

F. J. LEGERER:

Summary of and link to US Congress Hearing (Oct 17th, 2007)

Remark: Black carbon is detrimental to human health and it is a serious driving force for global warming; diesel soot in the range of nanometers is just one manifestation of bc.

Diesel soot can be removed by three orders of magnitude by means of particle filters; therefore, there should be no diesel engine without proper filter.

The Kyoto protocol ought to be amended to include reduction of black carbon too! Soot filters should be mandatory! Retrofitting of in use diesel engines, the almost universal work horse of power generation should become a public priority!

Just consider in a cursory way:

A vehicle engine produces roughly 300 grams CO₂/mi and some 10 milligrams of particles – say for ease 30mg - of which at least one third may be soot.

The driving force for global warming is per unit weight about 500.000 times that of CO₂. Hence, exhaust soot contributes to gw.

Consequently,

10 times 500 000 times 0.001 equals 5000 which is 16.66 times 300!

There is no way to achieve with more efficient engines any reduction of the driving force of gw comparable to applying DPFs and at the very same time there is a substantial benefit accruing to public health, because usually, the density of engines is highest where people live.

Of course, one should take into consideration, life time of soot is much less than that of CO₂!

<http://www.greencarcongress.com/2007/11/black-carbon-ma.html>

[Black Carbon May be Second-Most Significant Global Warming Pollutant After Carbon Dioxide; Alters Picture of Diesel Engine Benefits](#)

Black carbon—contained in soot from the combustion of biomass and fossil fuels—may be responsible for around 16% of the gross warming the planet is currently experiencing and may be the second-most significant global warming pollutant after carbon dioxide and ahead of methane, according to testimony provided by five scientists before the US House Committee on Oversight and Government Reform in October.

Because of their increased fuel efficiency relative to gasoline-engined vehicles, diesels are seen as an improvement over gasoline vehicles with respect to global warming issues. However, once soot warming is factored in, the difference between the two platforms is greatly reduced, as diesel emits more soot than gasoline.

Primary contribution to observed global warming since 1750. Click to enlarge. Source: Testimony of Dr. Jacobson

Testifying before the committee were:

- Dr. Mark Z. Jacobson, Prof. of Civil and Environmental Engineering, Atmosphere/Energy Program, Stanford University
- Dr. Tami C. Bond, Asst. Prof. of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign
- Dr. V. Ramanathan, Prof. of Climate and Atmospheric Sciences, Scripps Institute of Oceanography, University of San Diego
- Dr. Charles Zender, Assoc. Prof. of Earth System Science, University of California at Irvine.
- Dr. Joel Schwartz, Professor of Environmental Epidemiology, Harvard University

The black carbon in soot performs its warming by absorbing sunlight, converting it into infrared (heat) radiation, and emitting that heat radiation to the air around it. Soot on the surface of snow and sea ice contribute to both the melting of those surfaces as well as the warming of the air.

Because of the relatively short lifetime of soot in the atmosphere compared to greenhouse gases, control of soot may be the fastest method of slowing warming for a specific period, according to Dr. Jacobson.

Black carbon, noted Dr. Bond, adds 2-3 order of magnitude more energy to the climate system than an equivalent mass of CO₂ because black carbon is an extremely good absorber of visible light. While carbon dioxide stays in the atmosphere for decades, it absorbs just a small amount of infrared radiation.

Particles from burning biomass (which differ from biofuel particles) are less oily and contain a much lower black carbon fraction than fossil fuel soot particles, according to Dr. Jacobson. Biomass-burning particles thus tend to cool climate on a global scale (although the biomass-burning gas warming exceeds its global cooling due to permanent deforestation. The panel thus focused on soot particles resulting from the combustion of fossil fuels and biofuels.

...fossil fuel plus biofuel soot may contribute to about 16% of gross global warming (warming due to all greenhouse gases plus soot plus the heat island effect), but its control in isolation could reduce 40% of net global warming.

—Dr. Jacobson

Methods proposed to control fuel soot include improving engines; switching fuels; adding particle traps; and changing vehicle technologies.

In sum, there is not an advantage and a potential disadvantage of diesel versus gasoline in terms of climate and air pollution impact. However, neither type of vehicle is satisfactory or useful for solving climate and health problems as the emissions from both are very high. Even modest improvements in mileage standards for all vehicles are beneficial, but will only delay the eventual increase in emissions due to a larger population.

A more certain method of reducing global warming caused by both fossil-fuel soot and carbon dioxide is to convert vehicles from fossil fuels to electric, plug-in hybrid or hydrogen fuel cell vehicles, where the electricity or hydrogen is produced by a renewable energy sources [sic], such as wind, solar geothermal, hydroelectric, wave, or tidal power.

—Dr. Jacobson

(A hat-tip to Green Car Congress reader MR!)

Resources

- [Hearing on Black Carbon and Global Warming](#) (with video testimony and links to transcripts)