
GREEN POWER
Feeds Your Engine
Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines
The 2nd VegOil Project
Final Event
Brussels, Dec. 19th 2011


GREEN POWER
Feeds Your Engine
Pathways to Sustainable Biofuels in Agriculture
The 2nd VegOil Project
Stefanie Dieringer
Peter Pickel
John Deere European Technology Innovation Center
JOHN DEERE

LET'S START WITH A QUESTION



WHAT IS THE GREATEST INNOVATION OF MANKIND?




## Innovation Nº 1

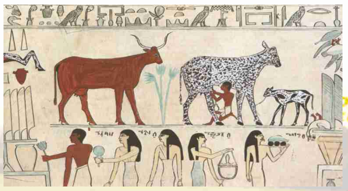
2ndVegOil EU

### Arable crop farming

- After more than 1 Mio years …
  - … mankind changed nutrition style completely from protein based to carbohydrate (energy) based …
  - … enabling unbelievable welfare and population growth up to 7,000,000,000 recently….
  - … creating the need for world climate summits
  - … and mankind started to settle down

nzz.ch

## Innovation Nº 2


wikimedia.org

### Live stock farming

- Animal proteins as the first luxury „mass product“ …
  - … bringing back protein based nutrition and …
  - … the 7,000,000,000 population will grow and with this people will develop a growing demand for better life conditions and thus for proteins

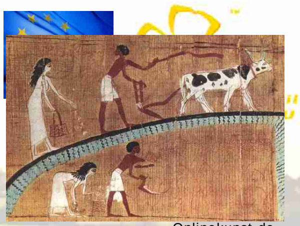

Weserbergland-ei.de


telewissen.de



JOHN DEERE

## Innovation Nº 3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### Agricultural machinery

### Agricultural production technology

- Improved welfare and prosperity
- Partially a combination with live stock farming
- Needs drive train energy (fuel)


fotofinder.com



JOHN DEERE

## Innovation Nº 4?

… You already know Nº 5 …



## Basic assumptions

John Deere - comitted to those who are linked to the land

- Diesel engines will stay basic drive technology for mobile agricultural machines at least for a mid term prospective
- The highest energy density produced by photosynthesis is found in natural vegetable oil
- The production process of cold pressed vegetable oil has the highest energy efficiency of all available biofuels (except from waste-based fuels)
- As a fuel vegetable oil can support global sustainability (but usage is strongly limited)
- We find optimal agricultural conditions for production of rapeseed oil in Central Europe
- JOHN DEERE's colours are the colours of rapeseed

# Basic Assumptions

## Potential (Self-)Supply

Diesel consumption of German agricultural sector

1.55 Mio t = $6.65 \cdot 10^{10}$ MJ

= 2,2% of total transport
= 5% of total diesel consumption

→ 1.82 Mio. ha

Maximum possible area for rapeseed:

1.8 Mio ha per year.

(UFOP)

≈ 10% of cultivated area


+ releasing cultivated area by combined protein feed production



JOHN DEERE

Pure Vegetable Oil Powered Tractors

## Mandatory side conditions


1. Minimum farm size
2. or farming societies
3. or increasing diesel price
4. Tax regulations must fit
5. Rapeseed cake usage
6. Decentralized / self supply
7. Manufacturer supply



JOHN DEERE

Pure Vegetable Oil Powered Tractor

## The challenges

Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines

2ndVegOil

1. Emissions (NOx)
2. Emission after treatment
3. Engine lubrication
4. Fuel viscosity
5. Thermal characteristics
6. Cold start behaviour
7. Transient behaviour
8. Engine power / characteristic
9. Storage of fuel
10. Quality of fuel and blends



# Innovation No. 4!
## Summary

Pure cold pressed vegetable oil as an agricultural fuel is an integrated technological approach

… combing the three grand innovations and

contributing to …

… sustainability and …

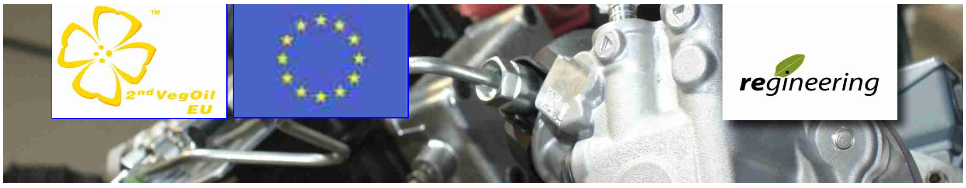
… agricultural economy and …

… to our future business

It‘s a puzzle piece! Let‘s go for it!

Highlights of Pure Plant Oil Fuel

Thomas Kaiser, VWP
Allersberg-Göggelsbuch
Germany




## Engine Demonstration (WP5)

Results field test 2ndVegOil project

regineering – Duft & Innerhofer GbR (IBDI)

**Tino Wunderlich**

## PPO as fuel, initial situation

- 100 tractors program (FNR, 2001-2005)
  - Initial experiences PPO in tractors!
  - Different tractors and conversion systems
  - OEMs no official project partners
  - Only recommendations for PPO quality

results:

  - Defective injection pumps, nozzles, valves, pistons
  - Fatal engine damages (due to fuel & conversion tech)
  - Unsettled operators




## Lessons learned, new approach

- 2ndVegOil project (EC, 2008-2011)
  - John Deere tractors and OEM PPO technology
  - Project consortium includes OEM
  - Double strategy, engine & fuel development
  - PPO requirements & Q.A.
  - field test support

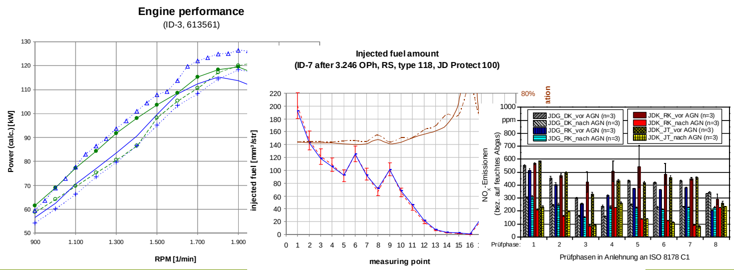
results:

  - Technical defects comparable to diesel use
  - No fatal engine damage
  - Other plant species work

# Highlights 2ndVegOil field test

➢Proof of concept

- ➢ 16-4-24000-0 (tractors – nations - operating hours – total failures)
- ➢ PPO tractors with stable power output
- ➢ Injectors with constant rate of flow
- ➢ PPO Emission limits EU Stage 3A, 3B, 4 proven






regineering

# Outlook

➢Goals PPO fuels

- ➢ Decentralized PPO fuel for agriculture
- ➢ Professionell R&D engineering
- ➢ PPO quality standards & Q.A.

- ➢ Improve framework conditions (basic requirement)



regineering

# Project results workpackage II (hybrid engine development)

Project 2ndVegOil

Institute of internal combustion engines
Technische Universität München

Prof. Dr.-Ing. Georg Wachtmeister

Authors: Georg Wachtmeister, Andreas Hubert

**Final project meeting**
**19.12.2011**
**Brussels, Belgium**



## Objectives

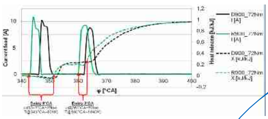
**Demonstration of Reliable Engine Operation**

- Identification of challenging operating conditions
- Avoidence of fouling tendency
- Consistent utilisation of vegoil properties

**Development of an Hybrid Driveline**

- Development of an hybrid operation strategy
- Adjustment / Optimization of the ICE for hybrid operation modes

# Injection Strategy Improved Low Load Operation



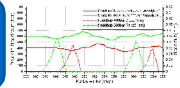
0D-working cycle-calc.

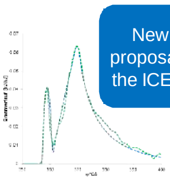
Engine measurement analysis

GOAL:
LOW LOAD
EMISSIONS

below Diesel level

1-D hydraulic-calc.

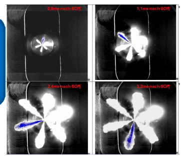




New mapping proposal: testing at the ICE test bench

3-D spray & combustion-sim.

Spray measurements



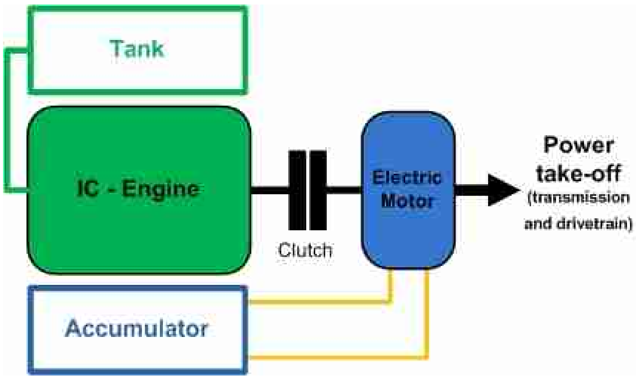




# Reduced Fouling Tendency

New injector → After operation with 1st Gen. Veg. Oil → After operation with 2nd Gen. Veg. Oil

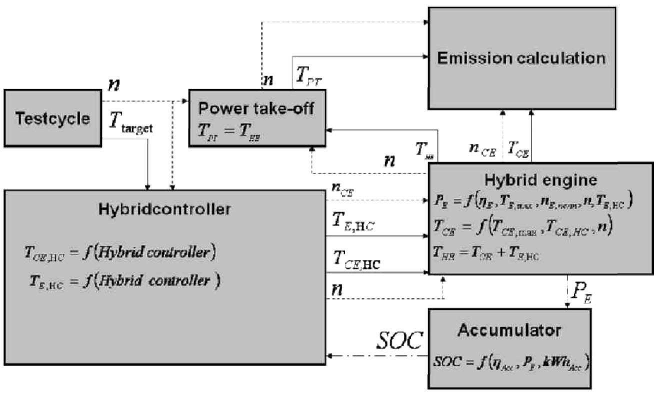
# Hybrid Calculation Model





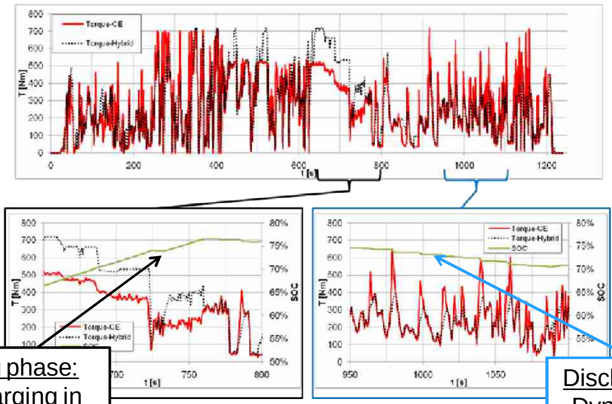



# Hybrid Calculation Model



# Optimization of Load Profile with Hybrid Strategy

NRTC – precalculation: Combustion engine vs. Hybrid driveline
Fuel: 2G-PVO, basis: rapeseed




**Charging phase:**
Accu. charging in moderate transient areas

**Discharging phase:**
Dynamic demand for ICE is reduced

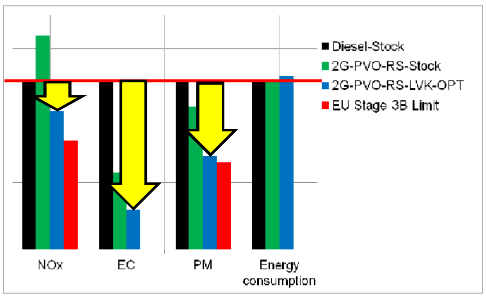




# Achievements

Diesel STOCK 100%

- 17% reduction of $NO_x$
- 76% reduction of EC, 44% reduction of PM
- Moderate increase (3%) of energy consumption




**WITHOUT EXHAUST AFTERTREATMENT!**

## Thank you for your attention!



# *6th Meeting EU 2nd VegOil*

Work Package 4: Engine Lubricant Development

(Used Lubricant Analysis)

19th December 2011

# Presentation Contents

- Lubricants being assessed in field trials
- Summary of used lubricant samples received
- Used lubricant analysis from German tractors
  - L06930N586574 – ACEA E7 Lubricant (OS241936)
  - L06930N613519 – ACEA E9 Lubricant (OS240946)
  - Conclusions from German tractors
- Used lubricant analysis from all tractors - in Germany, Austria, Poland and France
- Overall conclusions




# Lubricants being Assessed in Field Trials

| | | ACEA E7 Engine Lubricant | ACEA E9 Engine Lubricant |
|---|---|---|---|
| **Lubrizol Oil Code** | | **OS241936** | **OS240946** |
| **Viscosity Grade** | | 15W-40 | 15W-40 |
| ExxonMobil AP/E 150N | Group I Base Oil | 59.4 | - |
| ExxonMobil AP/E 600N | Group I Base Oil | 20 | - |
| Chevron 220R (220N) | Group II Base Oil | - | 71.1 |
| Chevron 600R (600N) | Group II Base Oil | - | 6.1 |
| Lubrizol® 4986E | Engine Lubricant Additive | 12.6 | - |
| Lubrizol® 40007 | Engine Lubricant Additive | - | 16.5 |
| Lubrizol® 7077 | Viscosity Modifier | 7.7 | - |
| Lubrizol® 7075F | Viscosity Modifier | - | 6.1 |
| Lubrizol® 6662 | Pour Point Depressant | 0.3 | 0.2 |
| **Typical Chemical & Physical Properties** | | | |
| Kinematic Viscosity at 100°C | mm2/s | 14.7 | 16.2 |
| Cold Crank Simulation at -25°C | mPa.s | 6600 | 6685 |
| High Temperature High Shear | mPa.s | 4.1 | 4.3 |
| Total Base Number | mg KOH/g | 9.1 | 8.4 |
| Sulphated Ash | % wt | 1.15 | 0.97 |

Lubrizol

# Summary of Used Lubricant Samples Received and Analysed

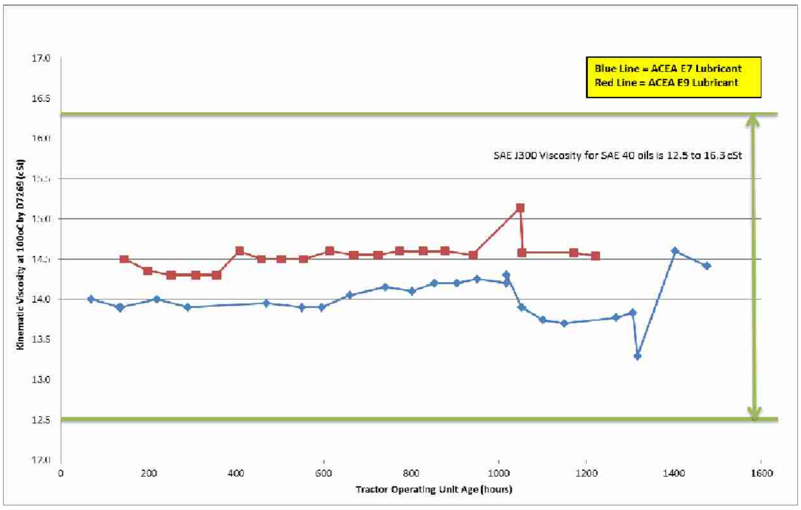
- 88 used lubricant samples have been sent from the trial to Lubrizol
  - Analysis of these used lubricant samples has been conducted
  - This presentation summarises the conclusions from the used lubricant analysis

| Location | UNIT NAME | Samples Received |
|---|---|---|
| Austria | L07430R604221 | 7 |
| | L07430R604472 | 4 |
| | L07530N604252 | 1 |
| | L07530N613561 | 4 |
| France | L06830P606579 | 5 |
| | L07530K616305 | 3 |
| | L07530N613532 | 2 |
| Germany | L06930N586574 | 24 |
| | CD6068R066040 | 4 |
| | L06930N613519 | 20 |
| Poland | L06830G612350 | 4 |
| | L06830K512170 | 2 |
| | L06830K596568 | 4 |
| | L06830K614003 | 3 |
| | L07430K494001 | 1 |



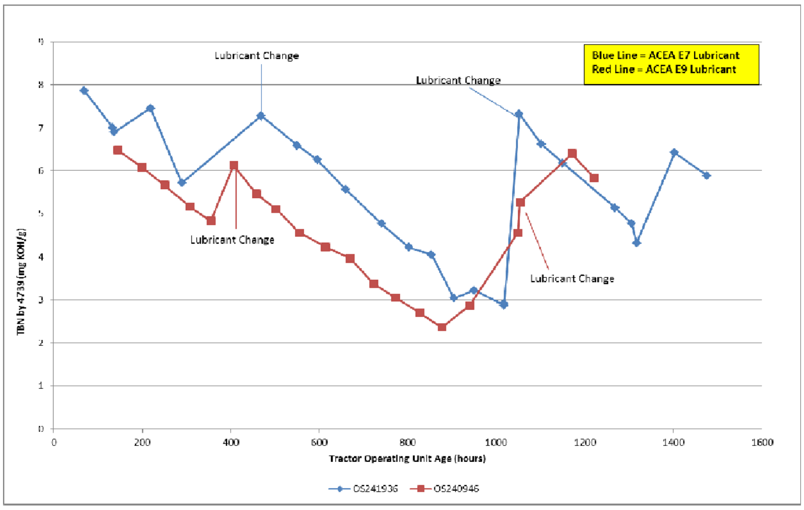

Lubrizol

# German Tractors – Kin. Viscosity at 100°C




- All used lubricant samples have stayed within SAE viscosity grade

# German Tractors - Total Base Number (D4739)

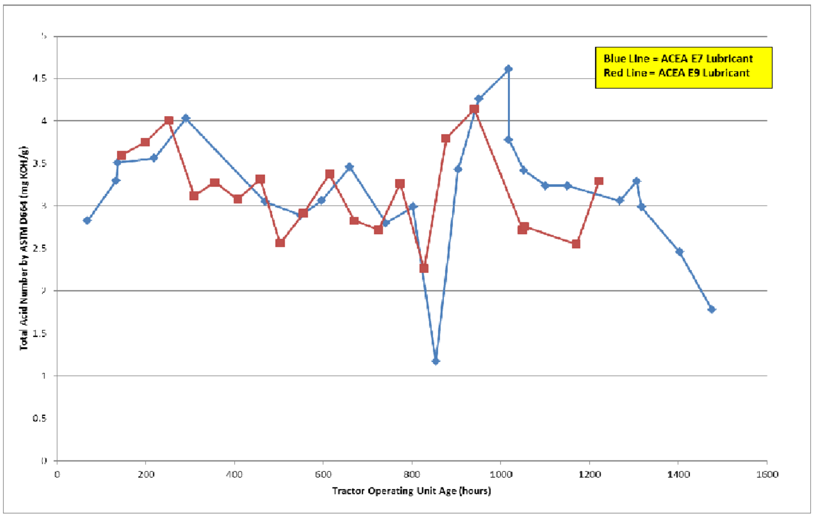



- Lubrizol considers the lubricants are successfully controlling acids (as demonstrated by acceptable TBN retention)






# German Tractors - Total Acid Number




- Lubrizol considers the TAN control of the lubricants to be acceptable

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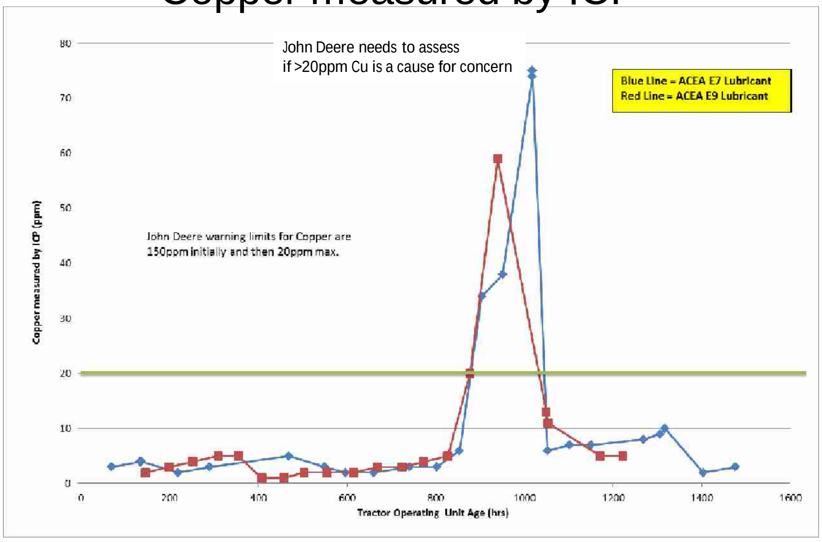
# Copper measured by ICP




- John Deere warning limits for Copper in used lubricants are 150ppm initially and then 20ppm max. Lubricant copper is below 20ppm until unit age reaches 900 hours



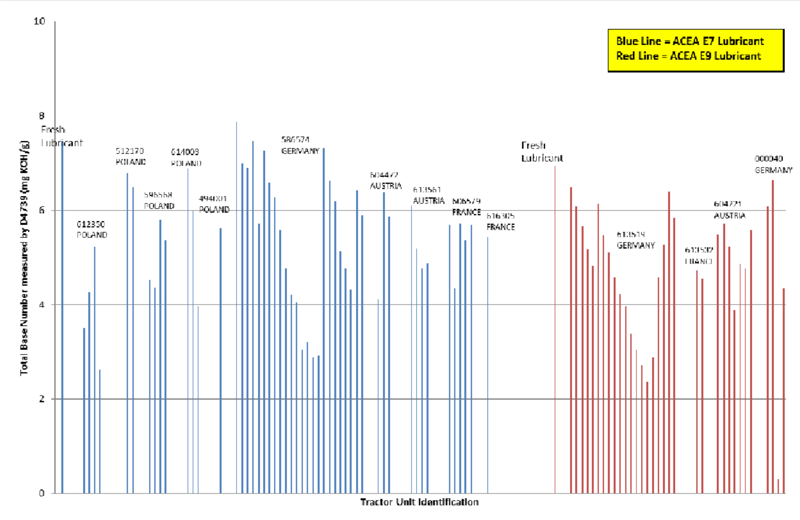

Lubrizol

# Conclusions from Lubricants in German Field Trial

- All lubricant samples have stayed in SAE viscosity grade
- TAN control (and TBN change) is seen as acceptable by Lubrizol
- The >20ppm Copper values for both units after 900 hours needs to be reviewed by John Deere to assess if this is a concern
- Iron values do not exceed John Deere's warning limit of 0.5g/hr
- Measured soot values in the lubricant samples are considered to be low

- No noticeable difference in performance from the ACEA E7 and ACEA E9 lubricants
- This confirms that the ACEA E9 lubricant has not degraded faster than the ACEA E7 lubricant even though exhaust after treatment systems have been used on the tractor

# All Tractors - Total Base Number (D4739)




- Lubrizol considers the lubricants are successfully controlling acids (as demonstrated by acceptable TBN retention)

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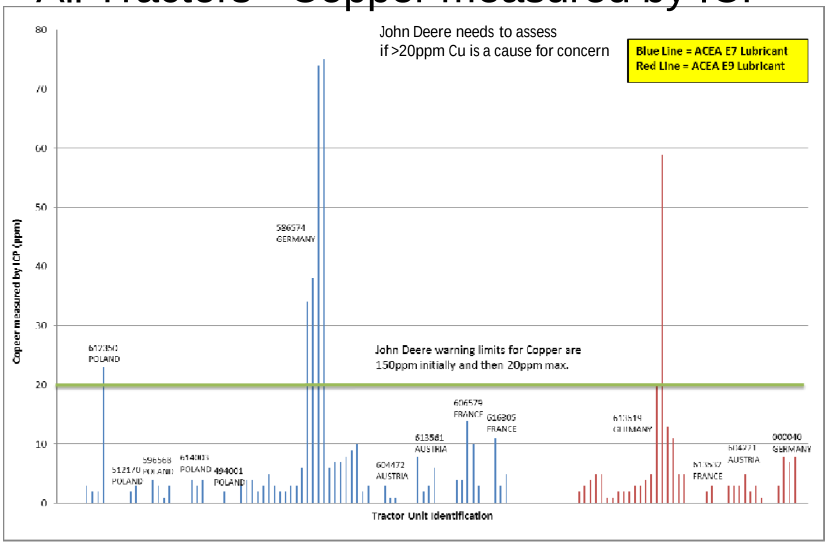
# All Tractors - Copper measured by ICP




- John Deere warning limits for Copper in used lubricants are 150ppm initially and then 20ppm max. Lubricant copper is exceeded for six samples (low viscosity Poland sample and extended lubricant drain samples running in Germany

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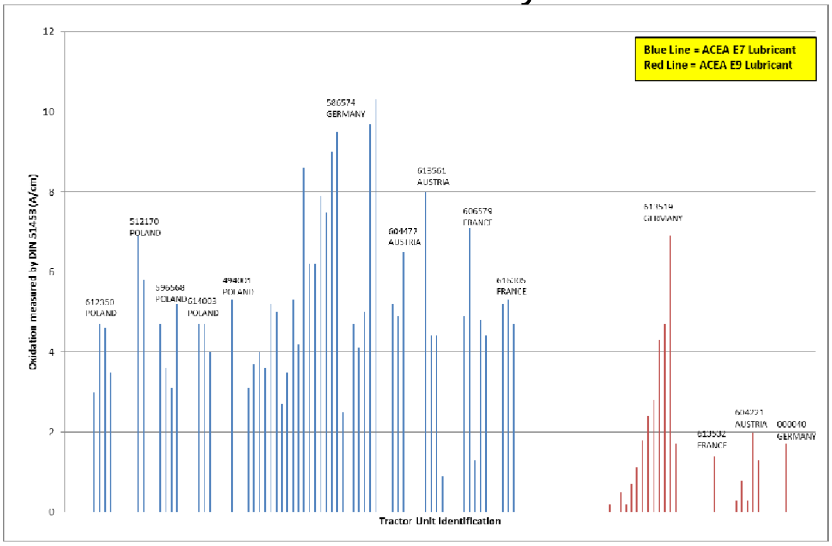
# All Tractors - Oxidation by DIN 51 453




- Oxidation level is acceptable. ACEA E9 lubricant provides better oxidation control than ACEA E7 lubricant

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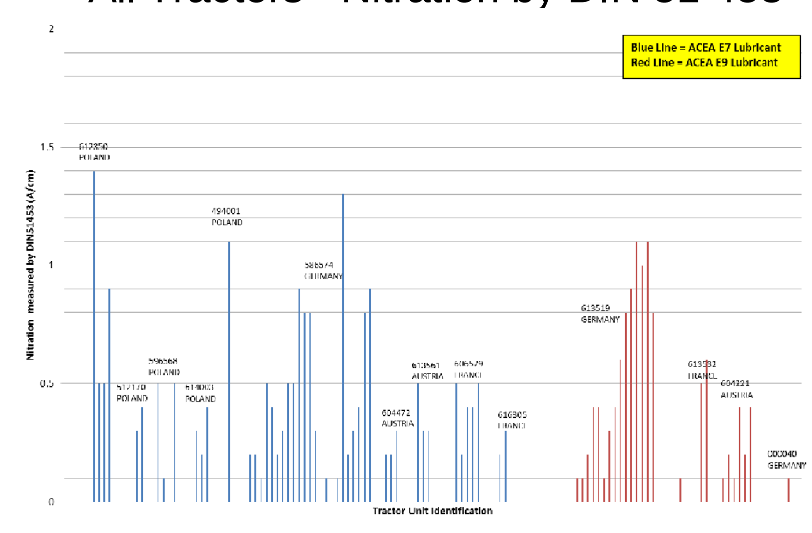
# All Tractors - Nitration by DIN 51 453




- Very low level of nitration

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# Overall Conclusions

- Good viscosity control has been demonstrated by 71 out of the 72 used lubricant samples staying in SAE viscosity grade
- Lubrizol consider that both lubricants have demonstrated good TAN control and TBN retention for the drain intervals assessed
- Six lubricant samples have a measured copper value greater than 20ppm. John Deere should asses whether this is a cause for concern
- Measured iron values are less than the John Deere warning limits
- The soot values in the used lubricants are considered low
- Oxidation and nitration control of both lubricants is acceptable, but ACEA E9 lubricant has better oxidation control than the ACEA E7 lubricant
- Lubrizol consider that the ACEA E7 and E9 lubricants have performed acceptably in the field trials so far






Lubrizol

NEN

# WP 6 Fuel standard development

Ortwin Costenoble, NEN

**2011-12-20**



# Objective

- Specification for plant oil
- Optimized for base product and pressing process
- For diesel type engines
- Produced and used locally
- Classes for at least two emission regimes
- To be applied outside EU, too (rural production)

NEN

# CEN workshop proposal

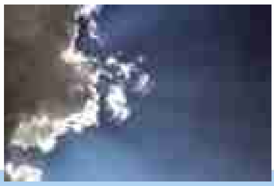
- Discussion initiated in 2009 with DIN and CEN
- Business plan on basis of various oil data in January 2010
- First workshop meeting April 2010
- Up to six meeting until October 2011

NEN



# CEN workshop development

- Two classes: PPO1 for regular, PPO2 for EuroV
- Major discrimination on P, Mg + Ca
- Long discussion on cold operability:
  - New idea for assisting producer and OEM to chose
  - maximum kinematic viscosity for permanent operation
  - lowest operational temperature



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| Property | Unit | Limits | | | |
|---|---|---|---|---|---|
| | | Direct processed | | Improved quality | |
| | | PPO1 minimum | PPO1 maximum | PPO2 minimum | PPO2 maximum |
| Visual aspect | -- | Free from visible contamination, sediment and free water | | | |
| Density at 15 °C | kg/m³ | 910,0 | 940,0 | 910,0 | 940,0 |
| Flash point | °C | 101 | – | 101 | – |
| Lower heating value | kJ/kg | 36 000 | | 36 000 | |
| Sulfur content | mg/kg | – | 10,0 | – | 10,0 |
| Water content | mg/kg | – | 750 | – | 750 |
| Total contamination | mg/kg | – | 24 | – | 24 |
| Oxidation stability at 110 °C | h | 6,0 | – | 6,0 | – |
| Acid value | mg KOH/g | – | 2,0 | – | 2,0 |
| Phosphorus content | mg/kg | – | 12,0 | – | 1,0 |
| Ca + Mg [g] | mg/kg | – | 20,0 | – | 1,0 |



# CEN workshop published

CWA 16379:2011, *Fuels and biofuels — Pure plant oil fuel for diesel engine concepts — Requirements and test methods*

Published 7 December 2011

Available for use and national adoption

Additional research and other publications planned

NEN

# *The 2nd VegOil Project*

Climate Design of Pure Vegetable Oil Fuels

Dr. Michael Stöhr, B.A.U.M. Consult GmbH

Representation of the Free State of Bavaria
Brussels, 19th December 2011

## Project assessment in 2ndVegOil

- Work has been done as part of project assessment within 2ndVegOil
- PREMIA assessment framework for bio-fuel use in passenger cars was adapted to tractors
- Result of engine development and field demonstration: Cleaned PVO is a suitable engine fuel
- Little difference between PVO and diesel fuelled tractor
- Focus on green house gas emissions (GHGE)
- Development of a mathematical model and calculations in line with Fuel Quality Directive 2009/30/EC
- Proof that PVO can meet 60% GHGE saving threshold for rape seed oil and false flax oil from mixed cultivation

## Using PVO for its own production

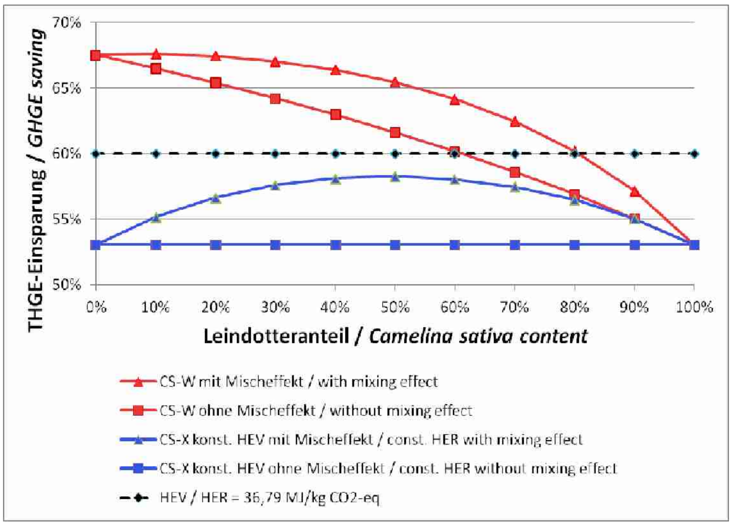
| Ersatz von Diesel durch Rapsöl bei: / *Substitution of diesel through rape seed oil for:* | a [g $CO_{2\text{-äq}}$/$MJ_{Öl\_im\_Tank}$] / *a [g $CO_{2\text{-eq}}$/$MJ_{Oil\_in\_tank}$]* | b / *b* | $E_B$ [g $CO_{2\text{-äq}}$/$MJ_{Öl\_im\_Tank}$] / *$E_B$ [g $CO_{2\text{-eq}}$/$MJ_{Oil\_in\_tank}$]* | THGE Einsparung / *GHGE saving* |
|---|---|---|---|---|
| Keinem Prozessschritt / *No process step* | 36,051 | 0,000 | 36,051 | 58,86% |
| Anbau / *Cultivation* | 32,358 | 0,042 | 33,782 | 61,45% |
| Anbau und Rapssaattransport / *Cultivation and rape seed transport* | 31,989 | 0,046 | 33,544 | 61,72% |
| Anbau und Rapsöltransport / *Cultivation and rape seed oil transport* | 32,178 | 0,044 | 33,666 | 61,59% |
| Anbau und Rapssaat- und -öltransport / *Cultivation and rape seed and rape seed oil transport* | 31,809 | 0,048 | 33,427 | 61,86% |
| Allen Dieselverwendungen / *All diesel usage in standard production process* | 31,793 | 0,049 | 33,416 | 61,87% |

## Synergy effects of mixed cultivation

- Oil crop and grain crop grow jointly on the same field
- Separation of seeds after harvest by sieves etc.

- Less chemical plant protection
- Higher yield than pure cultures
- **Less land use!**

## GHG saving with mixed cultivation




## Design rules for optimised mixtures

- The key parameter is the ratio of the lower heating value of the harvested oil seed and the GHGE related to its cultivation (HER).
- Chose mixture with higher HER than 36.79 MJ/kg $CO_{2\text{-eq}}$ i.e. at least one of the associated crops needs to reach this threshold in a pure culture.
- Vary mixing ratio to maximise synergy effects with regard to GHGE saving.
- Use produced pure vegetable oil as much as possible as heating and/ or engine fuel in its own production.

## Nitrous oxide field emissions

- Nitrous oxide ($N_2O$) field emissions account for more than 1/3 of GHGE of PVO
- The exact amount is very much dependent on the exact soil conditions, weather history, amount of (mineral) nitrogenous fertiliser used, etc.
- The use of typical regional values for nitrous oxide field emissions instead of European average values would greatly improve the GHGE calculations
- There is a need for acquiring a better knowledge of factors that influence the nitrous oxide field emissions
- The regional dependency of GHGE calls for linking bio-fuel certification with control of origin mechanisms

## Indirect land use changes (ILUC)

Proposal for a threshold for considering GHGE from carbon stock changes caused by ILUC in the GHG balance of bio-fuels:

*Such GHGE shall not be considered if the following cumulative conditions are met:*

✓ *The bio-fuels are entirely produced within agricultural enterprises*
✓ *The bio-fuels are used within the producing agricultural enterprises or within the closer region*
✓ *Not more than 10% of the agricultural area of the closer region is used for producing such bio-fuels*

## A role for regional marketing initiatives

- ✓ Regional marketing initiatives often have established certification schemes for regional origin and for sustainability criteria
- ✓ Pure vegetable oils can easily be included in such schemes
- ✓ Certification of PVO fuel by a regional marketing initiative could be the precondition for:
  - use of regional parameter values in GHGE calculation instead of European average values
  - exemption from considering indirect land use changes

WALDLAND

# *Decentralized Production of Different Plant Oil Fuels*

*Hannes Blauensteiner*
*Brussels, 19th of December 2011*

WALDLAND

# *WP 3 Fuel development*

*Development of a treatment system for decentralized oil mills to reduce the contents of P/Ca/Mg/Ka/Na in different plant oils*

www.2ndVegOil.eu

WALDLAND

***Fuel quality at the beginning:***

| | | |
|---|---|---|
| DIN V 51605 | → | sum content P/Ca/Mg = 32 mg/kg |
| | → | no experience for Ka and Na |
| | → | **useless for 2ndVegOil engines** |

***Goals for 2ndVegOil:***

| | | |
|---|---|---|
| 2ndVegOil fuel | → | sum content P/Ca/Mg = < 1.5 mg/kg |
| | → | sum content Ka/Na = < 2.0 mg/kg |

www.2ndVegOil.eu

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## Production procedure - step by step

1. Seed selection criteria
2. Optimisation and modification of oil press parameters
3. Purification process
4. Recommendations for storage of pure plant oils (PPO)

www.2ndVegOil.eu

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## 1. Quality Criteria for Seed Selection

| Parameters | Seed | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Sort | Age | Corn break | Maturity | Out growth | Soiling | Drying | Storage | Oil pressing | Oil filtration | Oil storage | Oil delivery |
| Density | Oil specific – no influence | | | | | | | | | | | |
| Flash point | Oil specific – no influence | | | | | | | | | | | |
| Kin. viscosity | Oil specific – no influence | | | | | | | | | | | |
| Heating value | Oil specific – no influence | | | | | | | | | | | |
| Combustibility | Oil specific – no influence | | | | | | | | | | | |
| Carbon residue | x | | | | | | | | | | | |
| Iodine number | | | | x | | | x | x | | | | |
| Purity | | | | | | | | | x | x | x | x |
| Acid value | x | x | x | x | x | x | x | x | | | | |
| Oxidation stability | x | x | x | x | x | x | x | x | | | x | |
| P content | | | x | x | x | x | | | x | | | |
| Ca content | | | x | x | x | x | | | x | | | |
| Mg content | | | x | x | x | x | | | x | | | |
| Water content | | x | | | | | x | | | | x | x |

WALDLAND

## 2. Optimisation of oil mill seetings

- Reducing of pressure inside the press
- Replacement of sieve bars
- Replacement of srew parts

*Reachable values under optimal conditions:*

| | |
|---|---|
| P: | 4.0 mg/kg |
| Ca: | 3.0 mg/kg |
| Mg: | 1.5 mg/kg |

WALDLAND

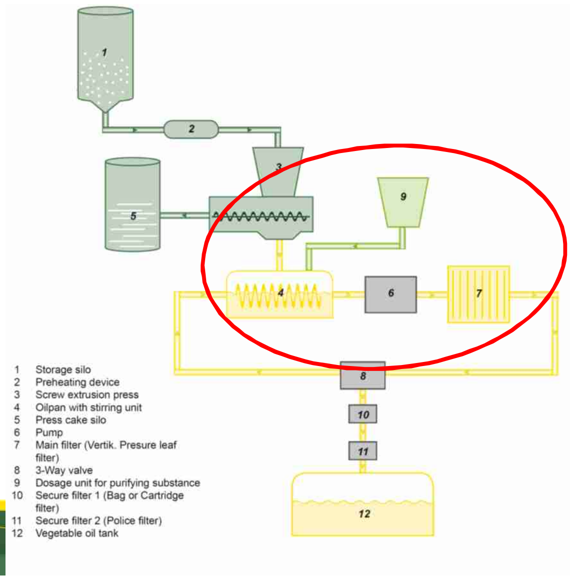
## 3. Development of a purification process (treatment system) for plant oil fuels

**Demands on the system:**

- easy to use
- simple to integrate in decentralized oil mills
- guarantee a continuous production of this high fuel quality
- working in accordance with quality management systems
- useable for different plant oils

WALDLAND

## Waldland Purification Process – Schematic diagram

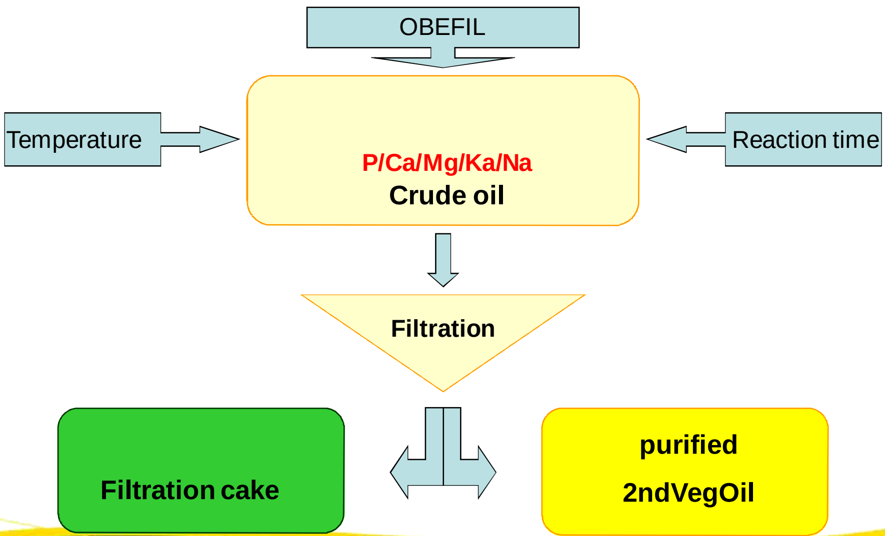






WALDLAND

## Waldland Purification Process – Functional principle



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## Further development for different seeds


Rape


Sunflower


Camelina sativa


Maize germs


Jatropha



WALDLAND

## 4. Recommendations for storage of PPO

a) continuous storage temperature between 4°C and 12°C
b) dark, frost-proof and dry storage room to avoid water condensation
c) dense storage tank, prevent inlet of oxygen and water
d) equipment, e.g. tank, pipelines or fittings from stainless steel or synthetic material
e) capability for completely emptying of the storage tank
f) duration of storage max. 1 year

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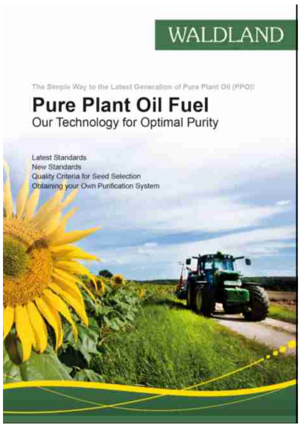
## *WALDLAND´s out put*

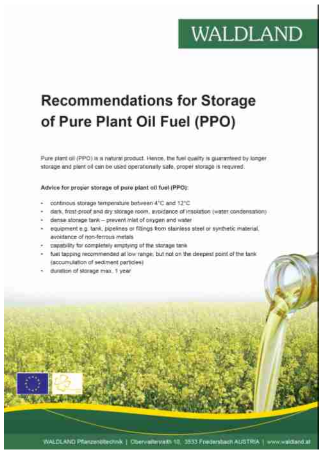

WALDLAND

The Simple Way to the Latest Generation of Pure Plant Oil (PPO)!

**Pure Plant Oil Fuel**

Our Technology for Optimal Purity

Latest Standards
New Standards
Quality Criteria for Seed Selection
Obtaining your Own Purification System


WALDLAND

**Recommendations for Storage of Pure Plant Oil Fuel (PPO)**

Pure plant oil (PPO) is a natural product. Hence, the fuel quality is guaranteed by longer storage and plant oil can be used operationally safe, proper storage is required.

**Advice for proper storage of pure plant oil fuel (PPO):**

- continous storage temperature between 4°C and 12°C
- dark, frost-proof and dry storage room, avoidance of insolation (water condensation)
- dense storage tank – prevent inlet of oxygen and water
- equipment e.g. tank, pipelines or fittings from stainless steel or synthetic material, avoidance of non-ferrous metals
- capability for completely emptying of the storage tank
- fuel tapping recommended at low range, but not on the deepest point of the tank (accumulation of sediment particles)
- duration of storage max. 1 year

WALDLAND Pflanzenöltechnik | Oberwaltenreith 10, 3533 Friedersbach AUSTRIA | www.waldland.at

www.2ndVegOil.eu

WALDLAND

## Thank you for your attention!

Ing. Hannes Blauensteiner

Waldland Naturstoffe GmbH
Oberwaltenreith 10
3533 Friedersbach
AUSTRIA

www.waldland.at

www.2ndVegOil.eu

GREEN POWER
Feeds Your Engine

# Farmers' Sight on Producing and Using Pure Plant Oil Fuel

# Contribution of French sites

Charles GUILLOT (FRCuma Rhône-Alpes - France)

Brussels – December 19th 2011

Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines
(EC project DG-TREN FP7EN-219004)

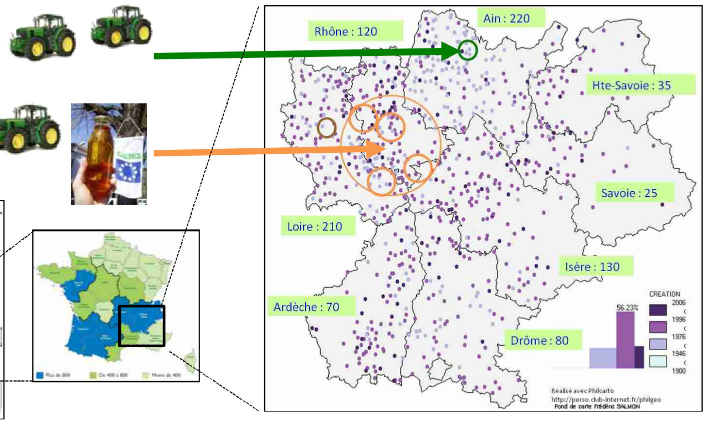
# Target and spirit: Short cycle!

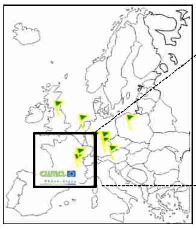
- Energy efficiency
- Local use of by-product
  (cake for animal feed)
- Self-supply of farms
- Traced quality (animal feed...)
- Local and sustainable development of added value, employment, know-how


# The power of field tests

CUMA Plaine de Faverges

CUMA Verte Prairie



2 CUMAs were involved, out of a regional network of 900 Cooperatives for Use of Machinery in Agriculture

Brussels, December 19th 2011

# 3 demonstrated tractors

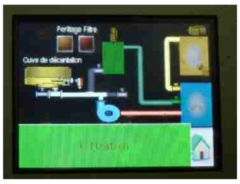
- 1 - JD6830-stage 3A : 2 200 op. hours
- 2 - JD7530-stage 3A : 2 000 op. hours
- 3 - JD7530-stage 3B : 1 150 op. hours

French fleet total : 5 150 op. hours

→ On a wide range of farm works
→ Under real field conditions
→ Without any major trouble

Brussels, December 19th 2011

# A converted oil press

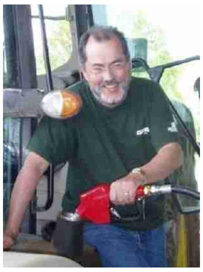



*2nd VegOil* quality standards were reached under farm conditions, to allow local supply of demonstration tractors under garantee.



# Satisfaction and prospect

- All project targets have been achieved
- Technologies proved reliable (on farm)
- Farmers, mechanics: trained, conviced
- Contributed to pre-standard (WS56)
- Wish to continue running on 2ndVegOil
- John Deere offers an extended garantee
- A local steady market is beeing organized
- <u>But</u> held back by price considerations
- A commercial <u>offer</u> is still expected…



Thank you for your attention!

*Further information:* www.2ndVegOil.eu / *www.cuma.fr*

*Charles GUILLOT (FRCuma Rhône-Alpes)*
*Ph. +33 472 393 653 / 608 774 150 -* *charles.guillot@cuma.fr*

# POLISH EXPIRIENCES


Total op. hours during field test
(on end of November 2011P

ID 9 – 1650 oph
ID 10 – 1720 oph
ID 11 – 1680 oph
ID 12 – 1710 oph
ID 16 – 1690 oph

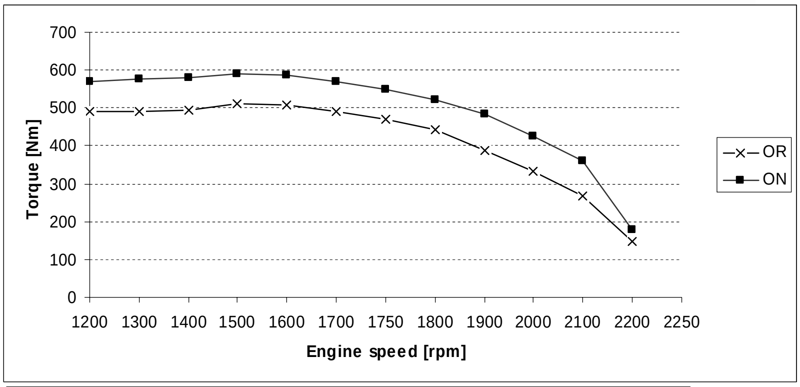
Total fuel consumption 83 000 l

**MAX. TEMP. OUTSIDE + 32 ºC**
**MIN. TEMP. OUTSIDE - 18 ºC**

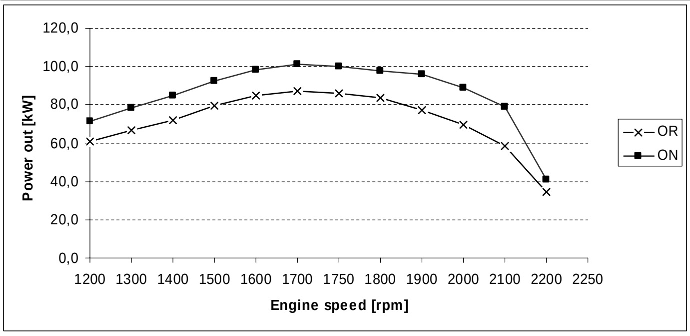


GREEN POWER Feeds Your Engine 2nd VegOil EU


pto test for all 5 tractors Summer 2011

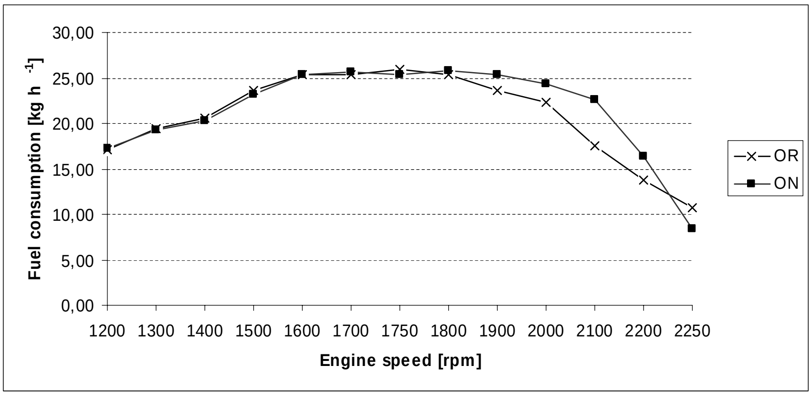



- PPO
- DIESEL




- PPO
- DIESEL

85




- ppo
- diesel

## THE MOST SERIOUS DAMAGE

-solenoid and pump pressure sensor - ID9, ID10, ID11, ID12
- fuel pump and injectors – ID 12
- stepper motor – ID9
-preheating system switch – ID 11




| | Sample I* | Sample II* | Sample III* |
|---|---|---|---|
| Batch size | 500 l | 800 l | 800 l |
| Oxid. Stab. | 6,88 h | 7,02 h | 6,83 h |
| Water cont. | 0,05 %<br>50 mg/kg | 0,03 %<br>50 mg/kg | 0,07 %<br>70 mg/kg |
| Microelements mg/kg | | | |
| Phosforus | 1,36 | 1,15 | 0,63 |
| Magnesium | 0,82 | 0,56 | 0,46 |
| Calcium | 0,43 | 0,48 | 0,32 |
| Σ | ≤ 3,50 | ≤3,50 | ≤ 1,50 |

INSTYTUT TECHNOLOGICZNO-PRZYRODNICZY

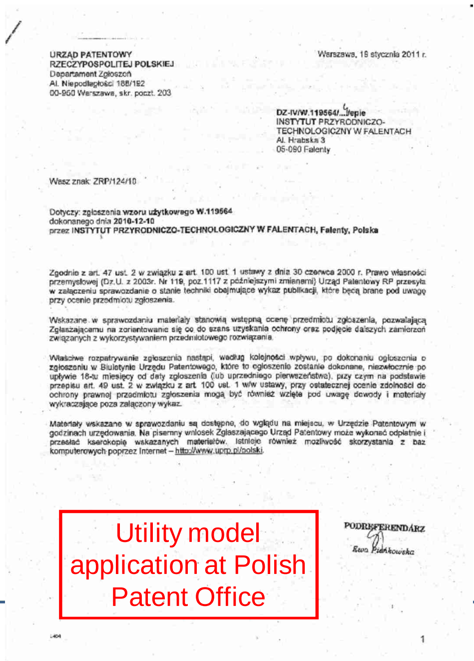
GREEN POWER Feeds Your Engine

## Technical Specification

| | |
|---|---|
| **Oil Press** | **2 x 35kg/h** |
| **Buffer Tank No 1** | **350 kg** |
| **Buffer Tank No 2** | **150 dm$^3$** |
| **Mixer** | **600 dm$^3$** |
| **Gravity Filter** | **100 dm$^3$/h** |
| **Plate Filter** | **80 dm$^3$/h** |
| **Pressure Filter** | **100 dm$^3$/h** |

**Fuel Production**

**600 or 1 200 dm3 per week**



URZĄD PATENTOWY
RZECZYPOSPOLITEJ POLSKIEJ
Departament Zgłoszeń
Al. Niepodległości 188/192
00-950 Warszawa, skr. poczt. 203

Warszawa, 19 stycznia 2011 r.

DZ-IV/W.119564/.../epie
INSTYTUT PRZYRODNICZO-TECHNOLOGICZNY W FALENTACH
Al. Hrabska 3
05-090 Falenty

Wasz znak: ZRP/124/10

Dotyczy: zgłoszenia **wzoru użytkowego W.119564**
dokonanego dnia **2010-12-10**
przez **INSTYTUT PRZYRODNICZO-TECHNOLOGICZNY W FALENTACH, Falenty, Polska**

Zgodnie z art. 47 ust. 2 w związku z art. 100 ust. 1 ustawy z dnia 30 czerwca 2000 r. Prawo własności przemysłowej (Dz.U. z 2003r. Nr 119, poz.1117 z późniejszymi zmianami) Urząd Patentowy RP przesyła w załączeniu sprawozdanie o stanie techniki obejmujące wykaz publikacji, które bęcą brane pod uwagę przy ocenie przedmiotu zgłoszenia.

Wskazane w sprawozdaniu materiały stanowią wstępną ocenę przedmiotu zgłoszenia, pozwalającą Zgłaszającemu na zorientowanie się co do szans uzyskania ochrony oraz podjęcie dalszych zamierzeń związanych z wykorzystywaniem przedmiotowego rozwiązania.

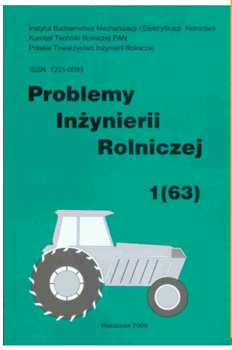
Właściwe rozpatrywanie zgłoszenia nastąpi, według kolejności wpływu, po dokonaniu ogłoszenia o zgłoszeniu w Biuletynie Urzędu Patentowego, które to ogłoszenie zostanie dokonane, niezwłocznie po upływie 18-tu miesięcy od daty zgłoszenia (lub uprzedniego pierwszeństwa), przy czym na podstawie przepisu art. 49 ust. 2 w związku z art. 100 ust. 1 w/w ustawy, przy ostatecznej ocenie zdolności do ochrony prawnej przedmiotu zgłoszenia mogą być również wzięte pod uwagę dowody i materiały wykraczające poza załączony wykaz.

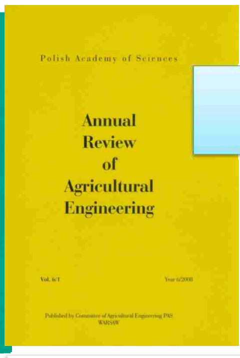
Materiały wskazane w sprawozdaniu są dostępne, do wglądu na miejscu, w Urzędzie Patentowym w godzinach urzędowania. Na pisemny wniosek Zgłaszającego Urząd Patentowy może wykonać odpłatnie i przesłać kserokopię wskazanych materiałów. Istnieje również możliwość skorzystania z baz komputerowych poprzez Internet – http://www.uprp.pl/polski.

PODREFERENDARZ
Ewa Pieńkowska

1

Utility model application at Polish Patent Office

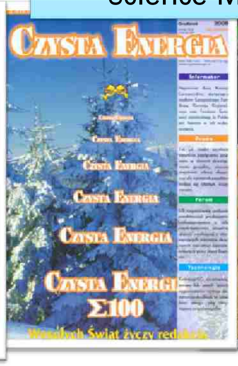


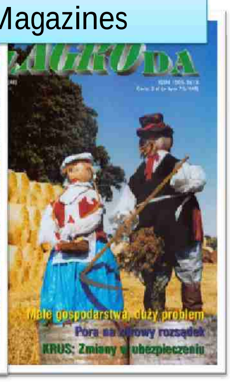




6 papers in Science Magazines

4 papers in Polish Popular-Science Magazines






6 Project presentation on International Conferences:

- Paris, Lyon – France
- Kielce, Warsaw, Poznan- Poland
- Suwon - South Korea

International Conferences in Warsaw:

- 90 Participants (Austria, Germany, France, Poland, Spain, UK, USA, Russia)



4 Project presentation for students High School and University

*ANIMALS and MACHINERY SHOW*

**First prize „Hit of the Show” from Polish Minister of Agriculture**

Participation in 8 exhibition and event

**AGRO SHOW Bednary,**

- **600 Exhibitors**
- **150 000 Visitors**



WALDLAND

Political Requirements on
Sustainable Mobile Energy Concepts

Dr. Ruppert Schäfer
Bavarian State Ministry
for Food, Agriculture, and Forestry

www.2ndVegOil.eu

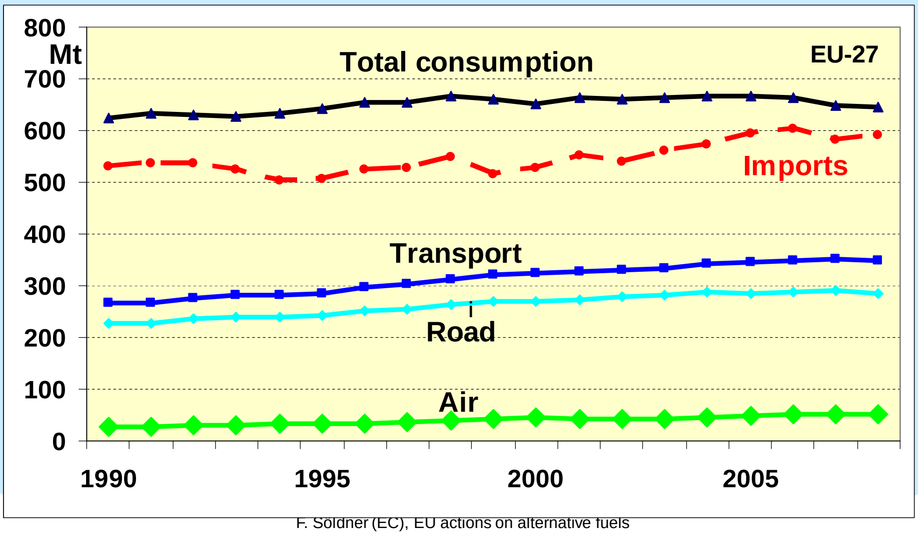
European Commission, Directorate General for Mobility and Transport

# Clean Transport Fuels for Europe

- Policy Drivers
- EU actions on alternative fuels
- Clean Transport Systems initiative

**Franz Söldner**
**European Commission**
**Directorate General for Mobility and Transport**

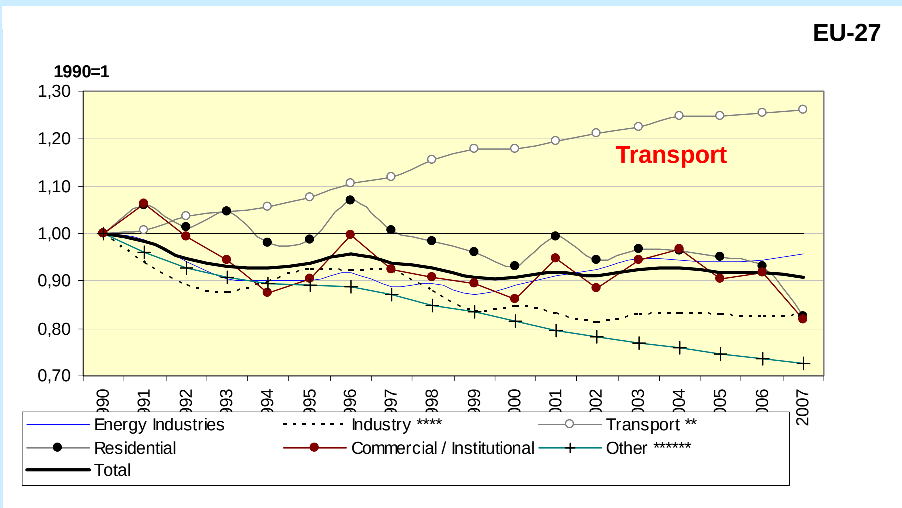
# Oil Consumption








# Greenhouse Gas Emissions



# Policy Drivers on Sustainable Transport

- **High demand on finite energy sources**
  **(Range of conventional oil: ~ 45 years)**
- **Increasing energy import dependence**
  **(Import dependence for oil: 80% now; ~ 90% in 2030)**
- **Increasing greenhouse gas emissions**
  **(Increase of transport $CO_2$ emissions: 25% since 1990)**
- **Remaining air quality problems in cities**
  **(70% of pollutant emissions in urban areas)**





# Measures in Support of Clean Vehicles

## Supply side measures

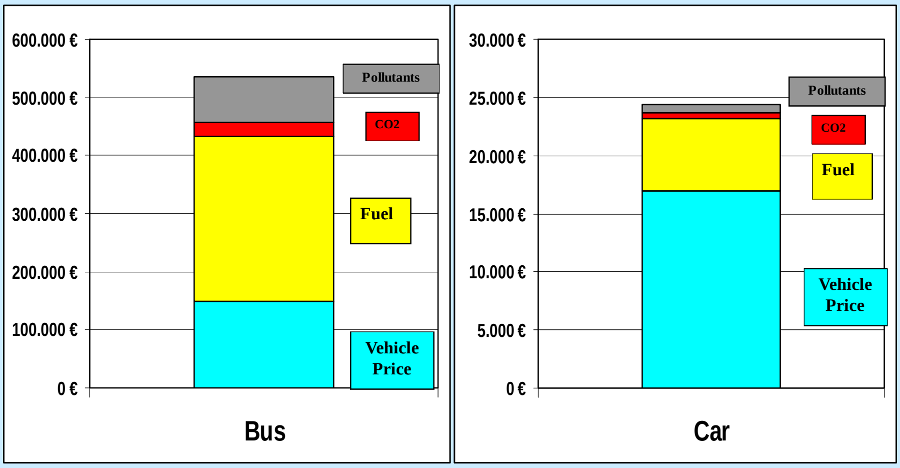
- **Regulation of pollutant emissions**
  Reduction of pollutant emissions through EURO standards
- **Regulation of $CO_2$ emissions**
  Cars: 130g/km by 2015; 95g/km by 2020
  Light Duty Vehicles: 175 g/km by 2017
- **Renewable Energy Directive**
  10% share of motor fuels from renewable energy sources by 2020
- **Fuel Quality Directive**
  Reduction of $CO_2$ intensity of fuels by 6 % by 2020

## Demand side measures

- **Greening Transport**
  Internalisation of external costs into vehicle operation (Eurovignette)
- **Directive on the promotion of clean and energy efficient vehicles**
  Inclusion of energy consumption, $CO_2$, and pollutant emissions in the purchase decision

European Commission, Directorate General for Mobility and Transport

## Clean Vehicle Directive
## Monetisation of Lifetime Costs




F. Söldner (EC), EU actions on alternative fuels

Slide 101

European Commission, Directorate General for Mobility and Transport

## Clean Vehicle Directive
## Support for Innovation with Lifetime Monetisation

**Lower pollutant emission costs less:**

➔ **Euro V bus ~ 100.000 € cheaper than Euro III bus:**
New vehicle cheaper than second hand vehicle

➔ **CNG bus at 0 pm emissions ~8.000 € cheaper than Euro V diesel bus:**
compensation for ~ 50% of higher cost of CNG technology

**Lower energy consumption costs less:**

➔ **Electric car ~ 5.000 € cheaper than petrol car:**
compensation for ~ 50% of additional cost of the battery

***Competitive advantage for cleaner technology***

F. Söldner (EC), EU actions on alternative fuels

Slide 102

# EU-Activities on Alternative Fuels

- **Communication on alternative fuels** (11/2001)
  Biofuels, natural gas, hydrogen
- **Directive on the market share of biofuels** (5/2003)
  Market share 2% in 2005, rising to 5.75% in 2010
- **Directive on the taxation of energy products** (10/2003)
  Lower taxation of alternative fuels enabled
- **Renewable Energy Directive** (April 2009)
  Binding target: 10% renewable transport fuels by 2020
- **Technology Platforms, Joint Technology Initiatives**
  Hydrogen/fuel cells (TP: 2004; JTI: 2008), Transport (2004), Biofuels (2005)
- **Green Cars Initiative of European Economic Recovery Plan** (2008)
  Focus on electromobility (EU demonstration project Green eMotion: 2011)
- **Communication on clean and energy efficient vehicle strategy** (4/2010)
  Focus on improvement of internal combustion engine and electric vehicles





# Alternative Fuels Strategy

**Comprehensive long-term fuel strategy**
**All transport modes, all segments to be covered**

**White Paper on Transport - Initiative 24 - Technology roadmap:**
**Sustainable alternative fuels strategy**
**including also the appropriate infrastructure**

**White Paper on Transport - Initiative 26 - Regulatory framework:**

- Appropriate standards for $CO_2$ emissions of vehicles in all modes, where necessary supplemented by requirements on energy efficiency to address all types of propulsion systems
- Rules on interoperability of charging infrastructure for clean vehicles
- Guidelines and standards for refuelling infrastructures

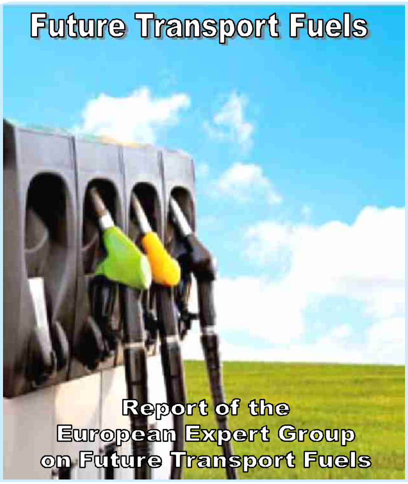
# Clean Transport Systems Initiative
## *- Activities -*

- **European Expert Group on Future Transport Fuels**
  ***Stakeholder experts***
  **Future Transport Fuels Report: 25 January 2011**
  **Alternative Fuels Infrastructure Report: November 2011**
- **Joint Expert Group Transport & Environment**
  ***National experts***
  **European Alternative Fuel Strategy Report: May 2011**
- **Conference on Future Transport Fuels**
  **13 April 2011 (European Sustainable Energy Week)**
- **Studies**
  **Clean Transport Systems study: final report October 2011**
  **European Alternative Fuel Strategy Implementation study: launch 10/2011**
- **Public Consultation**
  **11 August – 20 October 2011**





# Future Transport Fuels Expert Group




## European Expert Group on Future Transport Fuels

**Members:**

- **Manufacturers, operators, users**
- **Energy and fuel suppliers**
- **Civil society**

**Scope:**

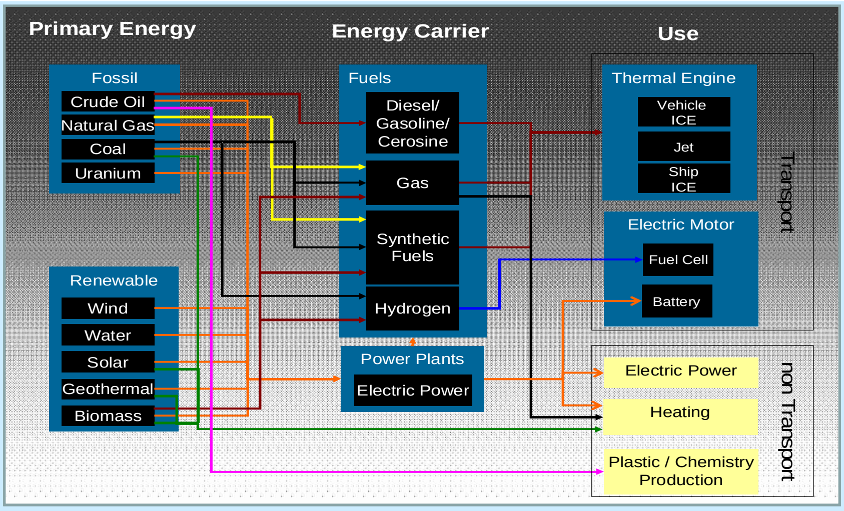
**Long term energy supply to transport**

- **All transport modes**
- **All fuels and energy carriers**

**Report published on 25 January 2011**

http://ec.europa.eu/transport/urban/vehicles/road/clean_transport_systems_en.htm

# Energy Pathways

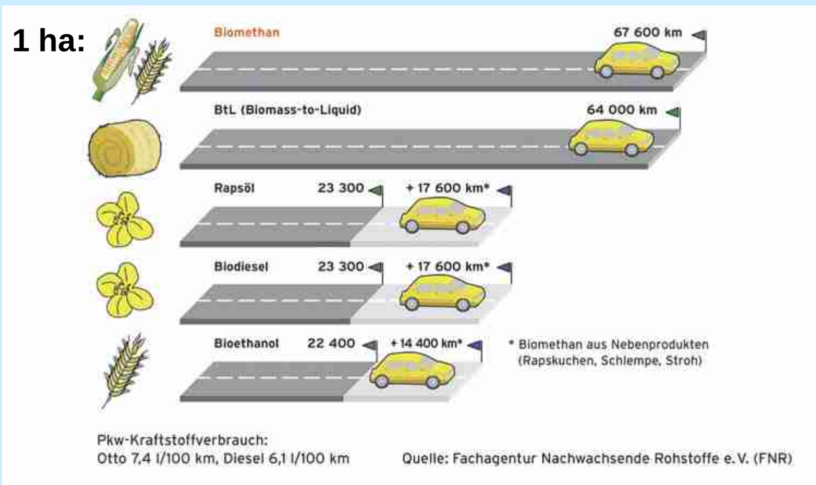



F. Söldner (EC), EU actions on alternative fuels





# Land Efficiency of Biofuels




F. Söldner (EC), EU actions on alternative fuels

# Fuel Choice

| | Range | Road - passenger short | Road - passenger medium | Road - passenger long | Road - freight short | Road - freight medium | Road - freight long | Rail | Water inland | Water short-sea | Water maritime | Air |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Electric | BEV | ■ | | | ■ | | | ■ | | | | |
| | HFC | ■ | ■ | | ■ | | | ■ | ■ | | | |
| | Grid | ■ | | | ■ | | | ■ | | | | |
| Biofuels (liquid) | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Synfuels | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Methane | CNG | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | CBG | ■ | ■ | ■ | ■ | ■ | | | | | | |
| | LNG | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | |
| LPG | | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | ■ | | |





# Alternative Transport Fuel Options

**Main fuel options:**

- **Electricity / hydrogen ➔ *electromobility***
- **Biofuels (liquid)**

**Bridge from fossil to biomass based fuels:**

- **Synthetic fuels (from coal, methane, biomass)**

**Complementary:**

- **Methane (natural gas and biomethane)**

**Supplement:**

- **LPG (now: from oil, natural gas; future: from biomass)**

# Summary

- **Comprehensive long-term European fuel strategy**
  **Substitution of oil for all transport modes, all segments**
- **Future transport fuel mix**
  **Electromobility and biofuels highest priority**
  **Synthetic fuels bridging from fossil to biomass sources**
  **Methane complementary**
  **LPG supplementary**
- **Alternative fuel infrastructure**
  **EU-wide coverage important**





# Contact

**Clean Transport and Sustainable Urban Mobility:**

**http://ec.europa.eu/transport/urban/index_en.htm**

**e-mail:**

**franz-xaver.soeldner@ec.europa.eu**

**Demonstration of 2nd Generation Vegetable Oil Fuels in Advanced Engines**
**The 2nd VegOil Project**

Presentation: Dr. Georg Gruber,
Vereinigte Werkstätten für Pflanzenöltechnologie
Dotzer, Dr. Gruber, Kaiser GbR,
Am Steigbühl 2, D-90584 Allersberg

Title: What makes 2nd VegOil different in Sustainability and the Biofuels Conflict of Food and Fuel

Location: Representation of the Bavarian State Government in Brussels

Date: Dezember 19, 2011

VWP VEREINIGTE WERKSTÄTTEN FÜR PFLANZENÖLTECHNOLOGIE

**Content**

The problem

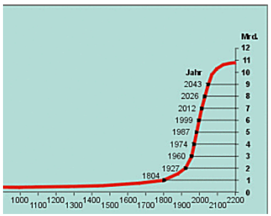
The solution

The situation

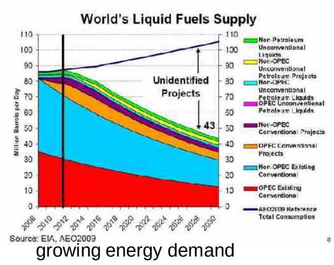
Conclusion

VWP VEREINIGTE WERKSTÄTTEN FÜR PFLANZENÖLTECHNOLOGIE

## The Problem: The Unhappy Quadrat




growing world population
growing food demand

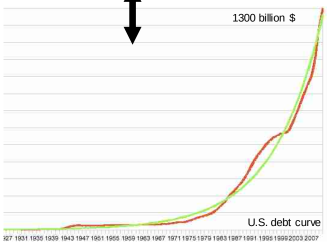



growing energy demand

decreasing fossile resources

agriculture and climate change,

less productivity




financial crisis,

blocks environmental investment

## The Solution: Highlights of 2nd VegOil

- European oil plants serve the production of fuel, protein and humus ($CO_2$ capture) at the same time
- No food vs fuel conflict like alternative biofuels which liquify the whole plant
- High socio-economic, ecologic impact by decentralized, local production and consumption of oil and oil cake and humification of left overs (straw)
- High energy density as fuel for efficient diesel engines for stage 3a/3b/4
- High quality fuel by reducing P, Ca, Mg
- High cost for engine adaptation

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## Situation: Sustainability Requirements for Biofuels

| | 2nd VegOil/ decentral | PPO industrial | Biodiesel palm oil | BTL hydrotreating | 3rd Gen. Algae |
|---|---|---|---|---|---|
| Food security | + | + | - | O | + |
| Biodiversity impact (monoculture, rainforest) | + | O | - | - | + |
| Agricultural practice (soil health, humification) | + | + | - | O | + ? |
| Water resources, air pollution of supply chain | + | + | O | - | O |
| $CO_2$-Reduction (GHG emissions) | + | + | O | - | + |
| Human-, labour right standard | + | + | O | O | + |
| Socio-economic impact | + | O | - | - | - |
| Property rights (land grabbing) | + | O | - | O | + |
| Total result of all sustainability criteria | ++ | + | - | O/- | + |

+ positive  O average  - negative

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## Cost and Market Share

| | 2nd VegOil/ decentral | PPO industrial | Biodiesel palm oil | BTL hydrotreating | 3rd Gen. Algae |
|---|---|---|---|---|---|
| Overall results of sustainability criterias | ++ | + | - | O/- | + |
| Business cost | - | O | + | O | ? |
| Macroeconomic benefit | + | O | - | - | ? |
| Market share | - | O | + | O | ? |

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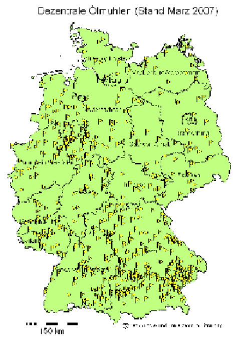
## Sustainability and Market Share

Palm Oil: Low sustainability but high market share

→ Primary (rain) forest

→ Existing palm oil plantation (with fuel certificate)

→ New palm oil plantation (no certificate as foodstock)



Pure plant oil (decentral): high sustainability but decreasing market share

From about 600 decentralized oil mills in Germany in 2007 only 274 have been in operation in June 2011 (TFZ) because:

- New mineral oil tax for pure biofuels (cars, trucks)
- Reduced mineral oil tax for natural gas (cars, trucks) and diesel (agricultural machines)
- Lost stationary market (CHP), no support through renewable energy law (EEG) anymore

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## Conclusion:
## It´s The Economy, Stupid!

(Bill Clinton)

Pure Biofuels with high sustainability standards are more expensive than biofuels with a low or no sustainability standard. ➔ More of the environmentally damaging fuel is used.

The reason for this market failure is the price setting system which does not internalises social/enironmental costs into market prices. Mikroeconomics does not function for social and environmental problems. These negative external cost need **polluter pays principles!**

The economical philosophy „Bigger is better“ is not valid for biofuels. A green economy and green economics are necessary to really save climate and globe.

Competition between pure biofuels and biofuel blending is the
competition between decentralized and centralized production strategies

2nd VegOil is an ideal result and synthesis between a central organized tractor producer and a decentralized biofuel strategy.

„If we want to strive for real sustainable energy supply we have to look for multiple, multi-scale and thus also for decentralized solutions.“
(John Deere)

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