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UTILISATION OF BIOFUELS IN THE FARM

Giovanni Riva

INCREASE OF THE COST OF FOSSIL FUELS IS DEALING WITH NEW PERSPECTIVES FOR AGRICULTURE

1 – COUNTRIES WITH INDUSTRIAL AGRICULTURE (I.E.: S. AMERICA)

2 - WESTERN INDUSTRIAL COUNTRIES (I.E.: EU)

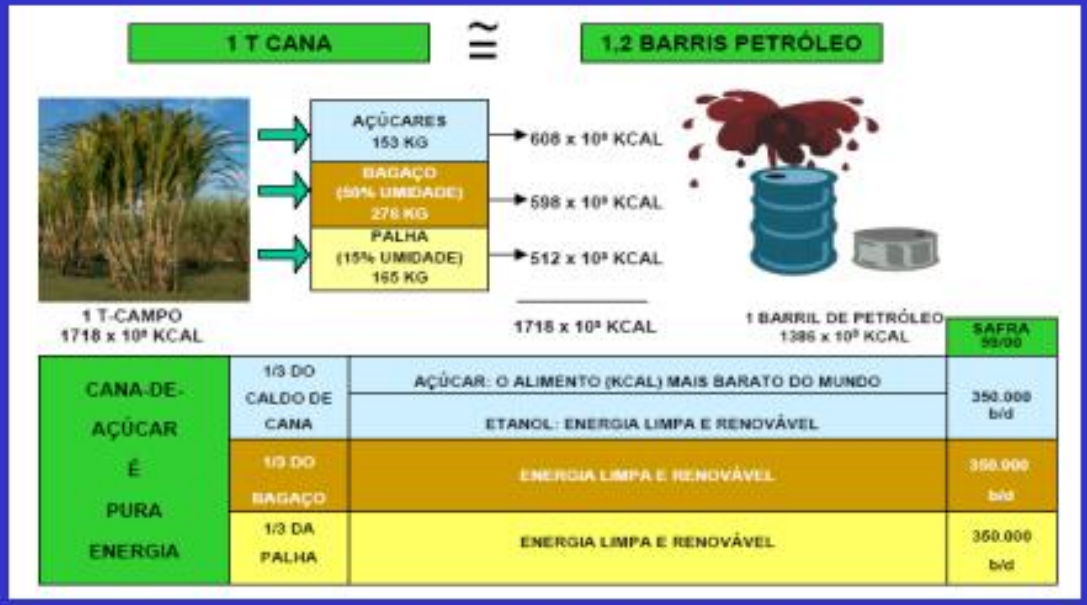
3 – LESS DEVELOPED COUNTRIES (MANY)

BIOFUELS

PRODUCTION OF EE

1 – COUNTRIES WITH INDUSTRIAL AGRICULTURE (I.E.: S. AMERICA)

- Costs of agricultural products is lower/competitive
- Big plant for the transformation of the raw materials could be feasible
- Very often the possibility to convert the raw materials both in food and/or in biofuels may be a way to optimise the income of agriculture.



COUNTRIES WITH INDUSTRIAL AGRICULTURE: THE ETHANOL – SUGAR CHAIN

COUNTRIES WITH INDUSTRIAL AGRICULTURE: THE ETHANOL – SUGAR CHAIN

EXEMPLO:	DE	PARA
- EXTRAÇÃO - %	93	97
- FERMENTAÇÃO - %	80	91
- DESTILAÇÃO - %	98	99,5
- RENDIMENTO GLOBAL L ÁLC HIDR/T CANA (% POL NA CANA - 13%)	66	86

PRODUTOS - FATURAMENTO	R$ P/TC MOÍDA
AÇUCAR – MERCADO INTERNO	68,00
AÇUCAR BRANCO – M. EXTERNO	65,00
AÇUCAR VHP – MERCADO EXTERNO	56,00
ANIDRO CARBURANTE – M. INTERNO	66,00
HIDRATADO CARBURANTE – M. INTERNO	59,00
ANIDRO OUTROS FINS – M. INTERNO	64,00
HIDRATADO OUTROS FINS – M. INTERNO	60,00
ANIDRO – M. EXTERNO –	47,19
HIDRATADO - M. EXTERNO –	48,00
MÉDIA –	61,00

1 - WESTERN INDUSTRIAL COUNTRIES (I.E.: EU)

- Value of commodities is decreasing → low profitability
- Incentives are given for RES development, especially for "green electricity"
- Very often the idea to produce crops for energy production is is studied with great interest

Additional details

EU Policies on Renewable energy/power

Gross inland energy consumption (in EJ) in the European Union (EU-15) and projected consumption in the baseline scenario (DG TREN 2003)

	1990	2000	2010	2020	2030
Solids	12.69	8.88	6.99	7.54	9.34
Oil	22.86	24.58	25.00	25.42	25.33
Natural gas	9.30	14.19	19.09	22.19	23.28
Nuclear	7.58	9.34	9.63	8.33	7.54
Electricity	0.08	0.17	0.13	0.13	0.13
Renewables	**2.76**	**3.68**	**5.11**	**5.82**	**6.45**
Total	**55.31**	**60.84**	**65.99**	**69.38**	**72.02**
of which					
Hydro	0.93	1.16	1.18	1.24	1.26
Biomass	**1.24**	**1.51**	**2.14**	**2.45**	**2.75**
Waste	0.50	0.78	1.02	1.10	1.06
Wind	0.004	0.08	0.56	0.76	0.99
Solar and others	0.004	0.013	0.06	0.10	0.19
Geothermal	0.09	0.138	0.16	0.17	0.20
Total renewables	**2.76**	**3.68**	**5.11**	**5.82**	**6.45**
Renewables as % of total inland consumption	*5.0*	*6.1*	*7.8*	*8.4*	*8.9*

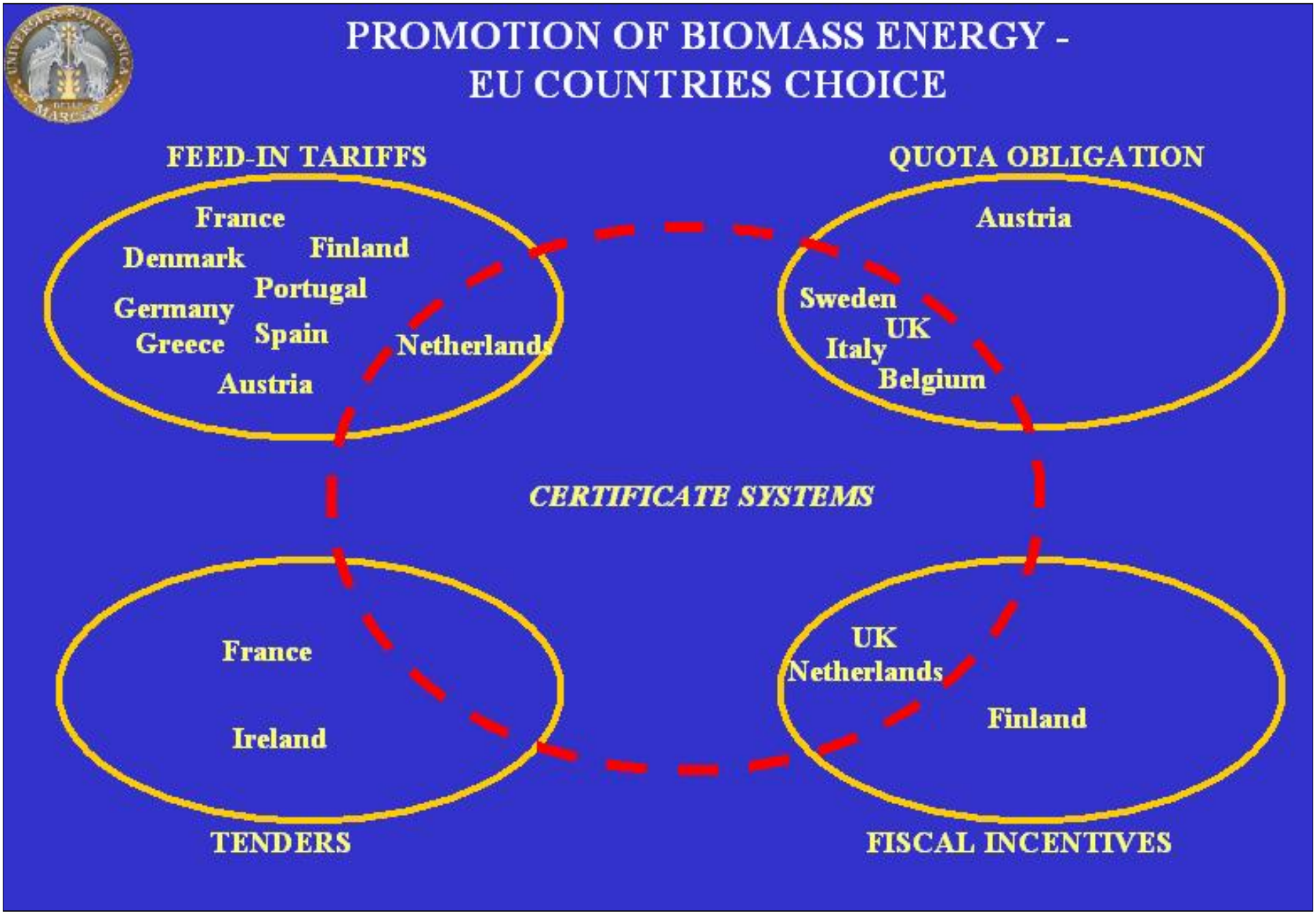
PROGRAMMES/DIRECTIVES

Renewable electricity → 22% of total generation (2010)

Transp. fuels → 2% of total (2005) - 5,75% (2010)

SUPPLY SECTOR	TYPE	EXAMPLE
AGRICULTURE	DRY LIGNOCELLULOSIC AGRICULTURAL RESIDUES	STRAW, RICE HUSKS, OLIVE POMACE, GRAPE POMACE, COCONUT SHELLS
	DRY LIGNOCELLULOSIC ENERGY CROPS	SHORT-ROTATION WOOD, MISCANTHUS
	LIVESTOCK WASTE	MANURE
	OIL, SUGAR AND STARCH ENERGY CROPS	OIL SEEDS FOR METHYLESTERS
		SUGAR/STARCH CROPS FOR ETHANOL
FORESTRY	FORESTRY BYPRODUCTS	WOOD BLOCKS, WOOD CHIPS FROM THINNINGS
INDUSTRY	INDUSTRIAL RESIDUES	INDUSTRIAL WASTE WOOD
		FIBROUS VEGETABLE WASTE FROM VIRGIN PULP PRODUCTION AND FROM PRODUCTION OF PAPER FROM PULP, INCLUDING BLACK LIQUOR
		WET CELLULOSIC INDUSTRIAL RESIDUES AND SLAUGHTERHOUSE WASTE
	INDUSTRIAL PRODUCTS	PELLETS, BIO-OIL (PYROLYSIS OIL), ETHANOL, BIODIESEL
WASTE	PARKS AND GARDENS	PRUNINGS, GRASS
	CONTAMINATED WASTE	DEMOLITION WOOD
		BIODEGRADABLE MUNICIPAL WASTE
		BIODEGRADABLE LANDFILLED WASTE, LANDFILL GAS
		SEWAGE SLUDGE

PROMOTION OF BIOMASS ENERGY - EU COUNTRIES CHOICE



VALUES FOR GREEN CERTIFICATES (EU)

AUSTRIA	10.2-16.0 € cents /kWh (10-2 MW), 6.5 € cents /kWh (hybrid plants)
DENMARK	Settlement price: 4 € cents/kWh + 1 € cent/kWh for RE certificate.
FINLAND	4.2 € cents /kWh
FRANCE	Standard rate of 4.9 € cents/kWh
GERMANY	up to 500 kW: 10 € cents/kWh, up to 5 MW: 9 € cents/kWh, up to 20 MW: 8.6 € cents/kWh
ITALY	Certificate prices up to 9.74 € cents/kWh, 2004
NETHERLANDS	Tariff 2004 / Tariff 2005 Pure biomass large scale: 5.5 / 7 Small-scale biomass < 50 MWe 8.2 / 9.7
SWEDEN	Prices in the range of 1.3 – 1.6 € cents/kWh
UK	Non-compliance 'buy-out' price (2003-2004) approx 4.5 € cents/kWh

CASE OF GERMANY

Type of biomass	General	Renewable resources [1]	CHP	CHP + innovative tech. [2]	Waste wood from 1.7.2006	
Plant dimension	€/MWh					Decrease *
< 150 kW	115	175	135	155		
150 -500 kW	99	159	119	139		
500 kW - 5 MW	89	129 (114 for wood)	109	129	39	1.5%
5 MW - 20 MW	84	84	104	104		

[1] a) from plants or parts of plants which have originated from agricultural, silvicultural or horticultural operations or during landscaping activities and which have not been treated or modified in any way other than for harvesting, conservation or use in the biomass plant; b) from manure

2] "…… if the biomass is converted by thermochemical gasification or dry fermentation and if the gas used for power generation is processed to reach the quality of natural gas or if the electricity is produced by fuel cells, gas turbines, steam engines, organic Rankine cycles, multi-fuel plants, especially Kalina cycles, or stirling engines……"

BIOGAS IN GERMANY

EE FROM VEG OILS IN ITALY

1.600 cows

Livestock

900 ha

1.800 t

200 kg/h

65% cake

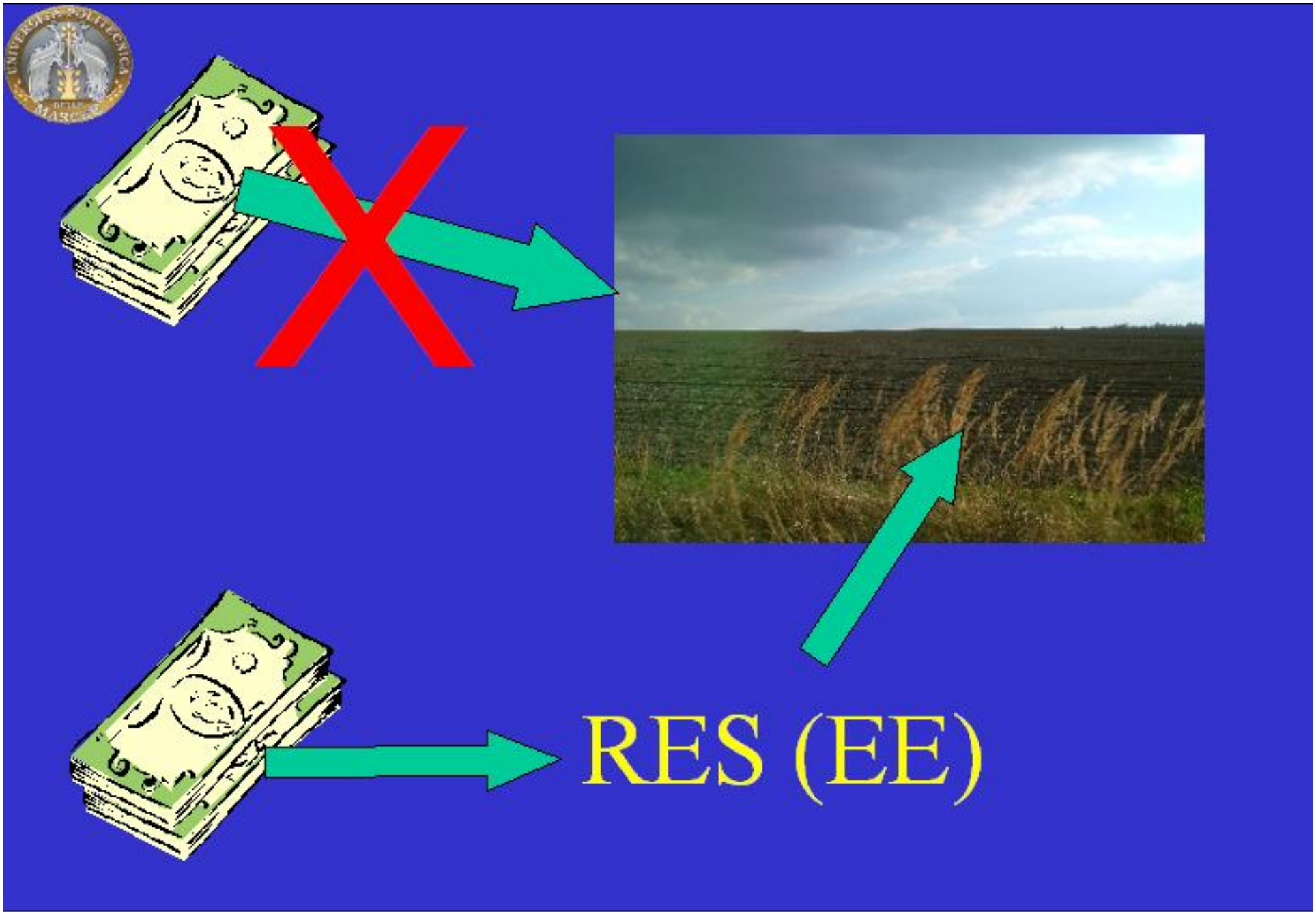
35% oil

Gen - set

350 kW

Electric energy
to the grid
(2,5 GWh/y)

7.200 h/y


RES (EE)

3 – LESS DEVELOPED COUNTRIES (I.E.: ASIA)

- Economy is stagnating and subsidies are given to fossil fuels
- Energy needs are often solved by diesel generators
- Rural development is problematic
- Cost of EE for rural communities is usually very high and this justify labour and investments for green EE production

THE CASE OF *GLIRICIDIA SEPIUM* IN SRI LANKA - 1

THE CASE OF *GLIRICIDIA SEPIUM* IN SRI LANKA - 2

THE CASE OF *GLIRICIDIA SEPIUM* IN SRI LANKA - 3

wood fuel: 2-3 cent$/kg

Family income: doubled

1 kWh: 1,3 kg of fuel

1 kWh: 3-4 cent$

1 kWh (sold from the grid): 8-10 cent$

1 kWh (real cost to the state): 12 cent$

PRELIMINARY CONCLUSIONS (1)

- In some countries the EE production from biomass is today more interesting than yesterday
- Sizes: 0,1 – 15 MW for developed countries
  3 kW – 3 MW for less developed countries
- This field is well known but "neglected" by the industry
- Could be an opportunity for farm-machinery industry

GEN-SET OPERATED WITH RAW VEG. OILS

- Oleaginous crops are possible with all climatic conditions
- The oil is extractable from oleaginous seeds with machines which might be very simple
- The co-product from the pressing operation is a cake (oil residue of 8-15%) and it is often interesting to be used as a fertilizer or as feedstock
- Diesel generator sets are not expensive (investment)
- Their application is immediate and relatively simple
- The changes requested by raw vegetable oils could be performed on standard engines

GENERAL CONCEPT

1.600 cows

Livestock

900 ha

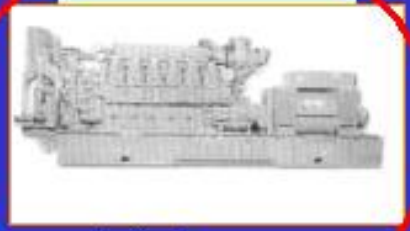
1.800 t

200 kg/h

65% cake

35% oil

Gen - set



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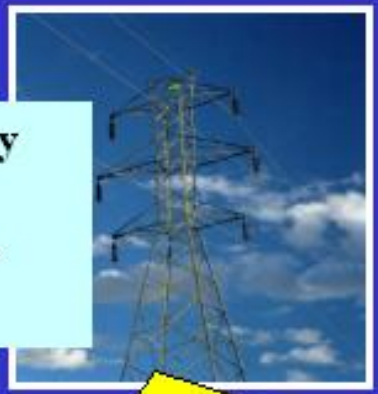
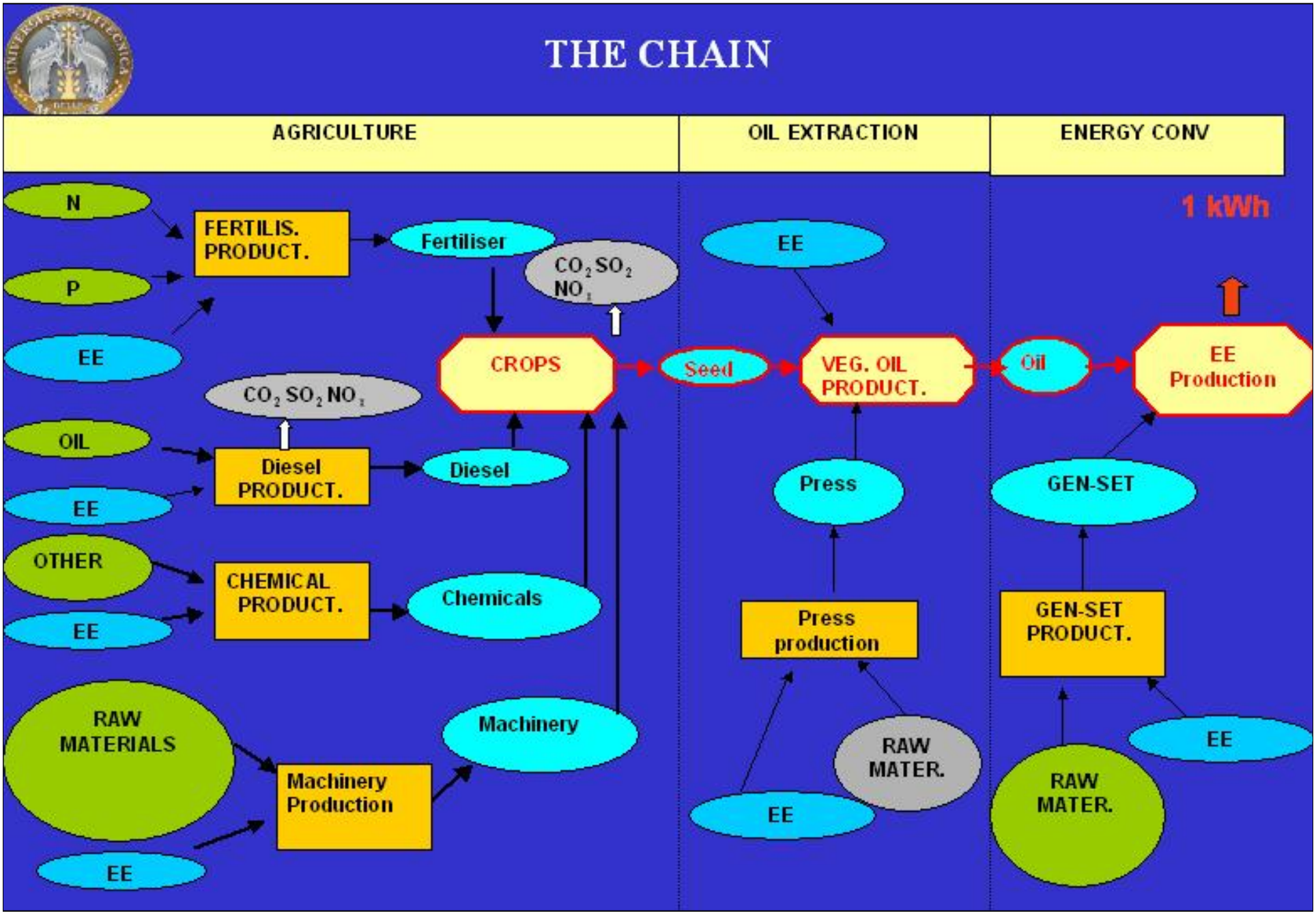



THE CHAIN
AGRICULTURE
OIL EXTRACTION
ENERGY CONV
1 kWh
N
P
EE
FERTILIS. PRODUCT.
Fertiliser
CO_2 SO_2 NO_x
CROPS
Seed
EE
VEG. OIL PRODUCT.
Oil
EE Production
CO_2 SO_2 NO_x
OIL
EE
Diesel PRODUCT.
Diesel
Press
GEN-SET
OTHER
EE
CHEMICAL PRODUCT.
Chemicals
Press production
GEN-SET PRODUCT.
RAW MATERIALS
EE
Machinery Production
Machinery
EE
RAW MATER.
RAW MATER.
EE

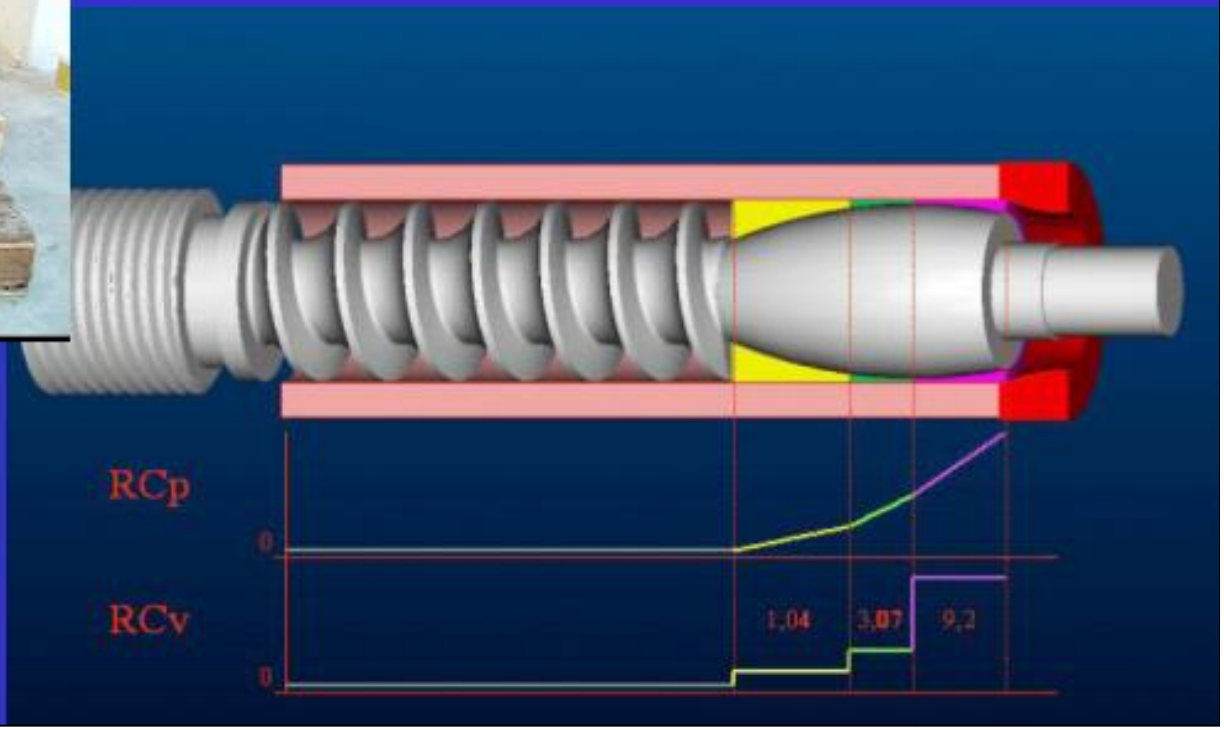
GENERAL RESULTS

Global efficiency: 1 MJ (EE) ⇔ 2,5 MJ primary energy

1 kWh (3,6 MJ of EE) ⇒ 0,2 kg of CO_2

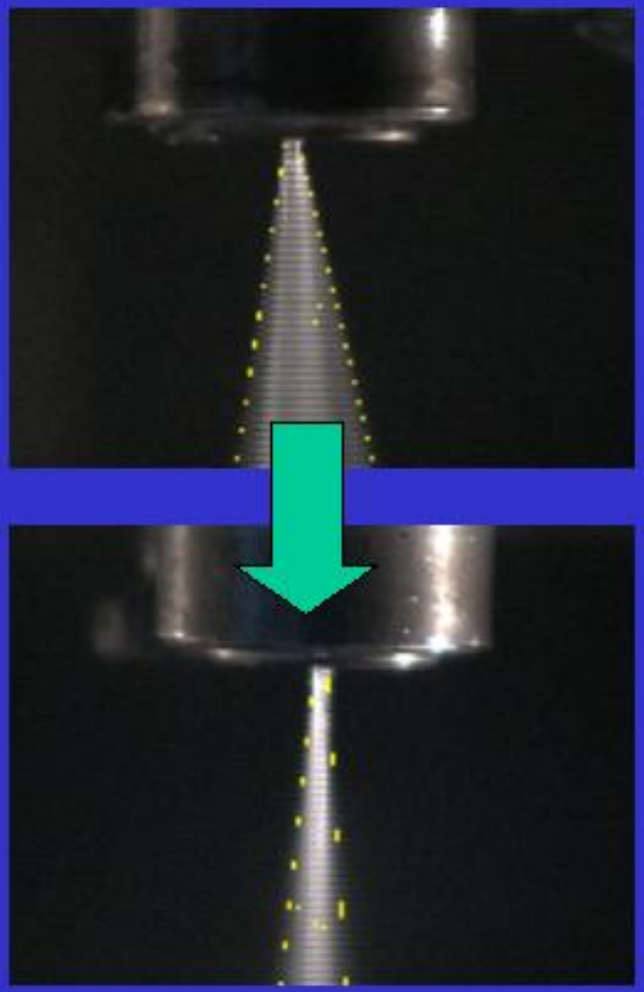
SOME ASPECTS TO BE DEVELOPED

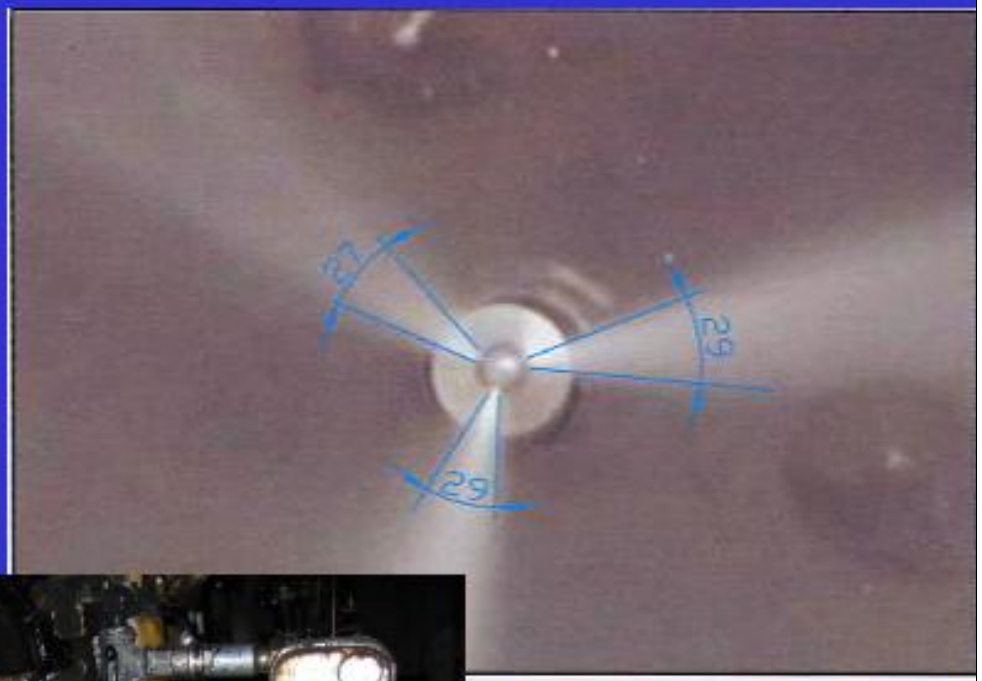
- Mechanical pressing of seeds
- Combustion of raw veg. oils in diesel engines



COMBUSTION OF RAW VEG. OILS IN ENGINES

Injection





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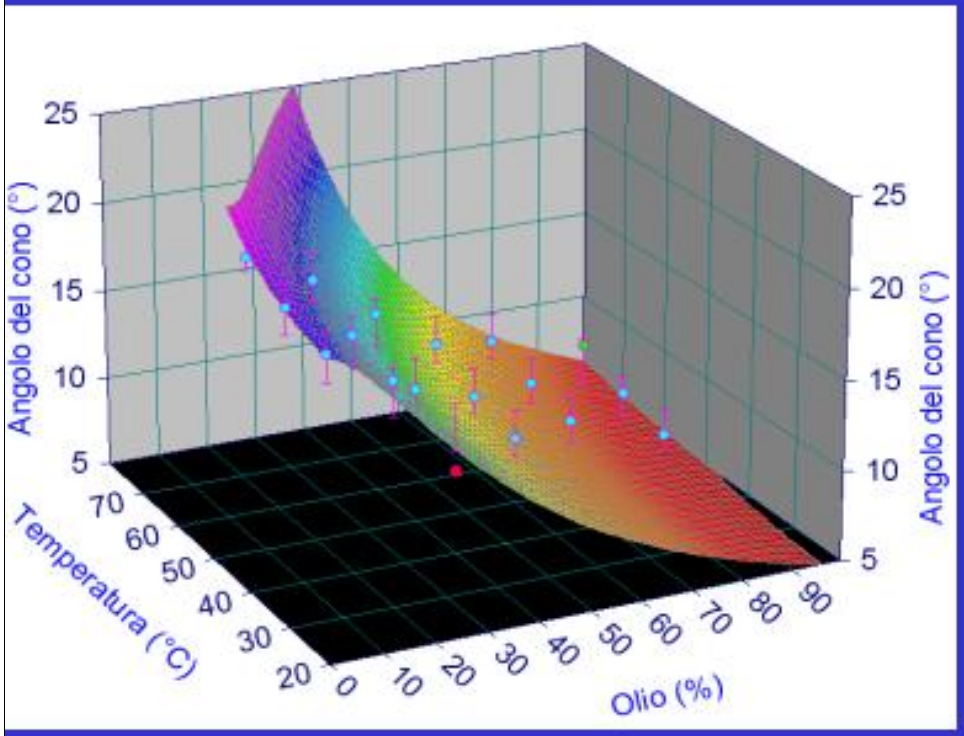
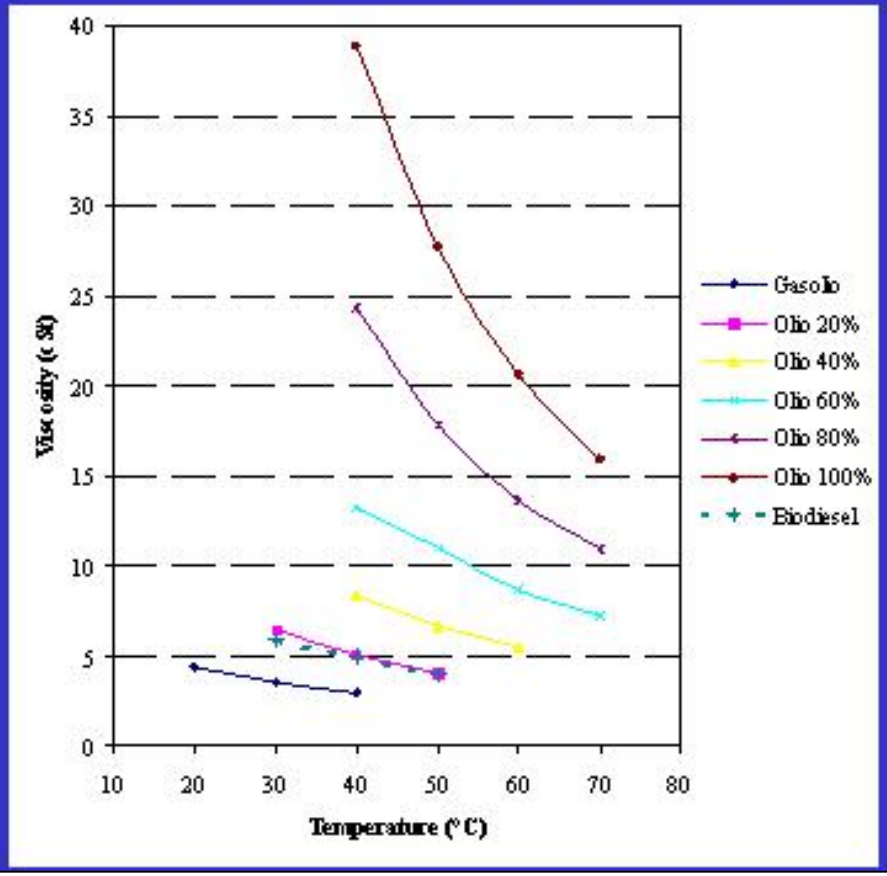
COMBUSTION OF RAW VEG. OILS IN ENGINES

Injection



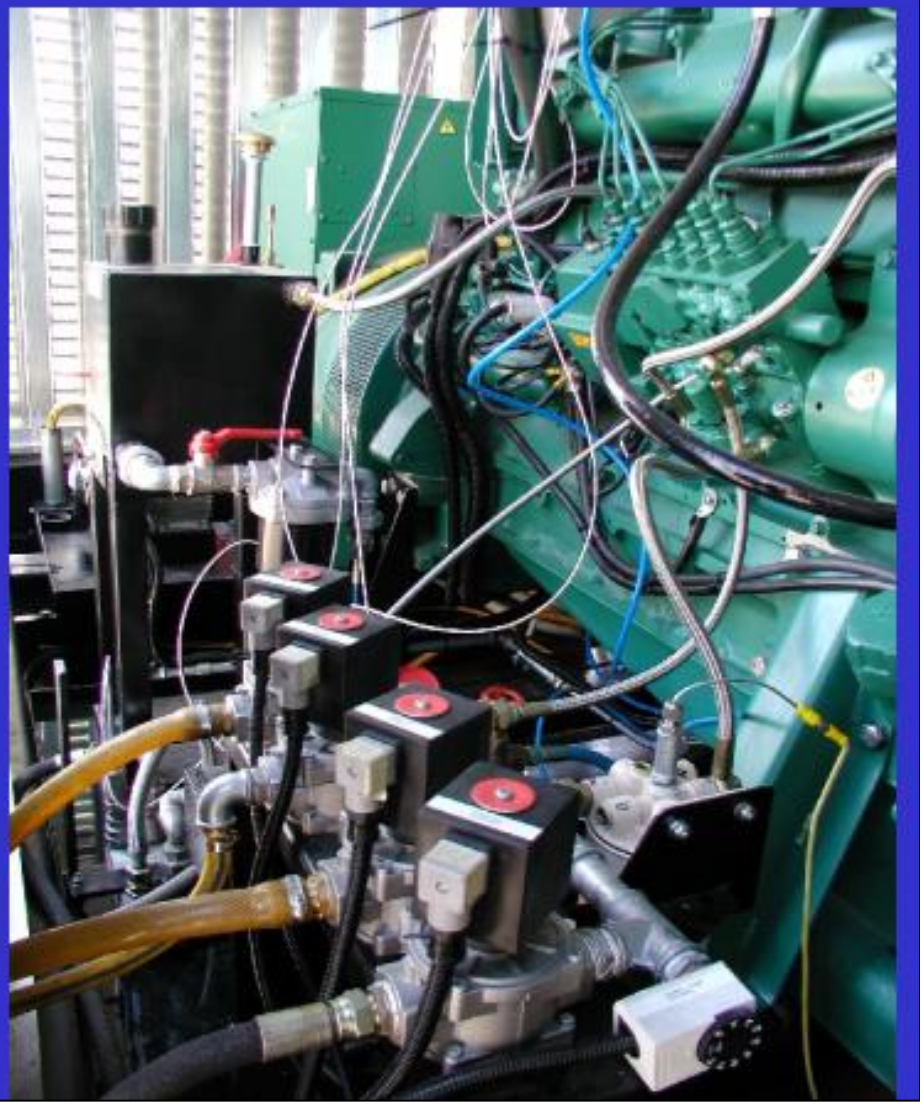


COMBUSTION OF RAW VEG. OILS IN ENGINES

Injection

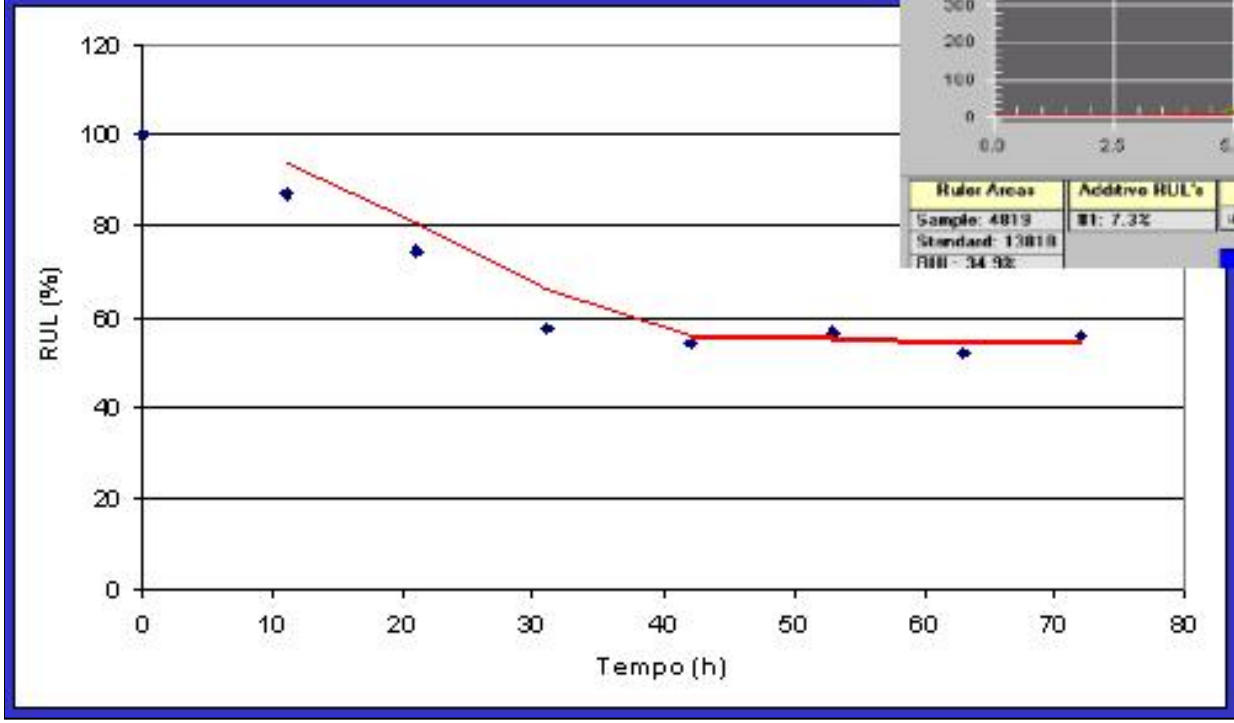
COMBUSTION OF RAW VEG. OILS IN ENGINES

Injection – Lubricant contamination



COMBUSTION OF RAW VEG. OILS IN ENGINES

Control of lubricant contamination



CONCLUSIONS (2)

- The use of raw veg. oils seems an interesting option
- The quality of the veg. oils is very important
- Should be interesting to prepare standard lines (press + oil cleaning + gen-set)