

# Update of the Guidance Document of the Gothenburg Protocol with information on Black Carbon

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# Mandate of the Working Group of Strategies and Review

Report of the WGSR on its 49<sup>th</sup> session from 12 to 16 September 2011

*III c "Requested the Expert Group on Techno-economic Issues to consider the available information on black carbon emission source categories and abatement measures contained in the report of Expert Group on Black Carbon (informal document No. 4 for the twenty-eighth session of the Executive Body) and other reports and assessments on black carbon for inclusion as relevant in the guidance document on best available techniques for stationary sources for the reduction of particulate matter emissions;*

## Recent information available (1)

IIASA works for the different bodies and for UNECE:

Implementation of near-term climate impacts into GAINS (TFIAM Feb 2011)

Support to the many international studies on BC,  
Report Emissions of submicron and carbonaceous Particles en Europe and the Potentials for their Control – M. Amann and alls 2004

UNECE Ad Hoc Expert Group on Black Carbon – 2010

Report of the co-Chairs of the Ad-Hoc Expert Group

Swiss federal office for the Environment – Contribution to EGTEI

T. Nussbaumer - Overview on technologies for Biomass Combustion and Emission Levels of particulate matter – June 2010

## Recent information available (2)

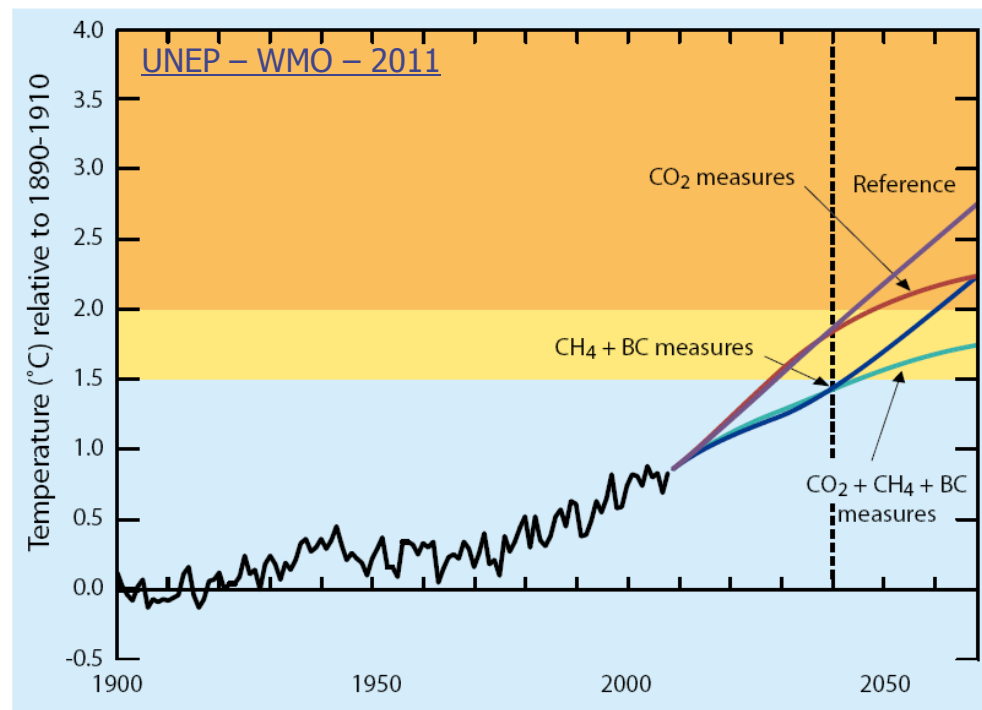
US Environmental Protection Agency – March 2011:  
Report to Congress on Black Carbon

Arctic Council Task Force on Short lived Climate Forcers – May 2011:  
An assessment of emissions and mitigation options for Black carbon for the Arctic council

UNEP – WMO – 2011:  
Integrated Assessment of Black Carbon and Tropospheric Ozone report  
Summary to decision makers

## Main messages of these studies

- ✓ Scientific evidences of the role of BC on human health and in the near term and regional/arctic climate change
- ✓ Immediate climate benefits of BC mitigation due to its short atmospheric lifetime, its high absorbing potential and its deposition on snow and ice
- ✓ Integrated air quality and climate change policies are recommended
- ✓ Still substantial rooms to improve the knowledge on BC emissions, its impacts, the reduction techniques and the atmospheric chemistry
- ✓ **Main sources of BC are known and emission reduction potentials exist**







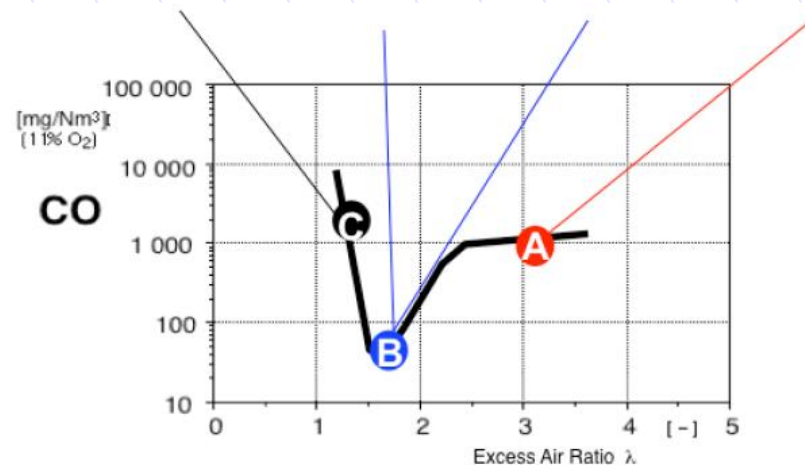
# Sources of BC

Main source of BC are :

**Incomplete combustion of fossil fuels, wood and other biomass**

Example of biomass combustion (T. Nussbaumer Report for EGTEI - 2010)

Aerosols from	Flaming Combustion			Pyrolysis
	high temperature and lack of O <sub>2</sub> in the flame	– Mix –	T and O <sub>2</sub> good	low temperature due to pyrolysis conditions or very high excess air
View				
PM	<b>Soot</b>	Salts + Soot	<b>Salts</b>	<b>COC</b>
Composition	EC / BC chemical / optical C/H > 6...8	↔	CC + Minerals carbonate C + inorg. M	OC = TC-EC-CC C/H < 2
Colour	black	grey	white	brown   none



[T. Bond, Testimony, US House of Repr. 10.18.07]: BC = 2000 x CO<sub>2</sub> for 20 y  
[ICCT, June 2009]: BC responsible of 0.34 Wm<sup>-2</sup> of total 1.6 Wm<sup>-2</sup>

# Sources of BC

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Example of biomass combustion (T. Nussbaumer Report for EGTEI - 2010)

	lack of O <sub>2</sub> in the flame	- Mix -	T and O <sub>2</sub> good	T low at start or high O <sub>2</sub> O <sub>2</sub> lack gas. or fl. ext.
View				
PM	<b>Soot</b>	Salts + Soot	<b>Salts</b>	<b>COC</b>
Composition	EC / BC thermo chem. / optical C/H > 6...8	↔	CC + Minerals carbonate C + inorg. M	OC = TC-EC-CC C/H < 2

PM in [mg/MJ]	Flaming Combustion			Pyrolysis
	Soot	Salts + Soot	Salts	COC
> 1000	Badly operated wood stoves and boilers			Badly operated wood stoves and boilers
150 - 1000				
50 - 150				
20 - 50		Pellet stoves and boilers	Wood stoves & boilers at ideal conditions	
10 - 20			Automatic wood boilers with part. sep. w/o fine particle separator	
< 10				

## Main sources of BC in the UNECE area

In the UNECE area, main sources of BC are:

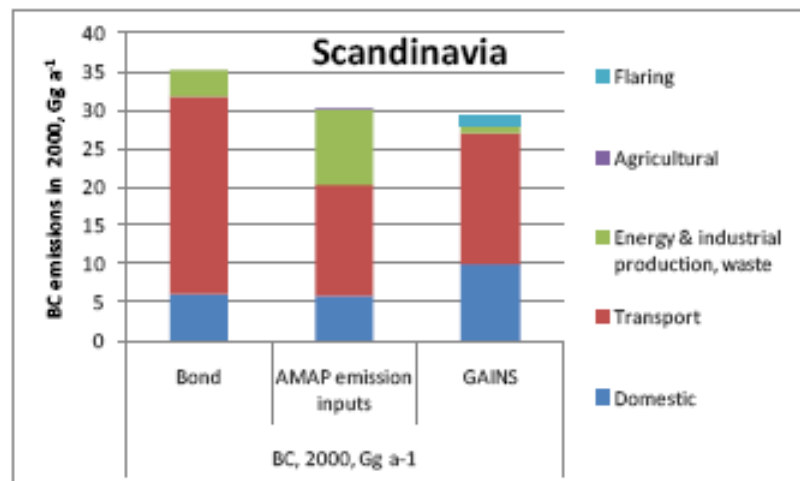
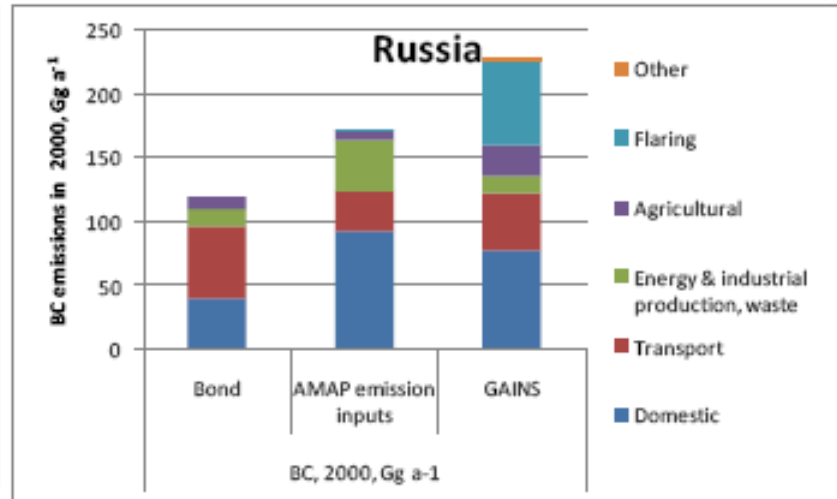
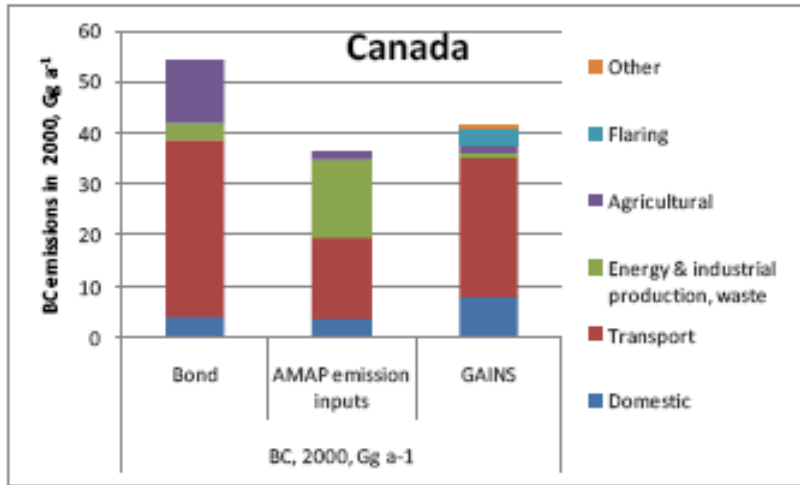
- ✓ Residential combustion, mainly biomass combustion
- ✓ Road transport
- ✓ Non road machinery
- ✓ Open burning of agricultural residues
- ✓ Shipping
- ✓ Industry, tertiary, power generation small combustion (small boilers < 50 MWth using coal, oils and biomass)
- ✓ Flaring
- ✓ Waste (garbage) burning



# Comparison of global BC inventories

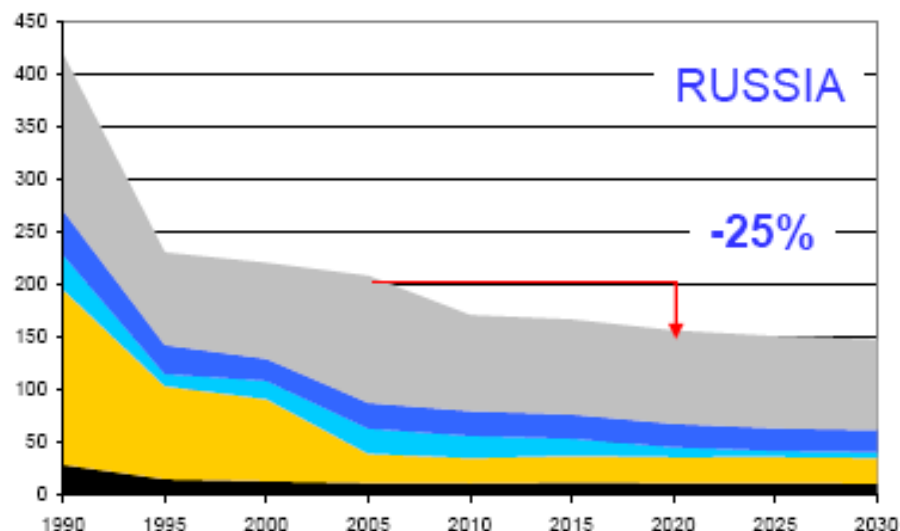
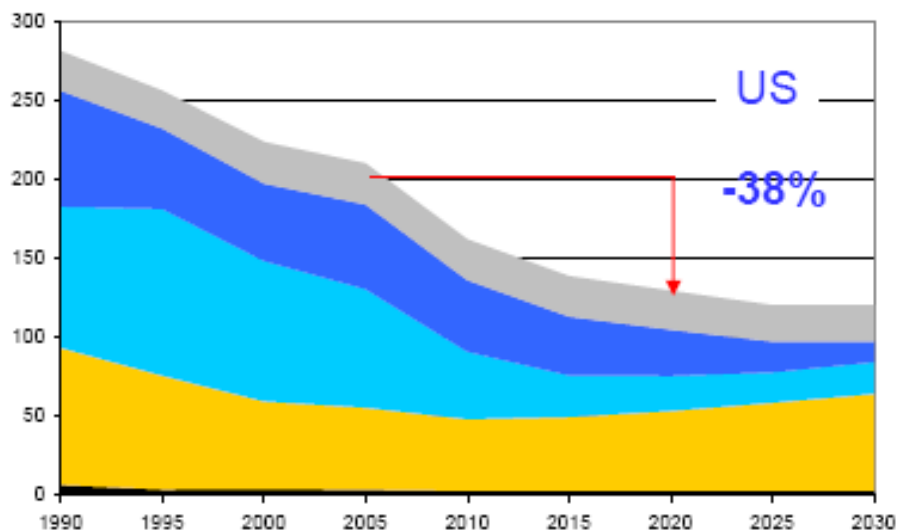
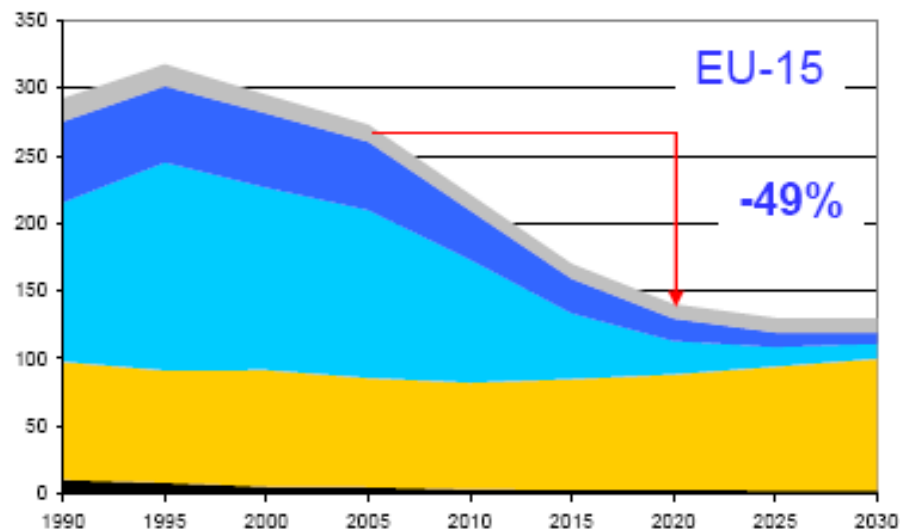
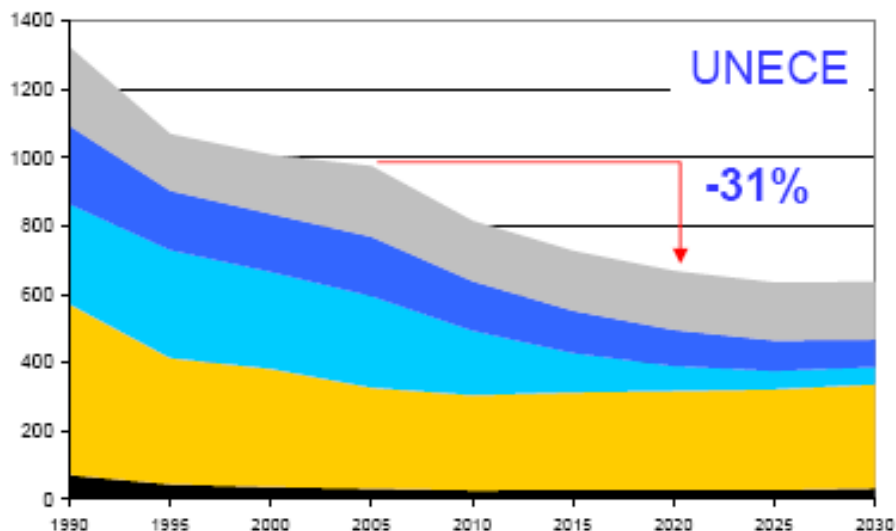
## By region

<http://gains.iiasa.ac.at>



Large uncertainties on emission levels

# Structure of BC emission in various regions and CLE reduction until 2030



Industry
  Residential
  Transport - Road
  Transport - Off-Road
  Other



# Main reduction techniques (1)

## **Residential combustion, mainly biomass combustion**

Appropriate technical measures, standards for small domestic appliances (pellet boilers and stoves, other high efficient appliances...)

Non technical measures : public information and awareness programmes , incentives to replace oldest boilers and stoves by new ones, harmonisation of measurement methods and certification tests

## **Road transport**

Current legislation (like EURO VI standards) should reduce emissions, particles traps on light and heavy duty vehicles, emission testing programmes

## Main reduction techniques (2)

### **Non road machinery**

Accelerated introduction of particles traps for new machinery and retrofitting of existing ones

### **Open burning of agricultural residues**

Banned in most UNECE countries but still operated!

Effective ban recommended by experts

### **Shipping**

Cleaners fuels and ships, use of BAT

### **Industry, tertiary, power generation small combustion (small boilers < 50 MWth using coal, oils and biomass)**

Operation of boilers (avoid incomplete combustion situation)

Efficient PM reduction techniques

## Reduction techniques (3)

### **Flaring**

Magnitude of BC emissions not well known

Reduction of venting and flaring (but low knowledge)

### **Waste (garbage) burning**

Banned in most UNECE countries but still operated!

Effective ban recommended by experts

## Reduction techniques (3)

### **Flaring**

Magnitude of BC emissions not well known

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## Efficiency of dust reduction techniques : ESP and FF

In combustion installation, ESP efficient for operation at optimum excess air (very low concentration of soot, low concentration of COC).

Salts are suitable for the ESP operation,

Soot forms dust layer with a weak adhesion. Re-entrainments of particles are possible in an ESP,

COC form a sticky layer, difficult to be removed and can cause operation problems both in ESP and FF,

Fabric filters and ESP restricted to low carbon content flue gases

< 5 % carbon for ESP

< 2 % carbon for FF

# Proposal for updating the guidance document





# Structure of the guidance document on control techniques for sulphur, NOx, VOCs, dust from stationary sources

Structure of the new guidance document on control techniques for sulphur, NOx, VOCs, PM10 and PM2.5 from stationary sources (including the solvent content of products) based on an activity approach

- Chapter 1: Introduction
- Chapter 2: General issues for the 4 pollutants
- Chapter 3: General issues for sulphur emissions
- Chapter 4: General issues for NOx emissions
- Chapter 5: General issues for VOC emissions
- Chapter 6: General issues for dust
- Chapter 7: Sectoral chapters (42 activities covered) Chapter 7.1 relates to small combustion plants < 1 MWth, Chapter 7.2 relates to combustion plants from 1 to 50 MW

# Proposal for updating the guidance document

The following proposal is done:

- ✓ update of the chapter 6 "general issues for dust", with information on:
  - Information on emissions of BC, the sources, the rates of emissions (The documents from IIASA can be used)
  - Complement the chapter on "combustion techniques and optimisation"
  - Complement the chapter on reduction techniques for dust with information on the efficiency for BC

# Proposal for updating the guidance document

The following proposal is done:

✓ update of the following chapters with information on BC and reduction techniques:

7.1 "combustion installations < 1 MW with domestic combustion installation included" **already done by Switzerland**

7.2 Combustion installations from 1 to 50 MW

7.4 Mineral oil and gas refineries for SO<sub>2</sub>, NO<sub>x</sub> and dust emissions (flare)

7.20 Offshore activities (flare)

7.6 Coke Oven furnaces

7.42 New stationary engines (diesel engines)

# Time schedule

Have an updated Guidance document for the next WGSR of April 2012

Proposals to be made by the EGTEI secretariat and circulated in the group (end of February, beginning of March)

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