

Alternative Fuels for a Sustainable Mobility

Peter Hofmann

Transport Fuels: Crucial factor and driver towards sustainable mobility

R&D-projects, research institutions and funding programs in Austria, Europe and global cooperation within the International Energy Agency

Vienna, 28.05.2008

in cooperation with  

A3 Projects - Overview

- Bio-Ethanol engine
- Bio-Ethanol
- BTL in a Diesel engine
- Biogas in an Otto engine
- CEP2020 - Clean Energy Pathways 2020 for Sustainable Mobility
- CNG600-mono
- Heavy-Duty Zero Emission (HDZ)

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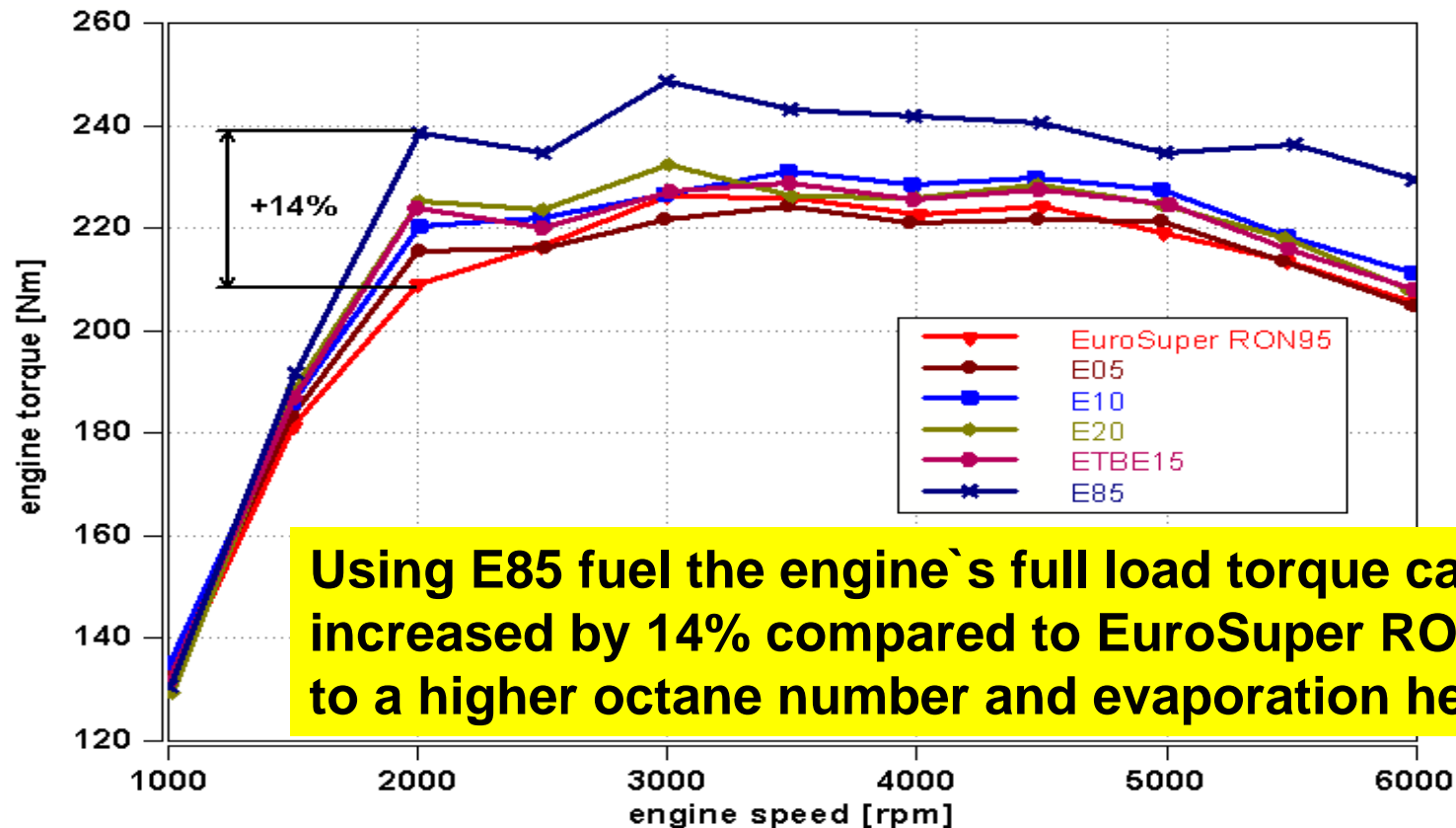
Bio-Ethanol Engine

Project targets and partners

- Production of different fuel mixtures containing various proportions of ethanol or ETBE
- Adaption of a modern, supercharged direct injection SI engine for ethanol operation
- Comparative motor test bench measurements for all different fuel mixtures with and without ethanol content (engine power, exhaust gas emissions, fuel consumption, abrasion, change in lubricant properties)
- Variation of relevant ECU settings
- Determination of the lubricant's chemical and physical properties after usage in the motor
- Measurement of unburnt ethanol and aldehyde emissions comparing the fuels Euro-Super RON95 and E85

Bio-Ethanol Engine

Full load engine torque with different ethanol fuels



Using E85 fuel the engine's full load torque can be increased by 14% compared to EuroSuper RON95 thanks to a higher octane number and evaporation heat.

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Bio-Ethanol

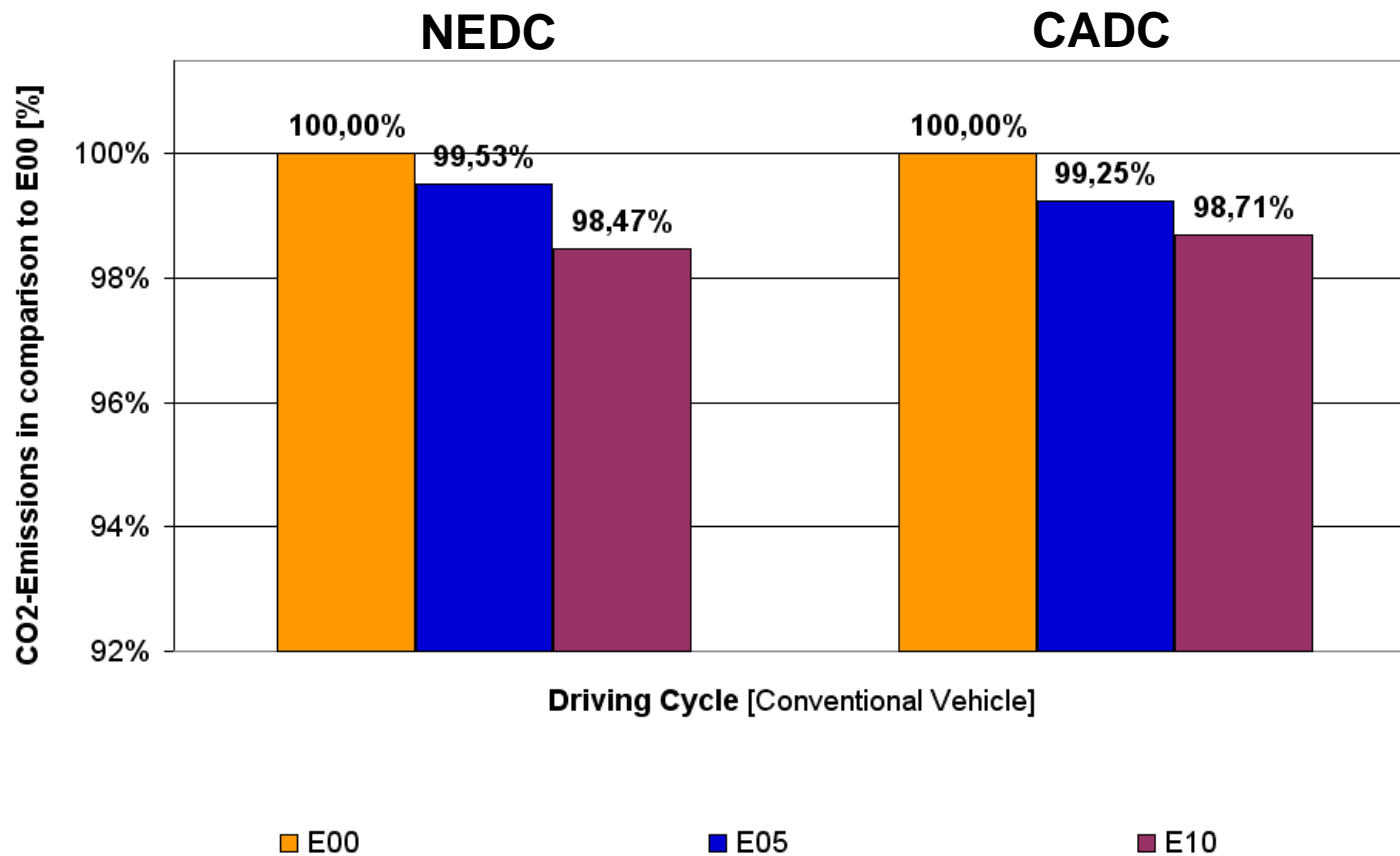
Targets

- Knowledge about vehicle operation with extended shares of Ethanol up to 10% with conventional vehicles. Impacts on emissions, fuel-consumption and start-ability.
- Knowledge about vehicle operation with highest shares of Ethanol up to 85% with Flex-Fuel-Vehicles. Impacts on emissions, fuel-consumption and start-ability.
- A vehicle fleet testing has to show the troubles that can appear in everyday life usage
- Impacts on the existing infrastructure and modifications on that to guarantee a trouble free use of fuel with these enhanced respectively highest shares of Bio-Ethanol.



Bio-Ethanol

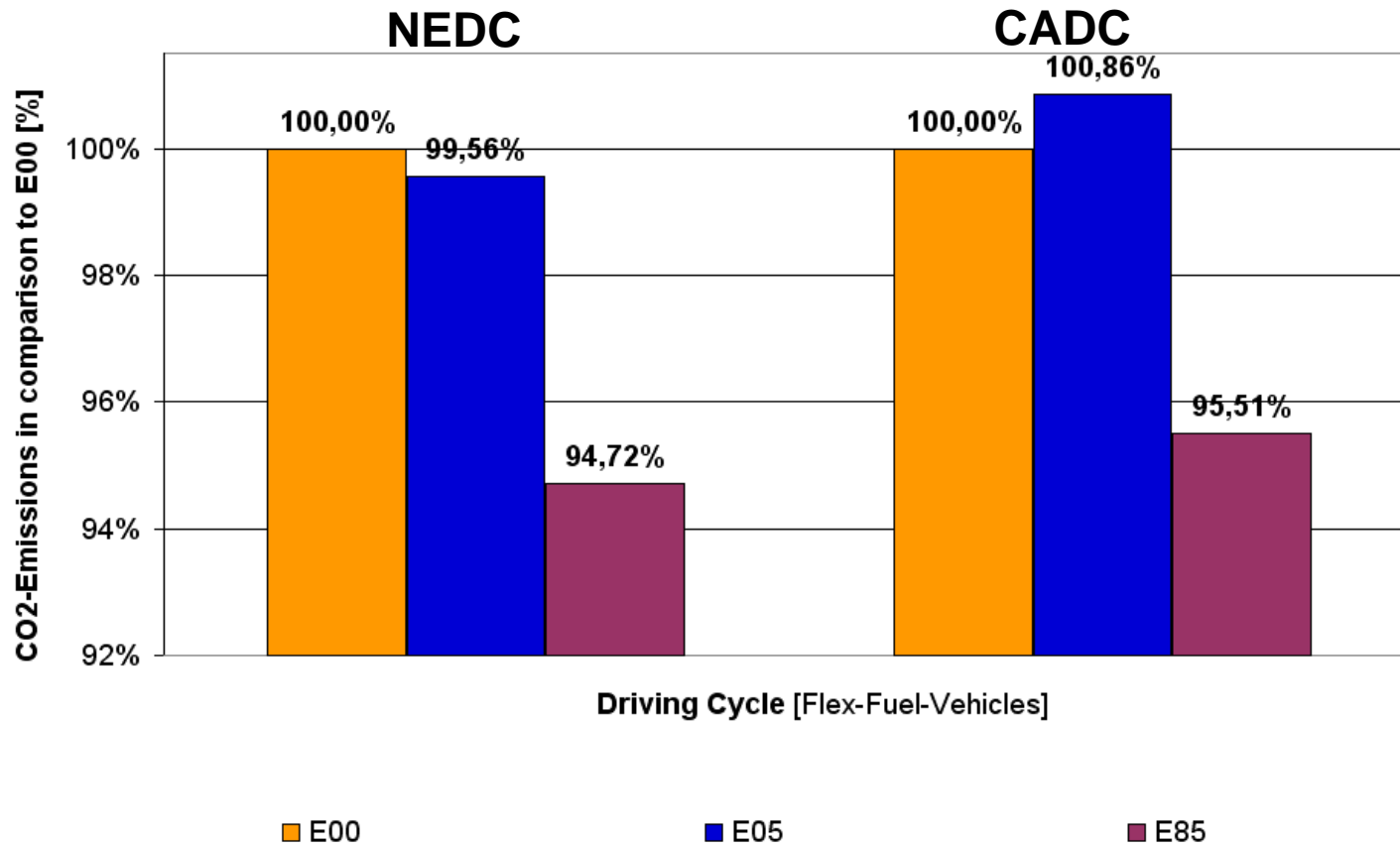
Results – Impacts on the CO₂ emissions of conventional vehicles





Bio-Ethanol

Results – Impacts on the CO₂ emissions of conventional vehicles



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BTL in a Diesel Engine

Project Definition

- Qualification of the adjustable fuel parameters to the effects of the combustion behavior in an ICE
- Analysis of impacts to the exhausted emissions and to the fuel consumption of a diesel engine by varying fuel qualities e.g. boiling characteristics or cetane number → feedback to BTL-production-process

Rethinking Propulsion.

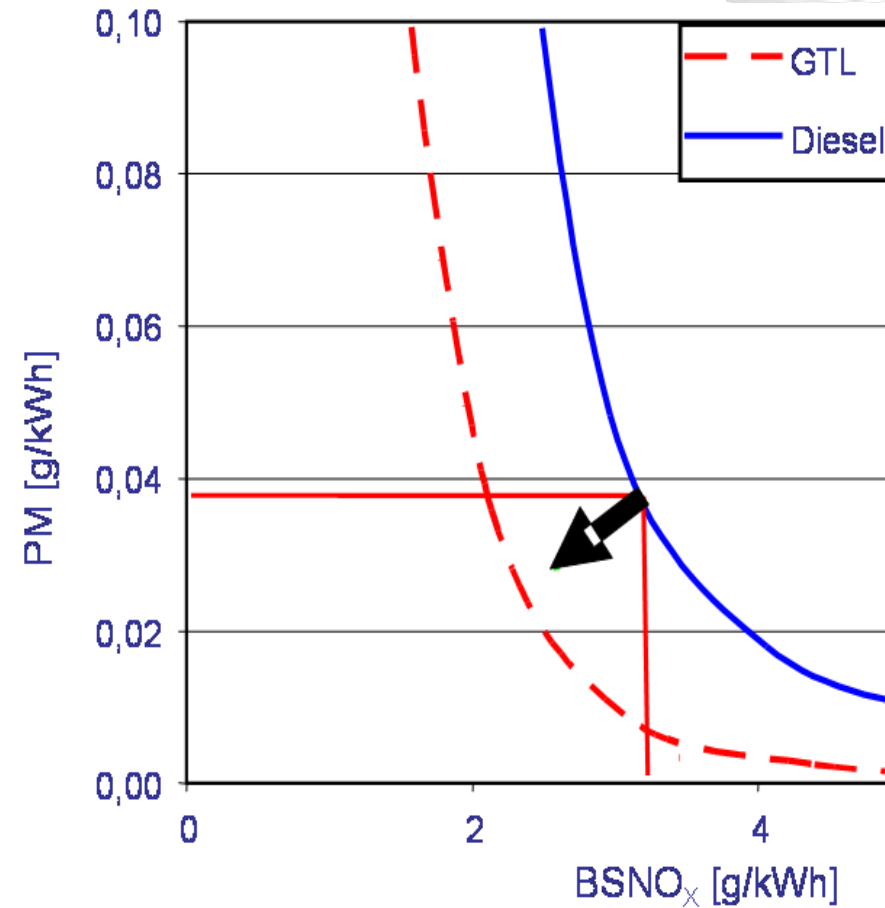
- ~~Adaption of the most relevant combustion~~



BTL in a Diesel Engine

Expected Fuel Qualities of BTL

- High cetane Number
- Low delay in ignition
- Decreased production of particulate matter caused by an improved internal mixture generation
- Close production tolerance results in constant fuel-qualities
- Free of aromatic compounds
- Free of sulfur





BTL in a Diesel Engine

Life-Cycle Assessment



Resource	Primary production	Transport	Fuel production	Distribution Dispensing	Fuel consumption
<ul style="list-style-type: none"> → Biogenous residues → Cultivated biomass → Fossil 	<ul style="list-style-type: none"> → Collection → Cultivation → Crude Extraction 		<ul style="list-style-type: none"> → BTL-Diesel (Input ProFactor) → BTL-Diesel (Input ProFactor) → Fossil-Diesel 		

Goal:

Analyse the potential in reduction of Greenhouse Gases with the Diesel substitute fuel BTL in comparison to fossil diesel.

Analysed components: CO_2 , N_2O , CH_4
 Aligned for: Austria with 2 possible BTL-pathways

Rethinking Propulsion.

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Biogas in the Otto Engine

Project Definition

- Biogas (main component methane) is fabricated from biogenous resources
 - nearly enclosed CO₂ cycle
 - reduction of CO₂ emissions
- Biogas offers high knock resistance (RON ~130) and therewith the possibility to increase the compression ratio
 - higher thermal efficiency
 - lower fuel consumption and CO₂ emissions respectively



Biogas in the Otto Engine

Aim of the project

- Process technical analysis of biogas fabrication
- Investigation of different biogas qualities on the engine operating performance
- Adaption of the engine parameters to monovalent engine operation with biogas
 - injection parameters, ignition timing and compression ratio
- Formulation of a new exhaust aftertreatment concept
 - investigation of different catalytic converter coatings

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CEP2020 - Clean Energy Pathways 2020 for Sustainable Mobility



TU Vienna, IVK, Prof. Pucher

EVN AG

ÖAMTC Akademie

MAGNA STEYR AG & Co KG

VENTREX Automotive

Association of Chemistry Teachers Austria

Nature taxi and car rental GmbH

Lower Austria state government coordinated by the Academy of Lower Austria

University of California at San Diego

NEOMAN Bus GmbH

Mercedes-Benz Technology

Fields of Research

- **Sustainable CNG- and Biogas vehicles**
- **Supply of clean energy sources as CNG und Biofuels**
- **Long-term behavior of CNG vehicles fleets**
- **CNG-vehicles of next generation**
- **Clean municipal vehicles**
- **Contributions to meet the Kyoto CO₂ criteria and the air quality limit values for nitrogen dioxide and particulate matter**
- **Diffusion to specialists and experts of other disciplines.**
- **Competition for young researcher "Energy-efficient vehicle "**

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CNG PROTOTYPE VAN WITH 600 KM RANGE CNG600



MAGNA STEYR AG & Co KG



**Prof. Ernst Pucher,
University of Technology, Vienna**



VENTREX Automotive



ÖAMTC Akademie



Opel Special Vehicles GmbH

CNG600 – fields of research

- Simulation of the entire system
- Composite material technology
- Lightweight construction tank technology
- Multi vessel management
- Integrated valve technology
- Monofuel engine concept
- Prototype van with CO₂ emissions target of 120 g/km
- Real-world validations



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HDZ - Heavy Duty Zero Emission



TU Vienna, IVK, Prof. Pucher
IAEA, TU Vienna



ÖAMTC Akademie



ECHEM K + Competence Centre for Applied
Electrochemistry



Competence Centre for special transportation
systems, Neoman Bus GmbH



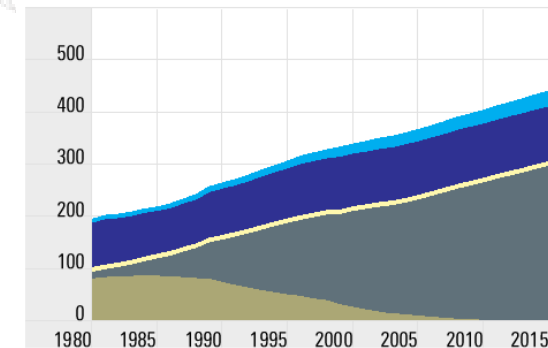
DHL Express (Austria) GmbH



Vossloh Kiepe GmbH

Heavy Duty Zero Emission – Fields of Research

LKW – BESTAND IN ÖSTERREICH
(in 1000)



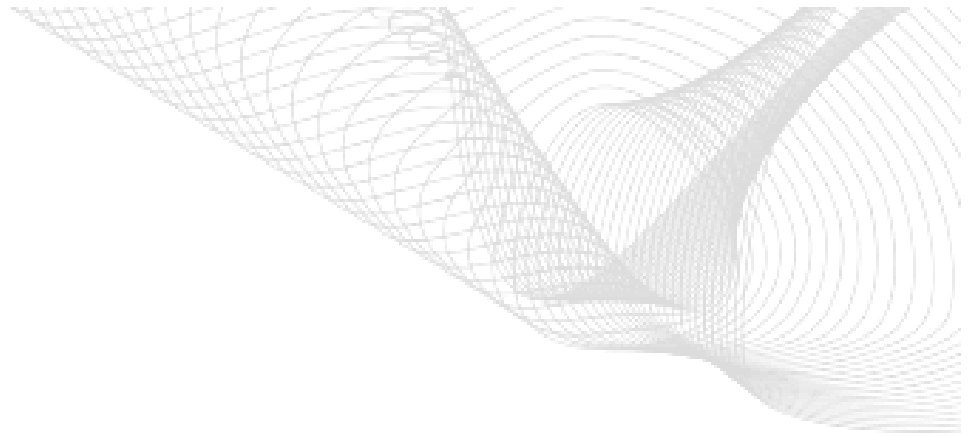
- Potential of clean technologies for heavy duty transport systems
- Sustainable development paths, potentials, demand and acceptance analysis
- Ecological potentials by the use of alternative drives and fuels in heavy traffic concerning pollutants and CO₂
- Scenarios: Alpine transit in dense buildings, main traffic transversals in the residential area concerning pollutants and CO₂
- Integration to international framework
- Recommendations for long term transport planning in Austria as a transit country and the Austrian automotive supply industry
- International workshop and networking with platforms and projects

Contact

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Thank you for your attention !!!!!