

COMPETING FOR LAND OR ENERGIZING THE AGRICULTURAL SECTOR?

Evaluating the bioenergy-food security nexus

by

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Biofuels Markets Africa Conference, Cape Town, 30/ 11/ 2006

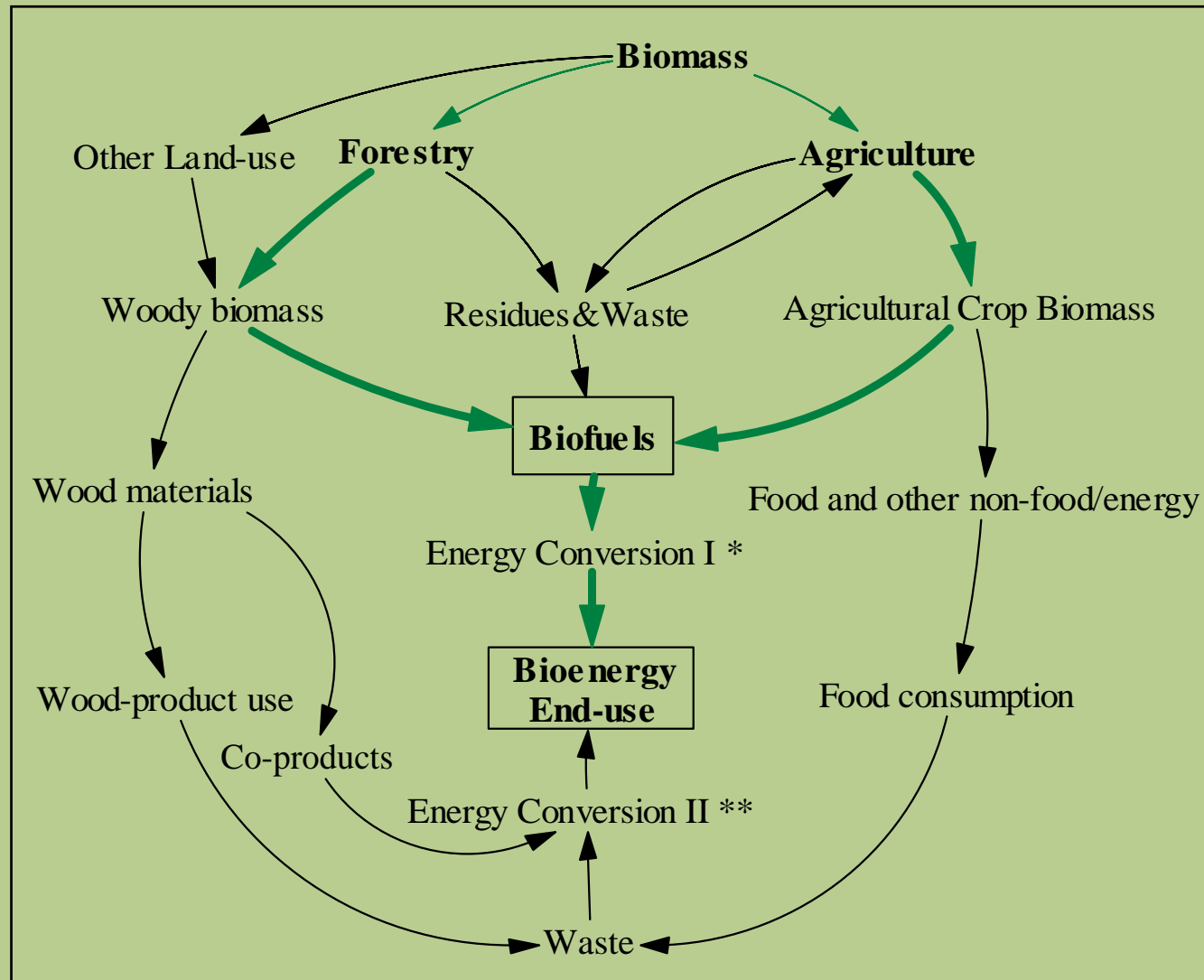
With major inputs from Josef Schmidhuber, FAO and the Trade and Commodities Division, FAO

Outline

- **Bioenergy: system, fuels, potential, complexity**
- **Competition for production factors between food, fibre and fuel**
- **Conceptual Linkages: Bioenergy and Food Security**
- **Is there an impact on agricultural commodity markets?**

Bioenergy: system, fuels, potential, complexity

Biomass → Biofuels → Bioenergy



Different Forms of Biofuels

Liquid Fuels

Ethanol (e.g. from sugar)

Methanol

Biodiesel (e.g. from maize, rape seeds)

Vegetable oils

Gaseous Fuels

Hydrogen

Methane (e.g. from animal manure)

Solid Fuels

Charcoal

Pellets

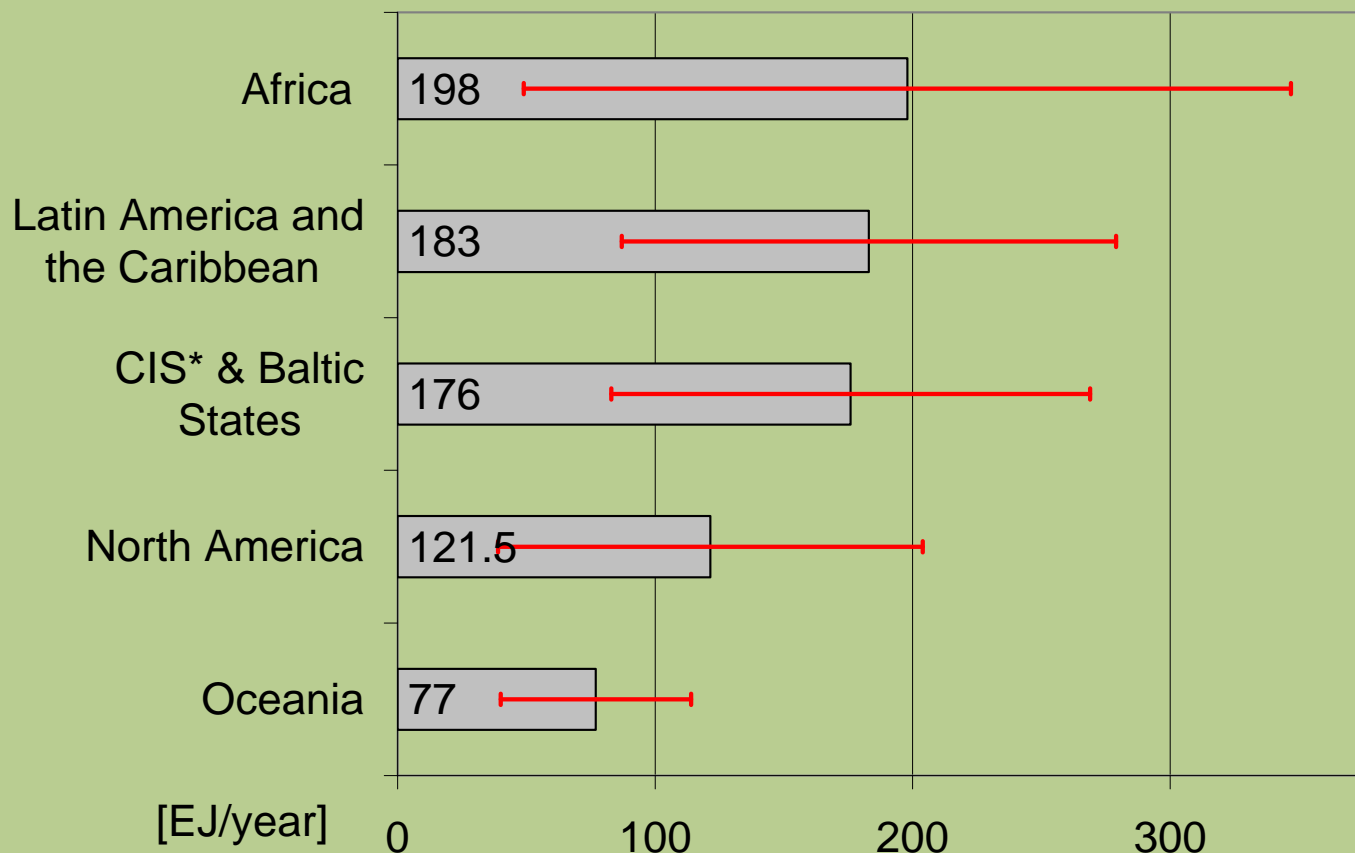
Wood Chips

Saw Mill Dust

Briquettes

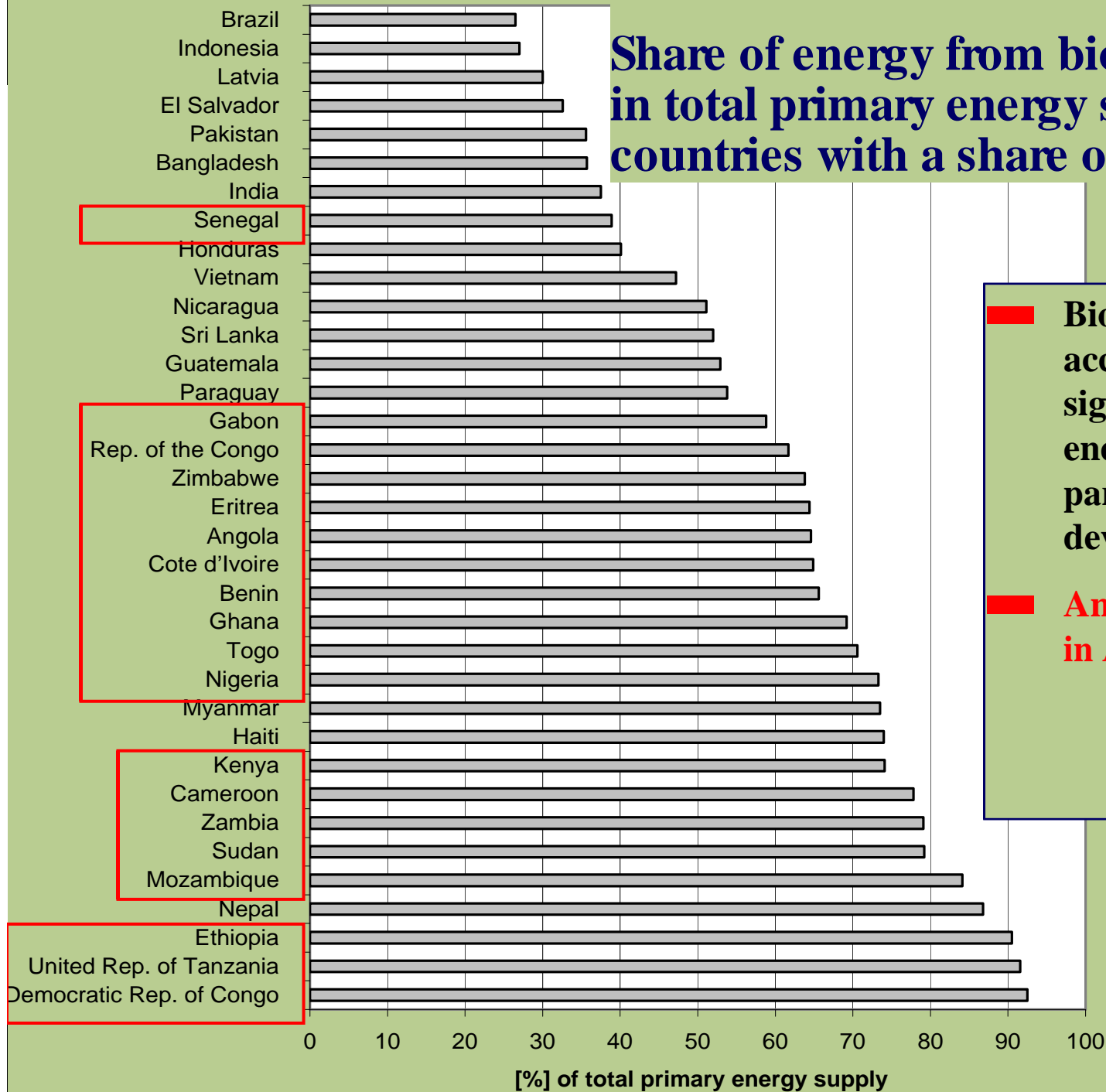
Agricultural Residues

Bioenergy potential per region: different scenarios, year 2050 Exajoules/yr



Source: Juergens and Mueller forthcoming 2007, based on data from WWI 2006)

Share of energy from biomass and waste in total primary energy supply for countries with a share of 30% and above



■ Bioenergy currently accounts for a significant share of total energy supply, particularly in the developing world

■ And the bulk is located in Africa

Source: Juergens (FAO) 2006 based on data from IEA 2006

Competition for production factors between food, fibre and fuel

Determinants of Bioenergy Production

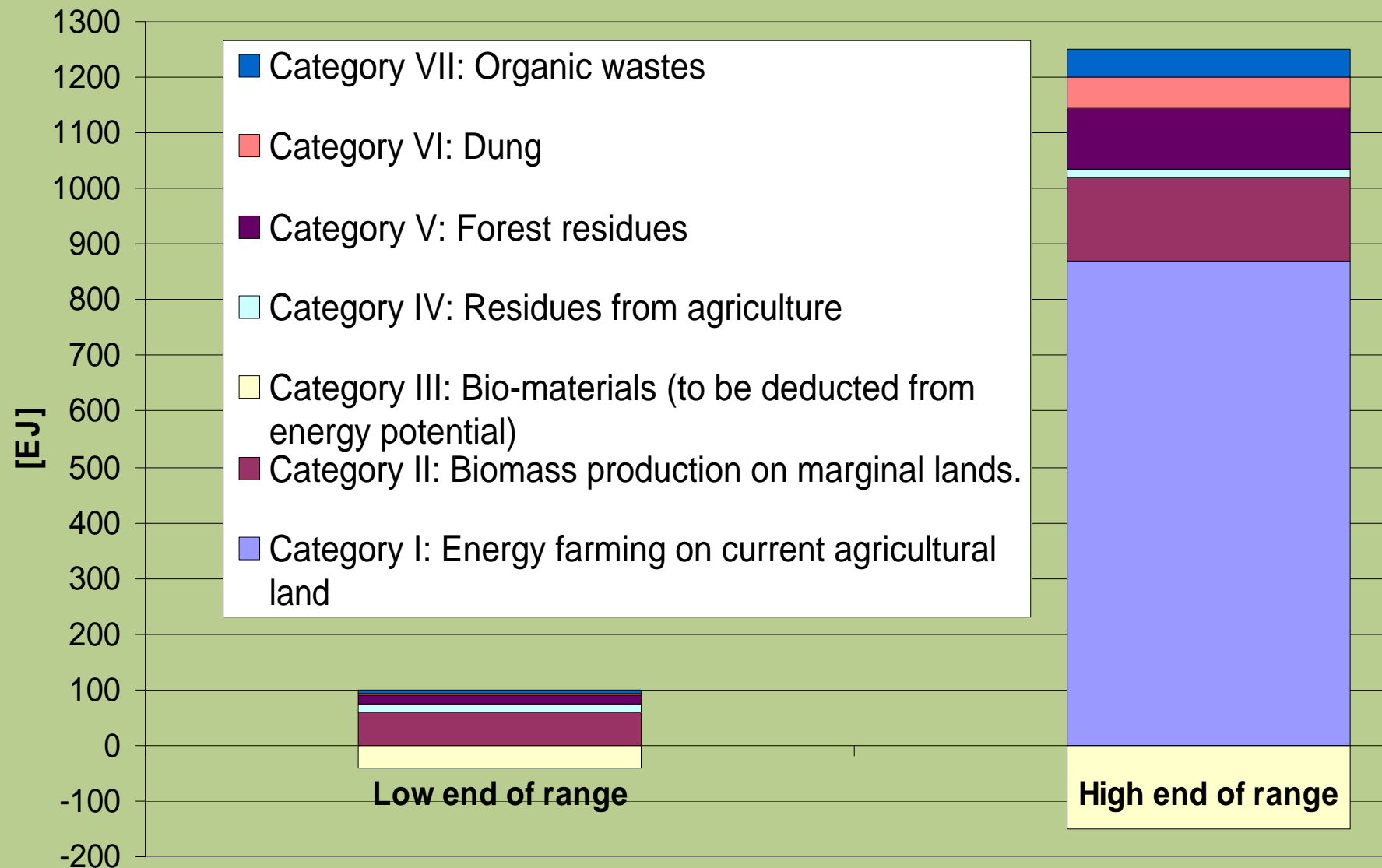
- Population growth and economic development**
- Energy prices**
- Food consumption: per capita calorie intake and composition of diet**
- Land use patterns (feasibility of marginal/degraded lands)**
- Efficiency of food production: crop yields, livestock production**
- Forest productivity and sustainable harvest levels.**
- Competing demands for land: nature reserves, endangered/protected ecosystems, recreation, amenity**
- Competing demands for wood and agriculture based bio-materials.**

Competition for Biomass

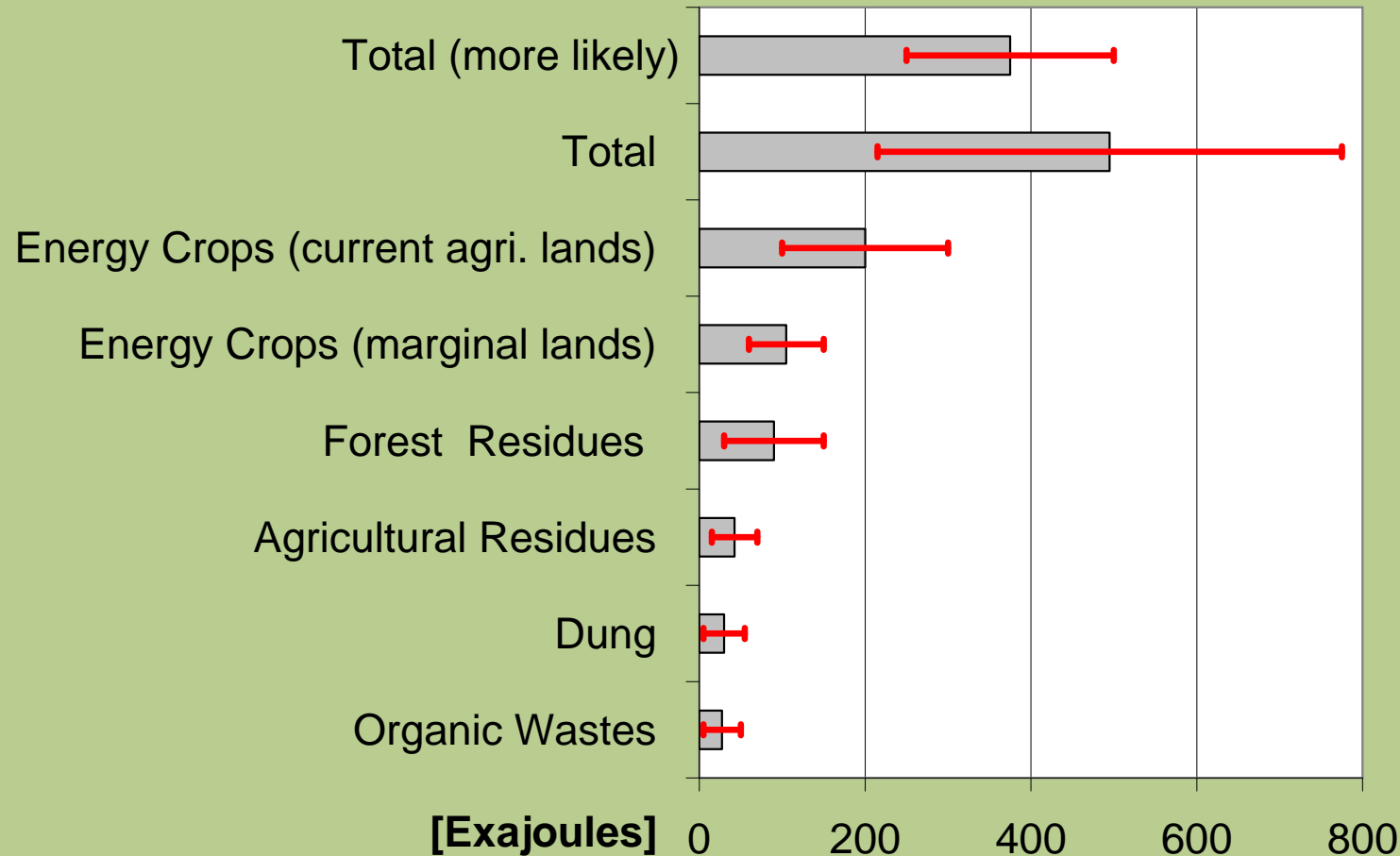
Resource	Alternative Use
Animal dung	Soil conditioner and fertilizer
Bagasse, sugar cane tops and leaves, molasses	Animal feed, paper and board industries, road cover
Cereal straw	Animal feed, soil conditioner, paper & board industries, roof thatching
Maize stalks	Cattle feed, soil conditioner
Rice husk	Cement and brick industries
Wood chips, bark, sawdust	Construction material
Wood logs, branches	Construction material, paper industry, handcraft

Source: Juergens (FAO) 2006, adapted from SEI/ESMAP 2005

Different Bioenergy Sources with different land requirements



Bioenergy potential per type of biomass: different scenarios, year 2050 Exajoules/yr



Source: Juergens and Mueller forthcoming 2007, based on data from Faaij 2006

Bioenergy and Land Use Scenarios (2050) : IPCC Third Assessment Report (2001)

Scenario / Biomass Energy Requirement	Bioenergy	% Primary Energy Supply	Land for Biomass
	EJ	%	Mha
Sørensen (1999) - bottom up assessment	178	74	-
IPCC (2001) - TAR - AIM - A1M	193	14	418
- TAR - A2 - ASF	71	27	
- TAR - B1 - Image	95	13	268
- TAR - B2 - Message	105	12	288
- TAR - A1F1 (A1G) - Minicam	52	4	68
- TAR - A1T - Message	183	71	418
IPCC (1996) – Second Assessment Report	280		
Average	145	31	292
Max	280	74	418
Min	52	4	68

Conceptual Linkages: Bioenergy and Food Security

Food Security indicators and determinants

- Domestic food production (food availability)**
- Purchasing power (food access)**
- Access to water and sanitation facilities (food utilization)**
- Food Stability**
- Population growth**
- GDP growth per capita**
- Agricultural contribution to GDP**
- Degree of import and/or export dependence**
- Proportion of adults infected with HIV**
- Adult literacy, particularly female**
- Proportion of household income directed to food**
- Health expenditure as a proportion of GDP**
- UNDP Human Development Index**

Potential Negative Impacts of Bioenergy Systems

- **Decreased access to food due to increased food prices driven by competition between biomass for energy or food**
- **Decreased food availability due to replacement of subsistence farm land by energy plantations**
- **Pressure on prices of other goods and services related to land-use and biomass**
- **Competition for all production factors and increased pressure on natural resources.[particularly land, water, biodiversity**

Potential Benefits of Bioenergy Systems

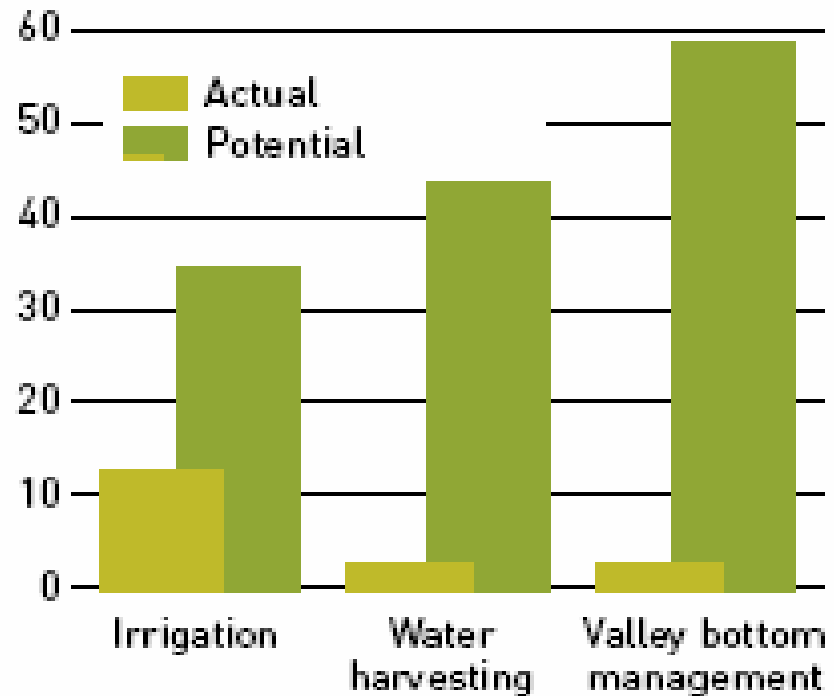
- **Diversification of agricultural output**
- **Development of infrastructure and employment in rural areas**
- **Competition for land and other production factors**
- **Diversification of domestic energy supply**
- **More time for income earning activities**
- **Access to energy for rural enterprises**
- **Climate change mitigation and carbon credits**
- **Mitigation of local environmental concerns - water pollution, loss of biodiversity, land degradation**

Possible Bioenergy Benefits

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Water management potential in Africa

Area (millions of hectares)

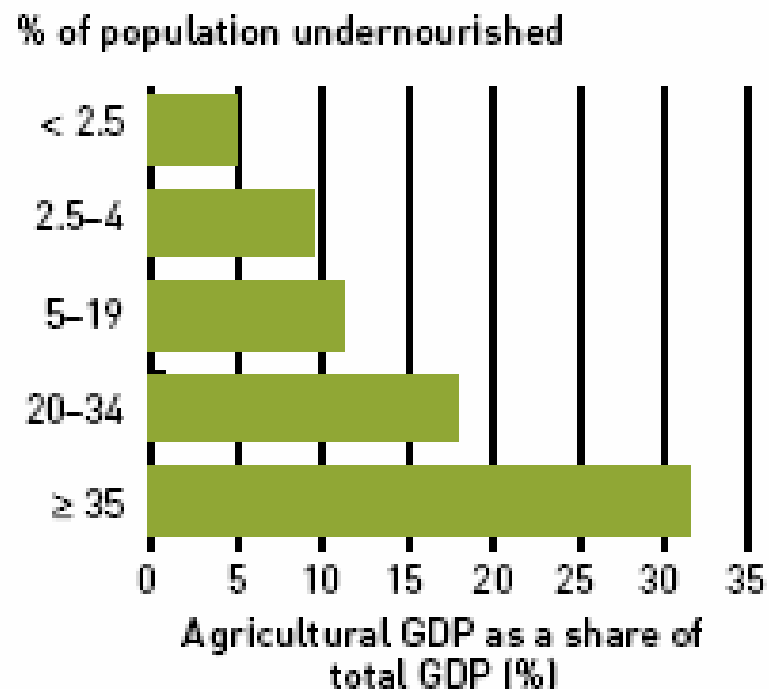


Source: FAO

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Agricultural GDP and undernourishment, 1996–2000

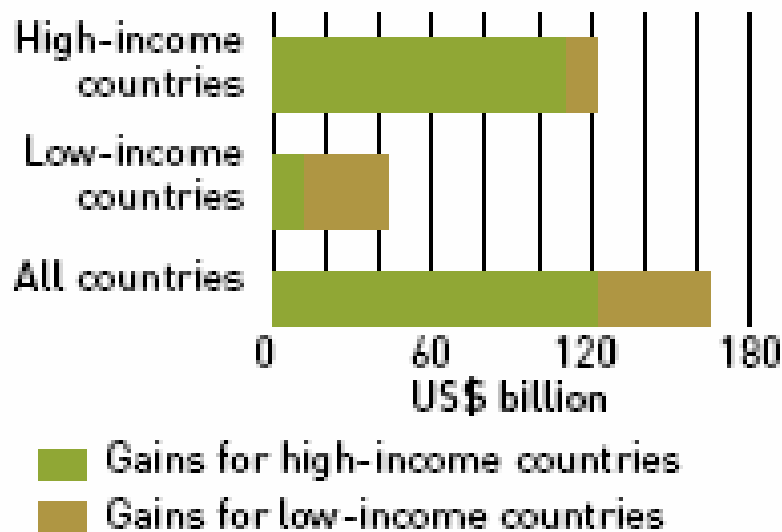


Source: FAO

Biofuels and value added – or simply feedstock for refineries in industrialized countries?

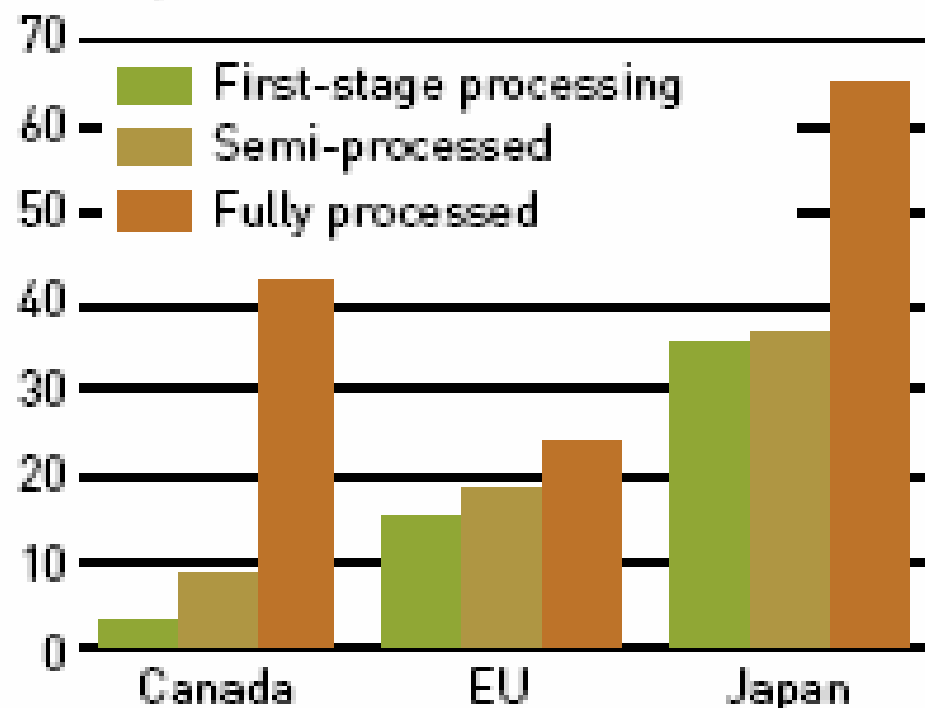
Potential annual welfare gains from agricultural trade liberalization

With liberalization of:



Source: Anderson et al

Average tariffs (%)



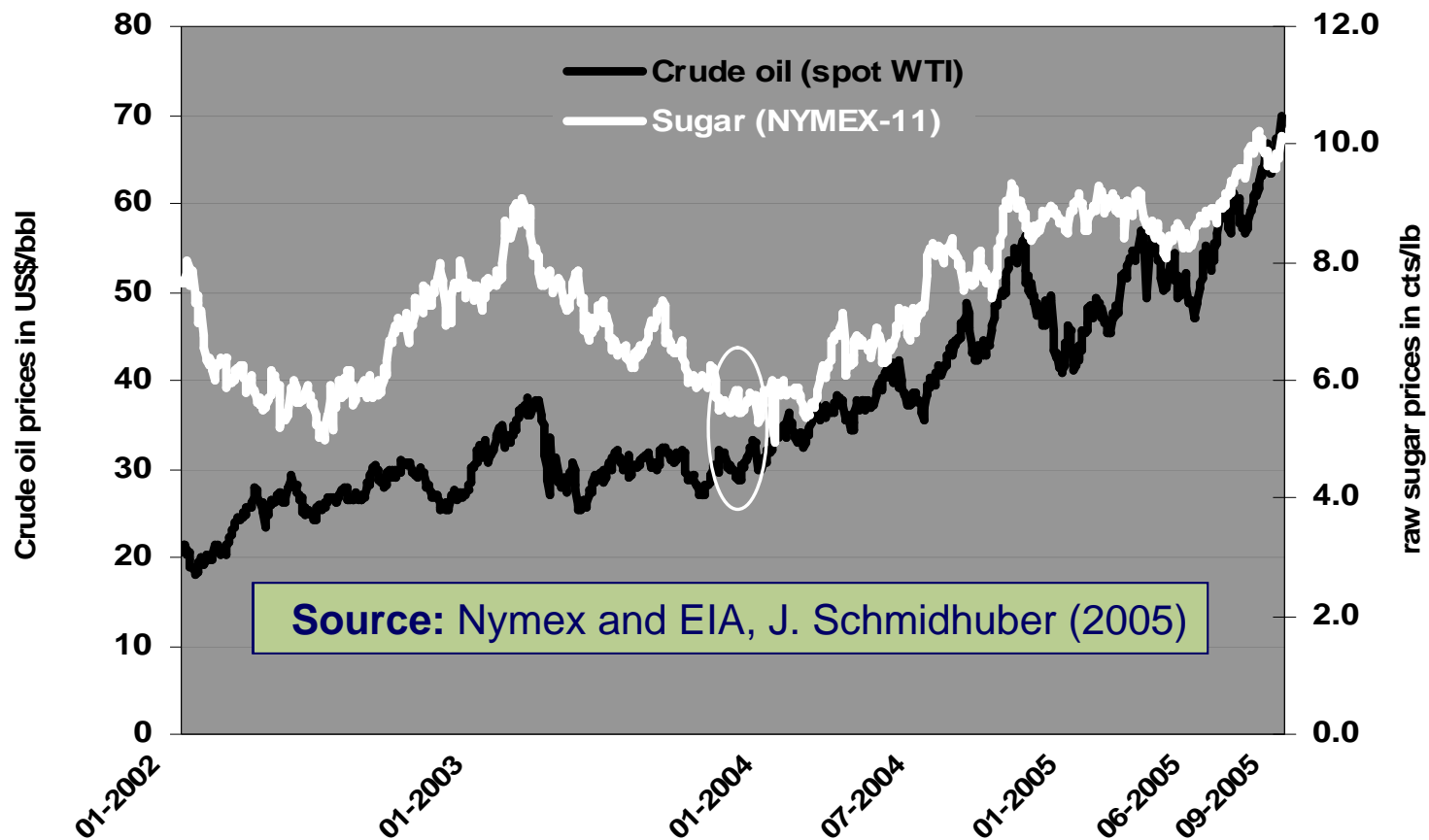
Source: FAO

Is there an impact on agricultural commodity markets?

The energy transition - the price links

"Sweet Substitutes"

Crude oil prices above 30 US\$/bbl drive world sugar prices



Estimated “parity” prices between crude oil and sugar

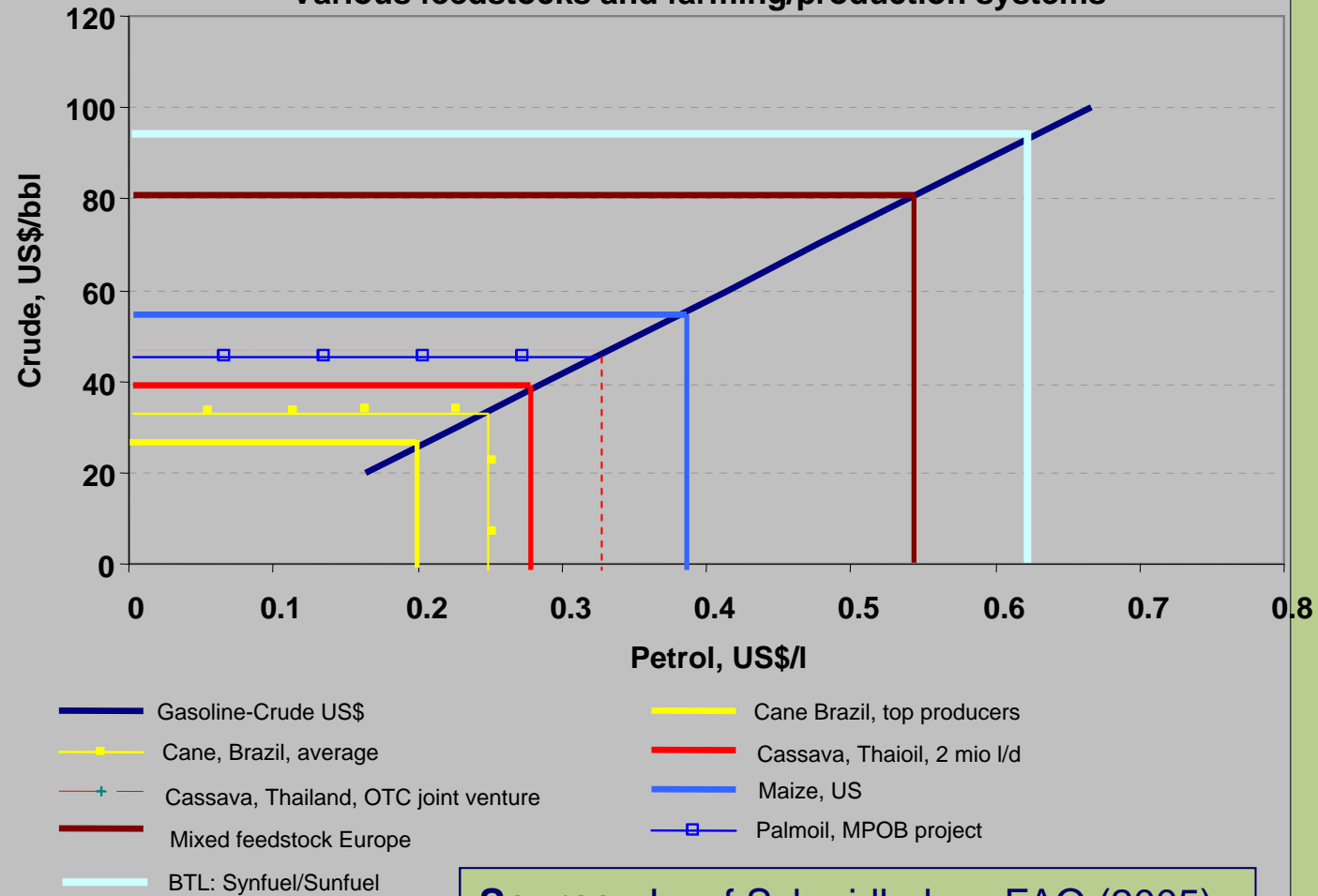
Crude oil price (US\$ per barrel)	Raw sugar (US cents per pound)
40	7.52
60	12.94
65	13.37
70	13.98

Source: FAO Commodities and Trade Division

Competitiveness and price links

Parity prices: Petrol–Crude oil – Ethanol

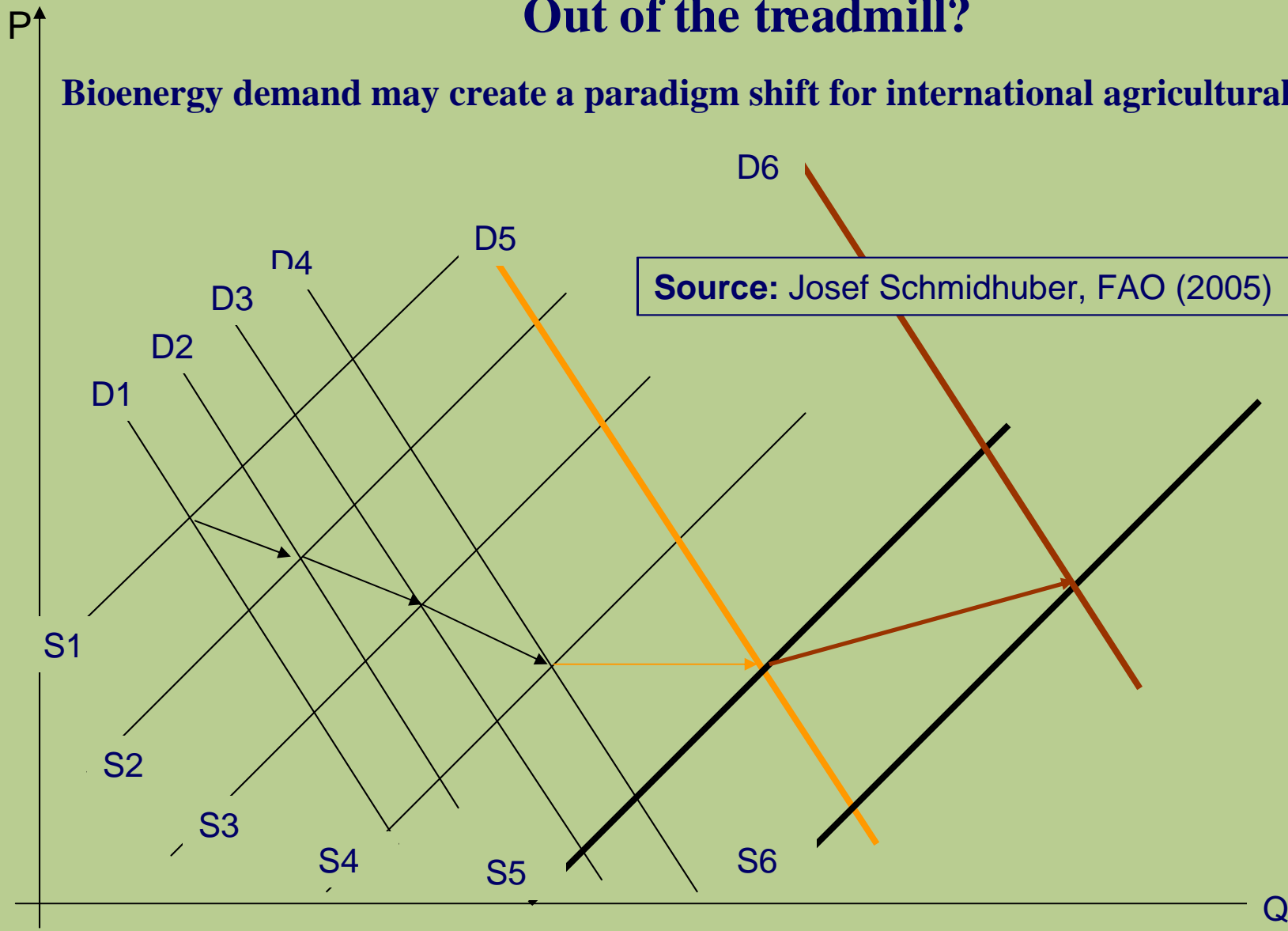
Various feedstocks and farming/production systems



Source: Josef Schmidhuber, FAO (2005)

Out of the treadmill?

Bioenergy demand may create a paradigm shift for international agricultural markets



Impacts on international commodity prices (2030 simulation results)

	An additional 10 million tonnes of ...				
	Sugar	Maize	Sugar and Maize	Soybeans and Maize	Sugar, Maize and Soybeans
Corresponding energy [biofuels]	0.195 EJ	0.087 EJ	0.282 EJ	0.167 EJ	0.349 EJ
Commodity	... used for biofuels would change international prices (percent) in the long-run by :				Source: Josef Schmidhuber (FAO) 2006
Sugar	+9.8	+1.1	+11.3	+2.3	
Maize	+0.4	+2.8	+3.4	+4.0	+4.2
Vegetable oils	+0.3	+0.2	+0.2	+7.6	+7.8
Protein	+0.4	-1.2	-1.2	-8.1	-7.6
Wheat	+0.4	+0.6	+0.9	+1.8	+2.0
Rice	+0.5	+1.0	+1.2	+1.1	+1.4
Beef	+0.0	+0.2	+0.2	+0.4	+0.4
Poultry	+0.0	-0.4	-0.4	-2.1	-2.0

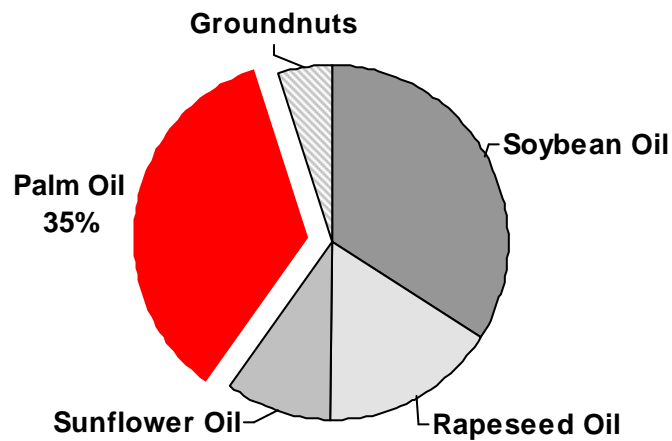
Example: Biodiesel (BD) and Palm Oil

- **BD is adding to global demand for vegetable oil, competing with demand for food uses**
- **on a production cost basis, palm oil is the most competitive BD feedstock**
- **demand for BD growing strongly, thanks to private investment and public support**
- **government presence and regulatory intervention is strong and has the potential to distort markets**
- **BD production for domestic consumption expected to increase further**
- **prospects for international trade in BD or BD feedstocks remain uncertain; national energy policies to play a critical role – but difficult to predict for the majority of cases**
- **future demand for and trade in BD feedstocks perhaps smaller than currently anticipated, possibly resulting in excess production capacity**
- **reduced trade prospect to be felt in particular by palm oil exporters**
- **in the longer term, conventional biofuels expected to face strong competition from high-quality 'second generation' biofuels**

Source: Peter Thoenes, FAO (2006)

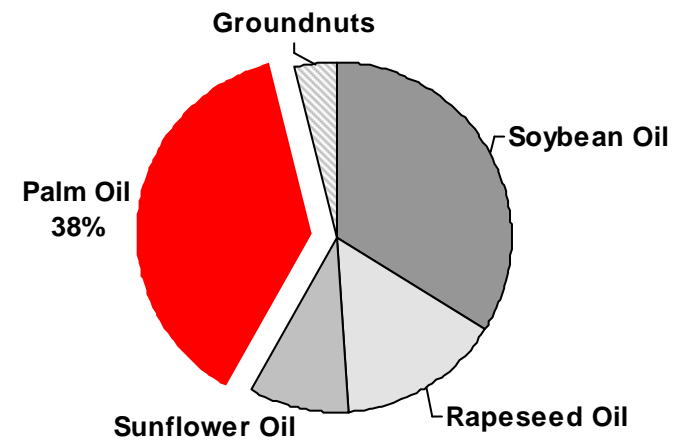
Palm oil's position in the outlook: global vegetable oil supply pattern, 2005/06 – 2015/16

2005-2006



Source: FAPRI data

2015-2016

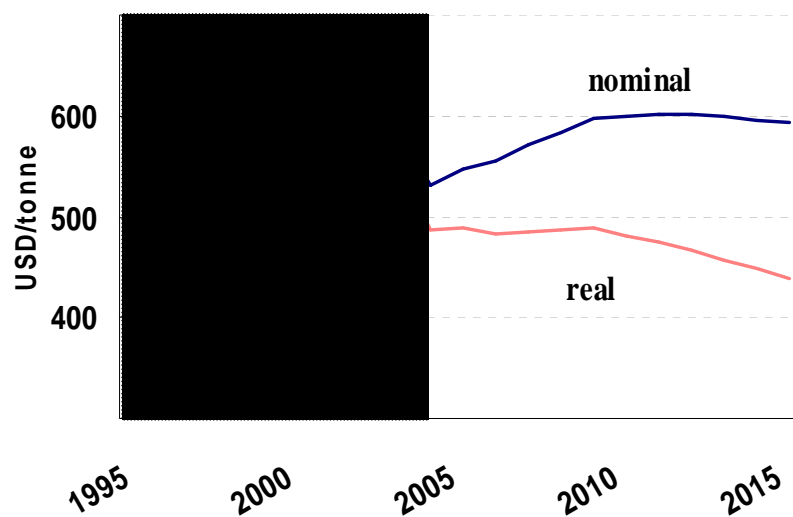


Source: FAPRI data

Source: Peter Thoenes, and Commodities and Trade Division, FAO (2006)

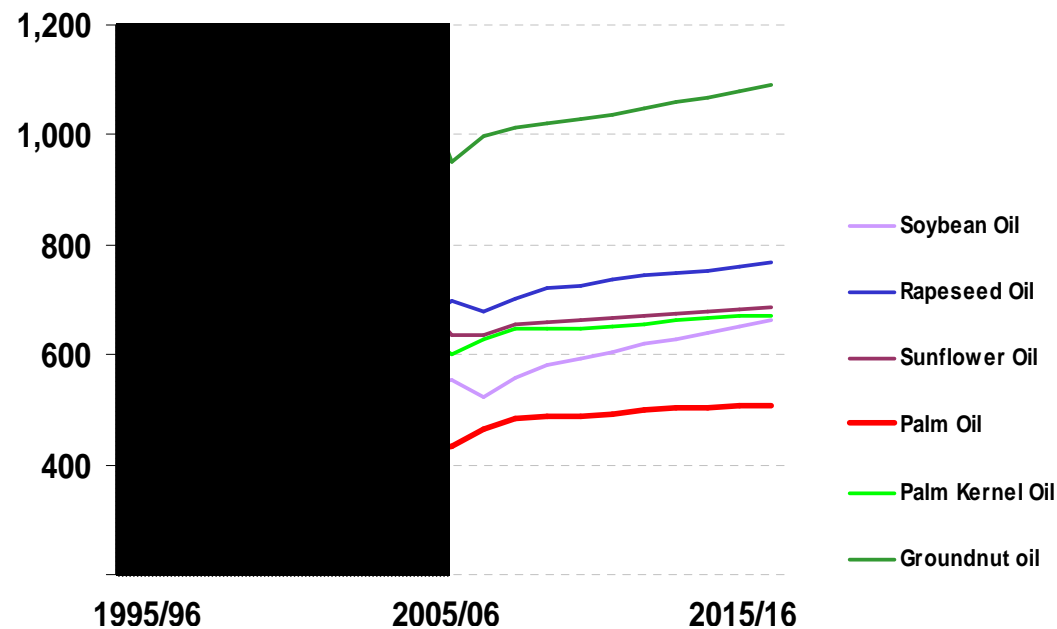
Country perspective: Malaysia & Indonesia: General price outlook

Average vegetable oil price



Weighted average import price, Europe
All prices deflated by the USA GDP deflator with 2000=1
Source: OECD and FAO Secretariats

Vegetable oil price



Import prices, Europe
Source: FAPRI data

Source: Peter Thoenes, and Commodities and Trade Division, FAO (2006)

Summary of AG-Commodity Market Effects

Energy prices above US\$30/ bbl directly affect agricultural prices

- they create a floor price for agricultural produce;
 - but agricultural prices will not rise faster than energy prices;
- **Paradigm shift possible with an end of falling real prices, but neo-Malthusian scenarios are unwarranted, as:**
- **Alternative fossil energy sources (CtL, GtL) limit increases in energy prices**
- **Important: This limits profitability of bioenergy investments (limits to euphoria) in the long-run!**
- **Bioenergy feedstock would price themselves out of the energy market.**

Source: Josef Schmidhuber, FAO (2005)

The speed and extent of the energy transition will depend on ...

- ... how fast end-use constraints can be overcome (FFV), blending, ETBE, co-operation of the oil industry, etc.;
- ... how long/ if energy price will stay above the US\$30-35/bbl range;
- ... costs and availability of alternative fuels (efficient fossil, hydrogen, etc)
- ... technological progress (cost-efficient conversion technology for ligno-cellulosic feedstock);
- ... whether and how fast trade barriers and NTBs can be lifted;
- ... adjustment of national (MTBE ban, etc.) and international legislation (Kyoto, etc.);
- ... availability of national and international support;

Source: Adapted from Josef Schmidhuber, FAO (2006)

Conclusions

- **Large potential for bioenergy in developing countries; as energy source, bioenergy is becoming increasingly competitive**
- **Differential impacts across commodity markets and countries (Schmidhuber 2006):**
 - winners and losers;
 - agricultural renaissance vs. food security concerns;
- **Externalities can be significant: large potential benefits but opportunity costs regarding land use of large scale projects are of concern**
- **The delivery of SD co-benefits is not automatic. It would be strengthened by an institutionalization of externalities valuation in the Energy market.**
- **Existing analysis has overemphasized the role of food production at the expense of the other dimensions of food security**
- **Food security and bioenergy systems are characterized by very complex interactions between the macro and micro level**

Need for further analysis and research

- What impacts on land prices, rents, the environment, biodiversity, etc.?
- What impacts on economic development and the traditional development paradigm? Will the ever excluded benefit? Pro-poor?
- How WTO compatible are support for and protection of agricultural bioenergy fuels and feedstock?
- What are adequate policy frameworks, institutional settings, etc?
- Partial Equilibrium Models (agriculture), Energy Models, and Global Land Use Models can be useful in determining the overall boundary conditions and some input variables for the evaluation of food security and bioenergy
- Careful, local/national analysis is required to qualify the different determinants of the food security and bioenergy nexus
- The results of this bottom-up analysis can feed back into the design of effective policies and the macro-models for LU, Energy and AG

With inputs from Josef Schmidhuber (2006)

Outlook and next steps

- **For synchronizing and/or coordinating the global modeling efforts a coordinating mechanism, forum or meeting point and respective incentives for collaboration for the different modeling communities should be created**
- **For the country level analysis, FAO would like to stimulate the formation of national task forces, subject to the interest of bioenergy producing member countries**
- **FAO's International Bioenergy Platform (IBEP) offers a reference and framework for a concerted analysis of sustainable bioenergy in general and the bioenergy and food security nexus in particular**
- **Project on Analysis, capacity building and national/local level strategy and project development regarding the Food Security-Bioenergy Nexus will start in 1/2007, including countries in Africa**
- **4/ 2007: Expert meeting on sustainable bioenergy and food security at FAO headquarters in Rome**
- **State of Food and Agriculture 2008: bioenergy focus**