[iii] For diesel vehicles, modest PM emissions reductions can be achieved with 500 ppm sulfur fuel, allowing for the use of oxidation catalysts. When sulfur is reduced to 50 ppm, low emissions for both PM and NO_x are possible with a combination of tuning, advanced engine technologies, and aftertreatment controls for NO_x. At this sulfur level, however, the only NO_x aftertreatment feasible is selective catalytic reduction (SCR), which requires a separate refilling infrastructure for the required urea additives. At 10-15 ppm sulfur, highly efficient PM and NO_x aftertreatments can reduce emissions to very low levels, without any additional infrastructure needs.

[iv] Recent findings (US EPA non-road rule) have shown that health benefits from ultra-low sulfur fuel and associated vehicle emissions control technologies exceed costs by 40:1. This regulation requires that the maximum sulfur level in non-road diesel fuel be reduced from 3000 to 15 ppm. US EPA. 2004. *Final regulatory analysis: Control of emissions from nonroad diesel engines*.

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TEN REASONS TO MOVE TO LOW SULFUR FUELS

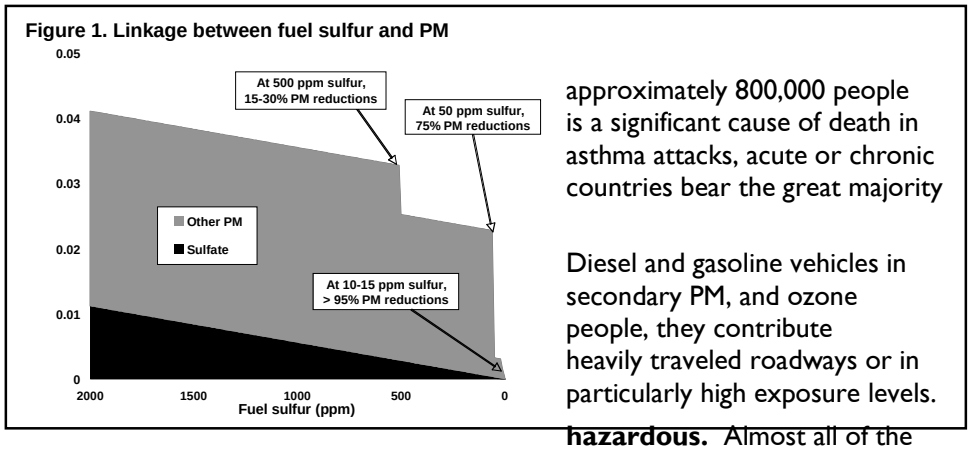
In the developed world, auto makers and fuel refiners have had to apply their impressive technical and organizational capabilities to meet increasingly strict environmental regulations. The result has been reduced sulfur levels in fuels and reduced emissions from vehicles of all types.

Meanwhile, in many developing countries, vehicle numbers are increasing exponentially and high sulfur fuels continue to be the norm, inhibiting the introduction of highly effective emissions control technologies. By acting quickly to lower sulfur levels and set strict emissions standards, these countries can allay the mounting human health impacts of increasing vehicle numbers and reduce the burden associated with cleaning up in-use vehicles.

Reducing fuel sulfur content in gasoline and diesel is a crucial step in addressing air pollution problems associated with new and existing vehicles. This short document highlights the compelling reasons for many developing countries to move quickly toward low sulfur fuels.

More information about low sulfur fuels and
clean vehicle technologies can be found at
www.cleantransportcouncil.org

TEN REASONS TO MOVE TO LOW SULFUR FUELS



1. **Urban air pollution kills.** The World Health Organization has noted that approximately 800,000 people die prematurely each year as a result of urban air pollution and that air pollution is a significant cause of death in infants and young children.[i] Many million more adults and children suffer from asthma attacks, acute or chronic bronchitis, and cardiovascular problems. The poorest people in developing countries bear the great majority of the disease burden.
2. **Vehicles are one of the most important sources of urban air pollution.** Diesel and gasoline vehicles in urban areas are a major source of direct particulate matter (PM) emissions, secondary PM, and ozone precursors. Because vehicle emissions take place in the breathing zone of people, they contribute significantly to human exposure.[ii] People living or working in close proximity to heavily traveled roadways or in urban vehicles – such as diesel buses, jeepneys or tuk-tuks – are subject to particularly high exposure levels.
3. **Particulate matter is largely to blame and diesel PM is especially hazardous.** Almost all of the quantified mortality impacts are attributable to particles. Because of their very small size (allowing deep penetration into the lung) and their toxicity, diesel particles are especially hazardous to human health.
4. **High ozone concentrations also cause severe health impacts, particularly in children and the elderly.** Ozone is formed in the atmosphere through the interaction of nitrogen oxides (NO_x) and hydrocarbons (HC), in the presence of sunlight. In many parts of the world, gasoline vehicles are the most important source of ozone precursors. Diesels can also be an important source of NO_x emissions.
5. **Technologies exist to dramatically reduce vehicle emissions.** Technologies available now can cost-effectively reduce emissions from both diesel and gasoline vehicles to very low levels. Many of these technologies require low or ultra-low sulfur fuels,[iii] and all catalyst-based technologies perform better with low sulfur fuels. Stringent new vehicle standards become feasible when ultra-low sulfur fuels are available.
6. **Low sulfur fuels reduce emissions from existing vehicles too.** Low sulfur fuels reduce PM emissions from all in-use diesel vehicles, even those not equipped with emissions control devices. In addition, low sulfur (500 ppm) diesel makes it possible to retrofit engines with oxidation catalysts to reduce PM emissions by 15-30%, and ultra-low sulfur (10-15 ppm) diesel allows for use of catalyzed particulate filters, capable of reducing PM by more than 95%. In many developing countries, a large number of vehicles are already equipped with catalytic converters, all of which will perform better with low sulfur gasoline.

Figure 1 demonstrates how sulfur in diesel is linked to PM emissions. In addition to reducing sulfate emissions, reducing sulfur levels allows for use of advanced technologies, achieving a step-down reduction in PM emissions. Reductions in NO_x emissions require additional aftertreatment technologies.[iii] (Actual engine-out PM emissions will vary depending on engine technology.)

7. **The costs are low.** The costs associated with switching to low sulfur fuels are much lower than the price variations typical in the global fuels marketplace.
8. **The costs are affordable and the social impacts limited.** Where necessary to neutralize negative impacts, a mix of taxation policies can also assure an equitable distribution of costs.
9. **The benefits of low sulfur fuels are much greater than the costs.** Every cost-benefit study thus far has found that the economic and public health benefits of low sulfur fuels significantly outweigh the costs, especially in combination with stringent emission standards.[iv]
10. **Early action will save lives and further reduce costs.** The longer a country delays addressing fuel quality, the longer its citizens will suffer adverse health impacts. Without access to low sulfur fuels, the population of highly polluting vehicles will continue to grow. And these vehicles will continue to pollute for the duration of their lifetimes, approximately 10 years for cars and 20-30 years for heavy trucks and buses.

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[i] Estimated global mortality was reported in *The world health report 2002 – Reducing risks, promoting healthy life*, by the World Health Organization. In Europe, approximately 14,000 deaths of children 0-4 were attributable to outdoor air pollution in 2001. Air pollution caused an average of 6% of all deaths in that age group throughout Europe, with

a greater impact in the less affluent countries. Valent et al. 2004. *Burden of disease attributable to selected environmental factors and injuries among Europe's children and adolescents*. WHO.

[ii] In a six city assessment, the World Bank found that vehicles contribute an average of 6% of direct PM emissions but 32% of PM exposure. In three of these cities, vehicles contributed an average of 50% of the direct PM emissions and over 70% of PM exposure. Lvovsky et al. 2000. *Environmental costs of fossil fuels*. The World Bank Environment Department.