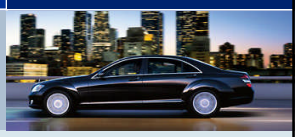
DAIMLERCHRYSLER

Alternative Fuel Concepts in the Automotive Industry

2nd International BTL Congress, 12-13 October 2006, Berlin
Dr. Hans-Otto Herrmann

DAIMLERCHRYSLER

Content

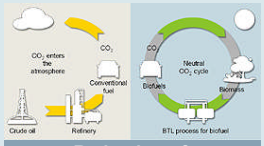


- Motivation for the Use of Biofuels
- Alternative Fuel Options
- Vision „Biofuels 2030“
- DC Biofuels Activities and Position
- Recommendations

DAIMLERCHRYSLER

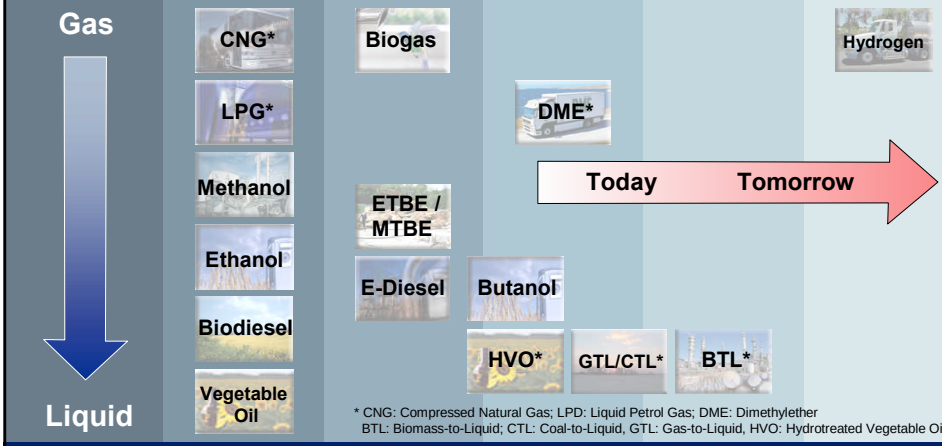
Motivation for the Usage of Biofuels

Biofuels have many advantages



DAIMLERCHRYSLER

Alternative Fuel Options



* CNG: Compressed Natural Gas; LPD: Liquid Petrol Gas; DME: Dimethylether
BTL: Biomass-to-Liquid; CTL: Coal-to-Liquid, GTL: Gas-to-Liquid, HVO: Hydrotreated Vegetable Oil

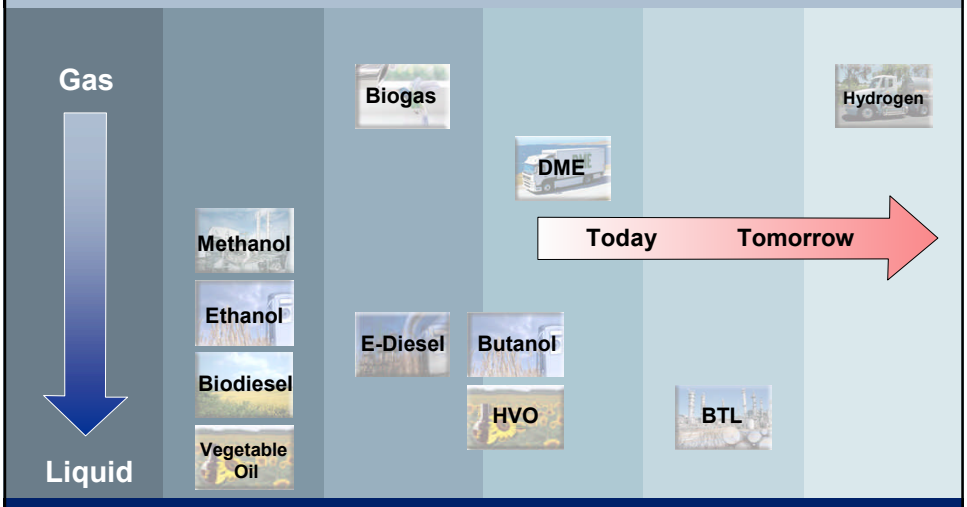
DAIMLERCHRYSLER

Top 5 Assessment Criteria for Alternative Fuels

Energy Security	Is the production of this fuel alternative completely domestic or is import necessary?
Substitution Potential	How much fossil fuel can be substituted?
Infrastructure / Powertrain	Does the fuel require a new infrastructure? Does the fuel require adapted propulsion technology?
Emissions	Does the fuel offer emission reduction potential?
CO_2 Reduction Potential	Is CO_2 Balance better or worse than other alternative fuel options ?

DAIMLERCHRYSLER

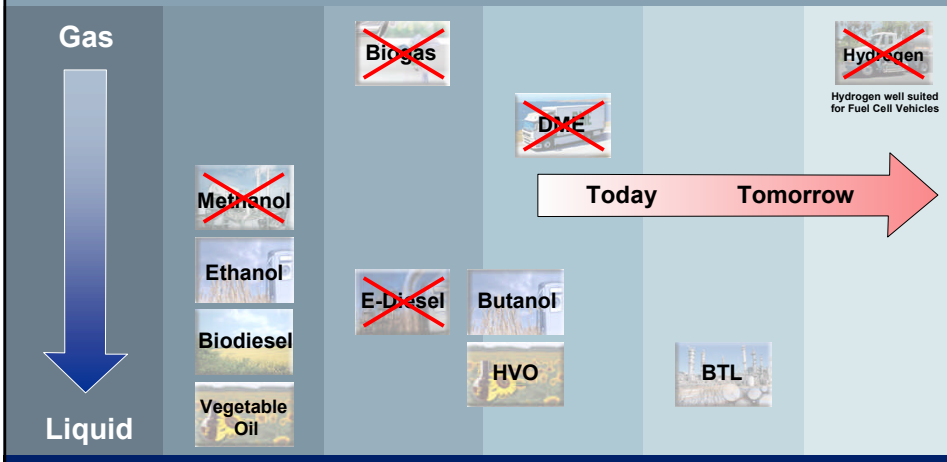
Biofuel Options



DAIMLERCHRYSLER

Biofuel Options (Internal Combustion Engines)

Only few Biofuels are suitable alternatives for internal combustion engines.



DAIMLERCHRYSLER

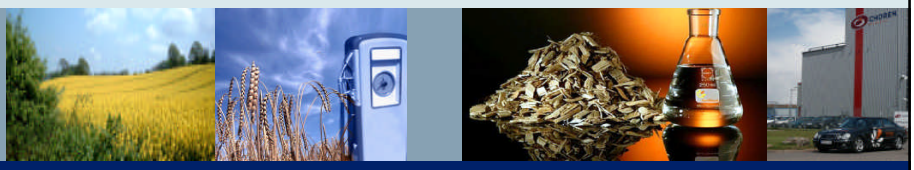
1st and 2nd Generation Biofuels

1st Gen. Biofuels (e.g. Biodiesel / Bio-Ethanol):

- Available on the market today
- Domestic production possible
- Limited substitution potential
- Limited CO_2-reduction potential
- Utilizes only part of the crop

2nd Gen. Biofuels (e.g. BTL / Cellulosic Ethanol):

- Available on the market soon (small quantities)
- Domestic production possible
- Higher substitution potential
- High CO_2-reduction potential
- Utilizes entire crop
- Also utilization of waste possible
- No competition with food production
- Synthetic fuels potential enabler for new combustion concepts



DAIMLERCHRYSLER

Biofuels Roadmap

Immediate action is required for early market introduction of 2nd Generation biofuels

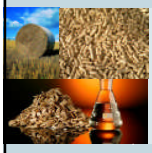
1st Generation Biofuels

Ethanol

Biodiesel

Vegetable Oil

2nd Generation Biofuels



Cellulosic Ethanol

SunDiesel
(FT or MT-Synfuel)

2005 2010 2015 2020 2025 2030

[Year]

DAIMLERCHRYSLER

Other Biofuel Alternatives

The potential of HVO, Butanol and other biofuel alternatives is currently unknown

Hydrotreated Vegetable Oil (HVO)

- Utilization of HVO looks very promising as a blending component in fossil Diesel fuel.
- Fuel / Engine interaction with advanced aftertreatment system still under investigation
- GHG – balance and LCA remain open issues

Butanol

- Butanol shows some better characteristics, compared with Ethanol, regarding:
  - Energy density
  - Cold start
  - Corrosiveness
  - Miscibility with gasoline
  - Vapor pressure
- Disadvantage is lower octane number than Ethanol
- Economic viability and GHG/LCA remain open issues

DAIMLERCHRYSLER

Vision „Biofuels in 2030“: Assumptions

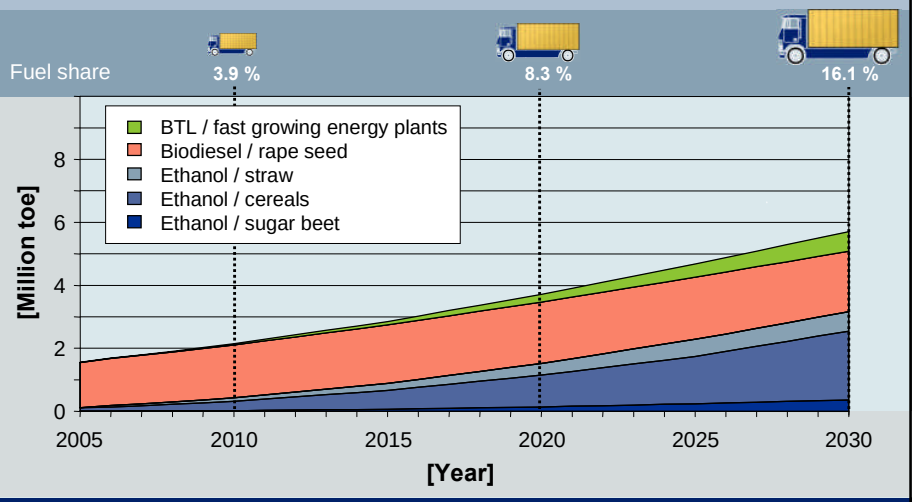
Two Scenarios „Vision Biofuels 2030“ for Germany

- **No imports** regarding biomass and biofuels considered
- Total **fuel demand** for 2030 estimated based upon MWV data
- **No waste wood** considered
- **No emerging biofuels** are considered (e.g. Bio-Butanol)
- All assumptions regarding **yield, conversion efficiency and CO_2-reduction** potential taken from FNR and EUCAR/CONCAWE/JRC study
- **Hydrogen not considered**, since only suited for Fuel Cell Vehicles

Scenario	Focus Biofuels 1st Generation Scenario „Business as usual“	Focus Biofuels 2nd Generation Scenario „Biofuels“
Land Use 2030	2.8 mio. ha 23% of arable land	2.8 mio. ha 23% of arable land
% Area for 2nd Gen.	6% of 2.8 mio. Ha	46% of 2.8 mio. ha

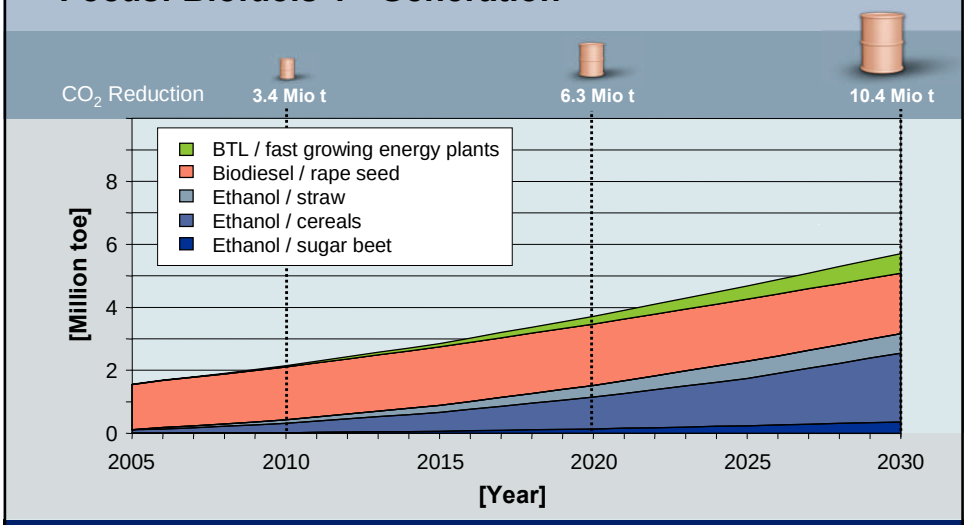
DAIMLERCHRYSLER

Scenario „Business as usual“ Focus: Biofuels 1st Generation



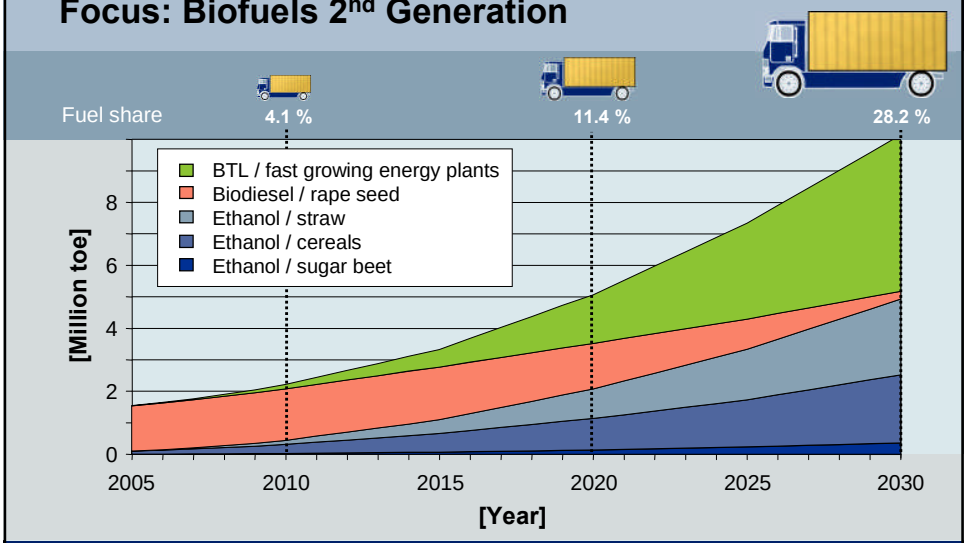
DAIMLERCHRYSLER

Scenario „Business as usual“
Focus: Biofuels 1st Generation



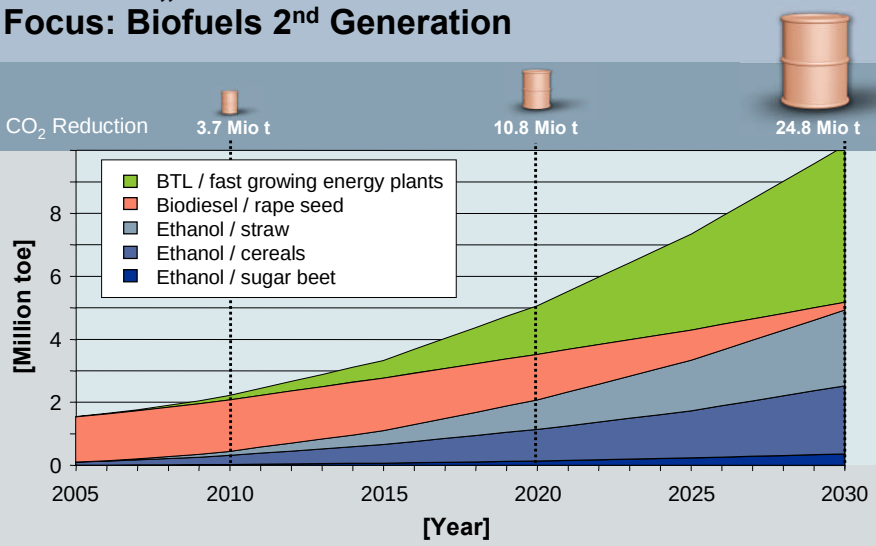
DAIMLERCHRYSLER

Scenario „Biofuels“
Focus: Biofuels 2nd Generation



DAIMLERCHRYSLER

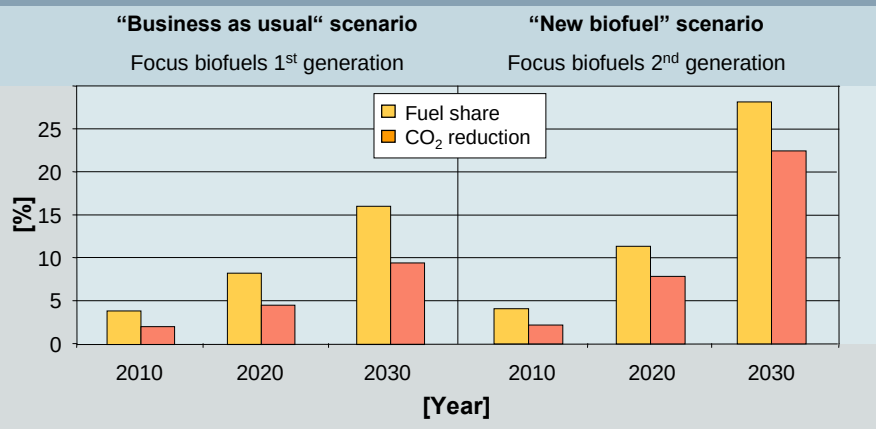
Scenario „Biofuels“
Focus: Biofuels 2nd Generation



DAIMLERCHRYSLER

Vision „Biofuels in 2030“:
Results of the two Scenarios

By switching from 1st generation to 2nd generation, biofuels production on the same area is about two times higher with CO_2 savings more than doubled in 2030



DAIMLERCHRYSLER

DaimlerChrysler's BTL Cooperation

SunDiesel (Cooperation DaimlerChrysler - CHOREN Industries since 2001)

Ultra clean biofuel with high potential

Substitution potential ca. 20% of European fuel demand

- CO_2 – Reduction potential (Europa) up to 200 mio. tons by utilization of SunDiesel
- Free of sulfur and aromatics, ultra clean combustion
- Sucessful vehicle fleet tests since 2003 at DaimlerChrysler
- August 2005: Start of Shell / Choren cooperation for SunDiesel production

Choren Industries GmbH

„SunDiesel"- Fuel pump in Stuttgart-Möhringen

Since 2001, DC is actively involved in BTL technology development

DAIMLERCHRYSLER

Recent DC Activities Regarding Alternative Fuels

- DaimlerChysler acknowlegdes the necessity of alternative fuels, in particular biofuels.
- In November 2005, DaimlerChrysler announced to prepare it's vehicles for blending ratios up to 10%.
- With it's activities on synthetic fuels and biofuels, DaimlerChrysler is among the leaders to promote the utilization of fuel alternatives.

asfe
alliance for synthetic fuels in europe

DAIMLERCHRYSLER
RENAULT
Sasol Chevron
VOLKSWAGEN AG


fourth environmental forum Magdeburg 2005

Magdeburg Statement

The United Nations Environment Programme (UNEP) and DaimlerChrysler AG share an aim of promoting sustainable approaches to mobility. One way is through dialog amongst technical experts, politicians, NGOs, and others concerned with reducing the environmental and social problems of arising from the transport of goods and people while making sure that mobility services are available to increasing numbers of people.

Through the Environmental Forum in Magdeburg, DaimlerChrysler and UNEP have offered such a platform for discussion and information exchange on sustainable mobility four times since the first Environmental Forum was organized in 1999.

DaimlerChrysler is well established as an active player in the alternative fuels discussion. Continue effort regarding utilization of alternative fuels as an enabler for low emissions and lower CO_2.

DAIMLERCHRYSLER

Recommendations

Today's biofuels are a valuable contribution for a sustainable mobility.

Blending with fossil fuels is the most cost effective way to introduce new biofuels in the market.

Since the potential of 1st generation biofuels is limited, development of 2nd generation biofuels is required. This development effort requires the joint effort of fuel producers, vehicle manufacturers and policy.

Introduction of 2nd generation biofuels offers significant CO_2-reduction potential.