

Deutsch-französisches Büro für die Energiewende (DFBEW)

Conference Thursday, October 7th, 2021:

**Resources and added value of bioenergy
at a local level in Germany and France**

The use of biomethane buses in cities

Presentation by Dipl.-Ing. Morell Predoehl

1. Brief introduction of the company Verkehr und Wasser GmbH (VWG)
2. Timeline: Migration of the fleet
3. Timeline: Use of bio natural gas
4. Local and global emissions of the Euro-VI-public buses, CNG
5. Local and global emissions of the Euro-VI-public buses , BIOMETHANE
6. Alternative electromobility based on “battery operated buses” ?
7. Development of fuel quantities
8. Bio natural gas as a fuel source: National purchase or in-house production?
9. Conclusion

VWG is a public company

Owner: city and energy supplier

Public transport:

- 112 busses in 2021, 127 planned for 2022
- 350 employees
- 21 million passengers per year
- approx. 190.000 residents in the service area (City of Oldenburg and region)
- mileage per year: small bus → 92.000 km,
 large bus → 80.000 km
- 9 million kilometers per year, over 900 bus stops
- completely accessible (vehicles and stops)
- Passenger WiFi and contactless payment in every bus



Drinking water supply:

- 3 waterworks, own pipeline network
- 170.000 Customers
- 10 Million m³ of drinking water per year

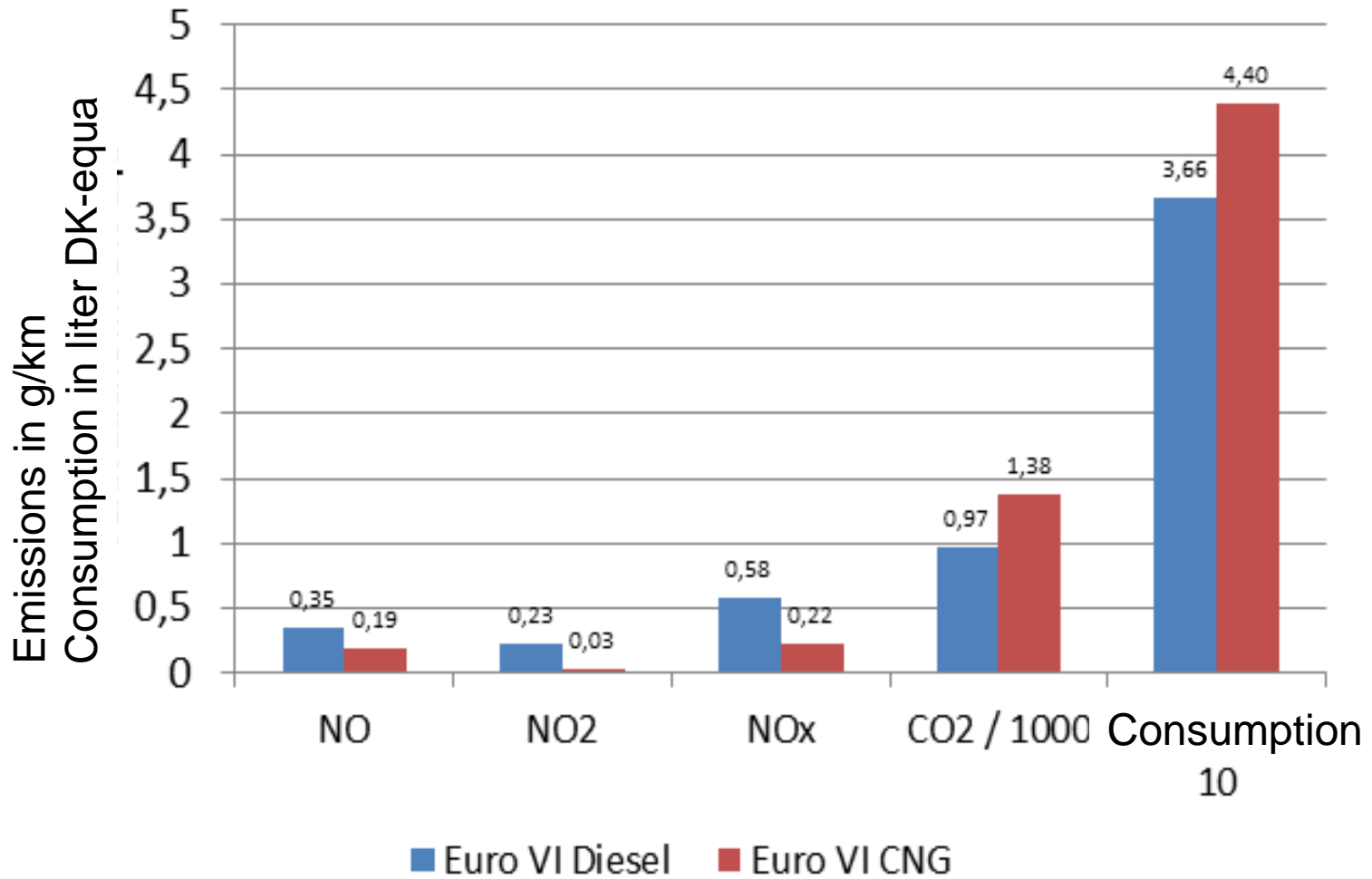
- 2004:** Feasibility study "Natural gas (CNG) in public transport" completed and fundamental decision made: Complete conversion of the entire fleet to a natural gas engine.
- 2005:** Construction of our own filling station at the depot and the first 10 vehicles (EEV) put into operation.
- 2005 - 2016:** Continuous replacement of diesel buses with buses operating on natural gas
- 2017:** 97 vehicles: 40 natural gas EURO-VI, 57 EEV.
- 2018:** Procurement of 26 Euro-VI-vehicles. A total of 103 vehicles, including three natural gas hybrid buses. First natural gas EEV vehicles withdrawn from service.
- 2019:** Additional 25 EURO-VI-vehicles. The fleet consists of 111 buses. Further replacement of natural gas EEV and additional vehicles.
- 2022:** Complete conversion to EURO-VI. 16 natural gas vehicles, 4 hydrogen buses added. A total of 127 vehicles.

- 2008:** Beginning of admixture bio-natural gas (10%).
- 2013:** Purchase of only "bio-natural gas" (=bio-methane).
- 2016:** Withdrawal of the last 10 diesel buses from service and thereby a complete conversion of the entire fleet to operating on "bio natural gas"
- 2016:** Ensuring carbon-neutral public transport in Oldenburg, all vehicles at least EEV, 30 EURO-VI vehicles, therefore, the lowest NOx emissions per kilometer (timetable) and since then

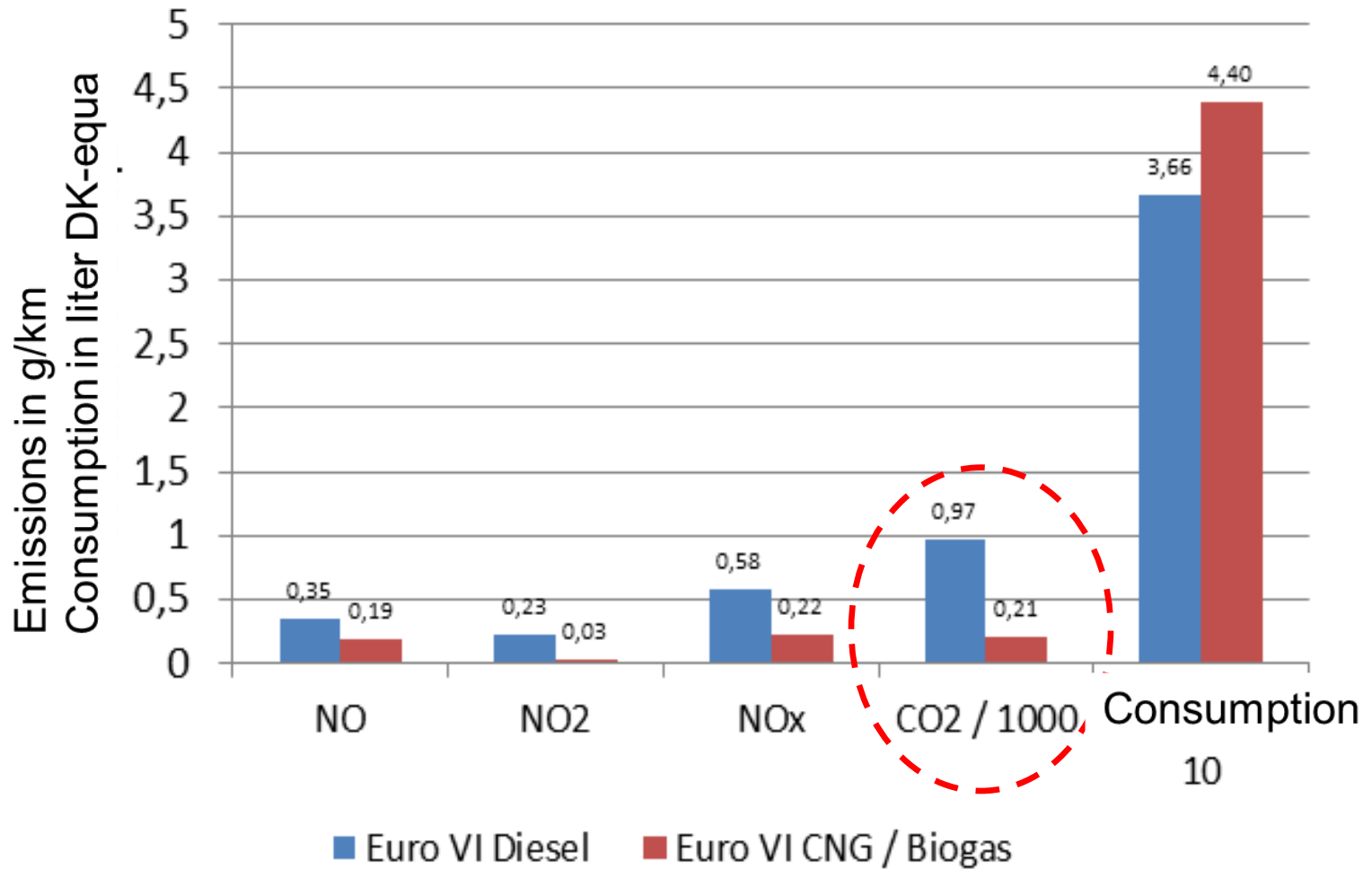
Germany's most environmentally friendly bus fleet!



Local and global emissions of the Euro-VI-buses (2016) on VWG-bus route 308 (PEMS-measurement 10/2016) – CNG



Local and global emissions of the Euro-VI-buses (2016) on VWG-bus route 308 (PEMS-measurement 10/2016) – BIOMETHAN



- **2017:** Investigation of the ecological status of conventional diesel and natural gas buses powered by internal combustion engines of the EURO VI level in real operation (!)
- Result: Neither the ecological efficiency nor the economic viability of the established, ultra-clean Euro VI concepts with internal combustion engines will be achieved in the medium term (2026) by the options of electromobility for the conditions of the majority of transport companies.

Natural gas technology with biogas offers the optimum.



Diesel:

2014	599.257 l
2015	348.031 l
2016	246.251 l
2017	0 l

Bio natural gas:

2014	3.305.094 kg
2015	3.737.125 kg
2016	4.091.318 kg
2017	4.378.785 kg
2018	4.505.440 kg
2019	4.749.679 kg
2020	4.459.004 kg (Impact of SARS-COV2 and economical engines)
2021	4.400.000 kg (forecast)

-> Equivalent: over 60,000 pigs or 5,000 hectares of grassland ;-)



Questions:

- In-house production? If so, based on which raw materials? Garbage, vegetable raw materials or animal waste products from meat production?
- Possibility of purchase from the producers in the region? Development and operation of your own, separate transport network?
- Failsafe concepts (monovalent vehicles)?
- Risks in economic operation (e.g. EEG etc.)?
- Third-party procurement through long-term supply contracts and accounting admixture?

1. In public transport, operational safety, i.e. the reliable provision of mobility, is of outstanding importance!
2. Existing legal framework, which
 - a) from a competitive point of view (EU regulation 1370/2017: direct awards, priority of self-economic efficiency) when awarding public services or
 - b) from a regulatory or environmental point of view (Directive (EU) 2019/1161 "Clean vehicle directive ") require, at least in the case of public bus companies, to think and act in sequences and periods of 8 to 10 years each.

The VWG has decided against a local supply or production of biomethane for the purposes of public transport and thereby for a usage or injection of biogas elsewhere.

Natural gas buses powered by biomethane are still the most useful option.

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