PEGRAS TECHNOLOGY CONSULTANTS

Bio Diesel

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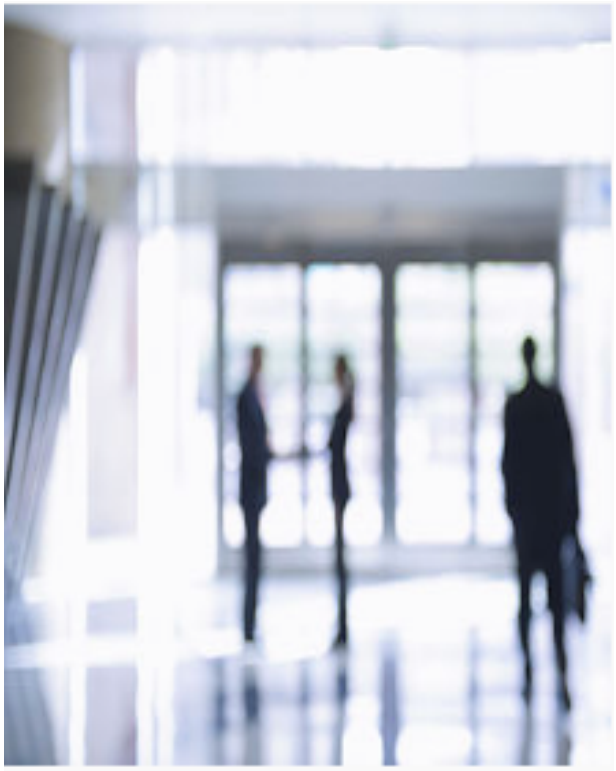
ABOUT US



PEGRAS established its roots in Europe, and over many years developed a deep understanding of Asian business cultures. Local experts are located in Australia, Germany, Hong Kong, Singapore and Thailand.

PEGRAS is a Technical Solutions Consulting company operating in the associated fields of chemistry, print media, industrial equipment and manufacturing sectors.

We deliver our services by leveraging from our international network of technology professionals who have extensive management and line experience in executing successful business development strategies into your region.

This includes business restructuring and optimisation for supply partners to extract maximum value from joint ventures.

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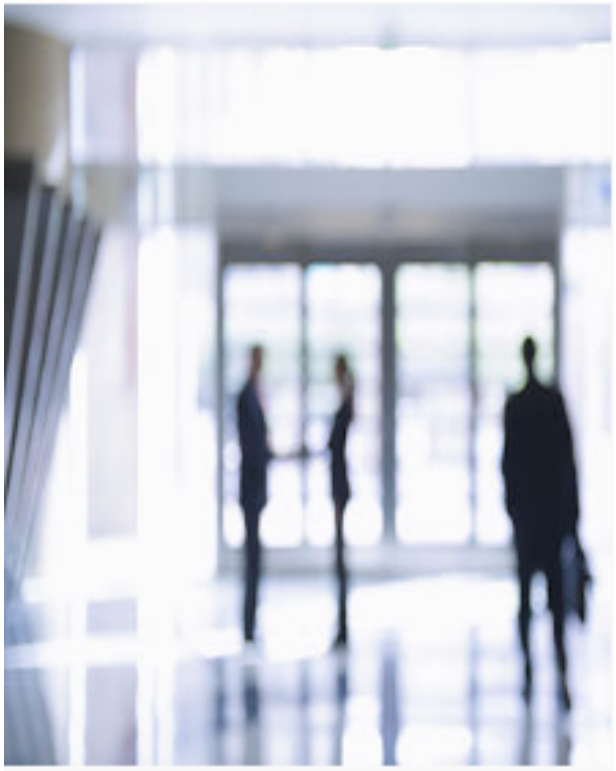

- Our beginnings are in Europe
- Our history is in the South East Asian region
- Understanding business cultures is in our DNA
- We are a network of Technology Professionals
- We span logically associated fields;
  - Chemistry
  - Print Media
  - Industrial Equipment
  - Renewable energy
- We are independent of the global players
  - We optimise
  - We restructure
  - We joint venture
- We are a resource to improve your profitability

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SERVICES in 4 market sectors

PEGRAS
Print Media

PEGRAS
Industrial Services

PEGRAS
International Relations

PEGRAS
Renewable Energies

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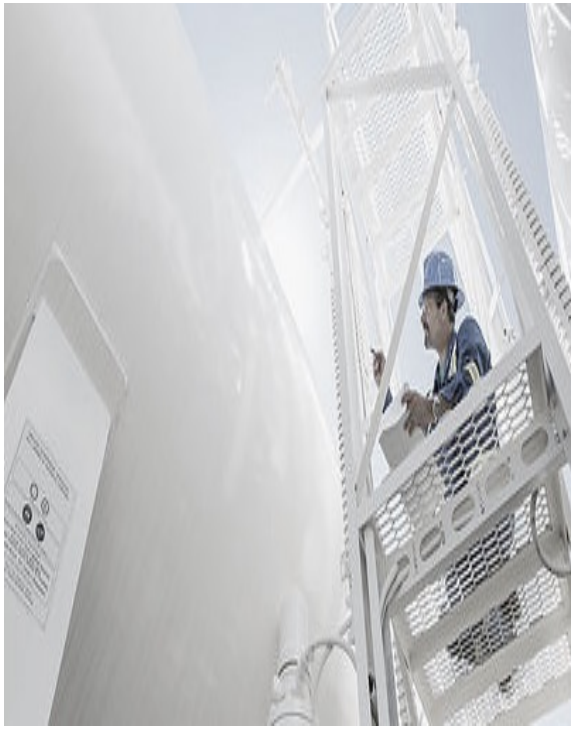
PEGRAS Renewable Energies



- **History Biodiesel**
- **Feedstock**
- **Process Tall-Oil conversion**
- **Advantages**
- **Services**
- **Example Productions**

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Bio Diesel

History of BIODIESEL

- The Transesterification of vegetable oil was conducted by E. Duffy and J. Patrick already in **1853**, many years before before the first Diesel engine became functional
- **Rudolf Diesel´s** first engine did run on the 10th of August **1893** with **Peanut Oil** in Germany**.**
- In **1937** the first patent concerning Biodiesel was issued in Belgium (Alcoholises of vegetable oils using Ethanol)
- More recently then **1977** patent in Brazil and **1983** a patent in South Africa
- The **worldwide first** commercial and industrial scale plant was build **1989** in Austria by the company Gaskoks, using the South African Patent

History / Policies

- Throughout the 1990´s several Biodieselplants where opened in many countries all over Europe (Germany, Austria, Switzerland, Italy, France, Sweden, etc.)
- France launched a production of Biodiesel (based on rape seed oil) which was mixed into regular diesel fuel **up to 5%**
- In 2005, Minnesota became the first U.S state which mandated mixing of Biodiesel into regular diesel fuel at a minimum level of 2%

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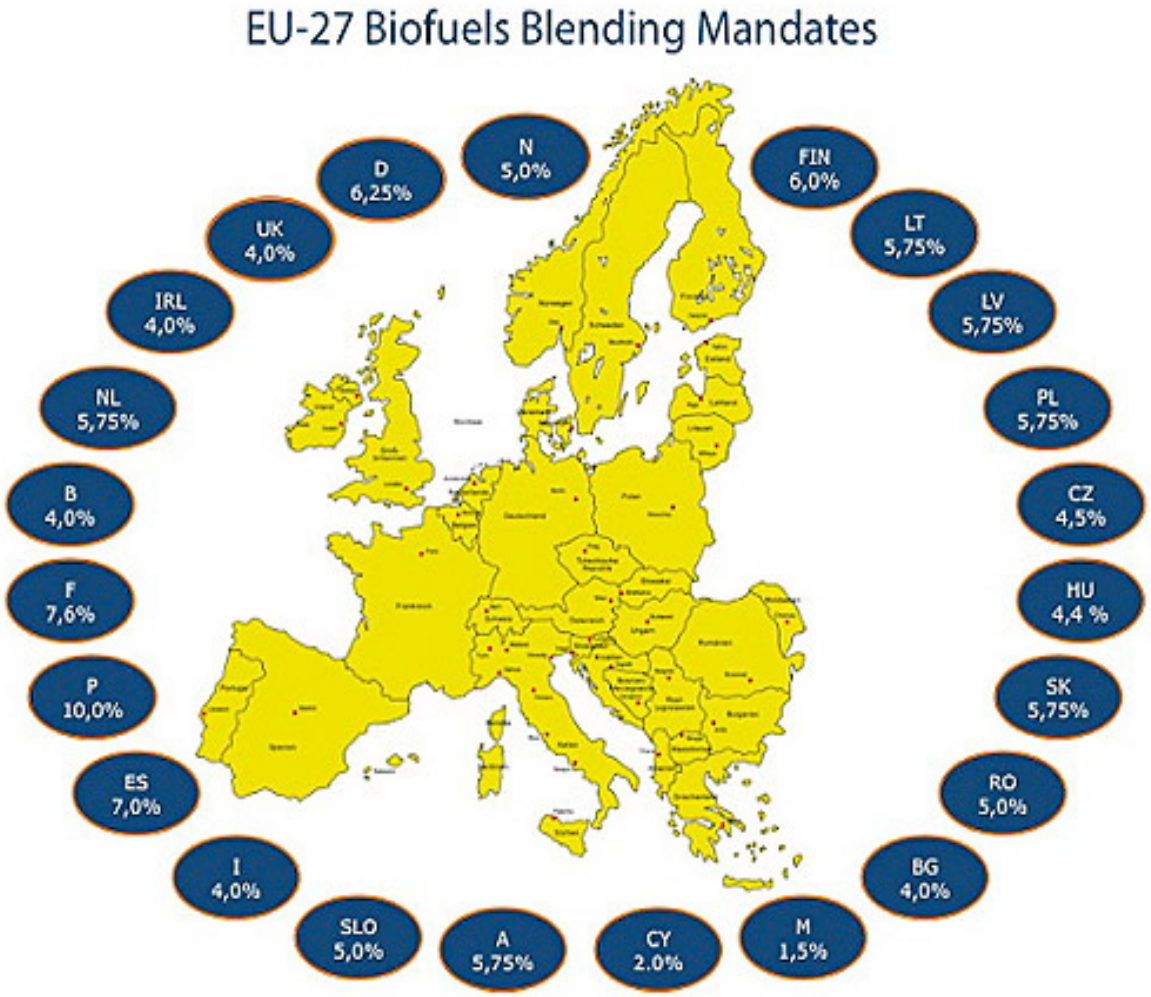
European policies on Biofuel blending



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Classical Process, from the Seed to Biodiesel

Farming

Seed
3,0t

Oil mill / Crushing plant

Cake
1,8t

Animal feed

Crudeoil
1,2t

Catalyst

Methanol
110kg
+ Catalyst

Transesterification plant

Glycerin
110kg

Chemical industrie

Biodiesel
1,2t

Gazol station

Classical BIODIESEL Feedstock

Rape Seed

Sunflower

Soy Bean

Oil Palm

Jatropha

Sustainable BIODIESEL Feedstock

Tall Oil

Used Cooking Oil

Yellow Grease

Animal Fat

BIODIESEL Feedstock

➢ Sustainability

Sustainability means, the earning (production) of vegetable oils (i.e. palmoil) with sustainable methods, so without damaging or destroying rain forest, displacement of small farmers or extinction of endangered species.

➢ Effect

Starting from 01.01.2011 (Germany as the first country within EU, the other countries to follow) only Sustainable certified Vegetable Oils may be used for (state supported) energy purpose (i.e. Biodiesel).

➢ **Double Counting**

Biodiesel from special defined feedstock, like **UCO**, is valued double (in Germany) if it goes to the mandatory blending. This creates a significant advantage for the producers which can handle such feedstock, because the Biodiesel can be sold on a higher price.

BIODIESEL Feedstock

- **Side facts**

Around 8 % of the global vegetable oil production is used for energy purpose, what means more than 90% goes to the food, cosmetics, cleaning agent and detergent industries. But the Sustainability plays a significant role for only the energy usage sector…..at least till now.

The Oil palm is the oil fruit with the highest yield with 4.3 ton of oil per hectare (almost 10 times higher than the yield of soy).

Various studies are showing a 38% to even 79% CO2 reduction using Biodiesel made from Palm Oil (compared to fossil Diesel) depending on the used technology and the usage rate of **UCO**.

For Soy Biodiesel the reduction can be seen in the value of 25% to 65%.

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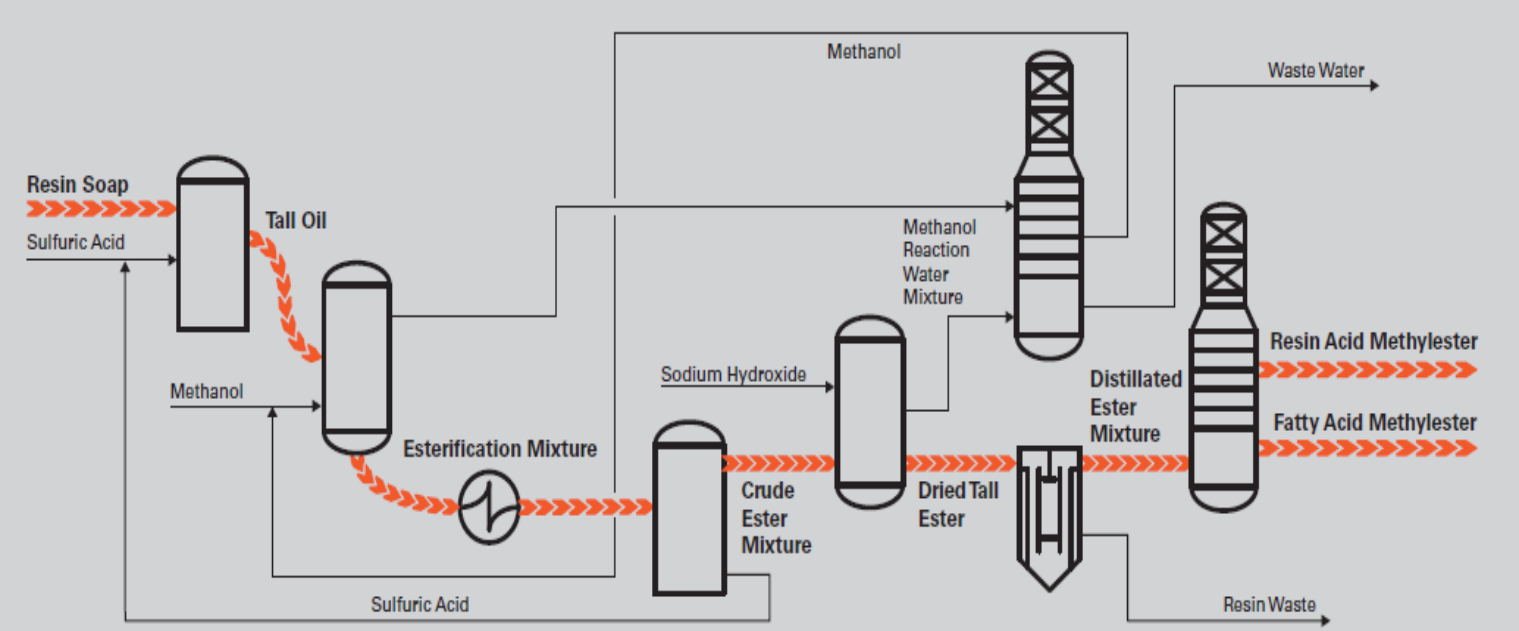
Biodiesel made from Tall Oil



Acidification of Resin Soap

The resin soap is pumped to an acidulation vessel and mixed with sulfuric acid. This converts the soap to free tall oil. At acid conditions, this will form a two phase mixture of crude tall oil and water sediment.

Esterification of Crude Tall Oil

Methanol is used to convert the crude tall oil to fatty and resin acid methyl esters under acid conditions. Undesired solids are removed in a sedimentation tank. Unreacted methanol is condensed from vapor to be recycled back to esterification.

Neutralization of Crude Tall Oil Esters

Unmarketable acidic crude tall oil esters and unreacted methanol are prone to decomposition. Sodium hydroxide neutralizes their pH from 3 to 7.5 at 50°C. Unreacted methanol is condensed from vapor to be recycled back to esterification.

Drying of Neutralized Crude Tall Oil Esters

The neutralized crude tall oil esters are preheated and fed to a falling film evaporator operating under a vacuum to remove water and methanol moisture, leaving less than 100 ppm water. They then go to distillation.

Methanol Recovery

Un-consumed methanol is recovered by the methanol rectification column at 99.9% purity and recycled to the front of the process.

Distillation of Crude Tall Oil Esters

Methyl esters and acids are distilled and removed from the residue of unsaponifiable compounds, salts, and other chemicals. In fractionation, columns of all esters will be separated by purity and quality.

Advantages

- Conversion of low grade resin soap / tall oil into **high value Biodiesel Fuel** and **high quality resin acid**
- Process specifically designed for cellulosic (second generation) feedstock
- **Efficient process** recycles chemicals for reuse
- **Short set up times** requirements due to industrial equipment
- **No special** infrastructural **requirements**
- Modular design
- **Short** Return of Invest

Environment Advantages

- Biodegradable
- Reduction of CO2 emissions (compared to petroleum / fossil diesel)
- Reducing particle emissions
- Free of Sulphur
- Feedstock locally available (farming)
- Renewable

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Services

- **Biodiesel Plant Technology Selection – Engineering - Construction**
- Flexible **Multi Feedstock** for UCO (used cooking oils) nearly all vegetable oils, used oils and animal fats
- Biodiesel made of **Tall-Oil**
- **Feedstock Management**
- Integrated **Esterification / Trans esterification Technology** to utilize all oil ingredients
- **Maximum yield** in Biodiesel production
- **Low Investment**

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Biodiesel production Plants (conventional)

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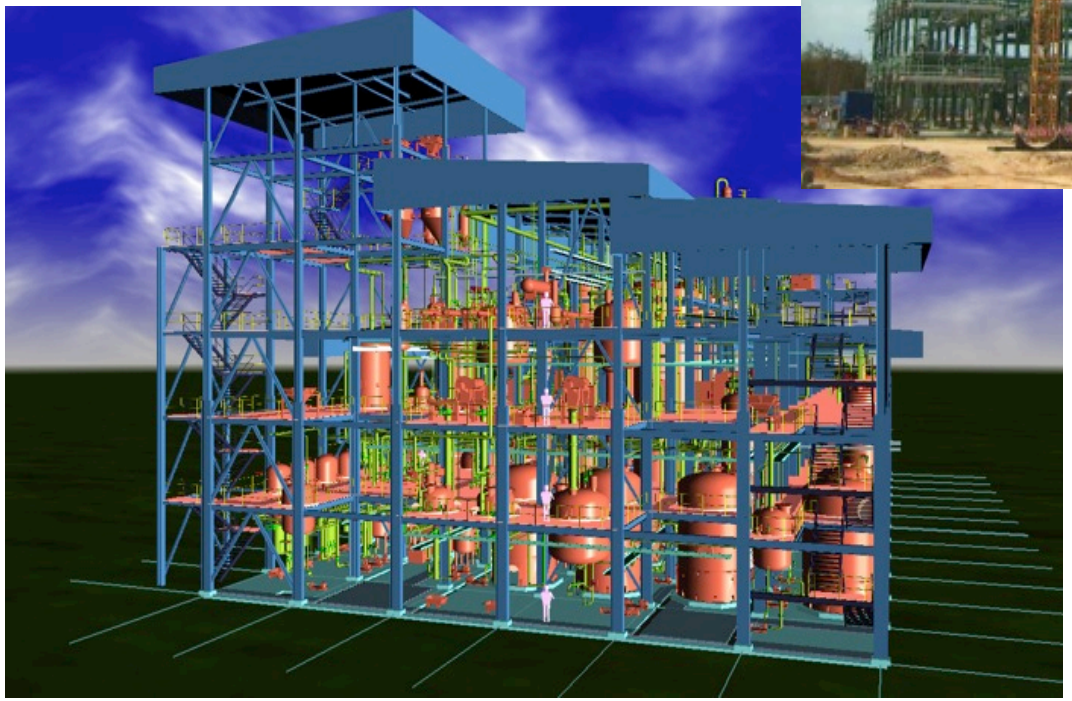
Biodiesel production Plant



Thailand: Rayong, Biodiesel 200.000 ton per year PLUS 36.000 ton per year of Glycerol

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Biodiesel production Plant

Thailand: Rayong

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Biodiesel

No matter how you do it – Quality

Biodiesel is a High Performance Product!