

Reducing Impacts of Particulate Pollution: opportunities for achieving air quality and climate change benefits

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EASAC section “Carbon in Particles”

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Overveiw

- **EFCA – Identity, Mission, Activities**
- **Policy initiatives: “One Atmosphere”**
- **Particulate Pollution and black carbon**
- **Sources and management**
- **Comparison of metrics**
- **Vehicle regulation**
- **Conclusions**

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What is EFCA?

European Federation of National Associations

Mission

To help to achieve policies and measures that will protect the environment, climate and human health in Europe against the effects of pollution while fostering sustainable development

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Membership

Full Members

- ✓ CAPPa, Croatia
- ✓ FAPPS, Finland
- ✓ APPA, France
- ✓ KRdL, Germany
- ✓ GUS, Germany
- ✓ CSIA/ATI, Italy
- ✓ VVM-CLAN, Netherlands
- ✓ PIGE, Poland
- ✓ SCAS, Sweden
- ✓ Cercl'Air, Switzerland
- ✓ TUNCAP, Turkey
- ✓ EP-UK, United Kingdom

Associate Members

- ✓ IUAPPA (International Union of Air Pollution and Environmental Protection Associations)
- ✓ NILU, Norway

Observers

- ✓ ASASPP, Austria

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Activities

- Conferences, organised by members
- Symposia
- Policy initiatives
- Forum discussions
- Newsletter, website (www.efca.net)
- Furthering professional activity: mutual assistance between Members



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Policy Initiatives

- 1. Improving the effectiveness of CAFE.** December 2004.
Recommended approaches, in addition to the system of air quality limit values to improve health protection in Europe.
- 2. Linking air pollution and climate change - a challenge for European legislation.** 2010. Showed inconsistencies between air quality and climate change legislation in the EU. Recommended improvements for Directives.
- 3. Black Carbon Particles (BCP): Opportunities to strengthen policies on Air Quality and Climate Change in Europe".** Proposal to include Black Carbon Particles as an additional indicator for the protection of human health. Connects this with the need to reduce the emissions of Black Carbon to reduce global warming.

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Overarching Theme

EFCA's overarching theme is "One atmosphere", endorsed by EU Commissioner Janez Potočnik

"One message that has been hammered home this year is "**only one air**". We all share the air we breathe, and we need to share global solutions.....

"EU air quality policy, above all in the transport sector, is used as a reference model for air pollution strategies in many other parts of the world.

"As well as a responsibility, this also represents a huge opportunity, and we need to make sure that European leadership will give the right direction."

EU Green Week Closing Speech 7th June 2013

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One atmosphere - Particulate matter

EFCA Activities

- **Conferences** on Integrated approach on clean air and climate (2008; 2011): furthering cost-effectiveness
- **Policy Initiative** „Linking air pollution and climate change“ (PI-2, 2010)
- **Symposium series** on UFP (2007, 2009, 2011, 2013, ..)
- **Metrics session** at UFP-3 (2011); proposal from the scientific community for Black Carbon Particles as additional metric, next to PM₁₀/PM_{2.5}
- **Forum discussion** at www.efca.net (2011/2012): what about Particle Numbers?
- **Policy Initiative** on Black Carbon Particles (PI-3, 2012)

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Recommendations

Policy Initiative-2: refer in air quality legislation to climate objectives (in 2010 missing in EIA-, IE- (former IPPC), NEC- and AQ-Directives):

- EIA Directive and energy efficiency
- IE Directive and BREF's
- NEC Directive and AQ Directive

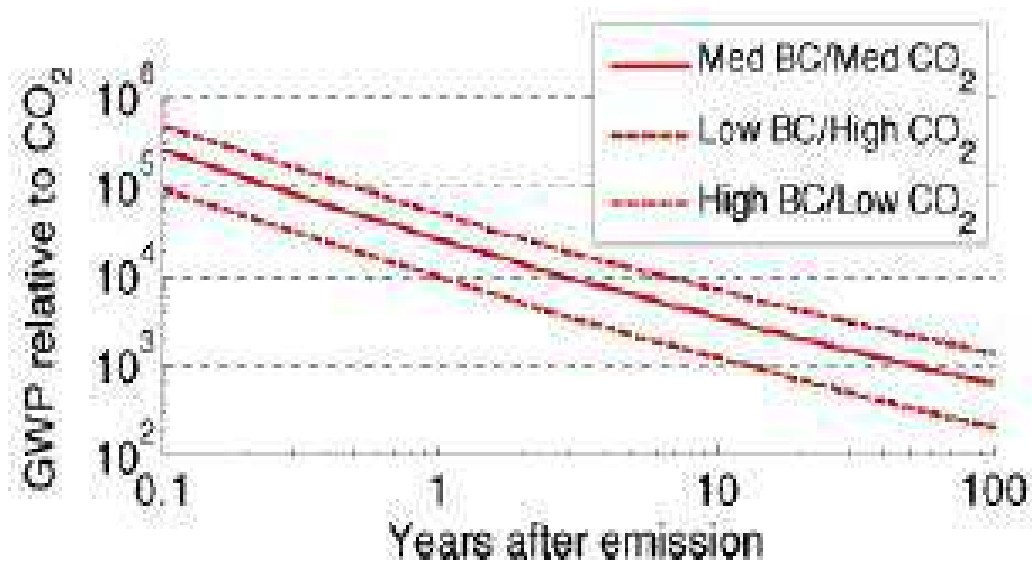
Policy Initiative-3: include BCP (not PN) as additional metric in the Air Quality Directive: serves clean air and climate objectives and facilitates its implementation

Why a Black Carbon Particulate metric?

- **Political consensus:** keep warming below 2°C temperature rise: essential to curb emissions of CO₂-and F-gases which have long atmospheric lifetimes
- But **no political consensus on actions** to achieve this
- Action on **Short-Lived Climate Pollutants** (Ozone, Methane, Black Carbon) may buy time
- BC is **major climate forcer** (WMO-UNEP, 2011; Pont et al, 2013) and responsible for 0.5-1.1°C warming in NH
- **Political consensus:** Particulate Matter (PM) is a major factor in health impacts of air pollution
- BC therefore **controlled through AQ legislation** as component of Particulate Matter: considerable potential for further action

WHY BLACK CARBON?

- MAGNITUDE OF GWP OF BC RELATIVE TO CO₂
- IPCC data indicates GWP (20) of BC to be 1600 and GWP (100) 460 but engine-derived soot has higher GWP than other forms
- Jacobson (2009) GWP (20) of fossil fuel soot about 2500, GWP(100), 865 to 1255



Direct-effect GWP of BC, relative to CO₂ mass

Bond and Sun 2005.

Dia 11

JM7

Can include table with range of estimates, or make it into a "whisker plot". As in the Bond and Sun paper.

John Murlis; 31-7-2009

JM8

need to give % for third place

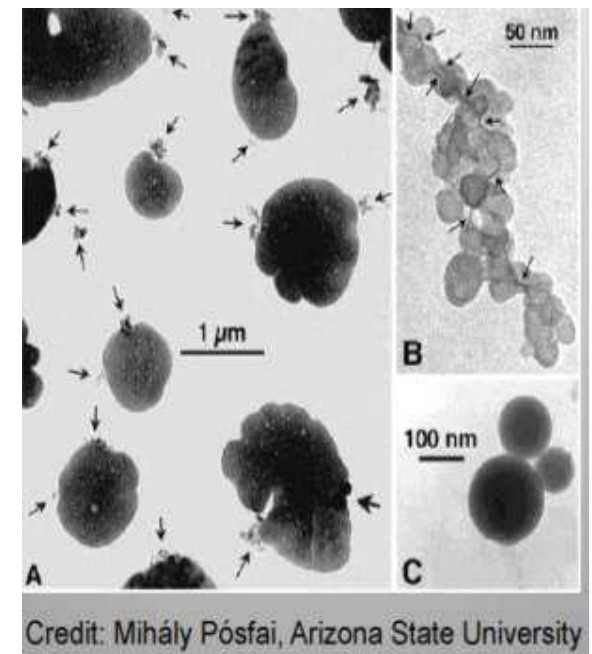
references?

integrated forcing = cumulative effect

John Murlis; 16-9-2009

WHAT IS BLACK CARBON?

- Combustion of all kinds produces pollution:
 - solid, including carbonaceous particles, sulphates and nitrates
 - gaseous, including SO_2 , NO_x , CO_2 , CO ,
- Black carbon (BC) is the carbonaceous fraction of the particulate emission from combustion
- Particles of BC are typically small (less than $1\ \mu\text{m}$ in diameter, known as $\text{PM}_{1.0}$) and come in many forms:
 - Charcoal
 - Tar
 - Soot
- All have the key property of absorbing energy from solar radiation
- **Note: EFCA UFP 2013** – Presence of high quantities of non-combustion components in UFP - tyre, road surface

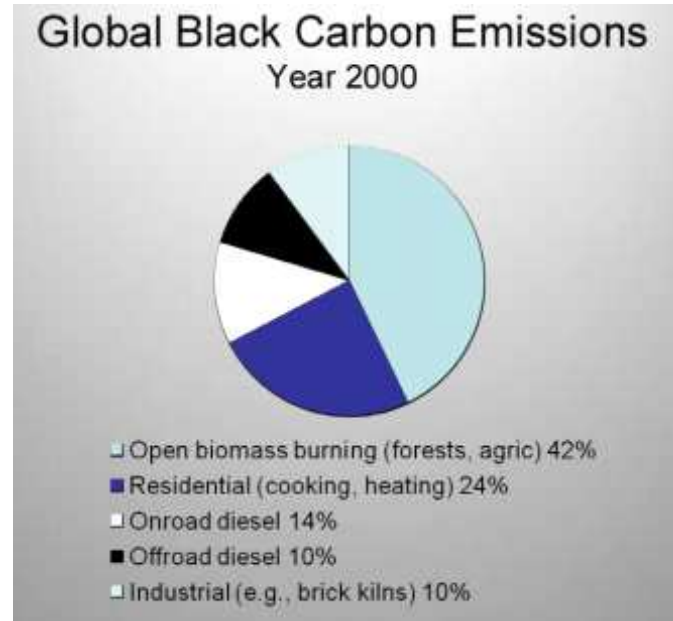


Dia 12

JM4

Swop bullrt points to highlight BC
John Murlis; 31-7-2009

WHERE DOES BLACK CARBON COME FROM?



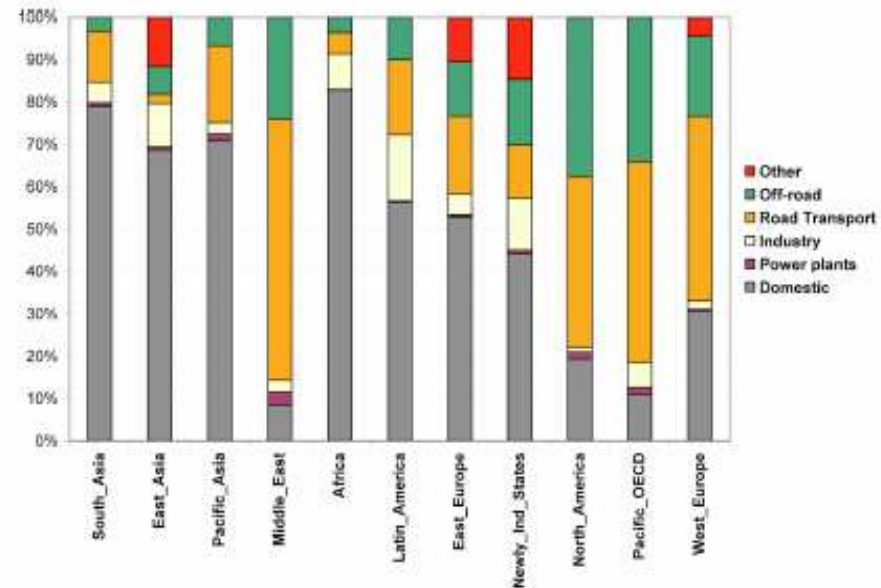
- fires from burning biomass (agriculture, forest clearance)
- Industry (incomplete combustion of fossil fuels)
- Residential: heating and cooking
- Diesel IC engines (transport and non-road) contribute nearly 25%
- Non-road about 40% of diesel BC emission
- **Note EFCA UFP 2013:** marine sources emerging as important new factor

WHERE DOES THE BLACK CARBON COME FROM?

SOURCES AND GEOGRAPHIC DISTRIBUTION

- EU emissions remain significant, despite historic reductions (IIASA 2007)
- In regions where agricultural burning is controlled (Europe, North America), diesel higher proportion of total (>50%)
- Europe is a major source of diesel-derived black carbon
- Note: importance of off-road and, not included, ships

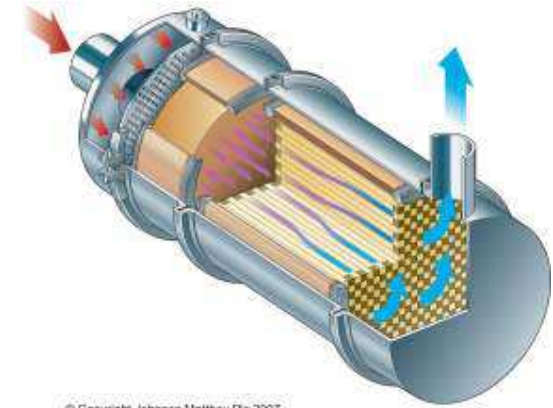
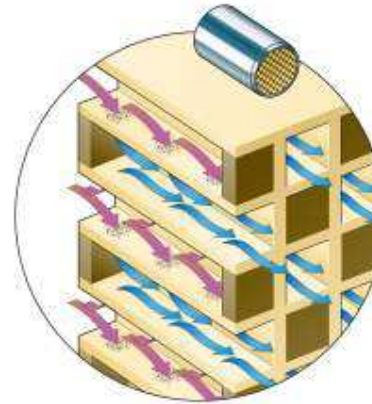
Figure 4: Regional share of black carbon emissions in 2000



Source: Compiled from IIASA paper 2007

BLACK CARBON REDUCTION TECHNOLOGY

- For developed countries control of diesel BC would have significant effect
- Current focus: diesel vehicles
- Diesel Particulate Filters (DPFs) reduce BC in diesel exhaust by 99%
- Currently widely fitted to new passenger cars, HGVs and Buses
- BUT further opportunities
- Retrofit to diesel in current road transport fleets
- Construction and other non-road vehicles and machinery



Dia 15

JM6

Need better illustrations. Would prefer SCRT, if possible, to deal with direct NO2 questions.

images from new JM presentation

John Murlis; 16-9-2009

Dennis Dart Single Decker Bus



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UK: Double Decker Bus Fleet



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Estimate of global warming potential of PM from a Euro III bus over representative drive cycle (MLTB)

Double deck bus, assuming:

PM emissions of 0.35g/km

Estimated 75% carbon = 0.26g/km

CO₂ emission of 1500g/km

Estimate of **GWP (20) = 2500**, BC is **30%** of total climate impact

Low estimate of **GWP (100) = 1000**, BC is **15%** of climate impact

1.5kg/km CO₂ eq to 120 tonnes CO₂/yr at 80,000km/yr or 1200 tonnes CO₂ over 10 years

Fitting DPF is equivalent to saving of between 210 and 525 tonnes CO₂ over 10 yrs or up to **44% of fuel consumption**

At a cost of **£2500/DPF**, the cost of removing the eq of **1 tonne CO₂ is £5 - £12** per tonne (or £17 - £44 per tonne of C)

Competitive with Carbon Capture and Storage (£30 to £60 per tonne C)

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Incorporating BC in EU Legislation

Do we have the evidence for the AQ impacts?

Requires elements of an air quality model

- Dose-response relation from epidemiological studies, in particular excess mortality
- EU-wide emission inventory
- Validated model: emissions - monitoring data
- Scenarios

Economic module

- Costs of emission reductions required to reduce (part of) excess mortality
- Monetaring benefits of reduced excess mortality

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Feasibility for PM, BCP and PN

	PM2.5	BCP	PN
Concern	+	+	+
Dose-effect relation (short term effects)	+	+	+/-
Dose-effect relation (long term effects)	+	+/-	-
Emission inventory	+	+/-	(+/-)
Monitoring data	+	+/-	-
Source specific	-	+	-
Co-benefits with climate objectives	?	+	?

+ available; +/- incomplete; (+/-) scarce data only; - data absent

EU Vehicles regulation

EURO VI Regulation for heavy vehicles:

Emission limit value for Particle Numbers (PN)

Helpful against global warming?	Uncertain
Quantifying health benefits?	Presently impossible
Will it protect public health?	Certainly: no regret

Hypothesis: Limiting PN-emissions reduces BC-emissions

Need for robust relation between BC- and PN-emissions

knowledge gap for air quality policy?

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International Dimension

IUAPPA, (EFCA is a regional member) a partner in the **UNEP Climate and Clean Air Coalition : UN CCAC**

UNCCAC:

- 34 UN members in partnership
- 36 non-state Partners
- Scientific Committee

Objectives : address short lived climate pollutants by:

- Raising awareness
- Enhancing and developing new national and regional actions
- Promoting best practices
- Improving scientific understanding

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Conclusions

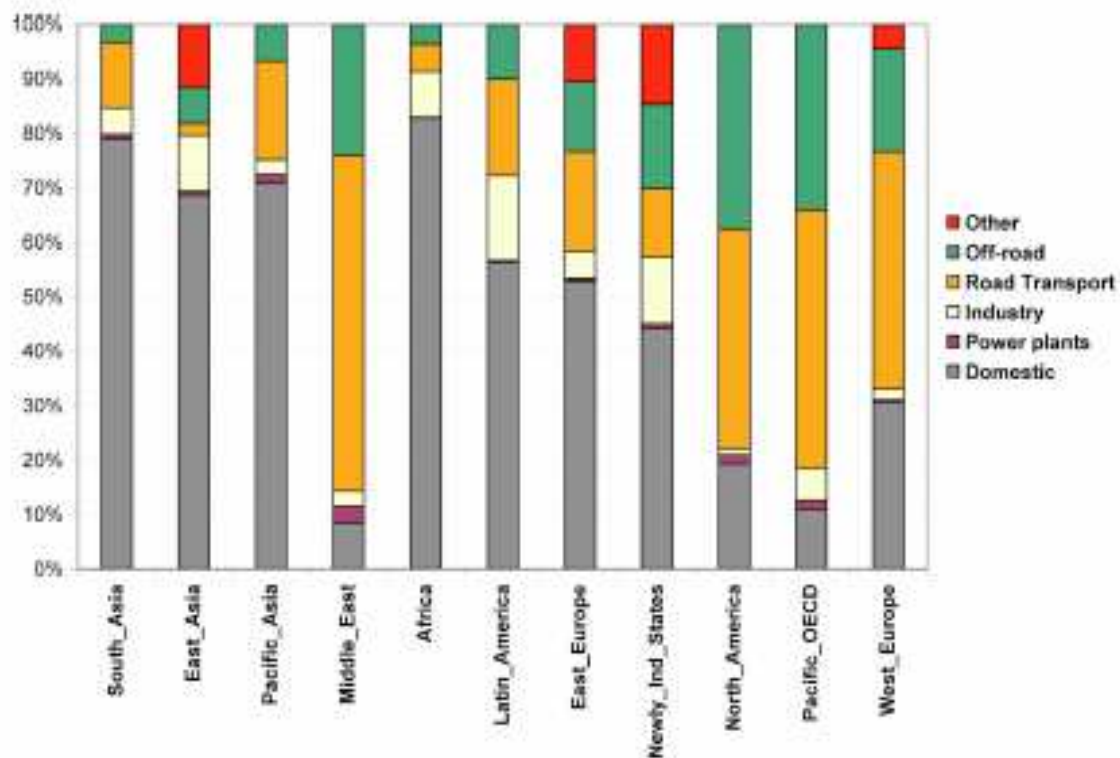
1. An integrated policy approach on air quality, climate and transport in EU would further cost-effectiveness; requires urgent attention
2. Specific regulation on BCP and/or PN are no-regret options
3. BCP regulation is the preferred additional metric
4. However, knowledge gaps include:
 - Dose-response relations for long-term health effects of BCP and for short-term and long-term health effects of PN
 - Databases of emissions and monitoring data of BCP and PN
 - Robust relation between BC-emissions and PN-emissions
5. EFCA ready to play a significant role

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Figure 4: Regional share of black carbon emissions in 2000



Source: Compiled from IIASA paper 2007

Thank you!

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EU Commissioner Janez Potočnik

Green Week Closing Speech

- One message that has been hammered home this year is "**only one air**". We all share the air we breathe, and we need to share global solutions.....
- EU air quality policy, above all in the transport sector, is used as a reference model for air pollution strategies in many other parts of the world.
- As well as a responsibility, this also represents a huge opportunity, and we need to make sure that European leadership will give the right direction.