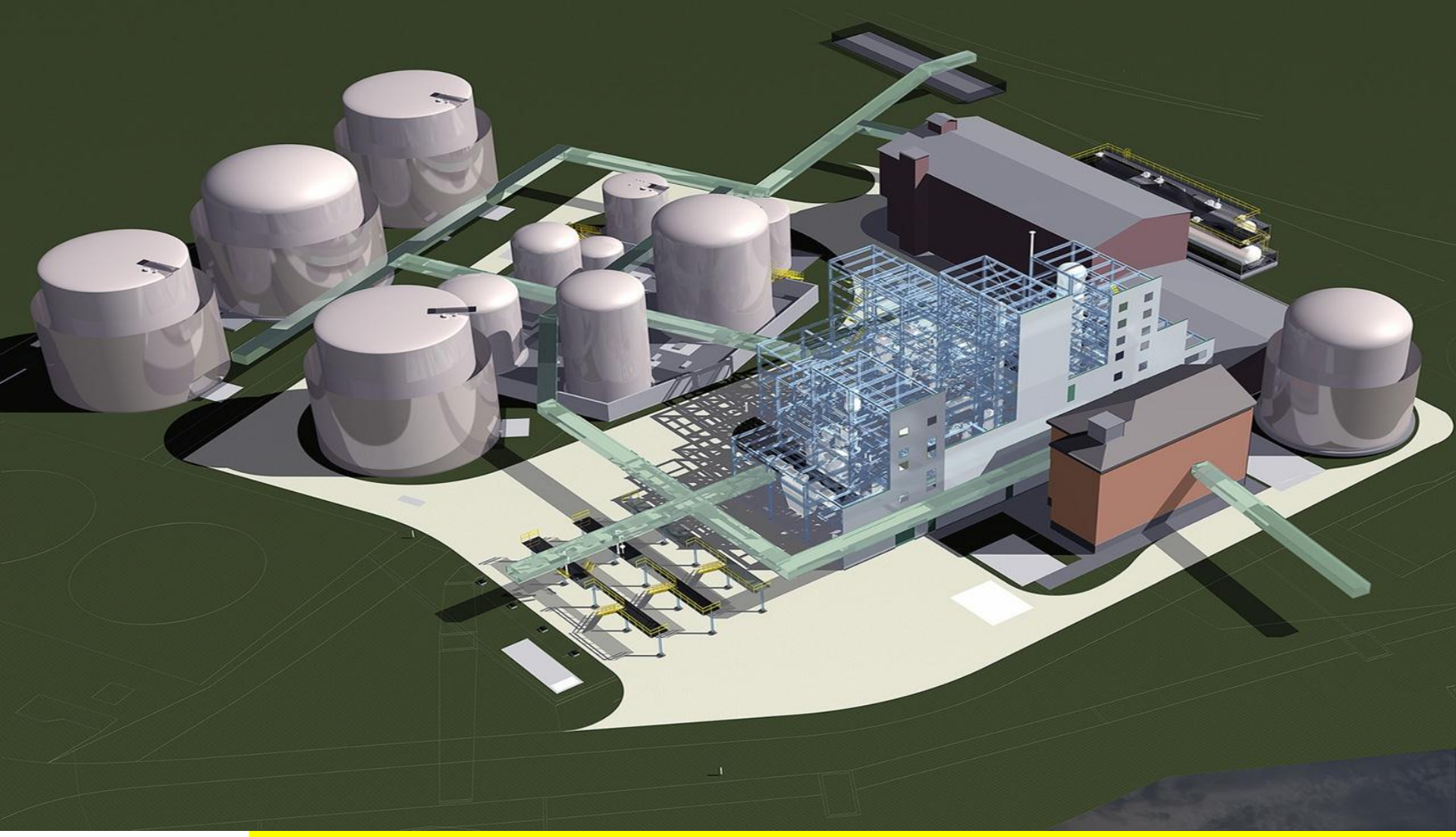


CHEMOPROJEKT

Biodiesel plant design, construction and operation

Cvengros Tomas, Chemoprojekt

CONGRESO INTERNACIONAL DE BIOCUMBUSTIBLES, 10-15 OCTUBRE DE 2011,
World Trade Center Veracruz - MEXICO

I N T R O D U C T I O N

- **The Main Biodiesel Market Players**
- **Biodiesel Market – Focus on Europe**
- **Biodiesel and its Classification in Czech Republic (CZ)**
- **Main Feedstock for Biodiesel Production**
- **Biodiesel Prices, Trading and Biodiesel Production Consumptions**
- **Major Biodiesel and Bioethanol Plants built during last years in CE**
- **Look at Biodiesel Plants being Constructed in CZ and SK recently**

THE MAIN BIODIESEL MARKET PLAYERS

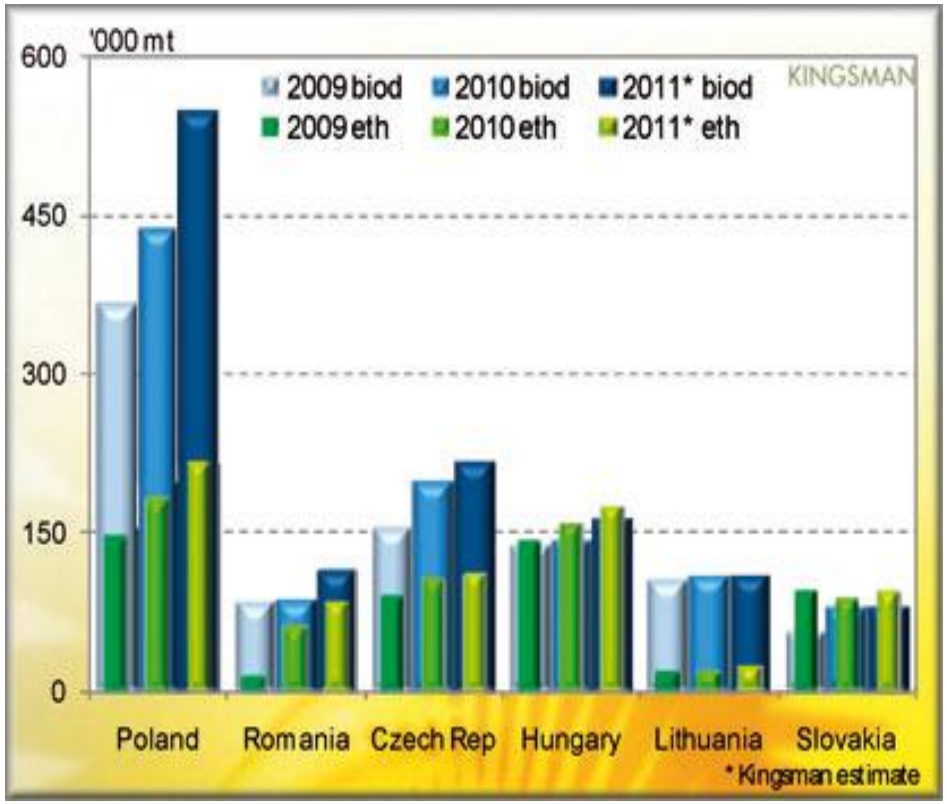
- **Europe: Germany, France, Spain, Italy, UK, PL**
- **North America: the USA**
- **South America: Argentina and Brazil**
- **Asia: Thailand, Indonesia, Malaysia and S. Korea**

BIODIESEL MARKET - FOCUS ON EUROPE

Market is dominated by the same countries as in 2010 (Germany, France, Spain, Italy, UK and Poland) – with 75% share in the demand and 70% in supply

- **France: overcomes Germany as the main consumer in 2010**
- **Germany: remains top producer**
- **Spain: the most significant increase in consumption (50%).**
- **Poland: to increase consumption by about 25%**
- **Italy: Consumption looks set to grow by about 5%**
- **Germany: biodiesel usage is expected to remain constant**
- **UK - Bucking the trend: consumption could fall**

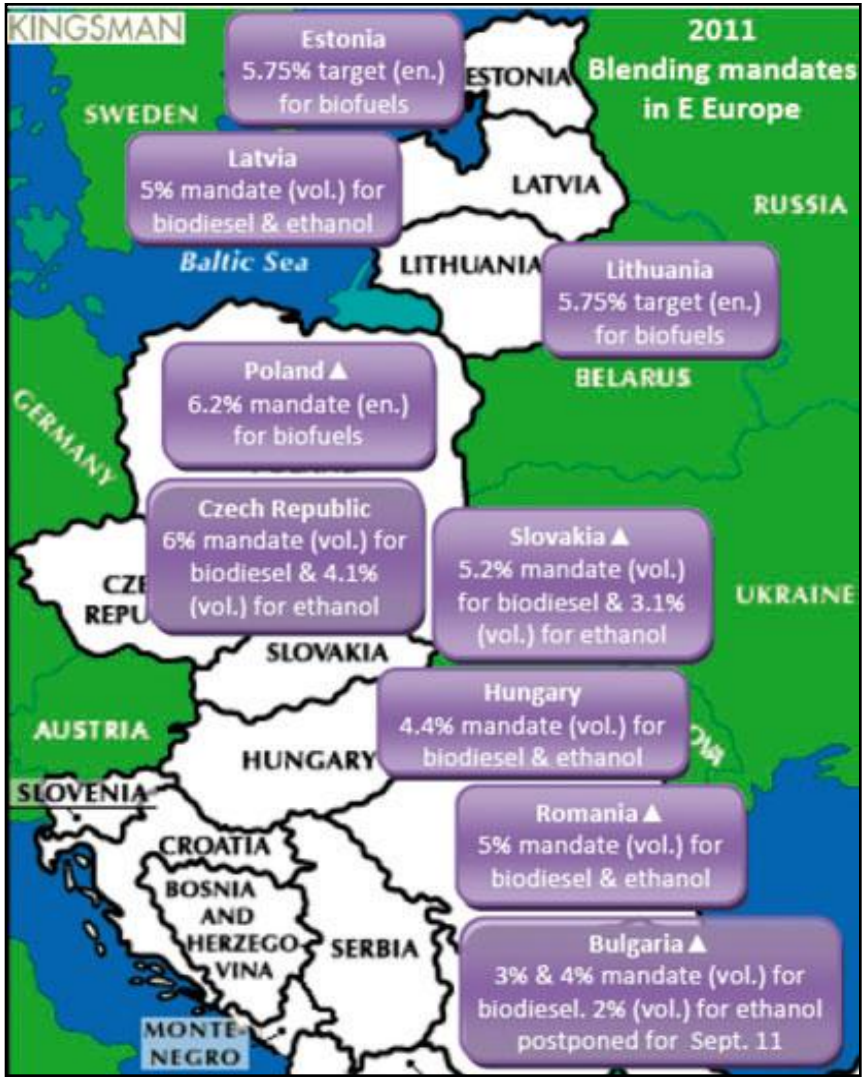
EASTERN EUROPE ON THE WAY UP IN BIOPRODUCTS?



Regional biofuels production figures for the main eastern EU countries (2009, 10, 11)

Eastern Europe is beginning to unveil an important biofuel and agricultural potential. **Dr Covrig** reviews the progress that eastern EU countries have made toward exploiting disposable arable land for the production of biofuels.

View online at www.wileyonlinelibrary.com); DOI: 10.1002/bbb.300, *Biofuels, Bioprod. Bioref.* 5:233–237 (2011)



Biofuels blending mandates and targets in 2011

BIODIESEL AND ITS CLASSIFICATION IN CZECH REPUBLIC

DIESEL (EN 590)

B7

- Volume of FAME in quality standard ČSN EN 14214 max. 7,0 %V/V
- Validity of the ČSN EN 590 from October 1st, 2009

B30 BIODIESEL

SMN 30 = Blend of fossil diesel and RME

- Volume of 70% of fossil diesel + min. 30% of RME
- Quality standard ČSN 656508

B100 BIODIESEL

FAME = Fatty Acid Methyl Ester

- Quality Standard ČSN EN 14214
- Name: FAME – for mandatory blending to fossil diesel
- Name: Biodiesel B100 – 100% biodiesel for diesel engine
- Different kinds of FAME (RME, SME, PME, etc)

MAIN FEEDSTOCK FOR BIODIESEL PRODUCTION

FOOD FEEDSTOCK

Vegetable Oils:

- **rapeseed oil**
- **soya oil**
- **palm oil**
- **sunflower oil**

NON – FOOD FEEDSTOCK

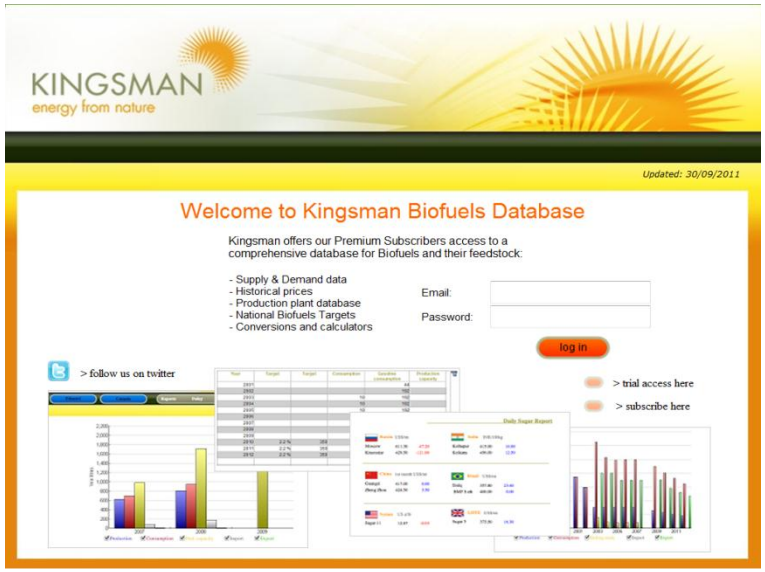
Used Cooking Oil (UCO)

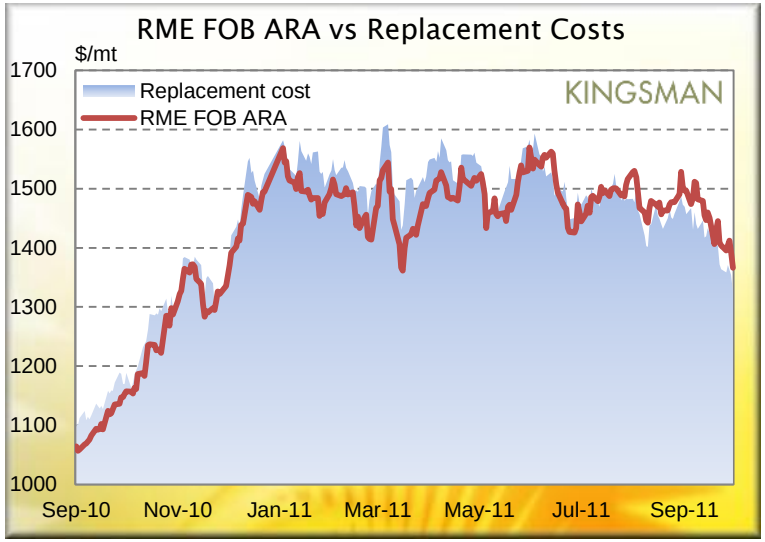
Animal Fats, Greases, Free Fatty Acids (FFA), etc

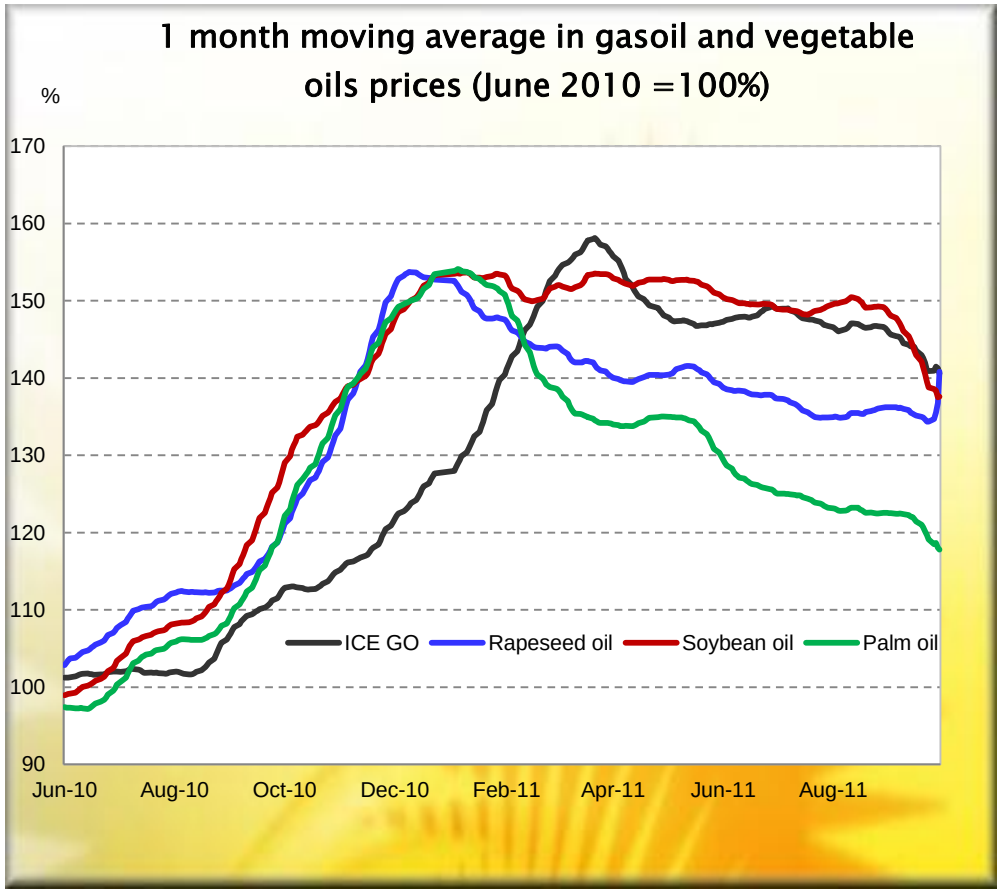
Non edible oils - jatropha, castor, algae, ...

85% of Biodiesel Production Costs from Feedstock

BIOFUELS AND FEEDSTOCK PRICES

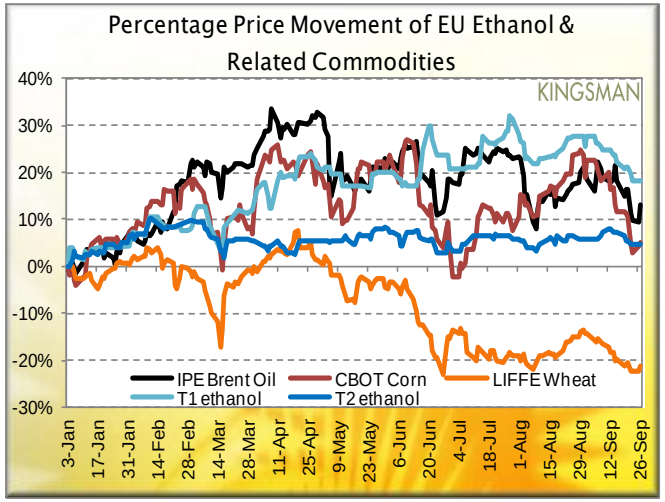


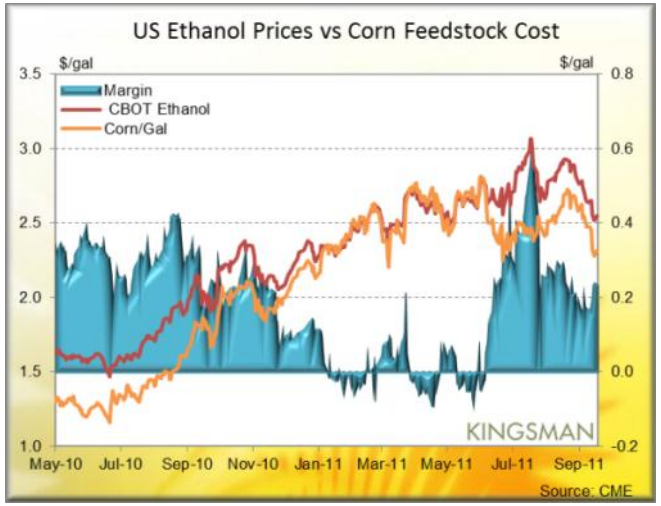




For more details visit:
www.kingsman.com

DAILY WORLD ETHANOL PRICES AND REPORTS





Daily Ethanol Market Report

30 September 2011

	Bid	Offer	Bid	Offer	Bid	Offer	Bid	Offer
	October		Nov/Dec		Q1		Q2	
HYDROUS ANP								
Domestic Ex-mill Ribeirao with taxes (R$/cu m)	1410	1430						
FOB Santos/Paranagua (US$/cu m)			700	770				
ANHYDROUS ANP								
Domestic Ex-mill Ribeirao with taxes (R$/cu m)	1430	1450						
FOB Santos/Paranagua (US$/cu m)	830	930	820	890			850	930
CIF Santos/Paranagua (US$/cu m)			620	640	610	630		
ANHYDROUS EN 15376								
FOB Santos/Paranagua (US$/cu m)	830	930	820	890			850	930
T1 FOB Rotterdam (US$/cu m)	700	800	695	795	690	775		
T2 FOB Rotterdam (€/cu m)	605	610	600	605	595	600		
GRADE B								
FOB Santos/Paranagua (US$/cu m)			760	790				

	October		*US$/cu m*		November		*US$/cu m*
ASTM 4806							
FOB New York (US$/gal)	2.58	2.61	*682*	*689*			
FOB Chicago (US$/gal)	2.46	2.49	*650*	*658*			
FOB Houston (US$/gal)	2.57	2.60	*679*	*687*			
FOB Los Angeles for CI 90.1 (US$/gal)	2.65	2.68	*700*	*708*			

DAILY PRICES

		US$/cu m
Spot Hydrous expressed in Raw Sugar equivalent (ct/lb basis 96˚ pol Fob Santos)	19.63	691
Spot Fob Santos Hydrous via CBI to FOB NY (US$/gal)	3.23	852
Spot Fob Santos Anhydrous direct to FOB NY (US$/gal)	4.33	1143

Spot Currencies USD/BRL 1.88 EUR/USD 1.34

KINGSMAN
energy from nature

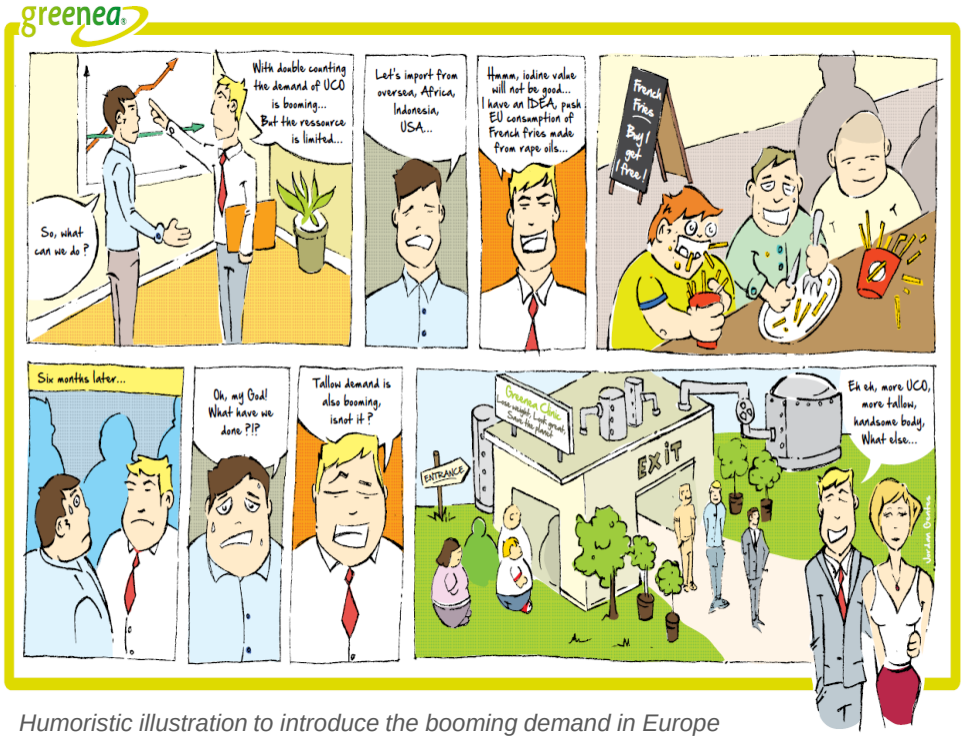
September 27, 2011

EU ETBE/ETHANOL REPORT

EU - ETBE spot			EU Gasoline FOB ARA Spot			EU - Ethanol		
27-Sep-11	Value	Wk change	27-Sep-11	Value	Wk change	27-Sep-11	Value	Wk change
Premium to MTBE			**Eurobob Barges**			**FOB RDAM T2**		
US$/mt	130-140	▼10 - ▼10	US$/mt	922-926	▼78 - ▼80	€/cu m	615-620	▼5 - ▼5
Premium to Gasoline			**EU - MTBE FOB AR spot**			€/mt	779-786	▼7 - ▼6
US$/mt	280-290	▲28 - ▲28	US$/mt	1072-1076	▼40 - ▼42	US$/mt	1059-1068	▼18 - ▼17

IPE Brent Oil Futures US$/bbl 107.14 **Spot Currencies** **Euros in US$** 1.36

Race for Raw Materials: Why the waste-based biofuels sector needs guidelines



Humoristic illustration to introduce the booming demand in Europe of used cooking oil and animal fats

Brokerage

Purchasing of feedstock becomes a key issue. GREENEA broker services helps to optimize purchasing and selling, to save time and to provide strong expertise in this specific sector. GREENEA provides reliable and unbiased information to buyers and sellers and helps set prices.

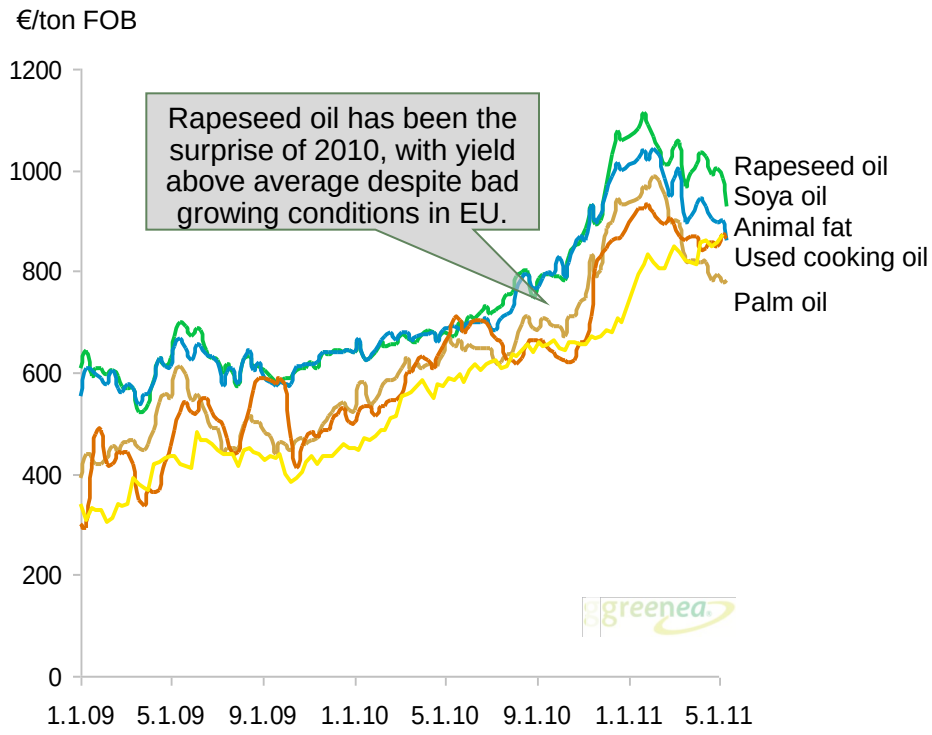
email : contact@greenea.com

website: www.greenea.com

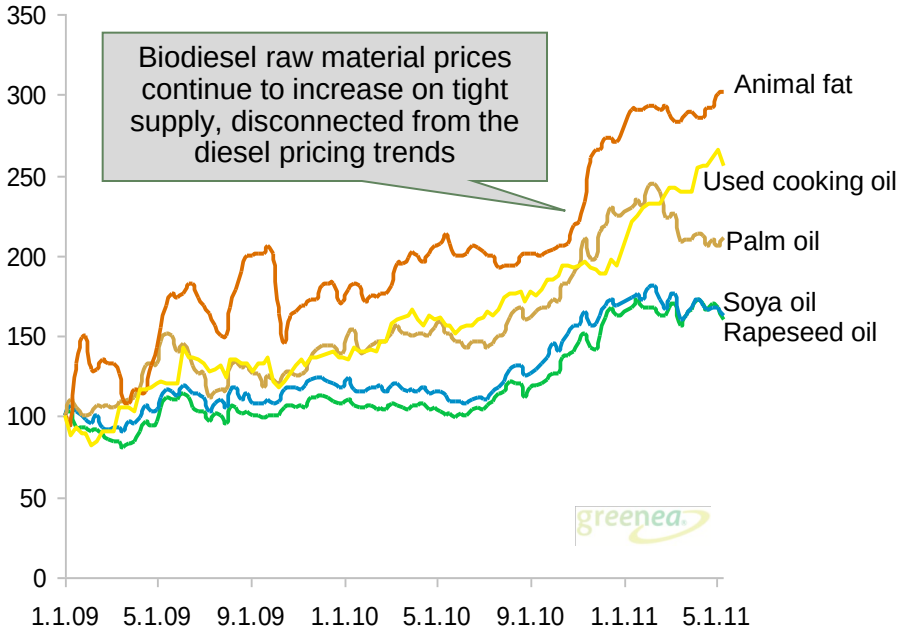
GREENEA member of the FOSFA (Federation of Oils, Seeds and Fats Associations)

FEEDSTOCK TRADING

Raw material markets is tight due to feedstock availability issues and poor 2010 harvests



Animal fats, palm oil and used cooking oil, the fastest increasing price in the biodiesel feedstock



Prices have risen substantially above the commodity peaks seen in June/July 2008. The biggest challenge the industry faces for 2011 is raw-material cost and availability.

CONSUMPTION DATA PER 1 TONE OF PRODUCED BIODIESEL

Parameter	Value
Virgin vegetable oil (VVO)	approx. 1020 kg / t
Used vegetable oil / animal fat (UCO - AF)	approx. 1050 kg / t
Methanol (VVO)	approx. 145 kg / t
Methanol (UVO)	approx. 140 kg / t
Potassium - methylate (VVO)	approx. 35 kg / t
Potassium - methylate (UCO – AF)	approx. 40 kg / t
Electrical energy (without heating of hall & tanks, ventilation system)	approx. 40 kWh / t
Compressed air	approx. 10 Nm^3 / h

NOTE: The consumption values must be understood as average values (tolerance +/- 5%) during continuous production (8 000 h/a) using a constant supply of materials of the quality and quantity defined in the contract.

CZECH REPUBLIC

PREOL, 2009

- Processing capacity of this crushing mill is 400 000 tons of oilseeds a year and production capacity of attached biodiesel factory is 100 000 tons of FAME a year.
- Technology includes also crude vegetable oil treatment, methanol recovery, distillation of glycerin, WWTP, storage facilities and logistics.
- Designer and supplier of this factory was Chemoprojekt, a.s. Prague (EPC Contractor).
- **More details on pages 18 to 22**

FAME Usti nad Labem, 2007

- operated under control of Chemoprojekt, a.s.

- Production capacity of this biodiesel factory is 100 000 tons of FAME a year.
- Technology includes also physical deacidification of crude degummed oil, methanol recovery unit, storage facilities and logistics.
- Designer and supplier of this factory was Chemoprojekt, a.s. Prague (EPC Contractor).

ÚSTÍ NAD LABEM FAME

Lisovna UL / Glencore

- crushing mill
- crude vegetable oil treatment
- edible oil & margarine production
- distillation of glycerin

SLOVAK REPUBLIC

MEROCO, 2008

- Production capacity of this biodiesel factory is 100 000 tons of FAME a year.
- **More details on pages 23 to 28**

ENVIRAL, 2007

- Production capacity of this factory is 100 000 tons of bioethanol a year (feedstock is corn).

BGV, 2009

- Total production capacity of this factory is 55 000 tons of bioethanol a year.
- As raw material in the process is used wheat and corn.
- Refined bioethanol from this factory is suitable for human consumption and liquid biofuels production

Major biodiesel and bioethanol plants built during last years in CE

POLAND

ZTB, 2009

New crushing and extraction unit together with crude vegetable oil treatment unit to produce rape or sun oil for technical or nutritional purposes was opened in Bodaczow.

Processing capacity of this new crushing mill is 450 000 tons of oilseeds a year.

HUNGARY

Rossi Biofuels, 2008

Production capacity of this new biodiesel factory is 150 000 tons of FAME a year.

Major biodiesel and bioethanol plants built during last years in CE

SERBIA

VICTORIA OIL, 2007

Production capacity of this biodiesel plant is 100 000 tones of biodiesel and 35 000 tones of cooking oil. This investment was financially supported by the European Bank for Reconstruction and Development.

More about biofuels market development in Central Europe is mentioned in the article published in BIOFUELS INTERNATIONAL MAGAZINE, March issue, 2010.

Case study: Look at biodiesel plant being constructed CZ

PREOL, a.s. Lovosice, Czech Republic (2009)

Production capacity of this biodiesel factory is 100 000 tons of FAME a year

Technology includes:

- crushing and extraction mill with processing capacity 400 000 tons of rapeseeds/y
- crude vegetable oil treatment (chemical degumming and neutralization)
- glycerine treatment on pharmaceutical grade,
- methanol recovery
- storage facilities and logistics.

Designer and supplier of this factory was Chemoprojekt, a.s. Prague (EPC Contractor).

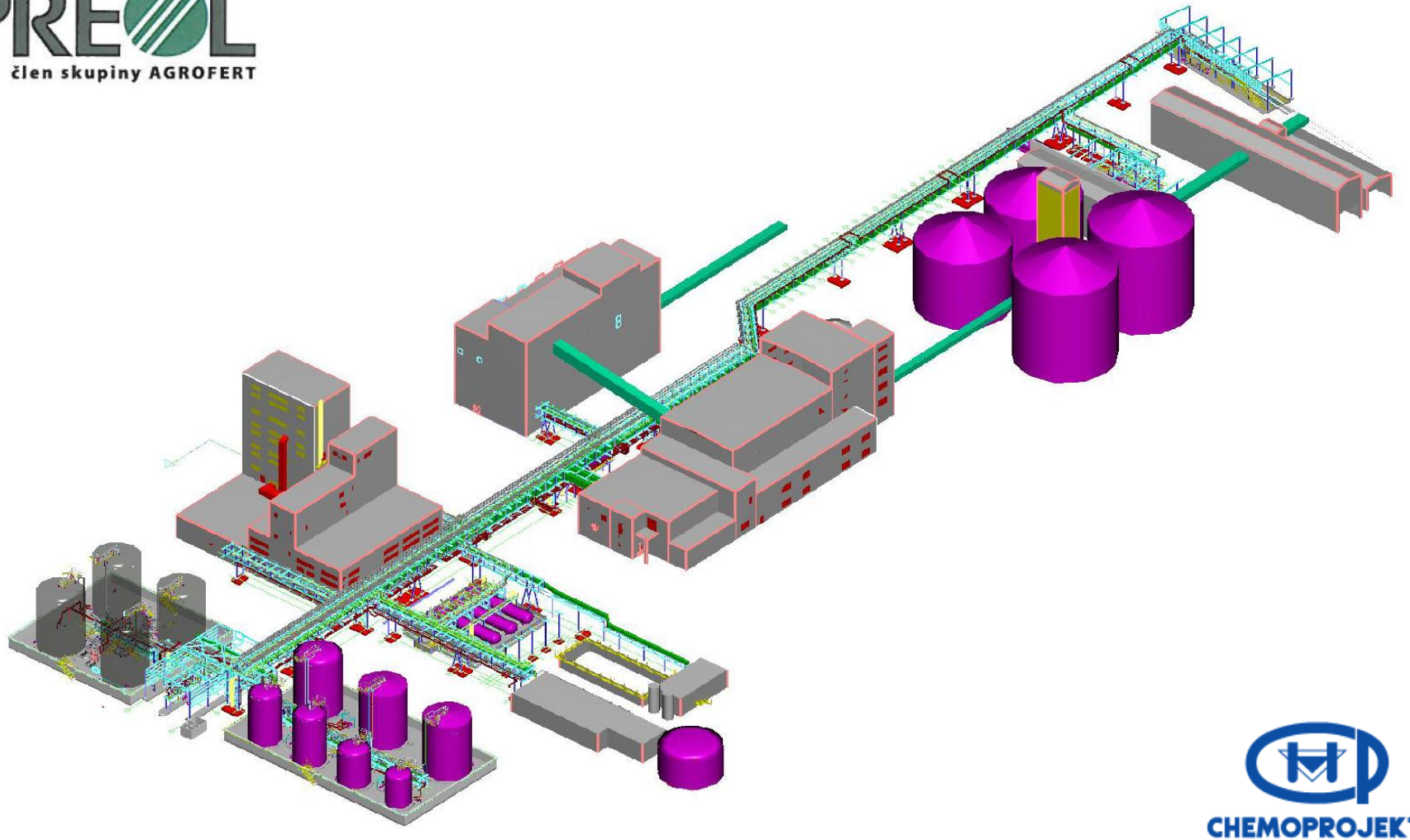
Investment costs

Area required: 365m x 140m

PREOL
člen skupiny AGROFERT

Case study: Look at biodiesel plant being constructed CZ

PREOL
člen skupiny AGROFERT



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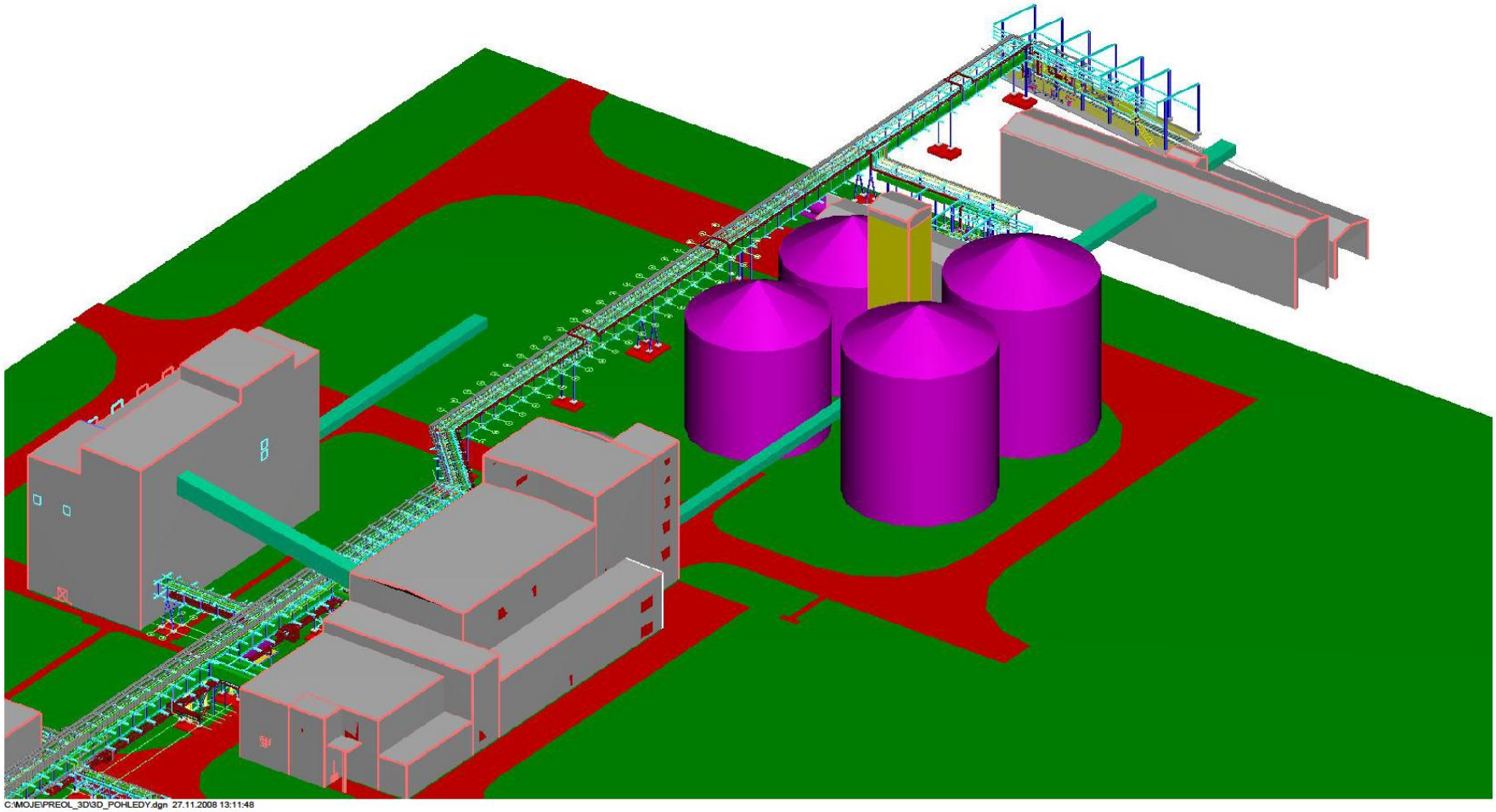
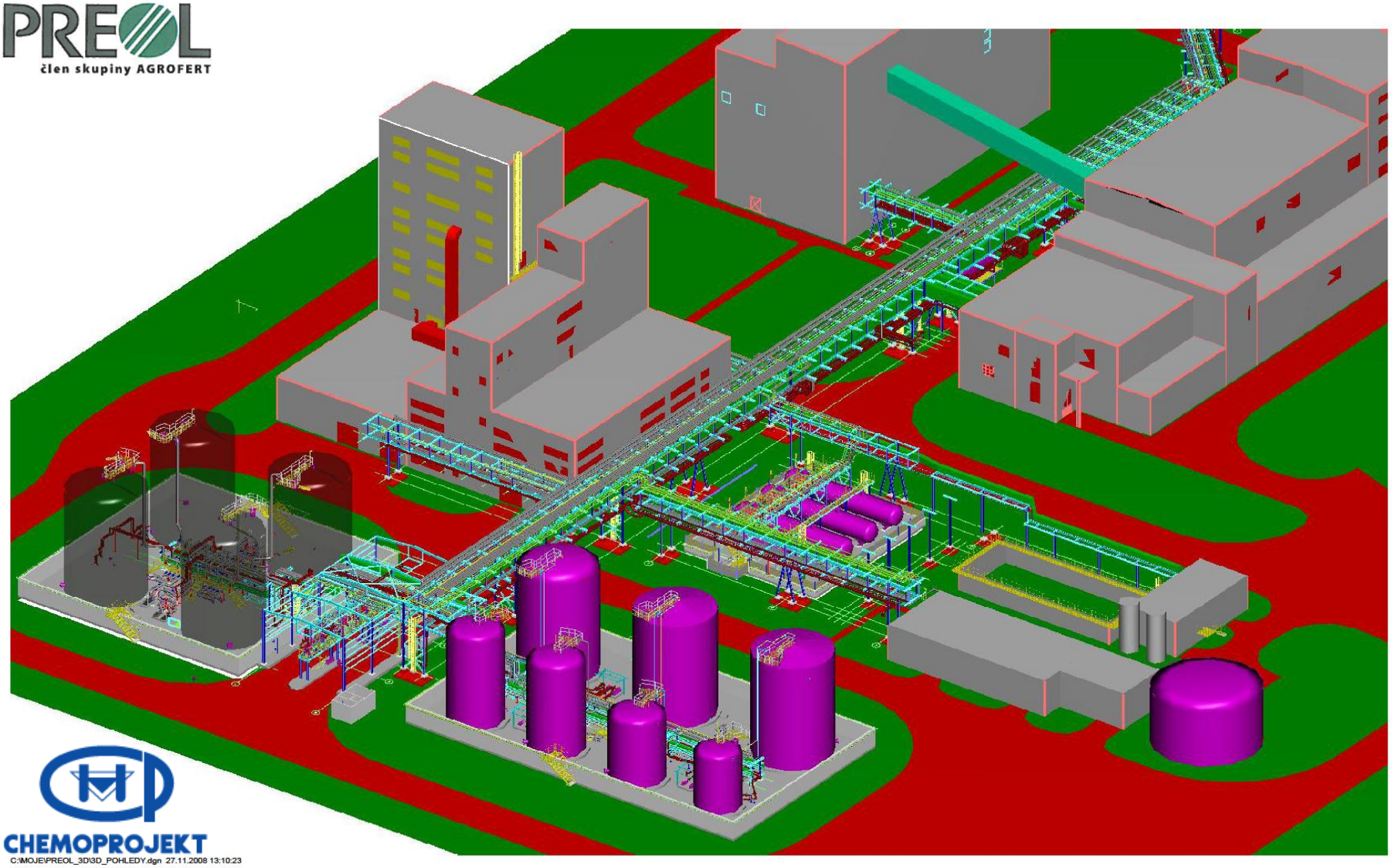
Case study: Look at biodiesel plant being constructed CZ

PREOL
člen skupiny AGROFERT

CHEMOPROJEKT



Case study: Look at biodiesel plant being constructed CZ



Case study: Look at biodiesel plant being constructed CZ

PREOL
člen skupiny AGROFERT

400kt Pressing and Extraction Unit

100kt Biodiesel Plant

CHEMOPROJEKT

Case study: Look at biodiesel plant being constructed SK

MEROCO, a.s. Leopoldov, Slovak Republic (2008)

Production capacity of this biodiesel factory is 100 000 tons of FAME a year

Technology includes: crude vegetable oil treatment (degumming and physical deacidification), winterization of sunoil, acid esterification, methanol recovery, glycerine treatment on technical grade G80, storage facilities and logistics.

Designer and supplier of this factory was Chemoprojekt, a.s. Prague (EPC Contractor).

Investment costs

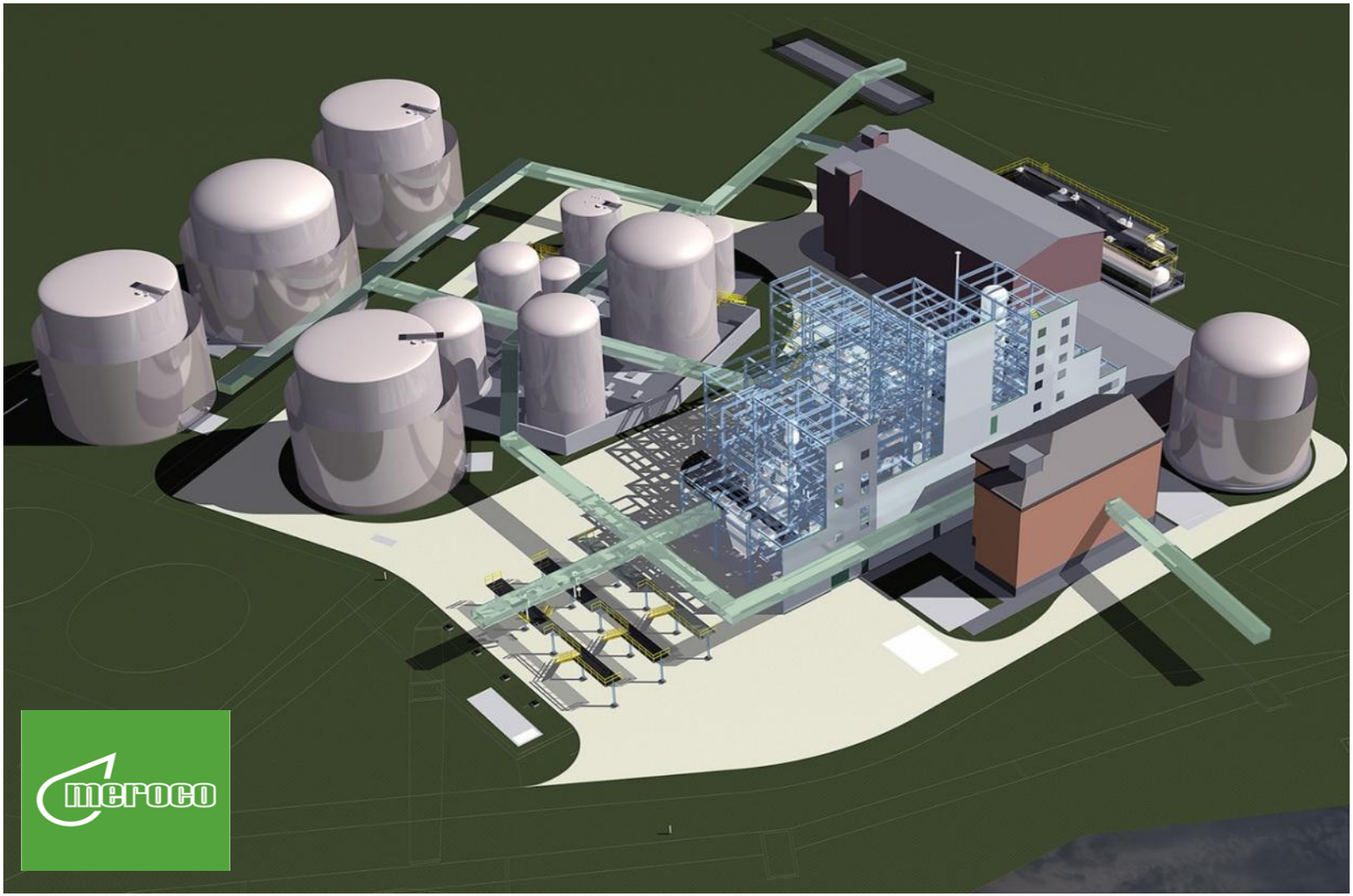
Area required: 110m x 150m

Time schedule of this project (in short):

contract validation	**November 2006**
demolition works	**winter 2007**
mechanical completion	**January 2008**
PAC	**May 2008**

Meroco operates also new crushing/extraction mill with processing capacity 250 000 t of rapeseeds a year.

Case study: Look at biodiesel plant being constructed SK



3D model of 100kt Biodiesel Factory

Case study: Look at biodiesel plant being constructed SK

Case study: Look at biodiesel plant being constructed SK

Case study: Look at biodiesel plant being constructed SK

Case study: Look at biodiesel plant being constructed SK

CHEMOPROJEKT

ALIANZA PARA LA PRODUCIÓN DE BIOCOMBUSTIBLES

OUR GROUP CAN PROVIDE ALSO THESE TECHNOLOGY:

- **- BIOGAS PLANTS**
- **- BIOETHANOL PLANTS**
- **- SECOND GENERATION BIOFUELS (BIOTURBOSINA, GREENDIESEL, ETC.)**
- **- ENERGY PRODUCTION COMPLEX**
- **- FOOD APPLICATIONS**

  (MILLS FOR YUCCA, SUGAR PLANTS, BREWERIES, ETC.)

Biogas plant

Biogas = an energy feedstock

Renewable energy produced from biogas is a means of providing long-term sustainable energy. Biogas technology involves a complex system of processes, ability to use organic waste or raw material for energy purposes and for the production of organic fertilizer.

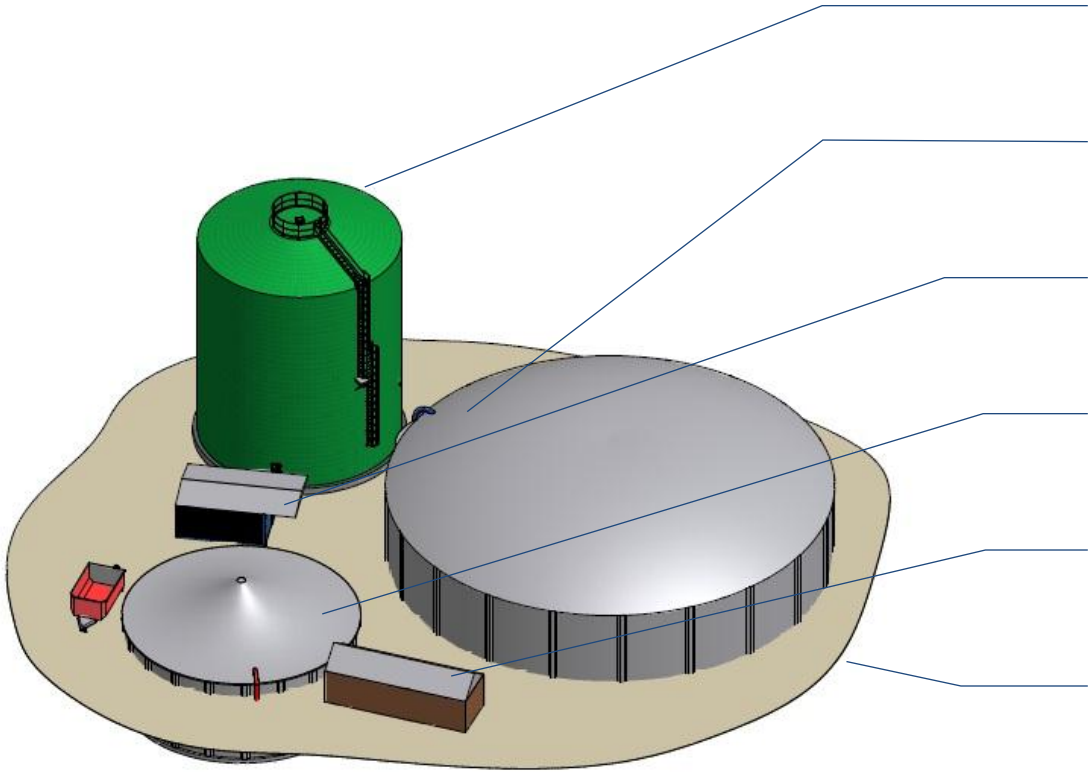
How is biogas produced?

Biogas is a mixture of gases. The basic components are methane (55% - 60%) and carbon dioxide (39% - 44%). Organic materials resulting from livestock or crop production, with the absence of air and under the optimum conditions are decomposed by bacteria in the fermentor. During the decomposition biogas is produced and desulphurised.

Biogas production

A biogas plant contains

of these technological components:



- Primary digester
- Secondary digester
- Technological centre
- Primary intake mix - tank
- Container with a cogeneration unit (CHP)
- Storage for digester (not drawing)

LIST OF PUBLICATIONS RELATED TO BIOFUELS I.

1 Vegetable oils and animal fats as alternative fuels for diesel engines with dual fuel operation. Kleinová, A., Vailing, I., Lábaj, J., Mikulec, J., Cvengroš, J. 2011 *Fuel Processing Technology* 92 (10), pp. 1980-1986.

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11 Substituted esters of stearic acid as potential lubricants. Kleinová, A., Fodran, P., Brnčalová, L., Cvengroš, J. 2008 *Biomass and Bioenergy* 32 (4), pp. 366-371.

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14 Cold flow properties of fatty esters. Kleinová, A., Paligová, J., Vrbová, M., Mikulec, J., Cvengroš, J. 2007 *Process Safety and Environmental Protection* 85 (5 B), pp. 390-395.

15 Processes for ME production from acidic triacylglycerols. Kocsisová, T., Paligová, J., Mikulec, J., Cvengroš, J. 2006 *CHISA 2006 - 17th International Congress of Chemical and Process Engineering.*

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19 High-temperature esterification of fatty acids with methanol at ambient pressure. Kocsisová, T., Cvengroš, J., Lutišan, J. 2005 *European Journal of Lipid Science and Technology* 107 (2), pp. 87-92.

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25 Alternative Fuels for Diesel Engines from Waste Vegetable Oils and Animal Fats. Cvengroš J., Cvengroš M., Petroleum and Coal, 37 (2), 25-28 (1995).

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Thank you for your attention

CONTACT DETAILS:

Tomas Cvengros

website: www.chemoprojekt .cz

mobile: 00421 911 402 147

email: tcvengros@chemoprojekt.cz