German Partnership for Sustainable Mobility

Sustainable Mobility – Made in Germany

10th BAQ Better Air Quality Conference Kuching, Malaysia 14-16 Nov 2018

Asian – German exchange on air quality

Levent Toprak, Advisor
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

German Partnership for Sustainable Mobility: Asian - German exchange on air quality

Moderator: Josh Miller, Senior Researcher
International Council on Clean Transportation

German Partnership for Sustainable Mobility: Clean Air – Made in Germany: Asian - German exchange on air quality

Thursday, 15 November 2018

Borneo Convention Centre, Kuching

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icct THE INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION

The transport sector is a major contributor to air pollution and associated health and climate impacts, but the solutions are known.

- Air pollution in Asia resulted in 3.4 million premature deaths in 2015 (HEI and IHME, 2017).
- A study of the sources of PM2.5 worldwide suggests that 25% of urban ambient PM2.5 is contributed by traffic, making it the largest sectoral contributor (Karagulian et al., 2015).
- The latest vehicle regulations developed in the US and Europe* are capable of reducing emissions of ozone precursor gases, PM2.5, air toxics, and black carbon up to 99% compared to uncontrolled levels.
- Similar standards have been adopted in China, India, Japan, South Korea, and elsewhere. Other countries in Asia can follow this regulatory and technology pathway to reduce transport air pollution.

* The European standards for diesel light-duty vehicles have not performed as well as the European standards for heavy-duty vehicles due to differences in regulatory design.

Soot-free vehicle emission controls require ultralow-sulfur fuels.

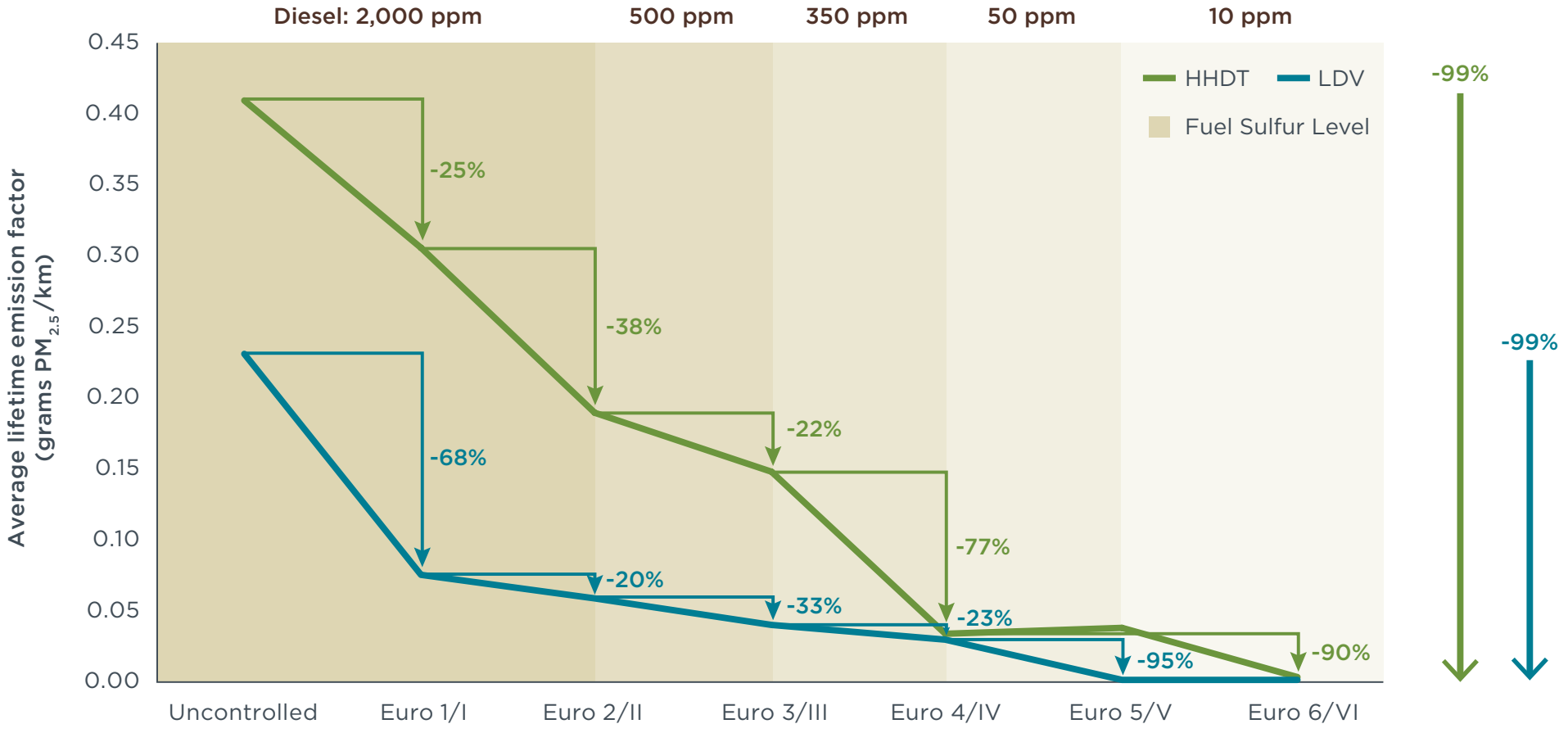

Figure S-3: Fine particulate ($PM_{2.5}$) average lifetime emission factors for diesel vehicles by emission standard and sulfur content

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Chambliss, S., Miller, J., Façanha, C., Minjares, R., & Blumberg, K. (2013). *The impact of vehicle and fuel standards on premature mortality and emissions*. International Council on Clean Transportation. Retrieved from http://www.theicct.org/sites/default/files/publications/ICCT_HealthClimateRoadmap_2013_revised.pdf

Targeting transport sector black carbon emissions reductions is an extremely important lever for climate as well as health.

- "Acting quickly, by 2020, to prevent catastrophic climate change will save millions of lives, trillions of dollars in economic costs, and massive suffering and dislocation to people around the world. Acting quickly to slow self-amplifying feedbacks and prevent runaway climate change is a global security imperative that can avoid the destabilization of entire societies and countries and reduce the likelihood of environmentally driven civil wars and other conflicts." (Ramanathan et al., 2017)
- "Immediately make maximum use of available technologies combined with regulations to eliminate high-GWP HFCs, reduce methane emissions by 50%, and reduce black carbon emissions by 90% by 2030." (Shindell et al., 2012)

References

- HEI and IHME (2017). “State of Global Air.” Retrieved from https://www.stateofglobalair.org/data

- Karagulian F., et al. (2015). “Contributions to cities’ ambient particulate matter (PM): A systematic review of local source contributions at global level.” Atmospheric Environment 120:475-483. Retrieved from https://www.sciencedirect.com/science/article/pii/S1352231015303320

- Ramanathan, V., Molina, M., Zaelke, D. (2017). “Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from Extreme Climate Change.” Retrieved from http://www.igsd.org/wp-content/uploads/2017/09/Well-Under-2-Degrees-Celsius-Report-2017.pdf

- Shindell D., et al. (2012). “Simultaneously Mitigating Near-Term Climate Change and Improving Human Health and Food Security.” Science 335(6065):183189. Retrieved from http://science.sciencemag.org/content/335/6065/183

Five principals for reducing air pollution from transportation

1.

Establish a legal obligation to reduce emissions

- Air quality standards
- Transboundary agreements and national emissions ceilings
- Nationally Determined Contributions that include targets for black carbon

2.

Prioritize and plan a course of action

- Emissions inventory
- Vehicle emissions measurement
- Air quality monitoring
- Cost-benefit analysis
- Air quality action plans

3.

Ensure vehicles entering the fleet are as clean as possible

- Standards for new vehicles/engines and fuels
- Compliance and enforcement
- Zero emission vehicle policies
- Feebates

4.

Clean up the existing vehicle fleet

- Identify and eliminate high-emitting vehicles
- Fleet transition through procurement and accelerated turnover
- Introduce low emission zones in highly impacted areas
- Economic incentives

5.

Promote a more sustainable transport system

- Public transport improvements
- Pedestrian areas
- Walking and bicycling networks
- Bicycle and car sharing systems
- Planning more liveable cities
- Speed limits
- Parking management and pricing

Panelists

- Dorothee Saar - Head of Transportation and Air Quality at the Environmental Action Germany
- Dr. Andreas Kerschbaumer - Senate Administration for Environment, Transportation and Climate Protection at the City of Berlin
- Omid Ejtemai - Managing Director Asia Pacific at PTV Group
- Antonio Multari - Director International Sales at MAHA

Introductory questions (part 1 of 4)

- Many cities in Asia suffer disproportionate air quality impacts from certain vehicle populations, such as jeepneys, buses, two-stroke motorcycles or tricycles, or taxis. Which actions can cities take to reduce pollution from high emitting vehicle categories?

- Moving quickly to reduce air pollution can require a lot of political capital. What can civil society and NGOs do to support actions to reduce vehicle emissions? What role does environmental education play?

Asian-German Exchange on Air Quality

The Role of Environmental Organizations in fighting for Stricter Law Enforcement

Dorothee Saar, Deutsche Umwelthilfe

BAQ Conference Kuching

November 15, 2018

Our Focus

Deutsche Umwelthilfe

- Our work on Air Quality and Transport
  - Raising awareness: Measurements (concentration and exhaust)

  - Results show need to act
  - Measures with area-wide effect

Our Focus

Deutsche Umwelthilfe

- Legal Action: 34 Cases for Compliance with AQ Standards lead to ban of dirty diesel

Why? Duties in Europe

Deutsche Umwelthilfe

- CO2 emission from transport have to decline by 40-42% in the next 11 years
- High exhaust emission, high diesel share and continued subsidies lead to exceedance of NO2 concentration limit values and severe health damages
- Emission of ultrafine particles not accordingly addressed
- EU legislation lacks implementation
- Market surveillance and effective periodic inspection still missing
- Strong lobby influence stands against effective measures
- Transparency of data and independent control is crucial

Where should that lead us to?

Deutsche Umwelthilfe

- Climate change and health requirements not only need technical improvement but a transformation of transport modes and systems
- While national authorities tend to protect industry rather than health, there is growing activity on the local level
- However, this level needs rear cover from EU and national level with regard to standards, taxation, financing etc.
- NGOs can and should be able to get and provide information, to urge for solutions and to support actors from all levels
- Legal action can help to keep the pressure high and to achieve short term action

Thank you!

Dorothee Saar

Deutsche Umwelthilfe

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Introductory questions (part 2 of 4)

- Which actions has Berlin taken to reduce air pollution from vehicles?
- What recommendations do you have for cities in Asia to achieve similar benefits?
- Which opportunities do cities in Asia have to move directly to zero emissions transport? How can cities encourage this transition while reducing emissions from conventional vehicles?

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Air pollution in Berlin: policies and instruments

Clean Air – Made in Germany

Dr. Andreas Kerschbaumer

City of Berlin, Senate Department for the Environment, Transport and Climate Protection

15 November 2018

Presentation Overview

I. The situation

II. Actions taken to improve air quality

III. Is it enough?

IV. Conclusion/Recommendation

The situation
a few facts about Berlin

Area: 900 km²

Inhabitants: ca. 3.7 Mio, growing: +40,000 residents per year, many young people

Dominance of service sector, media, IT, government, research, start-ups

Good public transport system

Low car density: 330 cars / 1,000 inhabitants

Diesel-share: almost 40 %

No heavy industry

Largest district heating network in Europe

The situation
Air Pollution

pollutant	main source	status
SO_2	power plants, industry, domestic heating	☺ problem solved 20 years ago ☞ switch to clean fuel & control technology
CO, HM	Traffic, heavy industries	☺ never a problem
Benzene	traffic	☺ problem solved 10 years ago
PAH	traffic, domestic heating	☺ problem solved 5 years ago ☞ switch to clean fuel & control technology
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, residential heating	😐 partly solved, shrinking local contribution ☞ switch to clean fuel & control technology
NO_2	Road traffic (Diesel)	☹ serious problem, time extension notified, infringement launched

Actions taken to improve Air Quality

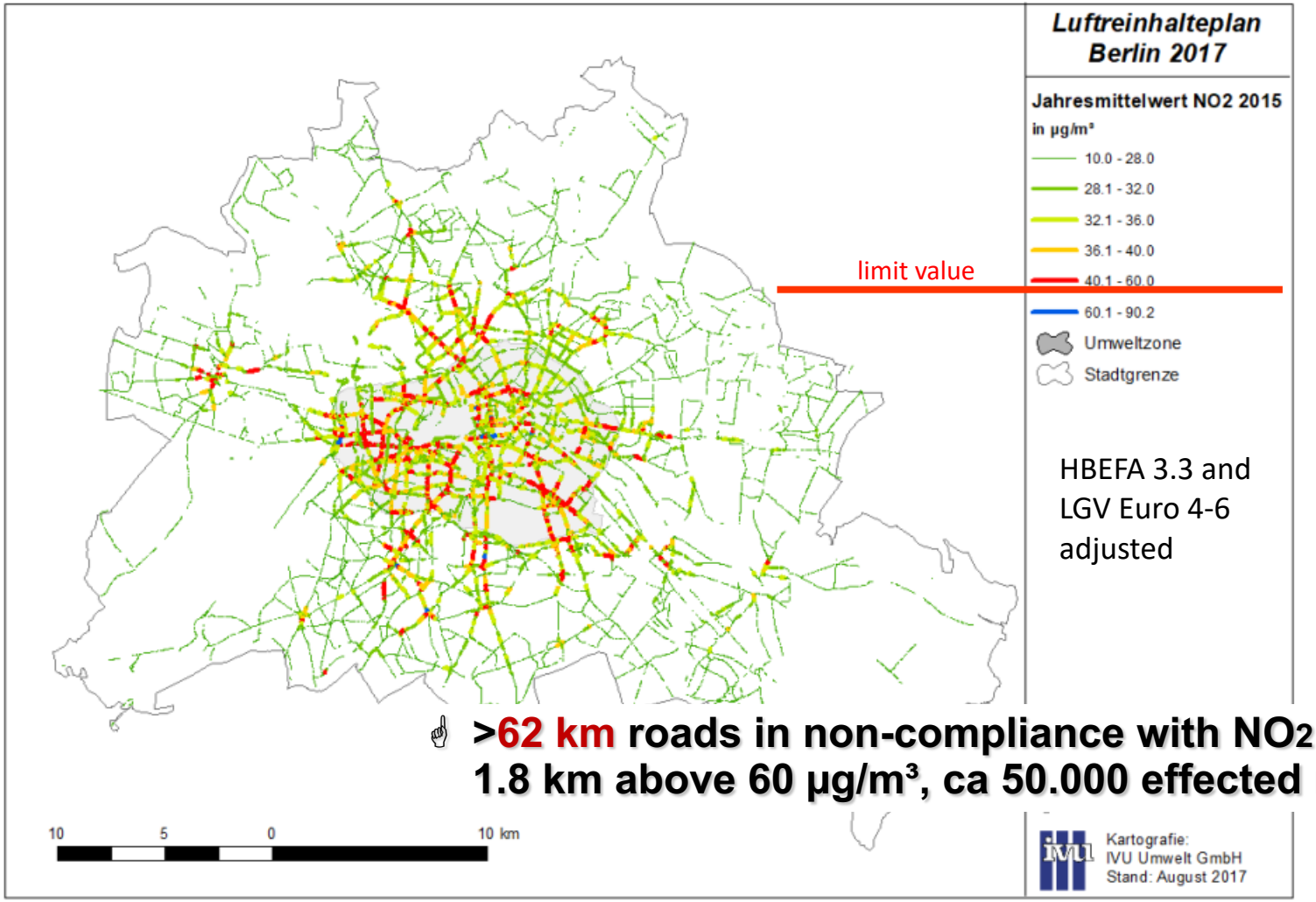
particles abatement strategy: no Diesel without a particle filter

- Problem: DPF mandatory in new Diesel engine applications…
  - only since 2014 for trucks and buses
  - only after 2019-21 for non-road machinery and vessels
- Solution: Retrofit of in-use vehicle/machinery stock with DPF
- Buses (1440 vehicles): DPF retrofit programme launched already in 1999, resulted in
  - > 90% reduction of soot emissions/vehicle
  - - 37 t/a Diesel soot emissions in total
  - almost 10% drop of Diesel soot emissions from road traffic in 2007

- Road vehicles: low emission zone
  - Road traffic was main contributor
  - Huge non-compliance problem
  - Transport planning measures not enough
  - Need for accelerated improvement of the growing Diesel vehicle fleet
    - replacing polluting by new cleaner vehicles
    - retrofitting existing vehicles with particle filters
  - ☞ Access restriction to central city for polluting vehicles

Is it enough?

No! NO_2 is much to high at street sites



HBEFA 3.3 and LGV Euro 4-6 adjusted

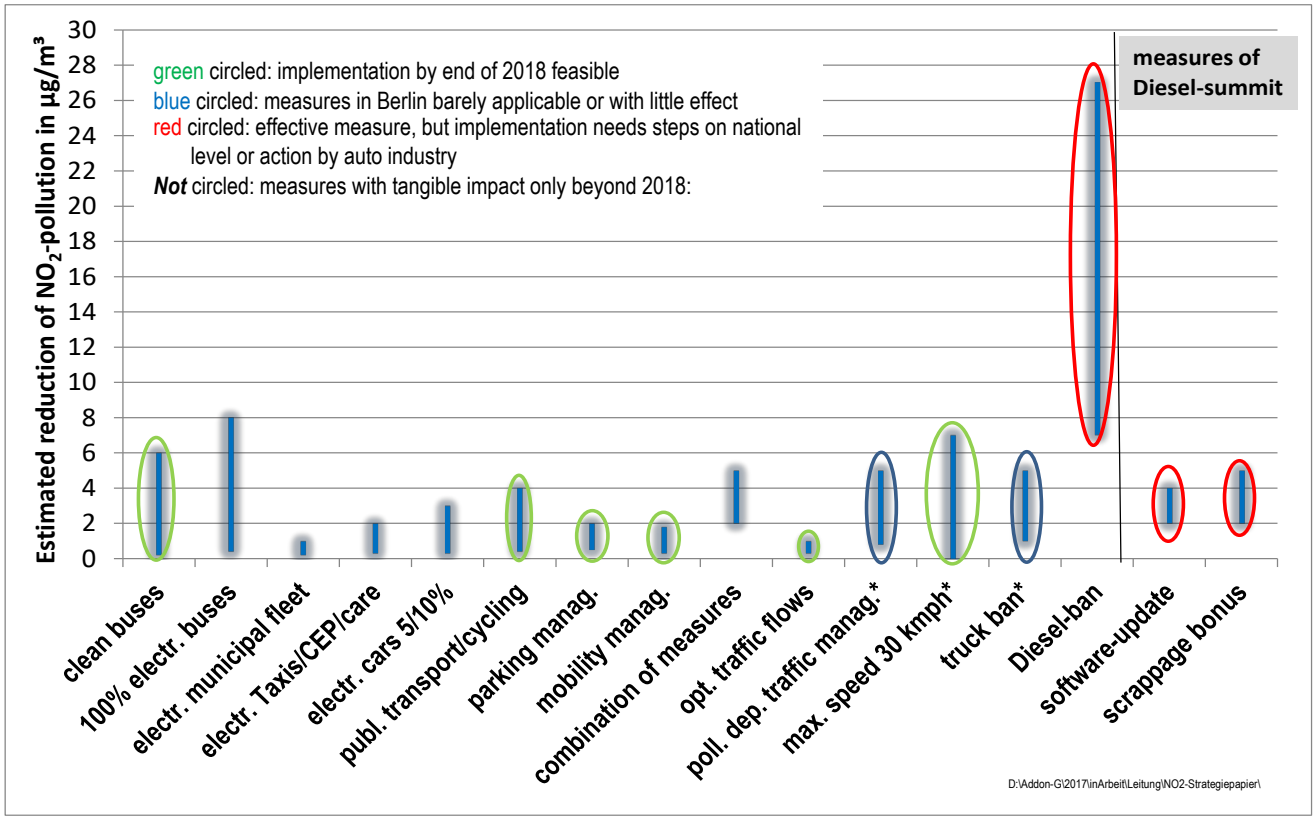
☝ **>62 km roads in non-compliance with NO_2 limit value**
1.8 km above 60 µg/m³, ca 50.000 effected residents

Is it enough?

No! NO_2 is much to high at street sites

Challenges:

- we need to bring down NO_2 by up to 25 µg/m³ by 2020
- Difficult to quantify short-term impact of planning and structural measures
- Ban of Diesel with high real driving emissions indispensible at least in some polluted roads
- Need to model effect of traffic re-routing and potential pollution increase



Conclusion/Recommendation

I. PM problem largely solved – at least in relation to AQ standards

II. Existing measures insufficient to meet NO_2 standards as soon as possible

III. Traffic & city planning & conversion to zero/ultra-low emission vehicles is indispensable, but takes fairly long

IV. Need to identify additional measures with a tangible & quick impact by using our model tools, traffic and emissions data

V. Berlin is to revise its Air Quality Plan

- access restrictions for Diesel in polluted roads
- Pushing clean vehicle technologies
  - Electric, CNG, LNG
- Traffic management incl. speed limits
- Traffic planning

Recommendation
Sustainable City and Transport Planning

I. Traffic management

- Re-routing lorry traffic
  - Reduces PM pollution by 7-9 %, needs alternative lorry routes
- Speed limits
  - Reduces vehicle emissions, if traffic flow remains good
  - Decrease of local traffic contribution to PM & NO_2 by up to 30 % and 15 % respectively
  - Reduces traffic noise by up to 2 dB(A)
- Traffic flow optimatisation
  - Conflicts with traffic light priority for bus & tram
  - Application limited in larger cities
  - Can reduce pollution by up to 8 % (PM) an d 15 % (NO_2)

II. Improving public transport

- Makes public transport more attractive
- Reduces air & noise emissions
- Makes transport more energy efficient

Recommendation
Sustainable City and Transport Planning

III. Enhancing inter-modality

- Bike & Ride
  - Makes public transport & cycling more attractive
  - Shifts car traffic to cleaner modes
- Freight transport
  - Makes rail-road more attractive
  - Keeps lorries out of sensitive urban areas
  - Last mile distribution of Urban Freight Transport
- Park & Charge & Ride (including priority for electric vehicles)
  - Makes public transport more attractive
  - Reduces car trips in cities
  - Incentives electric vehicles

IV. Promoting bicycle use

- Setting up a dense cycle – route network
- Re-allocation of road space in favor of cyclists & pedestrians (safe riding and walking)
  - Makes bicycle more attractive
  - Good for public health

Thank you for your attention!

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For more information on

Berlin Low Emission Zone
www.berlin.de/umweltzone

Berlin Air Quality Plan
www.berlin.de/luftreinhalteplan/

Berlin Mobility Act
www.berlin.de/senuvk/verkehr/mobilitaetsgesetz/

Berlin Energy and Climate Protection Programme 2030
www.berlin.de/senuvk/klimaschutz/bek_berlin/

Introductory questions (part 3 of 4)

- Which innovative mobility solutions has PTV presented Copenhagen, and are they useful for Asia? If so, when and how could they be implemented?

- How could intelligent transport management systems (ITS) improve the quality of infrastructure planning and development for pedestrians, bicyclists, and transit users?

- Which resources do cities need to access and fully utilize these tools?

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Large scale modelling of emissions and traffic flows to evaluate the impact of mitigation actions

Asian – German exchange on air quality

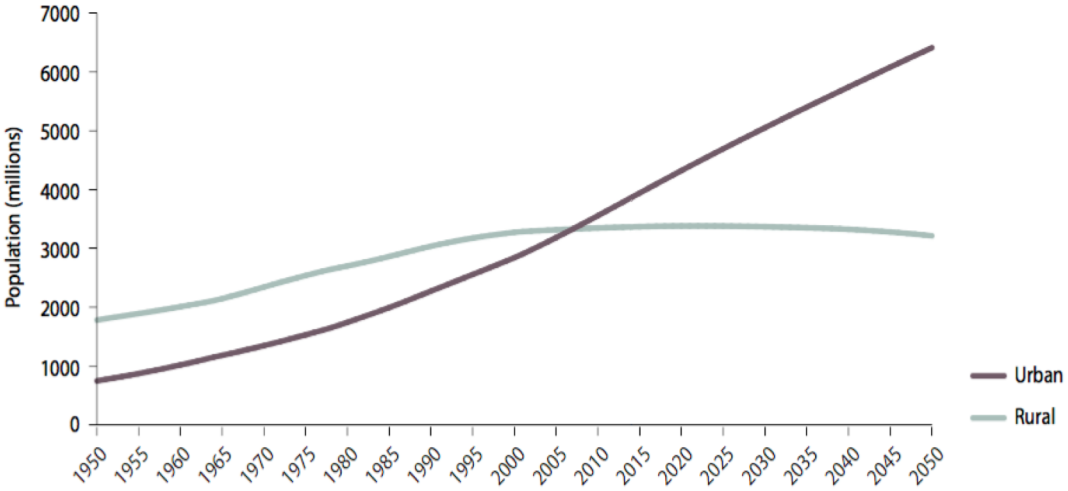
Omid Ejtemai
PTV Group
November 15, 2018

Urbanization Trend

World population lived in urban areas:

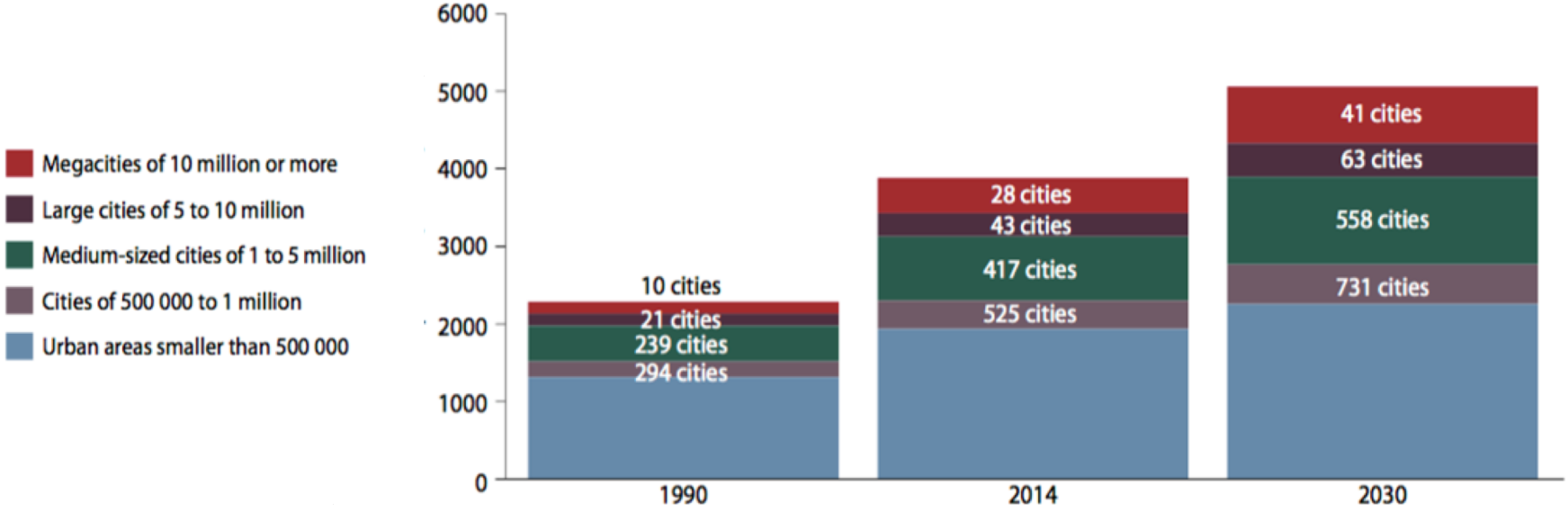
1950 – 30%
2007 – 50%
2030 - 66%

Between 2007 and 2030 the World population is expected to grow by 1.8 Billion
The entire growth during that period will be in the cities

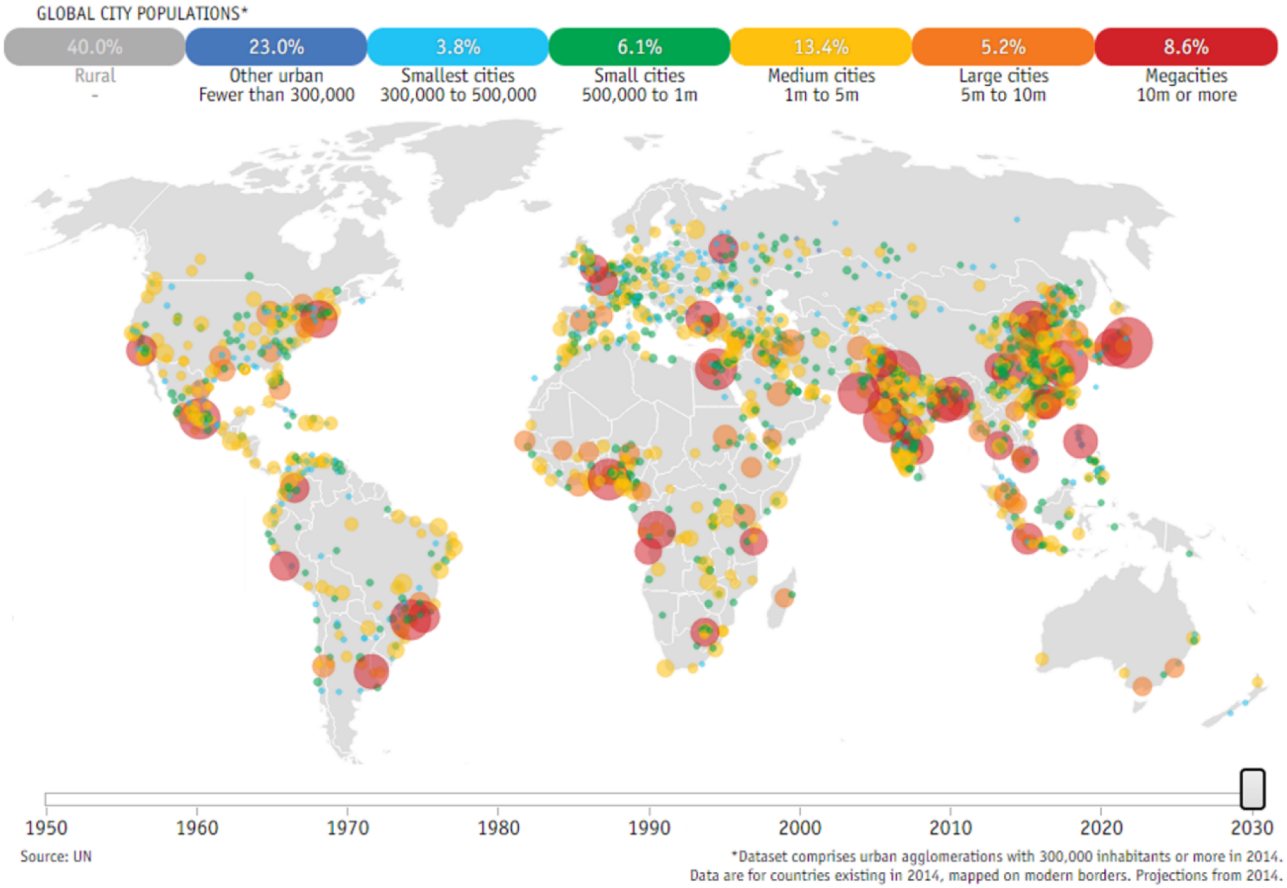


With an increase in urban population comes a scarcity of living space, a higher utilisation of the infrastracture, hence an increase of traffic and potentially congestion.

Global Urbanization Trends



Global Urbanization Trends



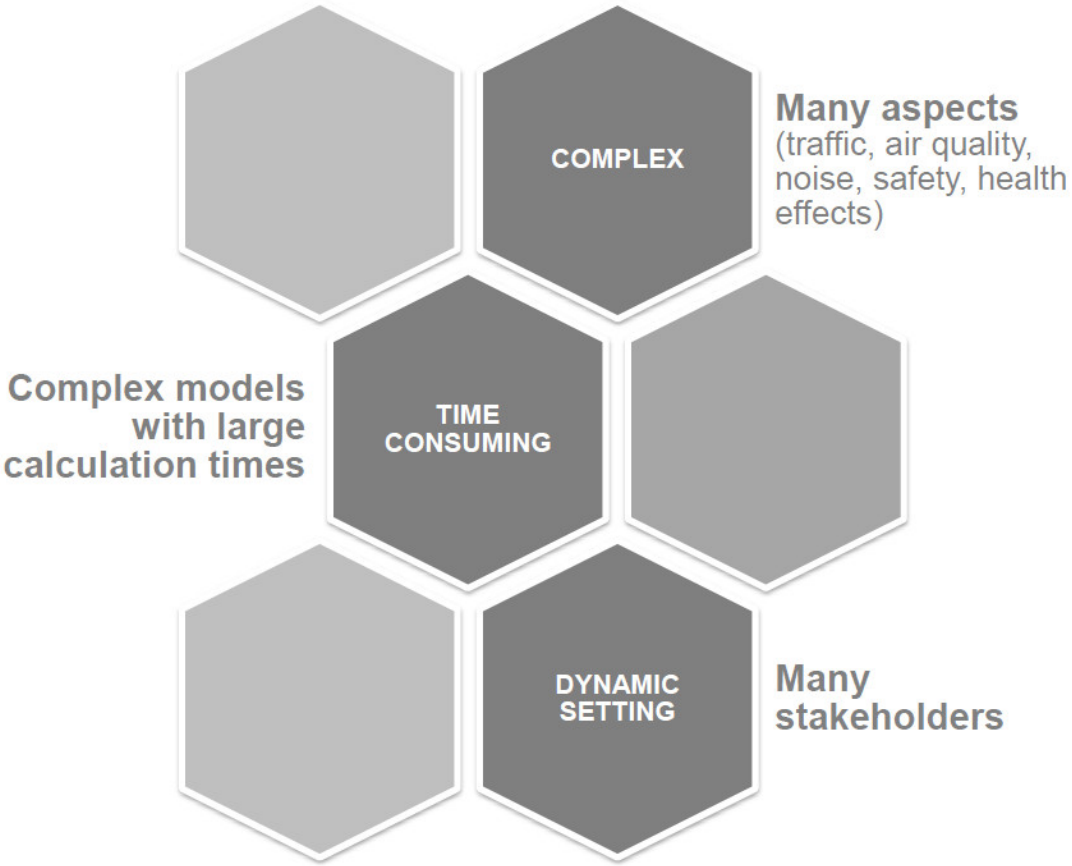
Density of people drives transport imperative

- Growth of urban population indicates the challenges faced by governments, urban planners and private sector:
  - $57 trillion investment is needed!
  - New approaches are needed to fund, manage, operate and optimize utilization of transport infrastructure

Shifting strategies and approach

Focus on supply	→	Maximize efficiency and focus on demand
Vehicle oriented	→	People oriented, customer-centric
Emphasis on: Knowing and seeing	→	Emphasis on predicting and anticipating
Invest in physical infrastructure	→	Invest in data fusion, emerging technologies and adaptive tools

Traditional Urban Planning

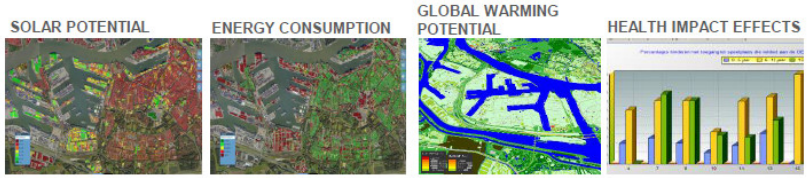


Holistic Urban Strategy Approach

MODELS

- Traffic
- Air Pollution (Industry)
- Air Pollution (Total)
- Transportation Noise
- Industrial Noise
- Safety Hazards
- Safety Hazards (Transportation)

Other models can be added, also region specific:



Smart City Strategies

I. Large Scale Dynamic Models

II. Realtime Traffic Management

III. CAV

IV. MaaS

Introductory questions (part 4 of 4)

- How can measuring vehicle emissions help cities in Asia design better policies?
- Which technology solutions are available to measure vehicle emissions? What is the accuracy of these technologies?
- How can cities access these testing solutions? Which resources do cities need?

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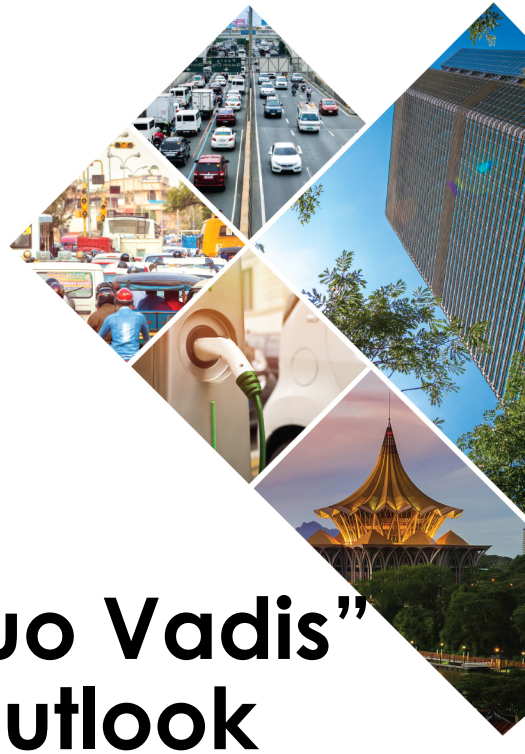


Emission Testing for Vehicles "Quo Vadis" – An International Review and Outlook

Antonio Multari

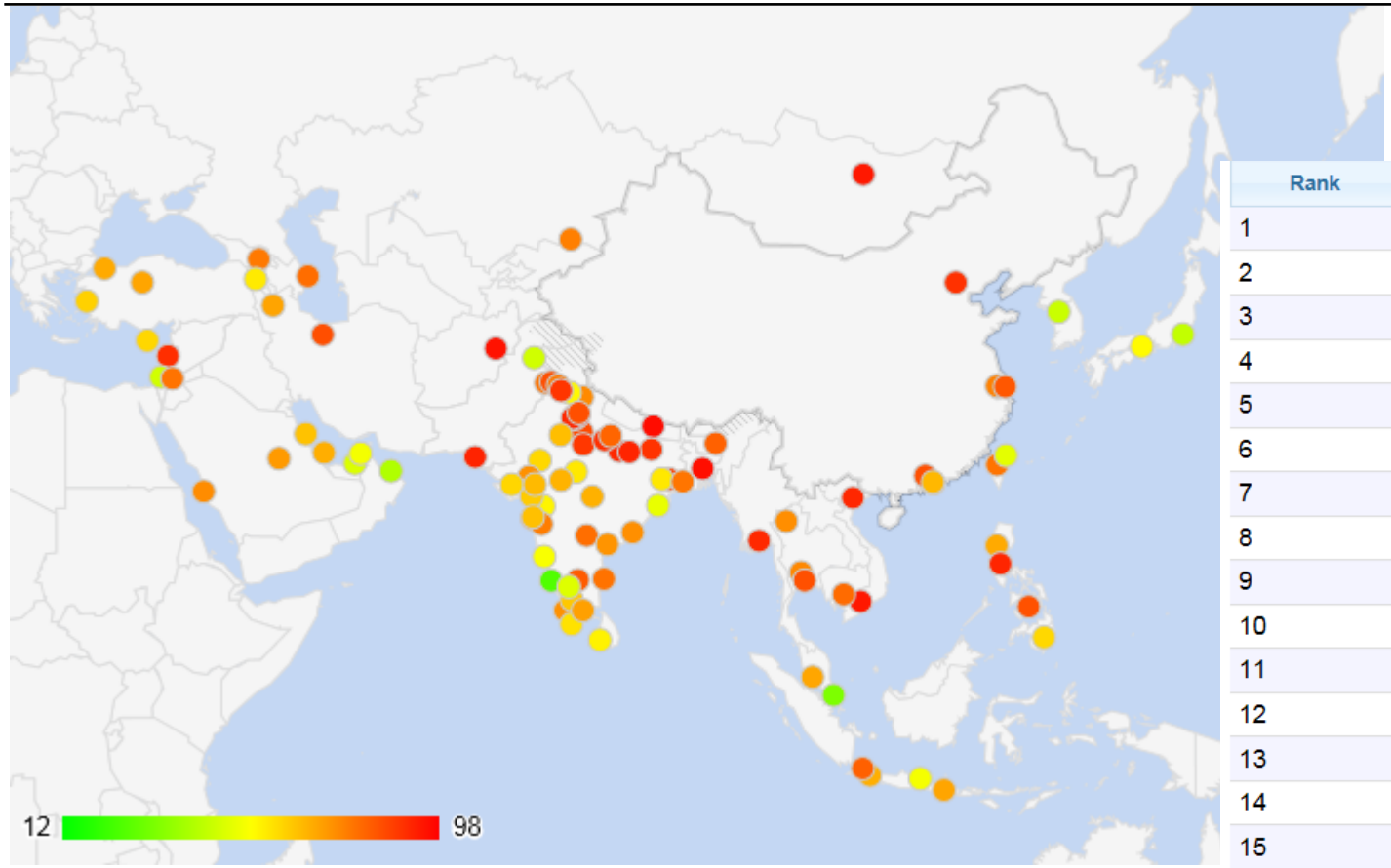
MAHA Germany

15 November 2018

Introduction

Challenges are arising in all major cities around the globe regarding emissions from vehicle combustion engines. Pollutants as CO, CO_2, HC, PM, PN and NO_x (NO and NO_2) are becoming a major problem. This presentation gives an international review and an outlook for the future.

Most polluted cities in Asia



Rank	City
1	Kathmandu, Nepal
2	Faridabad, India
3	Dhaka, Bangladesh
4	Ghaziabad, India
5	Kabul, Afghanistan
6	Ho Chi Minh City, Vietnam
7	Ulaanbaatar, Mongolia
8	Karachi, Pakistan
9	Noida, India
10	Varanasi, India
11	Manila, Philippines
12	Hanoi, Vietnam
13	Delhi, India
14	Gurgaon, India
15	Allahabad, India

https://www.numbeo.com/pollution/region_rankings.jsp?title=2018-mid&region=142

Deficits of the current periodic emission test

- Test procedures have been developed **25 years ago** (Euro 1)

- Simple **unloaded tail pipe test** procedures in many countries
  - Idle/high idle test for CO Vol. % (petrol/gasoline)
  - Free acceleration test for smoke (diesel)

- **Simple OBD-reading** since 2006 in Germany

- Other **dangerous pollutants** especially arising in high

concentrations in modern engines (e. g. nano-PM, NO_x) **are not measured**

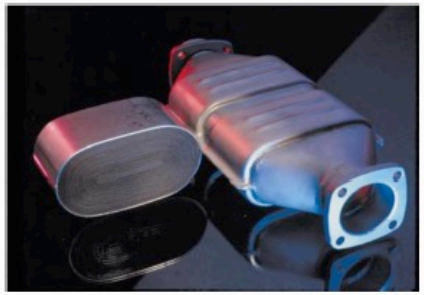
Consequences

Deterioration because of age or mileage and illegal manipulation of

the emission system (Diesel and Petrol/Gasoline) cannot be detected:

Blocking baffle (gas tube)

Zapping device



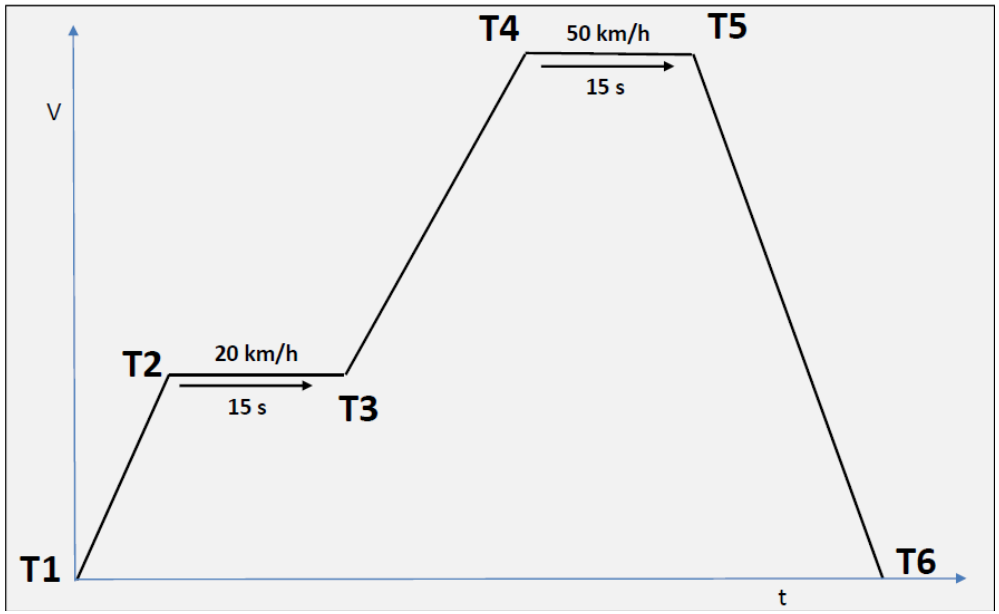
Refit 3-way catalyst

High number of **vehicles are exceeding** the allowed **pollutant concentrations**

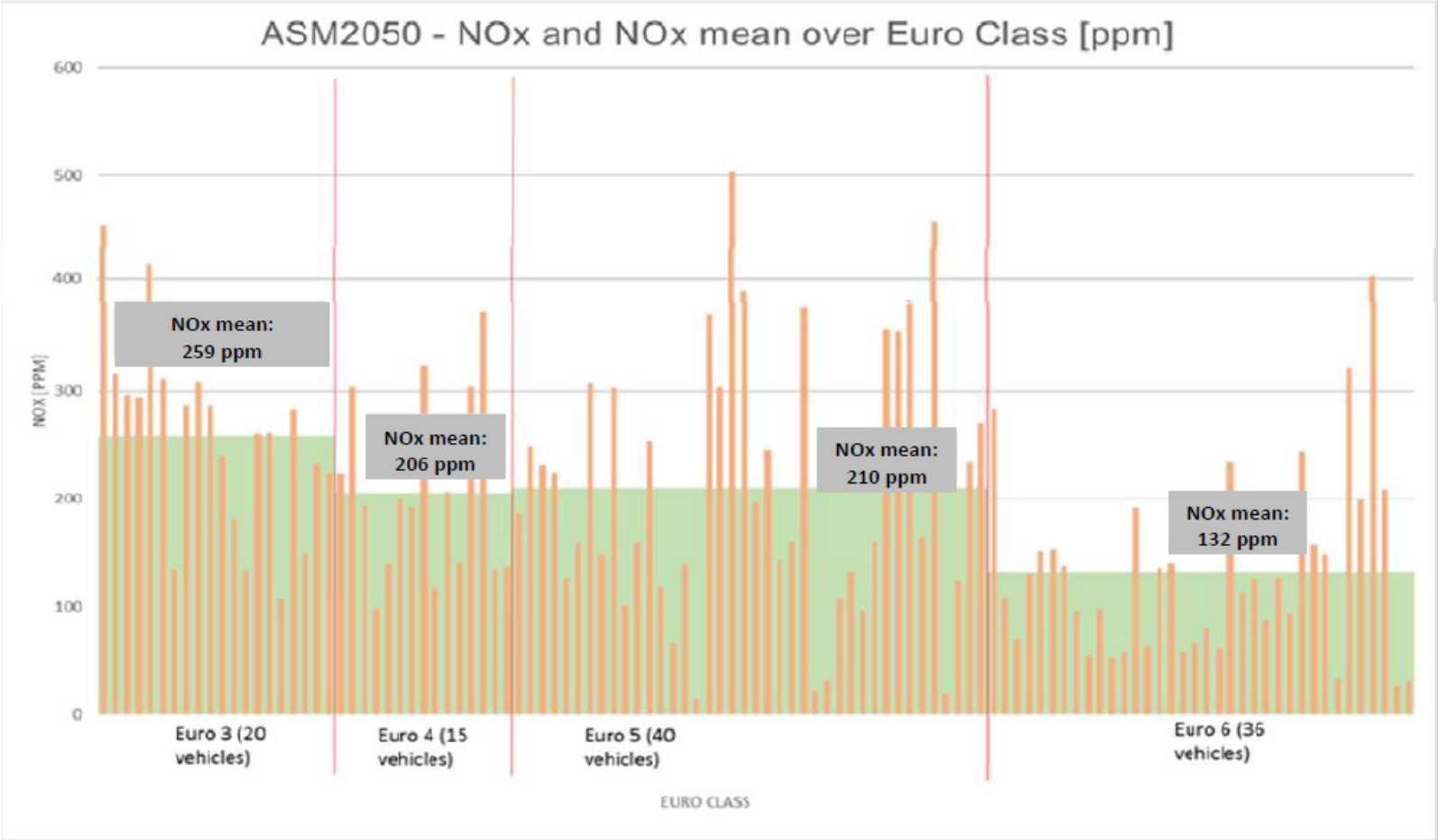
High **negative impact on air quality especially** in urban areas

Examples of different researches

Diesel NOx emissions: CITA SET II Study, ASM 2050 cycle (quick loaded test)



Field tests ASM 2050 (diesel vehicles)



Main Findings

- Concentrations of NO_x between 50 ppm and 600 ppm
- Average NO_x is decreasing from Euro 3 to Euro 6, but not in correlation with type approval
- Condition of vehicles was not known (e.g. software concept, SCR-temperature)
- Reasons for the wide spread of concentrations could be:

➢ Failure condition of components or engine (deterioration or manipulation)

➢ Legal reduction or switch off of the operation

➢ Vehicle not sufficient conditioned (e. g. temperature)

➢ Regeneration phase

The **ASM2050** shows promise for a **periodic emission test**. **Comprehensive information** regarding the after treatment systems and the software strategy (function) are necessary to evaluate the systems.

Main Findings

- The current periodic emission test procedures are not able to detect deteriorated or manipulated 3-way catalysts of petrol vehicles
- To measure only CO is not sufficient
- A loaded test seems applicable for a proper evaluation of a 3-way catalyst

Also emission systems of **petrol vehicles** need to be tested periodically with a **loaded test**.

Summary

The best way to deal with emissions from combustion engines is a modern tail pipe with testing incl. OBD test, PN test, loaded test for NO_x emissions. The best contribution is given for the public and environment with this combination!

Thank you for your kind attention!

Antonio Multari

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Questions for discussion

- We've heard from the panelists about the successes and challenges of reducing vehicle emissions in Germany, and about some opportunities for action in Asia. Where do you see opportunities for action in Asia?

- What is needed to support those activities? Which stakeholders need to be involved?

- How can we give adequate attention to near-term priorities (such as reducing air pollution from new and in-use vehicles) while ensuring progress toward long-term goals (such as zero emissions transport)? How could the measures and technologies we discussed serve to address both objectives?