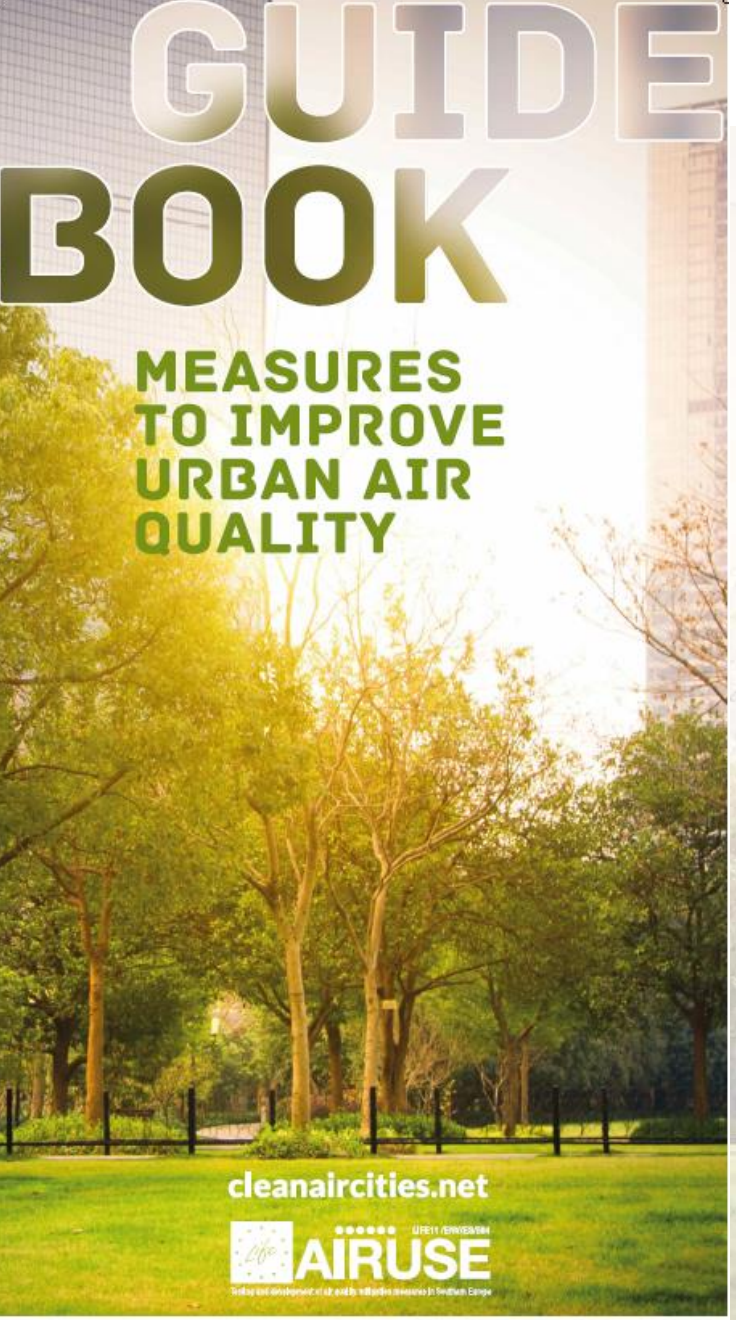
GUIDE BOOK

MEASURES TO IMPROVE URBAN AIR QUALITY



MEASURES TO IMPROVE URBAN AIR QUALITY

Editors

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What is?

Peer-reviewed Guide of state-of-the-art measures on traffic, industry, biomass burning, shipping, construction to improve air quality in cities in the short and long term.

For whom?

For policy makers, education, industry, research and environmental agencies. Especially focused to Southern European cities.

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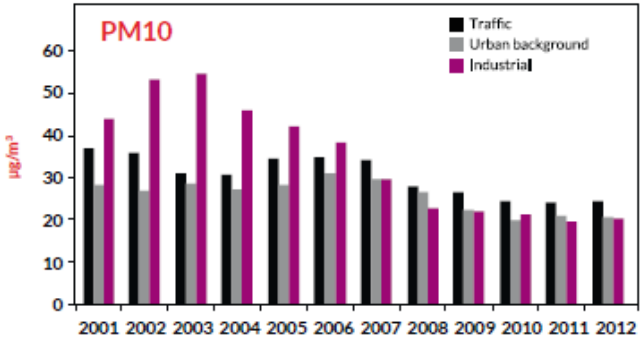
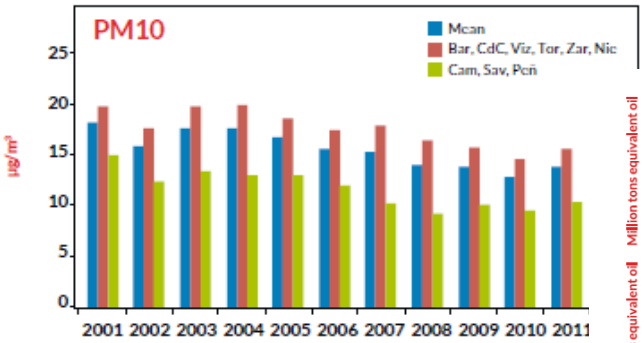
1 1.1 Air quality trends in Spain

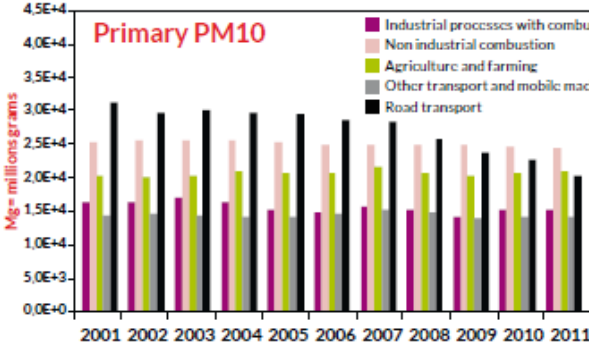
National averages

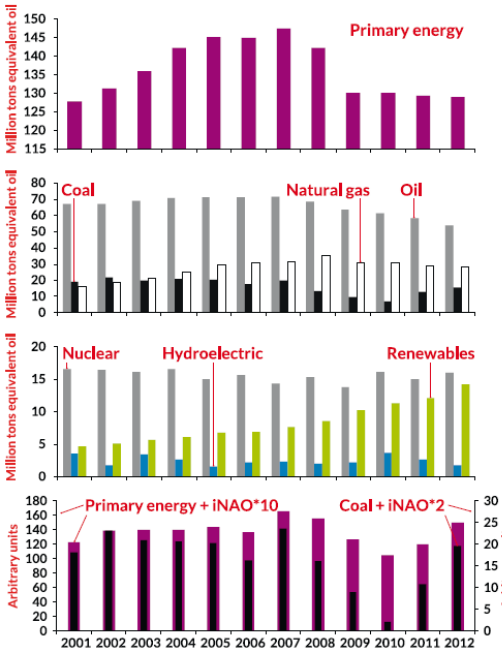


National EMEP regional background



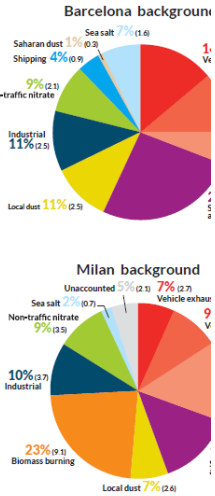
National emissions



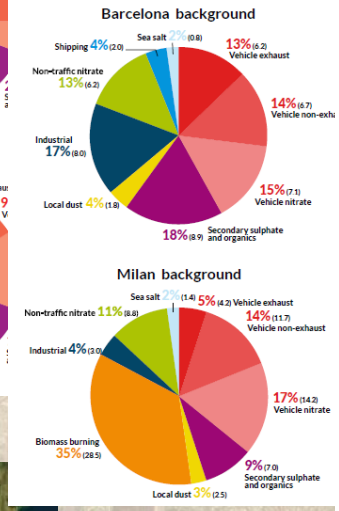


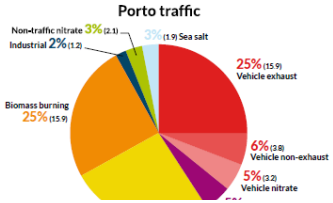
1.2 Harmonized source apportionment in Southern Europe

PM10
Contributions
to the annual mean

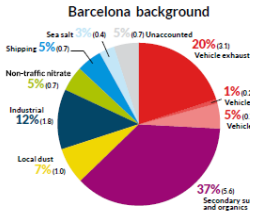


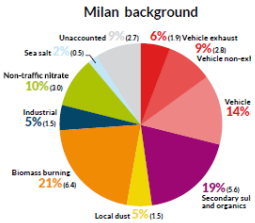
PM10
Contributions
during high pollution days

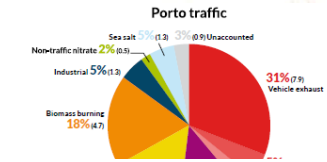




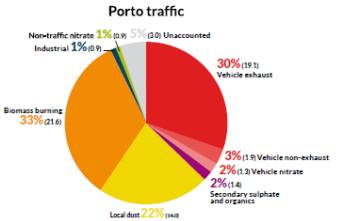
PM2.5
Contributions
to the annual mean

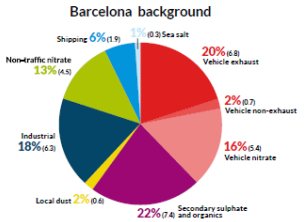


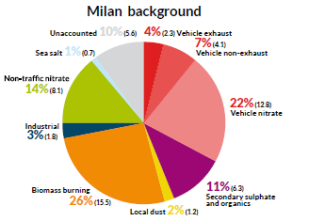


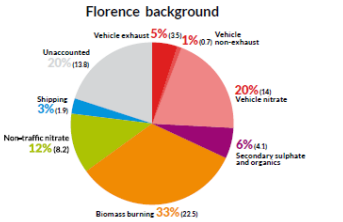


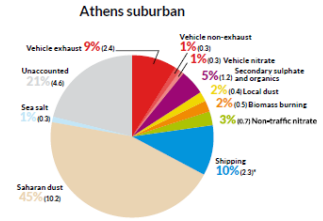
PM2.5
Contributions
during high pollution days











2. Measures to reduce emissions from construction/ demolition works

. 2.1 Relevant pollutants emitted by the construction sector
. 2.2 Measures for the reduction of dust emissions
. 2.3 Measures for reducing emissions of other pollutants
. 2.4 Air quality monitoring in the construction site

Emissions of	Without machinery		Machinery
	Dust	VOC, gases, (solvents etc)	NOx, CO, CO2 VOC, particles, etc.
Infrastructure of the worksite (roads)	■	•	□
Clearance of the worksite	□	•	□
Demolition			
Construction (drilling and cements spraying)			
Sealing of underground and bridge constructions			
Earth movements			
Excavation			
Hydraulic engineering			
Materials extraction			
Paving			
Train tracks			
In situ foundations			
Underground mining			
Traffic signalling (paintings)			
Maintenance of buildings			
Works with natural and cast stone			
Roofs and sealing plastics			
Cleanliness of the worksite			

Phase	Level of risk		
	Low	Medium	Large
Demolition phase	. total volume of building to be demolished <20,000m³, or . construction material with low potential for dust release (e.g. metal cladding or timber), or . demolition activities <10m above ground demolition during wetter months.	. total volume of building to be demolished 20,000m³ - 50,000m³, or . potentially dusty construction material, or . demolition activities 10-20m above ground level:	. total volume of building to be demolished >50,000m³, or . potentially dusty construction material (e.g. concrete), or . on-site crushing and screening, or . demolition activities >20m above ground
Earthworks phase	. total site area <2,500m², or . soil type with large grain size (e.g. sand), or . <5 heavy earth moving vehicles active at any one time, formation of stockpile enclosures <4m in height, or . total material moved <10,000 tonnes (where known), or earthworks during wetter months.	. total site area 2,500m² – . moderately dusty soil ty (e.g. silt), or . 5–10 heavy earth movin at any one time, or . ormation of stockpile en 8m in height, or . total material moved 20 100,000 tonnes (where kı	
Construction phase	. total building volume <25,000m³, or . construction material with low potential for dust release (e.g. metal cladding or timber).	. total building volume 25 100,000m³, or . potentially dusty constr (e.g. concrete), or . on-site concrete batchin	
Track out phase	. <10 HDV (>3.5t) trips in any one day, . surface material with low potential for dust release, . unpaved road length <50 m.	. 10-50 HDV (>3.5t) outwa in any one day, . moderately dusty surfac (e.g. high clay content), . unpaved road length 50 (high clay content):	

Table 2.3. Potential dust emission magnitude. Sources: IAQM, 2014. Holman et al (2014). IAQM Guidance Air Quality Management, London. www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf.

Mitigation measures	Low risk	Medium risk	High risk
Operating vehicle/machinery and sustainable travel			
Ensure all vehicles switch off engines when stationary – no idling vehicles.	XX	XX	XX
Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where possible.	XX	XX	XX
Impose and signpost a maximum-speed-limit of 10mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).	X		
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.		XX	XX
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	XX	XX	XX
Operations			
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	XX	XX	XX
Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible).	XX	XX	XX
Use enclosed chutes, conveyors and covered skips.	XX	XX	XX
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	XX	XX	XX
Ensure that equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event, using wet cleaning methods.		XX	XX
Waste management			
Reuse and recycle waste to reduce dust from waste materials	XX	XX	XX
Avoid bonfires and burning of waste materials.	XX	XX	XX

Manufacture of ceramic products including tiles, bricks stoneware or porcelain

Stages processes	BATs for reaching associated PM emission levels	BAT-associated PM levels (mg/Nm³)**	Abatement efficiency (%)
Dusty operations	FFs	1–10 mg/Nm³	
Glazes preparation and glazing	FFs Sintered lamellar filters	1–10 mg/Nm³	
Spray drying	FF		
	CYs and high efficiency WSs (existing plants)		
Drying	Ensure good maintenance		
Firing	Use of fuels with low ash generation ca city		
	FF (to treat gaseous pollutants*)		
	Cascade-type packed bed adsorbers (to treat gaseous pollutants*)		

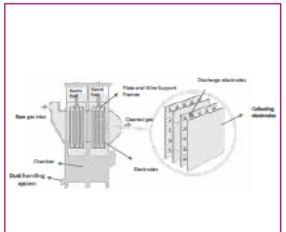
*BATs to reduce acid gaseous emissions are not considered under the scope of the
**Values given in concentrations for high temperature process stages (hot emission
by volume.
† Cascade-type packed bed adsorbers: In a cascade-type packed bed adsorber, the
HCl) in the flue-gas takes place in a chamber, in which the adsorbent sinks by g
the dust load arising from the calcium carbonate granules are possible, especially
Table 3.9. BATs Associated Emission Levels (AELs) and abatement effic

Production of pig iron or steel including continuous casting & metal ore (including sulphide ore) roasting or sintering installations

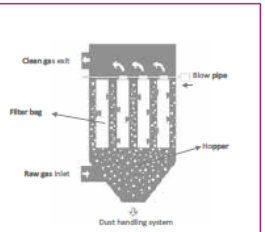
Activities	BATs for reaching associated PM emission levels		BAT-associated PM levels (mg/Nm³)*	Abatement efficiency (%)
Sinter Plants	Primary emissions from sinter strand waste gas: . FFs . Advanced ESPs (when FFs are not applicable)		FF: <1 – 15 mg/Nm³	FF: >98.5%
			ESP: <20 – 40 mg/Nm³	ESP: >95% –99%
	Secondary emissions from sinter strand dis-charge, sinter crushing, cooling, screening and conveyor transfer points: . Hooding and/or enclosure . ESPs or FFs.		FF: <10 mg/Nm³	FF: >98.5%
Pelletisation Plants	ESPs, FFs and WSs	For crushing, g drying		
		Other process gases treated		
Coke Oven Plants	Coal grinding plants: enclosure devi client extraction and dry dedusting			
	Charge coke oven chambers: efficie tion and FFs.			
	Coke dry quenching with heat reco			
	Coke firing: . Preventing and repairing (new pl leakage between oven chamber chamber. . Using desulphurised coke oven gas gases.			
	Coke pushing: . Extraction by means of an integrat transfer machine equipped with a . Using land-based extraction gas tr with a FFs or other systems, using or a mobile quenching car.			

Operational measures	Objective
1. Good operational practices	Defining the best activity management to prevent and avoid PM emissions
2. Good maintenance practices	Ensuring that the equipment works properly and will not adversely affect PM emissions
3. Technical preventive measures	These measures apply to all direct and indirect equipment involved in dry bulk cargo activities, mainly aimed at avoiding spillage
4. Technical complementary measures	These are extra-measures, required when the preventive measures do not provide high PM emissions reduction efficiency
5. Operational functioning with regard to wind	Dry bulk cargo activities are influenced by wind conditions (direction and velocity). Under severe PM emissions conditions such as high wind speed and/or wind directions towards vulnerable areas (residential area), all bulk cargo activities should be ceased

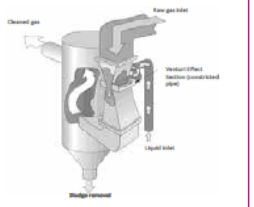
Table 3.14. Operational measures to be considered in bulk cargo activities management.



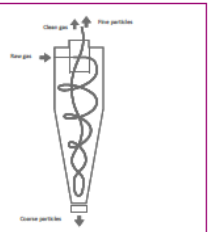
ESP. Electrostatic precipitator



FF. Fabric filter

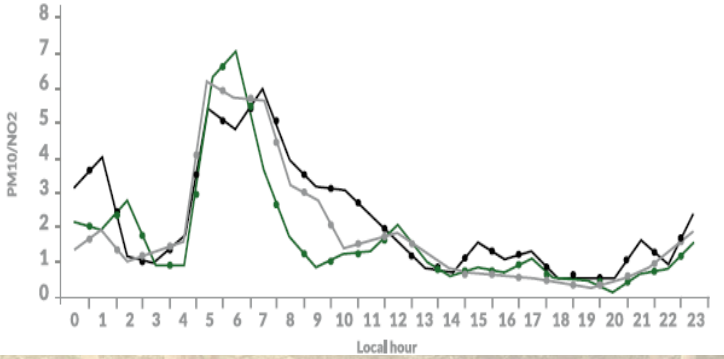


WS. Wet scrubber



CYs. Centrifugal separators / cyclones

Sweeper \ Mode	PM_1 - reduction in % for		$PM_{2.5}$ - reduction in % for		PM_{10} - reduction in % for	
	Reference (dry)	TOE-electrostatic	Reference (dry)	TOE-electrostatic	Reference (dry)	elec
	Curb	Street	Curb	Sreet	Curb	
TOA	96	98	94	95	90	
TGA	98	95	98	97	95	
NON	88	85	94	90	97	
TGM	101	100				
TOE water spraying	60	80				
TOE electrostatic	67	0				
Reference water spraying	53	84				
Reference (dry)	0	59				



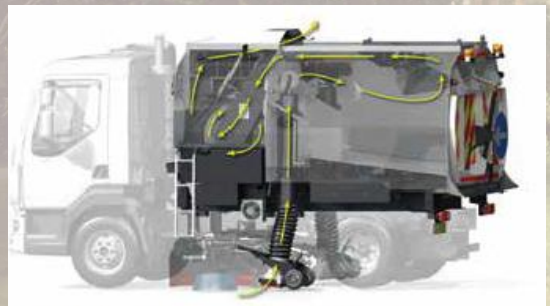
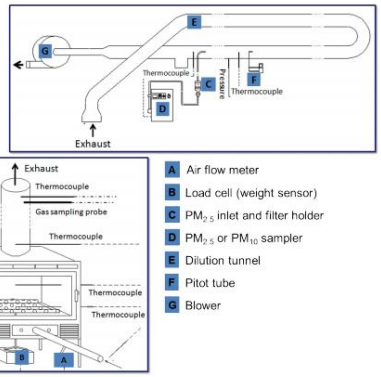


Figure 4.1. Example of a vacuum sweeper (VDI, 2012).

FIREPLACE			
	Softwood	Hardwood	Briquettes
mg $PM_{2.5}$ MJ^{-1} biofuel	390	939	767
µg BaP kg^{-1} biofuel	14	26	1.7
TRADITIONAL WOODSTOVE			
	Softwood	Hardwood	Briquettes
mg $PM_{2.5}$ MJ^{-1} biofuel	202	750	501
µg BaP kg^{-1} biofuel	2.6	18	4.7
ECO-LABELLED STOVE			
	Softwood	Hardwood	Briquettes
mg $PM_{2.5}$ MJ^{-1} biofuel	62	114	-
µg BaP kg^{-1} biofuel	86	8.1	-

PELLET STOVE							
	Pellets I	Pellets II	Pellets III	Pellets IV	Olive pit	Shell of pine nuts	Almond shell
mg $PM_{2.5}$ MJ^{-1} biofuel	27	86	102	76	168	117	112
µg BaP kg^{-1} biofuel	0.24	nd	nd	0.26	nd	0.92	0.50



Pellets label

The ENplus quality label exists since 2010. It confirms compliance with the quality requirements stipulated by EN 1461-2.

Pellets for stoves and small boilers should comply with Class ENplus A1.

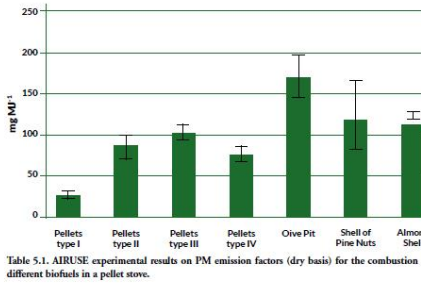
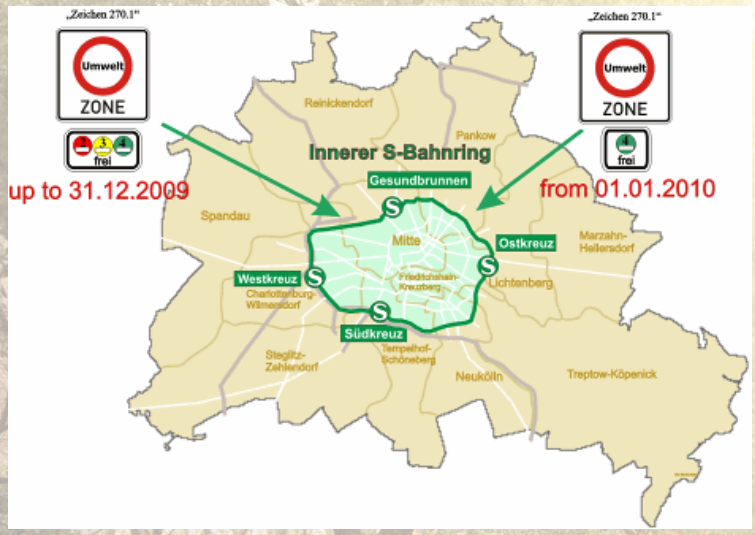
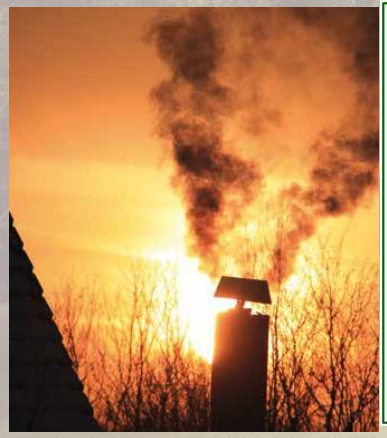


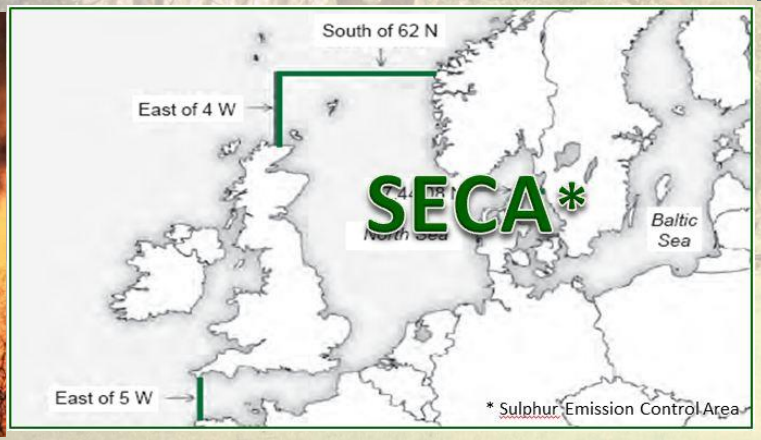
Table 5.1. AIRUSE experimental results on PM emission factors (dry basis) for the combustion different biofuels in a pellet stove.

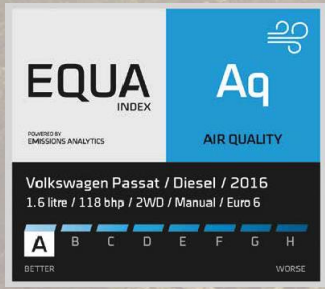
6. The experience of Northern and Central Europe in improving urban air quality

. 6.1 Measures to reduce traffic emissions
. 6.2 Measures to promote cleaner biomass combustion
. 6.3 Measures to promote cleaner shipping
. 6.4 Measures with co-benefits for air quality and climate









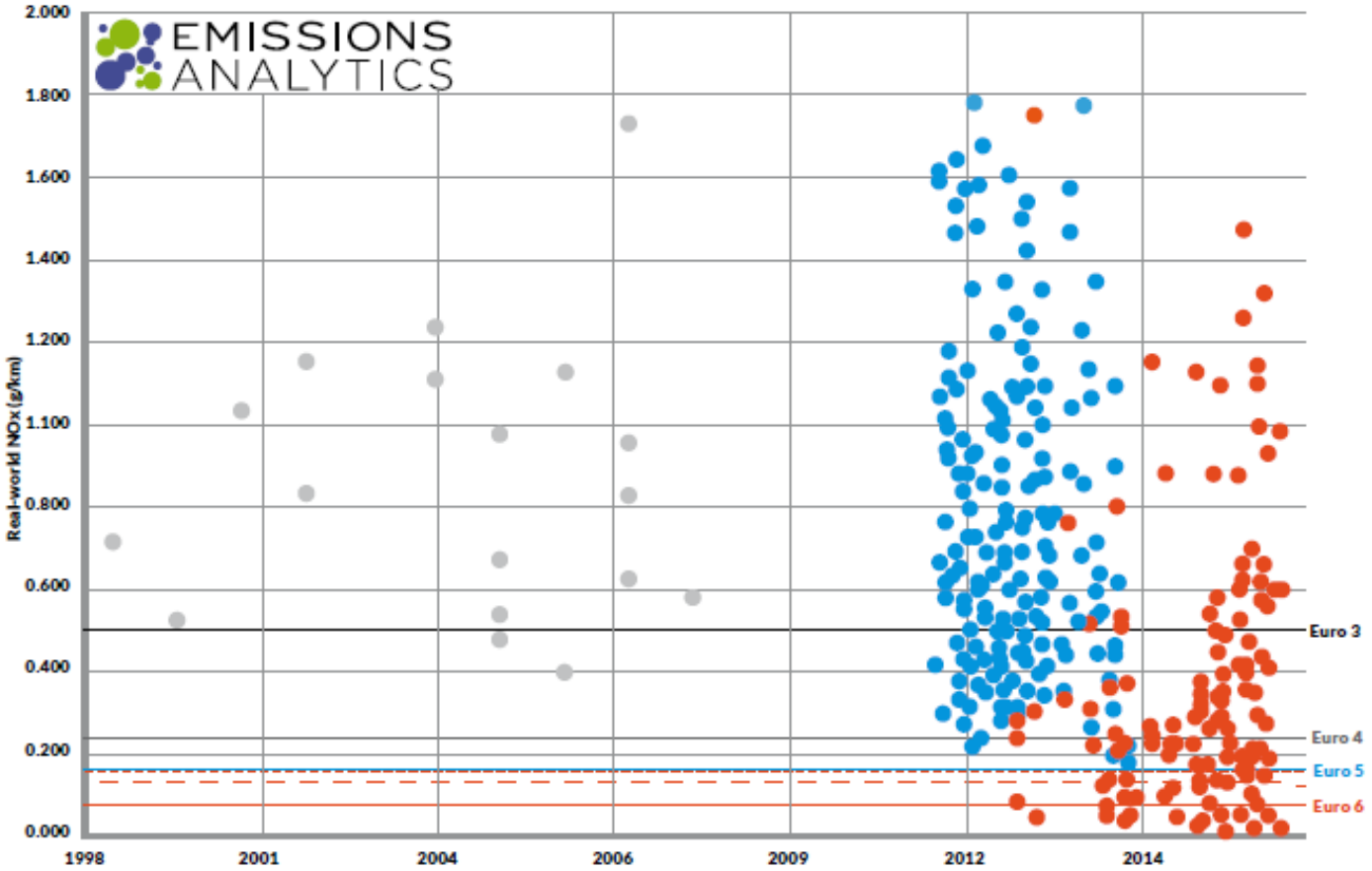
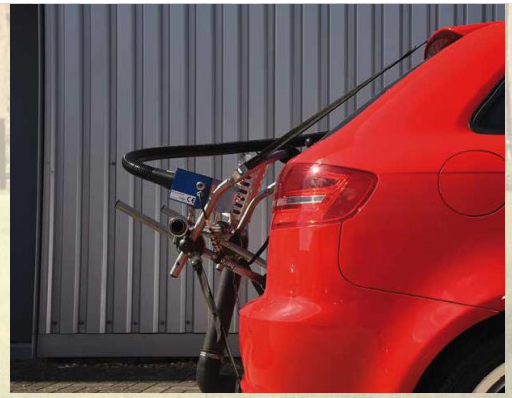
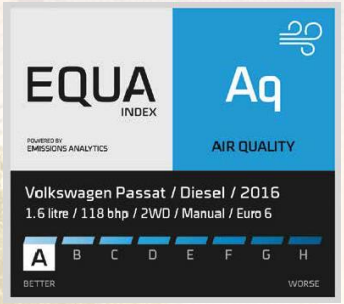


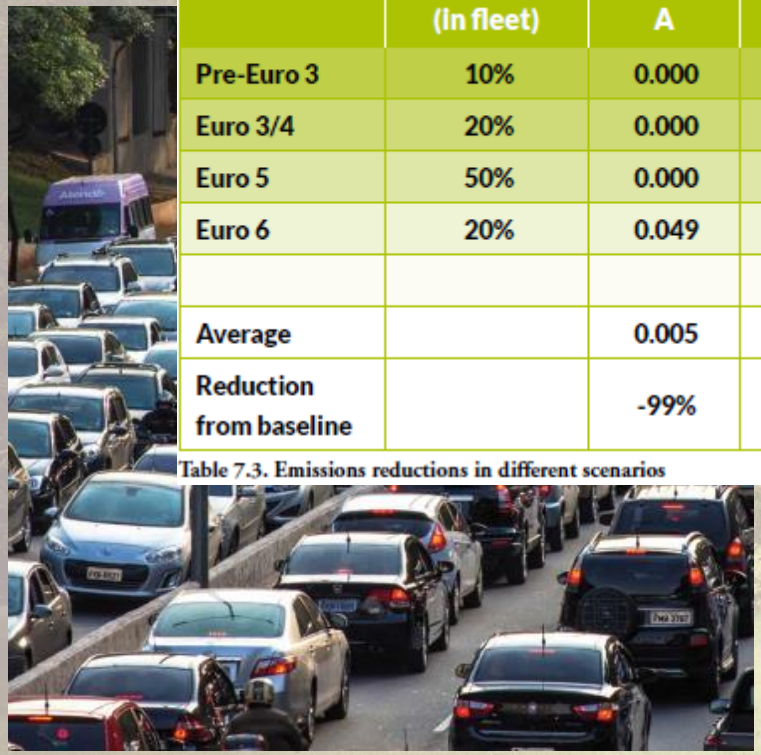
Figure 7.1 – Real-world NOx emissions from passenger cars

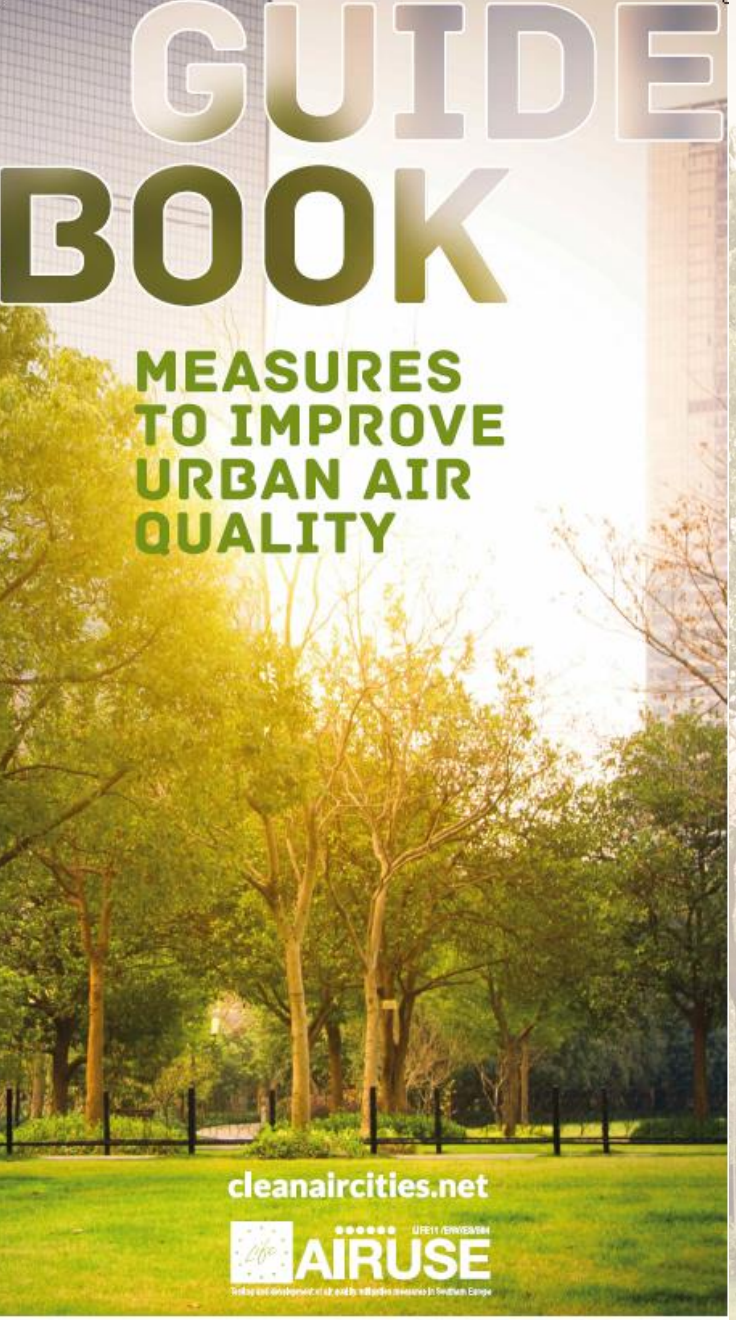




Euro Stage	Weighting	Minimum required EQUA Aq Index rating							
	(in fleet)	A	B	C	D	E	F	G	H
Pre-Euro 3	10%	0.000	0.000	0.000	0.000	0.445	0.571	0.681	0.994
Euro 3/4	20%	0.000	0.000	0.000	0.000	0.445	0.571	0.681	0.994
Euro 5	50%	0.000	0.000	0.151	0.292	0.370	0.484	0.566	0.765
Euro 6	20%	0.049	0.064	0.103	0.142	0.220	0.274	0.315	0.380
Average		0.005	0.006	0.056	0.102	0.356	0.458	0.542	0.765
Reduction from baseline		-99%	-99%	-93%	-87%	-54%	-40%	-29%	0%

Table 7.3. Emissions reductions in different scenarios





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Thank you very much for your attention!

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