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.

The Air Quality Benefits of Climate Change Mitigation

Drew Shindell
Duke University & CCAC
Science Advisory Panel
Where are we now?

Since pre–industrial times, human activities have caused approximately 1.0°C of global warming.

- Already seeing consequences for people, nature and livelihoods
- At current rate, global warming would reach 1.5°C between 2030 and 2052
- But past emissions alone do not commit the world to 1.5°C
Greenhouse gas emissions pathways

- To limit warming to 1.5°C, CO₂ emissions fall by about 45% by 2030 (from 2010 levels)
  - Compared to 20% for 2°C

- To limit warming to 1.5°C, CO₂ emissions would need to reach ‘net zero’ around 2050
  - Compared to around 2075 for 2°C

- Reducing non–CO₂ emissions would have direct and immediate health benefits
Greenhouse gas emissions pathways

- Limiting warming to 1.5°C would require changes on an unprecedented scale
  - Deep emissions cuts in all sectors
  - A range of technologies
  - Behavioural changes
  - Increase investment in low carbon options
Achieving 1.5°C means increased share of renewable electricity, less total energy from coal.

![Graph showing coal and renewable energy percentages compared to 2010 and 2010 levels for 2030 and 2050.](image-url)
Achieving 1.5°C means more forests and biofuels, less pasture

Reduced forest burning
reduced cattle-based foods
Achieving $1.5^\circ$C means reducing non-CO2 as well.
Ozone mortalities

2°C pathways lead to ~1.4 million fewer premature deaths per year in 2100 than baseline, ~59 million over century

Results from Silva et al., 2016
PM$_{2.5}$ deaths

2°C pathways lead to $\sim$600,000 fewer premature deaths yr$^{-1}$ in 2100 than baseline, $\sim$36 million over century
1.5°C pathways lead to ~1.3 million fewer premature deaths yr\(^{-1}\) in 2030 vs 2°C, ~150 million over century

Shindell et al, Nature Climate Change, 2018
Only 5% of benefits are national for US natural gas.

Shindell et al, Nature Climate Change, 2018
Economics of Clean Air Benefits from Climate Change Mitigation

~0.6% of world GDP due to reduced air pollution worldwide in 2060 (based on OECD)

Mitigation costs 1-2% of world GDP

Air pollution benefits: market costs due to labor, capital, healthcare and agriculture only – with non-market costs benefits greatly outweigh mitigation costs

Shindell et al, Nature Climate Change, 2018
Conclusions

Ozone: New epidemiology (Turner et al., 2016) indicates greater respiratory impacts and existence of cardiovascular effects. Net is larger effects despite evidence of model biases (see Seltzer et al., ERL, 2018).

PM$_{2.5}$: Likewise new epidemiology (Burnett et al., PNAS, 2018) indicates much larger impacts (>100%).

Health benefits presented here, ~250 million over the 21st century and ~1.8 million per year by 2030, are very likely to be biased low (& hence valuation likely the majority of mitigation costs).
Conclusions

Achieving 1.5°C is challenging, but means improved public health, more jobs, more fresh water, less poverty, less expense for disaster relief, less biodiversity loss, etc.