

# Air Quality in **Berlin: emerging challenges** and how clean fuels like **gas** could help

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- ⊗ Current **problems** with air quality
- ⊗ **Origin** and **reason**
- ⊗ Potential vehicle technology **solutions**
- ⊗ **Benefits** of using **gas** and existing **obstacles**
- ⊗ résumé

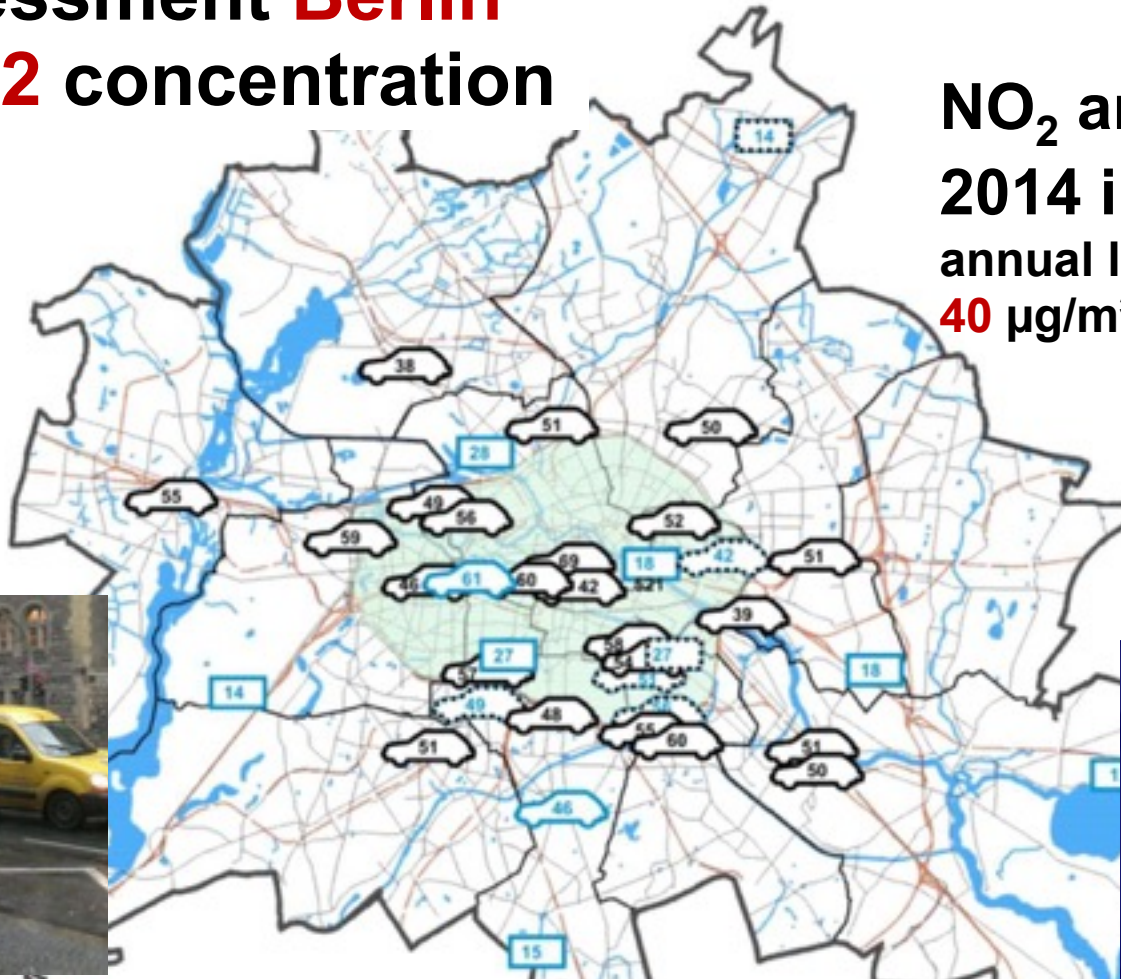
👉 **now a clean city? not quite...**

pollutant	main source	status
<b>SO<sub>2</sub></b>	power plants, industry, domestic heating	😊 problem solved 20 years ago
<b>CO, Pb, HM</b>	Traffic, heavy industries	😊 never a problem
<b>Benzene</b>	traffic	😊 problem solved 10 years ago
<b>PAH</b>	traffic, domestic heating	😐 still problems at few spots in years with adverse meteorology
<b>Ozone</b>	long-range transport, traffic	😐 diminishing problem, to be solved at national & EU level
<b>PM<sub>2.5</sub></b>	long-range transport, traffic	😊 No problem
<b>PM<sub>10</sub></b>	long-range transport, traffic	😐 still problem in years with adverse meteo, but local contribution shrunk
<b>NO<sub>2</sub></b>	traffic	😞 serious problem, time extension notified, infringement launched

# AQ assessment **Berlin**

## **NO<sub>2</sub> concentration**

**NO<sub>2</sub> annual mean  
2014 in  $\mu\text{g}/\text{m}^3$   
annual limit value of  
**40  $\mu\text{g}/\text{m}^3$  widely exceeded****



Low emission zone

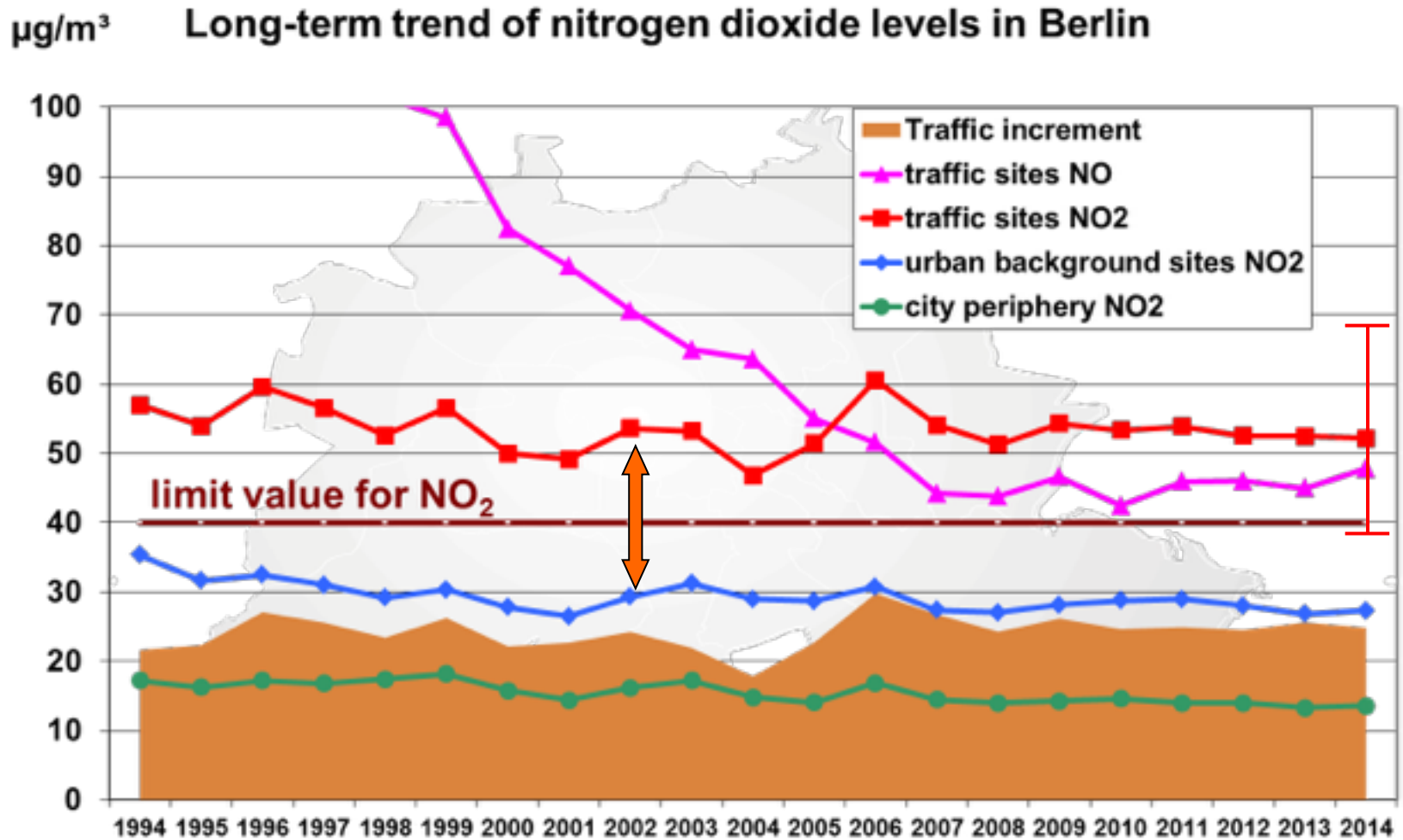
Automatic monitoring site in residential areas and at the cities' periphery

Automatic monitoring site in busy roads at the kerbside

monitoring site with miniaturised monitoring devices for traffic related pollutants in busy roads

(vereinfachte kleine Sammler zur Bestimmung von Feul und Stickstoffdioxid)

## 👉 NO<sub>2</sub> pollution trend



# Compliance with NO2

## time-frame in Germany

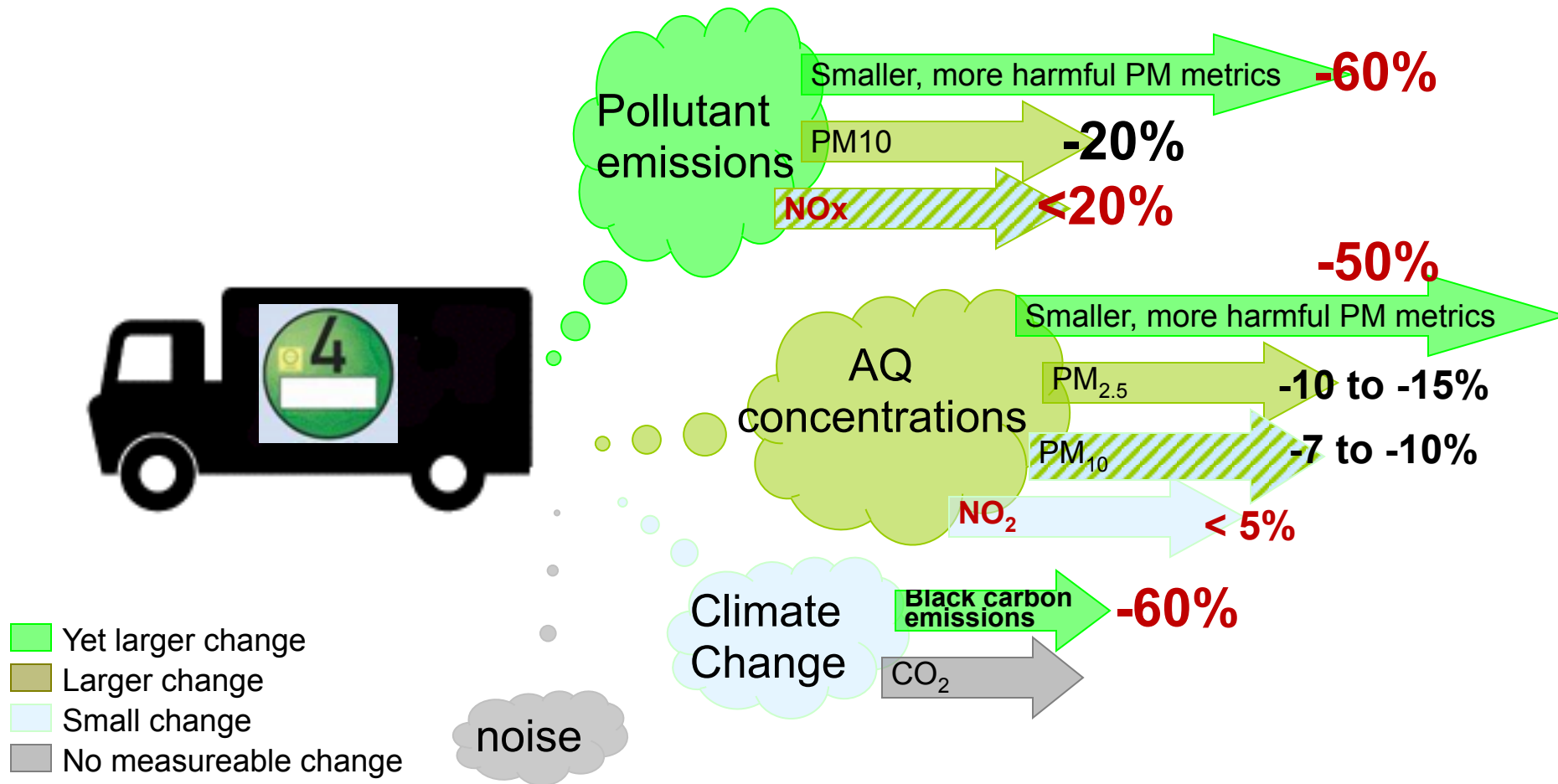
- Envisaged **time frame** notified to the Commission to **meet**  
**NO2 – limit value** with current AQ plans in Germany

Federal State	Expected compliance in non-attainment areas
Baden-Württemberg	<b>2030</b> In Stuttgart agglomeration, elsewhere 2016-2024
Bavaria	<b>2030</b> in Munich agglomeration, elsewhere before 2020
Berlin	<b>2020</b>
Hamburg	<b>2020</b>
■ Hesse	<b>2025</b> in Darmstadt, Limburg, elsewhere in <b>2020</b>
■ Northrhine-Westphalia	By 2015 for Bielefeld and Münster, After <b>2020</b> for Rhine-Ruhr Area
Rhinland-Palatinate	2018 - 2022
Saxony-Anhalt	By <b>2020</b>
Thuringia	2016/17 for Gera and Weimar, after <b>2020</b> for Mühlhausen



# LEZ in Berlin & Germany

## Summary of impact analysis



Source: L. Sadler, modified

# Diesel vehicle performance

## 👉 NOx emissions

Reason for the **meagre LEZ effect** and **missing downward trend** of NO<sub>2</sub>

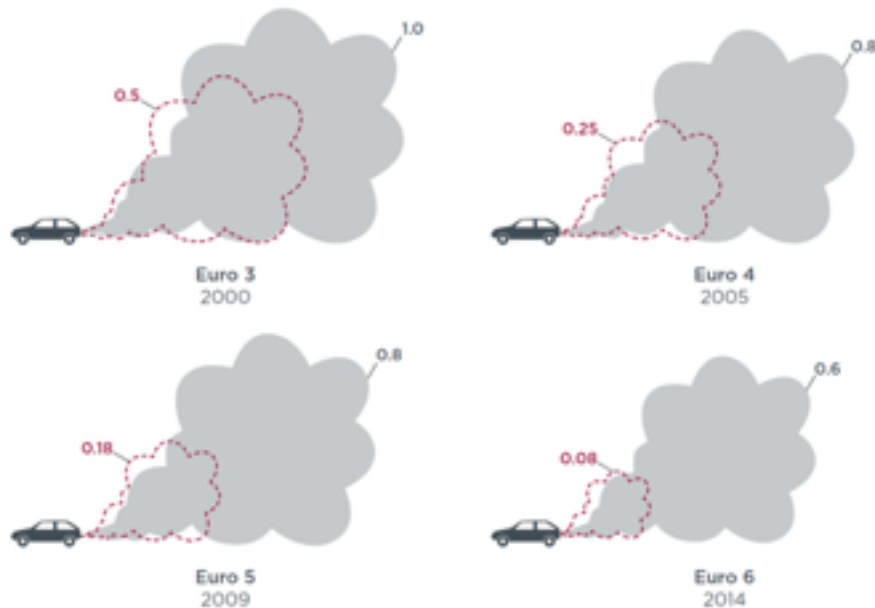
- **Increasing share of Diesel cars in Germany**

- ↪ From 20% in 2005 up to **>30% now**
- ↪ More than **50%** of cars entering into **service** are Diesel

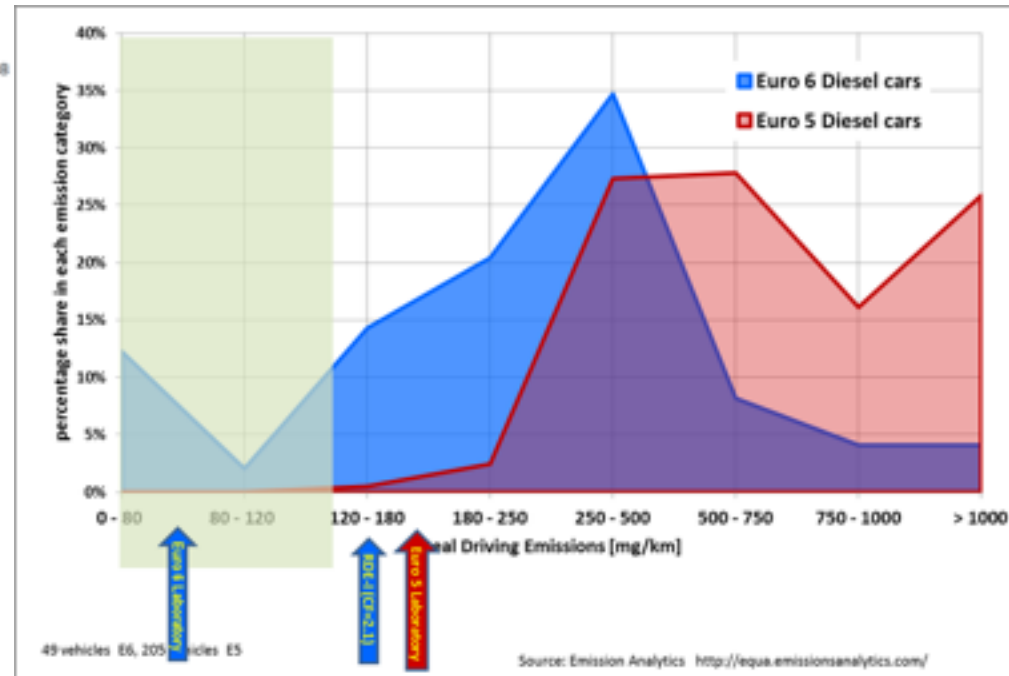
- **Rising NO<sub>2</sub> emissions** by Diesel cars since Euro 4

- **Very little improvement in real driving emissions (RDE) since Euro 3**

- ↪ Euro 6 not much better



Source: ICCT



# Tackling the **NO2** pollution

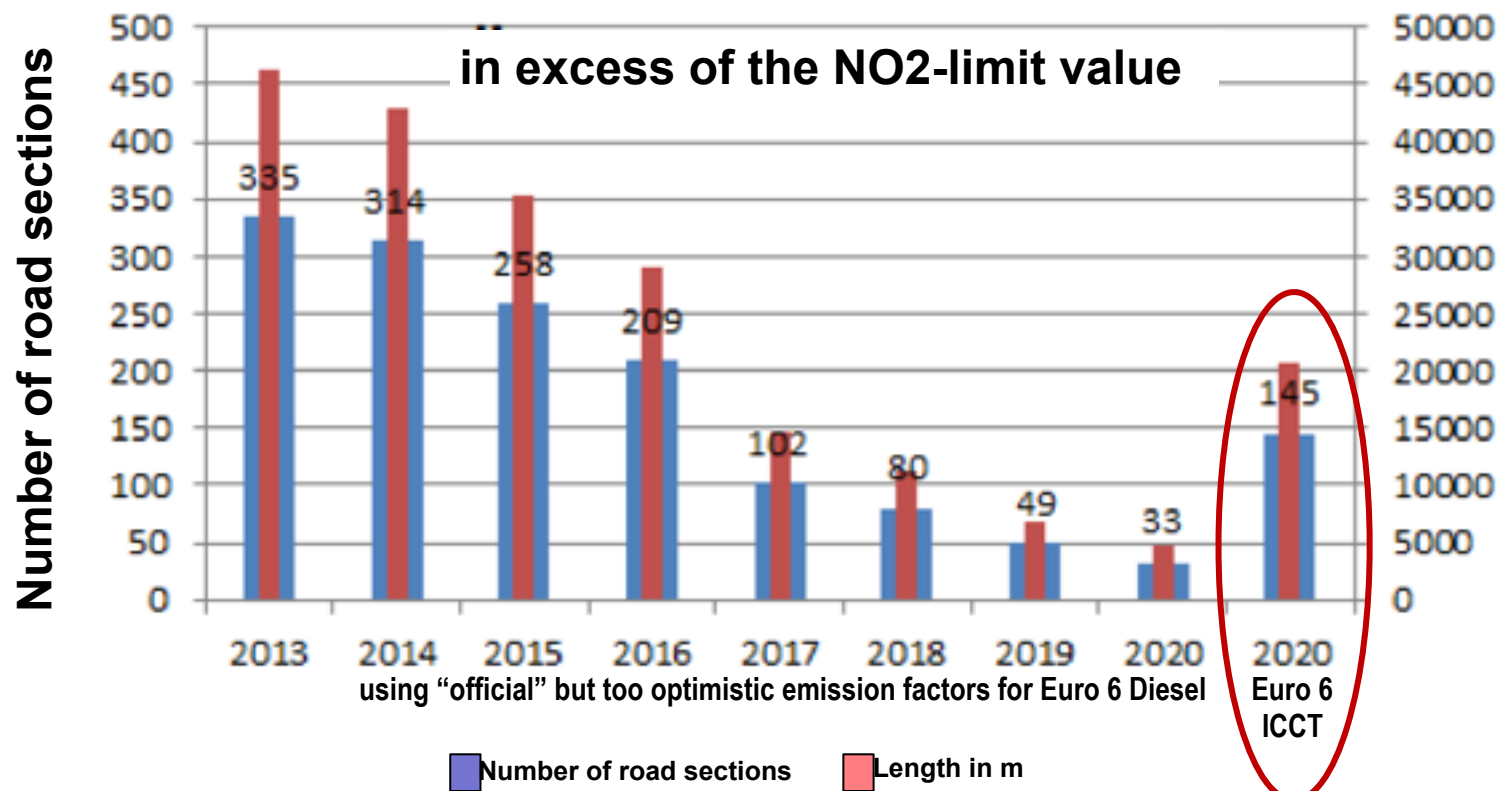
## 👉 potential vehicle technology **solutions**

### ■ Diesel vehicles? Certainly not !

#### Length and number of road sections above NO2-limit value in Berlin

preliminary scenario run for 2020 without extra measures

Length [m]





# Tackling the **NO<sub>2</sub>** pollution

## 👉 potential vehicle technology **solutions**

### ■ **Electric vehicles**

😊 **Zero** tailpipe NO<sub>x</sub> emissions

⚠ **Limited range** between charging cycles

⚠ **Battery durability** still **limited**, especially in fast charging mode

⚠ **Batteries & extension of charging infrastructure** **expensive**

⚠ **Not yet economically viable**, huge **funding needed**

⚠ **Sufficient renewable** power supply still **lacking**

↪ **No short/medium-term solution** for private car use

↪ **Poor perspective** for heavy goods vehicles

↪ **Useful** for **captive** fleets with defined daily mileage

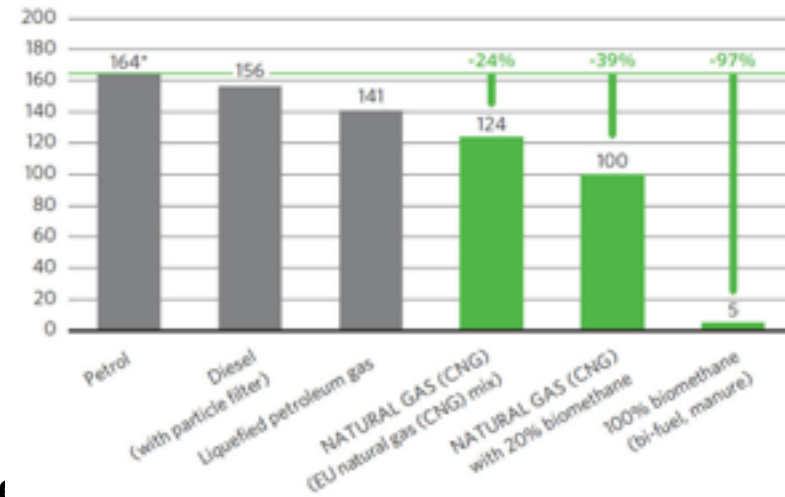
### ■ **Petrol and LPG engines**

👉 **Less** NO<sub>x</sub> – emissions than **Diesel**

👉 **Some**, but **limited** scope for further NO<sub>x</sub>-emission **reduction**

👉 **Limited** potential for switching to **renewable** fuel

Greenhouse gas emissions in the overall balance ("well-to-wheel") of different fuels in gCO<sub>2</sub>eq./km.



Source: [www.erdgas-mobil.de](http://www.erdgas-mobil.de)

# Tackling the **NO<sub>2</sub>** pollution

## 👉 potential vehicle technology **solutions**

### ■ Natural gas engine (CNG, LNG)

😊 **Low real** driving NO<sub>x</sub> - **emissions** below type approval

😊 Engine **technology** already well **developed**

😊 Fuel **efficiency** enhanced in recent years

K **Limited** market **availability** of different vehicle types/marques

😊 Similar **cost-efficiency** as Diesel

😊 Decent **refilling** infrastructure

😊 Potential for **LNG application** in heavy goods vehicles (**freight** transport)

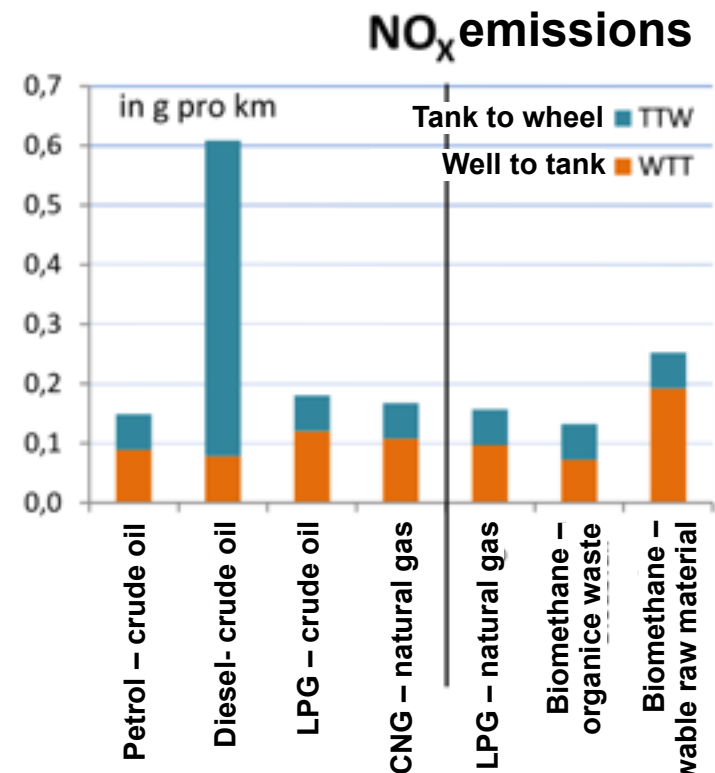
😊 Large potential for gradual switch to **renewable** gas

👉 Biogas from organic waste or renewable raw materials

👉 Hydrogen from surplus wind/solar power

👉 Power to Gas (methane)

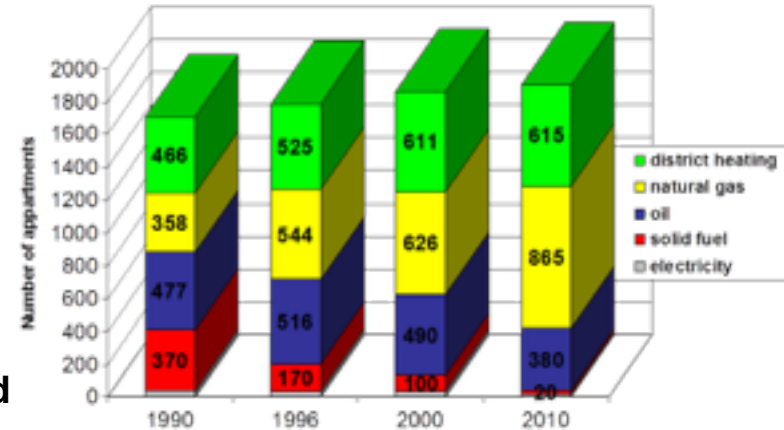
👉 **CNG/LNG** could help **curbing** NO<sub>x</sub> emissions from road **transport** fairly **soon**



Source: DLR-Study by German Transport Ministry 2013

# Promotion of natural gas as clean fuel

## 👉 Air Quality Plan Berlin



### ■ Increased use of gas as a clean fuel for domestic heating

### ■ municipal vehicle fleet

#### 👉 Garbage collection vehicles

👉 60% of whole fleet running on biogas produced from Berlin's organic waste collection system

#### 👉 Public buses

👉 (unfortunately) strategic decision for Diesel 15 years ago

👉 Diesel Part. Filter & SCR (de-NOx) retrofit programme as a compensation

### ■ Taxis, goods vehicles & private cars

#### 👉 funding scheme for purchase of up to 1000 CNG-vehicles for taxis and driving schools

👉 launched already in 2001, but still only 15% CNG taxis

#### 👉 Temporary funding through free gas-vouchers for up to 1000 new private CNG cars and 100 new CNG HGVs&LGVs to compensate the higher price of the vehicles

### ■ network of 24 natural gas refilling stations

#### 👉 increasing share of biogas



# Promotion of natural gas as clean fuel

## 👉 Germany

### ■ Limited success with stagnating CNG – vehicle numbers

👉 100.000 of 45 Mio passenger cars in Germany (0.2%)

despite of...

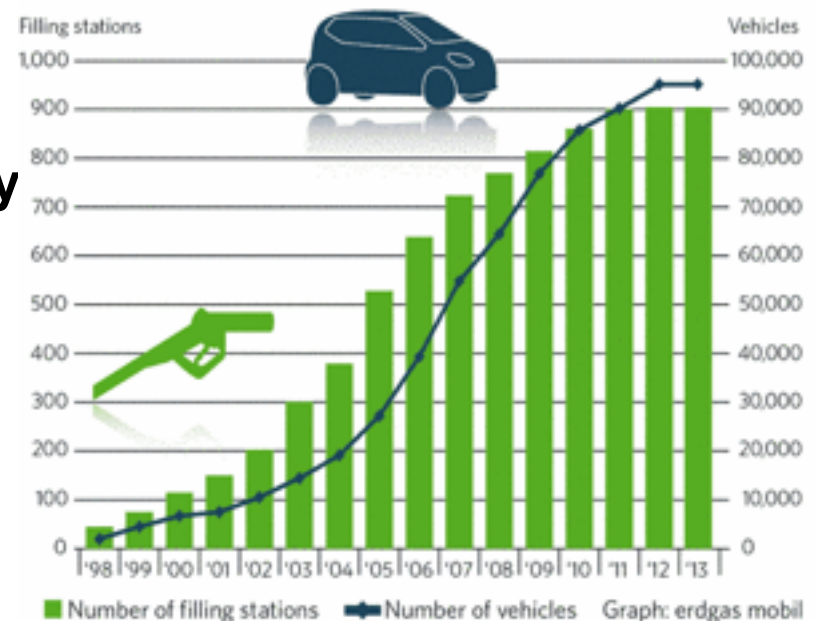
- Relatively well **developed network** of refilling stations at least in DE
- Strong economic **incentive** due to energy **tax deduction** for gas as fuel for vehicles
- **Low price** of CNG in relation to Petrol: 50%, Diesel: **60%**

Likely **reasons** are...

- **Weak** promotion by auto industry, despite of **increasing** market availability of CNG vehicles
- Relative **small** number of auto dealers **selling** CNG vehicles and offering technical **services**
- **Missing** clarity on continuation of tax **deduction**

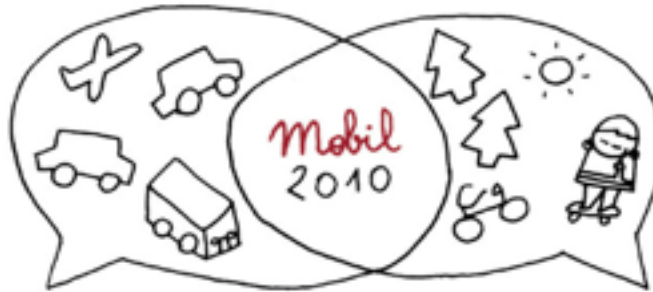
### Use of CNG in Germany

#### Number of filling stations and vehicles 1998-2013



## Conclusions

- Berlin still faces **air quality problems**, in particular high **NO<sub>2</sub>** – concentrations generated from road **transport**
- **Diesel** is the **problem**, rather than solution, because of **costly** emission control technology needed
- **Natural gas** could be a promising and cost-effective solution on the short-term
- Widespread use as a **clean fuel** for house **heating**
- **Similar** scope for road **transport**
- Strong perspective for use of **renewable** energy
- Decent framework, but still **obstacles** for growth
- **Funding** still needed to be **competitive** with **Diesel**
- **How** to boost CNG/LNG use for road transport?



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

**Thanks for  
listening!**

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