
Berliner Verkehrsbetriebe (BVG)
Public Service Bus Department
Public Law Company
Burkhard Eberwein

# Integrating Clean Vehicles into Berlin Fleets

CLEAN FLEETS WORKSHOP 26 March 2014

Es lebe Berlin. BVG

# *About BVG – Size and passenger trends*

## The BVG in figures

| | | |
|---|---|---|
| Rolling Stock | Subway | 1.242 |
| | Tram | 378 |
| | Bus | 1.316 |
| Operating Vehicle kilometre | Subway | 119,5 Mio. |
| | Tram | 25,8 Mio. |
| | Bus | 83,8 Mio. |
| No. Lines (Day - Night) | Subway | 10 - 8 |
| | Tram | 22 - 9 |
| | Bus | 149 - 62 |
| Passengers | Subway | 507,3 Mio. |
| | Tram | 174,4 Mio. |
| | Bus | 384,9 Mio. |

# Environmental measures experienced in BVG buses

| *Technology* | *Vehicle* | *Additional costs* |
|---|---|---|
| Methanol (1985 – 1988) | 7 MAN SL 200<br>7 Mercedes Benz O305 | approx. 28%* |
| CNG (1996 – 1999) | 4 MAN NG 232<br>2 Mercedes Benz O405 GN<br>4 Mercedes Benz O405 N | approx. 20%* |
| Aquazole (1999) | 15 buses | approx. 8% / 100km |
| CRT (1999 – 2001) | 800 buses retrofitted and all new buses | approx. 5500 EUR/unit |
| Euro 5 / EEV (2003 – to date) | | 25 VOLVO buses Funded by Ministry of Environment* |
| Euro 5 / EEV | new buses to be commissioned | series in 2006 |
| Hydrogen (2006 – to date) | 4 MAN suction engine | in operation* |

* funded by national and/ or European programmes

# *EU Air quality standards directly related to the transport sector*

**96/62/EG, 1999/30/EWG, 2000/69/EG**

| | Entry into force | Limit | |
|---|---|---|---|
| CO | 1.1.2005 | 10 µg/m³ | 8-h-average |
| $NO_2$ | 1.1.2010 | 40 µg/m³ | Yearly average |
| | 1.1.2010 | 200 µg/m³ | 1-h-limit, max. 18 exceedances per year |
| Benzene | 1.1.2010 | 5 µg/m³ | Yearly average |
| Particulate matter (PM | 1.1.2005 | 40 µg/m³ | Yearly average |
| | 1.1.2005 | 50 µg/m³ | Daily average, max. 35 exceedances per year |
| | | Guidance limits | |
| PM 10 | 1.1.2010 | 20 µg/m³ | Yearly average |
| | 1.1.2010 | 50 µg/m³ | Daily average, max. 7 exceedances per year |



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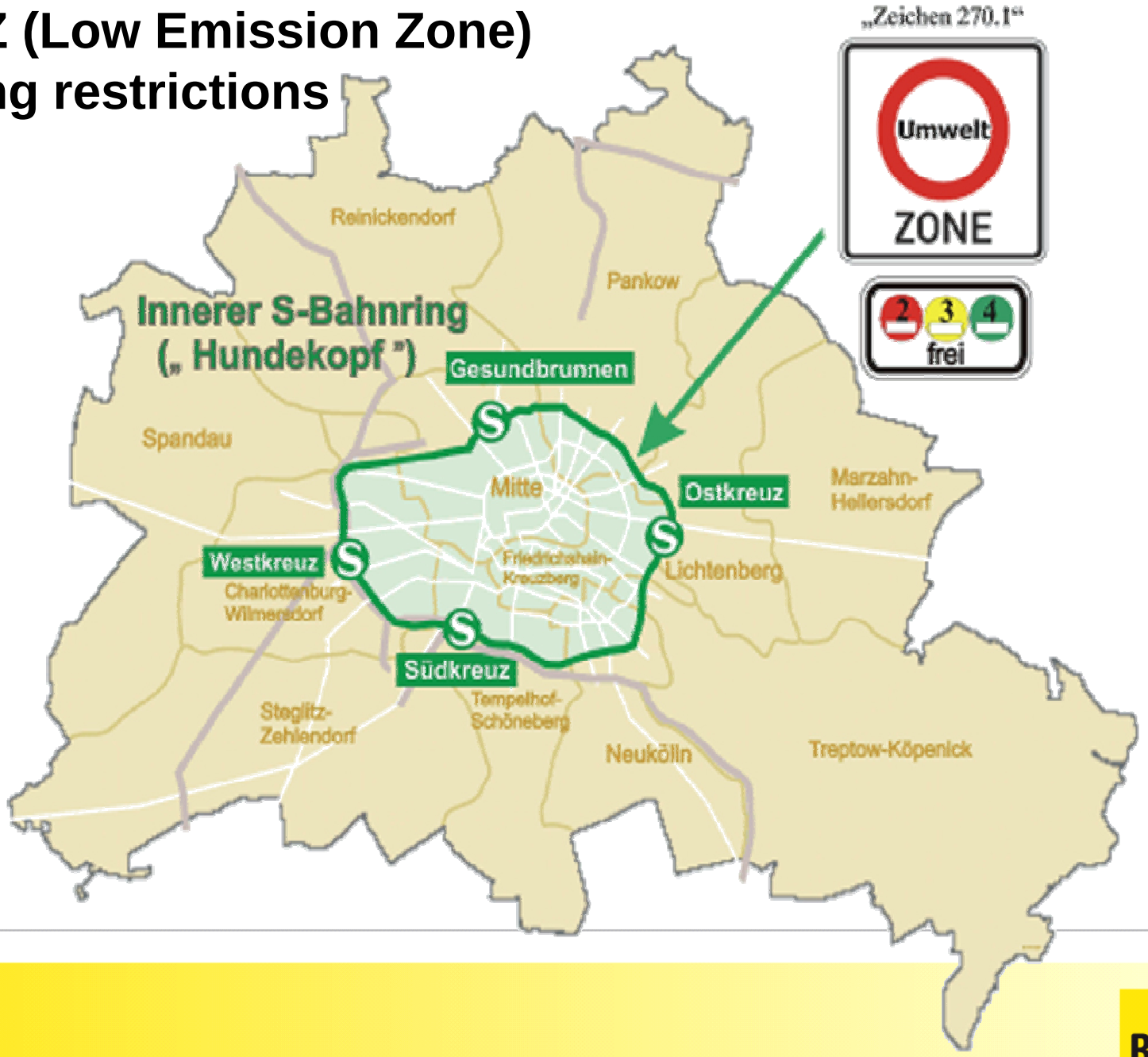
# Berlin LEZ (Low Emission Zone) with driving restrictions



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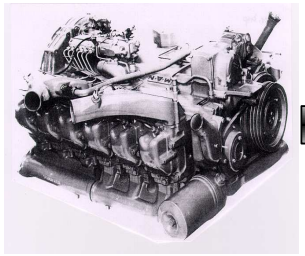
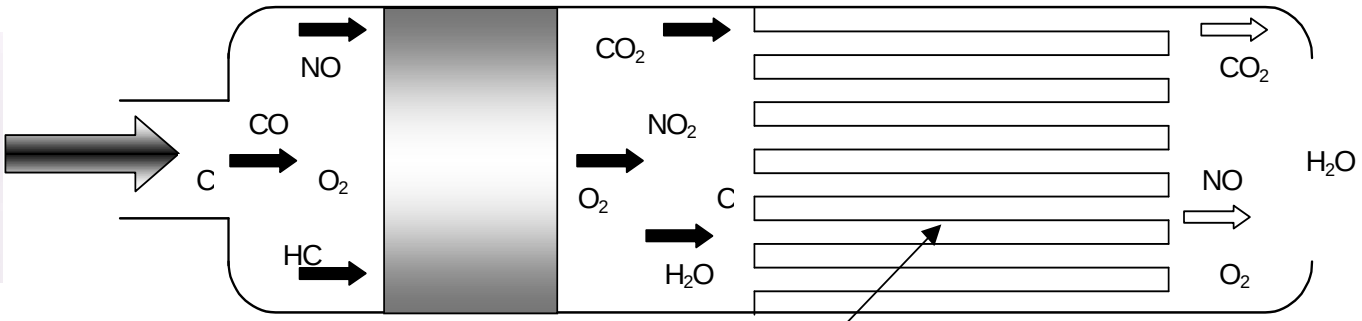
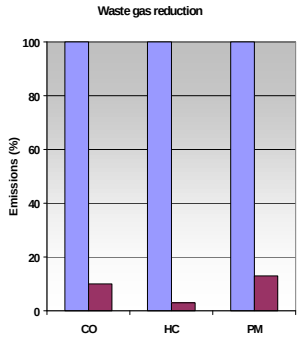
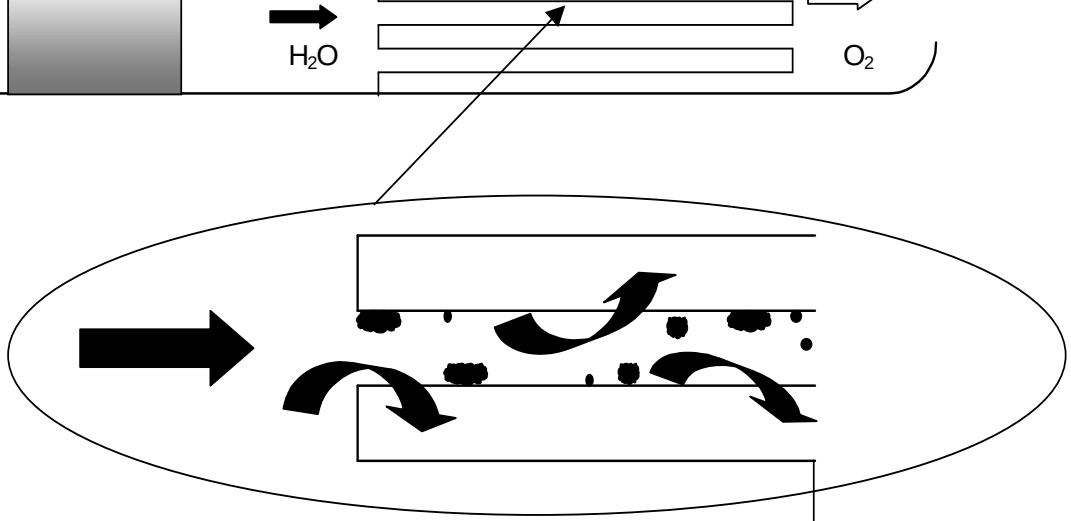
# *Exhaust gas after treatment CRT*

## *(Continuously regenerating trap)*





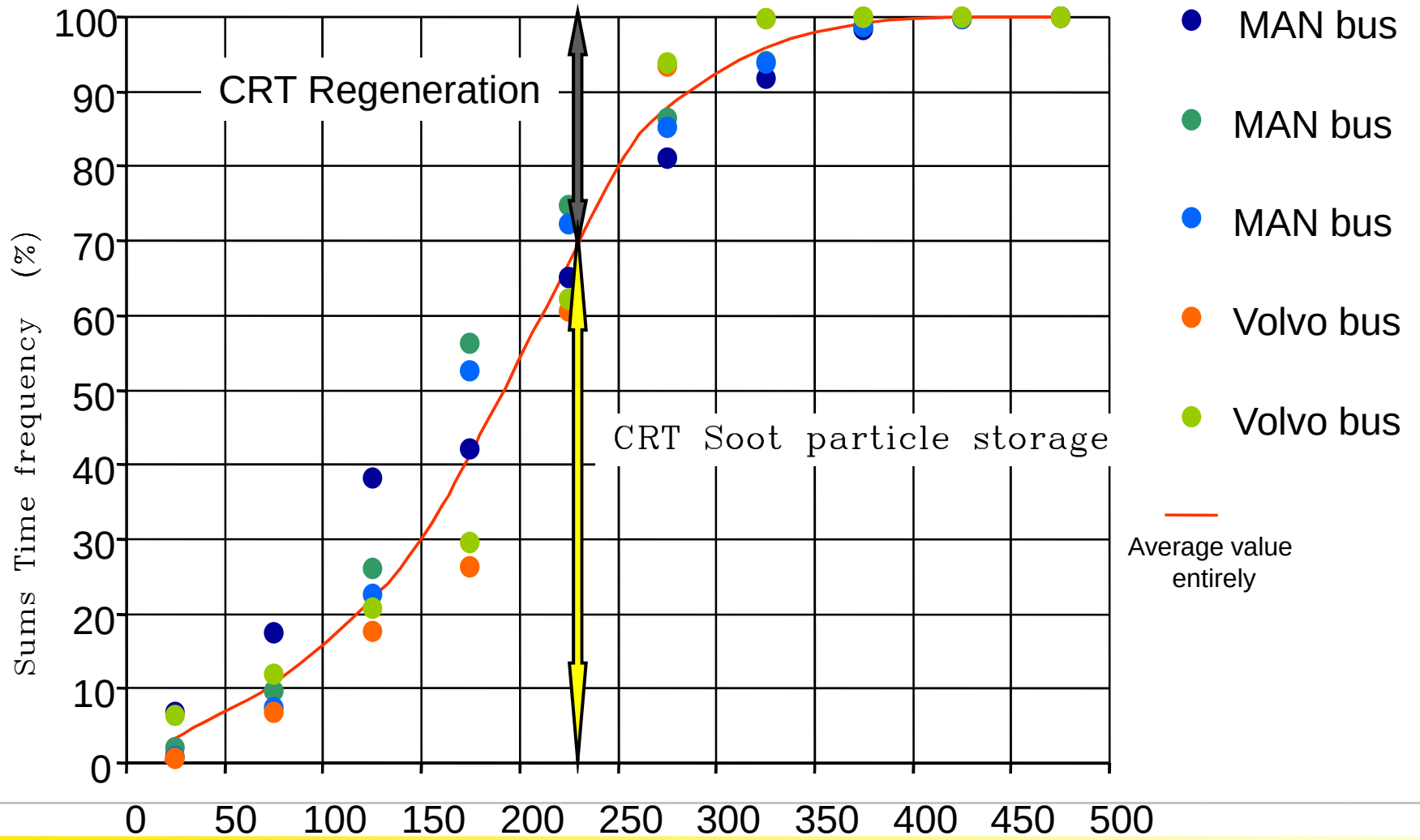



The diesel exhaust gases then flow through the oxidation catalyst. During this phase, levels of pollutant substances CO and HC are reduced. Nitrogen dioxide is then produced from the nitrogen oxide. As an oxygen carrier, this nitrogen dioxide leads to a continuous burning of the soot particles in the subsequent soot filter. This is how carbon monoxide, hydrocarbon and soot particle components can be reduced by over 90%. The basic prerequisite is to use diesel fuel with a sulphur content of max. 10 ppm and a exhaust gas temperature window of between 250℃ and 450℃.

# Cumulative probability of bus exhaust-gas temperatures

(CRT filter regenerates above curve, but accumulates particles below curve)



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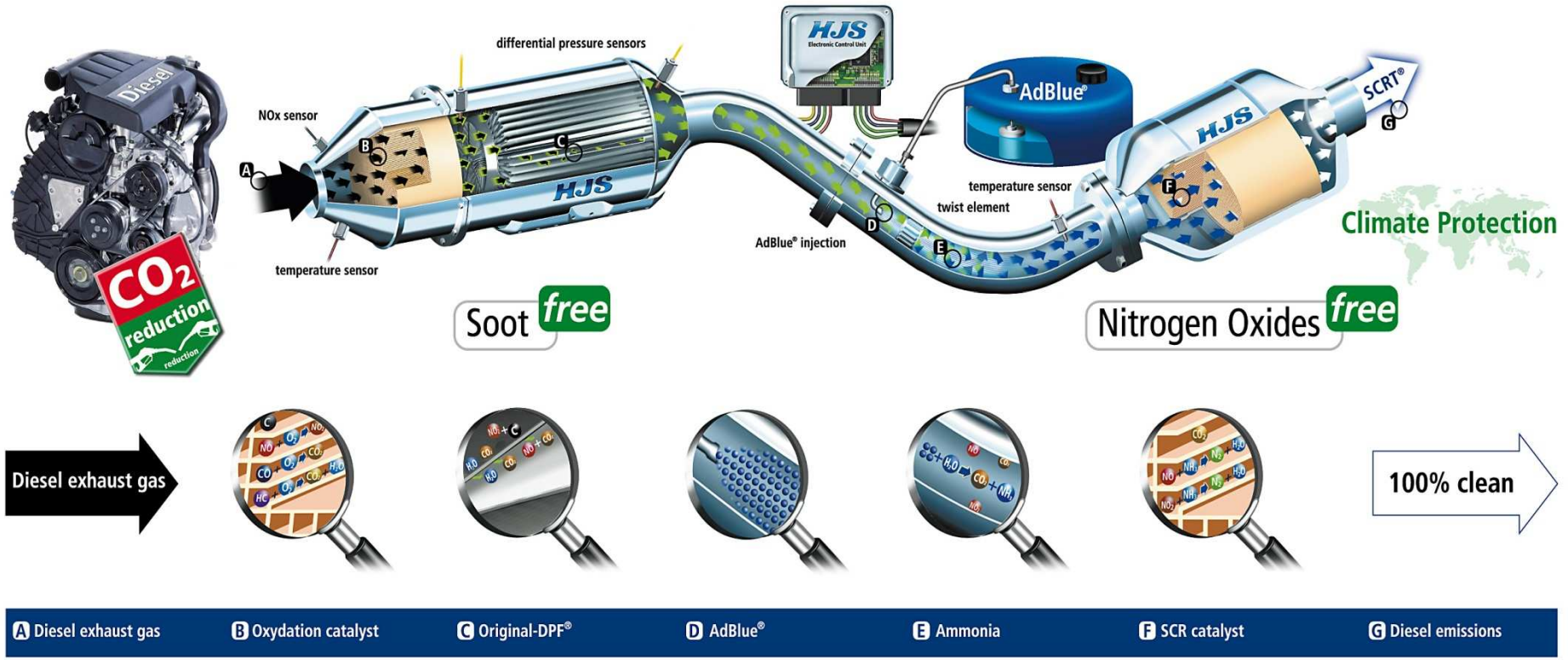
# *Engineering – SCRT®*
## *(Technology for Commercial Vehicle Applications)*



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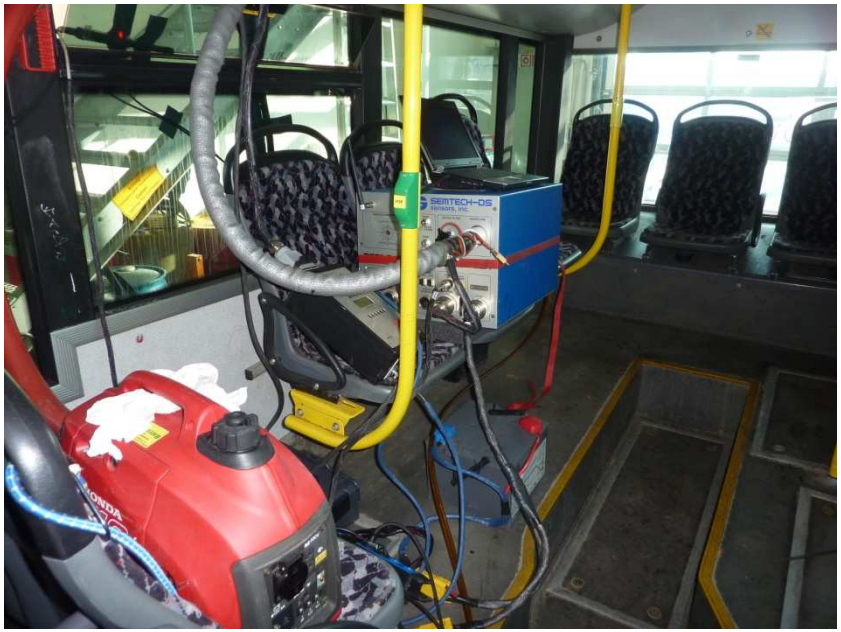
# *TÜV Emission Measurement*




measuring facility inside bus

Exhaust tube to measuring facility

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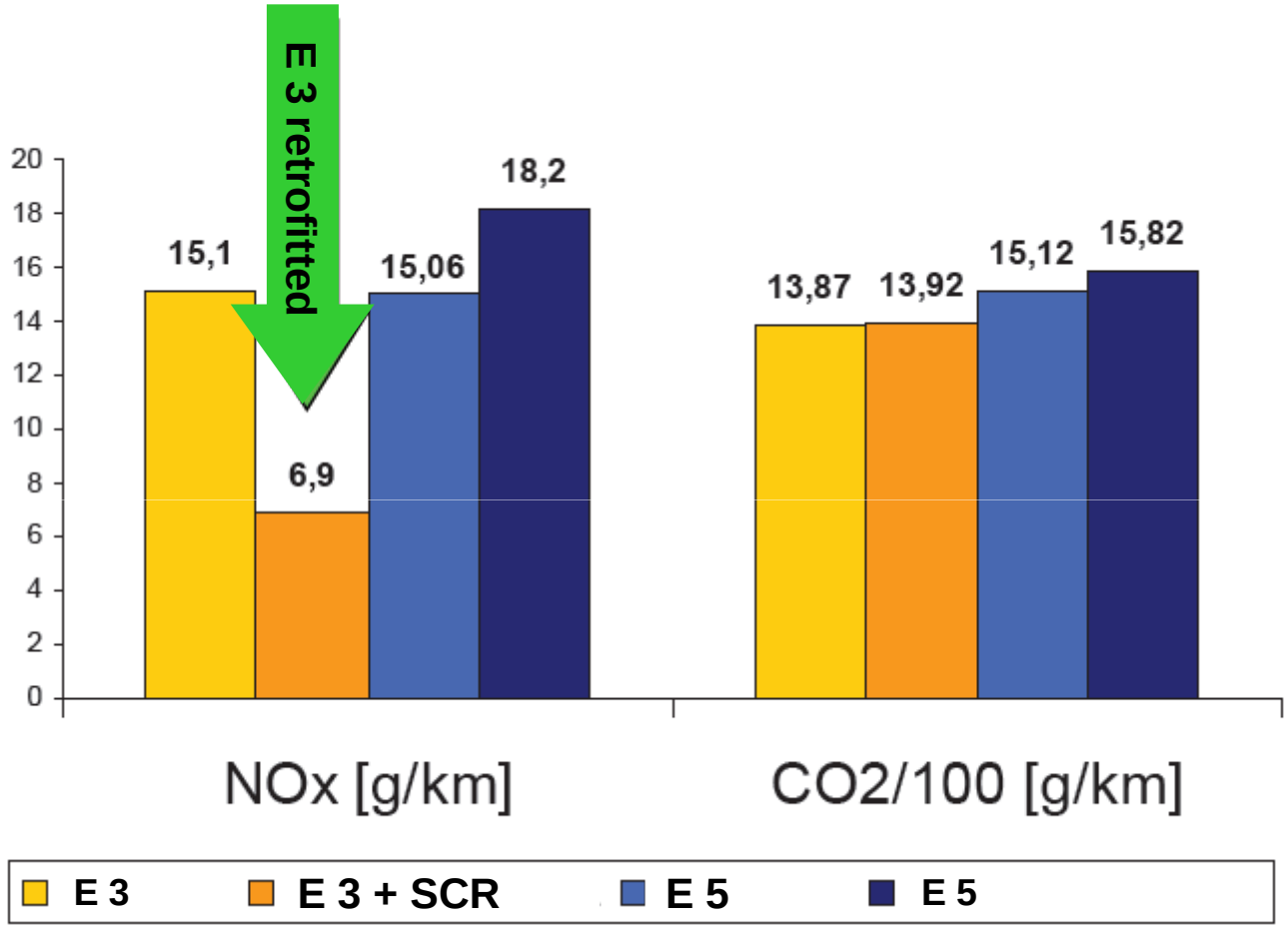
# *TÜV Emission Measurement: Berlin Cityline M27*



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# *TÜV Emission Measurement: cityline M49*


Reduction in %

| $NO_x$ | $NO_2$ | $CO_2$ |
|---|---|---|
| -76% | -92 % | - 2 % |

Source: Technical Report TÜV Nord, 8/2012



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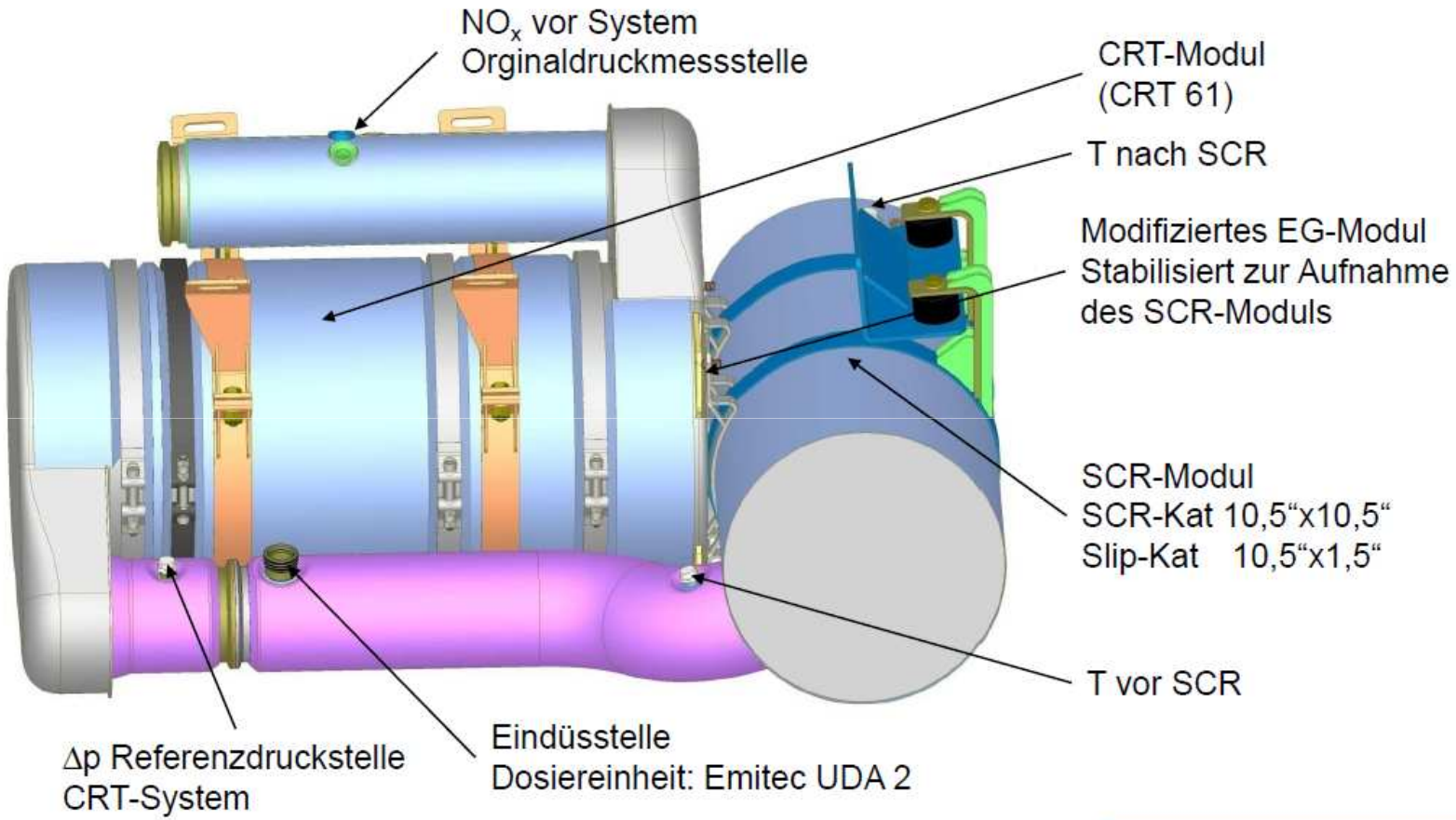
# *Schematic view of SCRT*

**retrofit this year 91 Euro IV double deck buses with SCR – System**




Source: HJS



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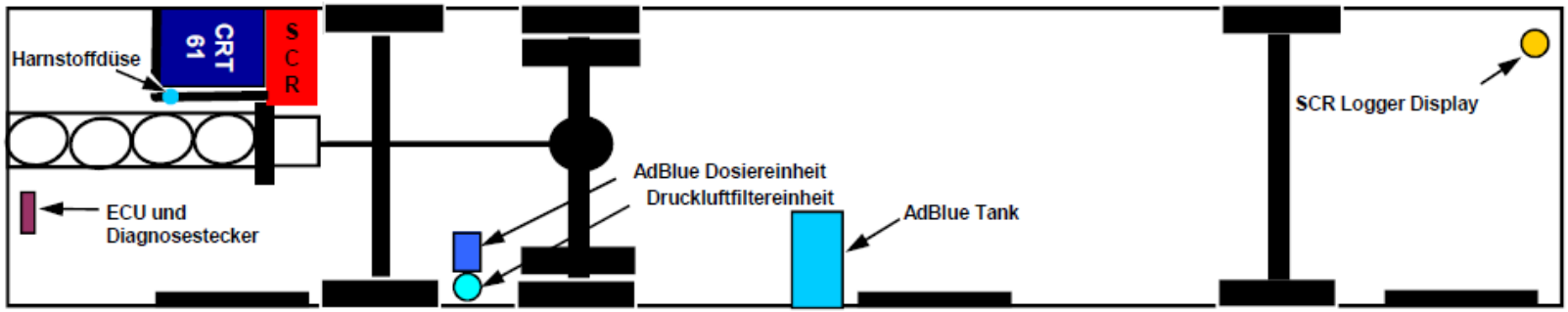
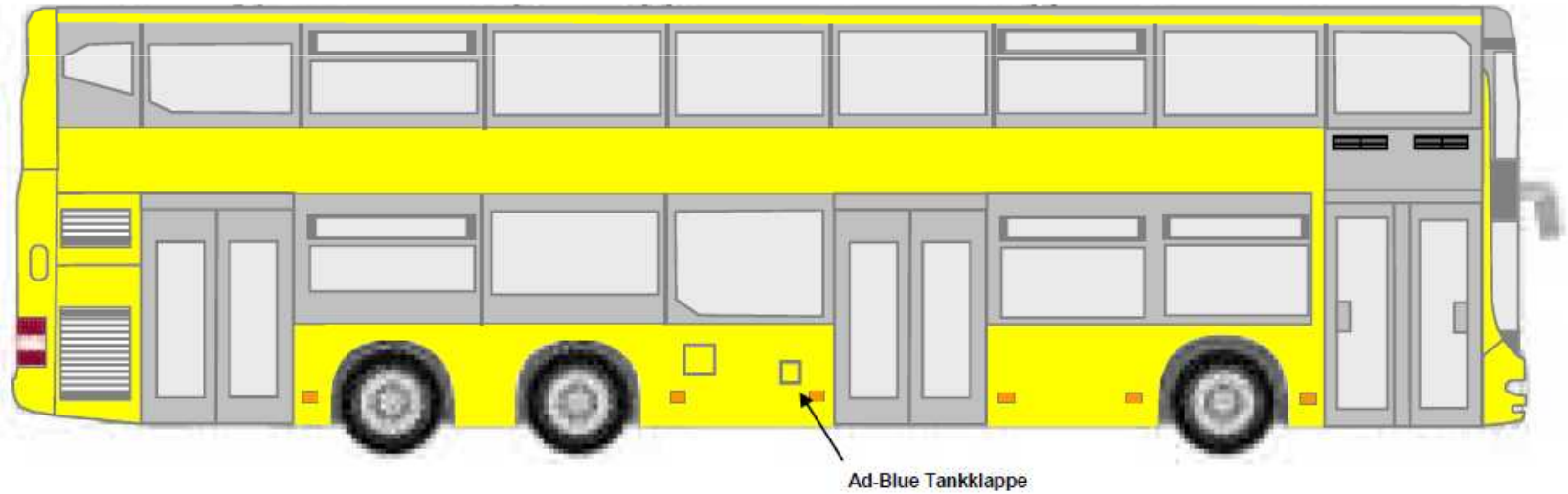
# *Application MAN A 39 DD*

## retrofit  this year 91 Euro IV double deck buses with SCR – System



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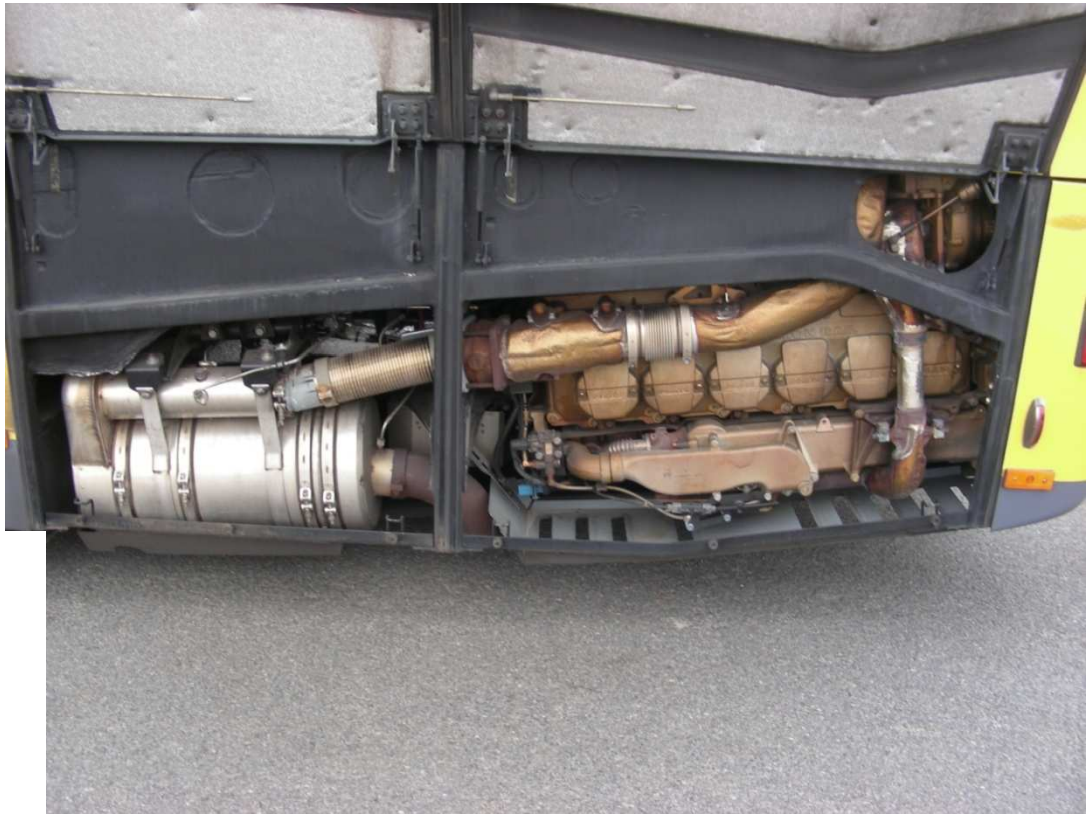

**Project**
**BVG, Berlin  /  HJS**



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