average real-life PM2.5 emissions of 12.5 g/kg.  
c Emissions calculated from total CO and CO₂ emissions in the CSIRO study, modified so that (as in the study of real-life emissions in Launceston), 15% of carbon is emitted as CO.  
d 20-year GWP for black carbon from wood stove emissions used in the California Air Resources Board Study (3).  
e 20-year GWP for methane and CO from the IPPC 5th assessment report (5).
up in the middle of the night to refuel their heater instead of leaving it to smoulder overnight (11).

Table 1 uses the same approach as the California Air Resources Board SLCP strategy of estimating climate impacts using 20-year Global Warming Potentials (GWP). Over this period, a typical Australian wood heater burning Sydney’s average of 2 tonnes of wood per year will cause as much global warming as heating 40 houses with an efficient heat pump (typical emissions of 0.5 tonnes CO$_2$ per year.)

**NSW Climate Strategy: Recommendation 2**

The NSW Government’s Climate Change Policy should be upgraded to include Short-lived-climate pollutants, including methane, black carbon and CO emissions from domestic wood heaters. The policy should also consider the health co-benefits, including the recommendation of the NSW Chief Medical Officer that wood heaters are so polluting and detrimental to health they should be banned and phased out in built-up urban areas (12).

**Leading by example**

**Excellent Guiding Principles.** The draft plan to save NSW energy and money has some excellent guiding principle, e.g. to “help vulnerable households access energy efficiency to reduce bill stress and place downward pressure on the cost of living.”

The Draft Climate Change Fund Strategic Plan also has some good ideas, e.g.: “The NSW Government will support a strong demand management market to reduce infrastructure costs and greenhouse gas emissions. Potential actions include: » engage with the COAG Energy Council to reform the National Electricity Rules to reduce barriers to broad-based demand management » advocate to the Australian Energy Regulator for greater implementation of demand management by network businesses” (p26).

**Government-owned networks should lead by example.** The NSW Council of Social Service (NCOSS) criticised the NSW Government-owned networks for ignoring the above guiding principles in a submission to the Australian Energy Regulator (AER) on the NSW Electricity Distribution Tariff Structure Statement (TSS):

> “NCOSS retains a number of serious concerns, both with the AER response to the initial TSS proposals, and with the re-drafted TSS proposals from the NSW distribution businesses. In summary those concerns include:  
> “The re-balance towards higher fixed charges, which NCOSS believes places disproportionate burden upon low-consumption customers, and limits their ability to understand and control the bill impacts of their usage.  
> “The acceptance of Flat Block Tariffs, which NCOSS believes have similar issues to declining block tariffs, in providing little price signal or incentive to reduce consumption or move to more reflective tariffs. Further, like the initial proposal for declining blocks, low-usage customers are disproportionately burdened with the recovery of residual costs under this structure.”  
> ” (13).

In response to the initial proposals NCOSS noted in May 2016:

> “Further, the application of new tariffs should provide price signals that enable consumers to respond either by altering their consumption behavior or investing in particular appliances or new technologies. In the long term, this should drive more efficient investment by the networks and result in lower prices
for consumers, including those less able to respond” (14).

NCOSS also cited Energy Consumers Australia in relation to the Long Run Marginal Cost (LRMC):
“The fact that LRMC is a “forward looking” concept does not mean that it can only be applied to actual future costs; it can be applied to the entire hypothetical cost base of the organisation on the assumption the network was being built today” (14).

The NCOSS submission also notes that:
“For the Sydney households in the IPART survey, 39% of the lowest income group were also in the very lowest consumption group. This low income-low consumption group were consuming less than 4MWh per annum when the average household was consuming 7.2 MWh ….Households in the first and second income quintiles spend 7% and 5.3% on energy respectively. Any increase in this proportion, that is likely under the proposed tariff structure, would represent a significant and disproportionate additional burden for some of the most disadvantage and vulnerable in our community.” (14).

The recent independent review by Dr Alan Finkel into the Future Security of the National Electricity Market envisaged the possibility that consumers might choose to disconnect from the grid:
“Advances in batteries and other storage technologies are likely to make it cost-effective for increasing numbers of residential and commercial consumers to partially or even fully disconnect from the grid and operate independently, or be supplied by a micro-grid (for example, small-scale local generation and storage supporting an entire town or suburb using its own separate network)” (15).

The above comments show that the NSW Government could help vulnerable households by setting price signals for its network businesses that encourage consumers to respond by changing their behaviour, resulting in reducing global warming because of the rewards for energy efficient behaviour, and reducing the need for the substantial amounts of additional spending on increased network capacity.

Instead of high connection fees, past expenditure on government-owned networks should be covered by charges per kWh of electricity used, in the same way that overheads a bakery or supermarket are incorporated into the cost of the goods sold. This will encourage energy efficient households to remain connected to the grid (and increase total revenue) instead of converting to stand-alone PV and battery storage. Tariff structures that lead to grid disconnections increase costs for remaining network uses because the network cost is shared among an ever-decreasing pool of customers.

Government-owned networks should also lead by example in developing fair network charges for peer-to-peer trading. Wiring in new suburbs was paid for by builders and developers, not network owners. A fair charge to use local networks should reflect this fact and therefore be much lower than the charge for transmitting a unit of power from a Hunter Valley power station to a remote corner of NSW.

South Australia Power Networks (SAPN) has installed 100 battery storage systems in a virtual power plant trial in northern Adelaide. SAPN operator hopes this initiative will help it avoid millions of dollars of costly network infrastructure additions (16). Section 3.8 of The NSW Climate Change Fund Strategic Plan recommends advocating “to the Australian Energy Regulator for greater implementation
of demand management by network businesses”. Advocating for rule changes is useful, but much more could be achieved if the NSW government-owned networks developed their own virtual power plants to avoid costly network additions, introduced fairer charging systems (including fair charges for peer-to-peer trading) that encourage households to remain connected to the grid, promoted demand management and rewarded energy efficient behaviour, thereby reducing the need for the substantial amounts of money that would otherwise be required to increase network capacity.

**NSW Climate Strategy: Recommendation 3**
The NSW government-owned networks should develop their own virtual power plants to avoid costly network additions and introduce fairer charging systems (including fair charges for peer-to-peer trading) that encourage households to remain connected to the grid, promote demand management and reward energy efficient behaviour, thereby reducing the need for the substantial amounts of money that would otherwise be required to increase network capacity.

**Additional Information**
