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"Alternative energy crops for agricultural machinery biofuels – focus on biodiesel"

Presented at the Club of Bologna Session held on 12 and 13 November 2005 during the 36th EIMA (International Agricultural Machinery Show) in Bologna (Italy).

This group of pictures is only to recall the variety of bioenergy sources, technologies and social and scientific implications.

Bioenergy has to do with:



it is about people, resources and knowledge



wood, forests, cooking stoves, rural poverty, high-tech industry, agronomy, new crop development and selection, land tenure issues, biodiversity impacts, rural employment.....

Bioenergy and Food Security: a critical nexus

**International Assessment of Agriculture Science
and Technology for Development**

World Bank – FAO – CGIAR

- **Scenarios** – (adapting the Millennium Ecosystem Assessment)
 - Global orchestration
 - Order from strength
 - Techno-Garden
 - Adapting Mosaic

- Bioenergy in all scenarios



Impacts of the Very Large Potential of Bioenergy

- Food security (+ or - ??)
- Climate Change ++++++
- Energy security +++++++
- Biodiversity (- ??)
- Trade (+ to whom ??)
- Commodities and markets

Bioenergy main Benefits

Impacts food security

Improves livelihoods

Reduces poverty and human drudgery

Promotes employment and rural infrastructure

Stimulates the double role of agriculture and
forestry:

energy users and energy producers

Reduces Carbon emissions

Food security/Biofuels

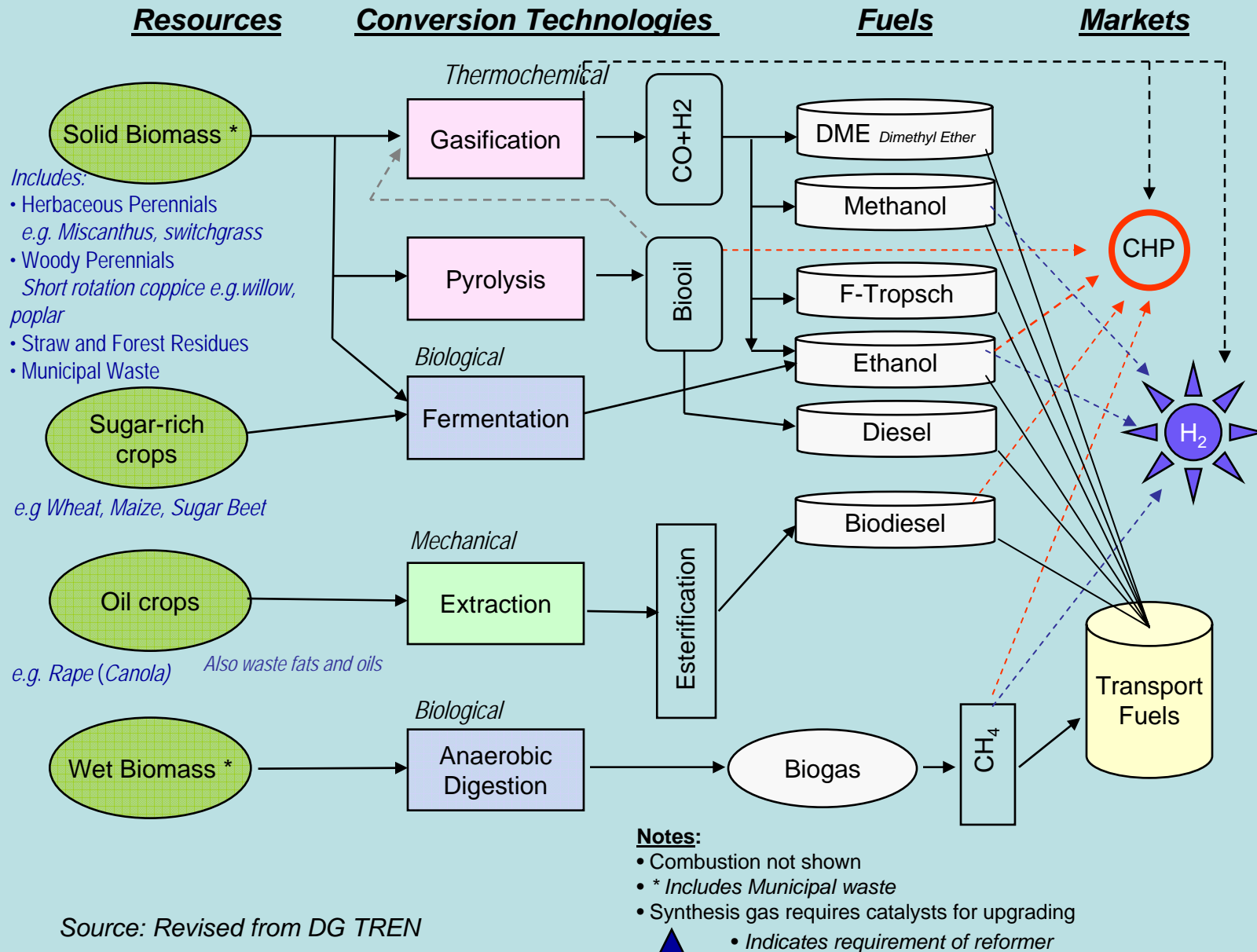
Problems

- Competition "status" site specific
- Integrated Policies in place
- Regulatory framework

Benefits

- Synergies, synergies synergies

Overview of Conversion Pathways (*biomass and waste*)



Source: Revised from DG TREN



Biodiesel Definitions:

Biodiesel is the name of a clean burning alternative fuel,
produced from biological oils.

Biodiesel contains no petroleum, but it can be blended at any level with petroleum diesel to create a biodiesel blend.

It can be used in compression-ignition (diesel) engines with little or no modifications

Biodegradable, non-toxic, and essentially free of sulphur and aromatics



Biodiesel – Brief History

- Rudolf Diesel – first “biodiesel” peanut oil engine in August 10, 1893
- International Biodiesel Day
- fossil diesel cheaper throughout 20th Century
- from 1990s new interest due to
 - environment
 - set aside lands
- NOW – new drivers:
 - oil prices
 - agriculture diversification
 - security



Biodiesel main origin:

- **soybean**
- **rapeseed**
- **sunflower**
- **palmoil**
- **linseed**
- **canola**
- **castor**
- **jatropha**
- **hemp**
- **beef tallow**
- **algae**
- **used frying oil - UFO**



Yields: T/ha

– soybean	1.7
– rapeseed	3.1
– sunflower	2.4
– palmoil	14.9
– jatropha	3.1
– algae	588.0
– coconut	6.7
– peanut	2.6



Energy balance

The US National Biodiesel Board concludes that the energy balance for biodiesel is 1.44, not including a credit for byproducts. Including the byproducts credit raises the balance to 2.51. Using state-of-the-art methods and best results gives an energy balance of 4.1.



Despite these numbers you may not be surprised to find out that some authors (Pimentel) finds that the energy balance for biodiesel is less than 1.0.

He does not give credit for byproducts.

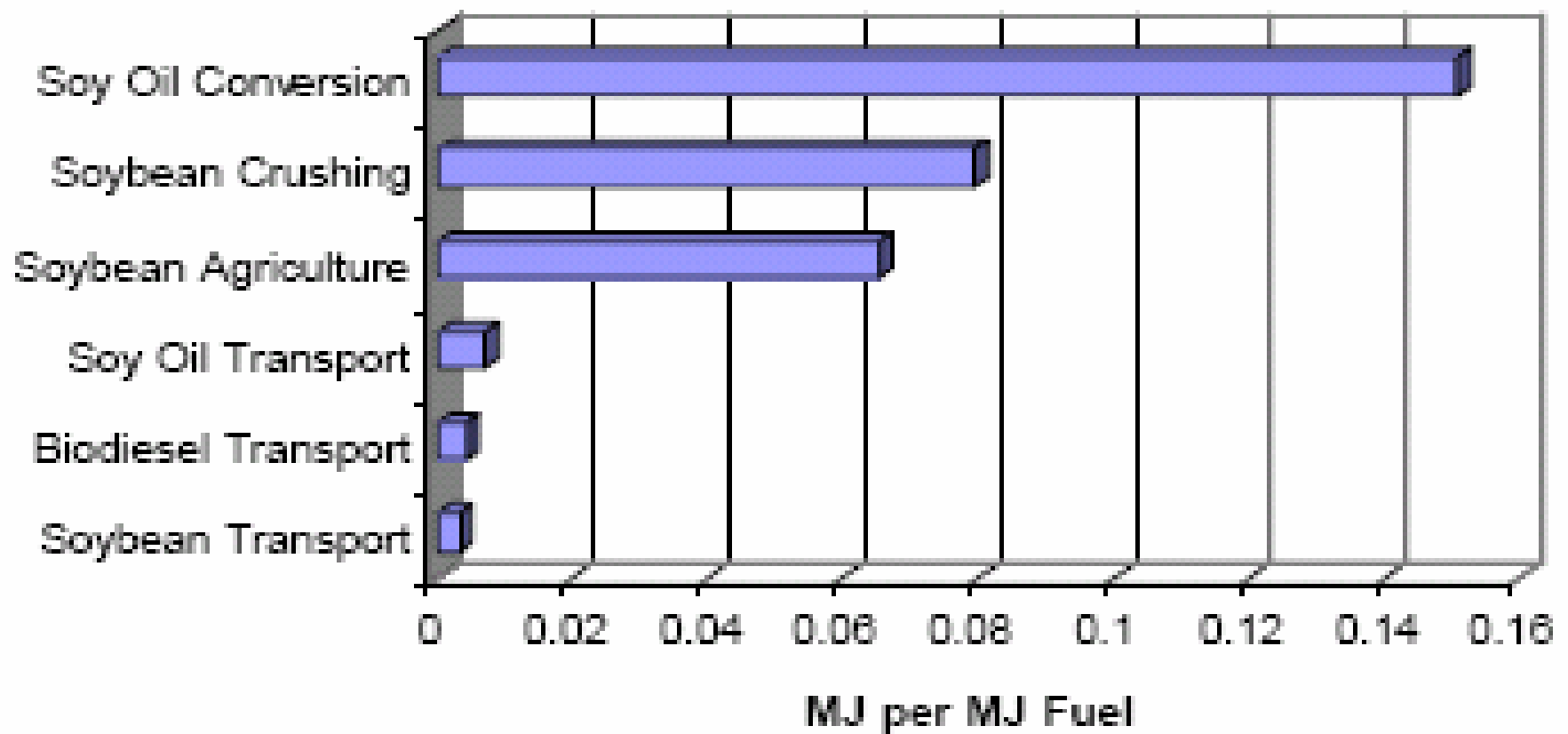


Energy balance

Summary - Energy Balance/Energy Life Cycle Inventory

USDA 2002

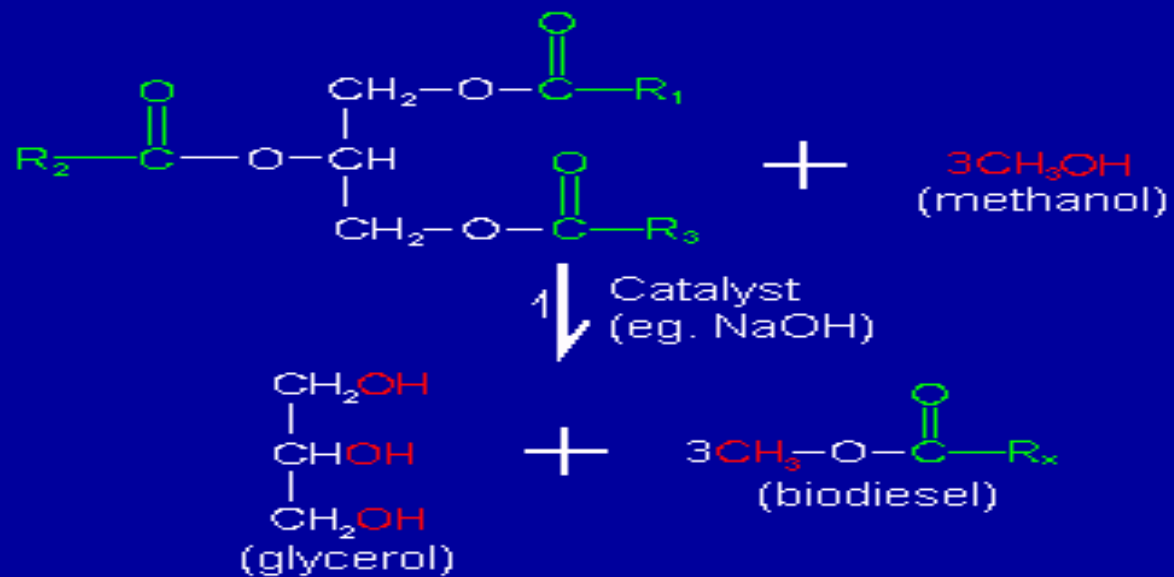
Fuel	<u>* Energy yield</u>	Net Energy (loss) or gain
Gasoline	0.805	(19.5 percent)
Diesel	0.843	(15.7 percent)
Ethanol (corn)	1.34	34 percent
Biodiesel	3.20	220 percent





Biodiesel – Production

- **made by chemically combining any natural oil or fat with an alcohol such as methanol or ethanol.**
- **This process, called transesterification, involves**
 - **mixing methanol with sodium hydroxide**
 - **mixing that with oil or fat**
 - **letting the glycerine settle**
 - **final products are methyl esterate and glycerine**



BIODIESEL MOLECULE





Biodiesel – some key advantages

- **environmentally superior to other fuels**
- **actually cleans engines**
- **yields 3.2 : 1.0 units of energy** (fuel produced: fuel used)
- **can be grown in arid, marginal, degraded lands**
- **less toxic than table salt** (+3 liters/60 kg person/50% death)



Environmentally:

- **50 % less CO; 80% less CO₂**
- **56% less benzofluoranthene; 71% less Benzopyrenes (less cancer)**
- **65 % less particulates**
- **no Sulphur (allows reducing NO_x which are higher than fossil diesel)**
- **Ozone forming potential (smog) 50 % less**



Cleans engines

- better solvent of particulates
- breaks down deposits in tanks and fuel lines
- initial clogging – (higher capacity filters required)
- long term positive cleaning
- extends life of engines
- larger engines benefit



Opportunities for agriculture

- **arid, marginal, degraded lands**
 - **jatropha**
 - **resistant oil seeds**
 - **algae (desert lands with high solar radiation)**
- **by products**
 - **agroindustrial**
 - **livestock industry**



Examples of Diesel Vehicle Warranties for 100% Biodiesel Operation

- **BMW Tractors All models since 1971**
- **Caterpillar MMT,**
- **Fiatagri Tractors For new models**
- **Ford AG Tractors For new models**
- **John Deere Combines, tractors Warranties since 1987**
- **Lamborghini Tractors Series 1000MAN Truck Engine numbers 8953591 to 8953001**
- **Nissan Tractors Since 1990**



Quote in The Solar Living Centre - California

“In agriculture, we find not only a possible source for biodiesel, but a consumer of biodiesel. Tractors, reapers, tillers, pickers, conveyors, generators, pumps, and irrigation systems all use diesel fuel in their work, bringing agriculture full cycle from producer to consumer.”

Quote in Arkansas Agricultural Experiment Station

"The more demand there is for biodiesel made with soybean oil, the more demand there will be for soybeans. It's a nice little circle that I can understand and appreciate."

“One day the oil man's wells will run dry, but we can plant more soybeans”

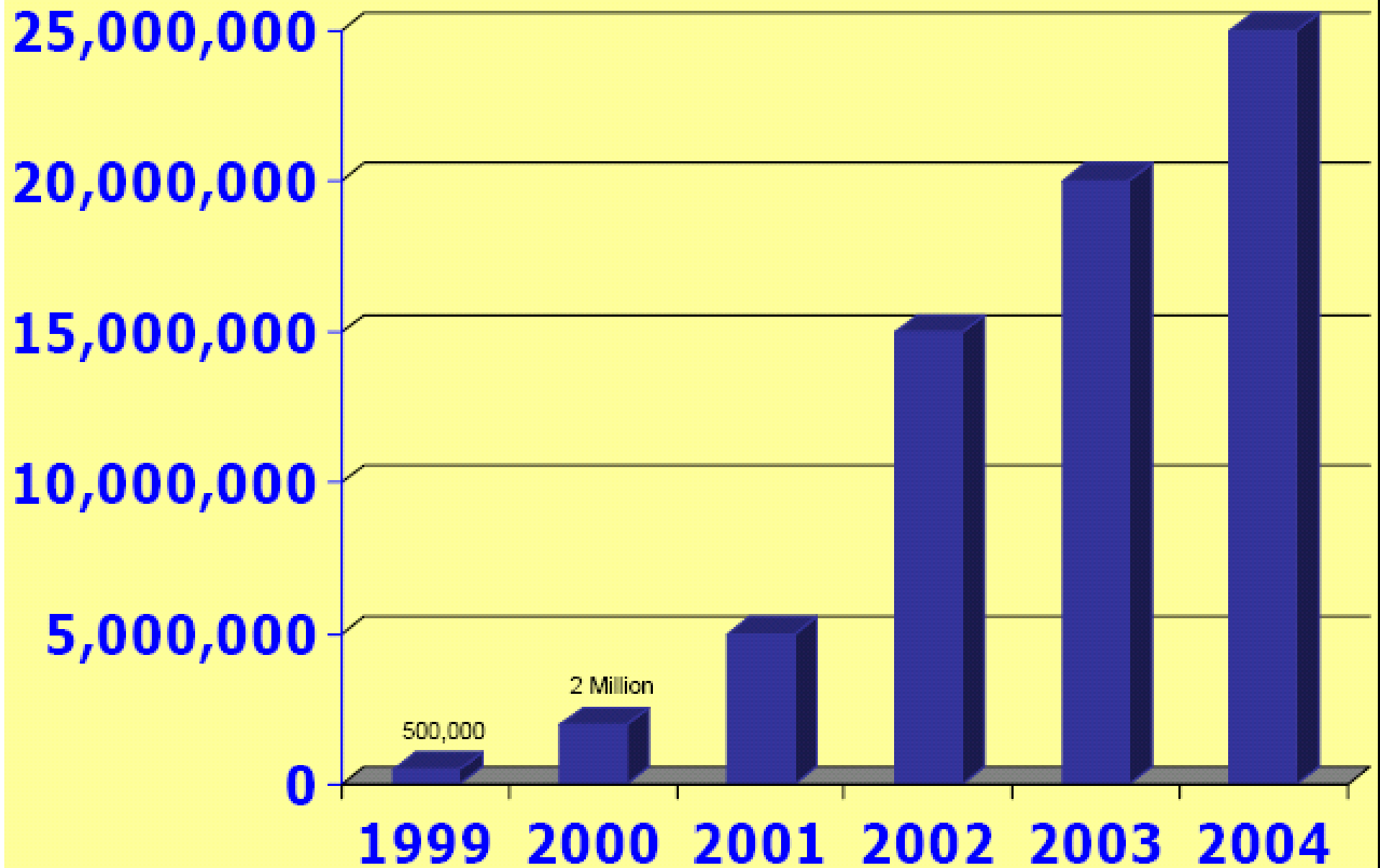


Examples of biodiesel industry 2004 ('000 TONNES*)

• Germany	1035
• USA	594
• France	348
• Italy	320
• Austria	57
• Spain	13
• Denmark	70
• United Kingdom	9
• Sweden	1.4
• Czech Republic	60
• Slovakia	15
• Lithuania	5

EU production was increased by 35% compared to 2003.

Biodiesel Production *(in gallons)*





FREE Biodiesel Book...

I may have promised you a FREE book about making your own biodiesel from used cooking oil, so just enter your name and email address in the form below and I'll email that book to you right now! This is a must read book because biodiesel is really starting to move from being an alternative fuel to a mainstream fuel - and that's a rare thing in the alternative energy world. If the fuel supply dries up, homemade biodiesel may be the only fuel that you can get your hands on! The book contains links to all the most popular biodiesel web pages too (and some you probably don't know about yet, but should). *Even Willie Nelson is promoting biodiesel and using it himself.* Also included is information on growing Jatropha for biodiesel oil production. And, if that isn't enough, I'll also send you four (4) very detailed government studies that were done on biodiesel. Don't worry - your email address will be kept strictly confidential and will not be sold or lent to any other company...

Enter your first/last name and email address here:

Name:

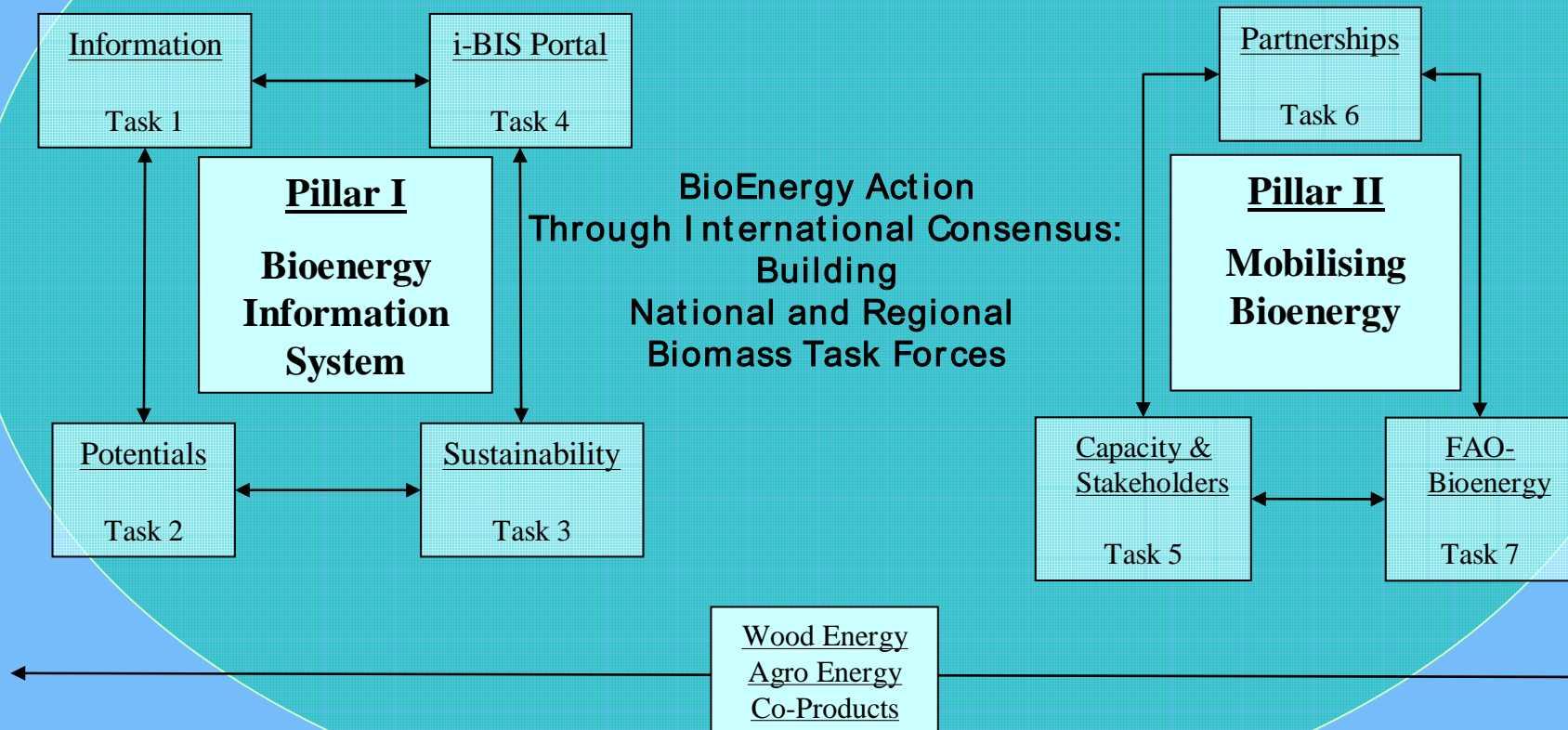
E-mail Address:

Submit

Don't just take my word for it, listen to what Terry of Australia and Sean of North Carolina have to say about the electricity book...

"The book is very interesting and shows that you have put a mountain of time and effort into it. I look forward to putting

International BioEnergy Programme (I-BEP)





Vision of International Bioenergy Programme:

Promote and monitor the sustainable use of modern biomass energy systems for sustainable development, energy security and climate change mitigation.

International Bioenergy Programme - Tasks/Objectives

- 1. Information.** Assist project development by providing examples of success and failure.
- 2. Potentials.** Develop tools to quantify the potential bioenergy resource base on a country-by-country level and therefore highlight opportunities.
- 3. Sustainability.** Assist in the development of sustainability strategies and assurance schemes aimed at ensuring the sustainable development of bioenergy.
- 4. i-BIS (Interactive Bioenergy Information System).**
Provide detailed 'real-time' data on consumption patterns and existing activities.





5. Capacity and Stakeholders.

Provide an enabling environment for establishing and developing bioenergy programmes and projects.

6. Partnerships.

Assist international bodies to collaborate in the development of coherent national and international bioenergy programmes.

FAO data and Information for decision making on bioenergy

- **Farming practices**
- **FRA**
- **Land type and use**
- **Water**
- **Wood energy (40 years old)**
- **Agricultural production – including by-products**
- **Rural institutions**
- **Livelihoods**
- **Nutrition**
- **SEEDS**
- **GTOS**
- **Fisheries**





Thank you !

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