

Progress towards attainment of EU limit values in Berlin

Ab 1.1.2010
wird die Umweltzone
grün

Informationen und Ausnahmeregelungen
in unserem Flyer oder im Internet unter:

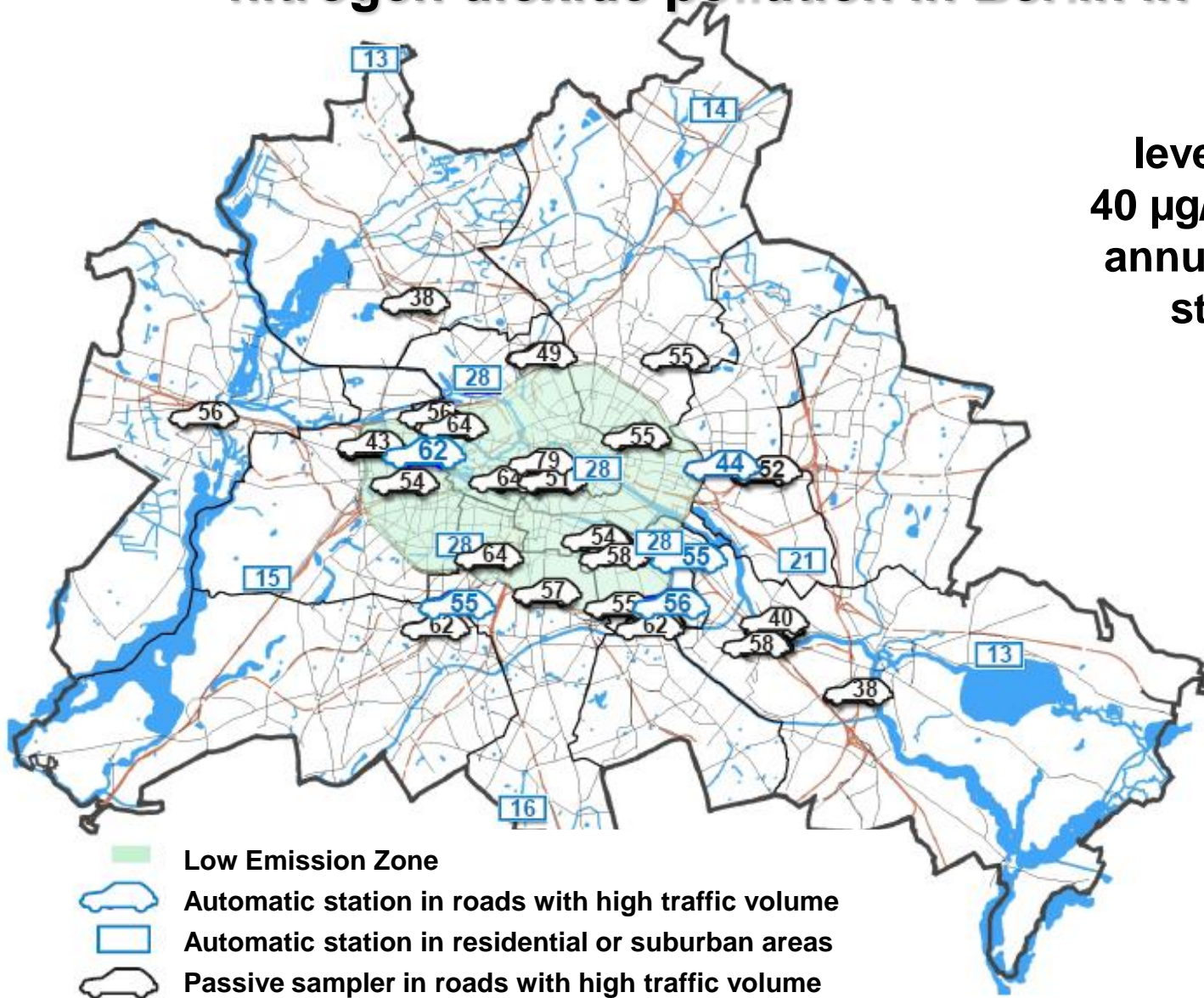
www.berlin.de/umweltzone







Martin Lutz
Annette Rauterberg-Wulff
Senate Department for Health, Environment
and Consumer Protection
Directorate III, Environment Policy

- ⊗ **AQ assessment & current compliance situation**
- ⊗ **actions in the pipeline**
- ⊗ **impact analysis of LEZ & other measures**
- ⊗ **compliance gap – how to deal with it**
- ⊗ **problems, outlook**

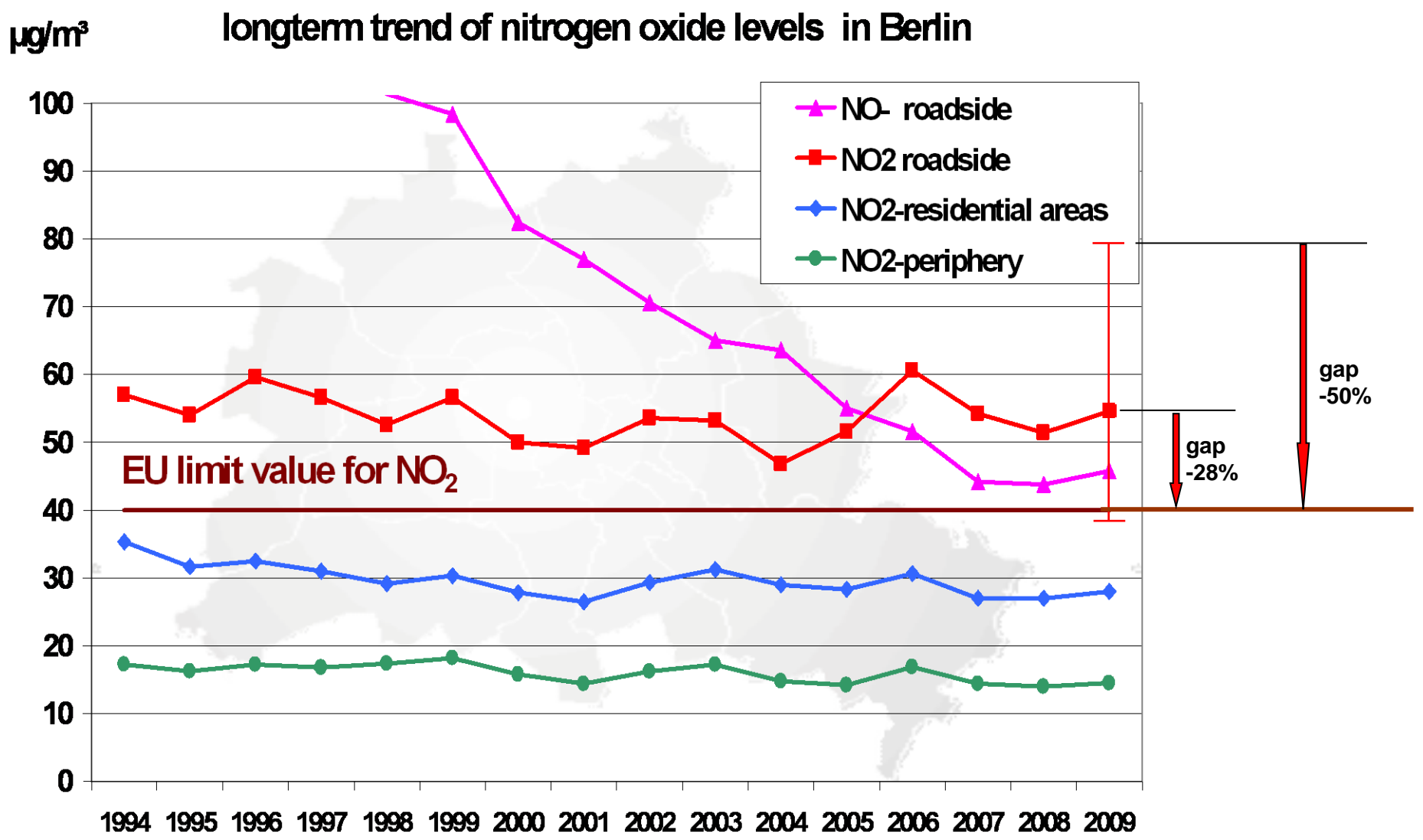
nitrogen dioxide pollution in Berlin in 2009



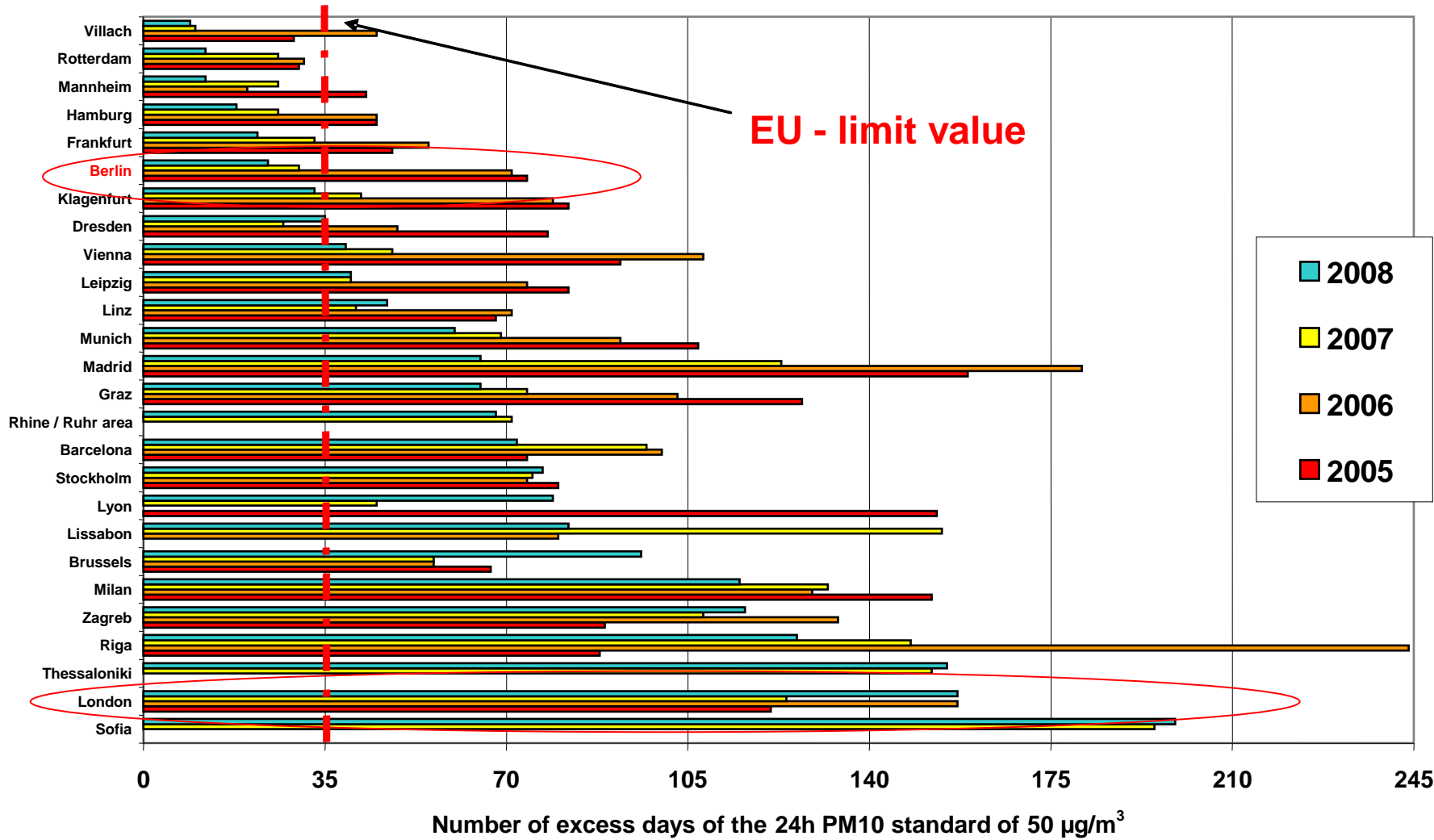
levels above
40 $\mu\text{g}/\text{m}^3$ exceed
annual NO₂ AQ
standard

-  Low Emission Zone
-  Automatic station in roads with high traffic volume
-  Automatic station in residential or suburban areas
-  Passive sampler in roads with high traffic volume

long-term trend of **nitrogen dioxide** in Berlin: no improvement despite decreasing NO_x-emissions

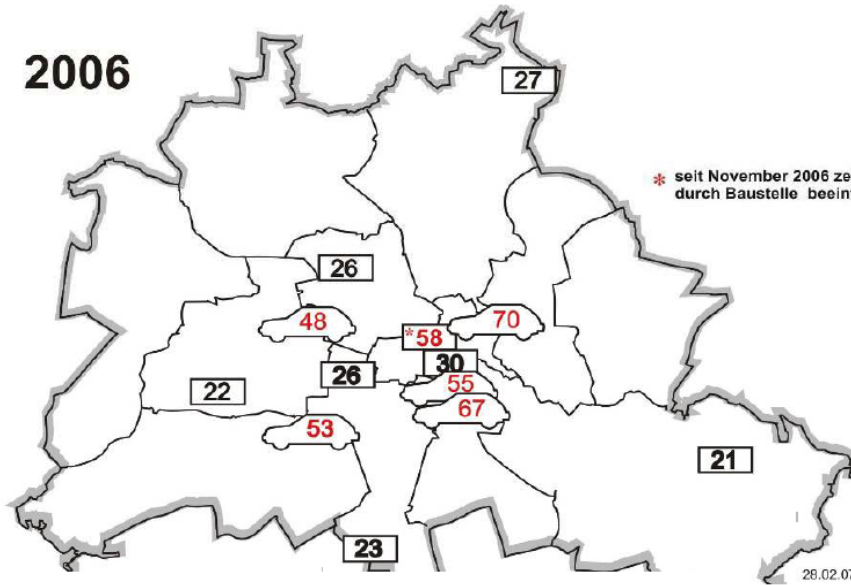


compliance with the PM10 air quality standard in Europe



source: City of Linz

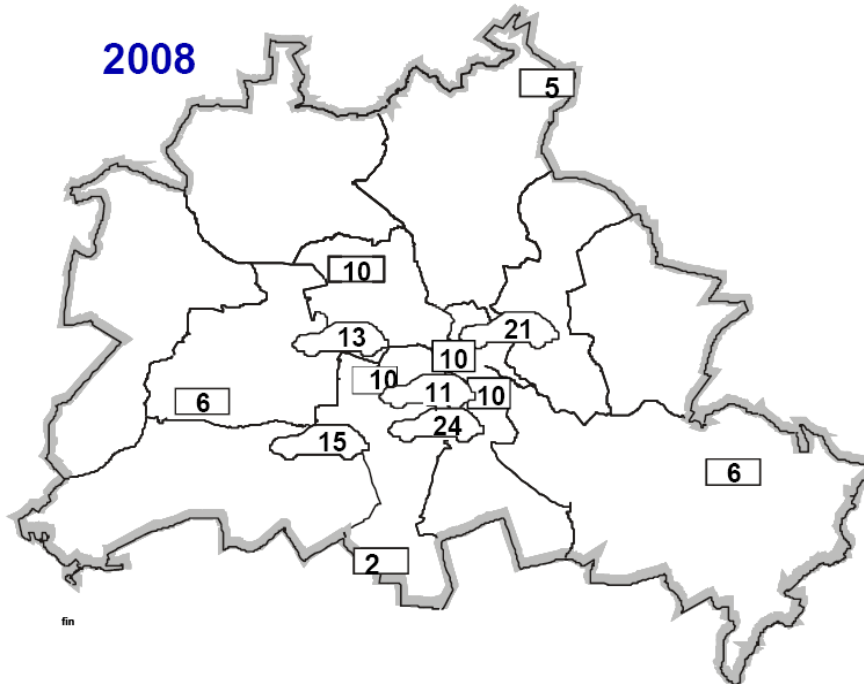
2006



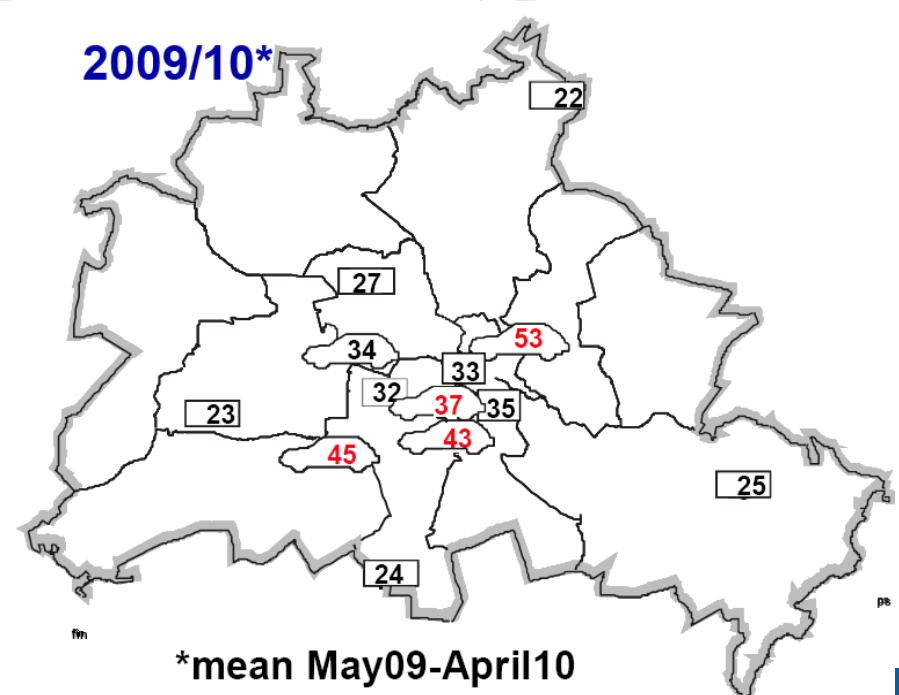
number of days in excess of the 24h-limit value of $50 \mu\text{g}/\text{m}^3$ for PM10 in Berlin

traffic station
 urban background station
 Red: above limit value of 35 excess day

2008



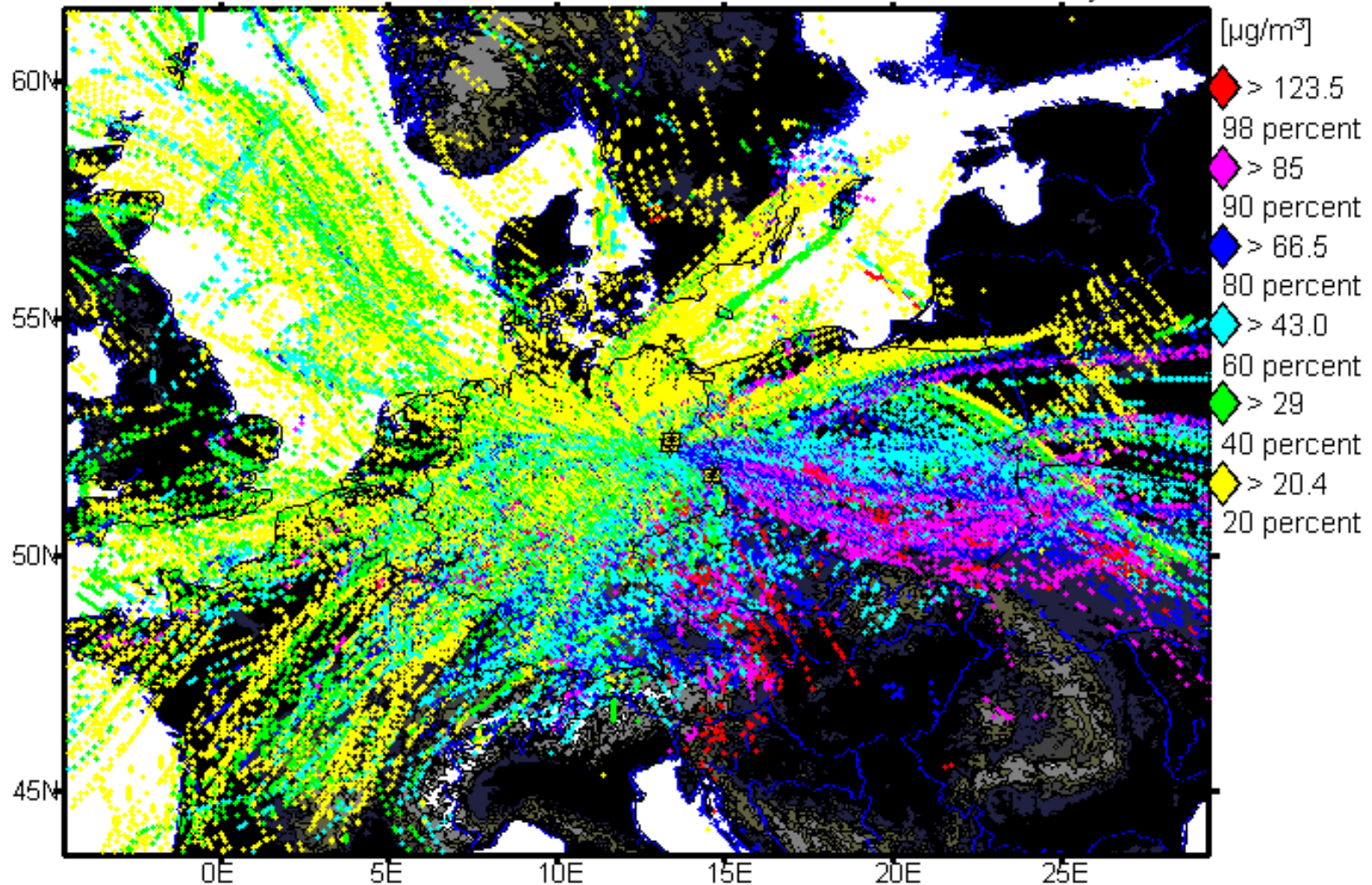
2009/10*



*mean May09-April10

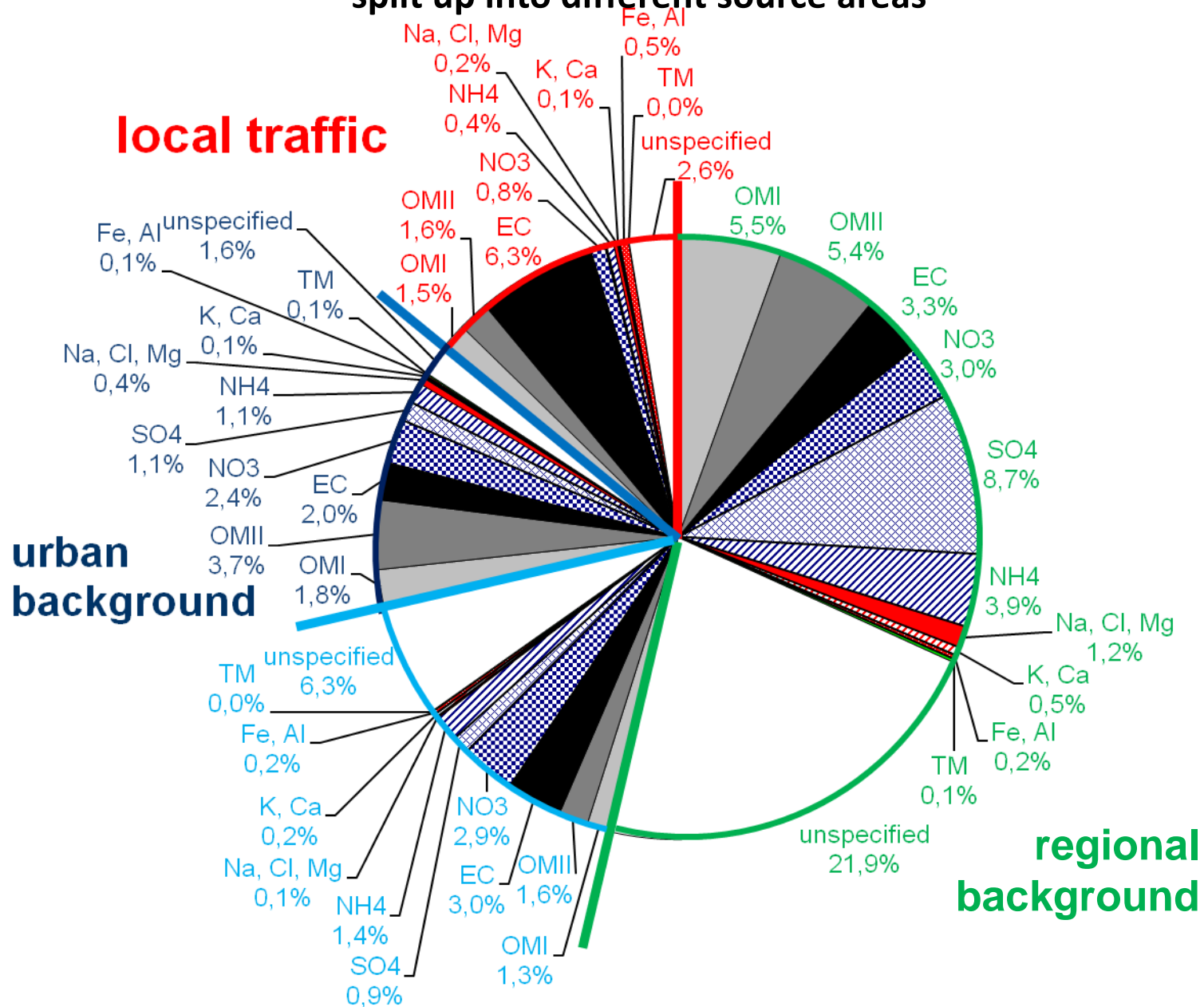
backward trajectory statistics Jan-April 2010

receptor point Berlin



Source: E. Reimer, IfM
Free University Berlin

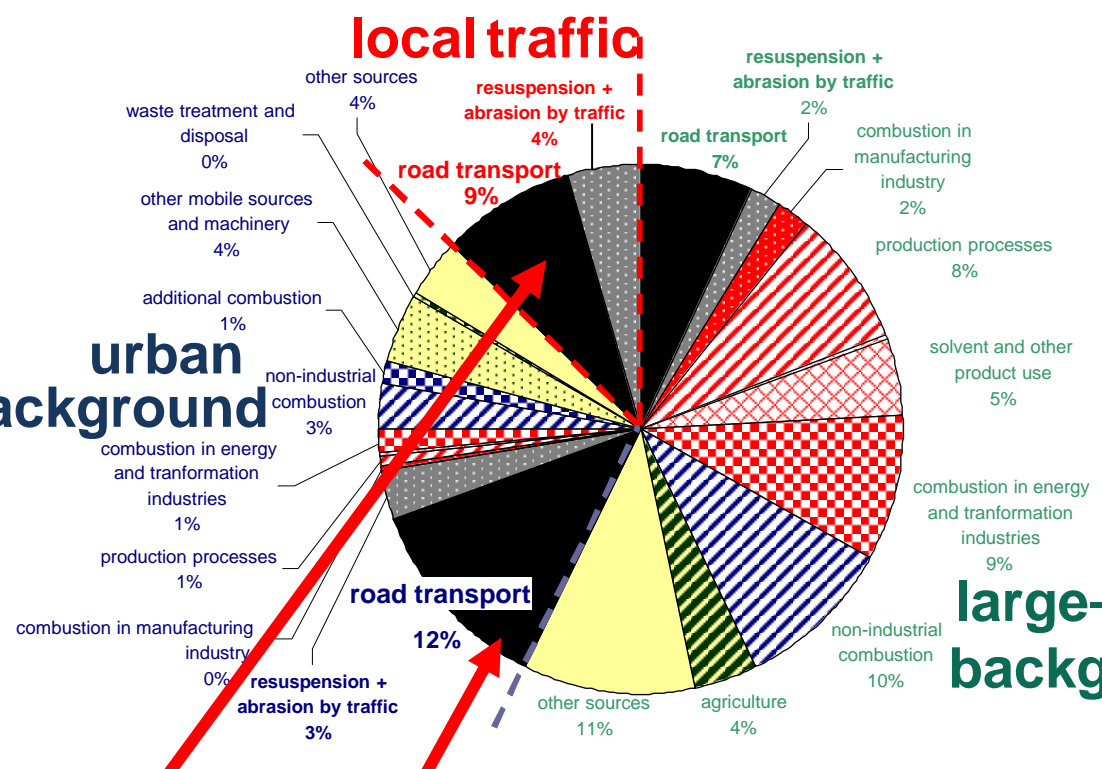
Chemical composition of PM2.5 at a busy city centre traffic spot in 2007 split up into different source areas



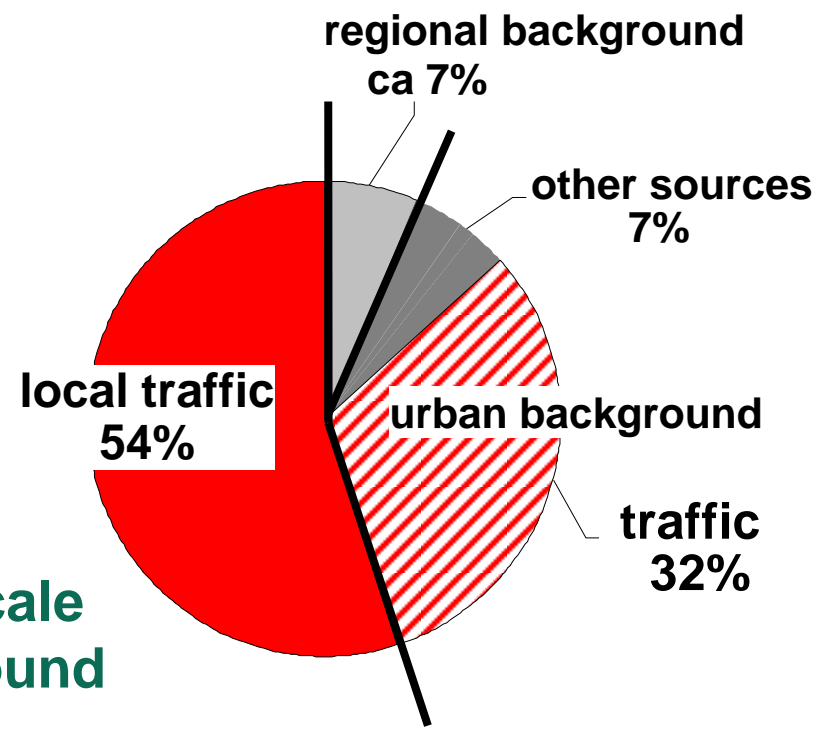
origin of kerbside PM2.5 and NO2 in Berlin

sources of roadside PM2.5 pollution

sources of roadside NO2 pollution



Berlin, 2007



Basis: NOx modelling

large-scale background

homemade vehicle tailpipe contribution

■ Large Stationary sources:

- ↪ Best Available Technology; already largely exhausted

■ Domestic heating:

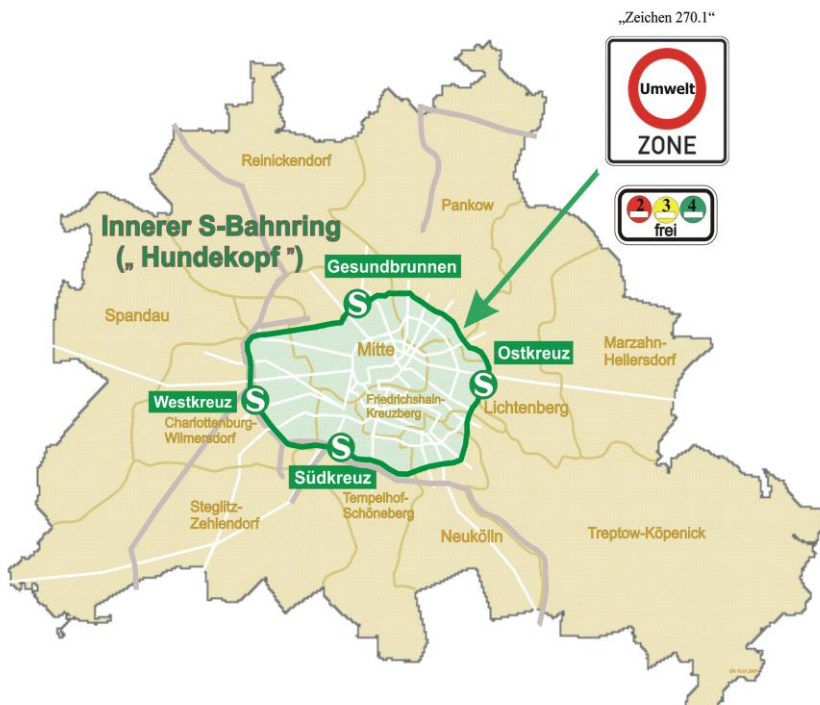
- ↪ cleaner fuels (nat. gas), heat&power cogeneration
- ↪ promotion of energy saving measures
- ↪ renewables (but **strict emission limit** values for wood fired burners)
 - ☞ option: stricter emissions standards for wood heating systems (< 10 mg/m³)
- ↪ synergies with new Berlin energy program
 - ☞ aim: 25% less CO₂-emission by 2010 (relative to 1990)
- 😊 only few single coal fired stoves left (<2% of all flats);

■ Construction:

- ↪ Guidelines & information about dust abatement measures
- ↪ **agreement** with construction business for **voluntary** application
 - ☞ ultimate option: regulation
- ↪ **DPF** as criteria for construction **machinery** for public tenders

■ Transport:

- ↪ Cleaner vehicles and fuels (CRT retrofit & CNG)
 - ☞ municipal vehicle fleet (CRT retrofit & CNG)
 - ☞ filter retrofit of passenger cruising ships
 - ☞ **LEZ (low emission zone)**
- ↪ Less traffic through sustainable transport- and city planning
 - ☞ master plan transport, "StEP"
- ↪ Optimized traffic management
- ↪ Speed limits (30 km/h)
- ↪ Ban of heavy duty vehicles in single streets
- ↪ ...

Area:

about 88 km²
(Berlin total area: 892 km²)

Inhabitants:

about **1 Million**
(Berlin total: 3,4 Mio)

Stage 1: since 1.1.2008

- Diesel vehicles: at least **Euro 2** or Euro 1 & retrofit
- Gasoline vehicles: at least **Euro 1**
- 7% of vehicle fleet affected**

**Stage 2: since 1.1.2010**

- Diesel: Particle emission **Euro 4**:
- cars: **Euro 3 + particle filter** or better
- goods vehicles: also **retrofit** of Euro 1-3 towards Euro 4_{Particle}
- 10% of the vehicle fleet affected**



more than 40 LEZ planned/in force in Germany, but with different emission criteria

Stage 2: Free entry only with **green** sticker

affected vehicles 2010:



(according to registration data base of 1. January 2010)

■ Diesel Passenger cars:

↪ 14.000 PC (7%) with red sticker



→ can barely be retrofitted to

↪ 60.000 PC (30%) with yellow sticker



→ can be retrofitted to



■ commercial Diesel vehicles:

↪ 10.000 LDV/HDV (12%) with red sticker



→ can be partly retrofitted to

↪ 25.000 LDV/HDV (30%) with yellow sticker



→ can be retrofitted to



affected vehicles in total: **ca. 124.000**

by mid 2010: **25%** Diesel PC & **18%** LGV/HGV retrofitted!

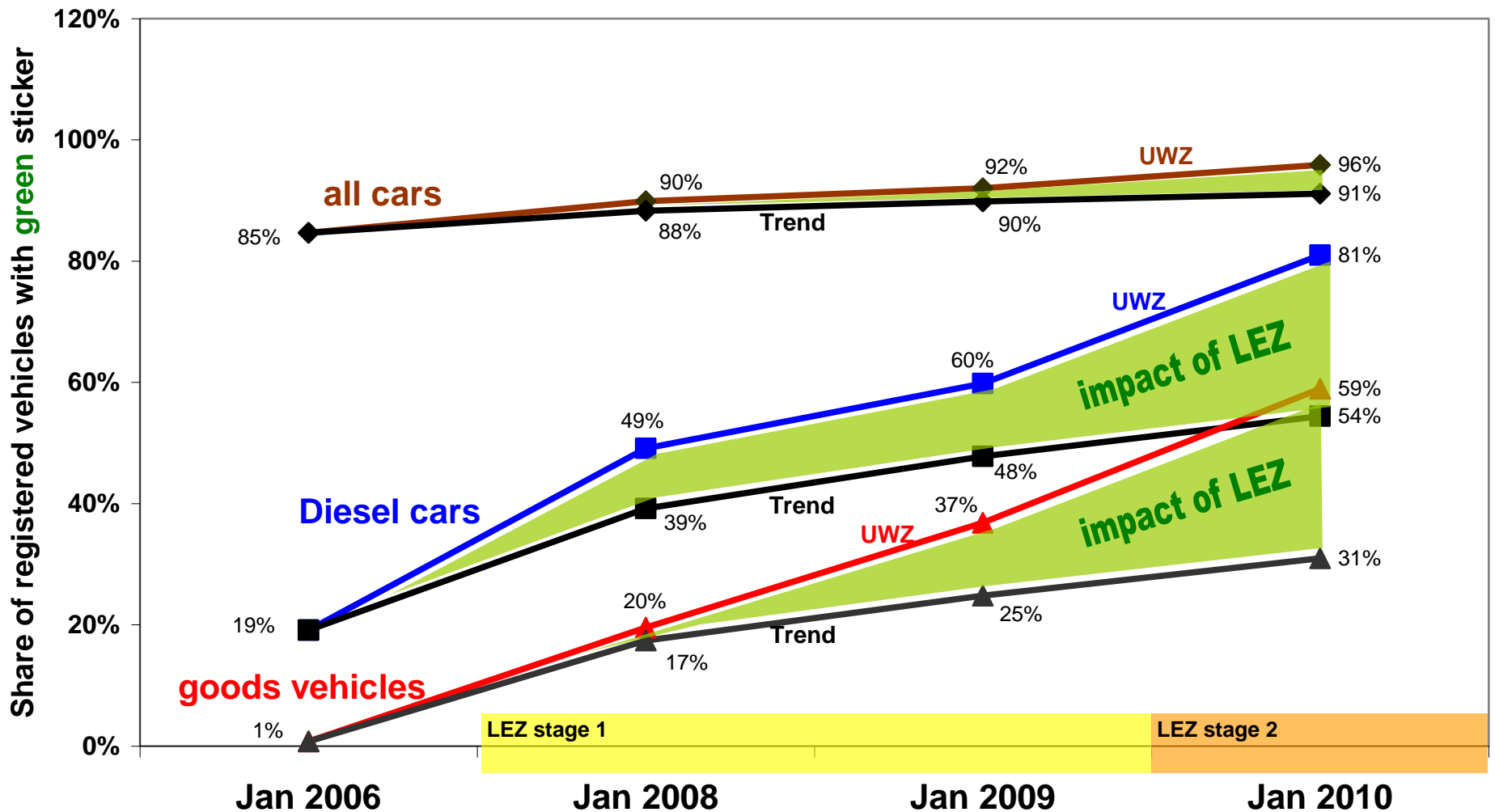
40% of Diesel PC have a **DPF** with **60%** closed systems



Share of **registered** vehicles with **4**



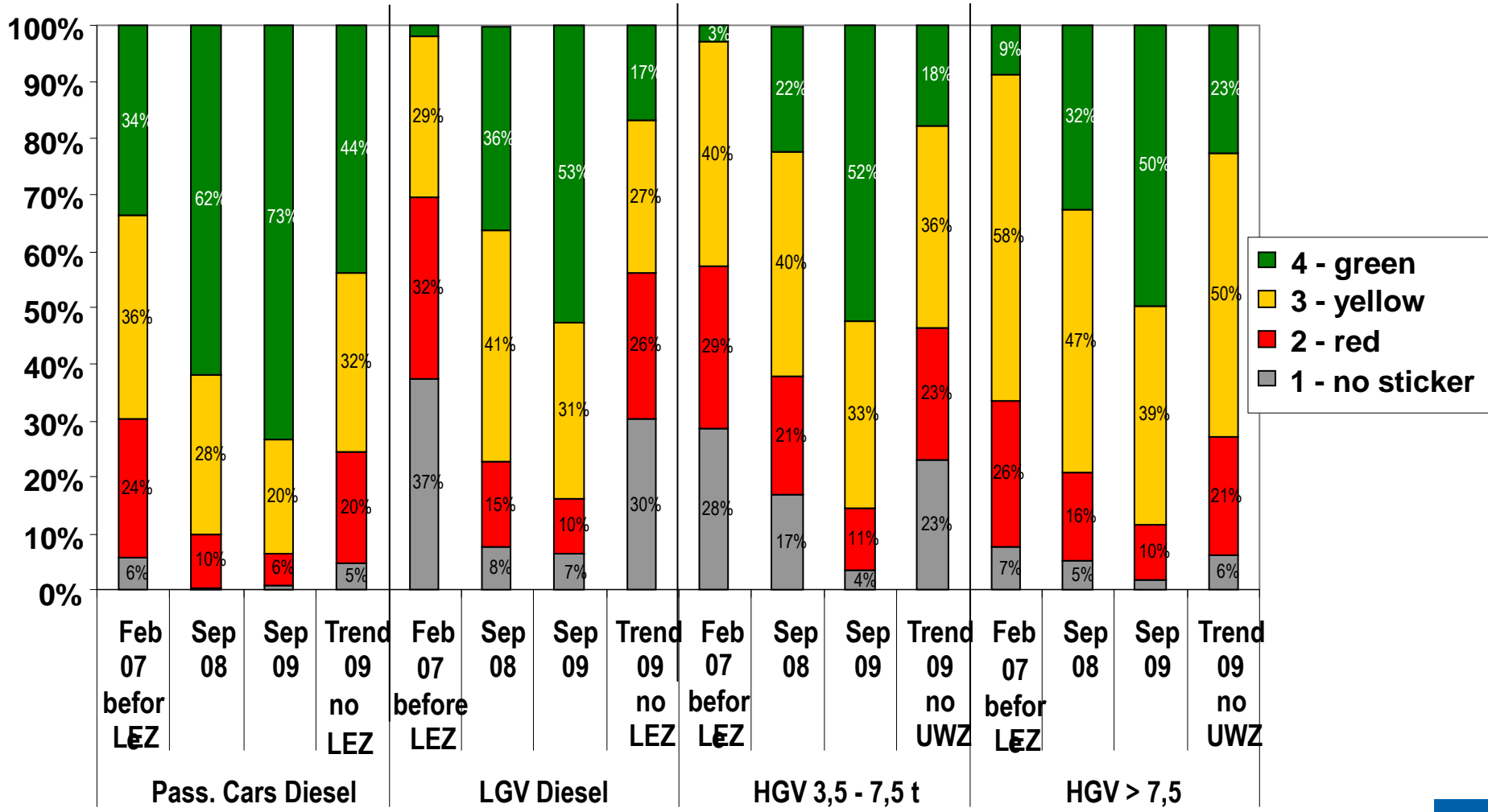
Positive impact of Berlin's LEZ on the registered vehicle fleet





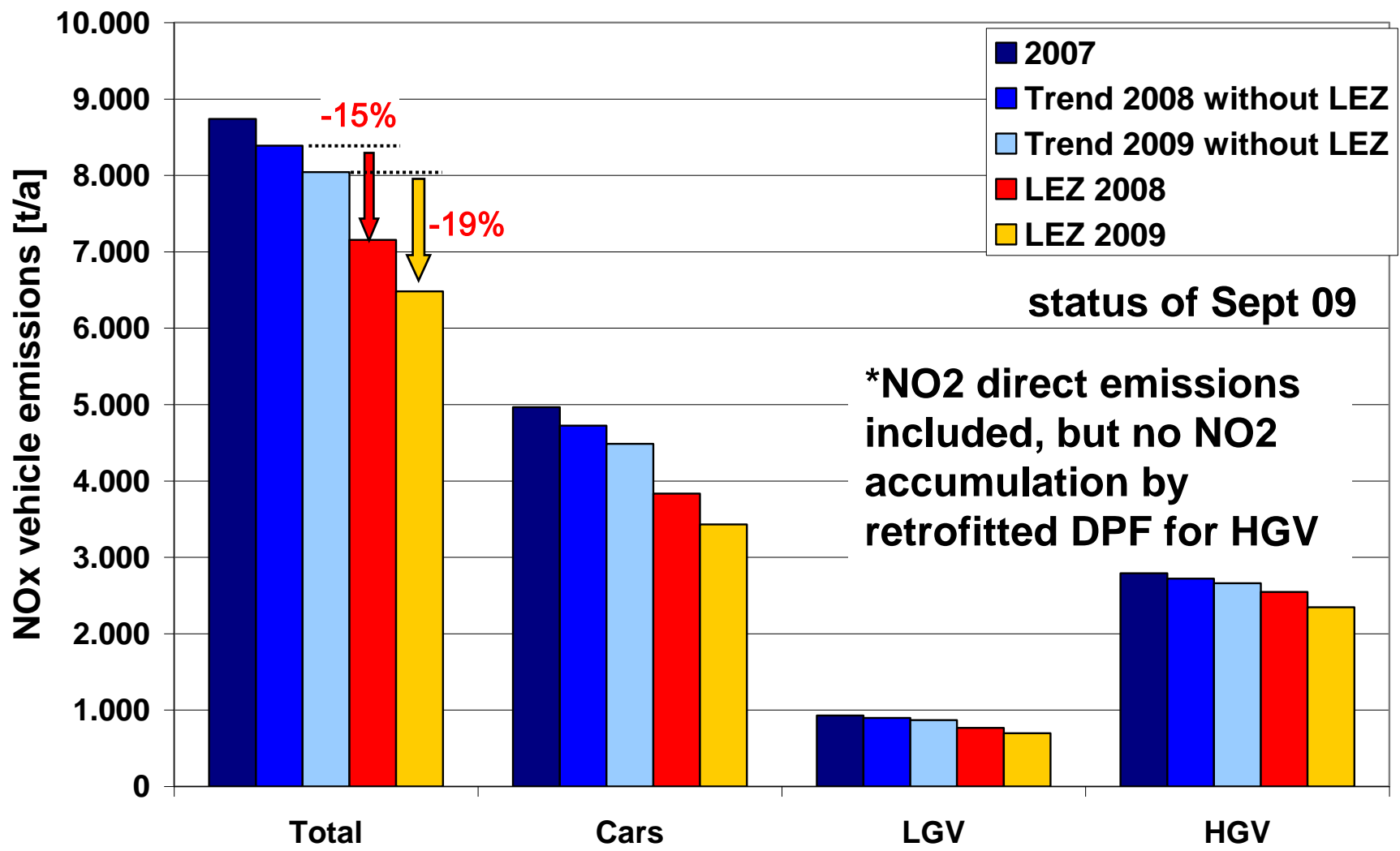
before-after comparison of the fleet composition at Frankfurter Allee

Fleet characteristic at Frankfurter Allee based on number plate recognition before and after introduction of Berlin's LEZ in 2008/9



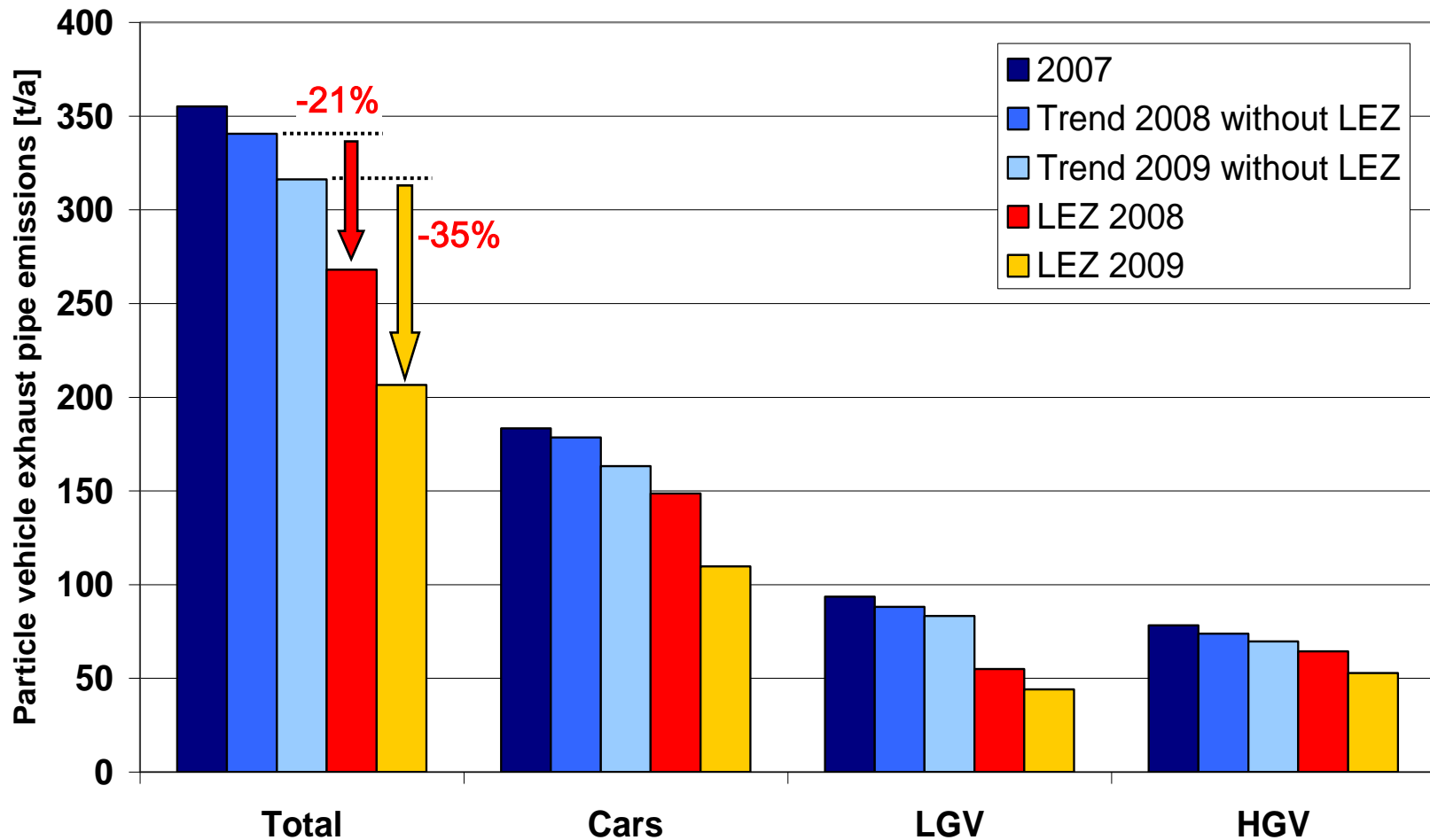
LEZ impact: change of NOx emissions from road traffic*

based on fleet composition at Frankfurter Allee (new emission factor data base HBEFa 3.1)



LEZ impact: change of **particle** exhaust emissions

based on fleet composition at Frankfurter Allee (new emission factor data base HBEFa 3.1)



emissions extrapolated to the entire main road network based on the fleet composition at Frankfurter Allee (without DPF retrofit, only warm emissions, no cold start impact)

based on the results of the PM2.5-source apportionment in a main road in Berlin's city centre

applying the emission reduction of the LEZ

of **-35% EC & OC**

→ **- 4.9% PM2,5**

of **-19% NOx**

→ **- 1.5% PM2,5**

Σ = - 6.4 % PM2,5

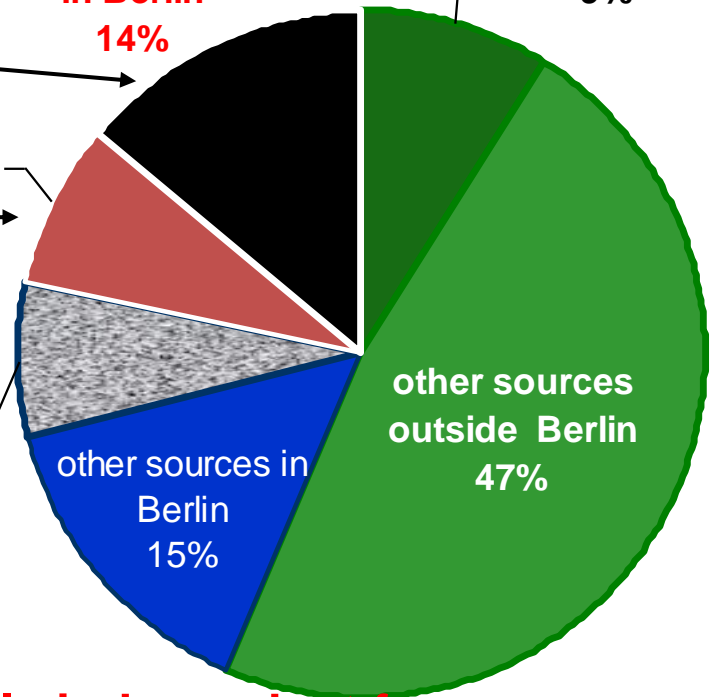
can be controlled by LEZ

soot + organic material from vehicle exhaust in Berlin 14%

traffic outside Berlin 9%

secondary particles from NOx-emissionen from traffic in Berlin 8%

resuspension + abrasion from traffic in Berlin 7%



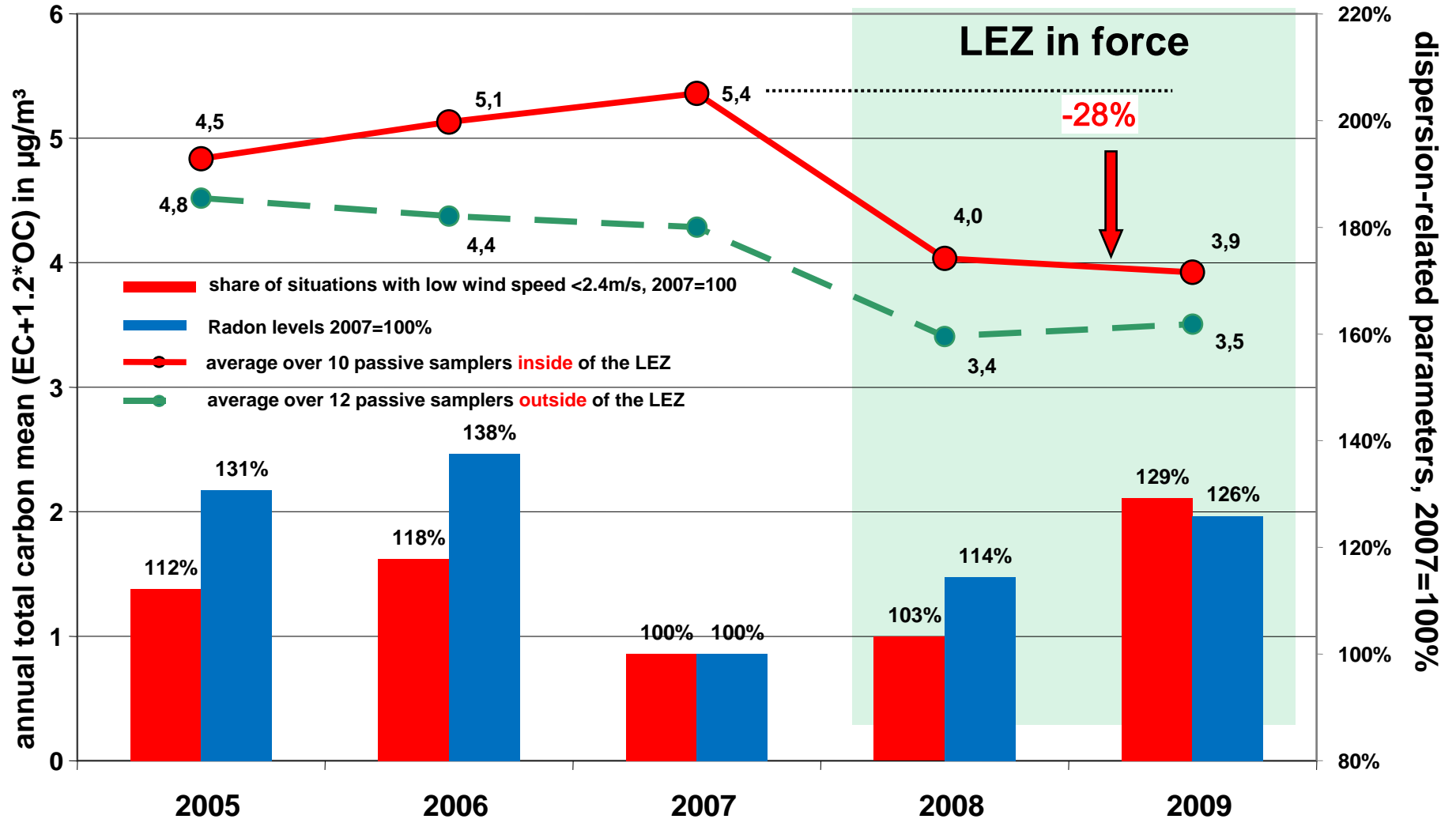
other sources outside Berlin 47%

other sources in Berlin 15%

related to PM10:
- 4.5 % PM10
(70% PM2,5 in PM10)

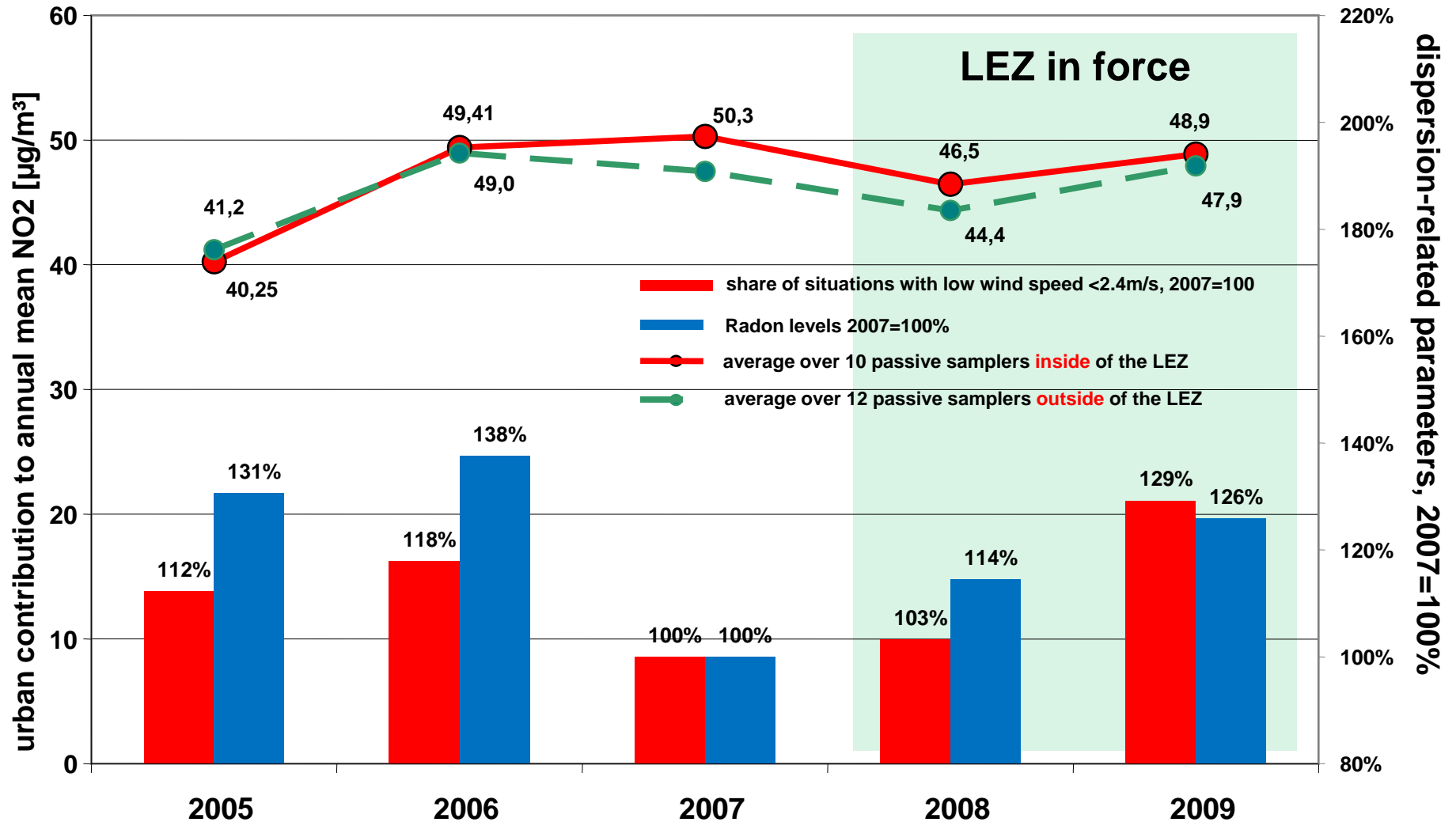
largely independent from traffic and meteo changes

traffic-adjusted trend of the local traffic increment of total carbon concentrations in main roads in and outside of the LEZ



traffic adjusted trend of Berlin's contribution to NO₂- levels in main roads in and outside of the low emission zone

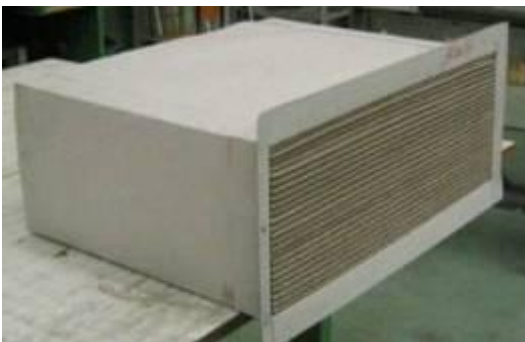
urban contribution = kerbside levels-upwind levels at city periphery (ca 10 -12 µg/m³)



- **no visible shift of traffic** into surrounding areas
 - **significant change in the vehicle fleet composition:**
 - ↳ **fewer „dirty“ vehicles (<E1):**
 - ↳ LGV/HGV: only **4-7%** instead of **30 %**
 - ↳ **more clean vehicles (E4):**
 - ↳ cars **73%** instead of **44%**,
 - ↳ lorries **50%** instead of **17-23%**
 - **decrease of traffic emissions** on top of trend :
 - ↳ exhaust particles: - **35 %**; NOx: - **19 % (probably less)**
 - **LEZ is most effective single measure, if**
 - ↳ based on **ambitious** emission criteria
 - ↳ covering a **larger area**
 - ↳ introduced **not too late**
 - ↳ **exemptions are limited**
- possible benefit for the air quality**
- ↳ **5-10% reduction of PM10/2.5 & NO2,**
 - ↳ traffic related decrease of black carbon **~30%**
 - ↳ **~10 less excess days** > 50 µg/m³ PM10



~2010-12

particle filter in passenger cruise ships

pilot project 2008-2010:

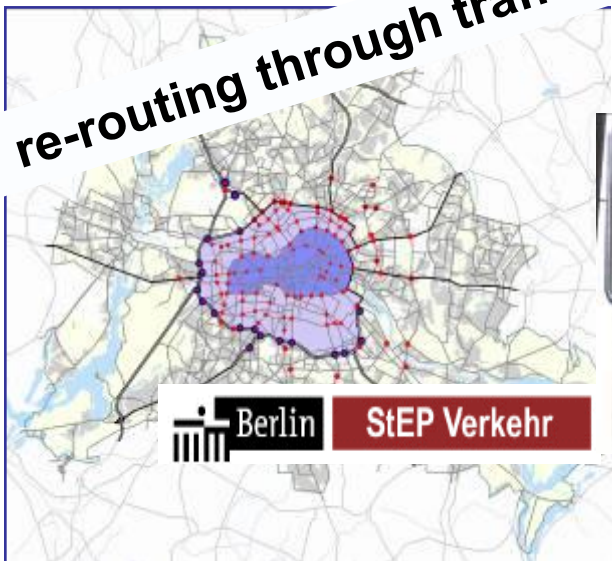
- retrofit of 3 vessels with different filter systems
- monitoring of filter efficiency, performance and handling during routine operation



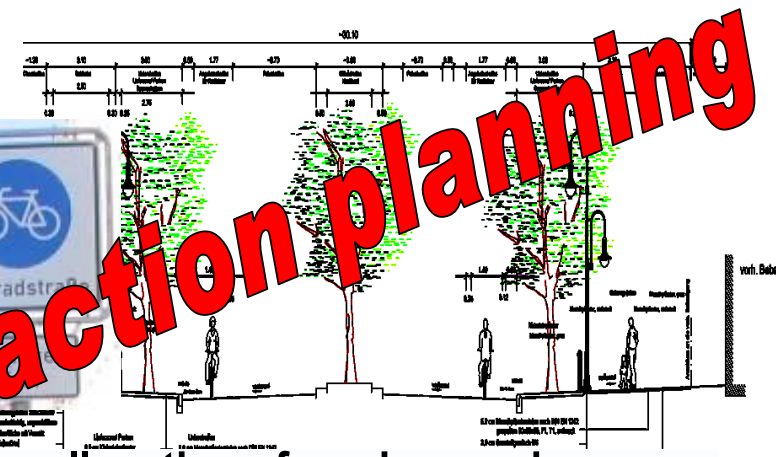


U M W E L T

re-routing through traffic



Promotion of sustainable transport modes & car sharing



action planning

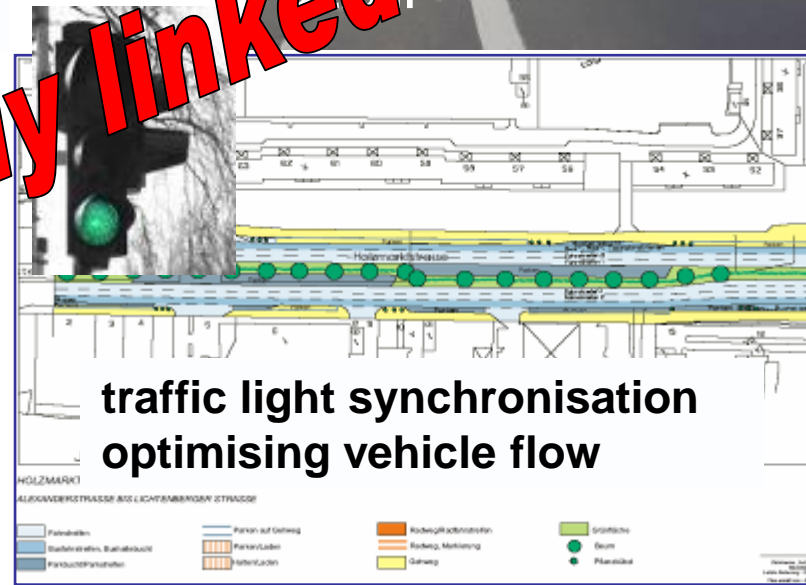
- extra bus lanes
- traffic priority for bus

re-allocation of road space in favour of cyclists & pedestrians

Speed limits



strongly linked to noise



traffic light synchronisation optimising vehicle flow

Parking management



Traffic bans



■ shift modal split from motor traffic to clean transport modes

- ↪ Berlin's planning objective:
-10% less motor traffic in 10-15 years
results in 5-10% less NO₂, 3-4% less total PM₁₀

■ optimizing traffic flows (progressive signal systems):

- ↪ impact difficult to quantify
→ local effect, traffic signal coordination works only in one direction, potentially negative effects on cross-roads

- ↪ conflict with acceleration of bus/tram
- ↪ risk that gained road capacities will attract more traffic
- ↪ small net gain in pollution control

■ speed limit 30km/h:

- ↪ example Schildhornstraße Berlin: 10 % less NO₂, -6% PM

if traffic light coordination with 30 km/h works well
speed limit is enforced

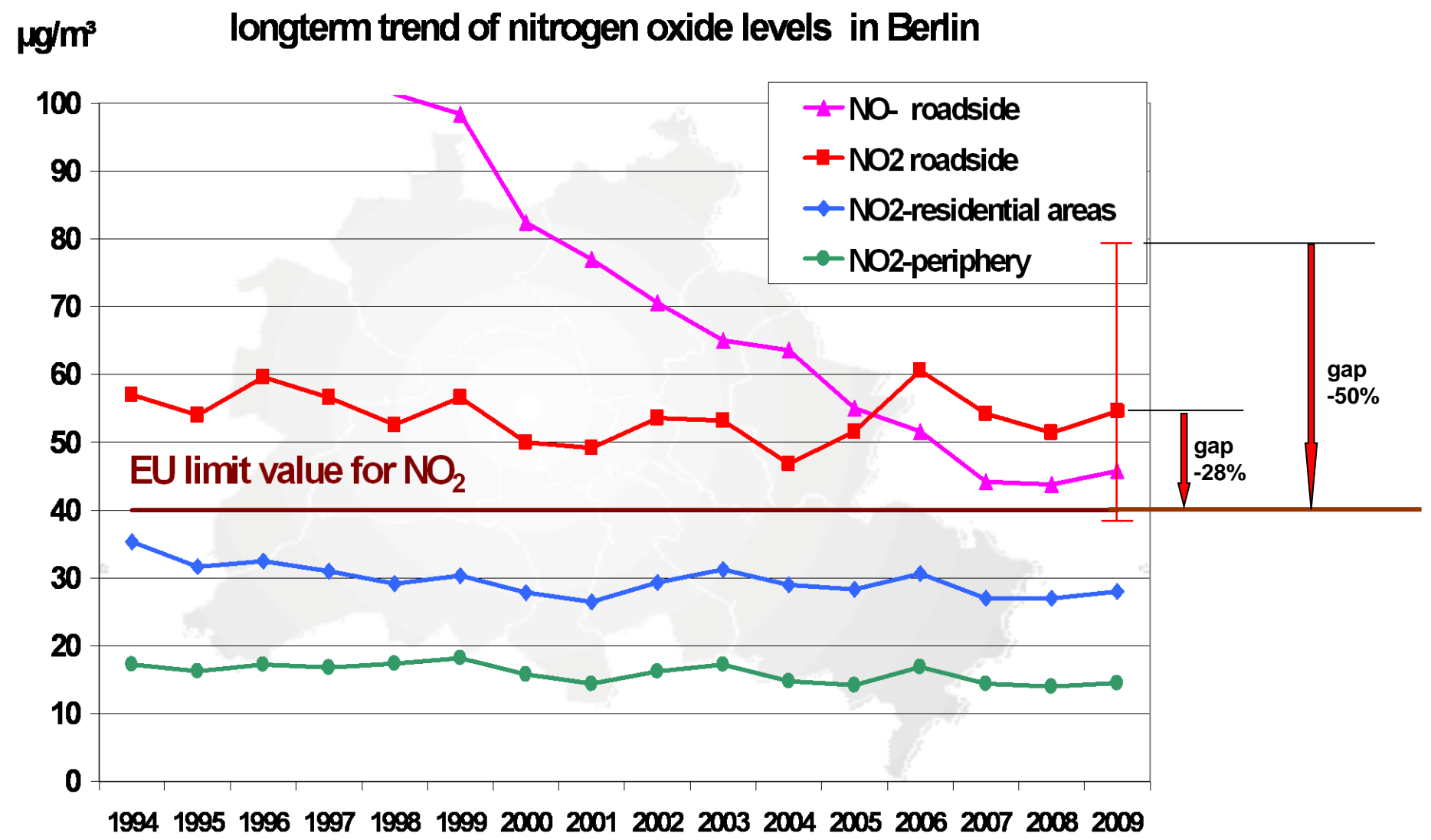
→ also less noise and traffic accidents

■ truck ban:

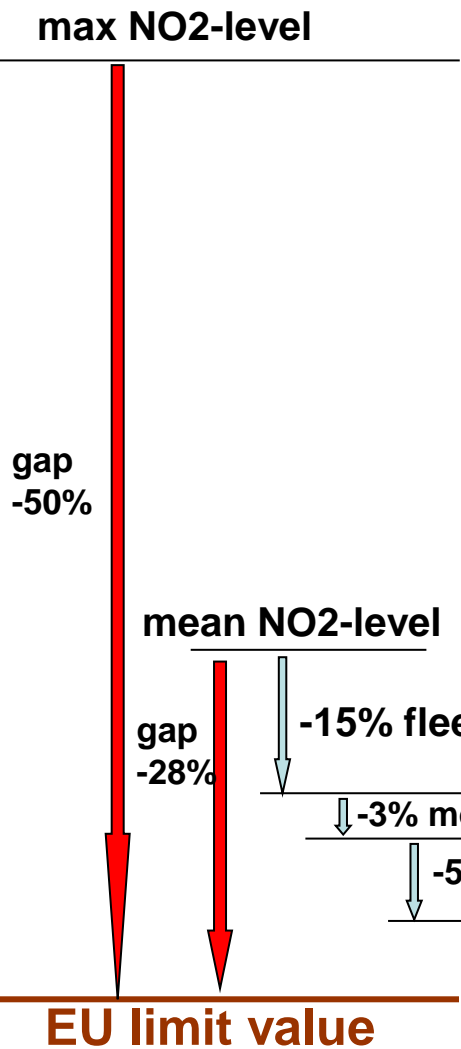
- ↪ example HEAVEN project: up to 20% less NO₂, -7% PM
→ only local effect in single roads,
merely shift to other roads, no net reduction



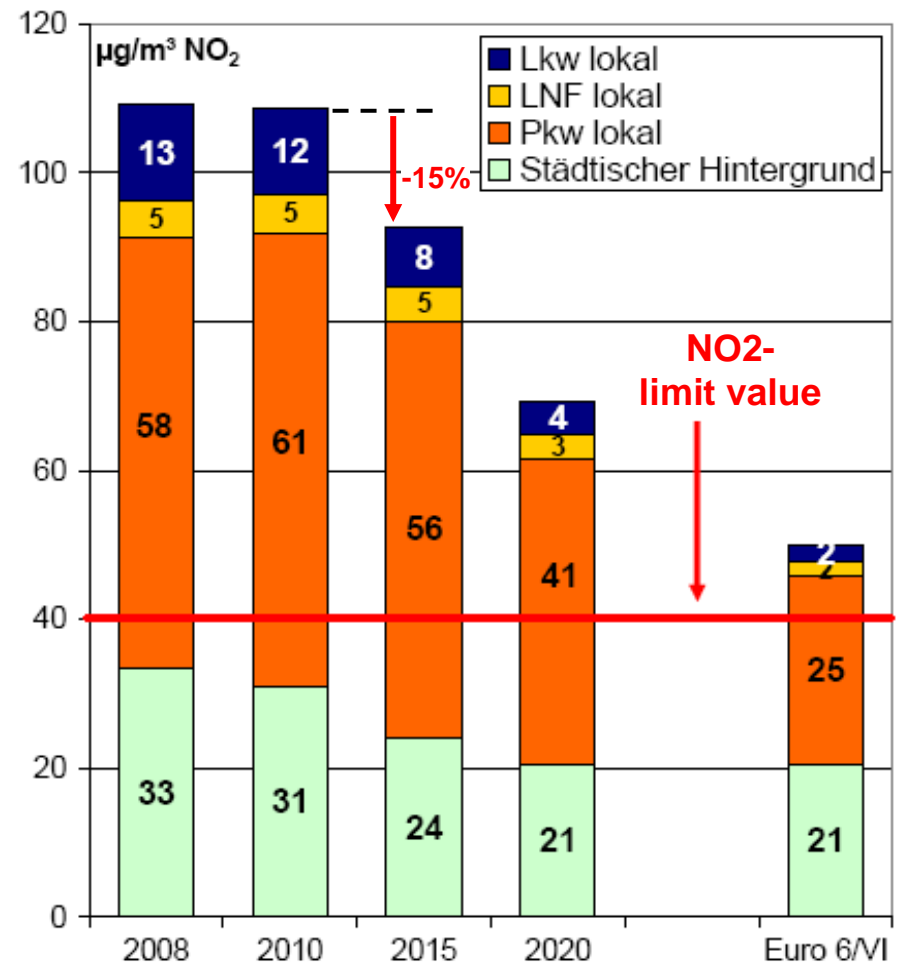
long-term trend of **nitrogen dioxide** in Berlin: no improvement despite decreasing NO_x-emissions



Closing the NO2-gap in Berlin



modelled NO2- levels at traffic site Stuttgart Neckartor



IFEU 2010 im Auftrag des UM Baden-Württemberg

⊗ LV excess even in 2020 and even if all vehicles were Euro 6/VI

source: Udo Lambrecht
IFEU Institute 2010

■ NO2 attainment 2015:

- full impact of **LEZ** stage 2 (☹ **fading away** by 2015)
- SCRT** retrofit program buses & perhaps for some HGVs
- speed limits, traffic light coordination, etc
- modal split** change due to transport strategy
- local (HGV) traffic bans (☹ **barely feasible** in Berlin)
- Euro 6/VI incentives (☹ need to **wait** for the **Federal Gov.**)
- realistic **scope** for improvement up to **30%**
- ☹ full compliance unlikely

■ PM10 attainment by 2011: short notification end of 2010

- full impact of LEZ stage 2
- tightening LEZ exemptions
- optional: stricter emission limits for small combustion units
- long-range (transboundary) PM transport is not Berlin's fault
 - (>50% of excess day 2010)
- compliance** in 2011 is a lottery game depending **on meteo**



For more information on

- ➔ Berlin's LEZ see www.berlin.de/umweltzone (also in EN & FR)
- ➔ LEZ in Germany see <http://www.umweltbundesamt.de/umweltzonen/index.htm>
- ➔ LEZ-cities in Europe visit www.lowemissionzones.eu, the website of the European Network of LEZ-cities (LEEZEN)
- ➔ transport related measures in EU cities visit www.civitas.eu