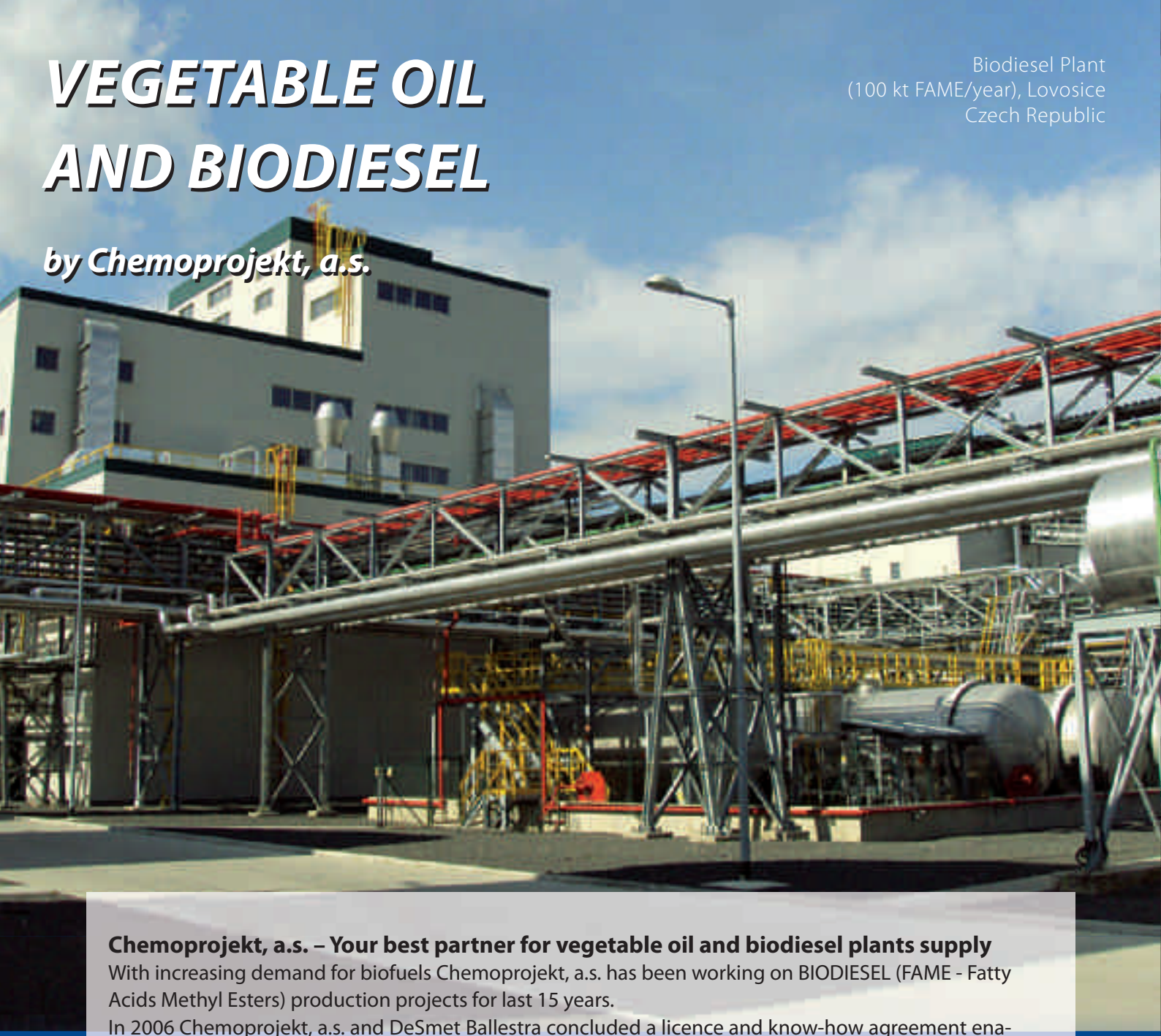
VEGETABLE OIL AND BIODIESEL
Chemoprojekt, a. s.

CHEMOPROJEKT

VEGETABLE OIL AND BIODIESEL

by Chemoprojekt, a.s.



Biodiesel Plant
(100 kt FAME/year), Lovosice
Czech Republic

Chemoprojekt, a.s. – Your best partner for vegetable oil and biodiesel plants supply

With increasing demand for biofuels Chemoprojekt, a.s. has been working on BIODIESEL (FAME - Fatty Acids Methyl Esters) production projects for last 15 years.

In 2006 Chemoprojekt, a.s. and DeSmet Ballestra concluded a licence and know-how agreement enabling Chemoprojekt, a.s. to design and construct vegetable oil and biodiesel production units on the basis of the modern DeSmet Ballestra biodiesel technology.

Technology utilized by Chemoprojekt, a.s.

Continuous catalytic transesterification of triglycerides in the vegetable oils (rapeseed oil or other) by methanol.

Basic raw materials for production of FAME

- Vegetable oil (new, used, non-edible, etc.)
- Methanol
- Catalysts - KOH, NaOH, MeONa

Side products

- Glycerol
- Fatty Acids

Variety of technologies

- Continuous
- Discontinuous/Batch
- The range of production capacity 10 - 250 kt/year

Advantages

MeONa (Sodium Methanolate) - liquid, easy dosing and manipulation, mild reaction conditions, reactions are selective to desired products

- Recycling of used MeOH
- Safe and environmental technology
- Capacities of the designed units 10-250 kt FAME/year
- Technology according to hi-tech licence

BIODIESEL STANDARDS

Quality of FAME is regulated by these standards:

- EU standard EN 14214
- US standard ASTM D-6751
- other national standards

EN 14214 STANDARD

STANDARD/ SPECIFICATION UNIT

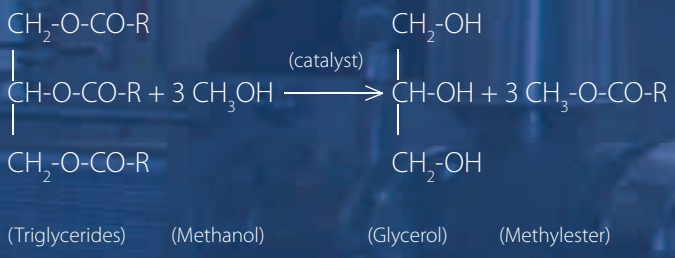
	Unit	Limiting Values	
		min	max
Ester content	% (w/w)	96.5	–
Density	kg/m^3	860	900
Viscosity(40°C)	mm^2/s	3.50	5.0
Flash point	°C	120	–
Sulphur content	mg/kg	–	10.0
Water content	mg/kg	–	500
Free Glycerin	% (w/w)	–	0.02
Phosphor content	mg/kg	–	10.0
Acid number	mg KOH/g	–	0.5
Cetane number	–	51.00	–
Iodine number	–	–	120

METHYLESTER and GLYCERINE PRODUCTION

Transesterification

The transesterification reaction is accomplished continuously, using three reactors in series operating under mild conditions (i.e.: Temperature = 55°C and Atmospheric Pressure).

The transesterification reaction can be presented as follows:



(Triglycerides) (Methanol) (Glycerol) (Methylester)

Reaction heat is negligible, and a heat supply from outside is necessary in order to keep the reaction mixture at the required temperature. Raw material is continuously fed to the three reaction steps consisting of pump, reaction vessel and relevant piping. The appropriate amount of methanol and catalyst are continuously dosed.

Methanol is fed to the reaction unit in a proper excess with respect to the stoichiometric amount with the aim to maximize the transesterification yield and to limit as much as possible the side reaction of saponification. Separately obtained glycerine, relatively rich in soap, is directly sent to the glycerine treatment unit. Light phase outgoing from the head of the reactor is transferred to the second reaction loop, after the addition of methanol and catalyst. Working conditions and the reaction volume of the second reactor are identical to the first reactor. Light phase coming from the top of the second reactor is transferred to the third reactor, with previous addition of methanol and catalyst. Reaction mixture leaving from the third reactor containing the main product (methylester), the excess of methanol and the glycerine (reaction by-product) and a limited amount of soaps is sent to the methylester purification section.

Methylester / Glycerine Separation

Reaction mixture coming from the third reactor and containing the product (methylester), the excess of methanol and the glycerine (reaction by-product) as well as the limited amount of soaps (formed by side-reaction of saponification of methylester), is transferred to the gravity separator after a partial removal of the contained methanol. Glycerine (containing glycerine, part of the excess of methanol and almost the total amount of soaps) is sent to the glycerine treatment unit. The me thylester phase coming from separator contains glycerine traces, soaps and catalyst; these impurities are removed through washing with water added up with citric acid. Methylester has to be dried to remove the remaining water and methanol.

The product – methylester is transferred to storage through the pump, after being cooled down to 30° - 40°C.

Vent Condensation And Recovery Unit

The unit is designed in order to condense all emergency vents from the upstream production unit.

METHANOL RECTIFICATION

The methanol coming from the upstream process units is fed to the rectification column.

The rectified and condensed methanol is send to the storage tank.

GLYCERINE PURIFICATION, CONCENTRATION and DISTILLATION

Raw Glycerine Purification – Soap Splitting

The purpose of the treatment is the acidification of the raw glycerine stream, so to neutralize the residual catalyst and to split the soaps formed during transesterification. Subsequently, the fatty acids derived from soap splitting are separated (for further acid esterification) and the pH of the purified glycerine is finally adjusted. Distilllation unit on pharma quality of glycerine is another option we can provide to our customers

CRUDE VEGETABLE OIL DRYING, DEGUMMING, DEACIDIFICATION AND DEWAXING

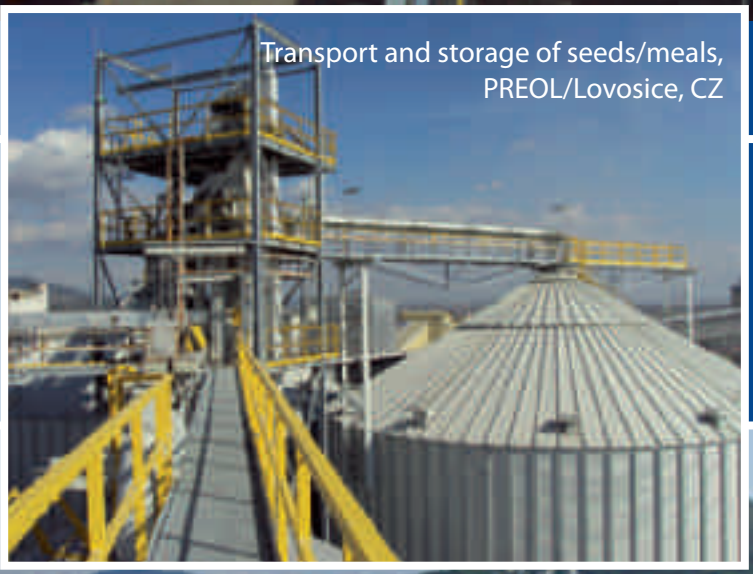
This units are not strictly required by the biodiesel production process if the water content, phosphorus/calcium/magnesium content and acidity of input crude oil are as required by the process book. Dewaxing treatment is required for sunflower oil only.

MOTOR FUEL ADDITIVES DOSING

This part allows dosing of CFPP chemicals to improve cold filter plugging point and dosing of antioxidants to improve oxidation stability of final product – methylester on values required by EN and seasonal motor fuel standards.

Pressing, extraction and biodiesel plant, PREOL/Lovosice, CZ

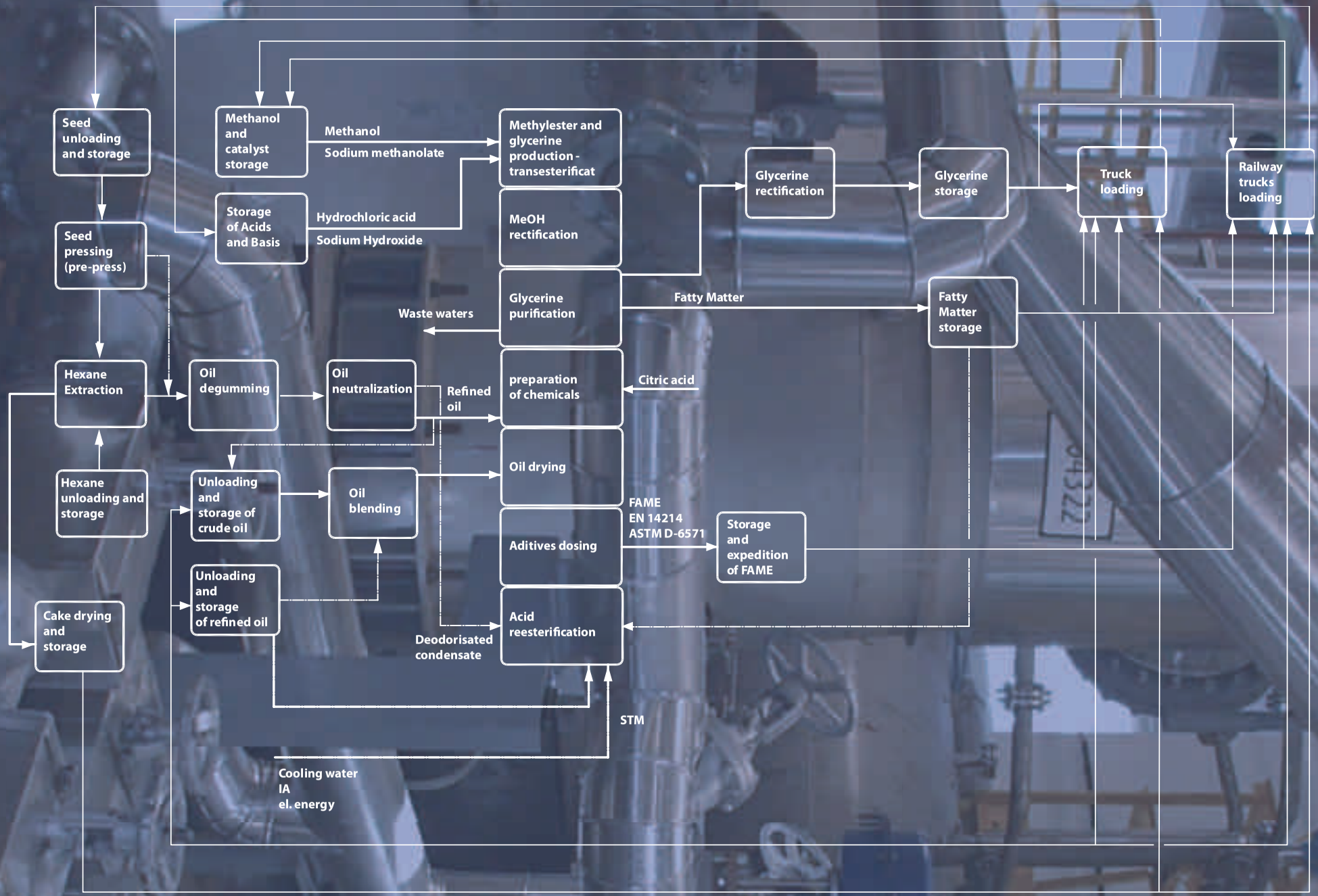
Oil extraction, PREOL/Lovosice, CZ



Transport and storage of seeds/meals, PREOL/Lovosice, CZ

Oilseeds storage and Pressing, PREOL/Lovosice, CZ

Seed to Biodiesel production - block diagram



VEGETABLE OIL PRODUCTION
OILSEEDS CRUSHING AND EXTRACTION

Vegetable oils are produced from cleaned and dried oilseeds by different kinds of pressing - cold pressing (one stage or two stages), hot pressing or by extraction (mainly by hexane). Integral part of vegetable oil production is logistic operations like transport of seeds from railway and road, storage of seeds, transport of seeds to pressing and extraction plant, transport of meals to storage silos, storage of meals in silos and loading of meals on road or railway vehicles. It is possible to expand this part by meals incineration plant followed by unit for steam and power generation.

Currently Chemoprojekt, a.s. aims its activities to 2nd generation biofuels. It is possible to produce 2nd generation biofuels from wood, agriculture, forest as well as from municipal waste. Chemoprojekt, a.s. has been recently preparing pilot biomass gasification power plant and other projects related to 2nd generation biofuels production.

…we do not impose limits on ourselves, we are constantly develo ping ourselves further. New technologies fascinate us. Acknowledgement motivates us. New ideas and markets inspire us. And because of that, it is not unusual that we look beyond all borders…

BIODIESEL – SELECTED REFERENCES:

Year	*Project*	*Client/Location*	*Process description/ Capacity*	*Scope of work*
2010	FAME unit Oil treatment	PREOL, a.s., Lovosice Czech Republic	Oil mill – pressing and extraction unit for capacity 400 kt rapeseed/ year. Chemical neutralisation of vegetable oil. Three-stage continual estherification of neutralised oil to methyl ester based on Desmet Ballestra technology. Capacity:100 kt FAME/year.	Turn key
2008	FAME unit Oil treatment	MEROCO, a.s., Leopoldov Slovakia	Acid Degumming unit. Sunflower oil dewaxing unit. Physical deacidification of degummed oil. Three - stage continual estherification of neutralised oil to methyl ester Capacity:100kt/year. Technology: Desmet Ballestra.	Turn key
2007	FAME unit Oil treatment	SETUZA, a.s., Ústí nad Labem, Czech Republic	Physical deacidification of degummed oil. Three - stage continual estherification of neutralised oil to methyl ester Capacity:100kt/year. Technology: Desmet Ballestra.	Turn key
2005	FAME unit	SETUZA, a.s., Ústí nad Labem, Czech Republic/STZ Mydlovary	Intesification of the unit from 12k t/year up to 30k t/year and modification from batch to semi-continual production with STZ+SEPARA Brno technology.	EP (FS, EIA, BP, IPPC)
2005	FAME unit	SETUZA, a.s., Ústí nad Labem, Czech Republic/STZ Olomouc	Intensification of the unit from 30 kt/year up to 50 kt/year and modification from batch to semi-continual production with STZ+SEPARA Brno technology.	EP (FS, EIA, BP, IPPC)
1996	FAME unit	Agropodnik a.s. Dobronín/ Jihlava, Czech Republic	Glycerine production 60%, 2000 t/year. Technology: Agro.	EP, DD
1993/1994	FAME unit	MILO Olomouc, Czech Republic	Vogel Noot batch process/ 30 kt/year.	Turn-key

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Storage tanks, MEROCO/Leopoldov, SK

Biodiesel plant and Crude oil treatment,
(100 kt FAME/year) 3D model, MEROCO/Leopoldov, SK

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Branches of Chemoprojekt, a.s.

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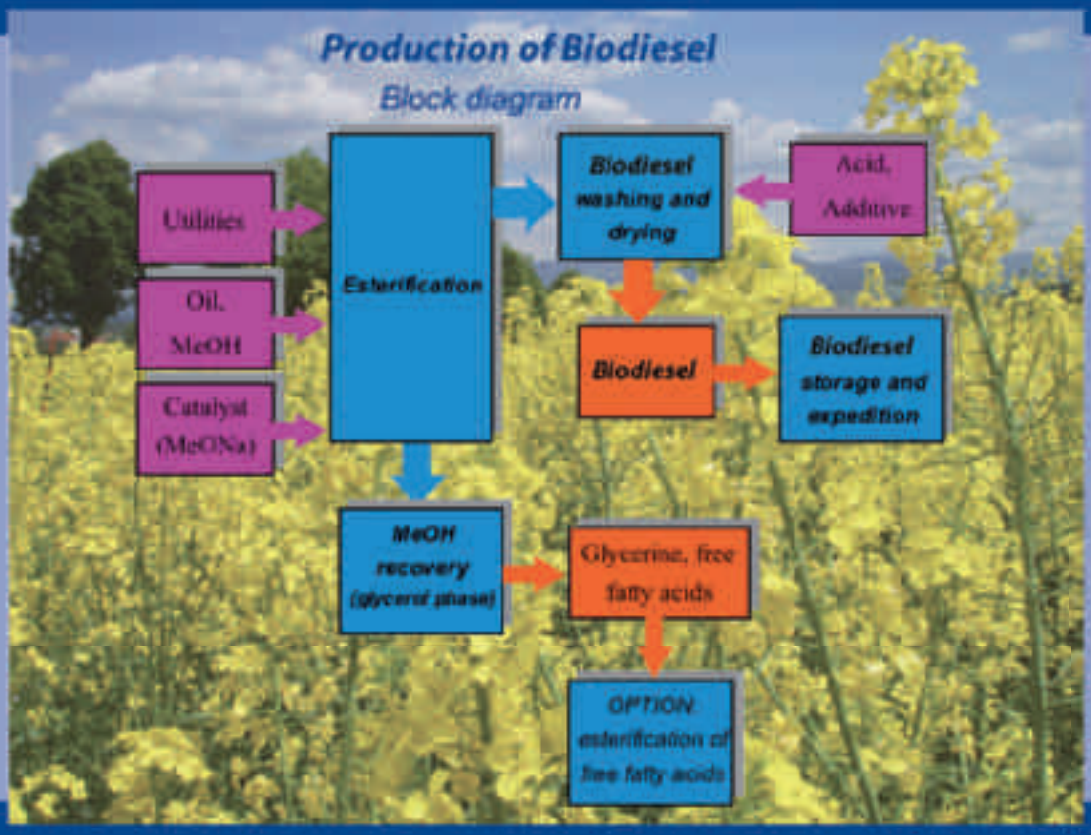
Brno, Czech Republic



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