



Overview of Low Sulphur Fuels Program

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Examples of sulphur in crude oil

Crude Oil	Sulphur ppm
• Algeria Saharan Blend	500 – 900
• Indonesia Minas	800
• Nigeria Bonny Light	1400
• North Sea Brent (Avg)	2400
• Dubai Fateh	20000
• Saudi Arabia (Arab Lt)	17700

Sulphur in fuels

- Sulphur is naturally found in crude oil
- Can range from 100 – 30,000 ppm or 0.01 – 3% by weight
- <5000 ppm sulphur content referred as “sweet crude”, > 5000 ppm “sour crude”
- Sulphur levels in fuels depend on crude oil and refining technology
- Both gasoline and diesel have sulphur though concentration differ – as high as 1000 ppm in gasoline and 10,000 ppm in diesel

Sulphur Pollution: Health Effects

- Diesel fuels present main concern for health reasons due to high tailpipe emission levels
- The higher the sulphur in diesel, the higher tailpipe Particulate Matter (PM) and sulphur dioxide (SO₂) emissions
- Low sulphur fuels enable the introduction of emissions control technologies that can significantly reduce vehicle emissions in diesel and petrol cars

“Particulate matter affects more people than any other pollutant” – WHO 2011

2012 WHO estimates 176,000 deaths per year in Africa due to outdoor air pollution

- International Agency for Research on Cancer June 2012: “diesel engine exhaust...sufficient evidence that exposure is associated with an increased risk for lung cancer.”
- **same magnitude as second-hand smoke**
- Small particulates are responsible for an estimated **3.7 million** premature deaths annually from outdoor air pollution

3.7 million deaths attributed to outdoor air pollution

58,000 in Americas

200,000 in Europe

236,000 deaths in Eastern Mediterranean

176,000 in Africa

2.6 million in South East Asia and Western Pacific



88% in low-middle income countries

455,000 in high-income countries



Over half of world's population lives in urban areas; **only 12% of cities** have air quality measures that meet **WHO standards**



Ground level ozone impacts food security by **reducing crop yields** by up to **50 million tons** each year



Financial cost of environmentally related **health risks** are in the range of **5%-10% of GDP**, with air pollution taking the highest toll

DISEASES DUE TO:

- O_3
- PM2.5 AIR POLLUTION



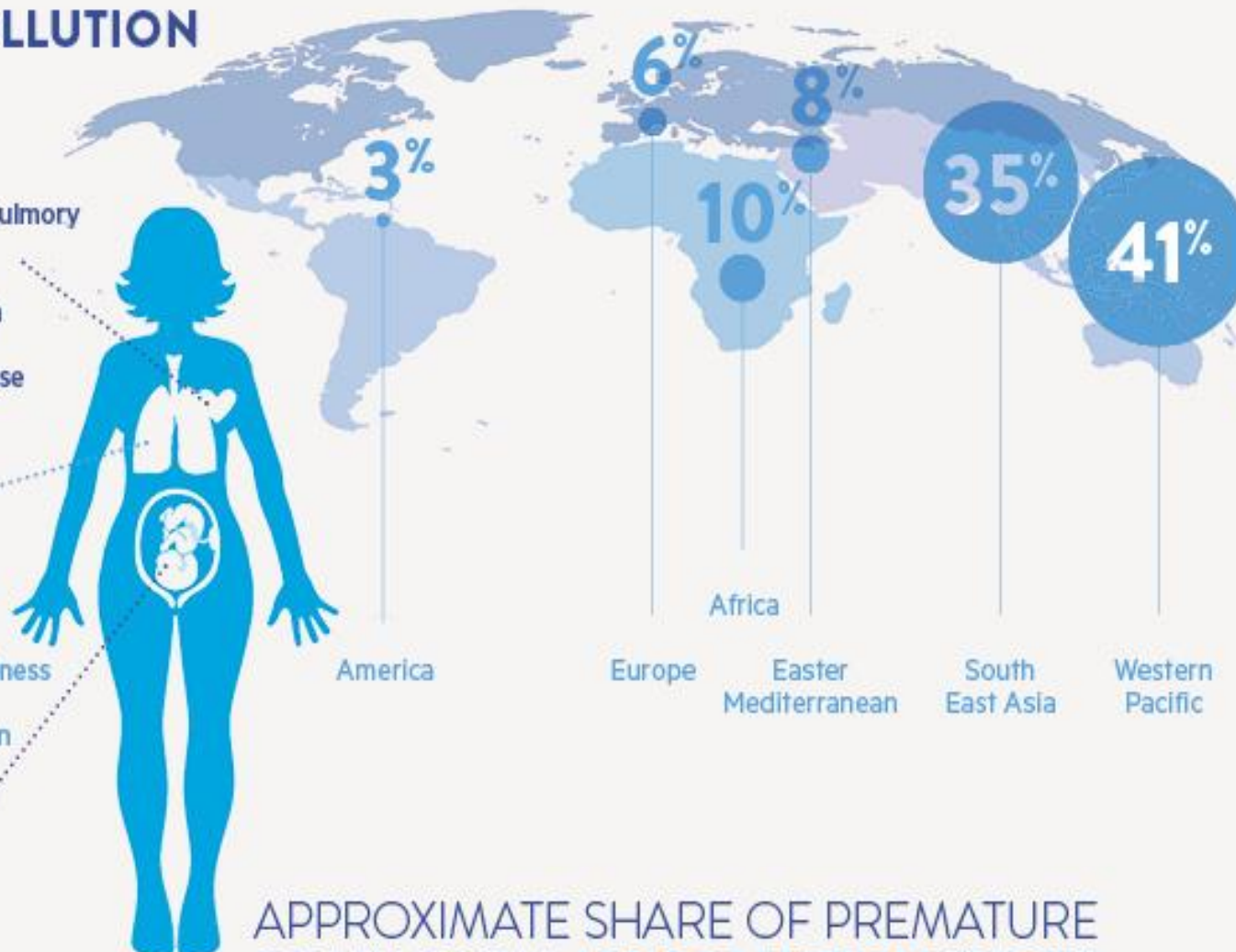
- Chronic obstructive pulmonary disease (COPD)
- Childhood pneumonia
- Ischaemic heart disease
- Stroke



- Asthma
- Breathing problems
- Chronic respiratory illness
- Reduced lung function

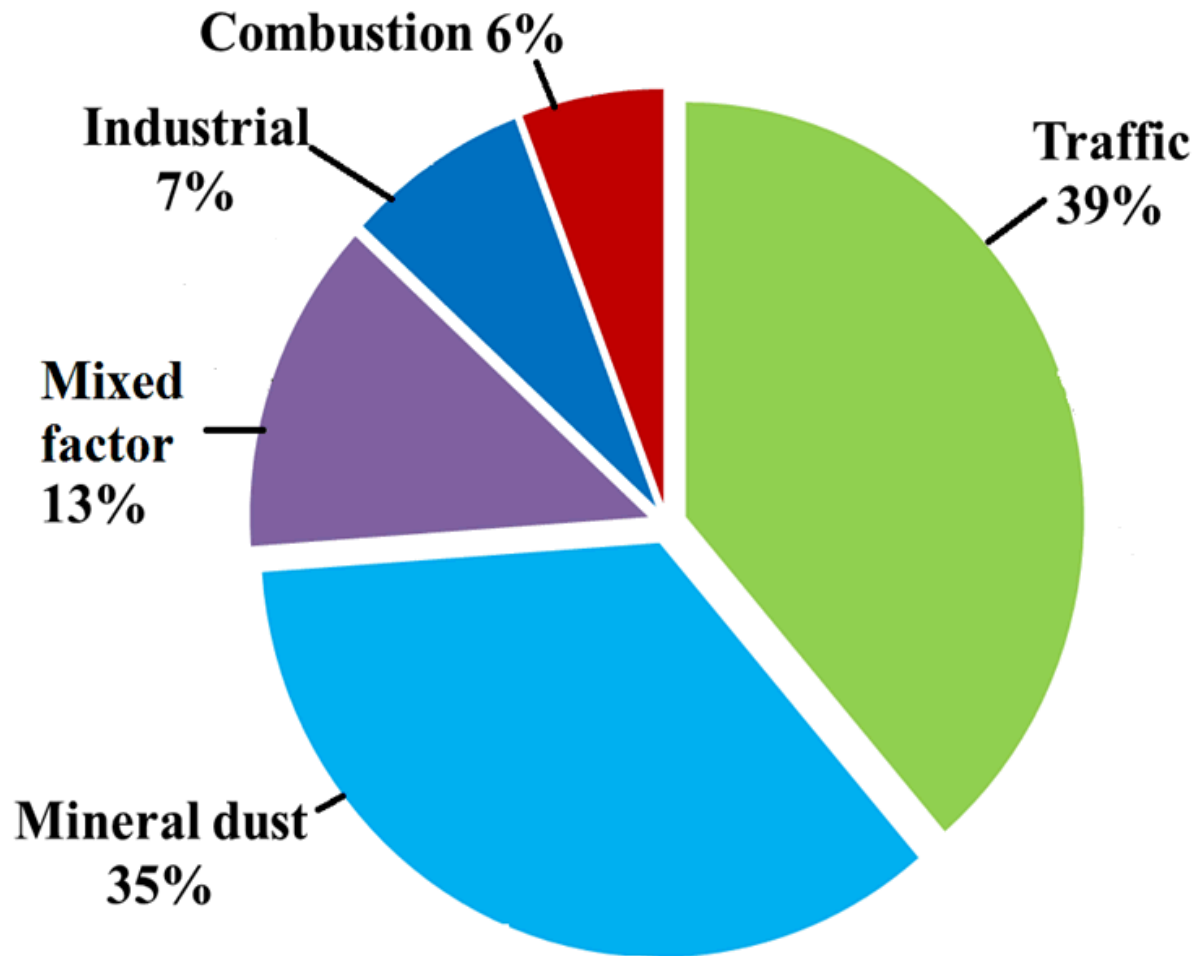


- Low birth weight



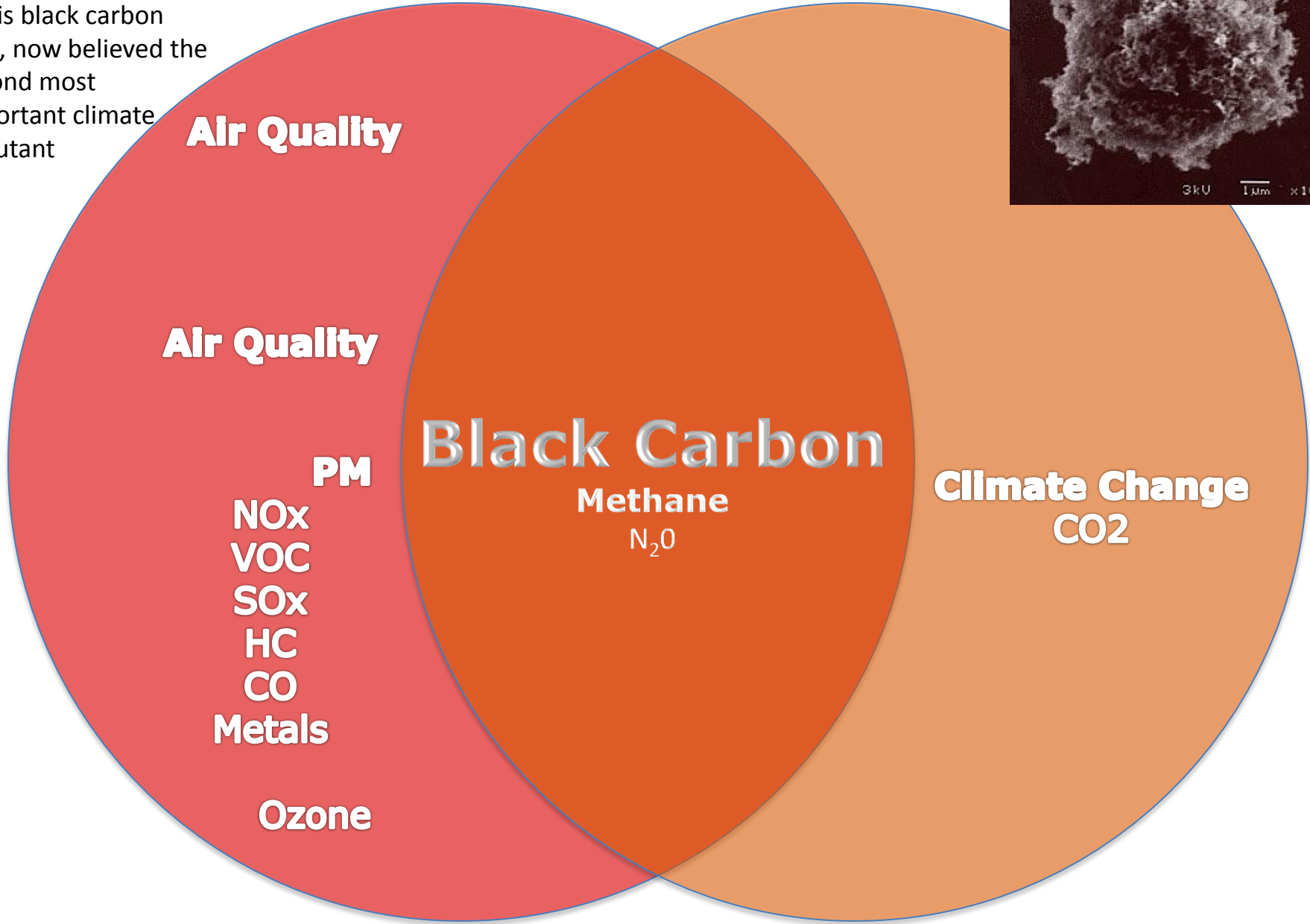
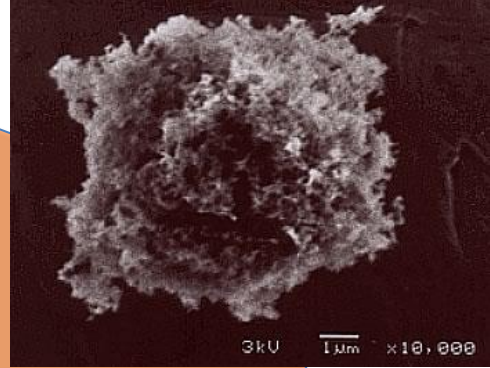
APPROXIMATE SHARE OF PREMATURE DEATH FROM **AIR POLLUTION** (YEAR 2012)

Main Sources of PM in Nairobi



Source: S. M. Gaita et al.: Source apportionment and seasonal variation of PM_{2.5} in Nairobi

The smaller part of PM is black carbon (BC), now believed the second most important climate pollutant

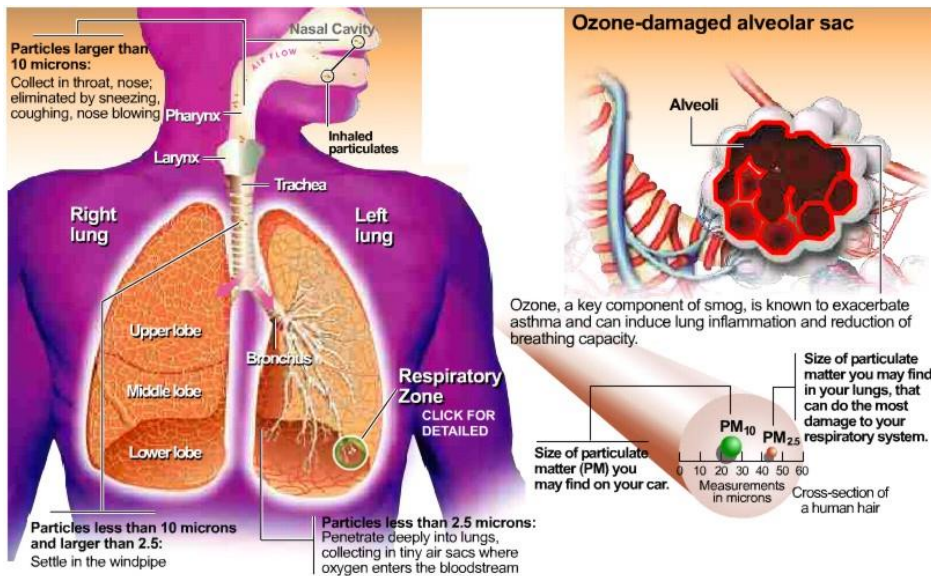


Fuel Quality/Emission Controls

Fuel Economy

3 benefits of low sulphur diesel fuels

1. Health: Diesel Exhaust Carcinogenic

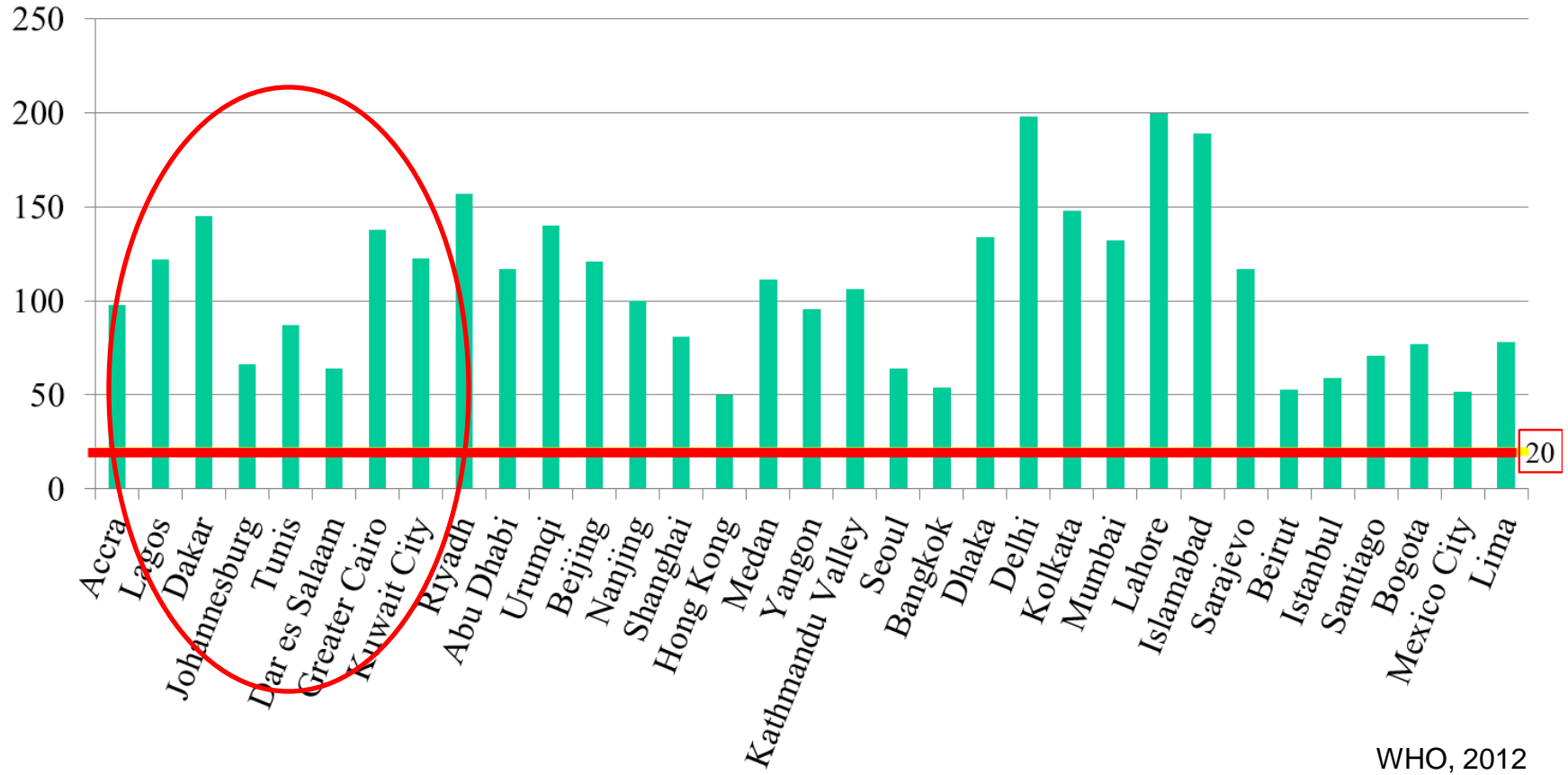


2. Cleaner Vehicle Technologies and Improves Engine Life



3. Environment- Reduces SCLPs

Annual average PM levels of major cities



— = 20 $\mu\text{g}/\text{m}^3$ WHO PM10 Annual Air Quality Guideline

Paris drives old cars off its streets

Life | Fri Jul 1, 2016 8:33am

Paris banned old, exhaust-belching cars from its streets on Friday in a war on air pollution that environmentalists hope will also drive dirty vehicles from the centers of other European cities.

Air pollution, in large part caused by fine particulate fuel emissions, kills 48,000 people each year in France, some 400,000 in Europe and around 3.7 million worldwide, data published by France's public health agency this month showed.

Any car registered before Jan. 1, 1997, will be barred from the city's streets from Monday to Friday, from 8 a.m. to 8 p.m.

Some owners protested by parking their vehicles near the National Assembly and Champs Elysees avenue to denounce a ban they say will hurt poor people most and slash the resale value of their vehicles...

Paris Mayor Anne Hidalgo says the ban could be extended in 2020 to all combustion-engine cars more than nine years old.

Norway is planning to ban petrol- and diesel-fueled cars from 2025 and several cities in Europe are testing various anti-pollution or anti-congestion measures based on tolls for city center access or temporary and selective car bans during surges in pollution levels.

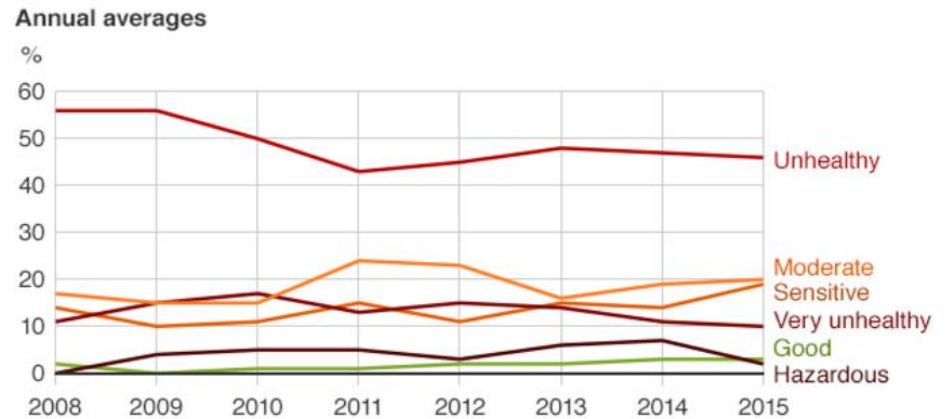


Articles on Britain & Beijing

Schools in Beijing are closed and outdoor construction halted as the Chinese capital's first ever pollution "red alert" came into effect.

The alert, the highest possible warning level, was issued late Monday and will last until midday on Thursday.

Limits have been placed on car use and some factories have been ordered to stop operations.



Daily average compiled from valid hourly readings Apr 2008-Jun 2015.
*AQI categories as set by the US Environmental Protection Agency

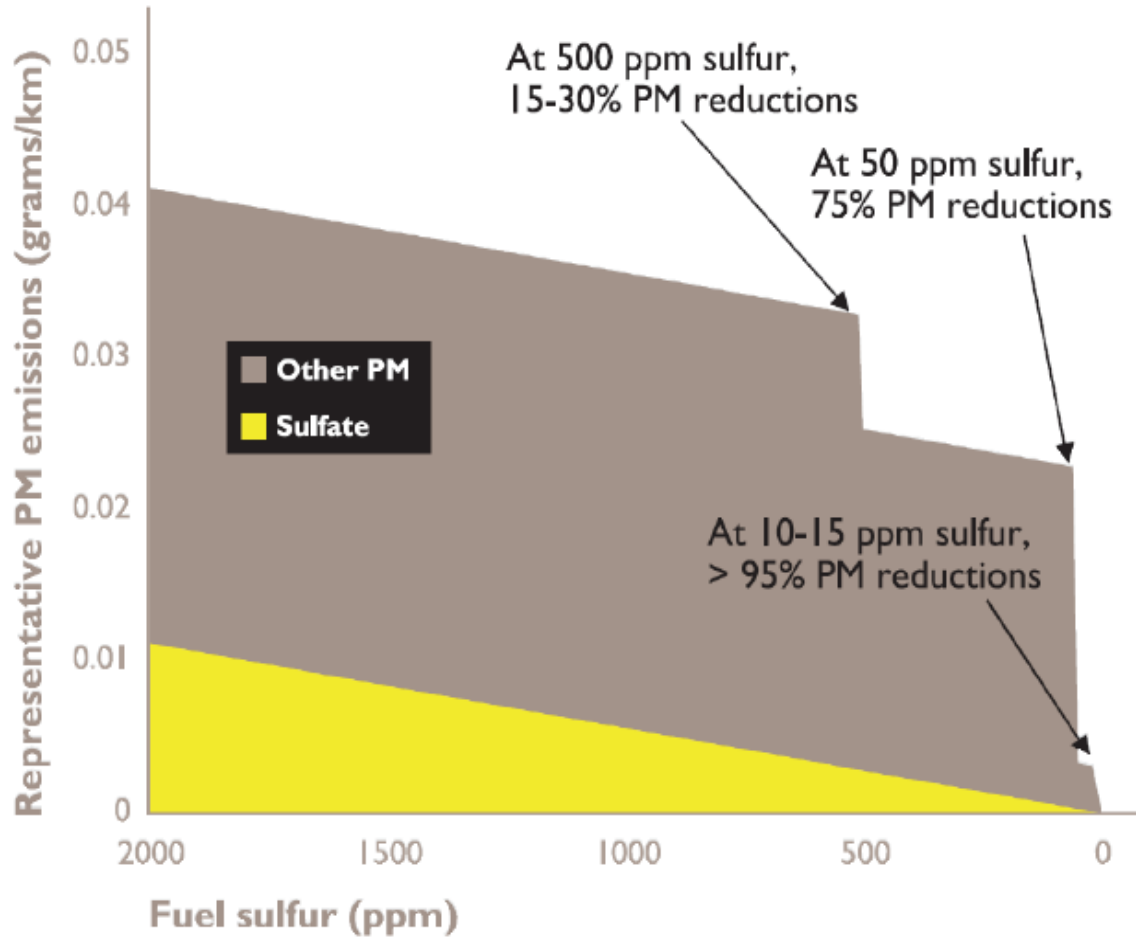
Source: US embassy, Beijing

BBC

Britain

Every year, around **23,500 Britons** die prematurely from inhaling **NOx emissions** such as nitrogen dioxide (NO₂) particles, emitted by diesel engines. Another **29,000** die from inhaling **sooty particulate matter**.

Lower sulphur fuels reduce vehicle emissions



Sulphur levels proportional to PM and SO₂ emissions in all cars - new and old cars

Stringent emission standards can reduce pollution by over 85%



No retrofit system
Uncontrolled Diesel Exhaust
(Level 1)

Old technology
Little black carbon removal
Little ultrafine PM removal
Does not remove lube oil ash



Retrofitted with
Diesel Oxidation Catalyst (DOC)
(Level 1)

Old technology
Little black carbon removal
Little ultrafine PM removal
Does not remove lube oil ash



Retrofitted with
Partial Filter
(Level 2)

Little black carbon removal
Little ultrafine PM removal
Does not remove lube oil ash

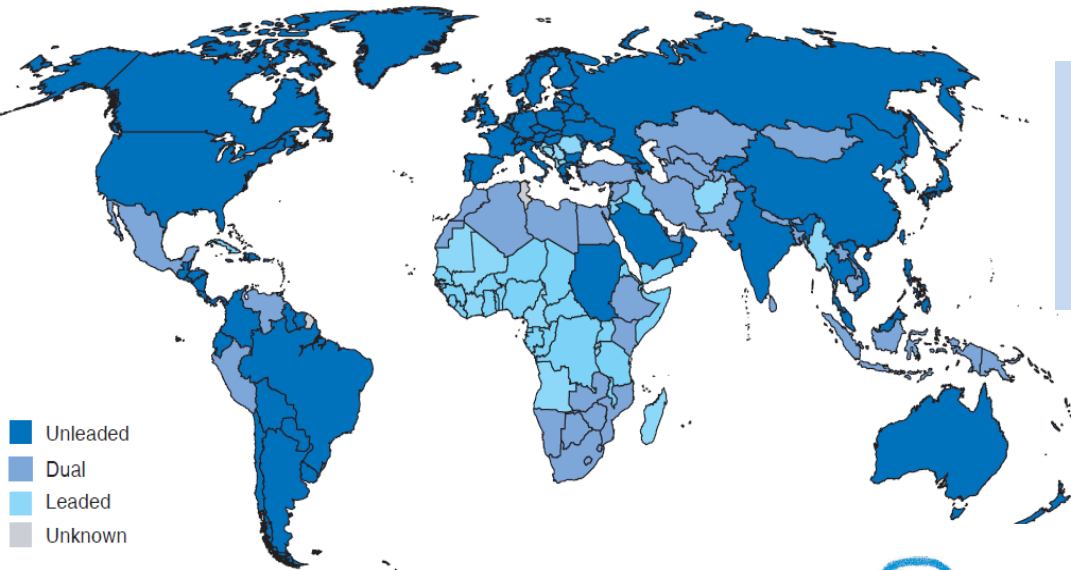


Retrofitted with
Diesel Particulate Filter (DPF)
(Level 3)

New Technology
Used on all new trucks since 2007
>85% black carbon removal
>85% ultrafine removal
>85% lube oil ash removal

Diesel particulate filters are needed to meet Euro 5 standards for light-duty vehicles and Euro VI standards for heavy-duty vehicles. Filters require diesel with sulfur content less than 50ppm, and require 10ppm diesel for optimal performance.

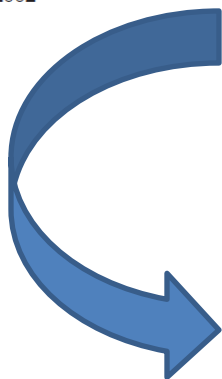
Progress towards Unleaded Petrol



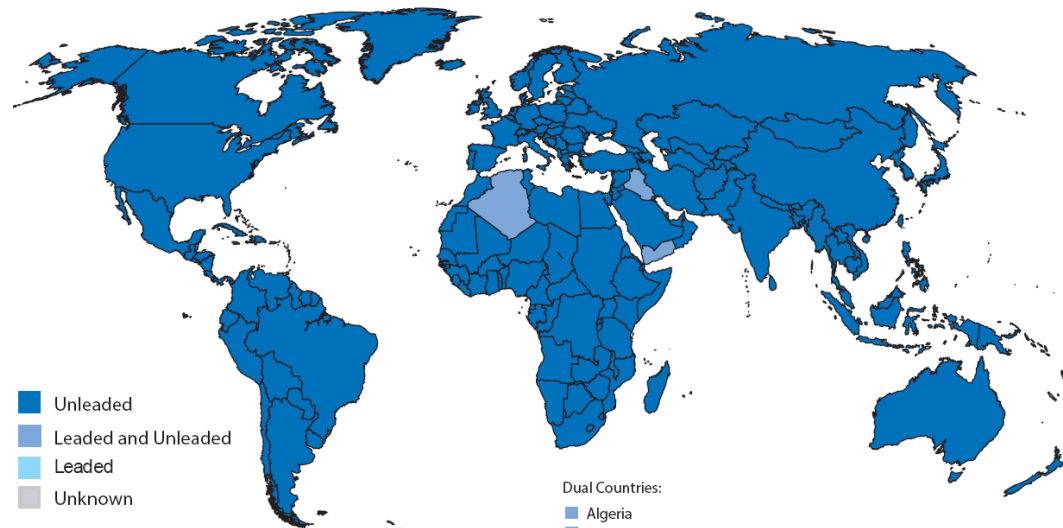
- Unleaded
- Dual
- Leaded
- Unknown

Status as of End 2002

2002



2017



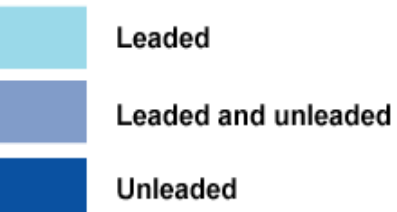
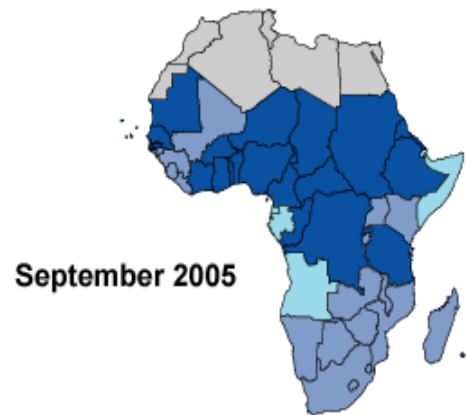
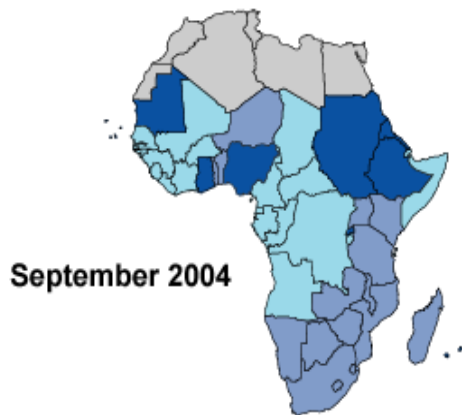
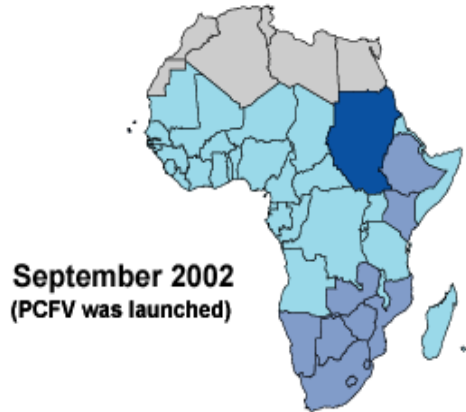
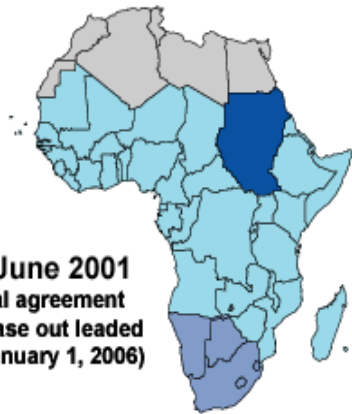
- Unleaded
- Leaded and Unleaded
- Leaded
- Unknown

Dual Countries:

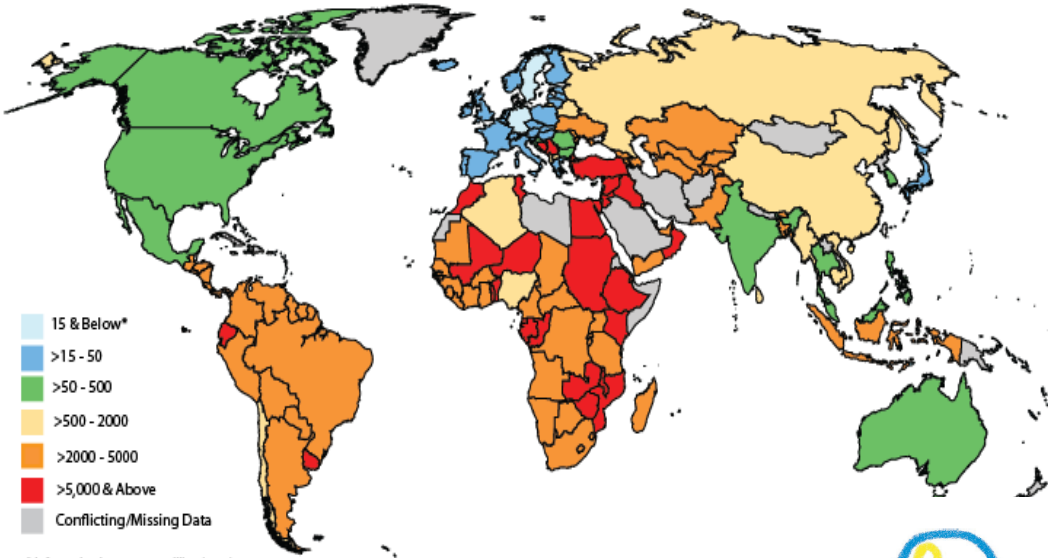
- Algeria
- Yemen
- Iraq



Progress of leaded petrol phase out in sub-Saharan Africa



Progress towards Low Sulphur Diesel



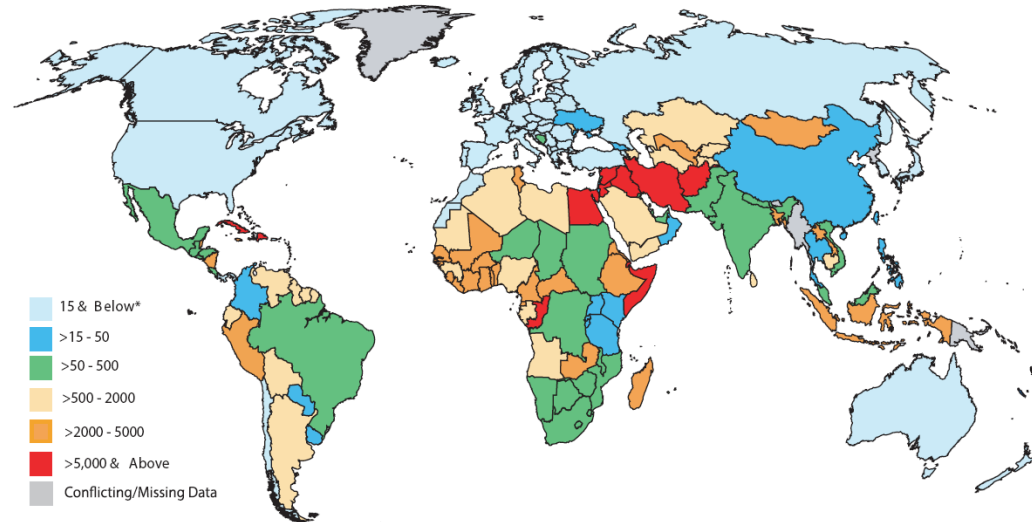
- 15 & Below*
- >15 - 50
- >50 - 500
- >500 - 2000
- >2000 - 5000
- >5,000 & Above
- Conflicting/Missing Data

* Information in parts per million (ppm)



2005

2017



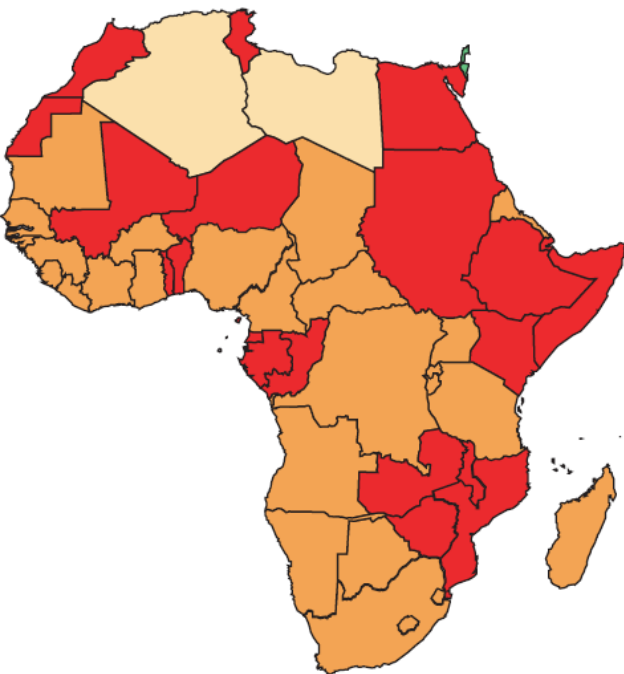
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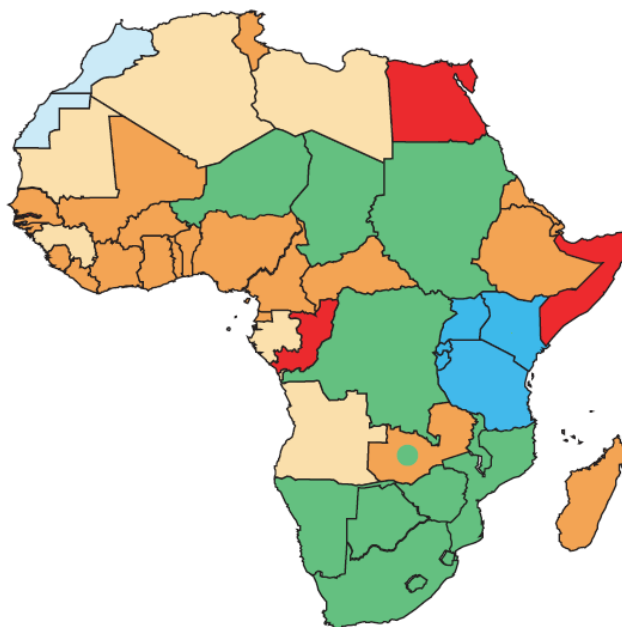
For additional details and comments per country, visit www.unep.org/transport/cfv/

Progress in Lowering Sulphur in Diesel in Africa

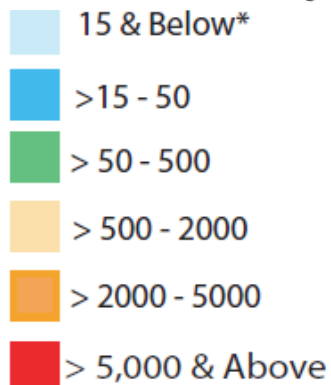
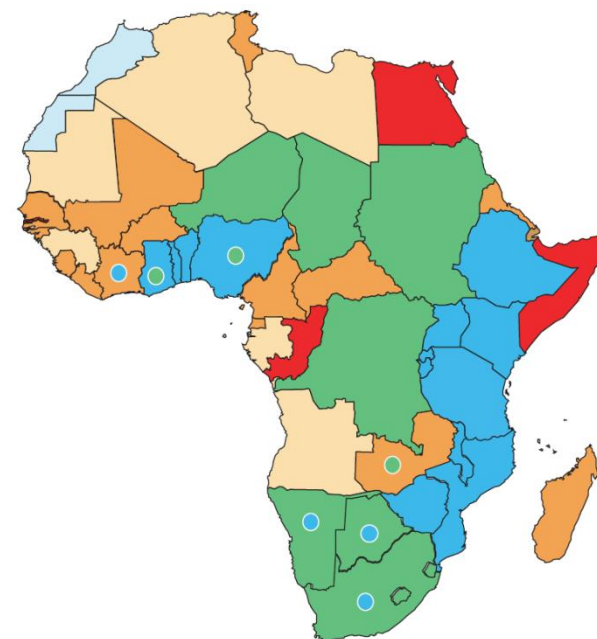
2002



2016

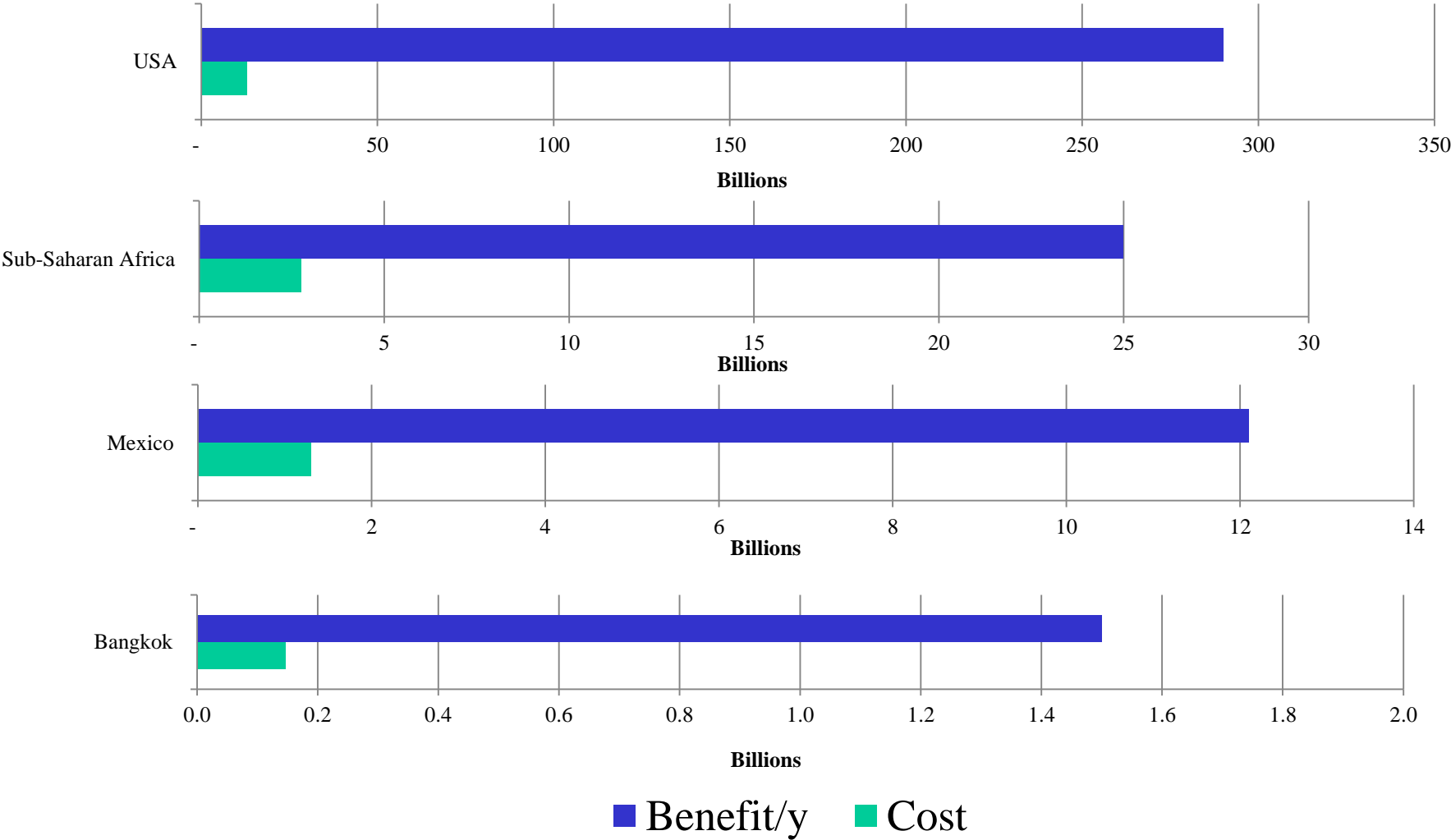


Planned 2017



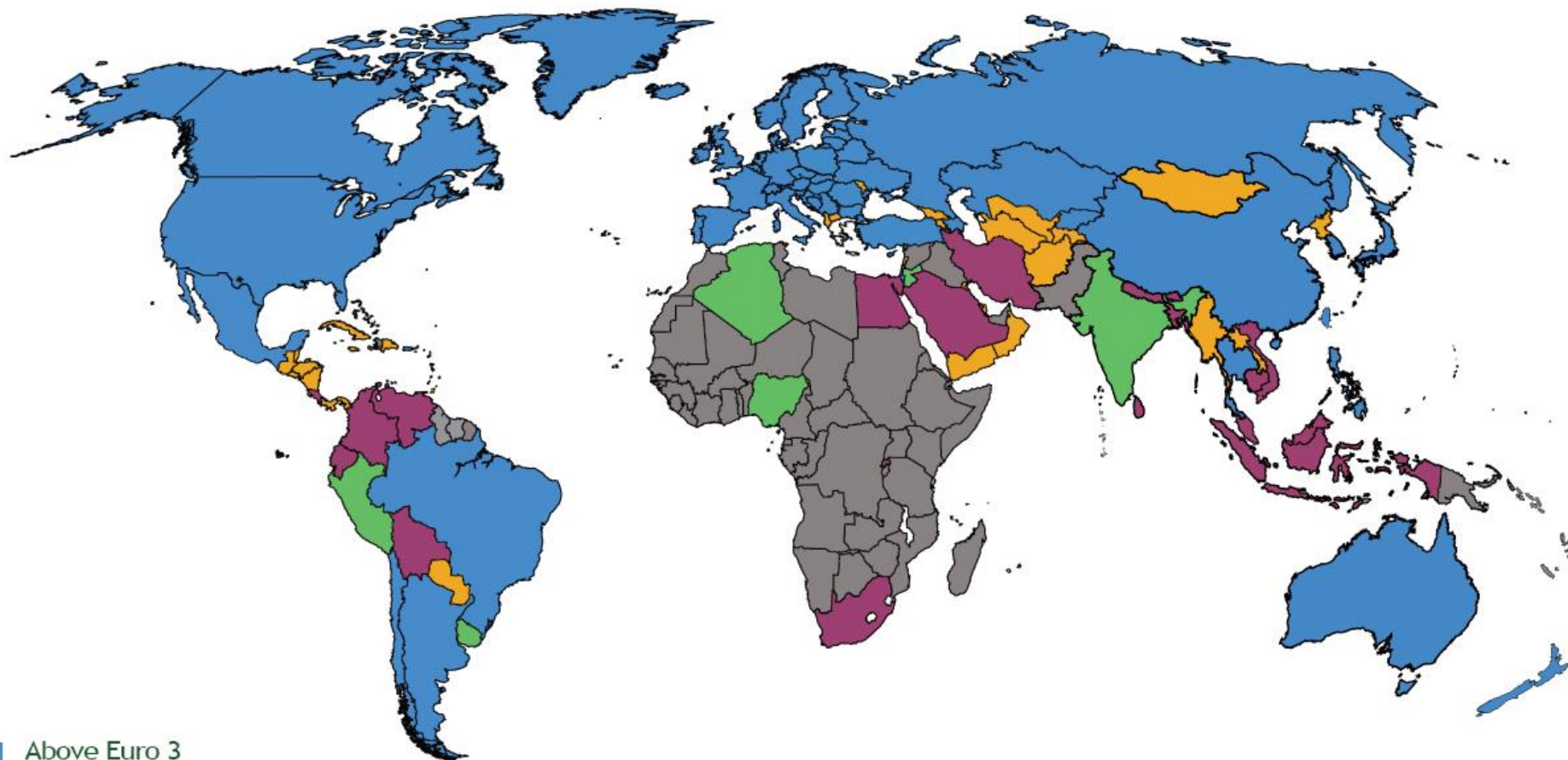
* Information in parts per million (ppm)

Benefits of Moving to Low Sulphur Fuel Far Outweigh Costs



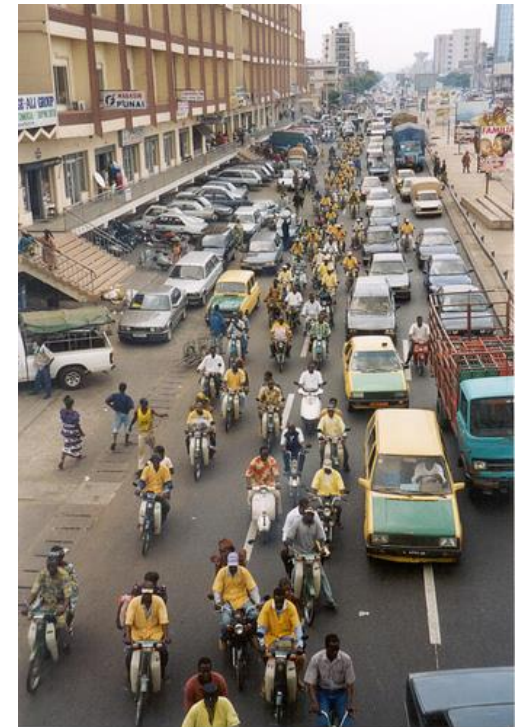
Vehicle Emissions Standards

June 2017

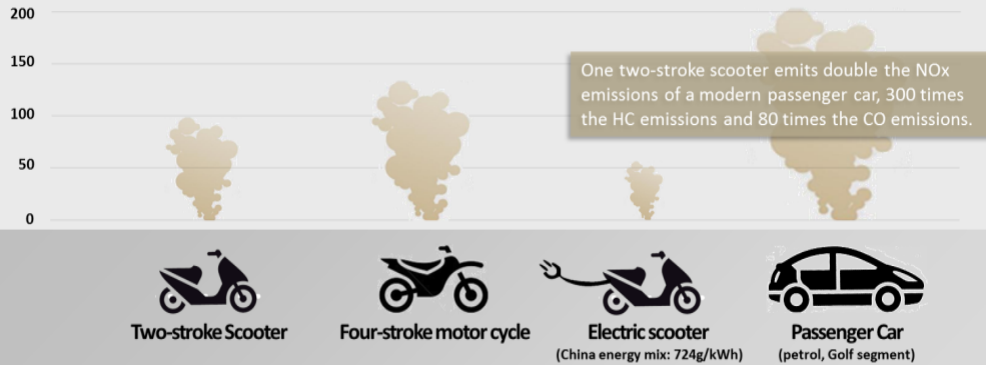


- Above Euro 3
- Euro 3
- Below Euro 3
- No Policy
- Unkown

Electric Mobility



Two-wheelers Emissions Comparison – Total Emissions [g CO₂-equivalents / km]



Particle Emissions [g PM/ km]

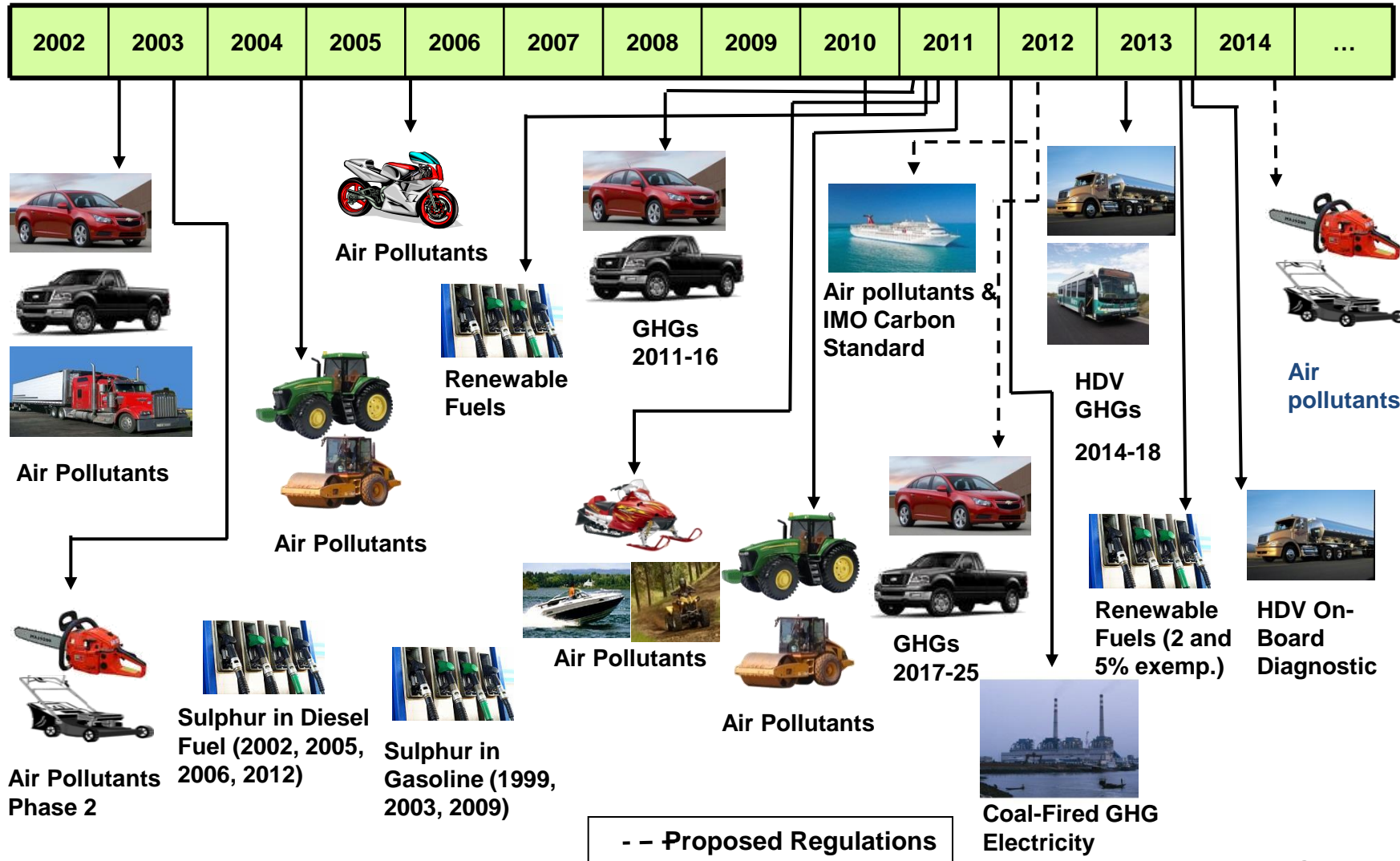


Clean Fuels & Vehicles Regulatory Toolkit

- Systems approach links fuel quality to vehicles emission standards for max emission reduction benefits
- Fuels and vehicles not matching thus potential emissions reductions not achieved
- Continued support to countries to develop long term roadmaps to reduce vehicle emissions
- Support for I & M programs



Canadian Vehicles and Fuel Quality Regulations



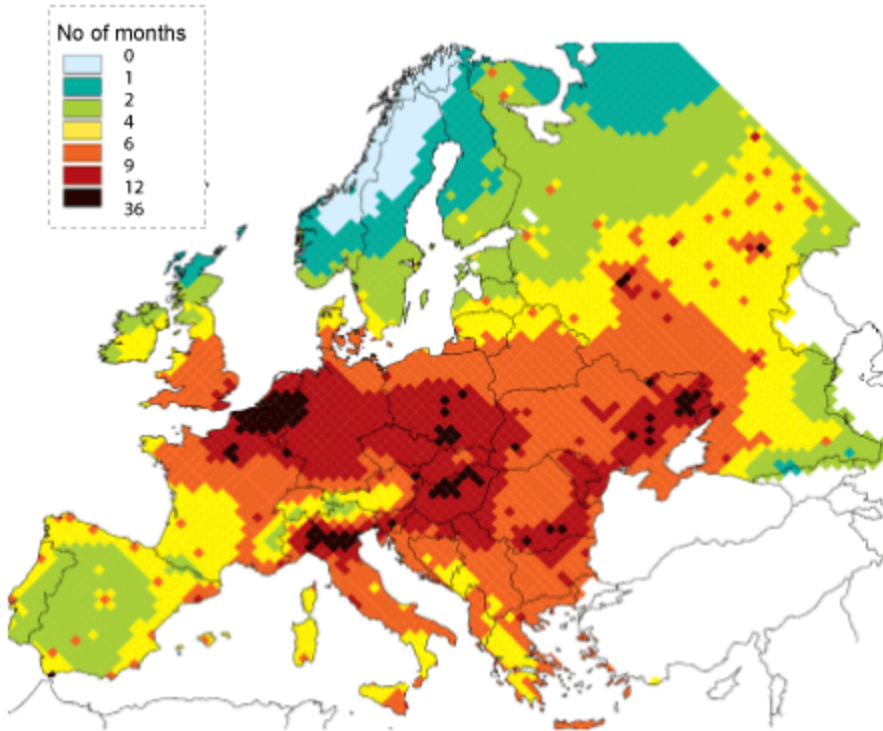
Summary of Euro Stages and Fuel Quality Standards in Europe - Timelines⁶⁷

Vehicle Emissions Standards			Fuel Quality	
Year	Light Duty	Heavy Duty	Year	Main Change in Properties
1980-90	Pre-Euro 1		1976-80	Sulfur and lead gradually reduced
1988		Euro 0	1989	Benzene (5%) and octane start to be regulated
1992		Euro I		
1993	Euro 1		1994	Further Sulfur reduction
1995		Euro II	1996	
1996	Euro 2			
2000	Euro 3	Euro III	2000	Directive 98/70/EC No Lead in gasoline Sulfur in gasoline 150 ppm, in diesel 350 ppm Aromatics, Octane, oxygen, olefins, benzene limits
2005	Euro 4	Euro IV	2005	Sulfur in gasoline and diesel 50 ppm (availability of 10 ppm must be ensured) Aromatics lowered
2008		Euro V		
2009	Euro 5		2009	10 ppm gasoline and diesel
2011			2011	E10 introduced
2013		Euro VI		
2014	Euro 6			

Source: Derived from IFQC

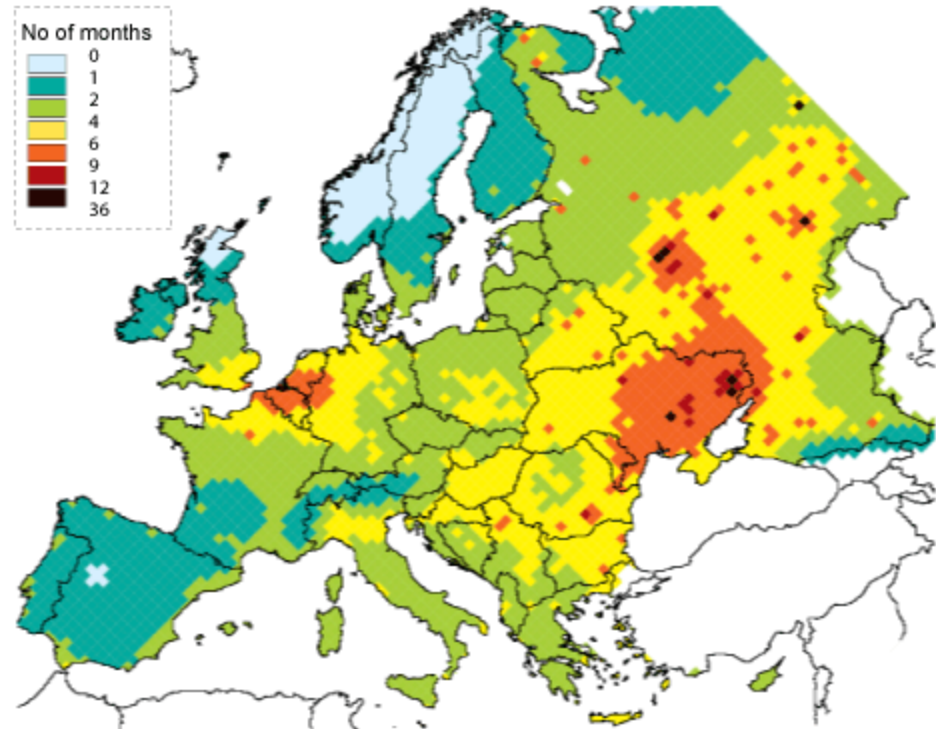
Progress in PM reductions in Europe 2000 - 2020

→ Reduction in life expectancy due to exposure to PM 2,5
Year 2000



SOURCE: Clean Air for Europe Programme / www.environment.no

→ Reduction in life expectancy due to exposure to PM 2,5
Year 2020



SOURCE: Clean Air for Europe Programme / www.environment.no

Vehicle Emission Standards in China

Year		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018-2020		
Category																
LDV	CI	II			III					IV					V	
	SI	II			III				IV						V	
	Gas-SI	II			III				IV						V	
HDV	CI	II		III					IV							
	SI	II				III		IV								
	Gas-SI	II		III			IV									
MC	<=50ml <=50km/h	II				III										
	>50ml >50km/h	II				III										
Low speed		N/A	I	II									IV	V		
Off-road diesel		N/A			I		II					III				
Off-road gasoline		N/A							I			II				

Next Steps to Low Emission Transport



Low sulphur fuels

Vehicle standards (Euro 4/IV)



Clean buses (Euro IV)



Fuel economy vehicles



Electric Motorcycles



NMT policies and infrastructure





INITIATIVES DIESEL

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Reducing Black Carbon Emissions from Heavy Duty Diesel Vehicles and Engines

ABOUT

The transport sector is a major contributor to ambient fine particles in major cities, and emits some 19% of global black carbon. Recent research has identified diesel vehicles and engines as one of the most attractive sectors for black carbon mitigation. Fine particles and black carbon from diesel vehicles and engines can be virtually eliminated through technologies that are present on half of new heavy-duty vehicles sold today.

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THE VEHICLES CAMPAIGN

Technological and legislative advances have reduced vehicle tailpipe emissions exponentially in the last decades. Yet most developing and transitional countries have yet to introduce the vehicle emissions standards that would prevent an estimated 80,000 premature each year in these countries....

[READ MORE](#)



THE PARTNERSHIP FOR CLEAN FUELS AND VEHICLES (PCFV)



The Partnership for Clean Fuels and Vehicles (PCFV) is the leading global public-private initiative promoting cleaner fuels and vehicles in developing and transition countries.

Established at the World Summit on Sustainable Development in September

Merci



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