Panel question 1
“Can reduced soot emissions counteract the warming effects of reducing sulfates?”

Broad question, broad answer:
“Sure.”
I mean, kinda sorta, y’know?
But to what extent?

- D. Streets projections: 2030: -30% to +40%
  2050: -60% to +60%
- Take “best” case for air quality; “worst” case for climate
  = greatest sulfate reductions.
- About -0.2 W/m² of direct effect?

(Note: Reduction could “count against” any forcing – doesn’t have to be sulfate reduction– could be GHGs)
Panel question 1

“Can reduced soot emissions counteract the warming effects of reducing sulfates?”

Uncertainties prevent precise answers.
(But not any answers!)

- \(~4000\) Gg/year BC reduction required to “offset” 0.2 W/m\(^2\)
  - if you can reduce BC by itself (which you can’t)
  - and if you can ignore indirect effect (which you can’t)

- 4000 Gg \(~\text{half}\) of 1996 BC inventory
  - but \(~\text{half}\) of inventory is open biomass burning (which we’re not discussing here, and is difficult to deal with)
  - so, eliminate 85% of energy-related BC, and no other aerosols?
  - Impossible. \(\Diamond\) But what is achievable?
Panel question 2
“What are the most effective actions in that direction?”

What fraction of the “4000 Gg solution” is achievable?
Where can we get it?

Where does it come from now?
Bond/Streets 1996 inventory

Where does it come from now?
Bond/Streets 1996 inventory
Panel question 2
“What are the most effective actions in that direction?”


$\text{cap cost/tonneCO2equivalent}$

<table>
<thead>
<tr>
<th>Category</th>
<th>$\text{cap cost/tonneCO2equivalent}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current LD vehicle</td>
<td>11%</td>
</tr>
<tr>
<td>Superemitting LD vehicle</td>
<td>4%</td>
</tr>
<tr>
<td>Truck without regulation</td>
<td>9%</td>
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<tr>
<td>Wood cookstove</td>
<td>17%</td>
</tr>
<tr>
<td>Coal cookstove</td>
<td>6%</td>
</tr>
<tr>
<td>Low-tech industry</td>
<td>3%</td>
</tr>
</tbody>
</table>

4000 Gg?
Panel question 2
“What are the most effective actions in that direction?”

✓ Even if you do incorporate “uncertain metrics”, BC is not a cost-effective method of reducing positive forcing in Annex-I countries.

✓ (That’s why I use GWP— as a “go/no-go” or “have we got a red herring here” answer)

✓ This is not an Annex-I solution. Isn’t cheap enough to make “Kyoto basket” attractive anyway, and doesn’t fit for a number of reasons.
In Annex-I countries, BC is not the cheapest climate action. \textit{and that’s considering maximum warming potential.}

Considering that positive forcing is offset due to (1) organic carbon, (2) indirect effect...

Cost per MJ of warming avoided becomes even more expensive

Good news: Projected reductions in Annex I Transport sector

- 10-40\% (2030), 50-70\% (2050)
- BC dominates over OC

Bad news: Only 60-260 Gg by 2030, 300-450 Gg by 2050

\textasciitilde10\% of the solution

Panel question 2

“What are the most effective actions in that direction?”

4000 Gg?
Panel question 2

“What are the most effective actions in that direction?”

Non-Annex I countries: **Major** opportunities for (potentially climate-cost-effective) reduction

✓ Transportation:

- Incoming Euro standards ↓; rapid growth ↑
- Projected to *increase*. Possible to accelerate reductions?
- Diesels: BC dominates over OC (probably)
  
  *Potential unclear.*

✓ Industry: AQ standards (sulfate offset)

- Projected to decrease by about ~50%
- Another 10% of the “target”; 20% if aggressive?

At stake, *i.e. today’s emissions*: ~800 Gg

4000 Gg?
Panel question 2

“What are the most effective actions in that direction?”

Non-Annex I countries: Major opportunities for (potentially climate-cost-effective) reduction

- Residential solid fuels: Definite health driver!!
  - Coal: BC dominates over OC
  - Wood: Unclear; recent evidence suggests high BC from some types of combustion

At stake: ~2000 Gg

A few challenges:
- Who pays? What’s the financial mechanism?
- How to implement/disseminate/verify?
- Do “we” have the right to call for change?

But: Consistent with Millennium Development Goals and local benefits
UNFCCC (which the U.S. did ratify) sez:

v Article II: GHG stabilization is the target; but

v Article III, *Principles*

The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects.

...Policies and measures should take into account different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors.