



## The Air Quality Challenges faced by Berlin: Approaches adopted to tackle these

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- **Compliance** with EU-limit values & WHO: What's the **state** of play?
- The (seemingly) **solved PM**-problem: Anything left?
- The **NO2**-problem: How did we (sort of) **manage** it?
- How **AQ** management **profits** from **transport** planning & vice versa?
- Full compliance, but still need for **action**: What's **next** ?
- Lessons for AQ **standard** setting: How to maximise (health) **benefits**?

# Driver for transport measures

## ☞ Air quality management

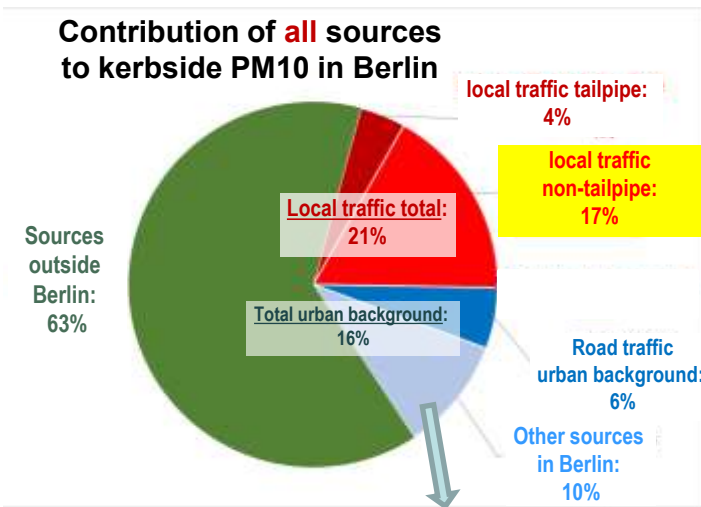
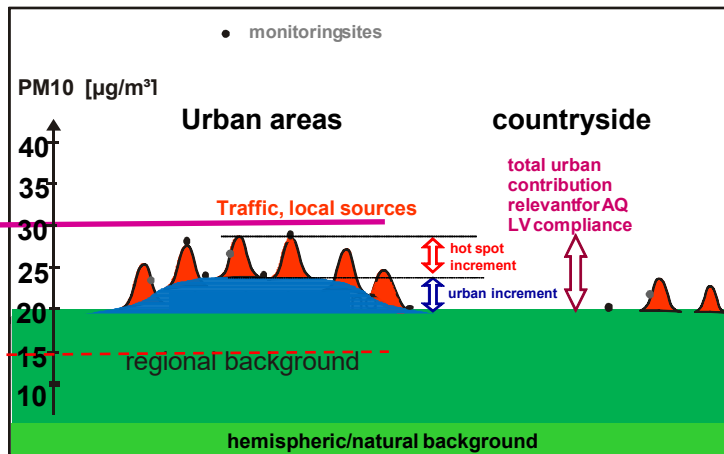


### Compliance with EU limit/target values and WHO guidelines in Berlin

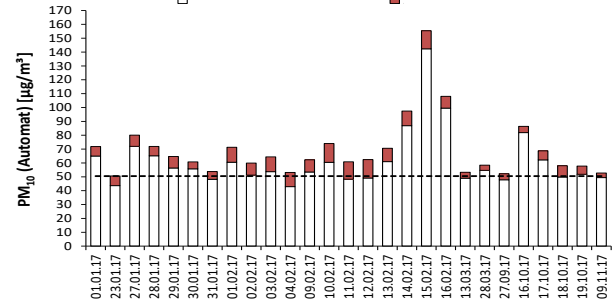
pollutant	main source	Status
SO <sub>2</sub>	power plants, industry, domestic heating	☺ problem solved 20 years ago ☞ switch to <u>clean fuel</u> & control technology
CO	Traffic	☺ never a problem
Ozone	long-range transport, traffic	☹ diminishing problem in relation to Air Quality Standards ☹ WHO guideline exceeded, but to be solved at EU & national level (e.g. by the national programs to meet NERC-Directive)
PM <sub>2.5</sub>	long-range transport, traffic residential heating, agric.	☺ EU limit value met, shrinking local share, inter alia due to LEZ ☹ WHO guideline still exceeded by 180%
PM <sub>10</sub>	long-range transport, traffic, residential heating	☺ EU limit value met, shrinking local share, inter alia due to LEZ ☹ WHO guideline still exceeded by 140%
NO <sub>2</sub>	Road traffic (Diesel)	☹ < 2019: EU limit value (= old WHO guideline) still exceeded, national court verdicts & law suit filed by EU, Diesel bans enforced ☺ 2020: EU limit values met, but 10 yrs too late & WHO exceeded by 300%

# Air quality in Berlin

## sources of particle pollution (PM10)



Visible biomass (=wood) combustion signal from Aethalometer measurements...  
 □ Residual PM10    ■ Share from wood combustion

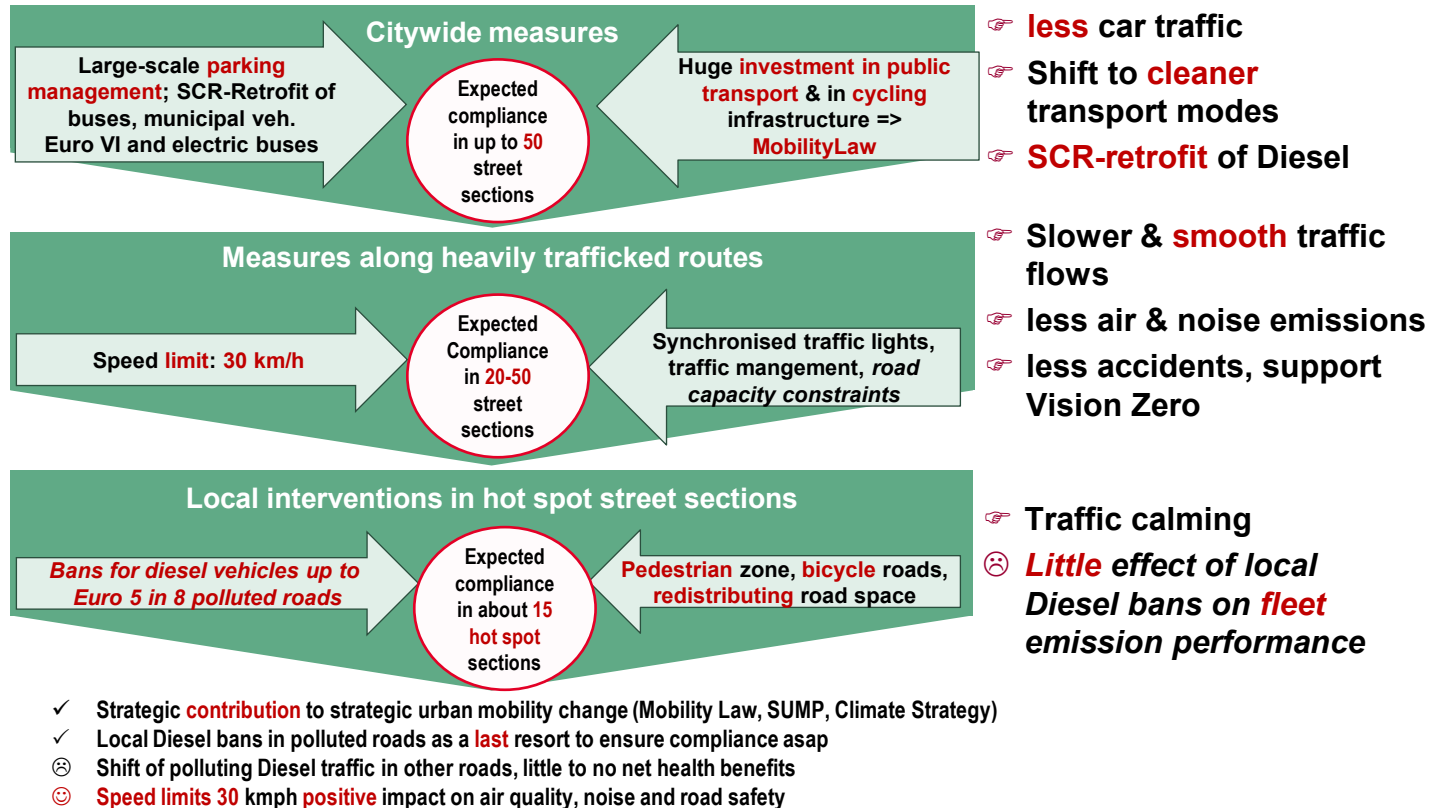


- 👉 LVs for PM10/PM2.5 are met, but WHO guidelines still **exceeded**
- 👉 **Shrinking** share of **Berlin's** sources due to LEZ and other measures
- 👉 Local road traffic **tailpipe** contribution only 4% of the total PM, **non-exhaust**, mileage-dependent part gains relative **importance**
- 👉 **National/EU measures** needed to reduce large-scale regional **background** (e.g. wood combustion)

# How to **solve** the **NO2** problem in Berlin in 2018?



## Holistic approach for 117 polluted road sections to **swiftly attain** NO<sub>2</sub>-limit value



# City-wide measures

## 👉 extending parking management



### ■ General objective:

- ↪ Incentive for a modal shift away from car use
- ↪ Strategic Urban Mobility Plan “MoVe” stipulates 100% coverage by 2025

### ■ Situation in 2018/2019

- ↪ Only 35 % of the central area managed

### ■ Target in the Air Quality Plan

- ↪ Extend the managed area to 75 % by end of 2020
- ↪ Financial support to boroughs for requisite feasibility studies, staff and infrastructure needed for implementation
- ↪ Modelled impact on NO<sub>2</sub>: 0.1 to 2.7 µg/m<sup>3</sup> reduction city-wide
- ☹️ By mid 2021: extension to only 52% realised

### ■ Higher short-term parking fees

- ↪ Raise parking fees for non-residents from 1-3€/h to 2-4€/h, which haven't been increased since 2006
- ☹️ Could not be put in force before the elections

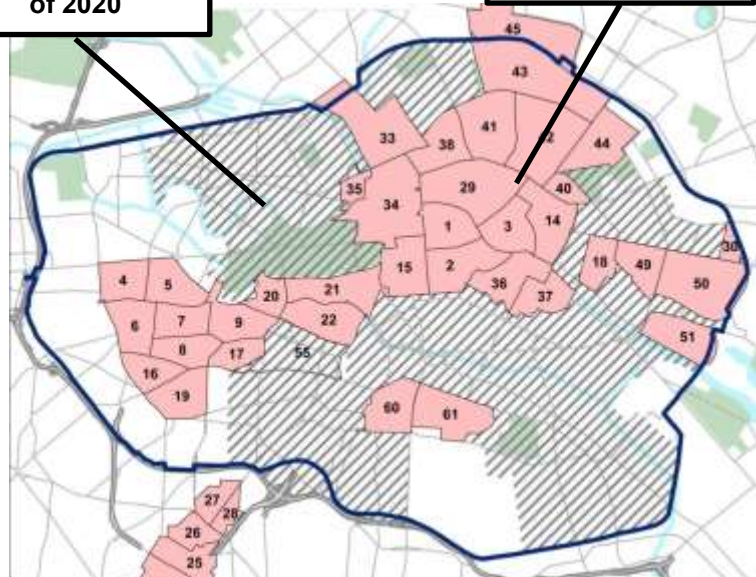
### ■ Higher fees for residential parking permits:

- ↪ Raise annual fees from 10 €/year to more than 100 €/year, which until recently were limited to 10-30 €/a by national law
- ☹️ Planned increase deferred to next legislative period



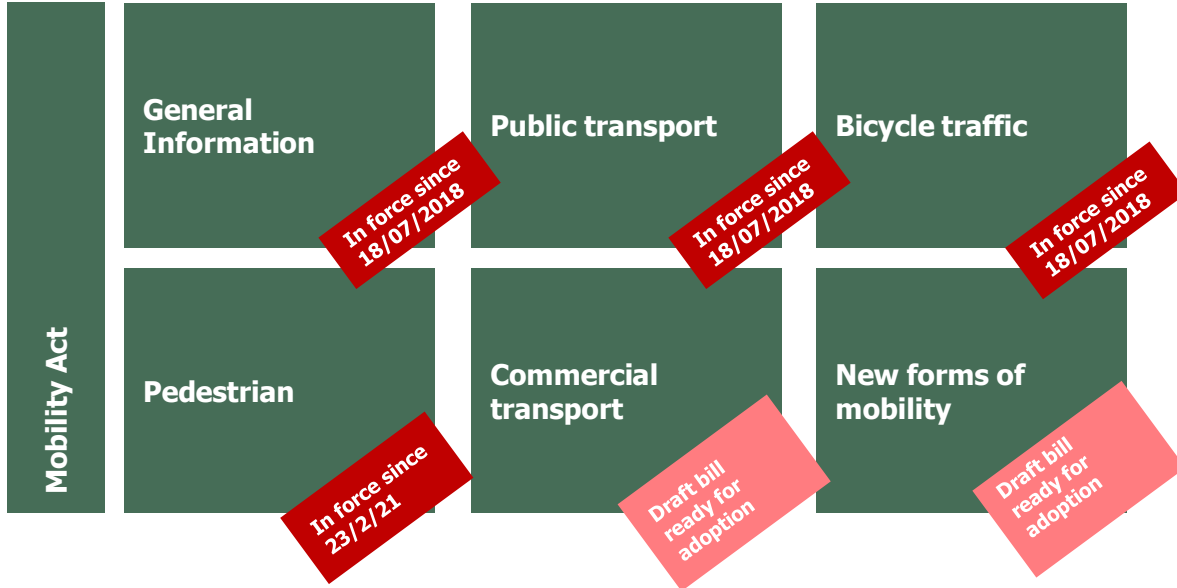
Planned extension by end of 2020

Current parking management areas



# Framework for sustainable mobility

## 👉 Berlin's Mobility Act (MobG)



Gesetz  
zur Neuregelung gesetzlicher Vorschriften zur Mobilitätswirtschaft  
vom 7. Juli 2018

Das Abgeordnetenhaus hat das folgende Gesetz beschlossen:	§ 29	Fahrradkategorie
	§ 30	Abkürzen: öffentlich, Dienstleistungspflichtige (Verkehrsunternehmen)
<b>Artikel 1</b> <b>Berliner Mobilitätsgesetz</b>	§ 31	Aufbauvorschriften im Elektrobus- und Omnibus des ÖPNV
<b>Inhaltsübersicht:</b>	§ 32	Einheit, Sitzbestimmung und Aufbau des Schienenverkehrsunternehmens
<b>Abteilung 1: Zukunftsorientierte integrierte Mobilitätswirtschaft für Berlin</b>	§ 33	Aufbauvorschriften des ÖPNV an die Verkehrsunternehmenstruktur
<b>Zweckbereich 1: Verkehrsmitteleinsatzrechtliche Ziele</b>	§ 34	Umstellung von Leistungen bei Bus und Straßenbahn
§ 1	§ 35	Umstellung des ÖPNV
§ 2		
§ 3		
§ 4		
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👉 its still a **novelty** in Germany



Safe, healthy, environmentally friendly, socially acceptable mobility

Promotion of walking and cycling

Consolidation of local public transport

Increase in traffic safety  
Vision Zero

Attractive and easily accessible public space

Conversion of public transport to non-fossil fuels by 2030

...initially **pushed** by a group of smart **cycling** activists

- launched a **public referendum** just a few months before the 2017 Berlin elections
  - ↳ called for a **cycling law** with binding **goals**, quality criteria and earmarked **budget**
- got huge **support** by civil society
- idea of a mobility law was taken up by **political** parties in their **election** manifestos
- new government invited NGOs to **participate** in the drafting process of the bill
- allocates extended **budget**
- sets the ground for detailed planning instruments (**Public Transport Plan**, **Bike-Plan**)





## Basis for **new transport contracts** – target horizon **2035**

### ■ **Growing** output volume until **2035**

- Suburban train, tube:  
+ approx. 20% each
- Tram: + approx. 68%
- Bus: + approx. 8%

### ■ **Extensive investment programme**

- **New lines** and **new vehicles** in rail
- **Decarbonisation: all buses electric by 2030**
- **Accessibility**

### ■ **Other measures**

- **Uncompromising timetable stability** for bus and tram
- **Ensuring sufficient capacity**
  - New vehicles are procured
  - More capacity will be ordered by Berlin in future
- **Incentive system** for high quality public transport



**Around €28 billion required for implementation by 2035**

**Risk due to drop in ticket sales revenues due to Covid-19**



# Bike policy in Berlin

☞ Pushed by the Mobility Act

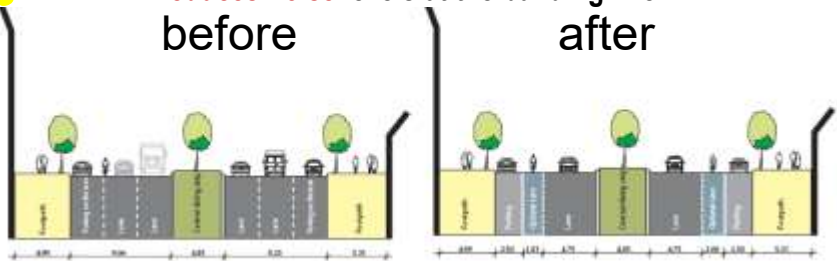


- Aims of Berlin's new Mobility Act:
- Massive and accelerated investments in better cycling infrastructure
- 30-40 Mill. Euro/year budget earmarked for better and safer cycling
- Network of dedicated cycling roads and bike lanes in all main roads
- 100 km of bike highways by 2030
- 200.000 additional bicycle parking stands, especially at subway/train stations
- Funding programme for electric cargo bikes, ....



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



# City-wide bike policy measures



## 👉 Pop-up bike lanes pushed by the pandemic

before

Popup

permanent

Kottbusser Damm – Kreuzberg  
Foto: Peter Broytman

Foto: Peter Broytman

Foto: SenUVK

- **Before:** planning process of **>2 years** too **long** to help meeting **NO<sub>2</sub>** asap
- **Now:** Shortened to **a few weeks** to provide safe cycling during the 1st Corona-lockdown
  - ↪ by now more than **25 km bike lanes** finished
  - ↪ Since 2020 more than **80 km new bike infrastructure** completed or under construction

# Bike lanes

👉 **impact** on pollution **exposure** of cyclists

- Study by the Institute for Advanced Sustainability Studies e.V. (IASS) rund um den Kottbusser Damm



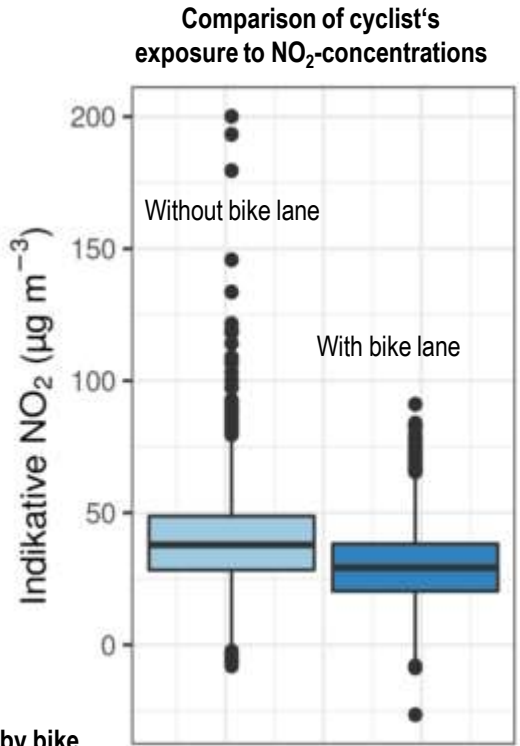
- Monitoring with EarthSense Zephyrs – **NO<sub>2</sub>-sensors**

- stationary and mobile measurements by bike

- **Exposure to NO<sub>2</sub>** for cyclists **dropped** by **8,7 +/- 5 µg/m<sup>3</sup>** or **22 %**



Monitoring sites and routing of the mobile measurements by bike



Source: <https://www.iass-potsdam.de/en/output/publications/2021/mobility-policy-and-air-quality-effect-new-bike-lane-and-community-space>



# Tackling NO<sub>2</sub> in Berlin

## Effect of other measures

- Pedestrianizing shopping road “Friedrichstraße”**
  - Pollution **dropped** to background levels (-7 µg/m<sup>3</sup> NO<sub>2</sub>)
  - Slight **increase** in parallel roads (+1 µg/m<sup>3</sup> NO<sub>2</sub>)
  - similar **improvement** in northbound section with **Diesel bans**, which could be lifted already
- Highest reduction occurred in roads with speed limits and Diesel bans...**



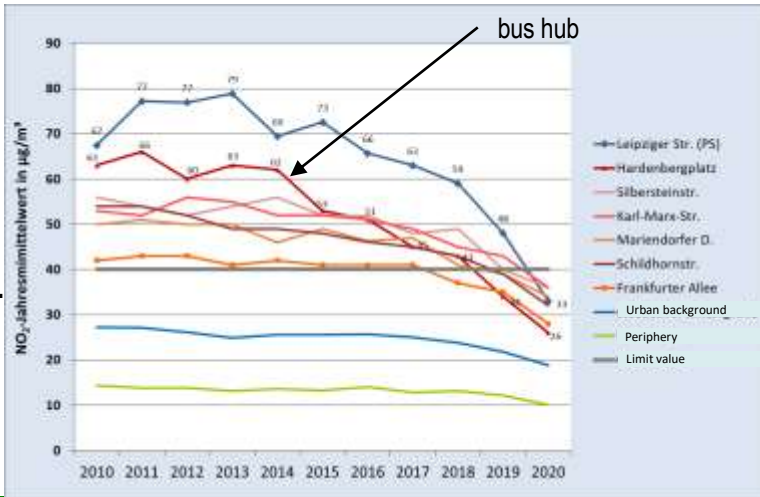
Average NO<sub>2</sub>-reduction 2019/20 in 117 polluted roads in Berlin



	Diesel ban & 30 kmph		No local measures
Reduction	30 kmph	30 kmph	
absolute mean	9 µg/m <sup>3</sup>	7,5 µg/m <sup>3</sup>	5,8 µg/m <sup>3</sup>
From - to	4 - 15 µg/m <sup>3</sup>	3 - 11 µg/m <sup>3</sup>	3 - 7 µg/m <sup>3</sup>
mean %	23%	17%	15%

- But **less** than expected due to **low compliance** rate by car drivers
- Speed limit 30 kmph effective in 20 km polluted main roads**
  - Result of “traffic trial” in 5 roads & based on previous data evaluations...
    - NO<sub>2</sub>: reduction by **2 - 12 µg/m<sup>3</sup>** or 6 - 19%
    - PM10: reduction by **2 µg/m<sup>3</sup>** or 5%
- Limit value of 40 µg/m<sup>3</sup> NO<sub>2</sub> met everywhere**
  - even without the **Corona-effect** of max. **2 µg/m<sup>3</sup> NO<sub>2</sub>**

Trend of NO<sub>2</sub>-concentrations in Berlin



# Interim summary

## PM – problem:

- **non-tailpipe** emissions from road traffic **dominating**
- Needs **less** car traffic, given the lack of technical means

## NO2 – problem:

- We exploited the legal **pressure** to meet NO<sub>2</sub>-limit values by including sustainable **traffic planning** measures into the Air Quality Plan

- ↪ **Parking management**                      ↪ partly successful
- ↪ **30 kmph** on main roads                      ↪ successful
- ↪ 5 measures promoting **bike-** und **pedestrian** traffic
- ↪ 5 measures making **public transport** more attractive
  - ↪ Success mainly due to mobility law & climate policy

- Aim: **Supporting traffic planning** by speeding up and facilitating the implementation of measures
  - ↪ **Limited** effect due to relatively **long** time for planning & implementation

- Diesel **bans** helped (only) **locally**
  - ↪ were **less effective** than expected
  - ↪ **little** net benefit for exposure and **health**

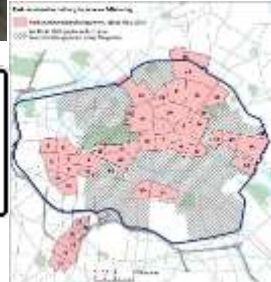


Bild: TKKurikawa / Depositphotos.com



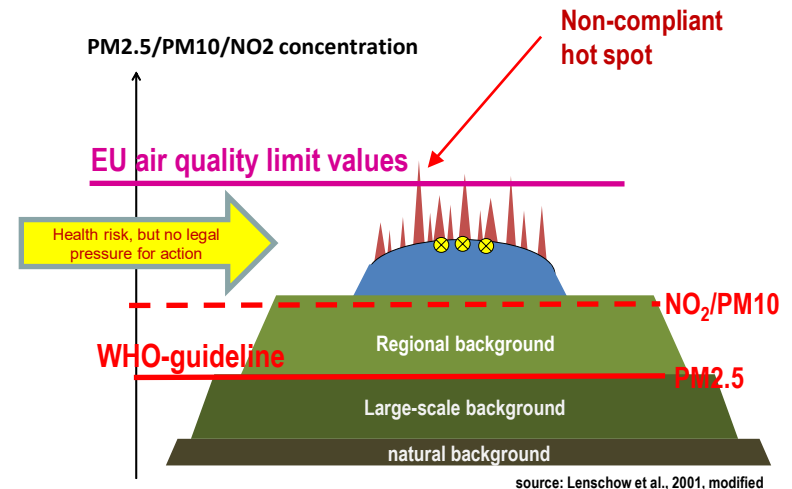
👉 extreme hot spot focus

**Air purifying filter** columns surrounding a pollution hot spot in Munich as an example for an extreme **hot-spot driven measure** with (almost) **nil health benefit**



Source: Bavarian Ministry for Environment

Expected effect on measured NO<sub>2</sub>:  
**-3.5 µg/m<sup>3</sup>**



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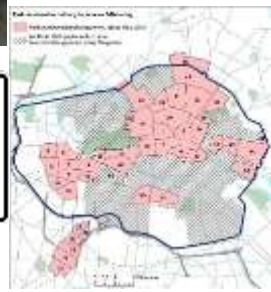
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- Anyway: **we met all air quality limit values in 2020**

- ? What's next with regard to **WHO**...
- ? What can we learn for the **revision** of the AQ Directive...





## 👉 lessons for the **AQD** revision

- **WHO** guidelines are widely **exceeded**
- **EU Air Quality Directive** and the **AQ standards (AQS)** are being **updated**
  - ↳ Based on scientific knowledge and “more closely **aligned with WHO**”
- **Dilemma**: the current Hot- Spot-approach with an absolute limit value must take account of the **feasibility** in the most **polluted EU-region**
  - ↳ **little** pressure for **action** in other less polluted regions as they’ll meet the AQS
  - ↳ focus for action **limited** to **Hot-Spots** despite of widespread pollution **above WHO**
- Supplement conventional hot spot AQS by a **relative** (%-) reduction of the **average population exposure** in a **region/agglomeration**

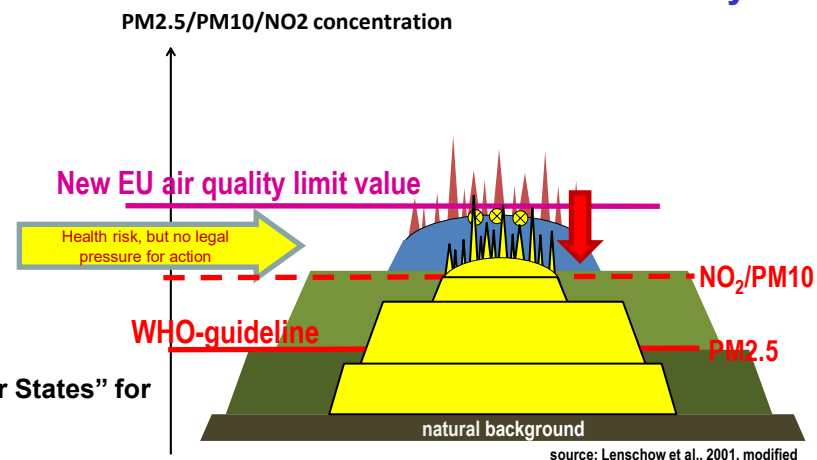
👉 Stipulated by >100 Medical, Public Health and Scientific Societies

Int J Public Health, 23 September 2021 <https://doi.org/10.3389/ijph.2021.1604465>

“What is needed is a **paradigm change** from relying solely on **fixed limit values**, with a **shift towards the concept of combining fixed limit values with a continuous reduction of the average exposure**”

- 👉 **Widens** the pressure for **action** to large parts of a city instead of concentrating on a few local Hot Spots
- 👉 **Facilitates** the definition of **ambitious new AQS** while taking account of the large variation of pollution levels in Europa
- 👉 **Basis**: **spatially averaged** pollution in urban residential (“**background**”) areas as a proxy for the exposure of the urban population
  - ↳ measurements, possibly combined with modelling
- 👉 Needs an accompanying **joint legal responsibility** of “the Union and the Member States” for additional **national & EU-efforts** to **curb** large-scale **background** pollution
  - ↳ Precedence in climate law

Exceedance of the new WHO-guidelines in Berlin by ...



# AQ management: Still anything to do?

## 👉 What's next in Berlin



## ■ Boundary conditions

- ☺ still need for **action** to improve the air quality
- ☹ Until 2024/25 **missing** legal mandate for a new Air Quality Plan with additional measures
- ☹ **Missing** clarity on the legal **instruments** for “**Push**”-measures and bold interventions
- ☺ Strong political **drive** for **climate action** with potentially high side-**benefits** for AQ management
  - 👉 Except **wood** burning
- ☺ Favourable **legal**, **budgetary** (Mobility Law) and **political** (Red-Green-Red coalition government) ground for continuing the **mobility change**
- ☺ Stronger legal and financial **support** from the **new national** government for the implementation of measures

# AQ management: Still anything to do?



## ☞ What's next in Berlin

### ■ develop by 2023 an “Air Quality Strategy 2030” for Berlin

☞ self-commitment **in the Air Quality Plan** & by signing the C40 “Clean Air Cities Declaration”

☞ Initial goal: **Achieving WHO** by 2030

☞ Barely feasible after the update

☞ Needs **adaptation** of the objective given the significant large-scale **background** levels of **PM**

☞ Shift from Hotspot-focus towards a percentage

**reduction of the population exposure**

☞ Stronger emphasis on **cost-effectiveness** and **health** benefit of measures

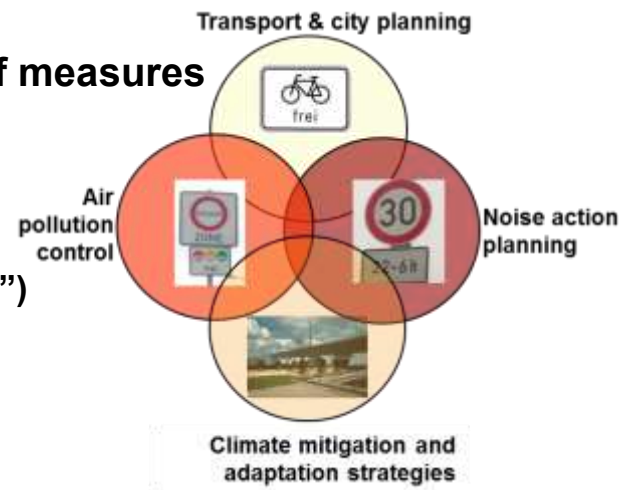
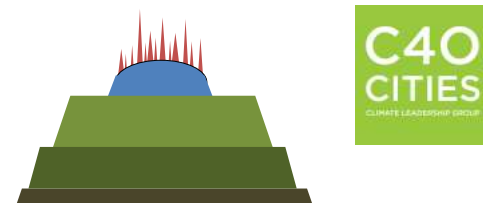
☞ Less interventionist, more in **cooperation** externally with stakeholder & civil society internally with other **departments**

☞ **Climate policy** (“phasing out fossil fuels for power and heat generation, residential heating, electro mobility, Zero Emission Zone”)

☞ **Traffic planning** (“Mobility Change”)

☞ **Urban development & housing** (“car-free neighbourhoods”)

☞ **Noise action planning** (“Slower and less car traffic”)





**Thanks for  
listening!**

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



#### More more information

On Berlin's LEZ

<https://www.berlin.de/sen/uvk/en/environment/air/low-emission-zone/>

On Berlin's new Air Quality Plan see

<https://www.berlin.de/sen/uvk/en/environment/air/air-quality-plan-for-berlin-2nd-update/>

On air quality scenario runs in

Berlin's Environment Atlas <https://www.berlin.de/umweltatlas/en/>

On the Climate Protection Policy

[https://www.berlin.de/senuvk/klimaschutz/index\\_en.shtml](https://www.berlin.de/senuvk/klimaschutz/index_en.shtml)

In case of questions contact

➤ [martin.lutz@senuvk.berlin.de](mailto:martin.lutz@senuvk.berlin.de)

# Regional exposure–reduction target

We need **stricter** AQ standards (notably for PM2.5/PM10) in the new AQ Directive for better health protection of the [urban] population

**Dilemma:** the current **HotSpot**-approach with an **absolute limit value** must take account of the feasibility in the **most polluted** EU-region

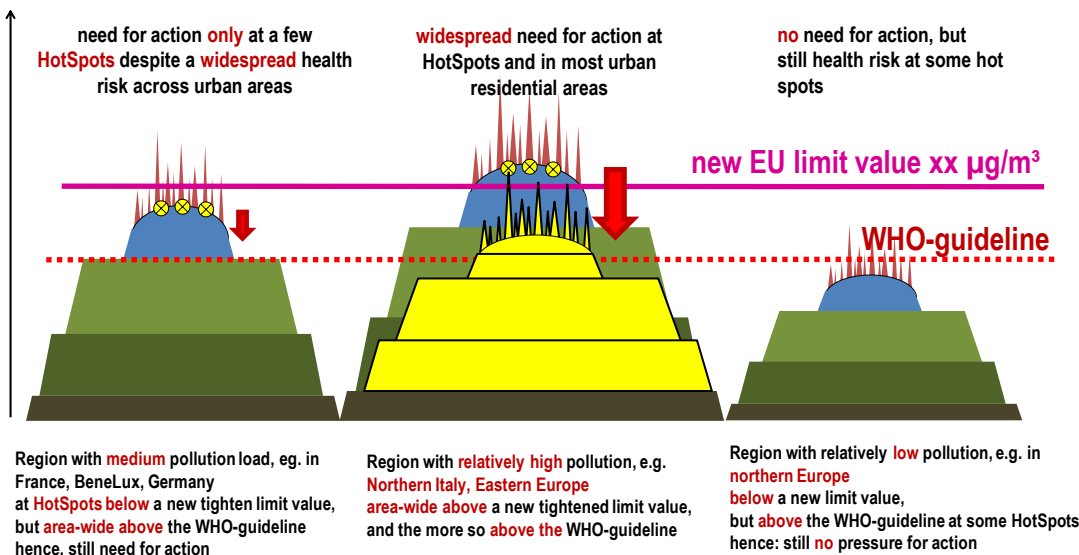
- ↪ little pressure for **action** in other less polluted regions due to **compliance** with the **limit value**
- ↪ focus for action limited to **HotSpots** despite of widespread pollution **exceeding** the **WHO-guideline**

## 👉 Possible **solution**?

### Exposure-reduction approach:

- ↪ **Basis:** **spatially averaged** pollution in urban residential areas as a proxy for the **exposure** of the **urban population**
  - ☞ measurements, possibly combined with modelling
- ↪ require a **relative reduction** (in %) within a given attainment period (~10 years) for each **region/agglomeration** separately, depending on the initial pollution level
- ↪ **supplementing** the traditional **HotSpot**-approach and the current **national** exposure reduction target
- ↪ needs a firm **obligation** for **accompanying national & EU-efforts** to curb large-scale BG

PM2.5 concentration



# Regional exposure reduction approach

☞ endorsed by global health community



## WHO Air Quality Guidelines 2021–Aiming for Healthier Air for all: A Joint Statement by Medical, Public Health, Scientific Societies and Patient Representative Organisations

☞ Int J Public Health, 23 September 2021 <https://doi.org/10.3389/ijph.2021.1604465>

### Essential points ....

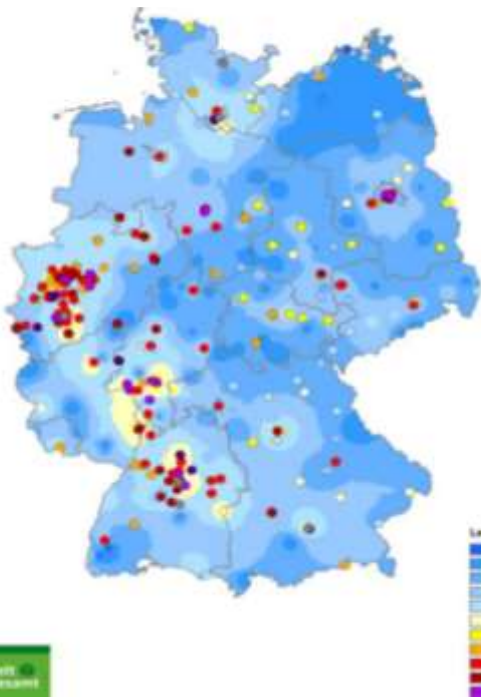
- **Reduction** in the outdoor concentrations of key air pollutants brings **health benefits** to the surrounding population, **even in places which already have low pollution concentrations**.
- **Linear exposure-response relationships** down to the lowest observable concentrations show that **every individual will benefit** from cleaner air. These findings provide critical input into clean air policies and regulation around the world..
- Adverse **health effects** of pollution exposure can be seen at all, **even at the lowest, observed levels of pollution concentrations**. It offers a **wake-up call, to reconsider current air quality legislation** and regulations.
- To **maximise health benefits**, we now understand better the **importance** of implementing **measures to reduce average exposures of all people**. Such an **approach must complement reductions in exposure at “hotspots” with high levels of air pollution**
- Most jurisdictions with clean air regulations have **relied on fixed limit values with little incentive to further reduce air pollution levels once compliance with the limit value is achieved**
- What is needed is a **paradigm change from relying solely on fixed limit values, with a shift towards the concept of combining fixed limit values with a continuous reduction of the average exposure**. For example, the current European Union (EU) Ambient **Air Quality Directive** already contains a **non-binding average exposure reduction target**.
- The upcoming 2022 **revision** of the EU Ambient **Air Quality Directive** will offer the **chance** to lead the way and implement **binding average exposure reduction goals** for air pollutants **in combination with lowered fixed limit values**.



# NO<sub>2</sub> – Problem & the Dieseldilemma

## ☞ Situation 2016 in Germany & Berlin

NO<sub>2</sub> annual mean in 2016



Berlin:

- **Decreasing** traffic volumes ☞ -15% car-traffic since 2002
- **But: no NO<sub>2</sub> - improvement** ☞

Germany:

- **148 Stations exceed** the annual limit value ☞ **58%** of all **traffic** stations
- **45 Stations measure more than 50 µg/m<sup>3</sup>** ☞ **EU-infringement launched**
- **~30 court verdicts** initiation by NGOs require more **drastic** measures **“as soon as possible”**

