clean air

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Ultrafine particles

- The missing link ?

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What causes excess mortality ?

- Excess mortality is 300-500 annual deaths among residents living alongside large roads in CPH (net excess: adjusted for income, NOx, noise etc.).
- $PM_{2.5}$ from traffic within Copenhagen can explain about 20 of these premature deaths every year.
- What is the missing link – how should we explain far the majority of the observed excess mortality ?

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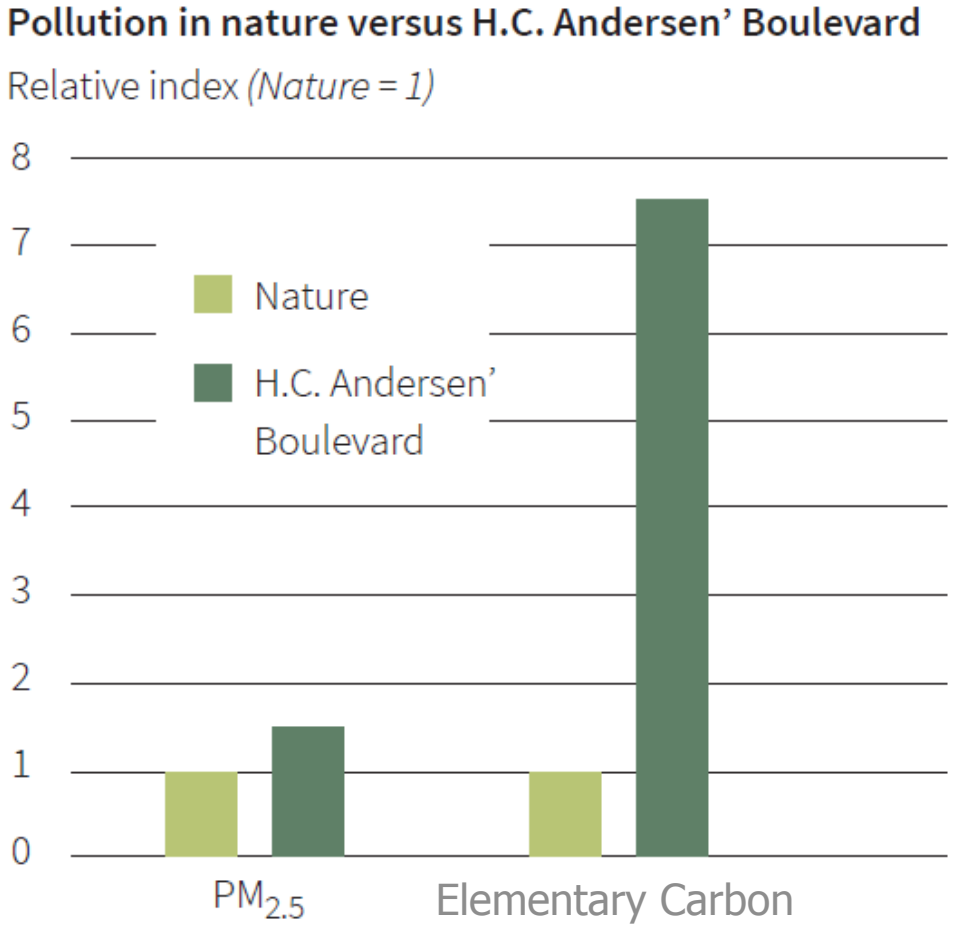
The right indicator ...



Fine particles ($PM_{2.5}$) are an inappropriate indicator of pollution from local road traffic !

EC/BC and UFP are much better indicators of air pollution from local traffic ...

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UFP as indicator in rush hour

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Closed filters remove UFP

We need LEZ with filter requirements !

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Suggested limit values

	Measurement	Limit Value
Soot particles	*Elementary carbon* as part of fine particles.	Yearly Average: 0.5 µg pr. m^3
Ultrafine particles [a)]	Number of particles larger than 0.02 micro-meters	Yearly Average: 7000 particles per cm^3 Hourly Average: 20,000 particles per cm^3

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NABU

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CEPTA

VCÖ MOBILITÄT MIT ZUKUNFT

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Life

associated campaign

SOOT FREE FOR THE CLIMATE

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Winter in Copenhagen

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Conclusion

- Fine particles only indicate regional pollution and are a very poor indicator of local traffic pollution
  – the opposite is the case for UFP (EC/BC).

- Therefore UFP (EC/BC) should be used as indicator for local air pollution from traffic and estimated on a street level (relevant exposure studies).

- We need air quality limits for UFP (EC/BC).

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UFP: A dangerous cocktail…

- Ultrafine particles have a high content of toxic soot. Their surfaces are coated with PAHs & heavy metals.
- Ultrafine particles are deposited in the finest parts of the lungs and transferred to the blood.
- Thereby ultrafine particles are a dangerous cocktail of toxic properties and a size allowing them to reach the most sensitive parts of the human organism.

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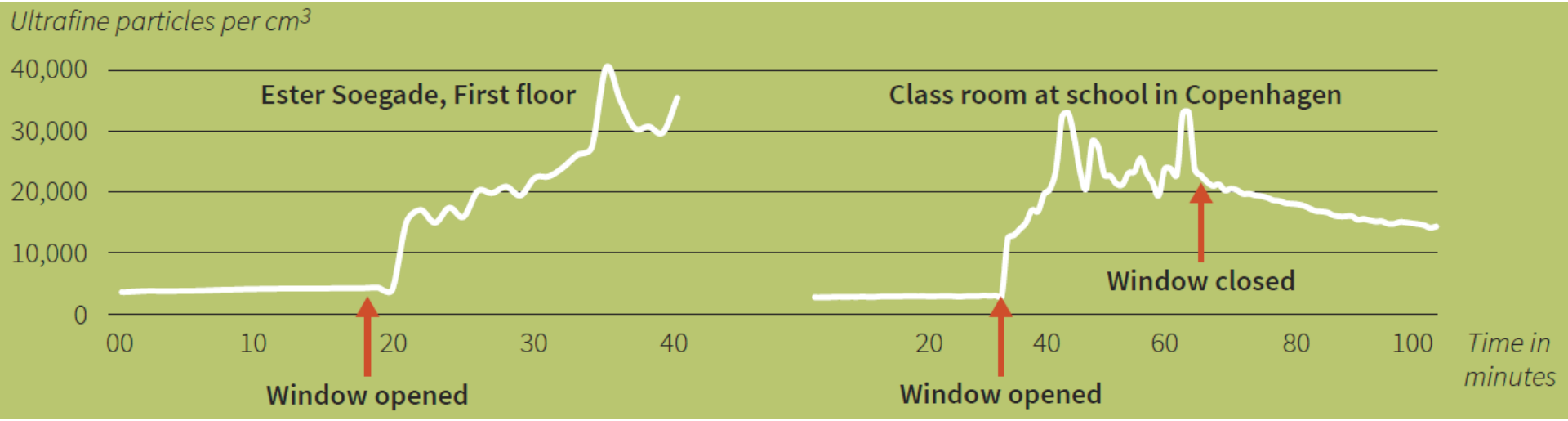
When we open windows ...



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Potentials of LEZ and CC

2015	Reference	I: Congestion charge	II: Low emission zone	III: I and II combined
PM_{10} (µg/m^3)	30.5	28.5	29.5	27.5
$PM_{2.5}$ (µg/m^3)	14.5	14	13.5	13
$PM_{0.1}$ (number/cm^3)	11,500	10,500	6000	5000
NO_2 (µg/m^3)	51	47	< 40	< 36

The annual average of ultrafine particles can be reduced by 50 % by LEZ – but up to 90 % in the rush hour – reducing the exposure of the population significantly.

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Quantify pollution sources

	PM_{10}		$PM_{2.5}$		$PM_{0.1}$		NO_2	
	µg/m³	%	µg/m³	%	number/cm³	%	µg/m³	%
Background pollution from outside the city	16	52	10	66.5	2500	18.5	9	16.5
Concentration on road level	31	100	15	100	13,500	100	55	100