

## Diesel Particle Filters, of Best Available Technology (BAT) for reducing both, risks to human health and forcing of global warming from engine emitted black carbon nanoparticles.

### Diesel Engines will be needed for many more decades:

No doubt: Society will have to meet increasing needs for mobility; therefore, more vehicles will be required. To provide these transport services, Diesel engines, being the most economic type of internal combustion engines with lowest CO<sub>2</sub>-emission will be indispensable.

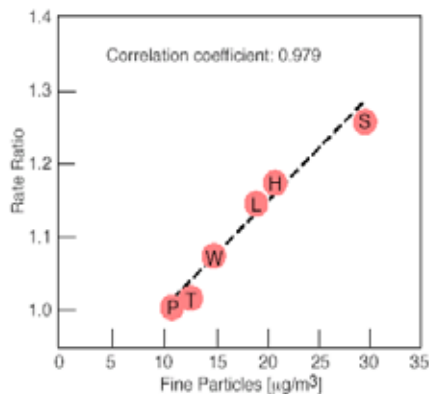
### Draw-back: Diesel engines emit large numbers of solid ultrafine particles:

Like all internal combustion engines, Diesels emit solid particles, comprising black carbon and metal oxides. Even with future fuels this issue will remain; since these particles are extremely small, nano-size (1 nanometre = 1millionth of 1 metre), they constitute an enormous risk for both, human health and global warming.

### Soot particles – No.1 as urban air pollutant and No. 2 substance in forcing global warming:

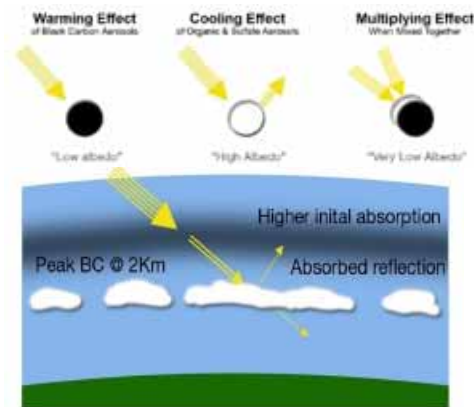
There is worldwide agreement that engine emitted solid particles are the most serious air pollutant in modern urban environments triggering cancer and heart attacks and many other diseases. Less known is the fact that black soot particles, due to their very effective sun light absorption, heat up the atmosphere and accelerate melting of glacier- and polar-ice. Recent findings suggest that **GWP of BC particles is 1'600 times higher than that of CO<sub>2</sub>** per unit mass (ICTT 6/2009); hence, BC has to be considered the second most important global warming substance (Hearing US-house of representatives 10/2007).

#### Health Effect of ultra-fine BC Particles



Mortality due to Particles in Urban Air: 6-Cities-Study, USA 1978-93, 15 % higher mortality when fine particle concentration increases by only 10 µg/m<sup>3</sup> !  
Source: Dockery, NEJM 1993

#### Climate Effects of ultrafine BC-Particles



Up: Absorption of sun radiation by black carbon particles without and without condensed water coating  
Below: the effect of black carbon particles in altitudes where they can stay without rain for several weeks.

### Particle filters are best available technology to cope with both challenges:

Readily available: A proven and cost-effective tool to simultaneously solve both of these two problems: Highly efficient catalysed particle filters detoxifying engine exhaust gas, eliminating all solid particles emitted from engines at lesser costs than can be achieved otherwise. These filters can be applied to all new engines and they can be retrofitted to in-use engines for upgrading them substantially.

- Filtration effectiveness > 99 %
- Ratio health-benefit/cost > 6; GW-benefit/cost much higher than CO<sub>2</sub> reduction measures
- Proven technology: 20 Mio operating in new vehicles, 400'000 in retrofits onroad and offroad

**CO<sub>2</sub>-Reduction** is needed, difficult to accomplish, extremely expensive and only effective on very long term  
**BC-Elimination** by filtration is immediately effective, available at comparatively low cost and proven technology

**No Diesel without particle filter for both, health and climate → 2 flies with only one flap!**

### The VERT-Association, November 2009

VERT (Verification of Emissions Reduction Technologies) is an international association of scientists, engineers and filter manufacturers that promotes BAT soot filter technology for health and climate –