

Air quality management in Berlin: **tools, challenges and solutions**

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- ⊗ Berlin's **past actions** to combat **winter** smog
- ⊗ **Current challenges** and need for additional **action**
- ⊗ Example: the **low emission zone**
- ⊗ Portfolio of **extra** measures
- ⊗ Estimation of their likely **impact** on the AQ
- ⊗ **Link** to other planning activities
- ⊗ **résumé**



Framework for Air Quality Management in the EU

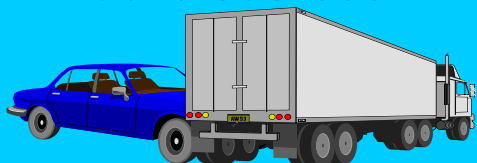
7th Environment Action Program

...to **safeguard** EU citizens from environment-related pressures and risks to health and wellbeing, like **air pollution**, and further **reduce** its impact on ecosystems and biodiversity

Controlling Emissions

National Emission Ceilings

Mobile sources



EU-Standards for vehicle emission and fuel quality (EURO 5/V – 6/VI)

Product standards, e.g. solvents in varnishes, Eco-Design

additional **national strategies**, e.g.
Economic measures
Road pricing
Fiscal incentives for BAT
Energy taxes
Scrappage schemes....

Air Quality Plans: additional measures on a **local** level, e.g.

- green public procurement
- traffic planning & management,
- small combustion units
- building sites, etc.....
- short-term action plans if useful

Stationary sources



EU-Directive to control industrial emissions (LCP, waste incineration, industrial plants)

Improving Air Quality

AQ Directive 2008/50

- sets **air quality standards** for
 - SO₂, PM, NO₂, lead
 - Benzene, CO
 - Ozone
 - PAH*, heavy metals*
- requires **Air Quality Plans** in non-attainment areas
- sets common **criteria for air quality assessment**
- sets minimum **requirements to inform the public** about air quality

achieve Air Quality standards

trigger for further measures

Critical loads for Acidification & Eutrophication

*seperate Directive 2004/107

Berlin

☞ a few facts

Still 30% lower than elsewhere in Germany

- **low** commuter numbers & **car density**
- in the past: economic stagnation/slow growth due to severe structural changes after fall of the wall
 - ☞ per capita income 30% below Hamburg
- **now:** higher growth compared to rest of Germany
- ageing population, but slower process than elsewhere as Berlin attracts young people
 - ☞ about 150.000 students
 - ☞ 50.000 more residents/year
- dominance of service sector, media, IT, government
- lot of small & medium businesses
- **no heavy industries**
- largest district heating network in Europe
- flat orography



area: 889 km²

inhabitants: 3,4 million

48% car-free households

☞ car ownership: 317 cars/1.000 inhab.

☞ passenger cars: 1,1 million

bicycles: 1,8 million

147 bus lines - 1662 km

22 tram lines - 189 km

9 metro lines - 144 km

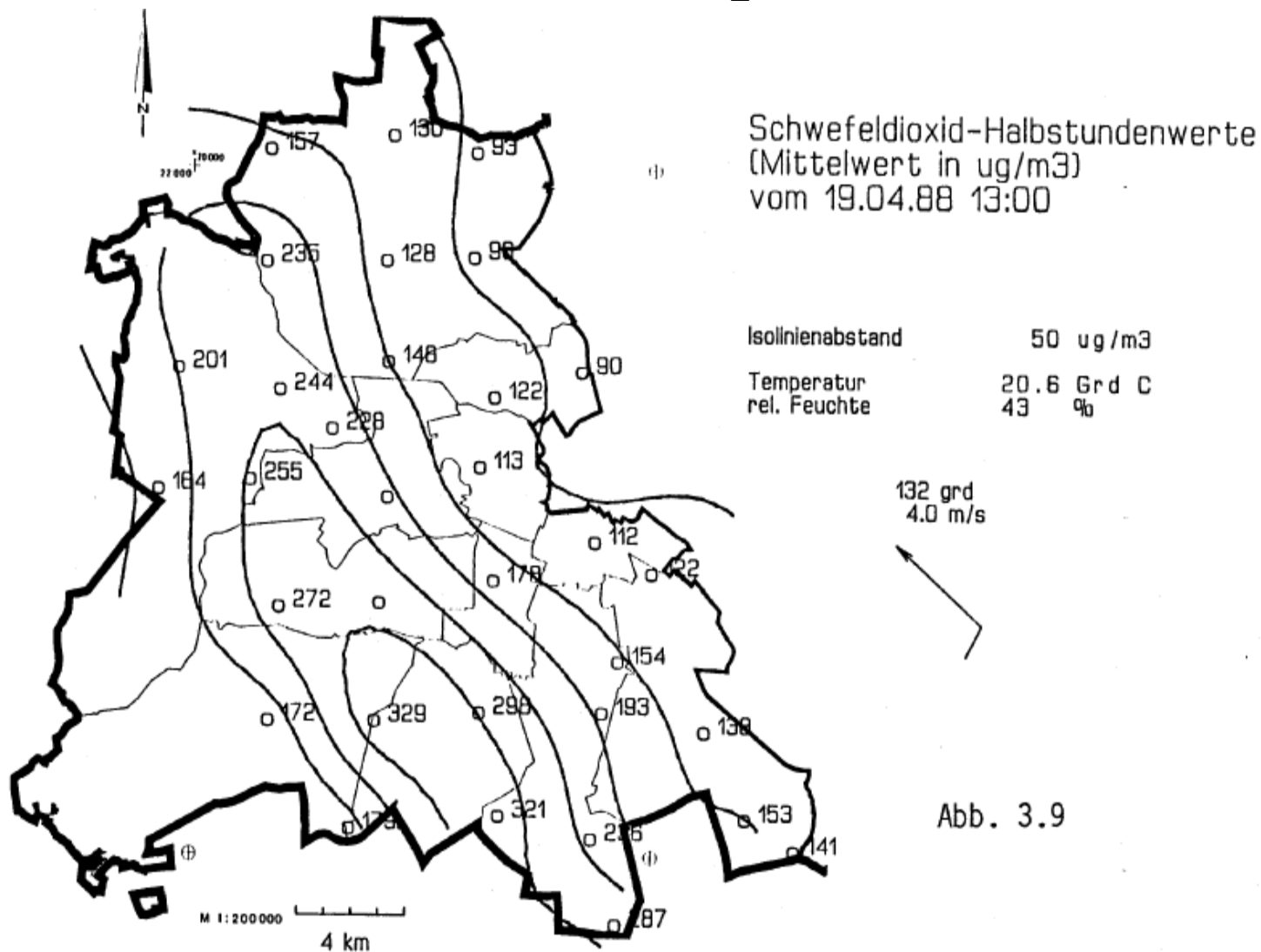
32 MRT lines* - 458 km

* S-, RB-, RE- lines

divided city 1945 – 1990

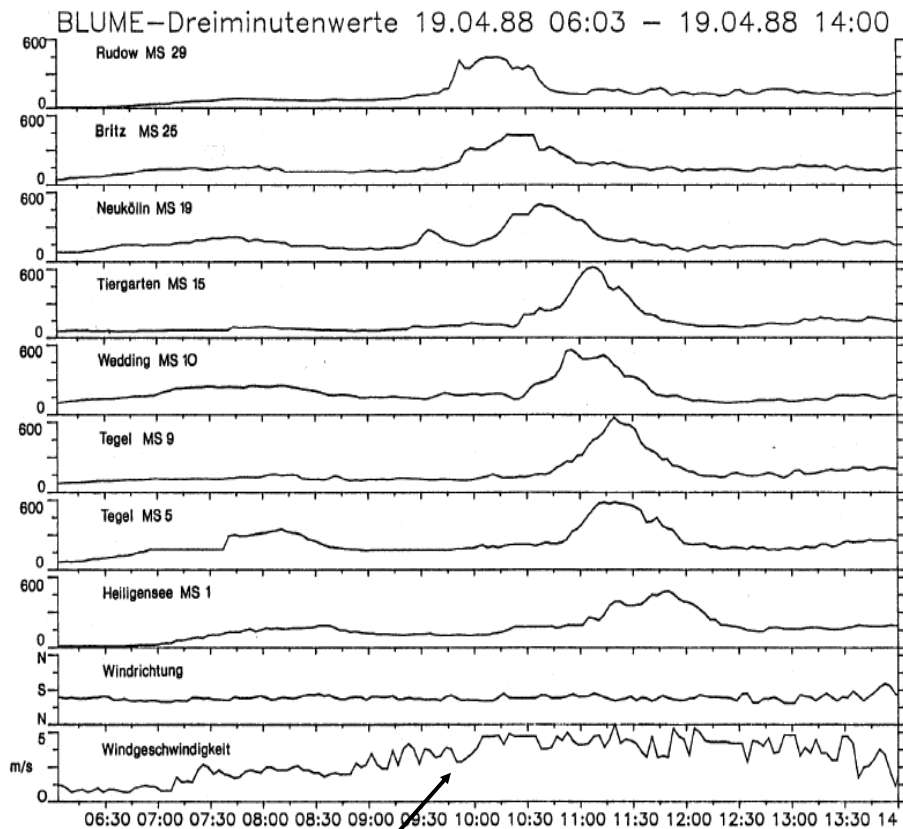


☞ once suffering from heavy SO₂ pollution



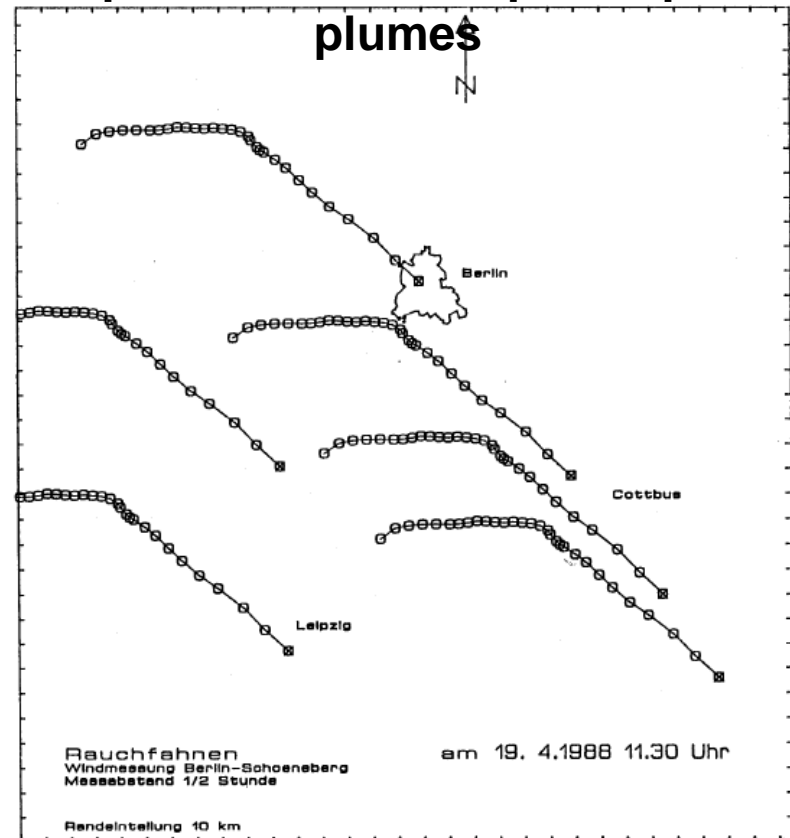
☞ once suffering from heavy SO₂ pollution ...

SO₂ 3-min averages



wind speed

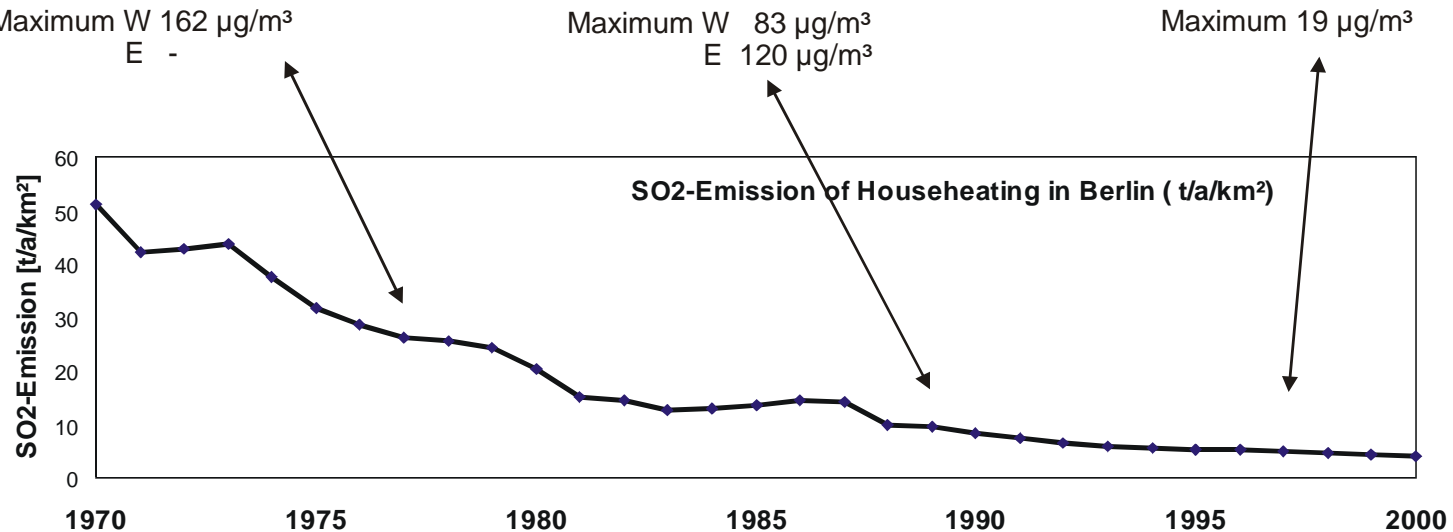
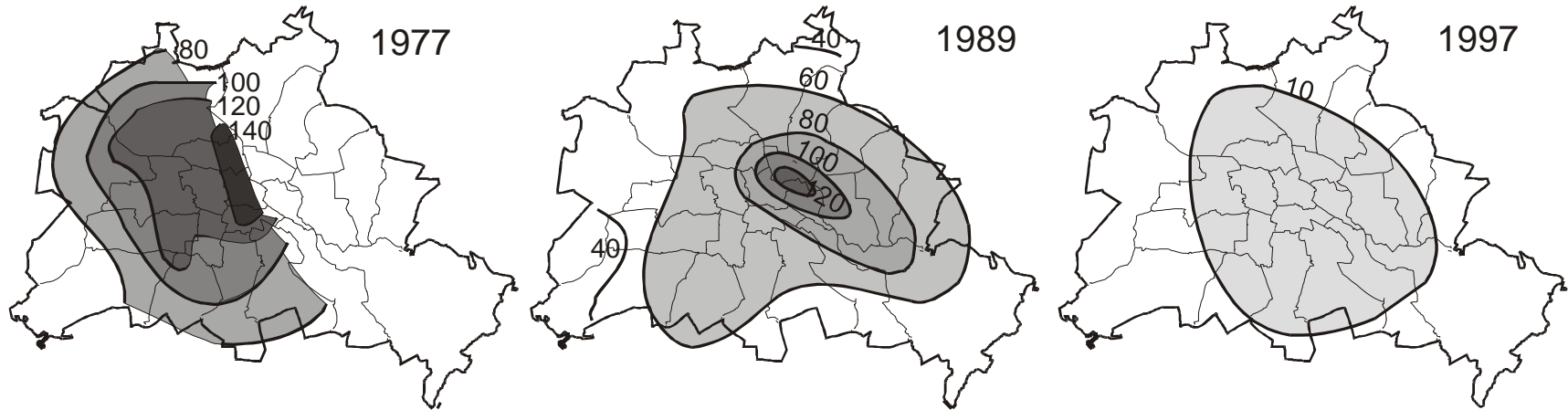
simple calculation of power plant



Berlin's AQ Management in the past

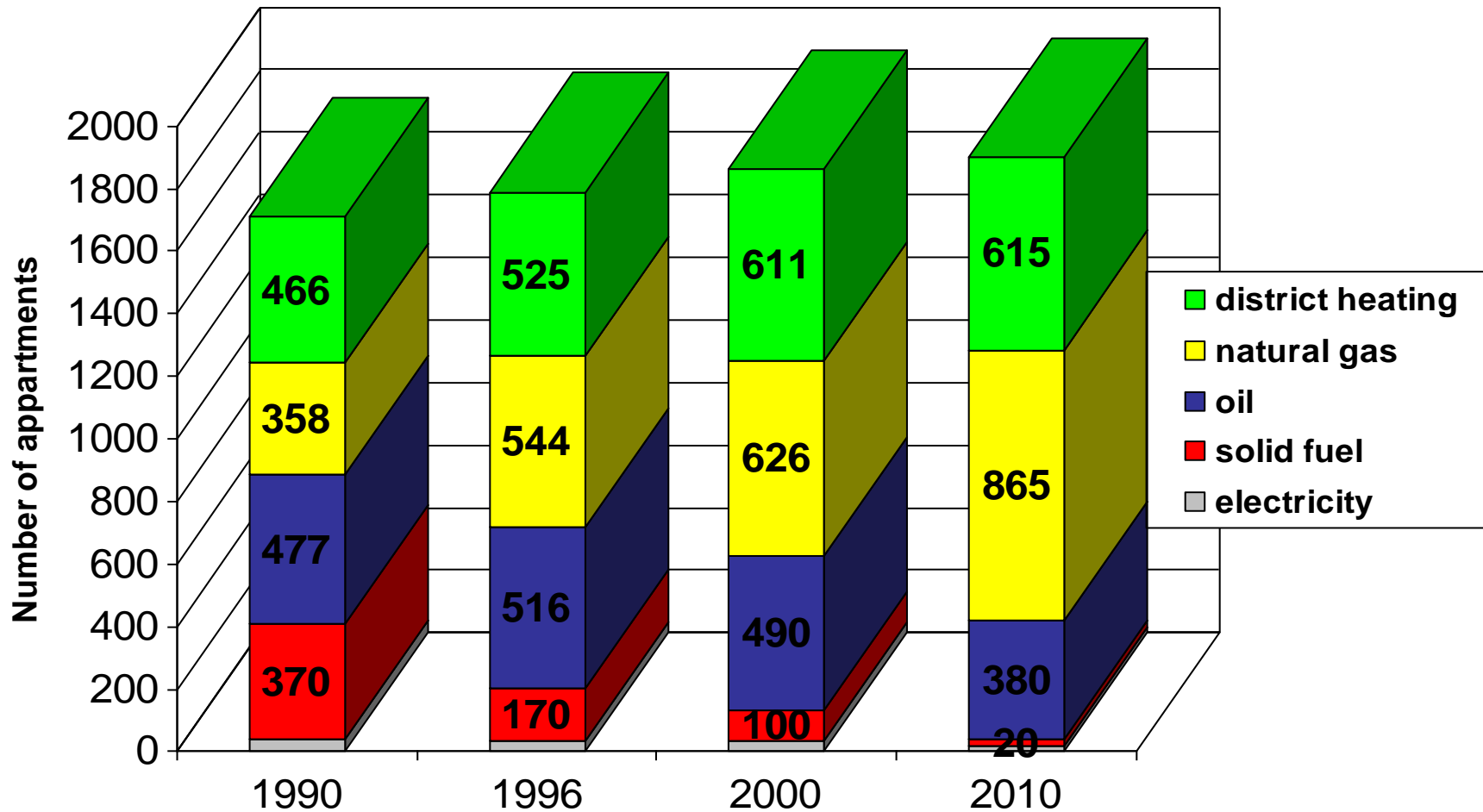
👉 success story of SO₂ control

Annual averages of SO₂-concentration in Berlin



Berlin's AQ Management in the past

☞ **fuel** switch for **domestic** heating (in 1000 units)



Berlin's AQ Management in the past

☞ Control measures for **Stationary Sources**

Power plants and Industry

■ **“end-of-pipe”** pollution control technology

- ☞ SO₂: Flue Gas Desulphurization (FGD) in large combustion plants
- ☞ NO_x technology (SCR)
- ☞ PM: fabric or electrostatic filters

■ enhanced **combustion&process** efficiency

- ☞ NO_x: Low-NO_x burners, Fluegas re-circulation

■ **fuel switch**

- ☞ SO₂: use of coal/oil with less S-content
 - ☞ **ban of heavy fuel oil**/lignite in the absence of FGD
- ☞ natural gas

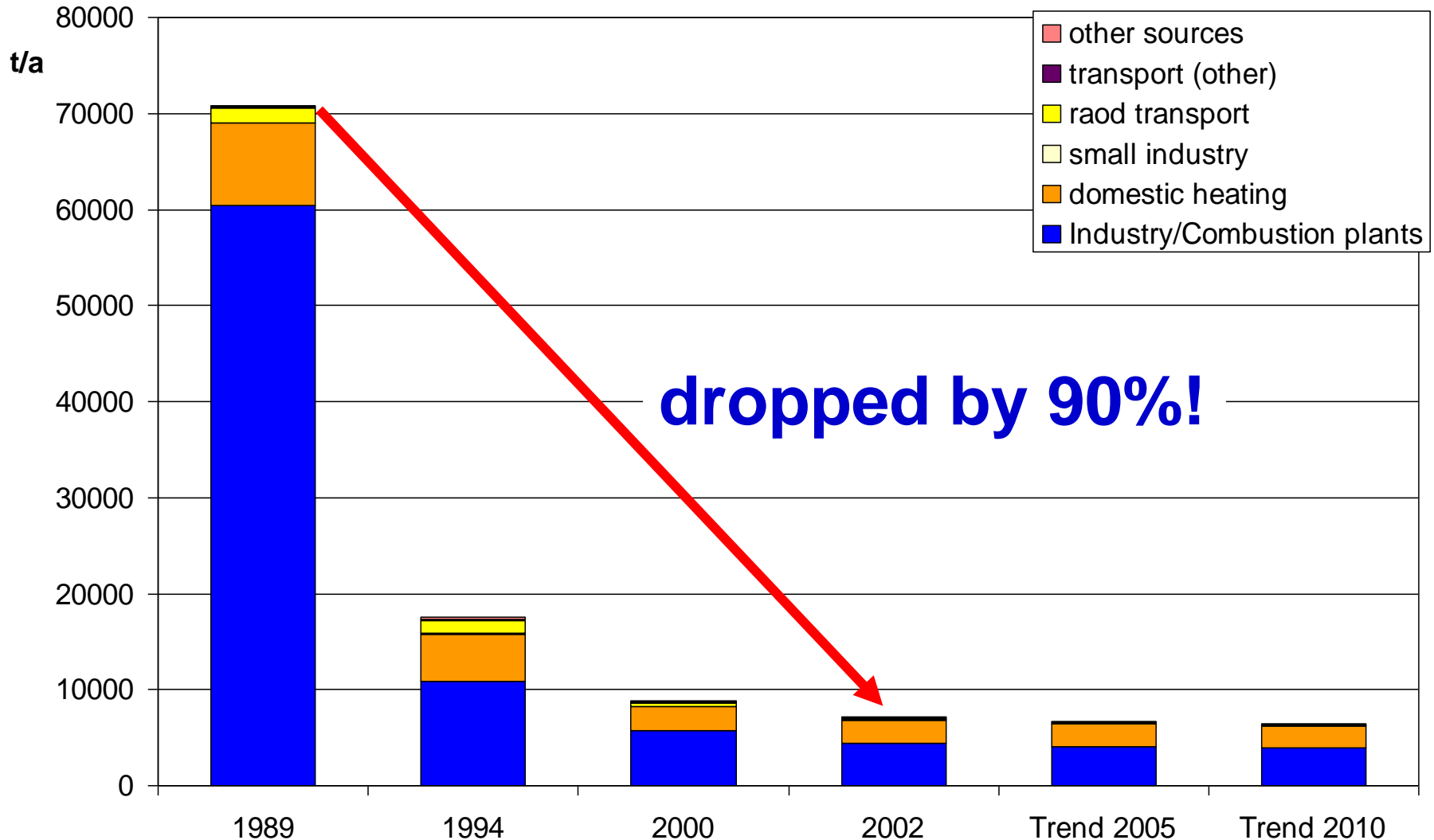
■ control of **fugitive emissions**

- ☞ Material handling and storage
 - ☞ PM: housing, sheltering
- ☞ VOC: Capture and recovery systems



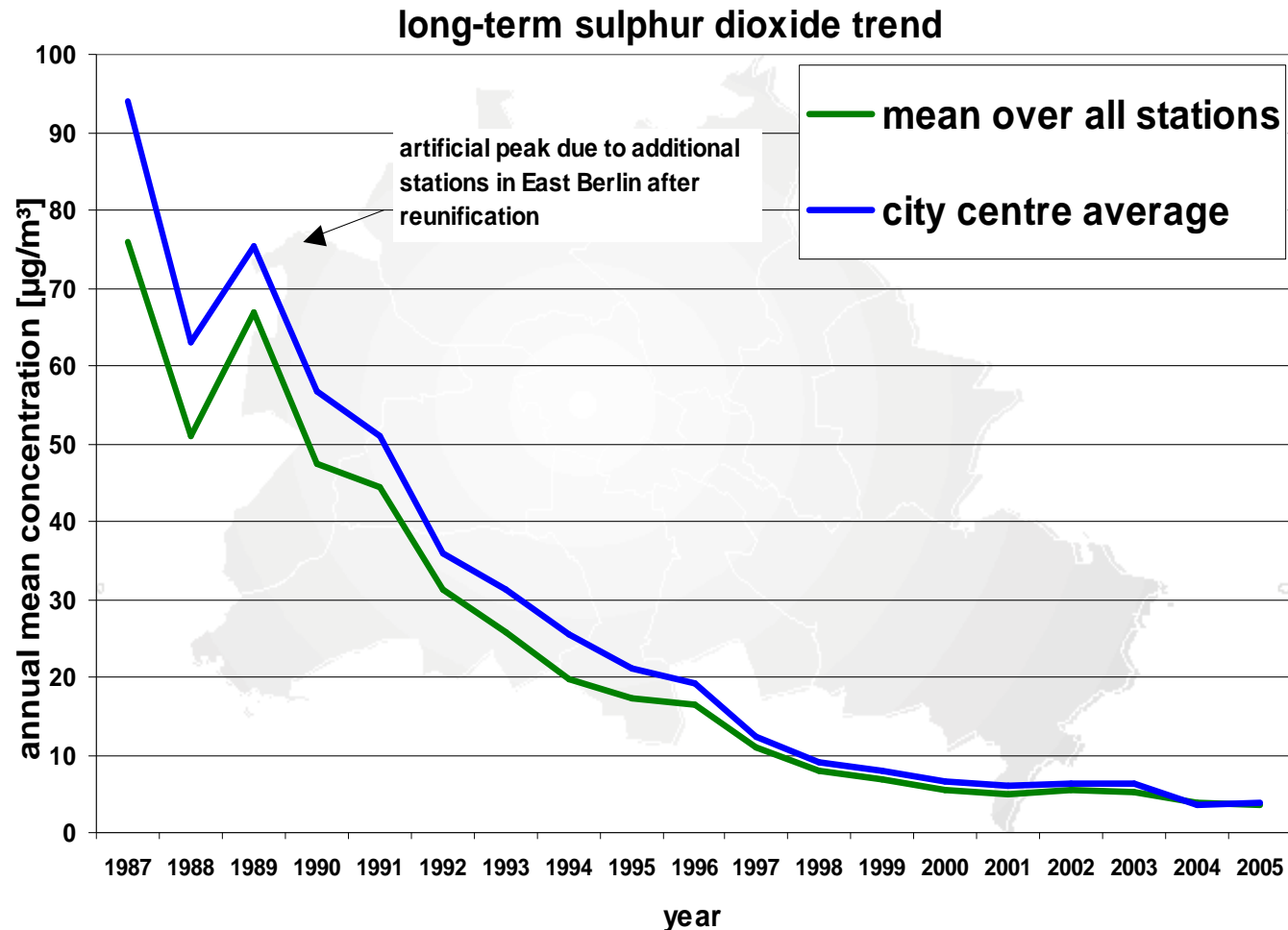
Berlin's AQ Management in the past

☞ Trend of SO₂ emissions



SO₂ monitoring in Berlin (West):

☞ **demonstrating the success story of SO₂ control**



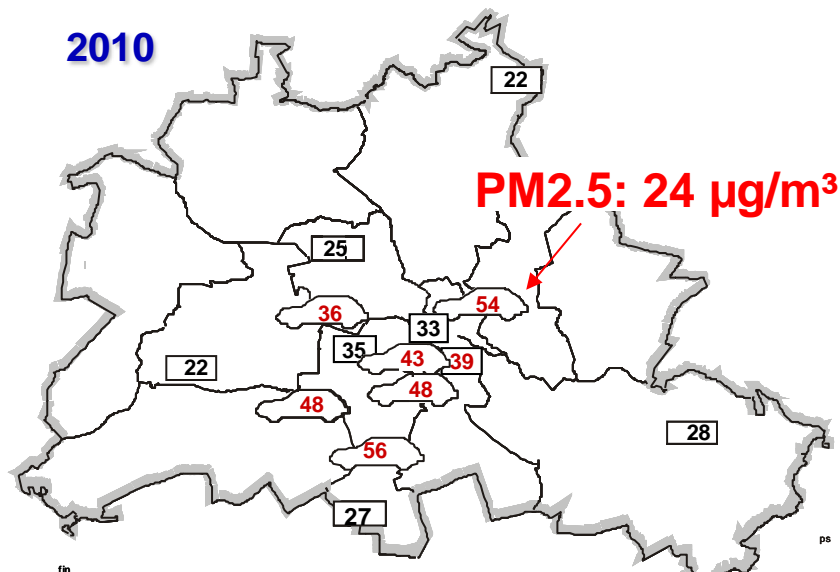
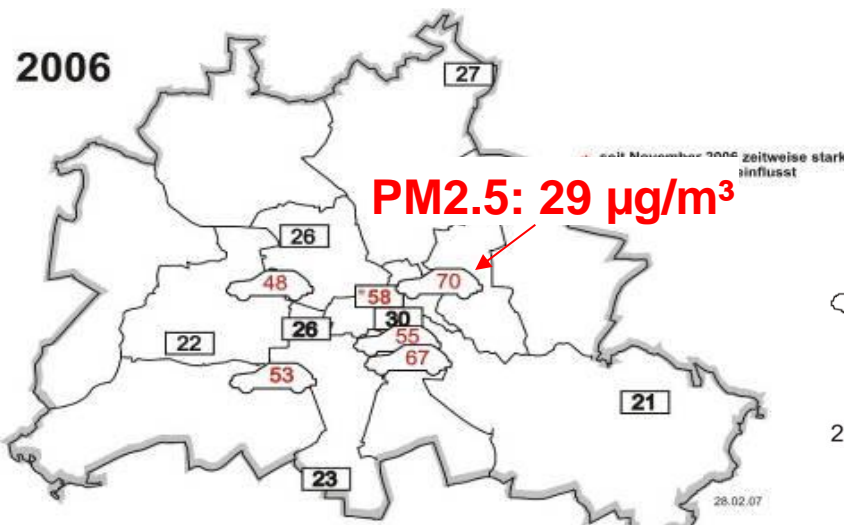
now a clean city?

pollutant	main source	status
SO ₂	power plants, industry, domestic heating	☺ problem solved 20 years ago
CO, Pb, HM	traffic	☺ never a problem
Benzene	traffic	☺ problem solved 10 years ago

Berlin AQ assessment

☞ **PM10** not yet solved

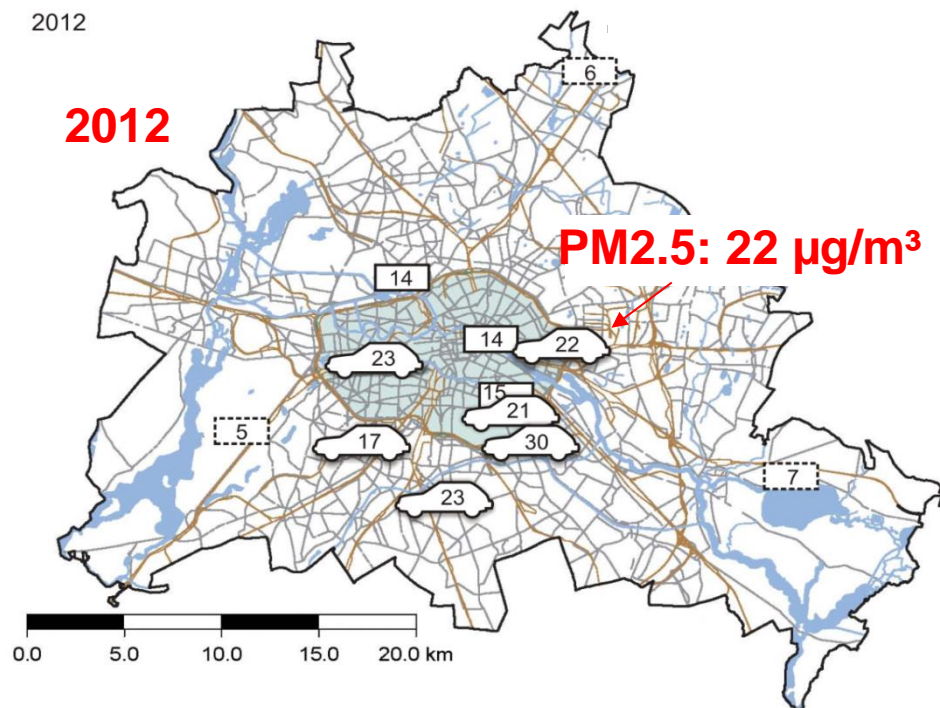
number of days above the
24h-limit value of $50 \mu\text{g}/\text{m}^3$
PM10 in Berlin
non-compliance in 2006/7, 2009-2011
and 2014



☁ traffic sites
□ stations in residential
areas or at the periphery
and air cleaning

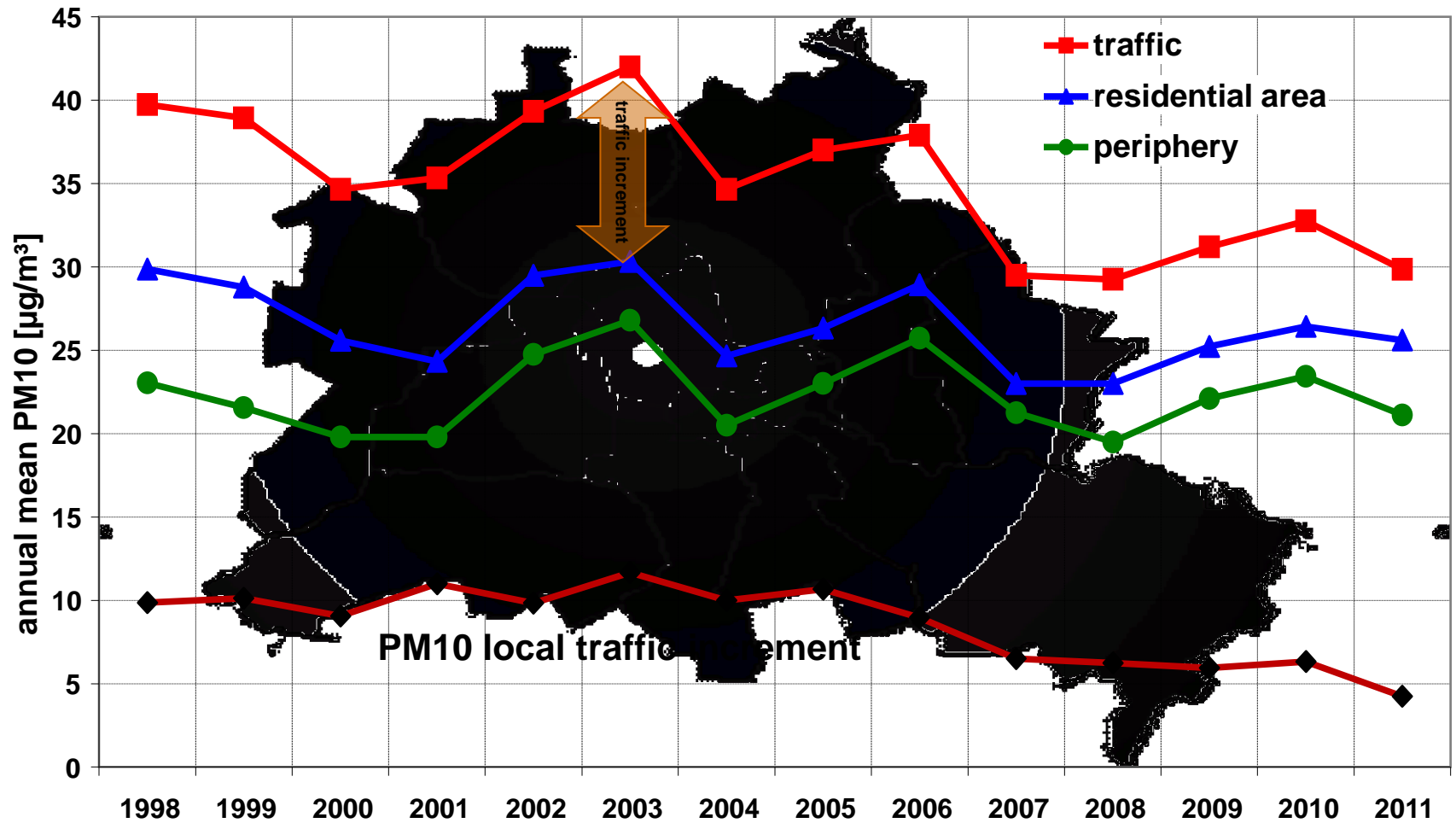
Red: limit value exceeded
Bold: limit value + margin of tolerance
exceeded

2012



Berlin AQ **assessment**

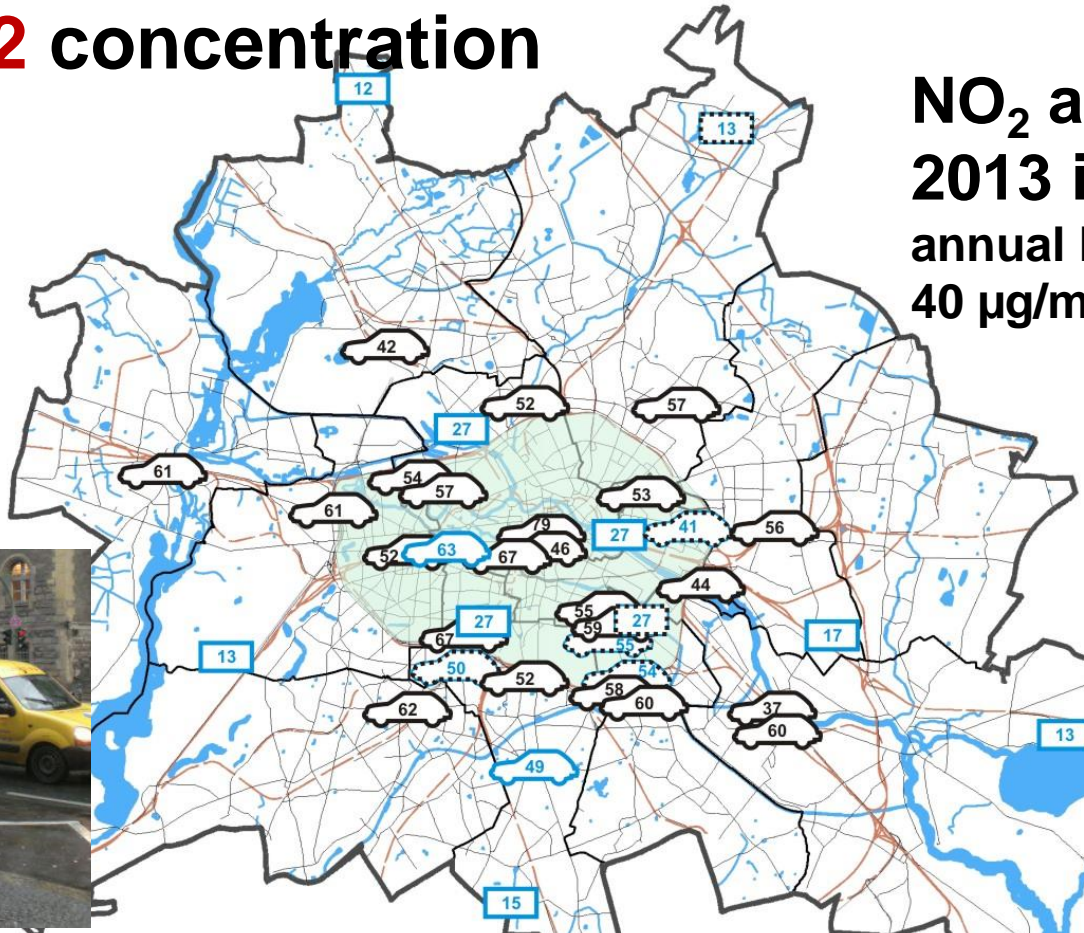
👉 long-term AQ **PM10** trend Berlin







Berlin AQ assessment

NO₂ concentration

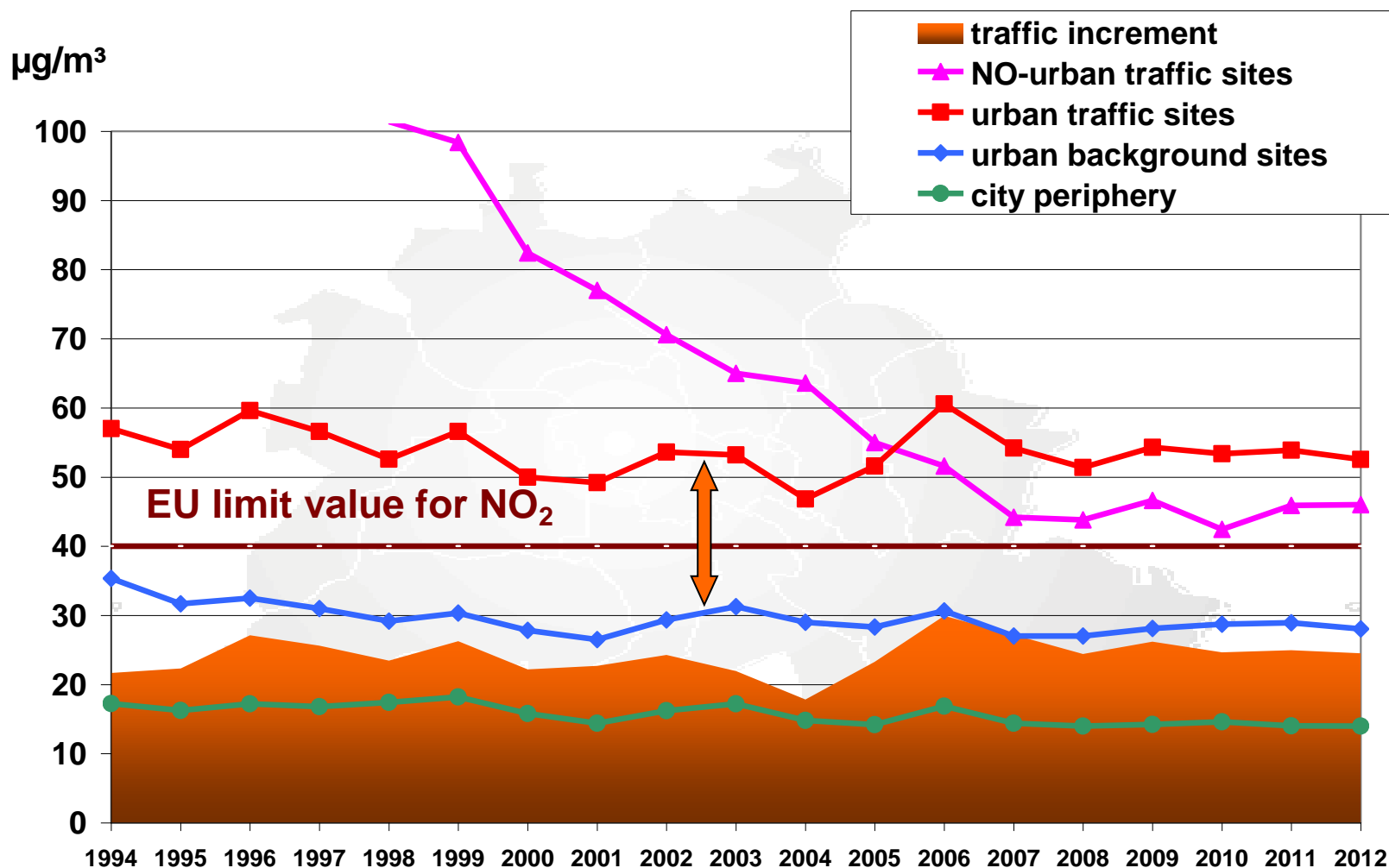
NO₂ annual mean
2013 in $\mu\text{g}/\text{m}^3$
annual limit value of
40 $\mu\text{g}/\text{m}^3$ **widely exceeded**



-  Low emission zone
-  Automatic monitoring site in residential areas and at the cities' periphery
-  Automatic monitoring site in busy roads at the kerbside
-  monitoring site with miniaturised monitoring devices for traffic related pollutants in busy roads

Berlin AQ assessment

NO_2 pollution trend



👉 **now a clean city? not quite...**

pollutant	main source	status
SO ₂	power plants, industry, domestic heating	☺ problem solved 20 years ago
CO, Pb, HM	traffic	☺ never a problem
Benzene	traffic	☺ problem solved 10 years ago
PAH	traffic, domestic heating	☹ still problems at few spots in years with advers meteo
Ozone	long-range transport, traffic	☹ diminishing problem, to be solved at national & EU level
PM _{2.5}	long-range transport, traffic	☺ problem solved
PM ₁₀	long-range transport, traffic	☹ still problem in years with adverse meteo, but local contribution shrunk
NO ₂	traffic	☹ serious problem, extension notified

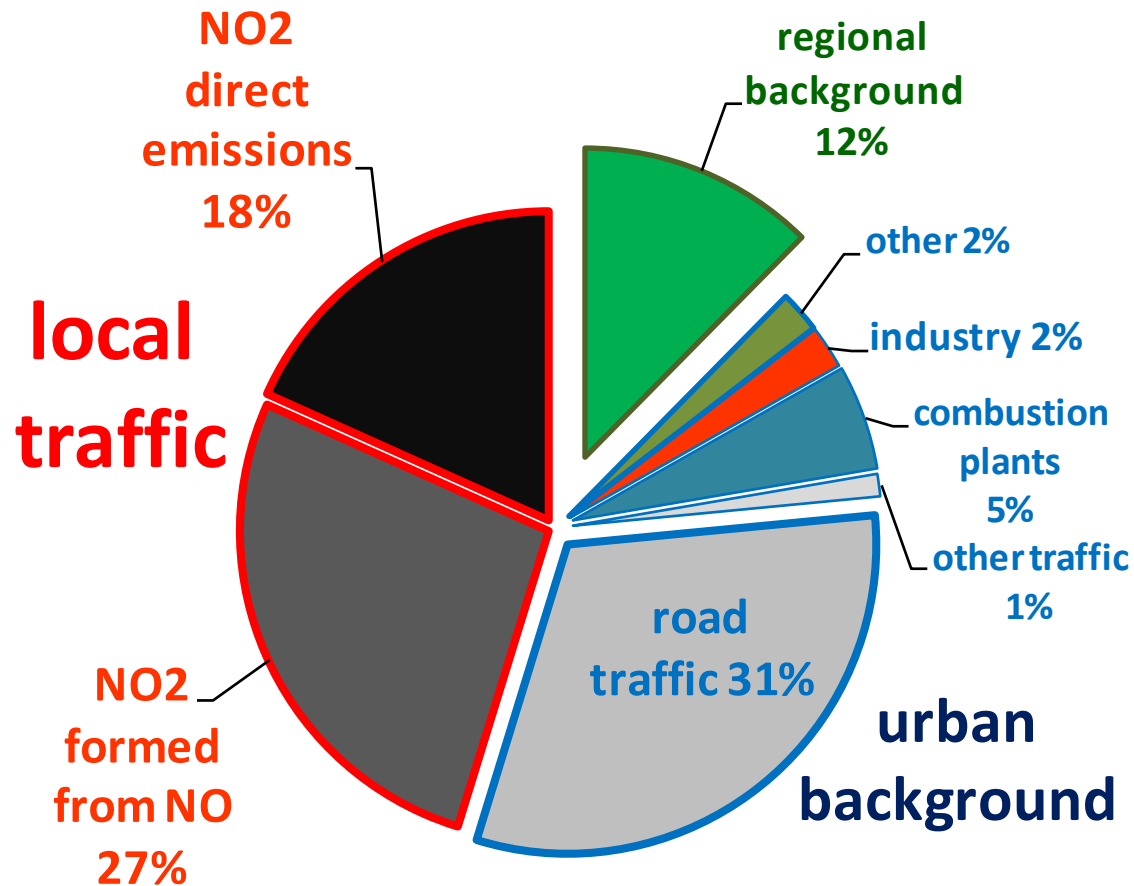
👉 **résumé** for air quality management

- (historical) problems with winter smog pollution solved
 - ↪ big **success** in cleaning up **domestic & industrial sources**
 - still problems with PM10 & NO₂ compliance, despite...
 - ↪ **spacious** street geometry
 - ↪ **flat** terrain – both **good** for **dispersion**
 - ↪ a clear **shift** of modal split towards **public transport & cycling**
 - ↪ still very **low** level of **car density** of about 320 car/1000 people
 - ↪ **shrinking traffic** volumes in the city centre
 - ↪ implementation of an **ambitious** set of **measures**
- ... generally favourable boundary conditions

Why?

Source analysis Berlin

👉 origin of kerbside NO₂



Based on dispersion modelling

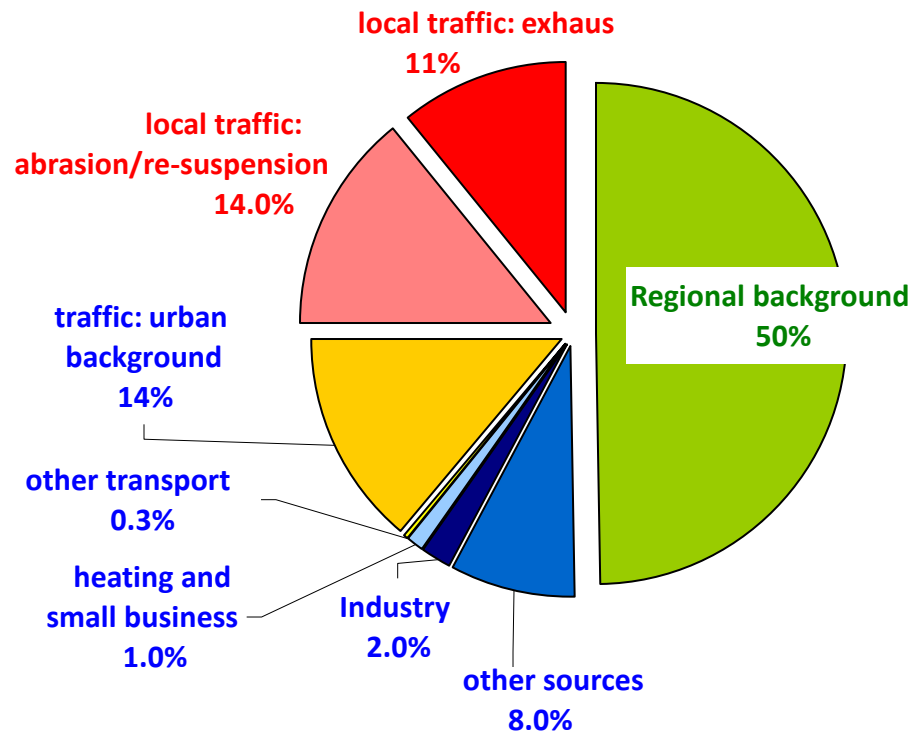
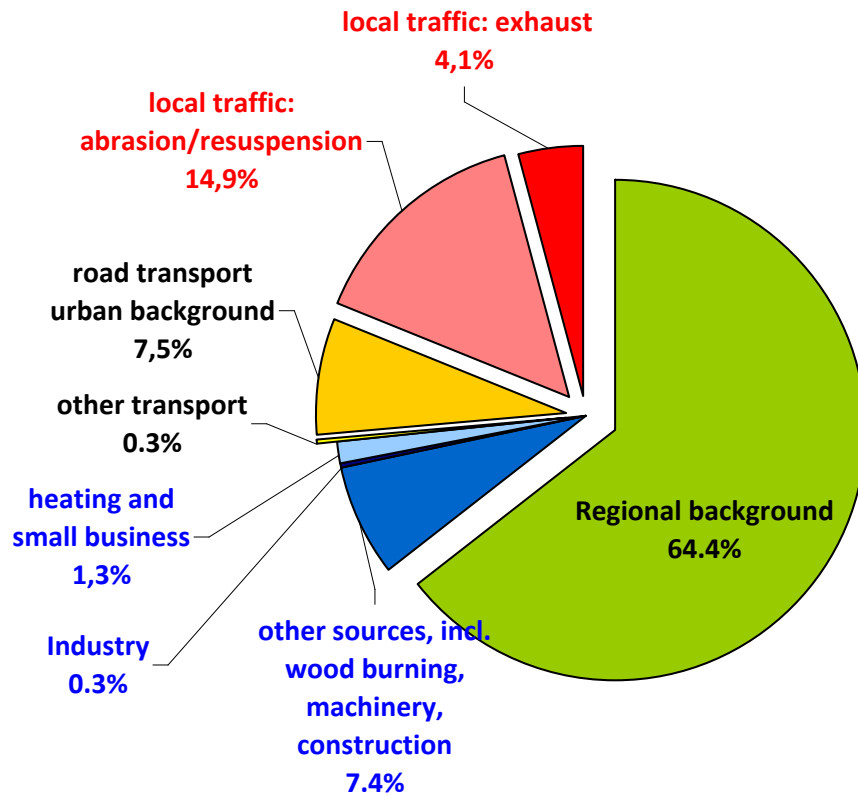
Source analysis Berlin

sectoral origin of kerbside PM10

2009

based on dispersion modelling

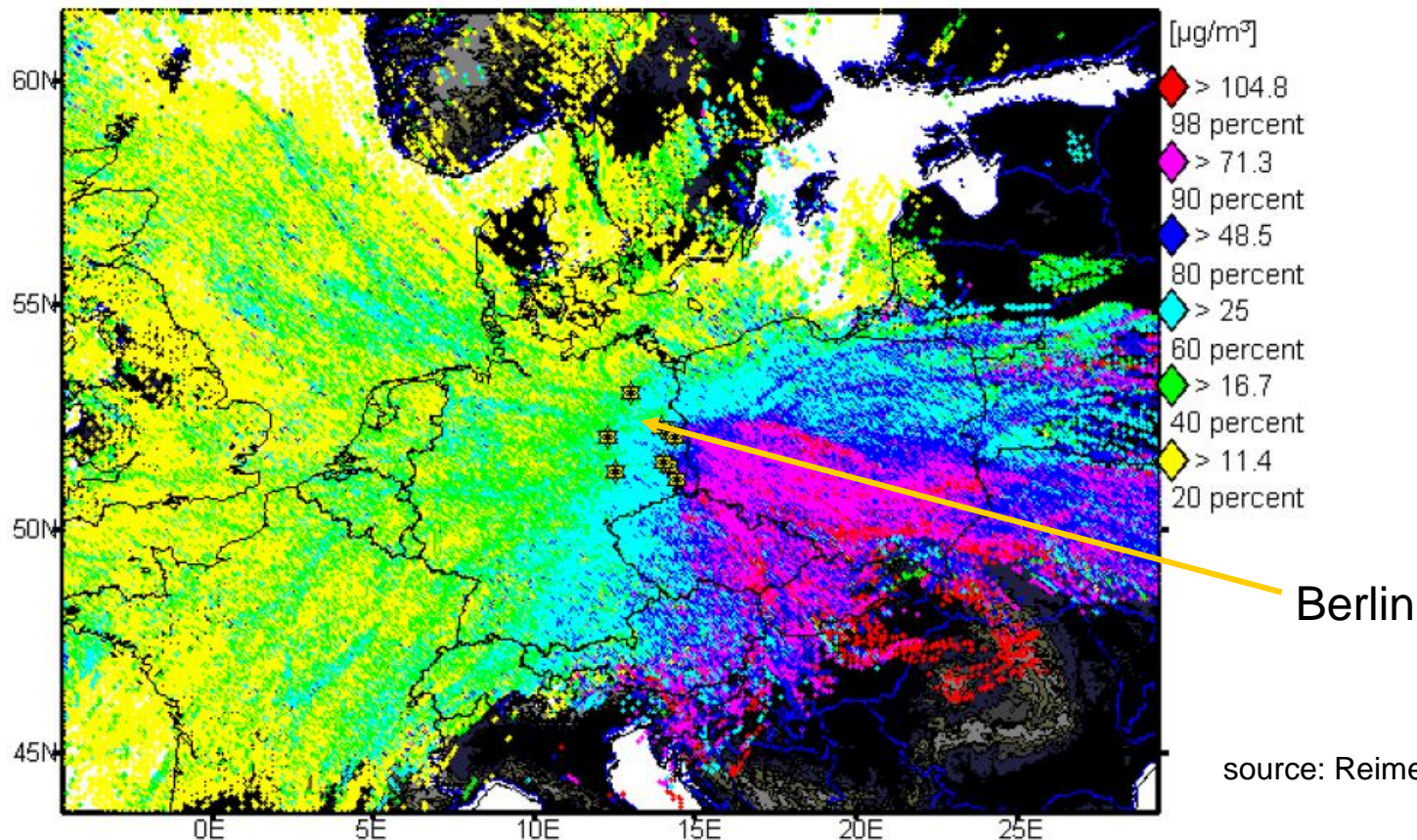
2002



Source analysis Berlin

👉 **spatial** origin of PM₁₀ in NE Germany

Result of a 2010 **statistics** of **backward trajectories** arriving at monitoring sites in Brandenburg



source: Reimer, Pfäfflin et. al. 2012

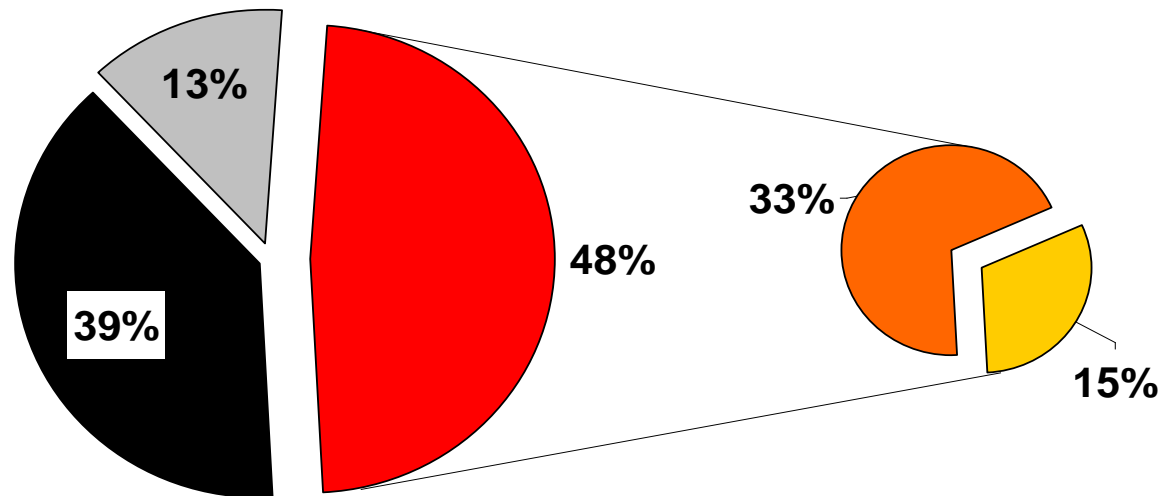
👉 spatial origin of **kerbside** PM10

Result of a **backward trajectory analysis**:

☹️ Still significant **transboundary** transport of **PM10**

👉 after several years of compliance again > 50 excess days in 2010,
but...

reason for excess days > 50 $\mu\text{g}/\text{m}^3$ PM10
at traffic sites in Berlin in **2010**



👉 **Berlin's** homemade contribution to PM excess days has **shrunk by 1/3** since 2006

👉 **almost 50% of excess days** in Berlin in 2010 are **due to cross-border PM-transport**

■ predominantly local or domestic

■ mix of local & LRT

■ predominantly crossborder LRT* from PL

■ predominantly crossborder LRT* also from CZ

Senatsverwaltung für Stadtentwicklung und Umwelt | Abteilung IX Umweltpolitik

need for action

■ **Drivers:**

 **air quality** standards for fine particles (PM10) and nitrogen dioxide (NO2) still exceeded

 need for city strategy to reduce air pollution

 obligation for **noise** actions planning

 Berlin's target levels: 70 dB(A) day/60 dB(A) night

 long-term goal: 65 dB(A) day/55 dB(A) night

 ambitious goals to curb **greenhouse gas** emissions

 -40% CO2 emissions by 2020 compared to 1990

 control soot particle emissions as a driver for climate change

■ **Focus on road transport:**

 road traffic is **main contributor** to PM10 and NO2

 transport is the only sector with **rising** CO2 emissions

 +7% from transport since 1990, -10 to -40% other sectors

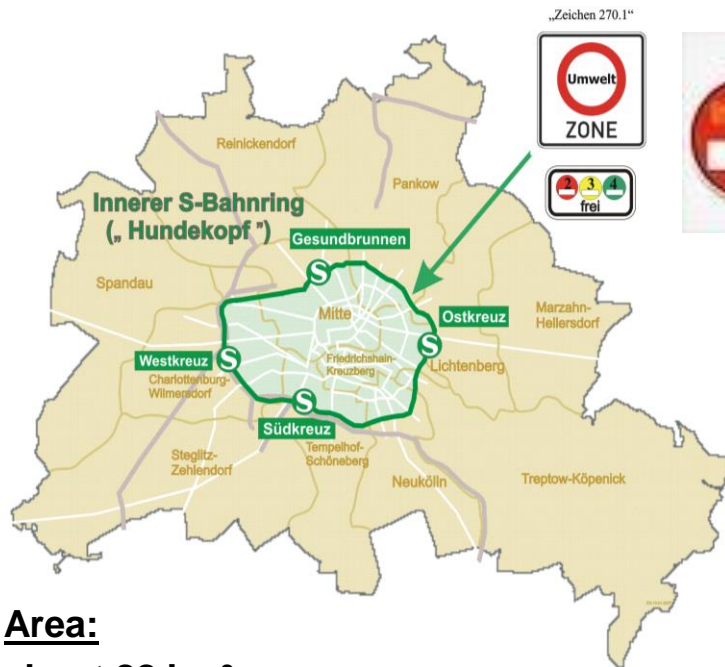
 urban noise pollution is **mainly** generated by road traffic

 **need for action to make road transport more sustainable**

Berlin's AQ management

☞ Key measure: The **Low Emission Zone (LEZ)**....

... a selective traffic ban for high polluting vehicles



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 **Euro1**

☞ affected **7%** of the vehicle fleet

■ 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}

☞ affected **10%** of the vehicle fleet

By now...

☞ Up to **3 times** more “**green**” vehicles

☞ More than **60.000 filter** retrofits
(up to **25%** of the **Diesel vehicle fleet**)

☞ LEZ in force in almost 60 German towns

Low Emission Zones in Europe

LEZ found in:

- Sweden: 5
- Denmark: 5
- UK: 2
- Germany: 60
- Greece: 1
- Czech: 1
- Austria: 2
- Italy: 7 regions, 12 towns
- Netherlands: 17
- Hungary: 1 planned

More information:

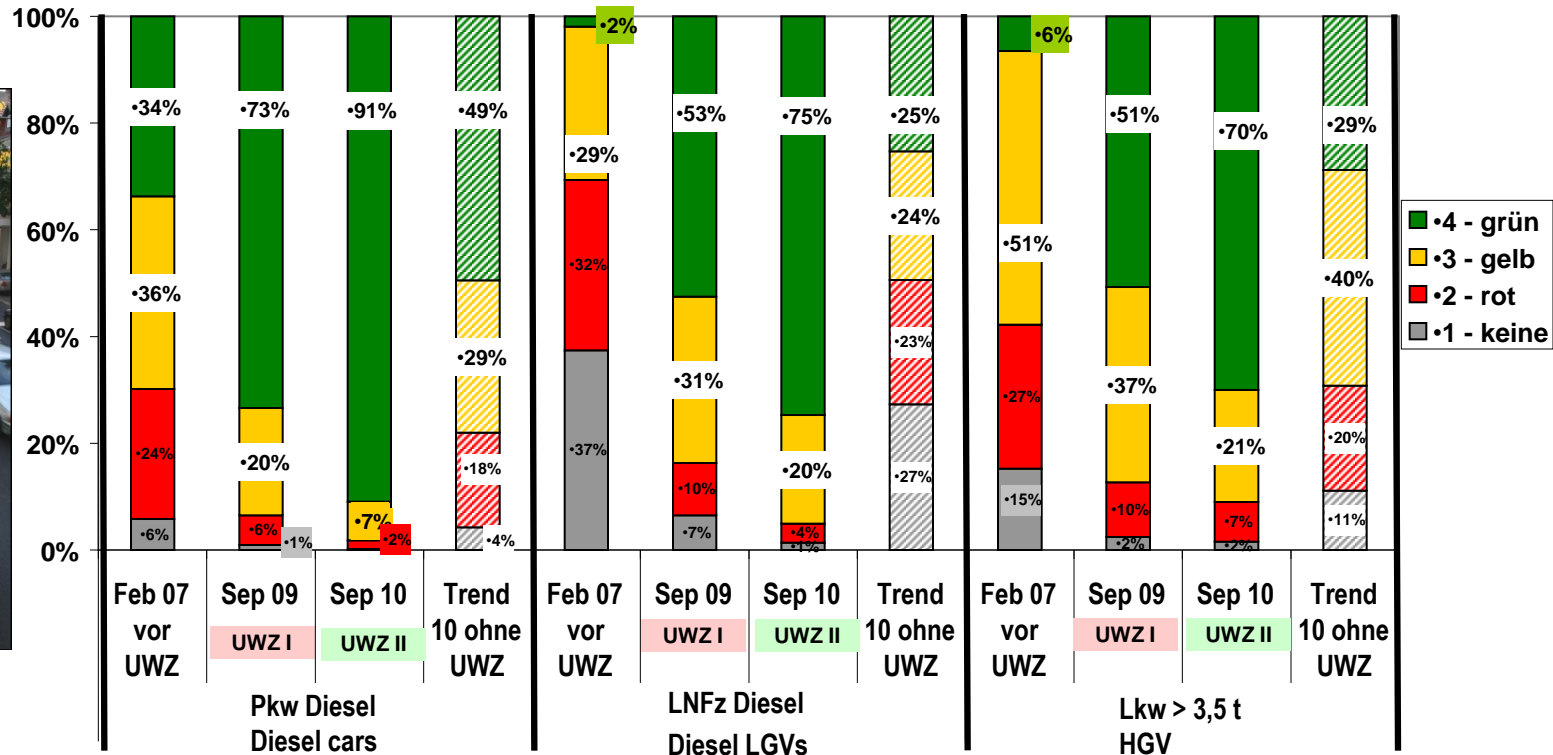
Low Emission Zone in Europe Network
(LEEZEN):

www.lowemissionzones.eu



👉 vehicle fleet composition

change of the vehicle fleet composition on the road (from number plate recognition Frankfurter Allee)



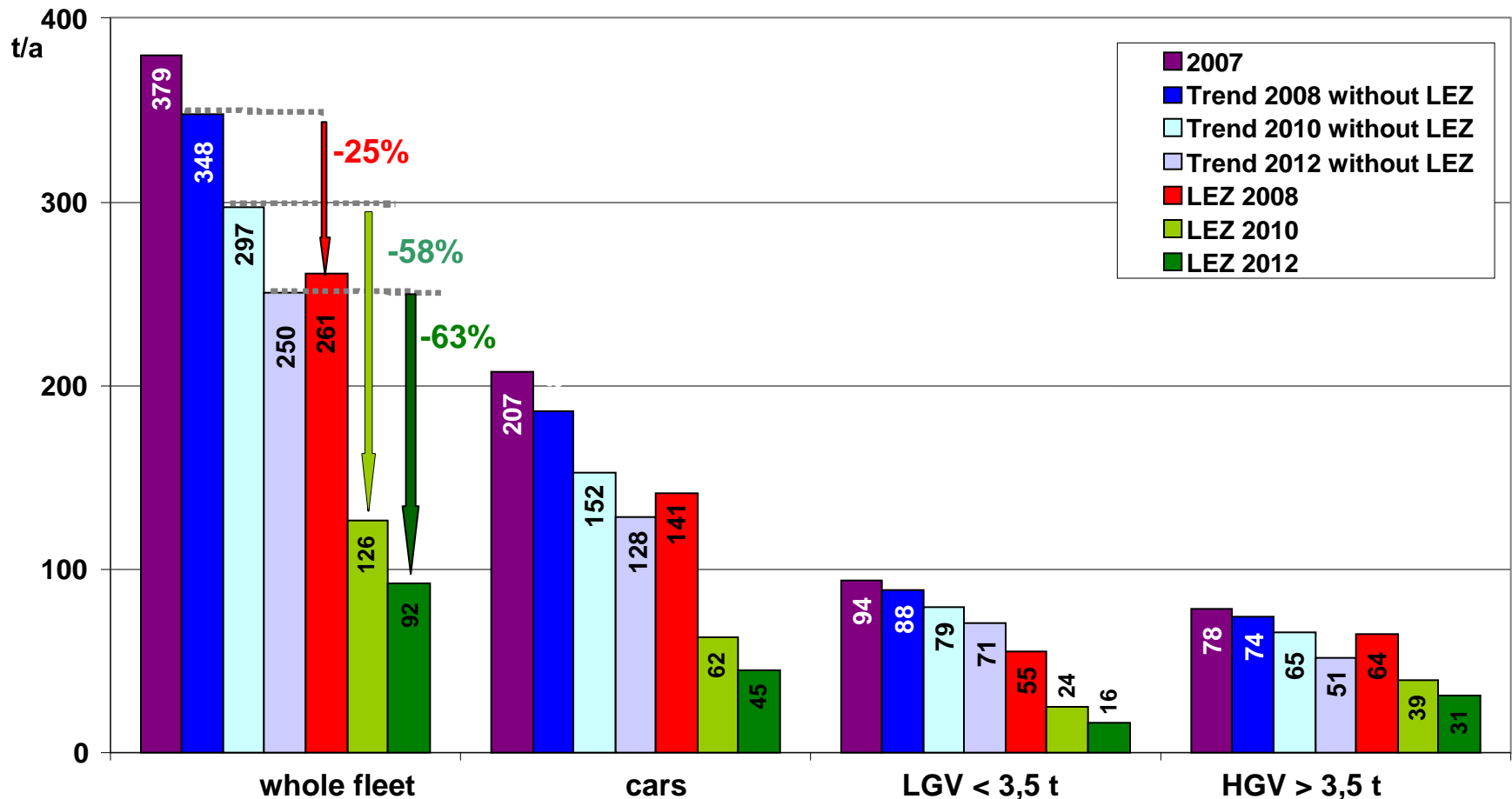
decrease: cat.1 (no sticker) by 70-90 %; Cat 2 (red) by 50-80 %
increase: category 4 (green) by factor 1,5 to 3

Berlin LEZ – impact analysis

👉 Emissions of PM

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

based on fleet composition at a busy main road (new emission factor data base HBEFa 3.1)

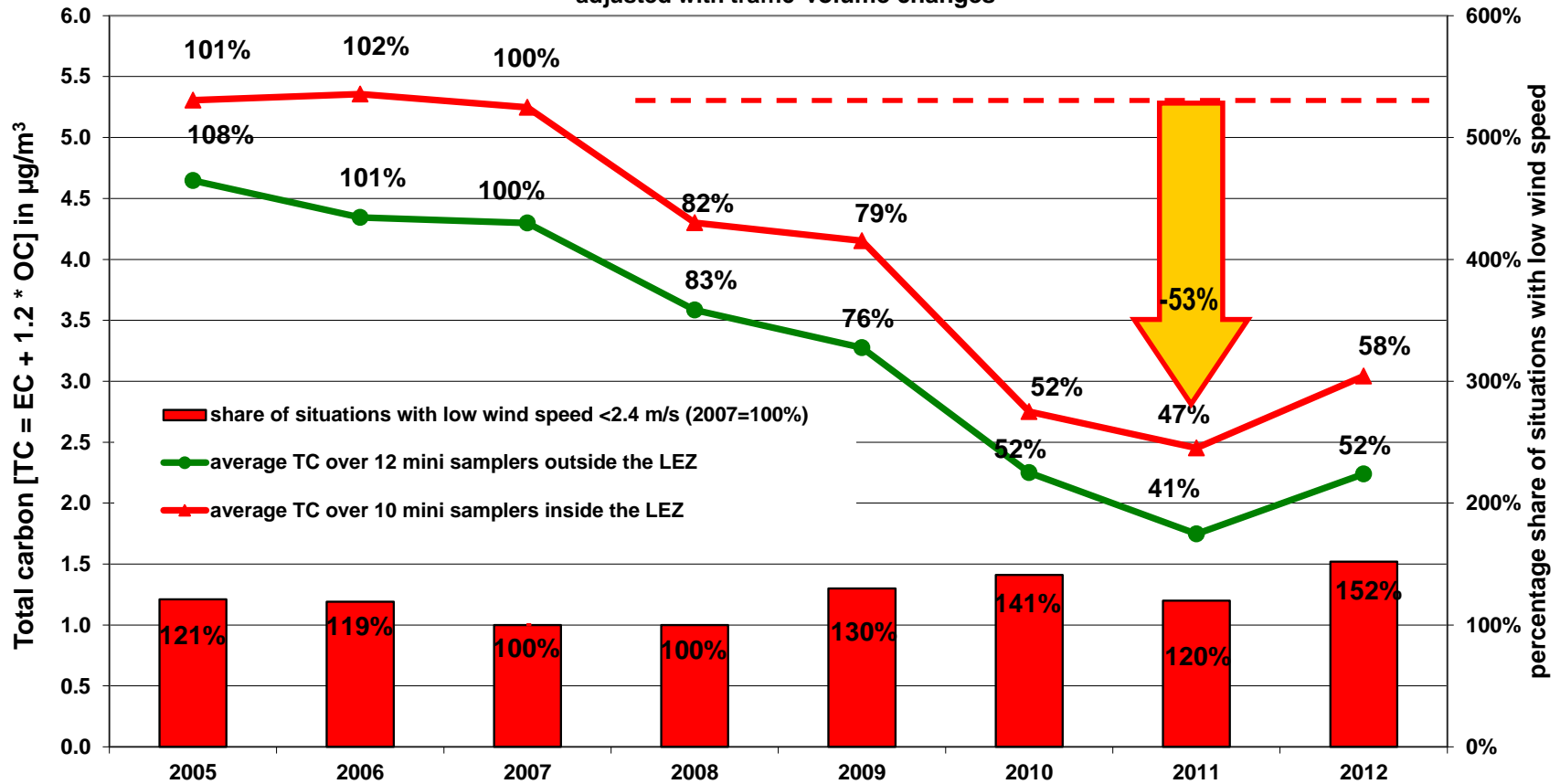


Berlin LEZ – impact analysis

➡ trend of **total carbon** levels from **traffic**

traffic related* total carbon particle concentration in Berlin

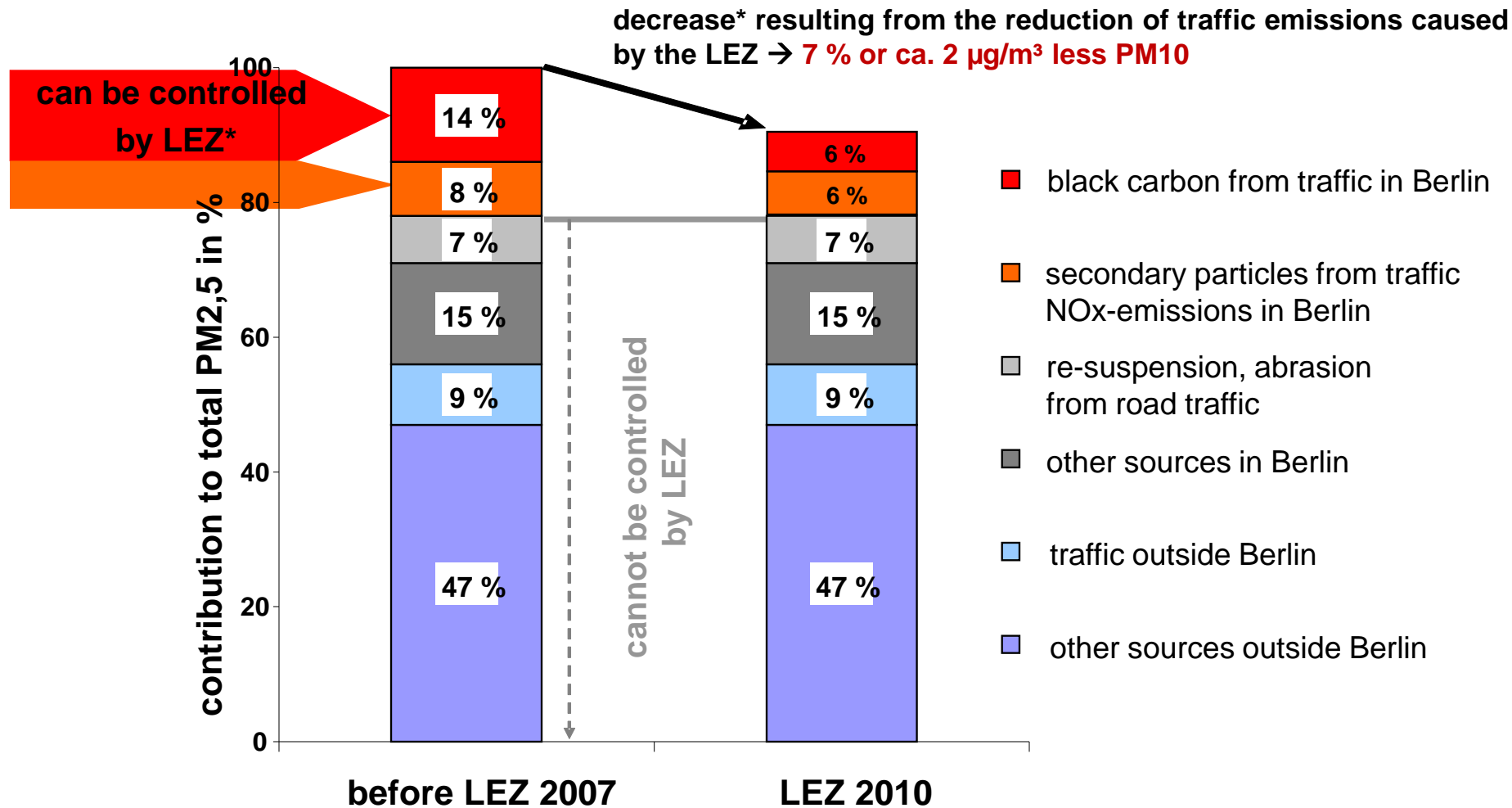
adjusted with traffic volume changes



*traffic increment based on the difference between kerbside stations and urban background sites

Exploiting clean technologies & fuels

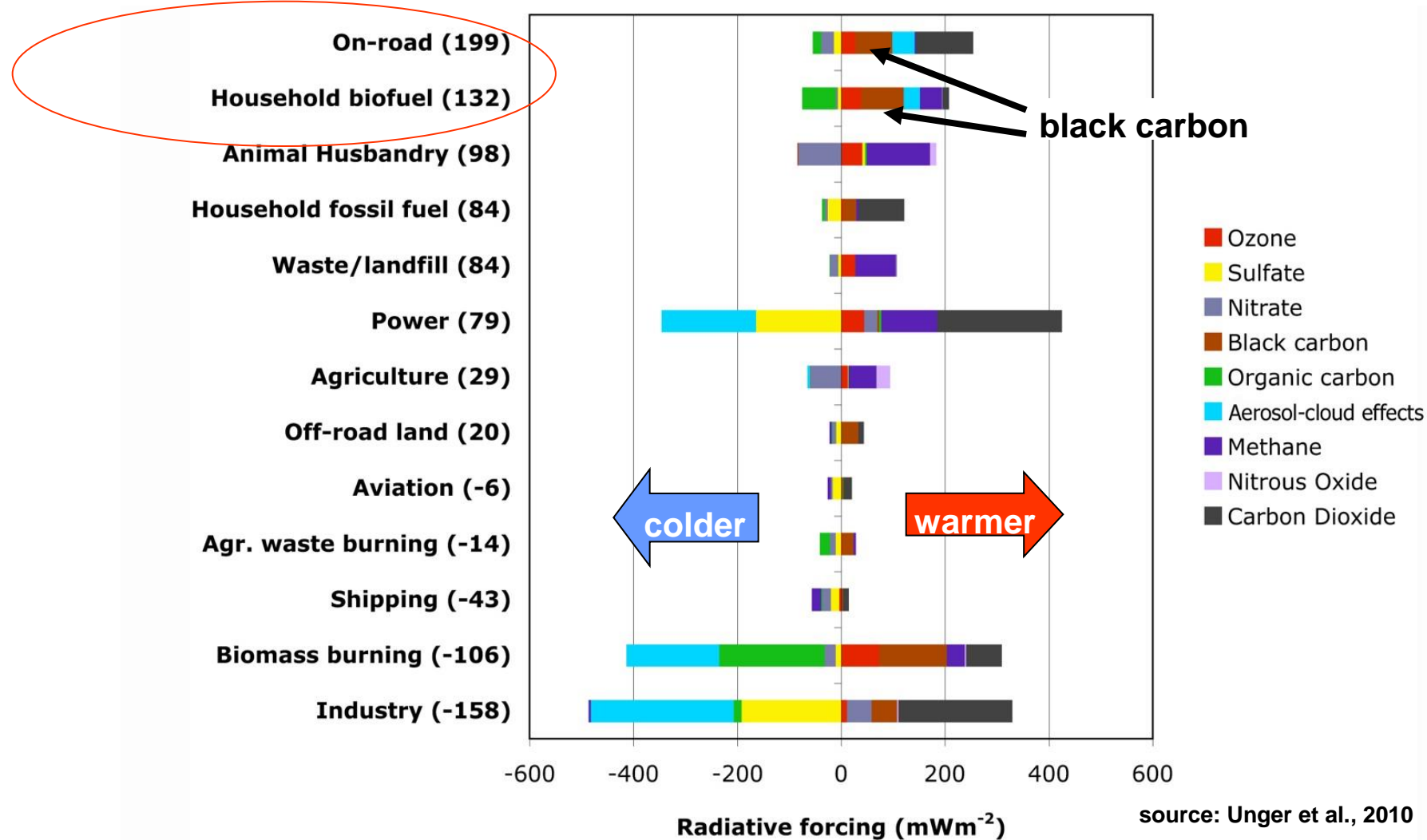
☞ Berlin's LEZ impact on total PM concentrations....



* related to PM_{2,5}-levels in a busy main road in Berlin's city centre in 2007 before the LEZ

👉 benefit for climate change

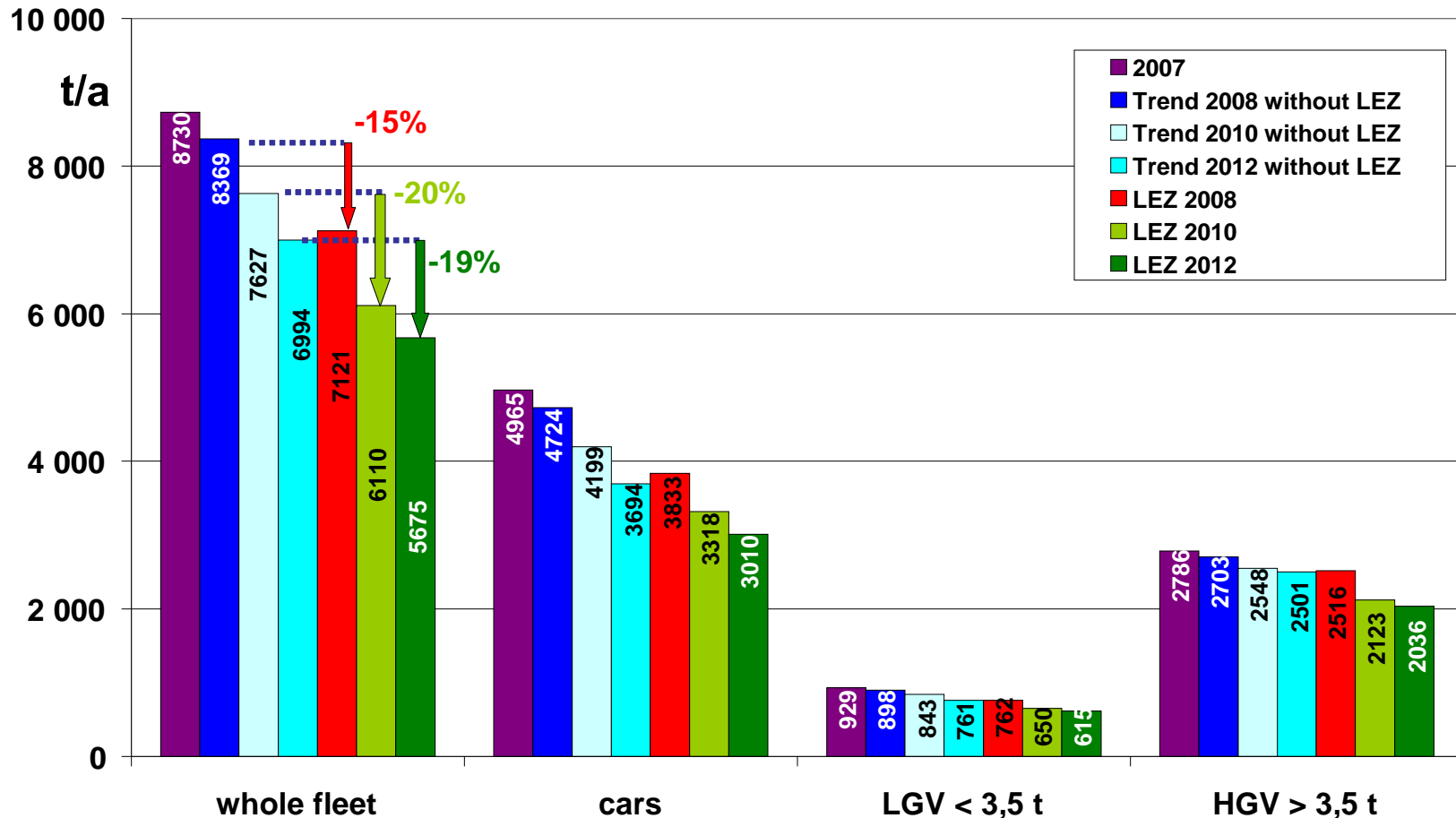
radiative climate forcing per sector



Berlin LEZ – impact analysis

👉 NOx 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 (with DPF-retrofit, only warm emissions, no cold start impact)

☞ **summary** of impact analysis

■ **no visible shift** of **traffic** into surrounding areas

☞ provided that LEZ covers sufficiently large parts of a city

■ **significant modernisation of the vehicle fleet:**

☞ **Increase** of category 4 (green) vehicle by **factor 1.5 to 3**

☞ more than **60.000 vehicles retrofitted** with DPF

■ **decrease** of traffic **emissions** on top of trend :

☞ - 60% exhaust particles, -20% NOx

☞ - **175 t/a** in total Diesel emissions from road traffic

☞ - **30 t/a** diesel emissions of **heavy goods** vehicles > 3.5t

■ LEZ is **effective**, if

☞ based on **ambitious** emission criteria

☞ covering a **larger** area

☞ introduced **not** too late

☞ exemptions are **limited**



☞ **now!**

■ **potential benefit** for the **air quality**

☞ **5-10% reduction** of total **PM10/2.5**

☞ traffic related decrease of **black carbon** ~50%

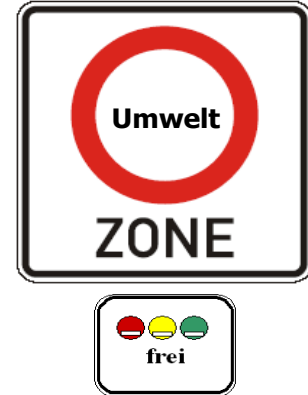
☞ ~**10** less excess **days** > 50 µg/m³ PM10

☞ smaller progress for NO2: **<5%**

■ **Reduces the most toxic PM component & mitigates CC impact**



„Zeichen 270.1



■ Objective:

-  faster modernisation of vehicle fleet


■ Criteria: When should a LEZ be considered?

- ☑ high contribution of urban **traffic-related** air pollutants
- ☑ air quality limit values exceeded in many urban **streets**
- ☑ **low** proportion of **through** traffic or no alternative routes
- ☑ **High** share of **Diesel** vehicles

■ Advantages:

- 😊 aims specifically at the highest emitting vehicles
- 😊 **rewards** vehicle owners who invested in **clean** vehicles
- 😊 reduces the emission of the overall vehicle fleet all over the LEZ → decrease in all streets → decrease of urban background concentrations → **decreasing** urban **population exposure**

■ Disadvantages:

- ☹ financial **burden** for owners of high emitting vehicles
 -  in particular for small business
- ☹ in Germany: every car owner has to buy a sticker to facilitate control
- ☹ considerable **administrative** effort, e.g. for granting single exemptions

LEZ what's needed

implementing an LEZ: lots of tasks - many stakeholders

tasks

- basic planning process
- delimitation, monitoring – deployment of traffic signs
- vehicle identification/labelling – stickers or camera systems
- granting some exemptions
- funding
- surveillance
- communication
- legal action
- evaluation, impact assesement



actors

- pollution control authority
- traffic authority
- local district authorities for traffic
- vehicle registration office
- police
- public order office
- department for the economy
- press/public relations bureau
- public banks, gas supplier (funding of clean vehicles/fuels)
- vehicle inspection agencies
- chamber for industry and commerce, haulier organisation, other lobby groups, NGOs

- ☑ (national) **vehicle classification** scheme (& stickers) in force in time
 - ☞ compatible with existing schemes as much as possible
- ☑ technical **criteria for retrofit** systems to be set early
 - ☞ UN-ECE REC regulation will ensure cross-border compatibility in the future
- ☑ sufficient **market coverage** for retrofit kits, in particular for commercial vehicles
 - ☞ exists by now
- ☑ **economic incentives**
 - ☞ tax discounts, funding for cleaner/retrofitted vehicles (with particle trap, CNG)
- ☑ sufficiently long **transition period**
 - ☞ At least one year
- ☑ **few exemptions** from traffic ban
 - ☞ In Berlin less than 10% of vehicles affected from the access restriction
- ☑ intensive public **information**
- ☑ effective **enforcement & sanctions**
 - ☞ In Germany 80€ (☞ should be higher in practice)

New air quality plan 2011-17

☞ Stipulated type of measures

■ Regional-, urban- and landscape planning

■ Traffic on road, rail and inland waterways

- ☞ Vehicle technology
- ☞ Traffic management
- ☞ Avoiding & shifting traffic to more sustainable transport modes
- ☞ Transport infrastructure improvement

■ Domestic heating

- ☞ study on PM contribution from wood combustion
- ☞ potentially regulate small combustion sector

■ Construction sector

- ☞ DPF for construction machinery

■ Industry und commerce

■ Measures **not** pursued

- ☞ no tightening/extending of the LEZ
 - ☞ But exemptions will largely end in 2015
- ☞ no road pricing/city toll/congestion charge
 - ☞ lacking legal ground
 - ☞ might generate traffic or push it in city areas without road pricing

New air quality plan 2011-17

☞ Clean **vehicle technology & fuels**

■ Funding and benefits for Euro 6/VI vehicles

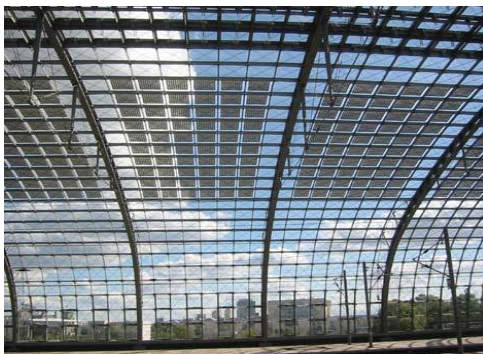
- ☞ Vehicle tax discount, labelling
- ☞ national government
- ☞ reduced parking fees

■ Promoting natural gas for vehicles and domestic use

- ☞ Programme for gas taxis & garbage collection vehicles

■ Promoting electro mobility

- ☞ The Berlin Capital Region as one of 4 national **showcases** for **electromobility**
 - ☞ Focus on practical implementation of electromobility in concert with intelligent energy and transportation concepts
 - ☞ 74 projects will be implemented
- ☞ Underpinned by Berlin's Energy Strategy aimed at boosting **renewable power production**



PV panels on roof of Berlin's new main railway station



Berlin eTukTuks at the Brandenburg Gate

👉 **Emphasis on Diesel exhaust control**

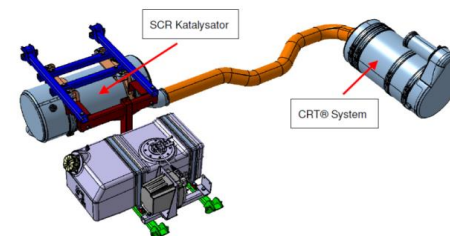
■ since 1999: filter retrofit & fleet modernisation programme of Berlin's 1400 Diesel buses, resulted in

- ↪ **> 90% reduction** of Diesel soot emissions
- ↪ **- 37 t/a Diesel** soot emissions
 - 👉 1/4 of the mitigation effect of the LEZ
- ↪ **- 732 t/a NOx** emissions
 - 👉 1/2 of the mitigation effect of the LEZ



■ Now: setting criteria for public bus services

- ↪ attainment of **Euro 5/EEV-standard** for NOx in the **whole fleet** by 2014
 - 👉 300 t/a less NOx emissions
- ↪ **SCR – retrofit of 200 Euro IV busses by 2015**
 - 👉 50% funding through EU regional funds
- ↪ **Upgrade of OEM Euro V/EEV buses to enhance SCR performance**
 - 👉 Better **insulation** of tailpipe & extra **heating** to ensure operation of SCR during **urban driving mode**
- ↪ **Accelerated replacement by Euro-VI/CNG/biogas-vehicles**
 - 👉 Procurement condition: **E VI performance required** in urban driving conditions



SCRT® Anordnung für SOLARIS Urbino 18 (Quelle: HJS)

■ Successful pilot project on **DPF retrofit** of passenger **cruising vessels**

- ↪ retrofit of 3 vessels with different filter systems:
 - 👉 >90% filter efficiency, **no** extra fuel consumption
 - 👉 **successful** filter regeneration also in difficult **operation conditions**
- ↪ **Retrofit programme** funded through EU regional funds



New air quality plan 2011-17

☞ Emphasis on Diesel exhaust control of mobile machinery

■ Reason for action

- ☞ Machines release **5-10 time more Diesel – PM** than comparable Diesel trucks
 - ☹ **NRMM** emission standards **lag 5 years behind** road vehicle standards
 - ☹ Even latest standard tier IIIB does **not require** efficient **DPF**
- ☞ cost-efficient **solution** exists for older machinery by **retrofit** of closed/regulated **DPF**
 - vast experience in Switzerland, cost/benefit ratio >> 3:1
- ☞ Diesel soot is a **health** and safety issue **at work places**

■ Implementation in Berlin:

- ☞ **Demonstration project with DPF retrofit**
 - ☞ retrofit is **technically & economically feasible** for different machines and **operation modes**
 - ☞ **Setting environment standards** in public **tenders** for construction services as **from 2014**:
 - ☞ machinery need to meet the **latest EU particle emission standard** (IIIB/IIIA depending on the size of equipment), or
 - ☞ **retrofit** with an efficient **regulated/closed Diesel particle filter**, **type-approved** with reference to new UN-ECE REC-regulation
 - ☞ **Setting similar criteria** in **permits** granted to operators of large construction sites
- ### ■ impact: in Berlin about **60-100 t/a reduction of Diesel soot emissions**
- ! this is of the **same** magnitude as the benefit of the **low emission zone**
 - ! Problem: **missing** incentives to invest in NRMM **with DPF**



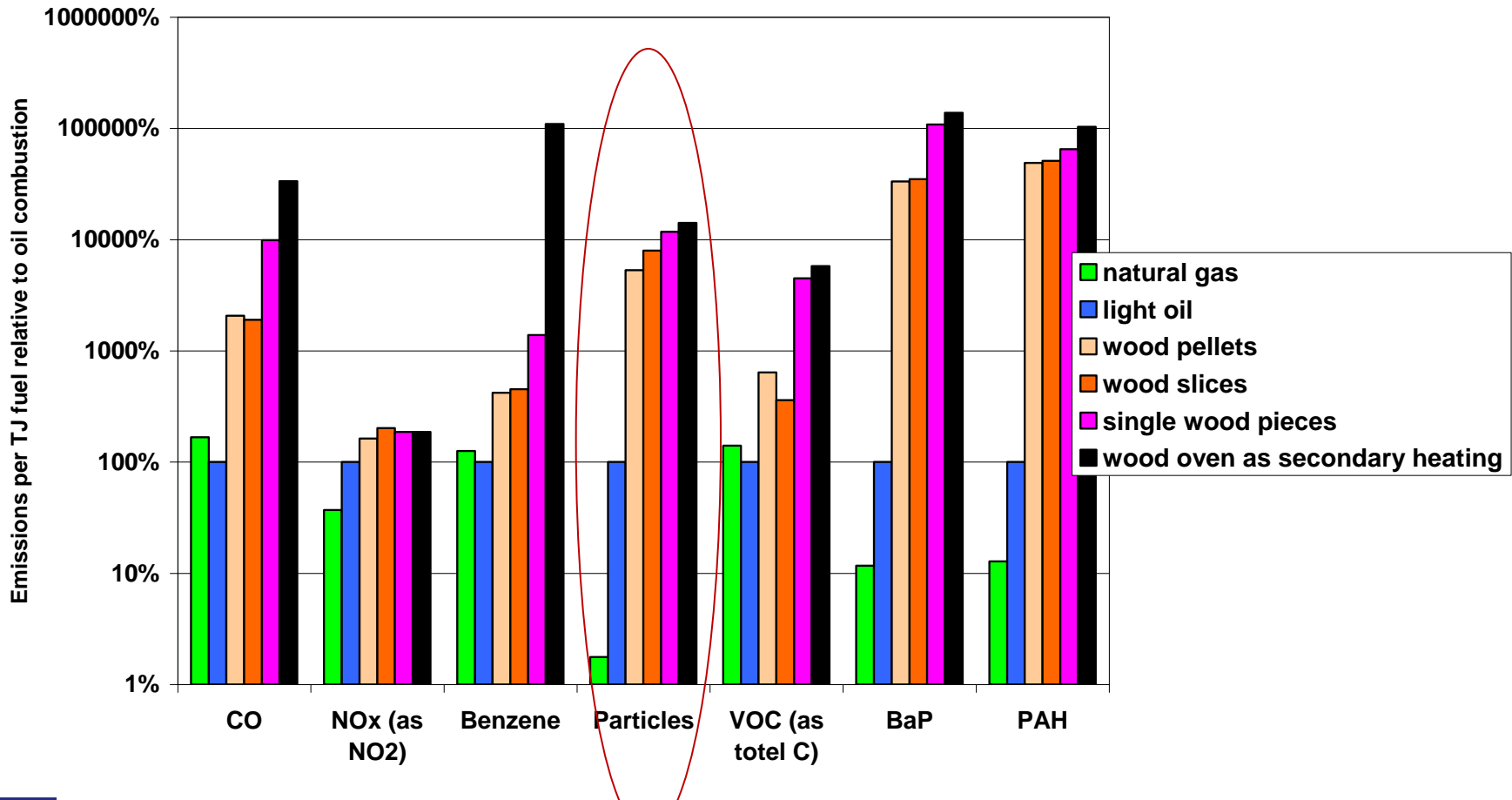
small combustion plants

👉 fuel dependant emissions

Emissions of small combustion units depending on fuel use

100% = oil combustion

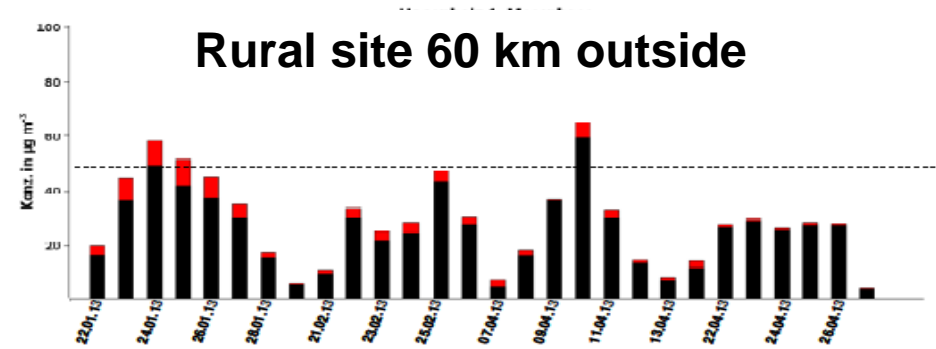
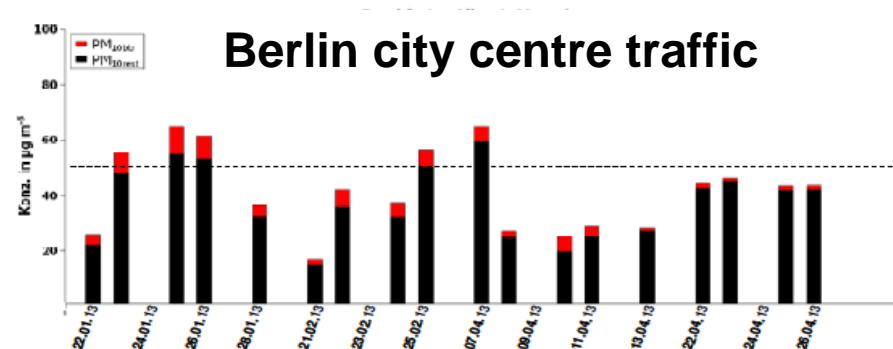
source: UBA-Forschungsbericht 2009



New quality plan 2011-17

☞ Focus on **house heating**

- We undertake extra **source analysis**
- We'll consider setting **stricter standards than the national regulation** for solid fuel combustion with single units
- We might **expand existing restriction** in central Berlin to set up new small heating systems based on solid fuel
- assumption for impact analysis until **2015**:
 - ☞ replacement by **particle free/reduced** heating technology (natural gas/district heating)
 - ☞ **reduction** of PM emissions of house heating **by 60%**



 PM10 from wood burning

☞ Needs joint regulation with region surrounding Berlin

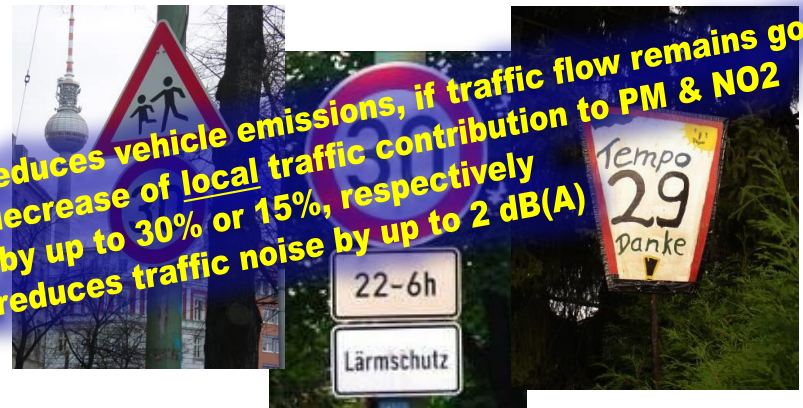
☞ traffic management measures

■ Re-routine lorry traffic



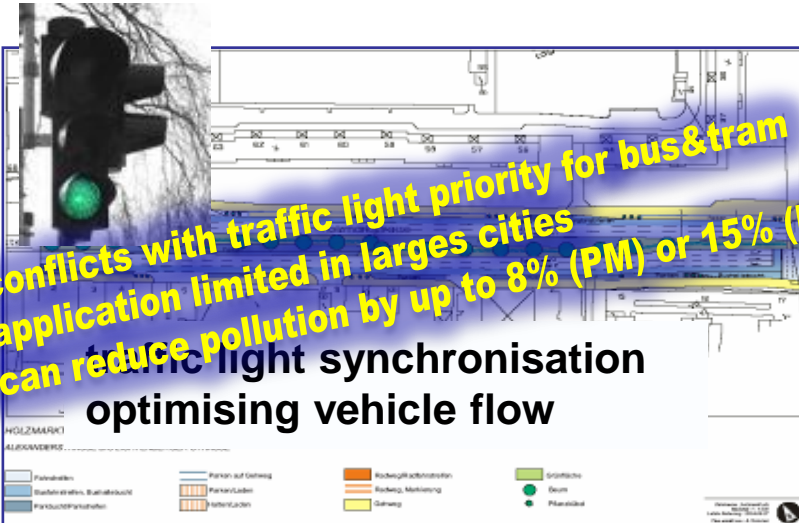
- Reduces PM pollution by 7-9%
- needs alternative lorry routes
- Application limited in large cities

■ City-compatible speed limits



- reduces vehicle emissions, if traffic flow remains good
- decrease of local traffic contribution to PM & NO₂ by up to 30% or 15%, respectively
- reduces traffic noise by up to 2 dB(A)

■ Traffic flow optimisation



- conflicts with traffic light priority for bus & tram
 - application limited in large cities
 - can reduce pollution by up to 8% (PM) or 15% (NO₂)
- traffic light synchronisation
optimising vehicle flow

Sustainable City & Transport Planning

👉 Improving public transport



- extra bus lanes
- traffic light priority for bus and tram

• makes public transport more attractive
• avoids car trips in urban areas
• reduces air & noise emissions
• makes transport more energy efficient
• Hence: strongly linked noise action planning, CO and AQ strategies



- Building the new Main Circle
- Enhancing Berlin's connectivity
- Making railway more attractive

Closing gaps in the metro network



Expanding the tram network into East Berlin



Closing gaps in the light-train network

Sustainable City & Transport Planning

☞ Enhancing inter-modality

■ For freight transport...

■ Bike & Ride



- makes PT & cycling more attractive
- shifts car traffic to cleaner modes



- makes rail-road more attractive
- keeps lorries out of sensitive urban areas
- Reduces noise and air pollution
- makes freight transport more energy efficient



■ Park (& Charge) & Ride

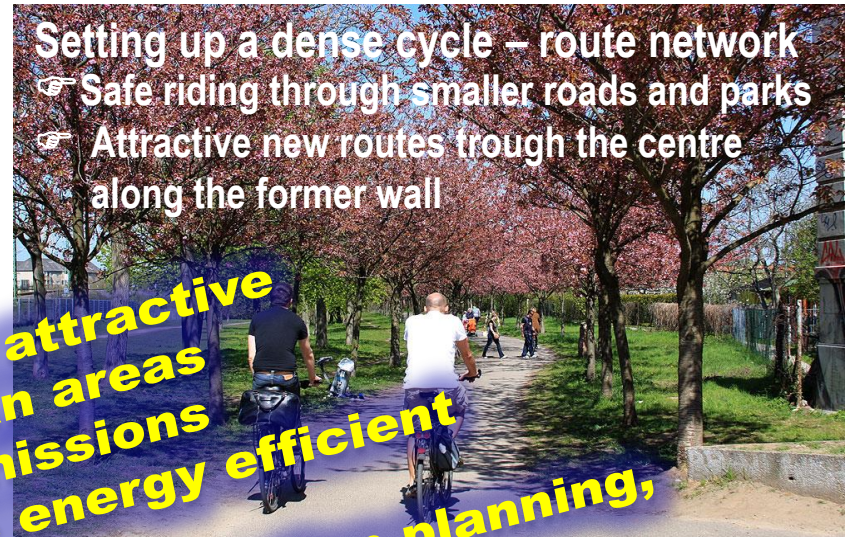
- ☞ incl. priority for electric vehicles



- makes PT more attractive
- reduces car trips in the city
- incentives electric vehicles

Sustainable City & Transport Planning

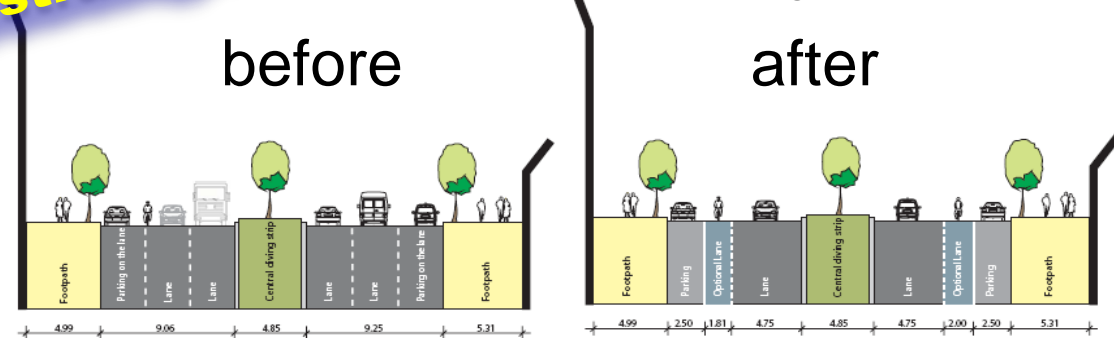
👉 **promoting bicycle use**



makes bicycle use more attractive
avoids car trips in urban areas
reduces air & noise emissions
makes transport more energy efficient
good for public health
Hence: strongly linked CC and AQ strategies



Re-allocation of road space in favour of cyclists & pedestrians:
 • Safe riding on extra bicycle lanes on the road
 • Reduces noise levels at the building line



Sustainable City & Transport Planning

👉 **promoting walking**

■ **Berlin's pedestrian traffic strategy**

👉 **Some examples...**



New green walks along the former wall



**Redesigning road space along
Boulevards**



**Safer pedestrian crossing at frequented
junctions**

Sustainable City & Transport Planning

👉 Focus on **urban climate adaptation**

Micro-scale: measures for single streets & buildings

- increase albedo of building surfaces
- roof and facade greening
- courtyard greening
- tree planting
- de-sealing of surfaces

Good also for AQ (dust concentrations)















Macro-scale: Largely maintaining open space & green areas so as to keep free flow of fresh and cool air into the city centre



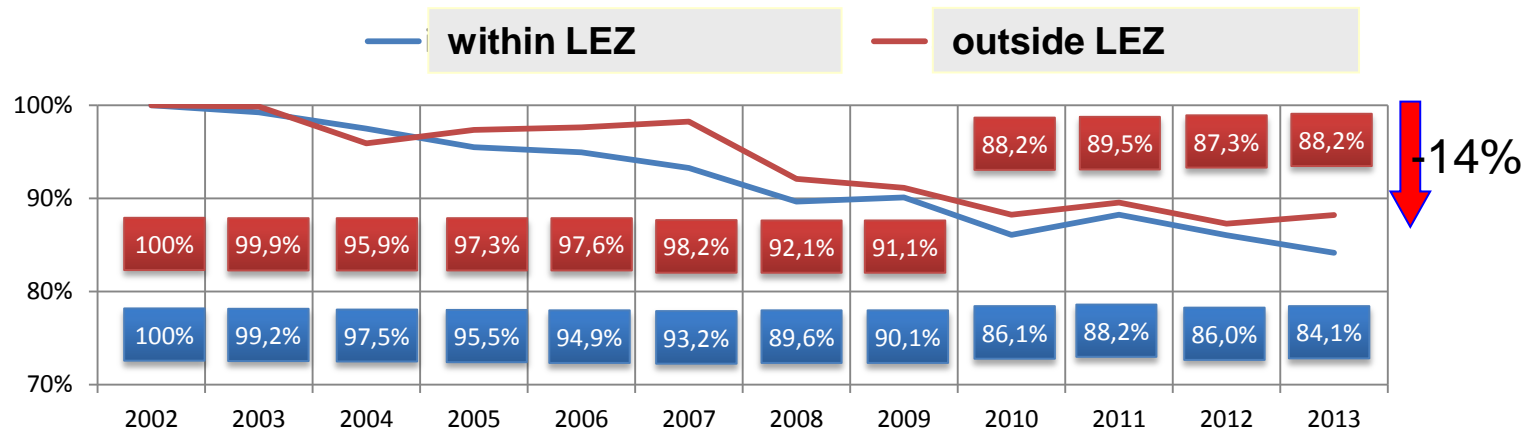
Berlin **noise** action plan

conceptual approach for traffic noise

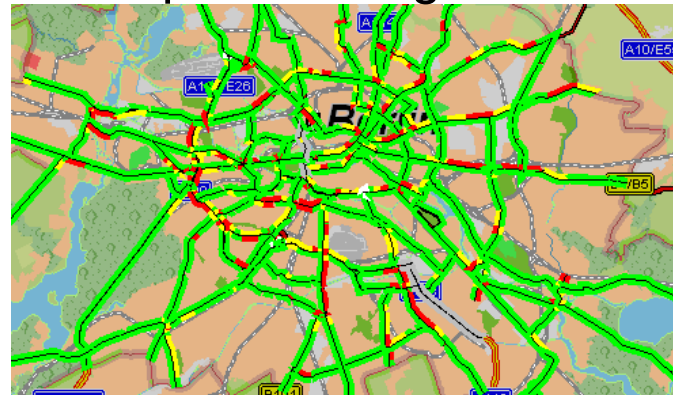
Concept	good for climate	good for air quality
Urban Planning and Development  setting objectives for low-noise city planning	(✓)	(✓)
Traffic Development and Planning  promotion of eco-mobility & clean transport modes  mitigation of source & target traffic, area parking management  mobility management by business  enhancing intermodality, park & ride	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓
Traffic network design and traffic control  re-routing traffic to new or existing roads outside of residential areas  re-routing or ban of commercial traffic		✓ ✓
Traffic management and road space re-allocation  speed limits  improving traffic flows without traffic growth  altering road space design in favour of green transport modes	✓ ✓ ✓	✓ ✓ ✓
Technical noise control measures for vehicles and infrastructure  Renewal of road surface with silent asphalt & silent tracks for trams/trains  noise standards for vehicles		✓ for PM (✓)

👉 **Impact** on traffic volumes & congestion

Less Traffic: trend in traffic volumes 2002-2013 in Berlin (2002 = 100%)



Less congestion: Morning traffic peak during an „normal“ Thursday



(Forecast from 24/02/10 for the 25/02/10)
Quelle: Verkehrsmanagementzentrale Berlin
i.A. der Senatsverwaltung für
Stadtentwicklung. www.vmzberlin.de/vmz

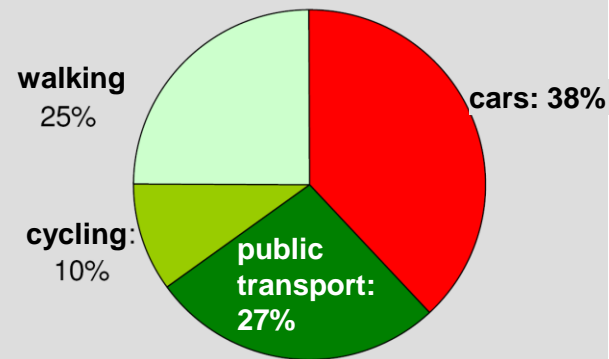
- Traffic Jams
- Disruptions
- No Problems

Sustainable City & Transport Planning

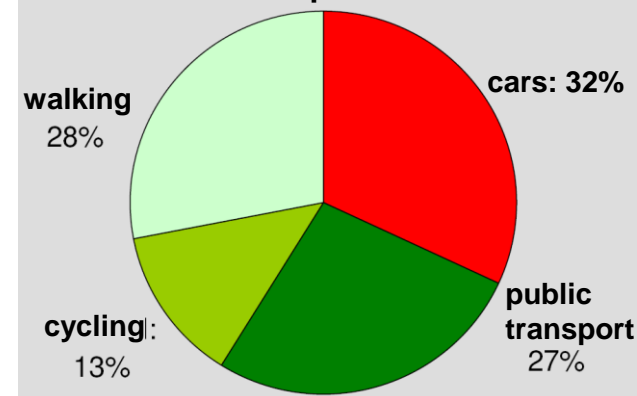
👉 **Impact** on CO₂ – emissions

Shift towards cleaner means of transport

modal split 1998



modal split 2008



source: master plan transport 2011

expected decrease of
CO₂-Emissions from
road transport on
Berlin's main road
network

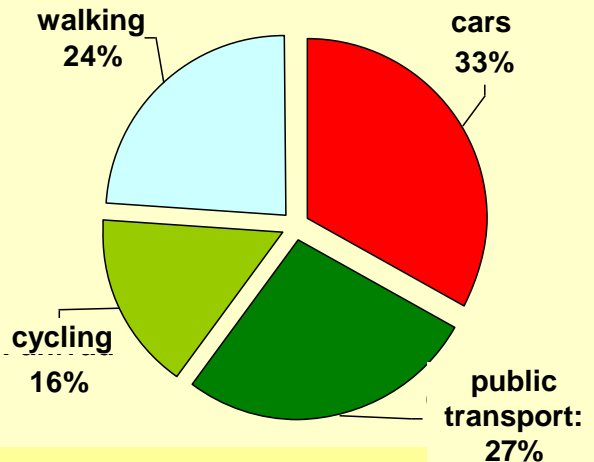
2.6 Mio t CO₂ in 2006

↓ -38%

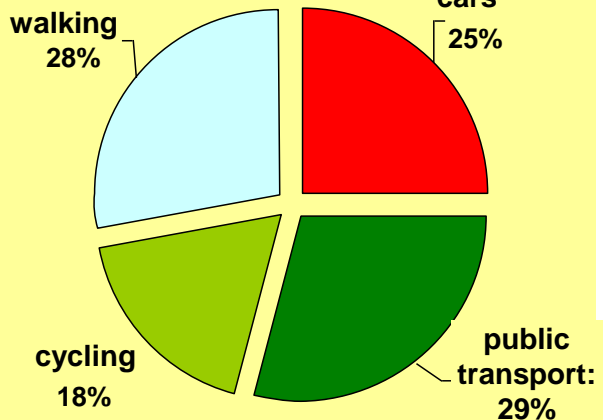
1.6 Mio t CO₂ in 2025

incl. renewal of
vehicle fleet

transport means 2025
trend scenario without extra measures



transport means 2025
objective of the master plan transport



AQ planning

👉 relevance of urban planning processed

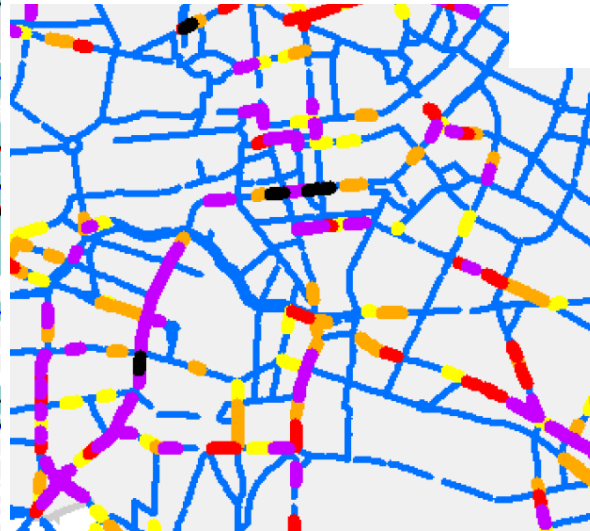
■ exemplary case Leipziger Straße

↘ mitigation trough new road link Axel-Springer Str

change in traffic volume
2009-2015



NO2-pollution 2009



NO2-pollution 2015
implementation of traffic
management & vehicle-
technology measures



! still limit values excess despite LEZ & mitigation by 10.000 less veh/d due to alternative route

! additional traffic load (+3.000 veh/d) due to planned business & shopping centre not yet taken into account

traffic management measures

👉 potential **impact** on **air quality**

■ shift modal split from motor traffic to clean transport modes

⇒ Berlin's planning objective:

-10% less motor **traffic** in 10-15 years
results in up to **-10% NO₂**, **3-4% less of total PM₁₀**

😊 **noise ~0.5dB(A)**

■ 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

😊 **noise ~1 dB(A)**

■ 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

😊 **Noise ~2 dB(A)**

■ speed limit 30km/h whole day:

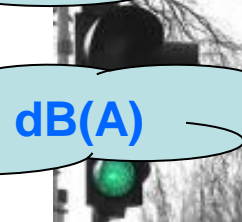
⇒ example Schildhornstraße Berlin: **-10 % of total NO₂**, **-6% of total PM**

if traffic light coordination with 30 km/h works well

speed limit is **enforced**

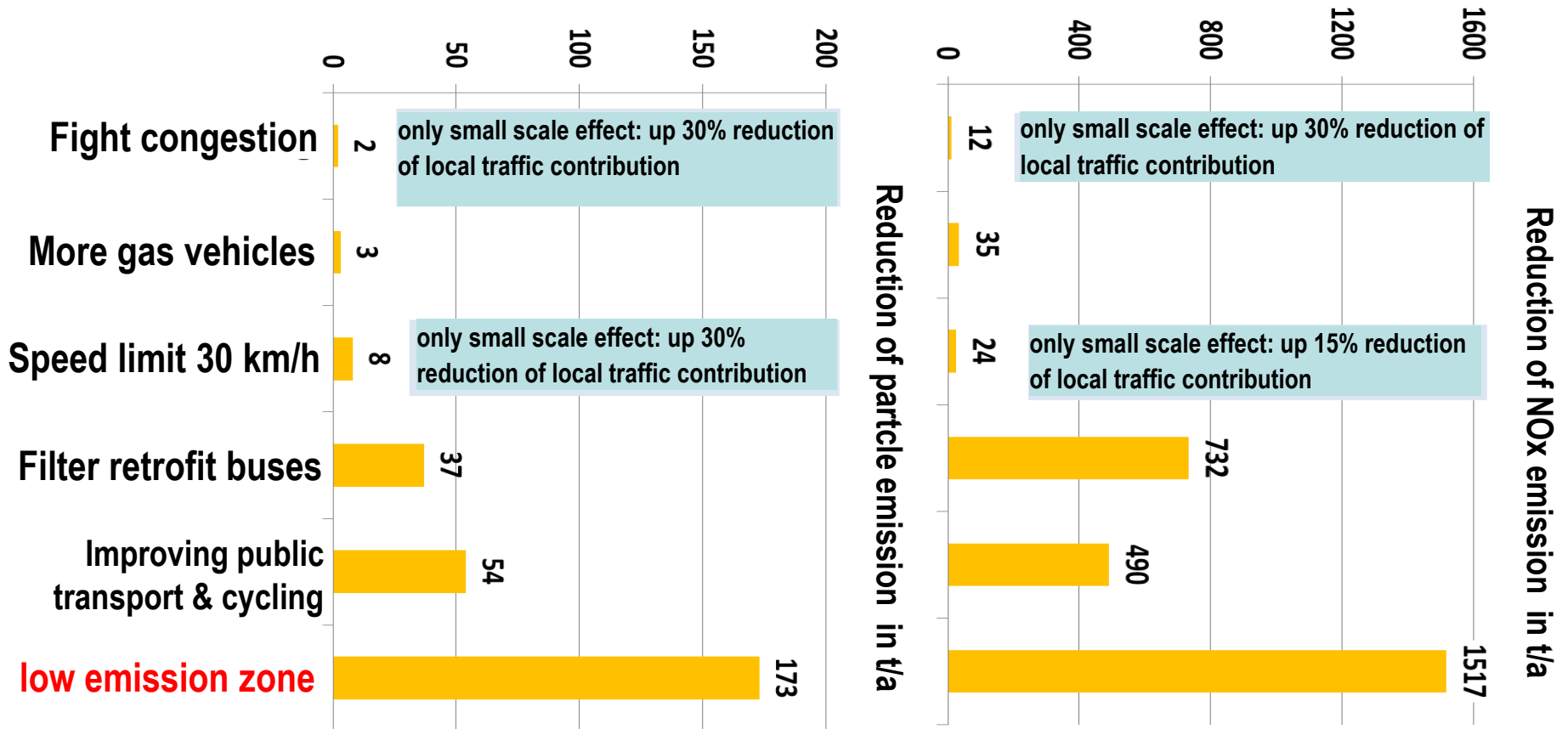
→ also less noise and traffic accidents

😊 **Noise ~2 dB(A)**



Impact of different measures

👉 current emission reduction



Total PM10-Emission in 2005: 3854 t/a

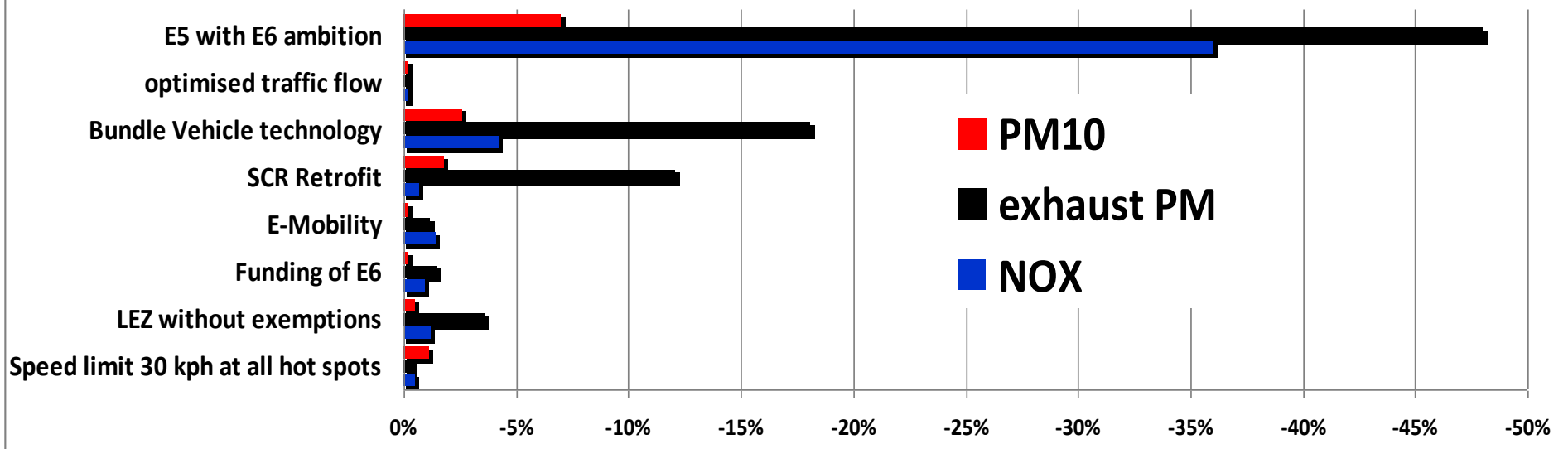
Total NOx-Emission in 2005: 20292 t/a

New air quality plan Berlin

👉 **impact** of extra measures **by 2015**

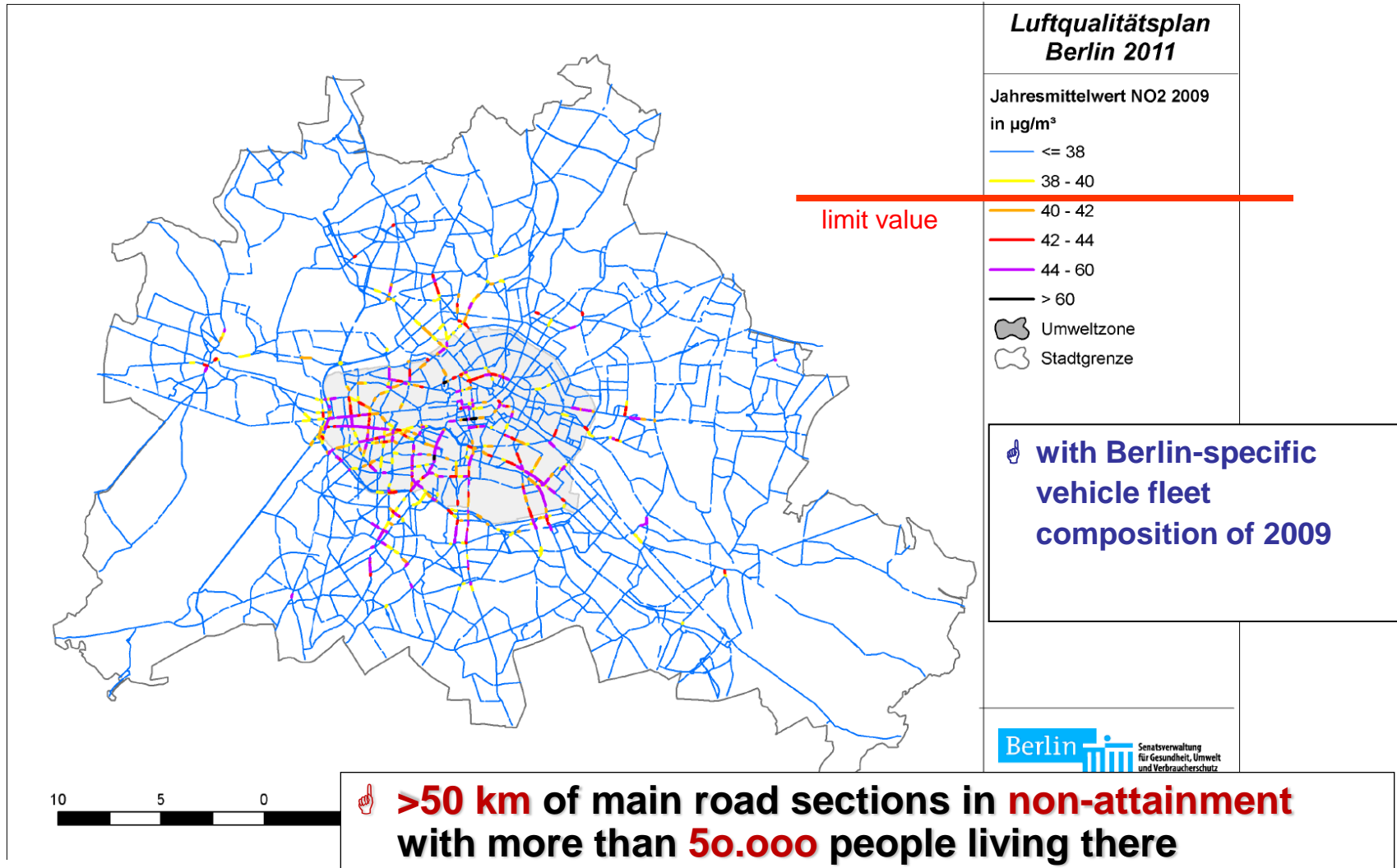
■ Impact of different bundles of measures **on emissions**

Impact of various measures on vehicle emissions relativ to the trend scenario 2015



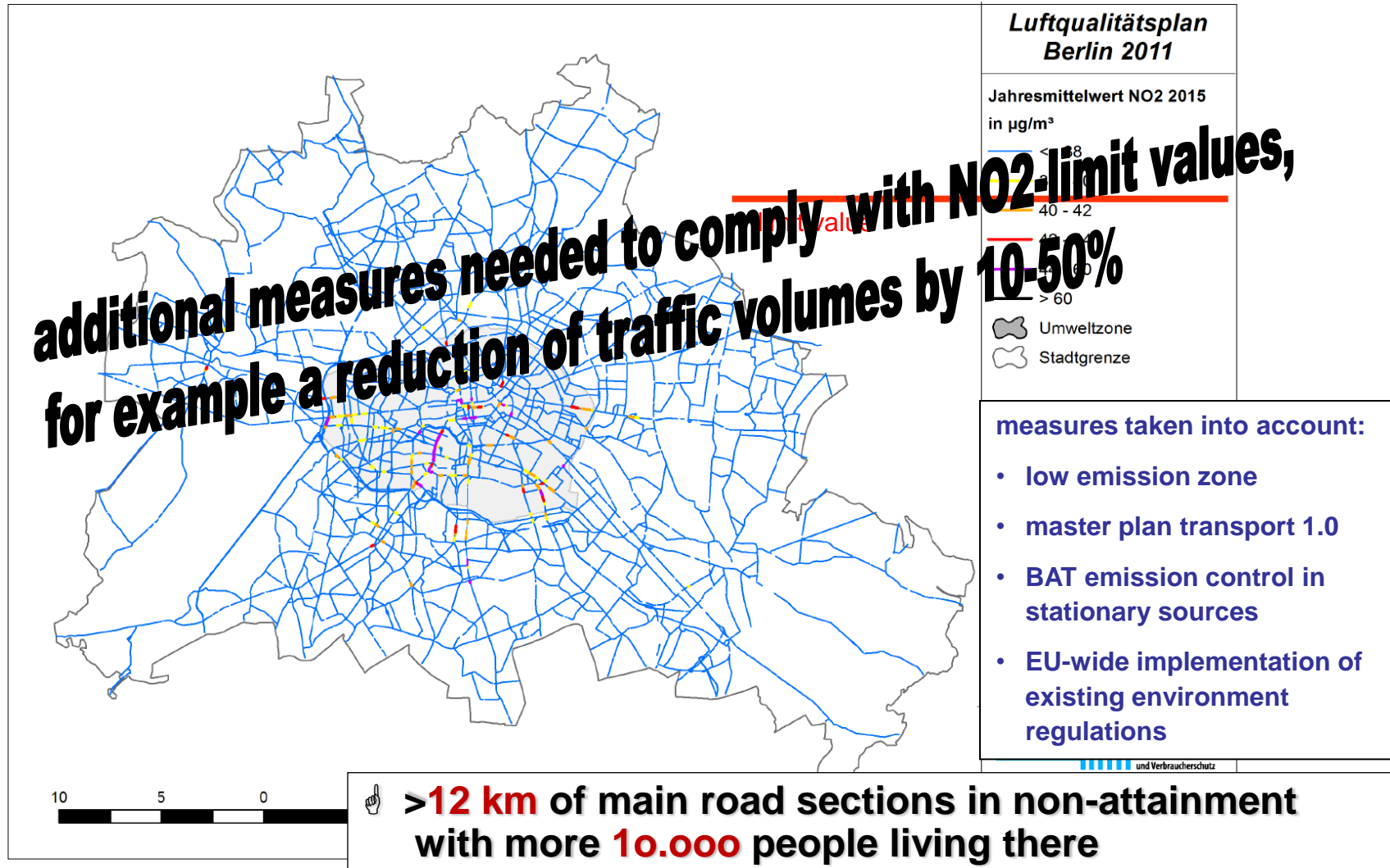
New air quality plan 2011-17

👉 simulated **NO₂** - pollution **2009**



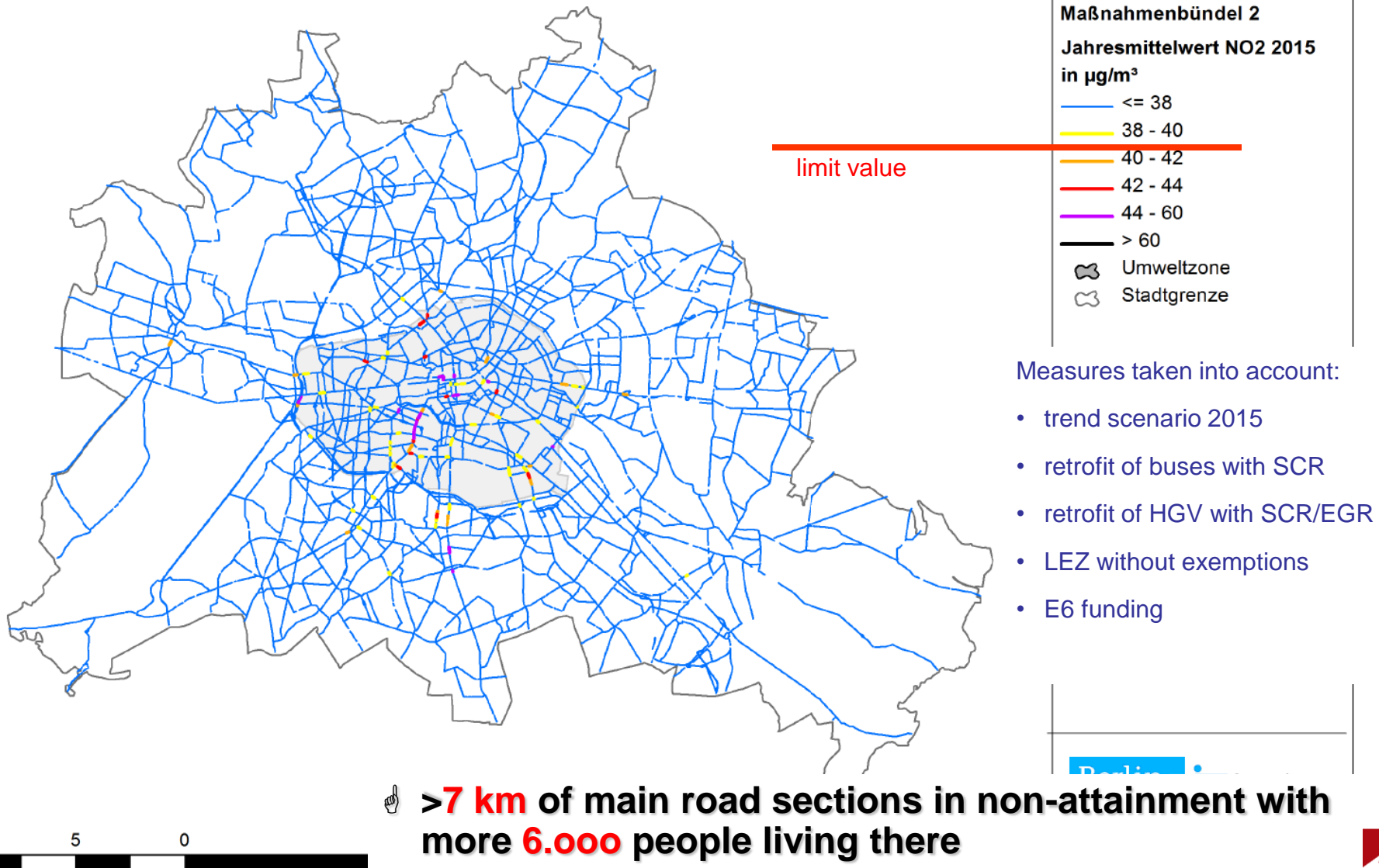
New air quality plan 2011-17

👉 simulated **NO₂** - pollution **trend** scenario **2015**



Simulation of **NO2-pollution 2015**

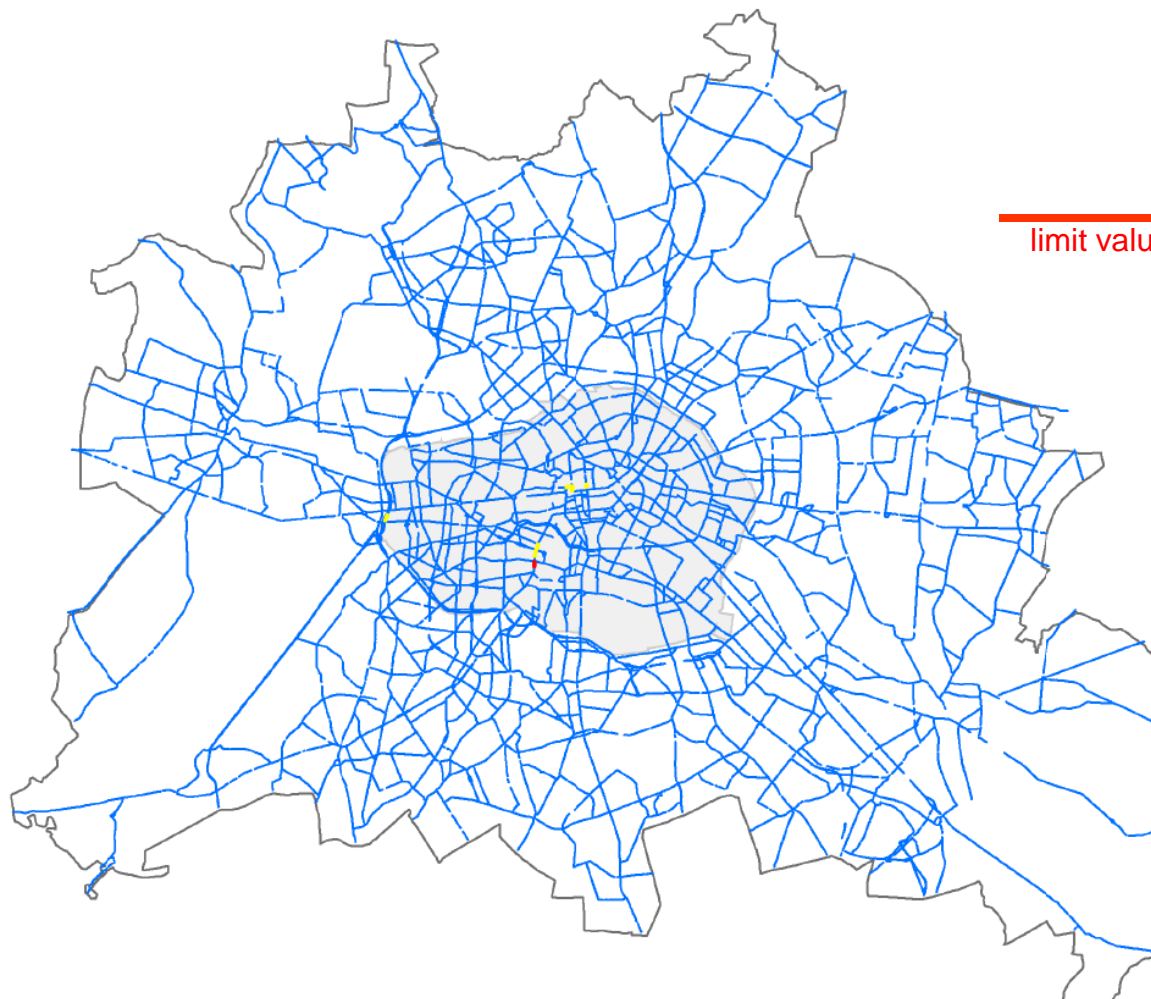
action bundle **vehicle technology**



simulation of **NO₂-pollution 2015**


Senatsverwaltung
für Stadtentwicklung
und Umwelt

👉 **scenario E5 with ambition of E6**



Maßnahmenbündel 5
Jahresmittelwert NO₂ 2015
in µg/m³

— ≤ 38
— 38 - 40
— 40 - 42
— 42 - 44
— 44 - 60
— > 60

 Umweltzone

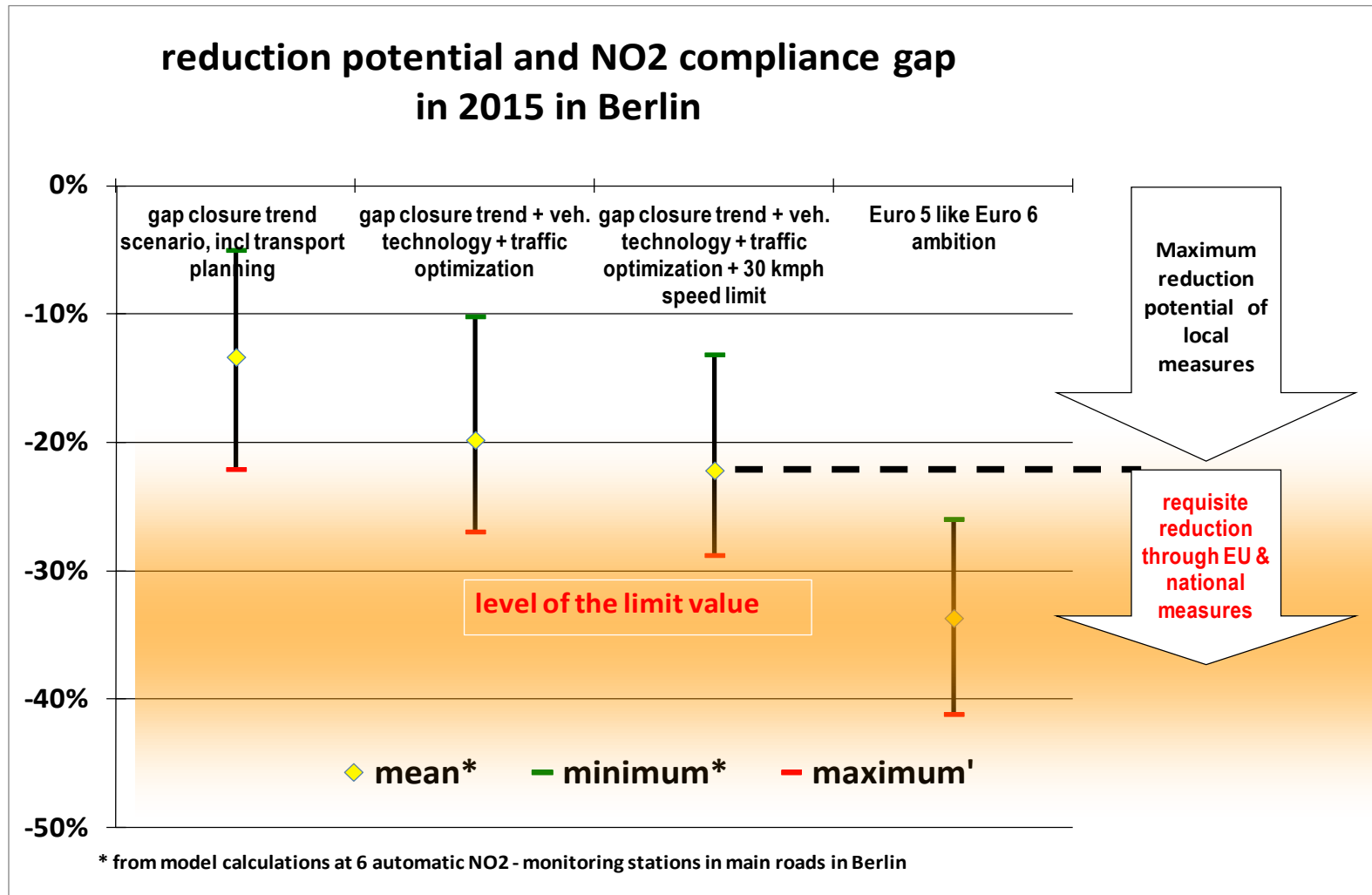
limit value

- Measures taken into account:
trend scenario 2015, plus
implementation of our plea of 2005:
- 👉 set new **Euro 5** NO_x- emission standard for Diesel – vehicles at an level **equal to E4 petrol vehicles** = 80 mg/km
 - 👉 equivalent to **E6** introduction **5 years earlier**

👉 **0.14 km** of main road sections in non-attainment with
about **150** people living there

New air quality plan Berlin

👉 NO₂ reduction potential of local measures



Technical & Planning Measures

👉 Projected **impact** on PM10 levels

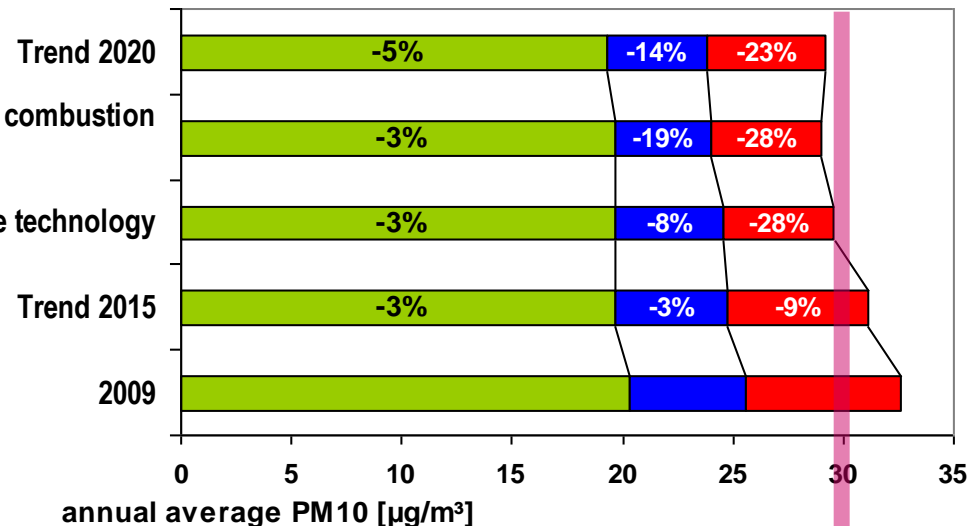
Impact of different bundles of **additional** measures to reduce **particle** pollution by **2015** & **2020**

Expected decrease of particle (PM10) pollution* in Berlin

■ regional BG ■ urban increment ■ local increment

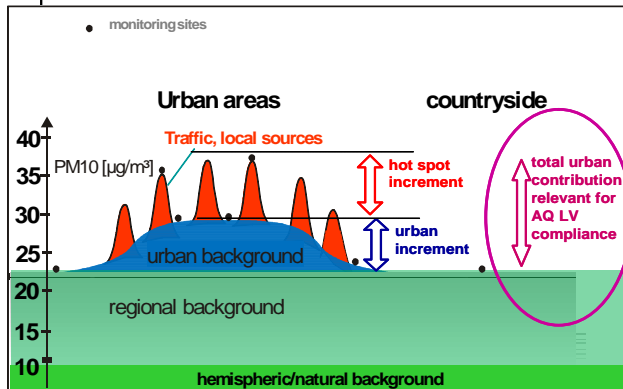
Trend 2015 & traffic measures & control of small combustion
mobile machinery with DPF &

Trend 2015 & traffic management & vehicle technology



*averaged over 27 traffic spots, based on modeling

24h-limit value



résumé

■ Efficiency of **previous** measures

- ✚ **Industry**: Requiring **Best Available Technology** for emission control & strict enforcement and permitting regime was huge success
- ✚ Residential **heating**: Enforcement of switch to **cleaner fuels** & expansion of **combined** heat & power generation
- ✚ Road **traffic**: significant reduction PM (black carbon) and NO2 due to LEZ
- ✚ improvement of similar magnitude through **transport planning** & traffic management

■ Focus on **new** measures

- ✚ Faster introduction of **Euro 6** vehicles & **alternative** concepts
- ✚ Exploit potential of **optimizing traffic** flows
- ✚ clean up off road machinery & local shipping

■ **remaining** problems

- ✚ long-range transport of particulate matter
 - ✚ missing **national** strategy
- ✚ timing of compliance critical with regard to ultimate NO2 compliance
 - ✚ Requires national & **European** action

☞ some **final recommendations**

- AQ Planning needs **networking** across different administrative levels, departments, interest groups, lobbyist, stakeholders
 - ☞ on the long-term: **integration** of environment objectives into other policy making processes
 - ☞ Commitment for other administrations to take into account the needs of air quality management in their business
 - ☞ **Set up AQ Steering Committee** as a durable platform for collaboration, also during implementation phase
 - ☞ consider setting up a **sub-working group drafting** the chapters on **measures**
 - ☞ **Environment** Department need to take the **lead**, invite important departments of transport, city planning, economic affairs, etc
 - ☞ provide for **permanent sufficient** personnel **resources**
- Some hints regarding the **drafting** of an AQ plan
 - ☞ **measures** to reduce the pollution are the **essence** of an AQ plan
 - ☞ put the focus on justification, description and definition of measures
 - ☞ try to be as **concrete** as possible
 - ☞ if concrete action is not possible now, stipulate a clear **commitment** for further scrutiny/study/investigation & subsequent decision on action
 - ☞ add steps to **improve** databases/tools/resources as **measures**

Measures of Berlin's Air Quality Plan 2011-2017

Measures vehicle emission control technology				
M 2.1	low emission zone without exemptions	☺city-wide ☺+	to 2015	SenStadtUm
M 2.2	funding of purchase of Euro-6-vehicles	☺city-wide ☺+	to 2015/16	SenStadtUm Federal Gov.
M 2.3	funding of purchase of CNG vehicles	☺city-wide ☺limited	laufend	SenStadtUm Federal Gov. GASAG
M 2.4	Promotion of electro mobility	☺city-wide; ☺unclear	medium- to long-term	SenStadtUm SenWiTechForsch Federal Gov. Districts
M 2.5	clean vehicles for public transport	☺city-wide ☺+ /local ++	short- to long-term	SenStadtUm BVG
M 2.6	clean municipal vehicles	☺city-wide ☺0	Medium-term	all municipal enterprises
M 2.7	retrofitting Euro-4-Diesel vehicles	☺city-wide ☺+	Medium-term	SenStadtUm Federal Gov.
M 2.8	Particle filters for passenger cruising vessels	☺local ☺0/+	short- to medium-term	SenStadtUm Districts
M 2.9	environment standards for Diesel locomotives	☺local ☺0/+	medium- to long-term	SenStadtUm Federal Gov., VBB
M 2.10	Communication campaign to promote procurement of clean vehicles	☺city-wide ☺-/0	medium-term	SenStadtUm business associations

M 1.2 Avoid new pollution hotspots

Time frame	Competence
Until the end of 2013	SenStadtUm, Bezirke
Reduction potential	Costs
To be modelled for the individual case	n.A.

Changes in the urban development must be examined with regard to their impact on potential limit value exceedances. Particular attention should be given to street canyons, which are characterized by largely enclosed roadside structures on both sides of the street. The narrower and the more closed the canyon is, the worse is the dilution of exhaust gases from vehicles. High air pollution levels thus occur particularly on roads with high traffic volumes, and concurrently, a low width/height ratio.

Objective:

No additional road sections or pollution hotspots as a result of urban development changes.

Implementation:

- Development of guidelines and recommendations on the preservation of wide road spaces and the avoidance of new pollution hotspots due to urban development changes
- Guidelines on modelling air quality
- Consideration of the guidelines in the context of mandatory urban land-use planning
- Examination of the effects of ventilation passages in areas with high pollution levels and poor ventilation

Effect:

Locally high - depending on the initial situation, the traffic-induced incremental pollution on a local level can more than double through the creation of a street canyon⁸⁴. The shorter the distances to the next building and the higher the buildings are, the higher is the air pollution from traffic. Gaps between buildings in the development of road spaces reduce the traffic-induced local incremental pollution by/through a better dilution. The share of empty sites/gaps between buildings at 20%, leads to an incremental pollution that is approximately 10% lower than of enclosed road spaces.

New AQ Plan Berlin: Example how to describe measures

Thanks for listening!

Better you slim
down rather than
the ice shelves.
So, take the
bike!

For more information on

- ➡ **Berlin's LEZ see**
www.berlin.de/umweltzone (also in EN)
- ➡ **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)
- ➡ **The air implementation pilot by EEA**
<http://www.eea.europa.eu/themes/air/activities/the-air-implementation-pilot-project>

