Economic diversification, food security and the interlinkages between the agricultural and the energy sector.

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Competition between food and non-food uses

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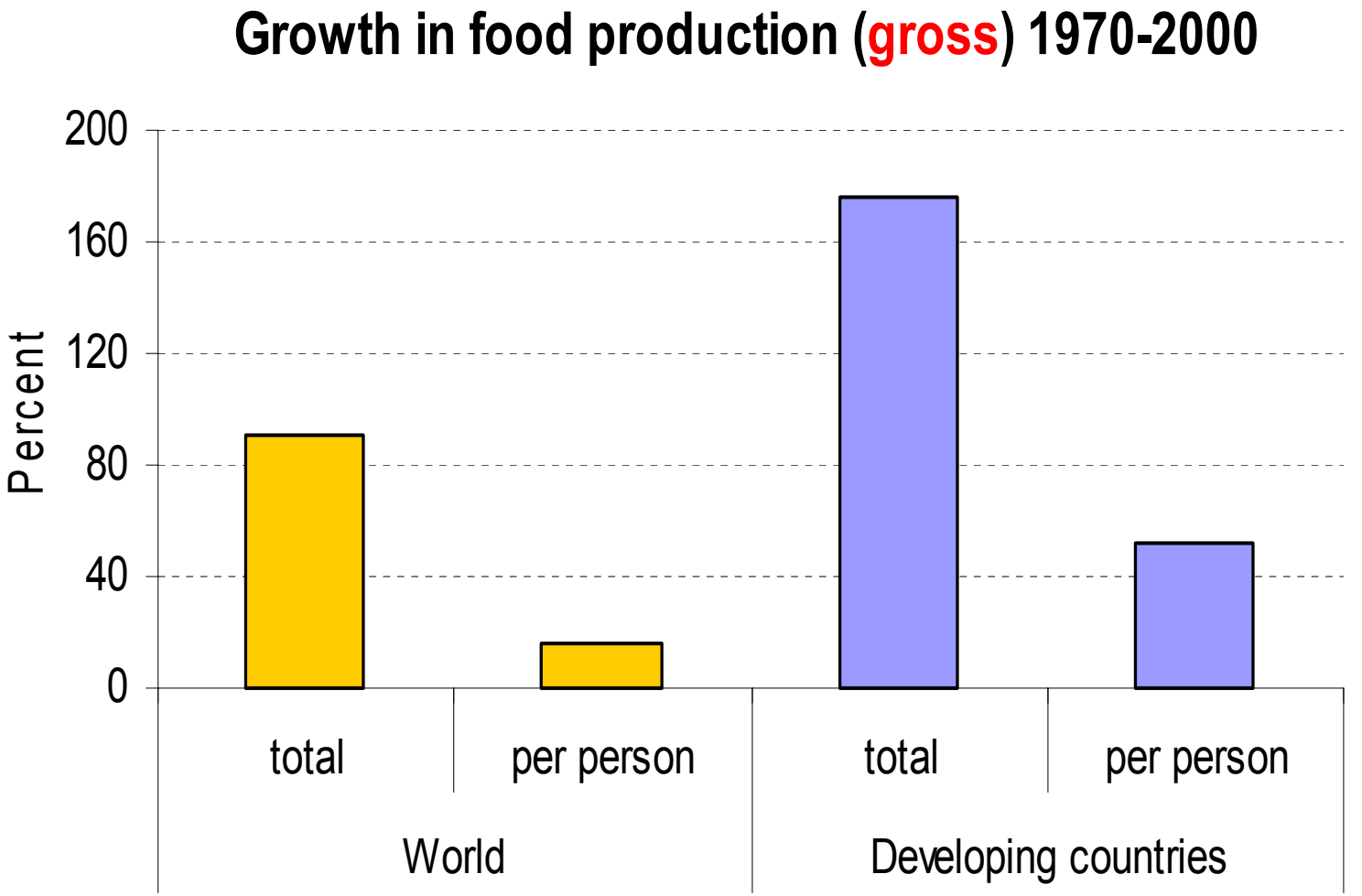
Overview

1. Food markets: where do they come from...
   ... and where are they headed for?
2. Non-food markets: How big is the potential, globally and regionally?
3. How does an increased use of bioenergy affect food prices and markets and ...

   ... how competitive are the various forms of bioenergy?
4. How does food-fuel competition and higher food and fuel prices affect international food security?

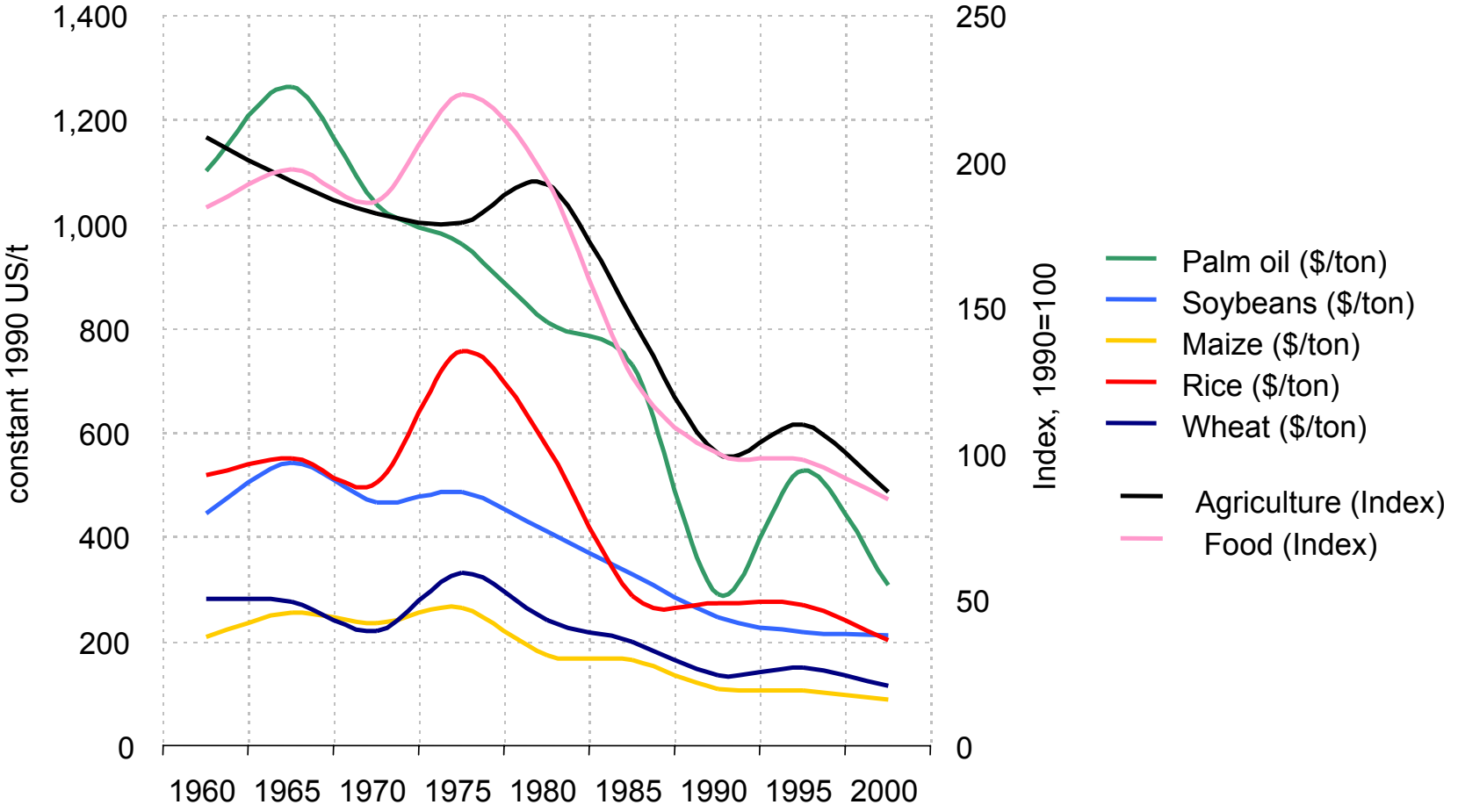
A. Looking back on past achievements

The benefits of modern agriculture have been immense…



Looking back on past achievements ...

A drastic decline in real prices for food and agriculture



Source: World Bank, "Pink Sheets"

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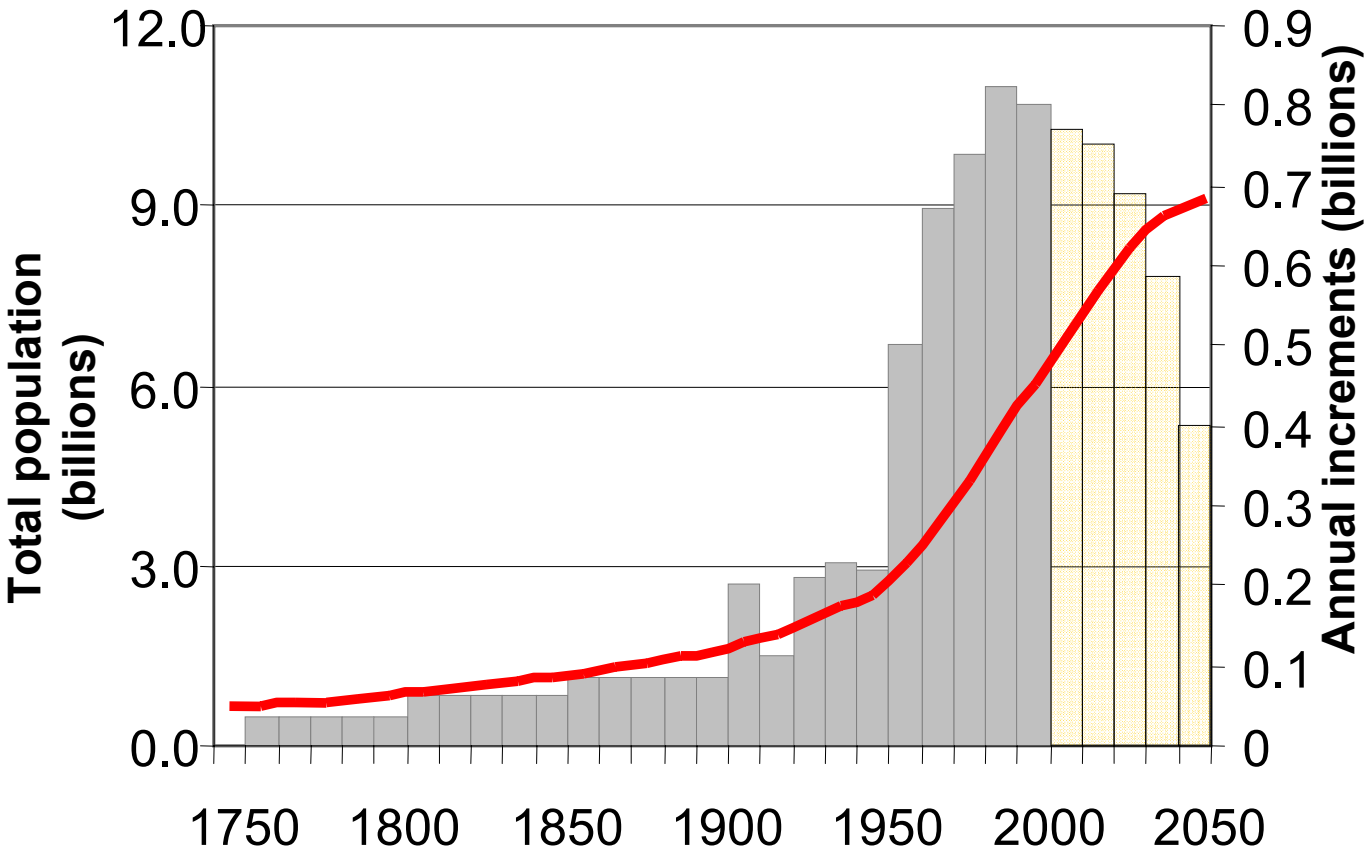
1. Food markets: where do they come from...

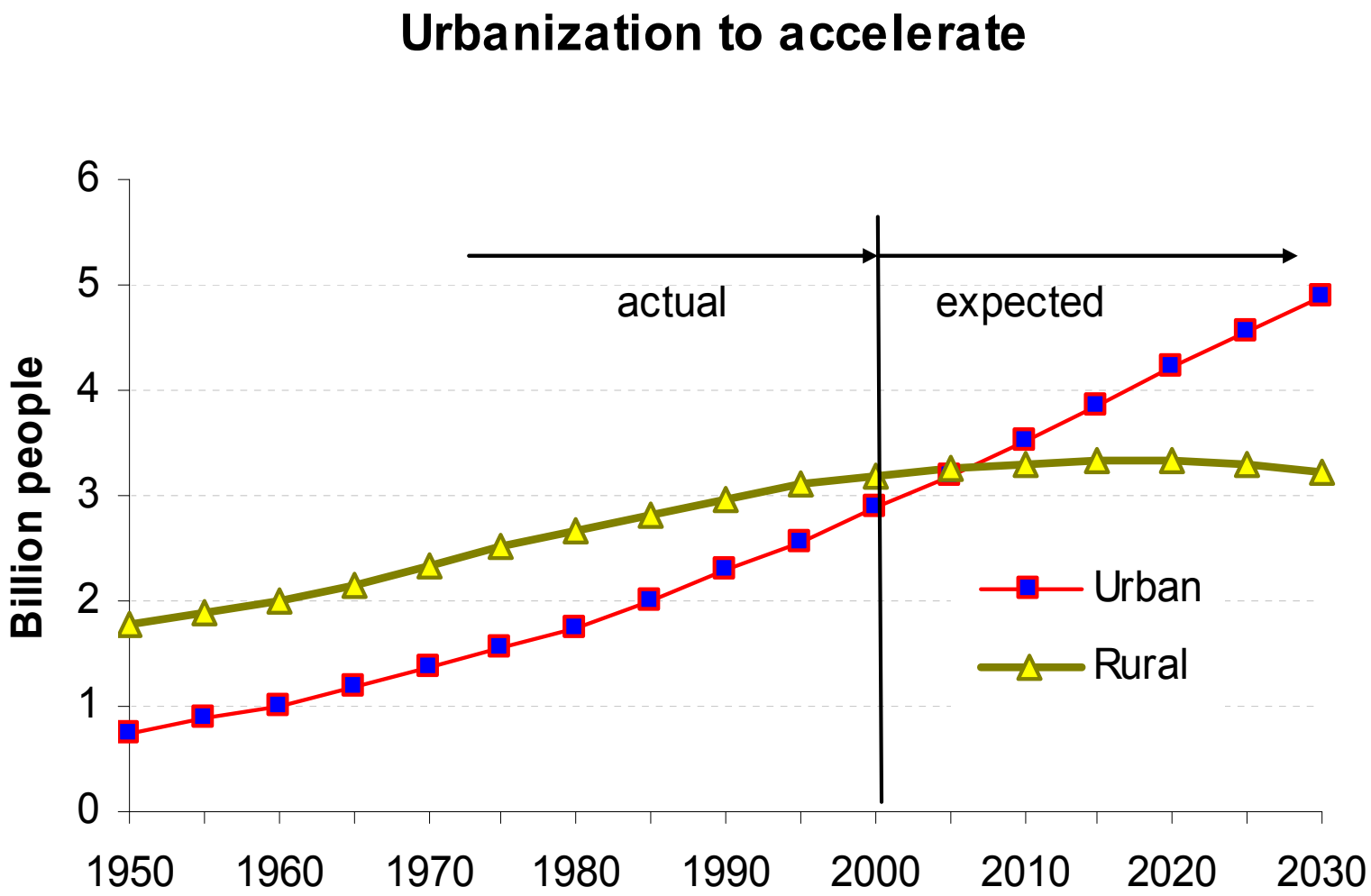
   ...and where are they headed for?

Food markets: drivers of the long-term outlook

A drastic slow-down in world population growth



Food markets: drivers of the long-term outlook



Source: UN, World Population Assessment 200

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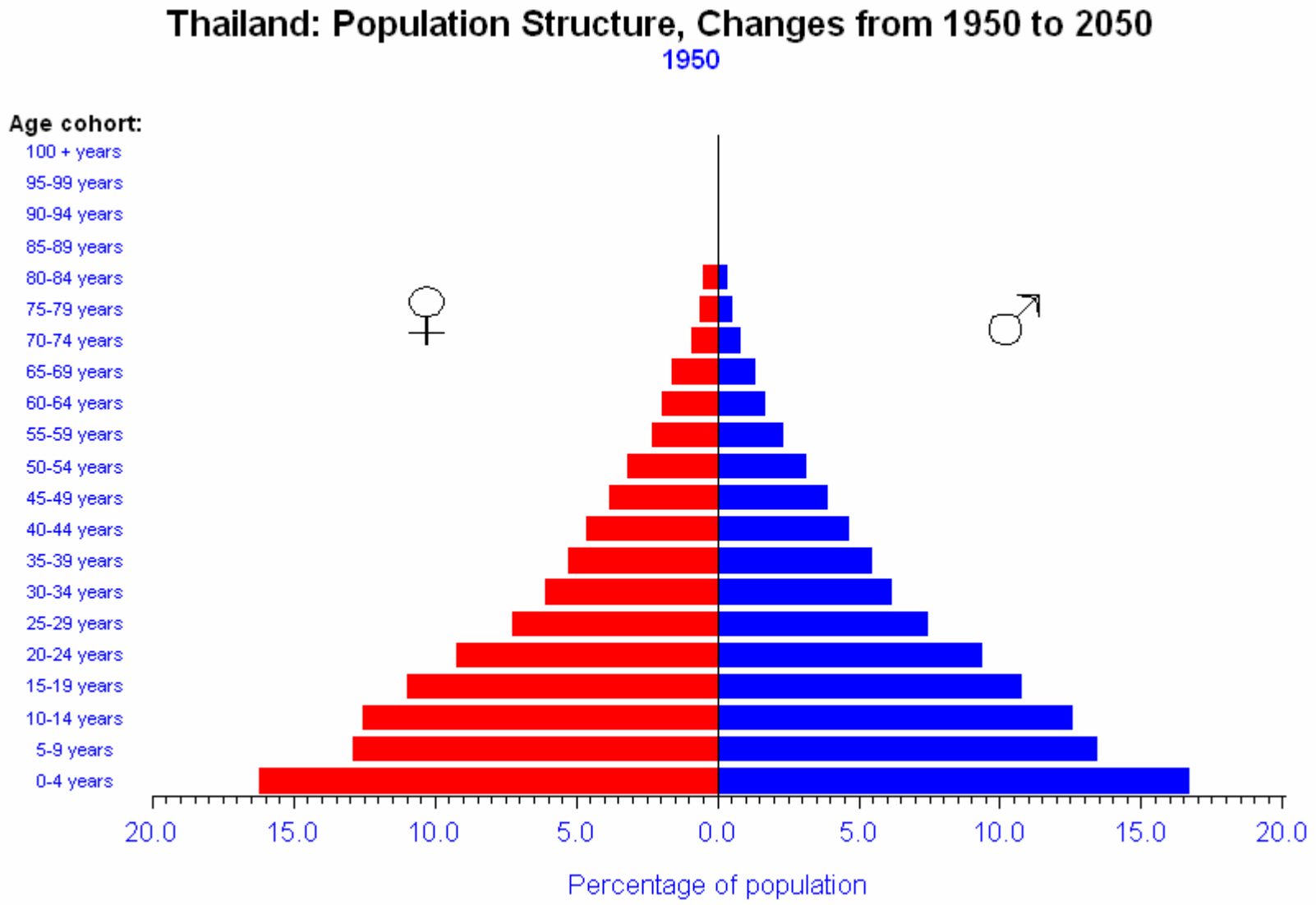

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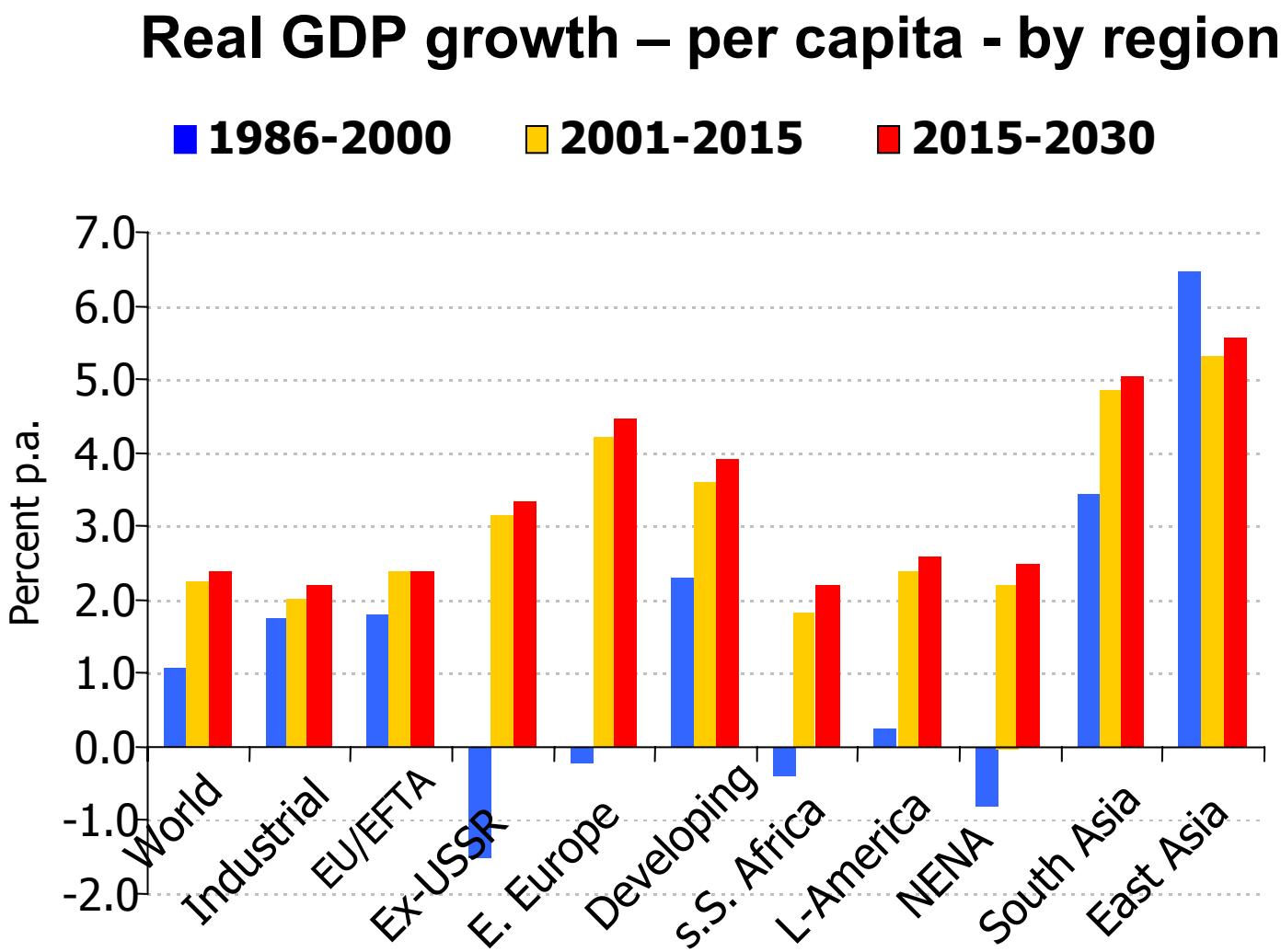
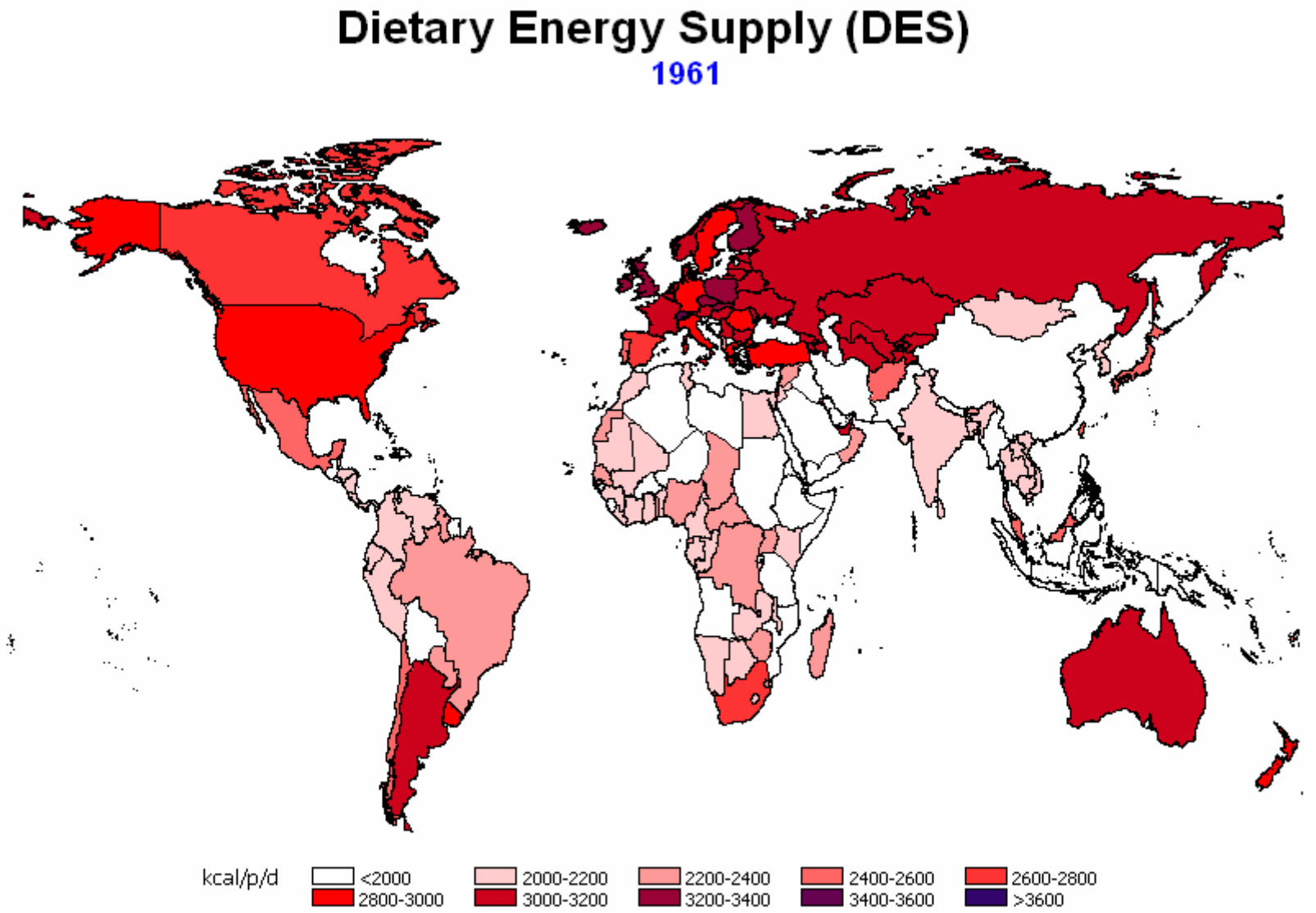
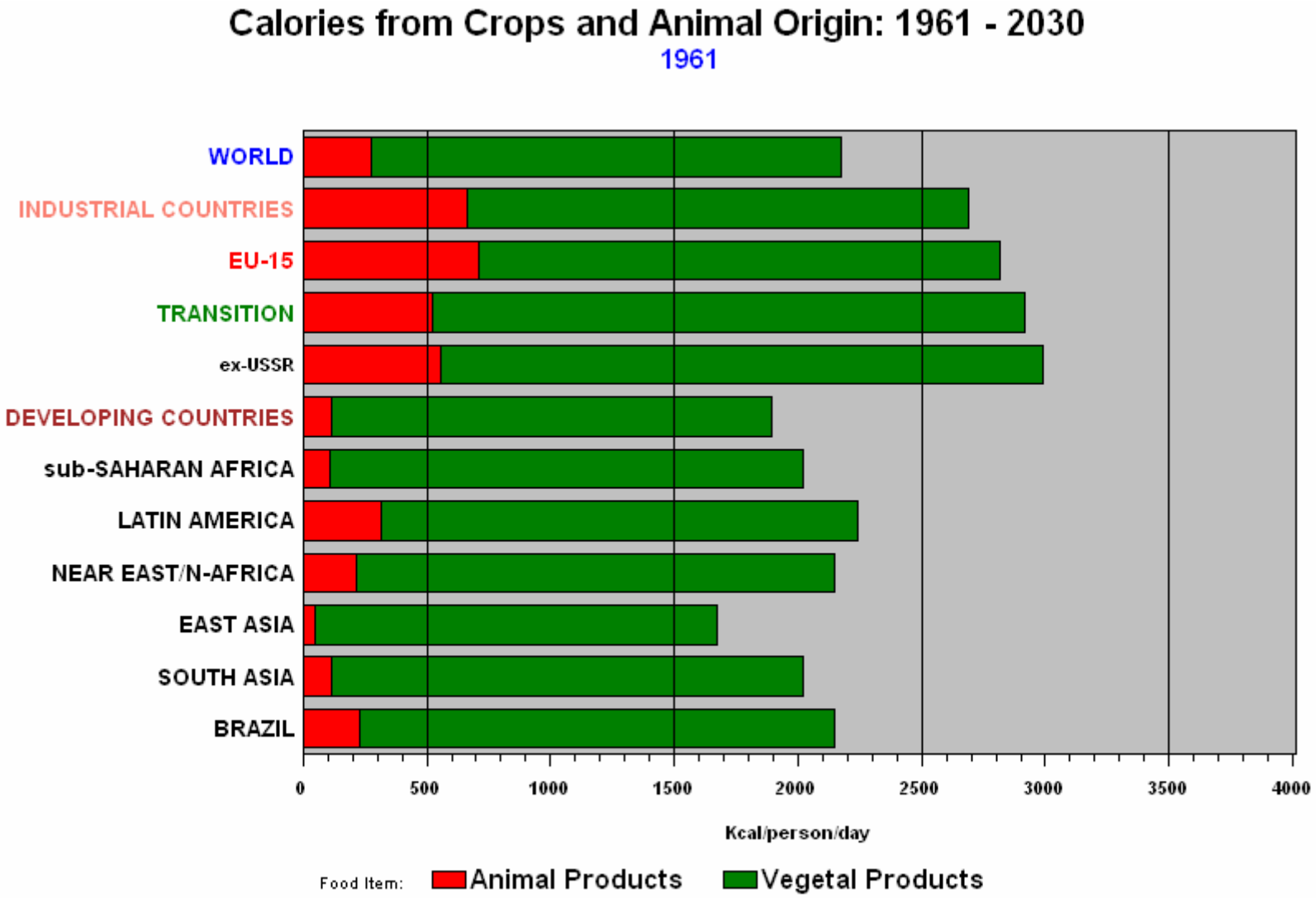


Source: World Bank, GEP 200

Food markets: Review and outlook to 2030

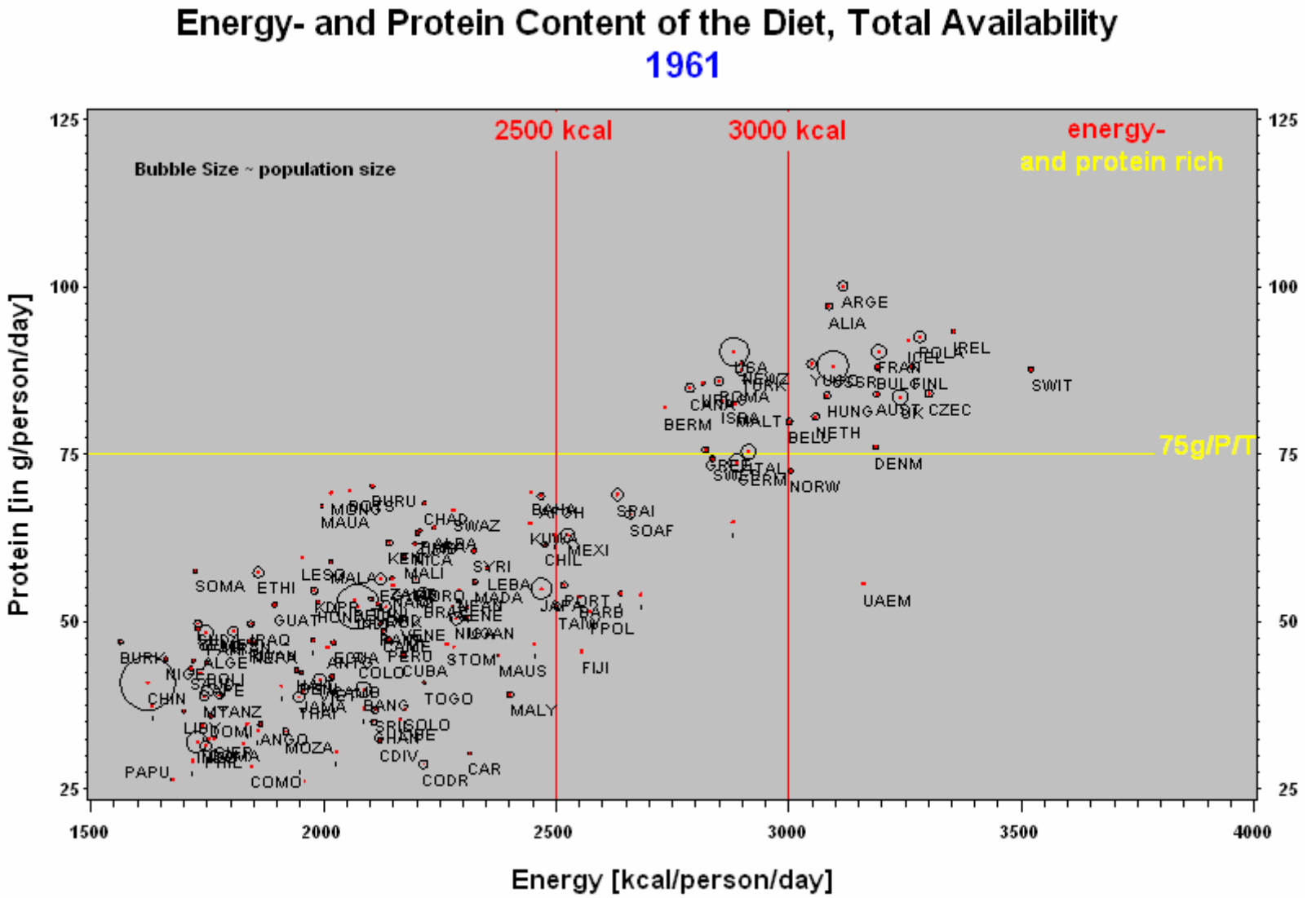


Food markets: Review and outlook to 2030



Source: FAO, Global Perspectives Studies Group
Josef Schmidhuber(2006)

Food markets: Review and outlook to 2030



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How big is the market for biofuels?

Energy production and potential, biofuels and land use

			Exajoule (10^{18}), EJ[9]			million ha
Energy source		Year	World	OECD	non-OECD	World
All sources (TPES)		2002[2]	428	224	205	
		2030[2]	670			
		2050[2]	850			
Biomass	Actual use	2002[2]	47[11]	14	33	
	Theoretical potential		>>2000	Global photosynthesis: ~ 4000 EJ		
	Technical potential	1990[1]	225			
		2050[1]	400			
	Economic potential	1990[1]	89			
		2050[1]	158			
Biofuels	Ethanol[7]	2004[3]	0.84	0.34	0.51	9.52[4]
	Biodiesel[7]	2003[3]	0.06	0.04	0.02	0.47[4]
	Potential[1]	2050[1]	53[10]			
			million ha			
Agricultural land[8]	Used	1997-99	1506	658	848	850[4/5]
	Total suitable		4188	1406[6]	2782[6]	(4730)

1.) Potential based on Schrattenholzer and Fischer, IIASA, 2000
2.) Based on IEA: Key energy statistics, 2004
3.) Derived from http://www.earth-policy.org/Updates/2005/Update49.htm, Earth Policy Institute
4.) Assuming an average yield per hectare for ethanol of 4200 l (3000 l US maize, 5500 l Brazil cane, 6900 l France sugar beet) and of 3800 l/ha for biodiesel (average). Most recent yields are about 10% higher for cane and 20% higher for maize.
5.) 850 million ha would be required to meet today's transport fuels needs (77 EJ) at current yields (l biofuel/ha), technology, and crop composition.
6.) Area for developing and developed countries, not OECD and non OECD
7.) Assuming an energy content of 34 MJ/l for biodiesel and 21.1 MJ/l for ethanol
8.) Bruinsma (ed), World agriculture: towards 2015/2030, An FAO Perspective, 2003, total suitable land for rainfed agriculture
9.) 41.868 Mtoe = 1 EJ
10.) IEA (2003), "Biofuels for Transport", table 6.8.

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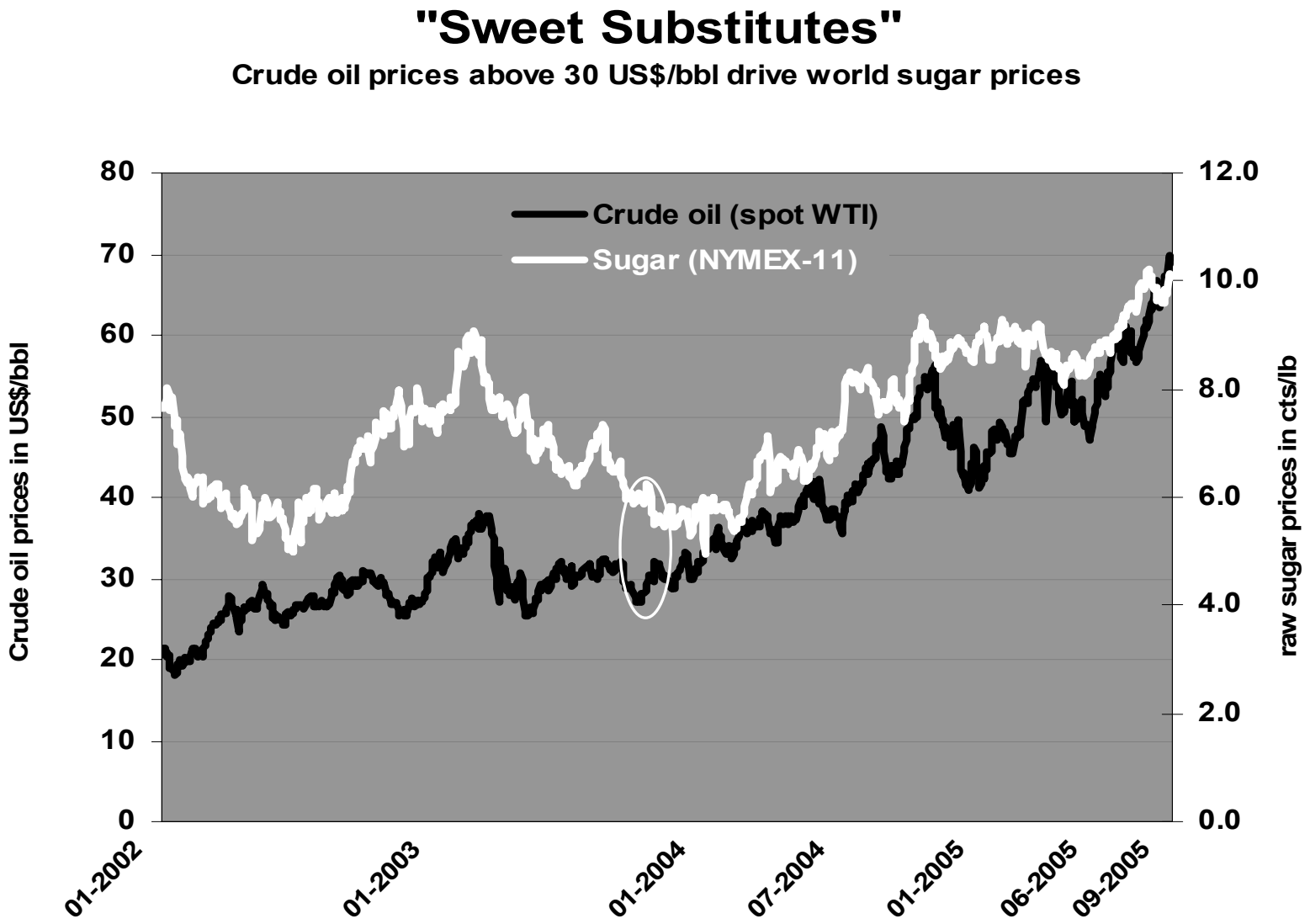
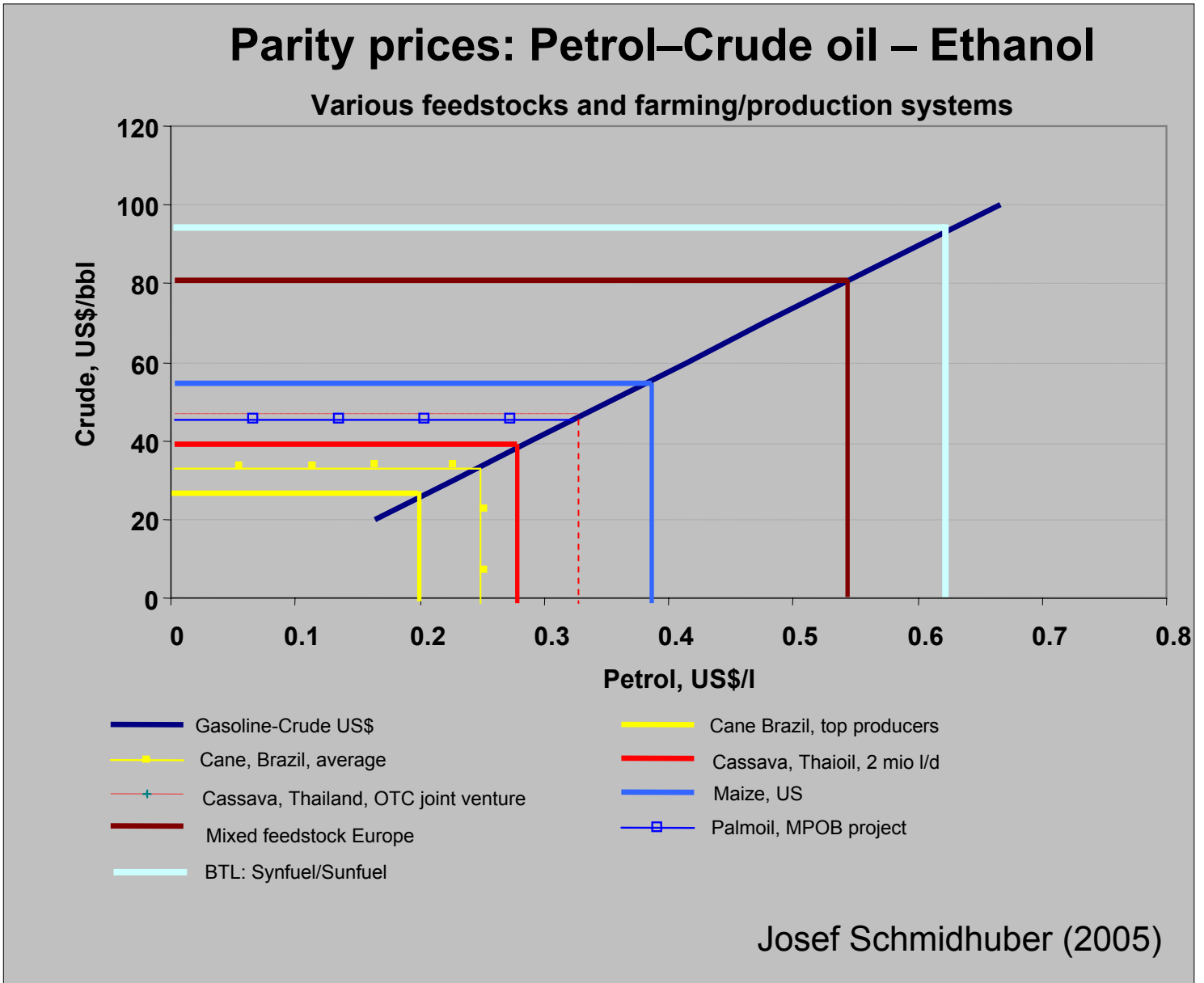
The price links

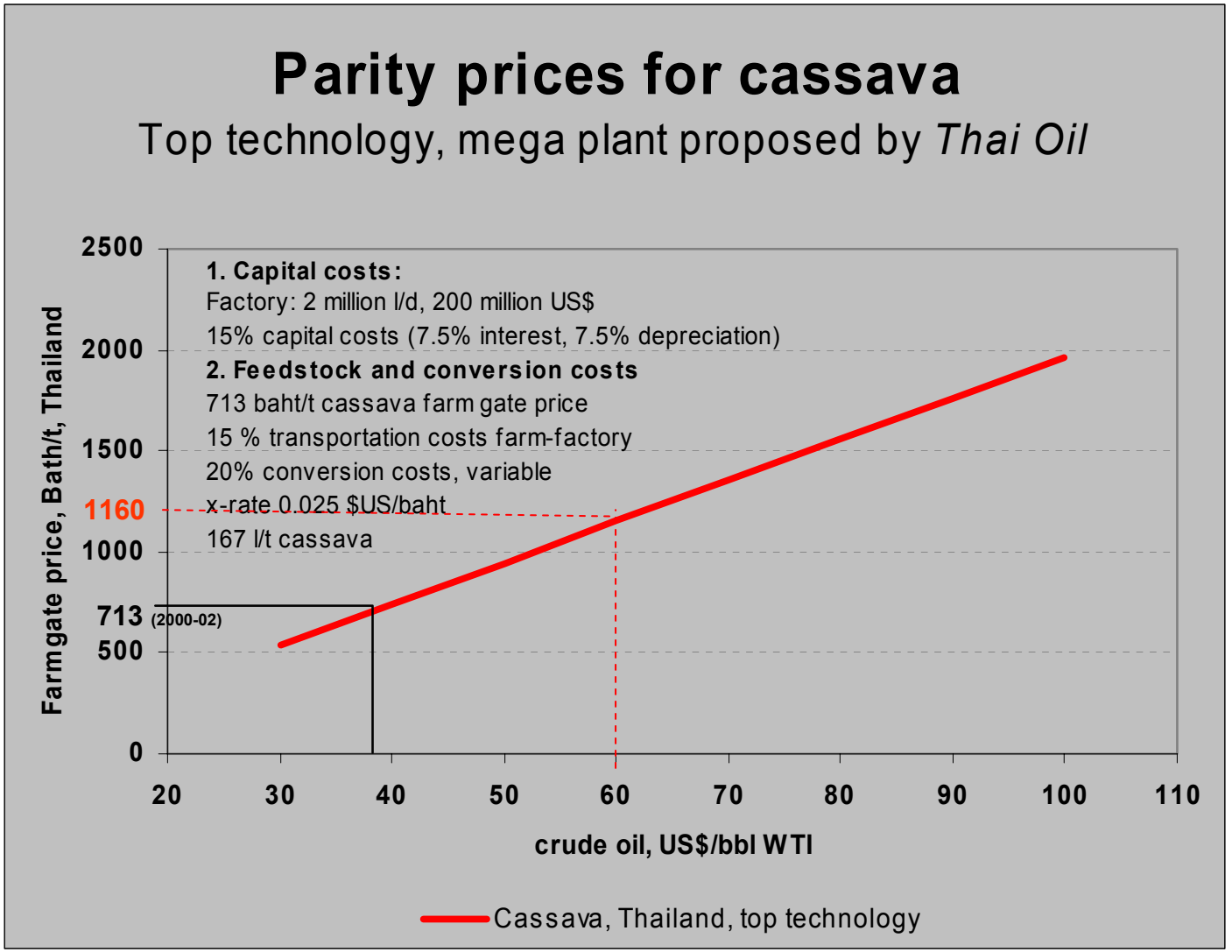


Data: Nymex and EIA, J. Schmidhuber (2005)

Competitiveness by feedstock



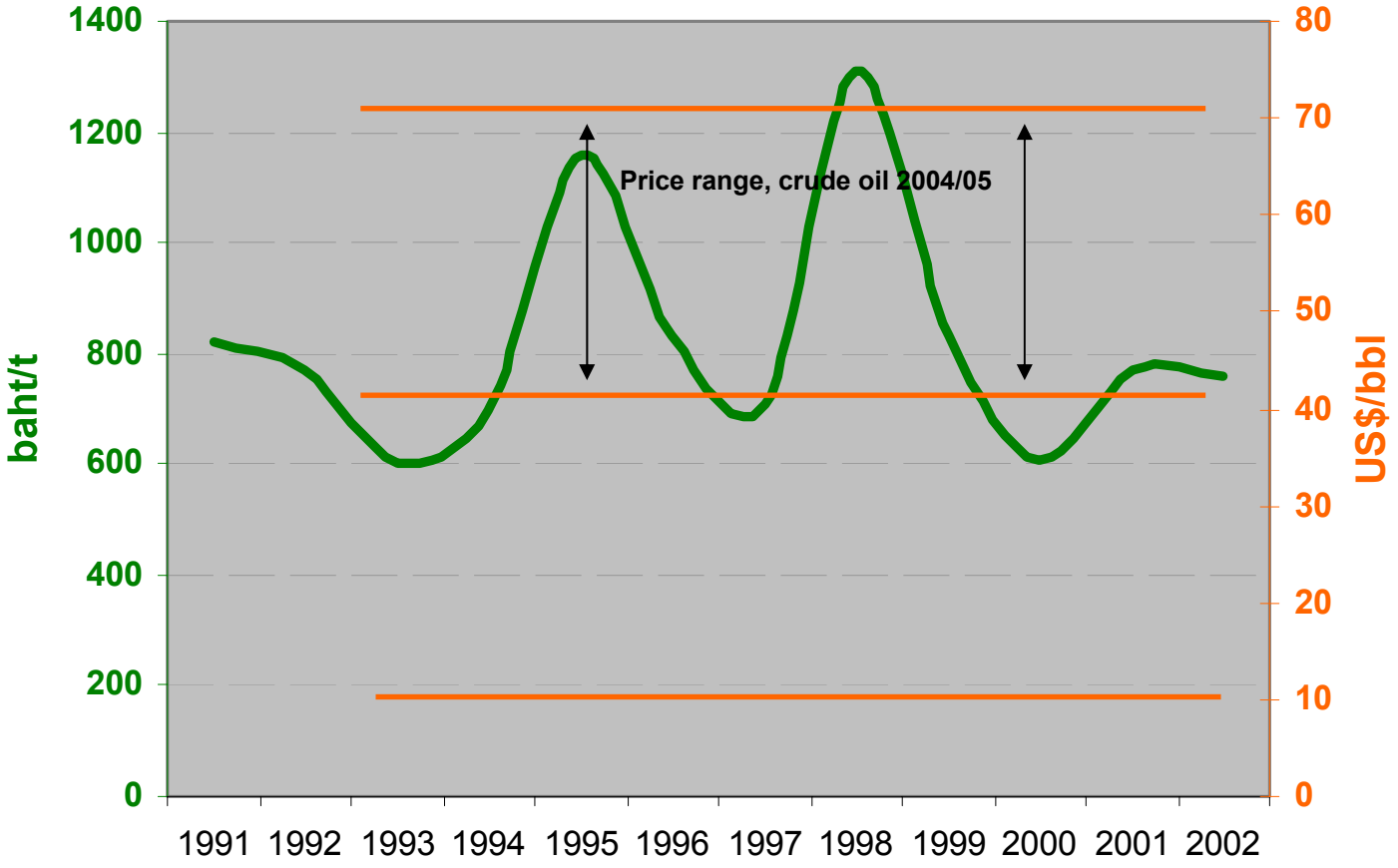
Cassava, mega plant, top technology



Source: own calculations based on EIA, IEA, FAO data. J. Schmidhuber (2005)

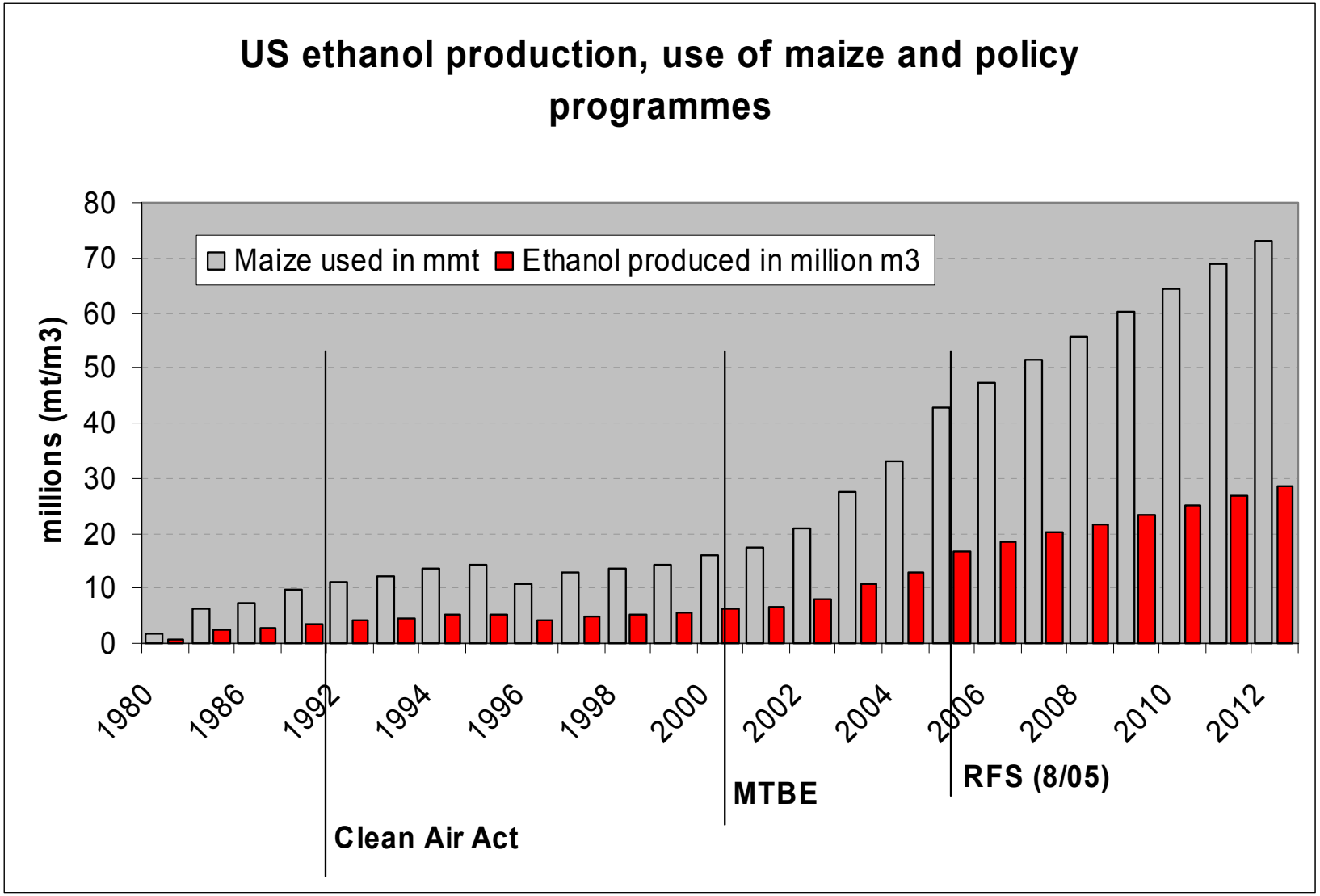
Price corridor for cassava: prices should not fall below the energy equivalents and not rise faster than energy prices

Thai farm gate prices for cassava and parity prices for crude oil



Source: Farm gate prices from FAOSTAT
Parity prices for oil from own calculations

US ethanol-some market impacts

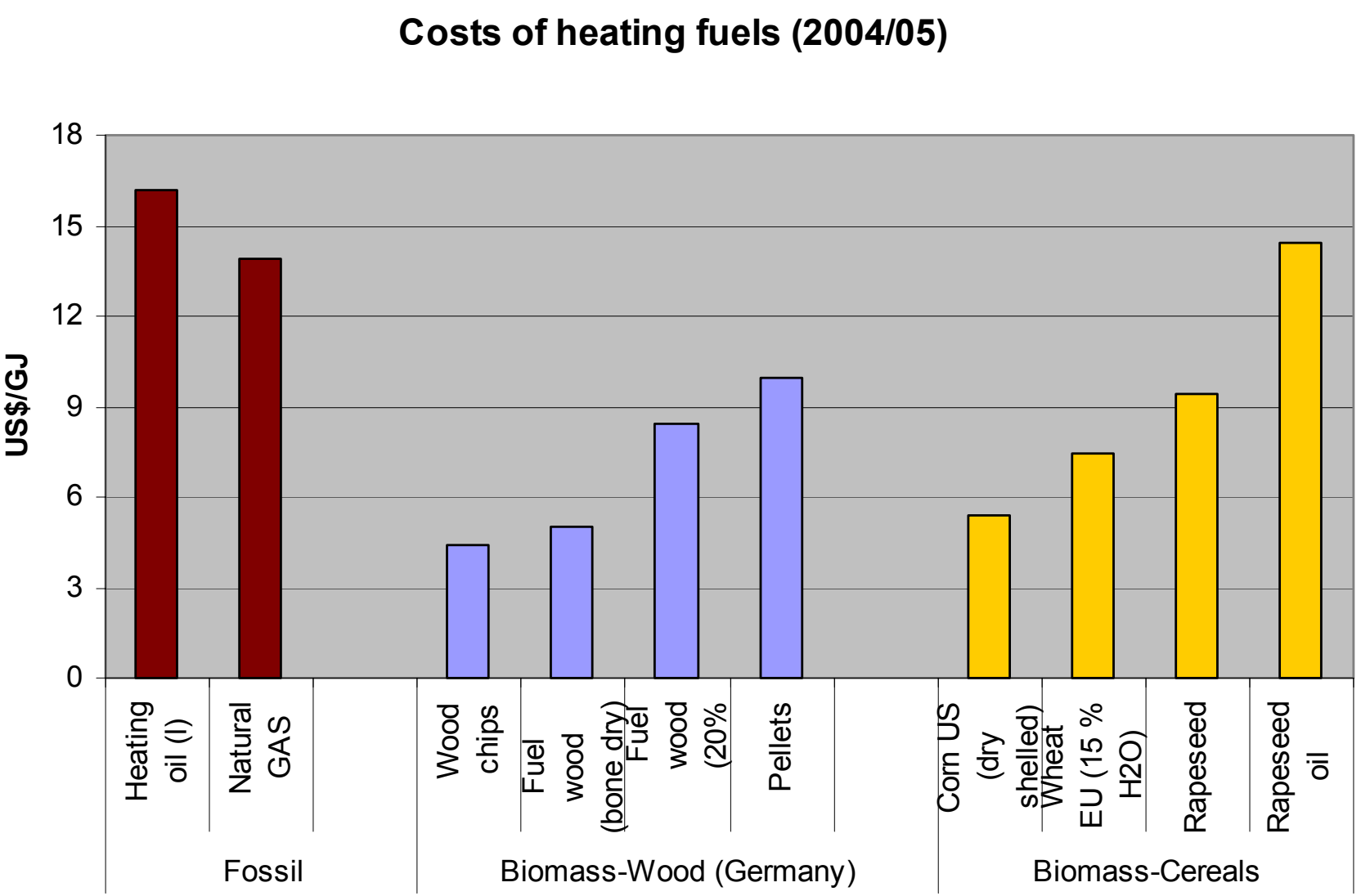


Cross links: Impacts on international commodity prices

	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 :				
Sugar	+9.8	+1.1	+11.3	+2.3	+13.8
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

Source: @2030 simulation results

Saving the conversion costs ...



Source: own calculations based on EIA, IEA, FAO data, J. Schmidhuber (2005)

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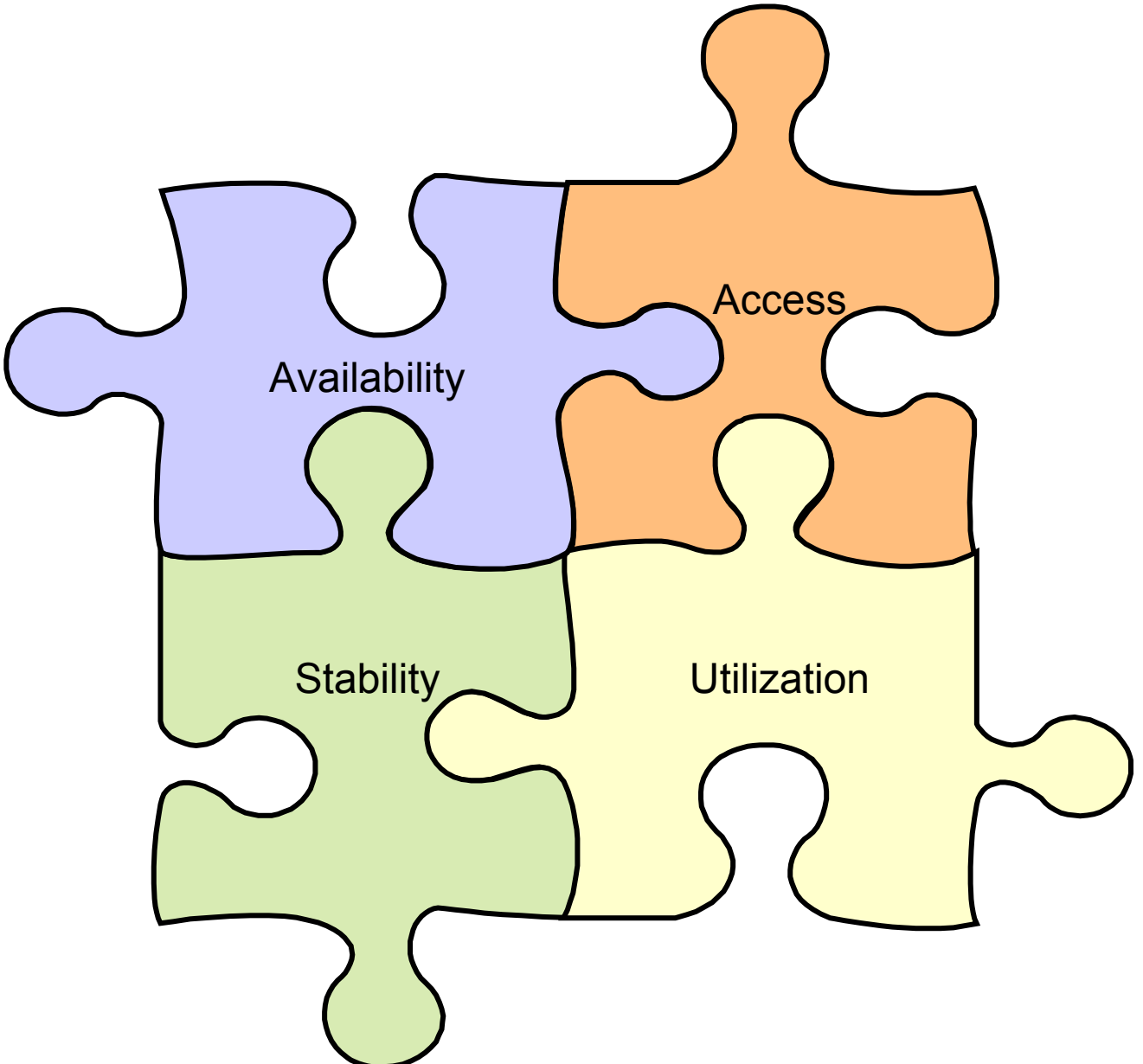
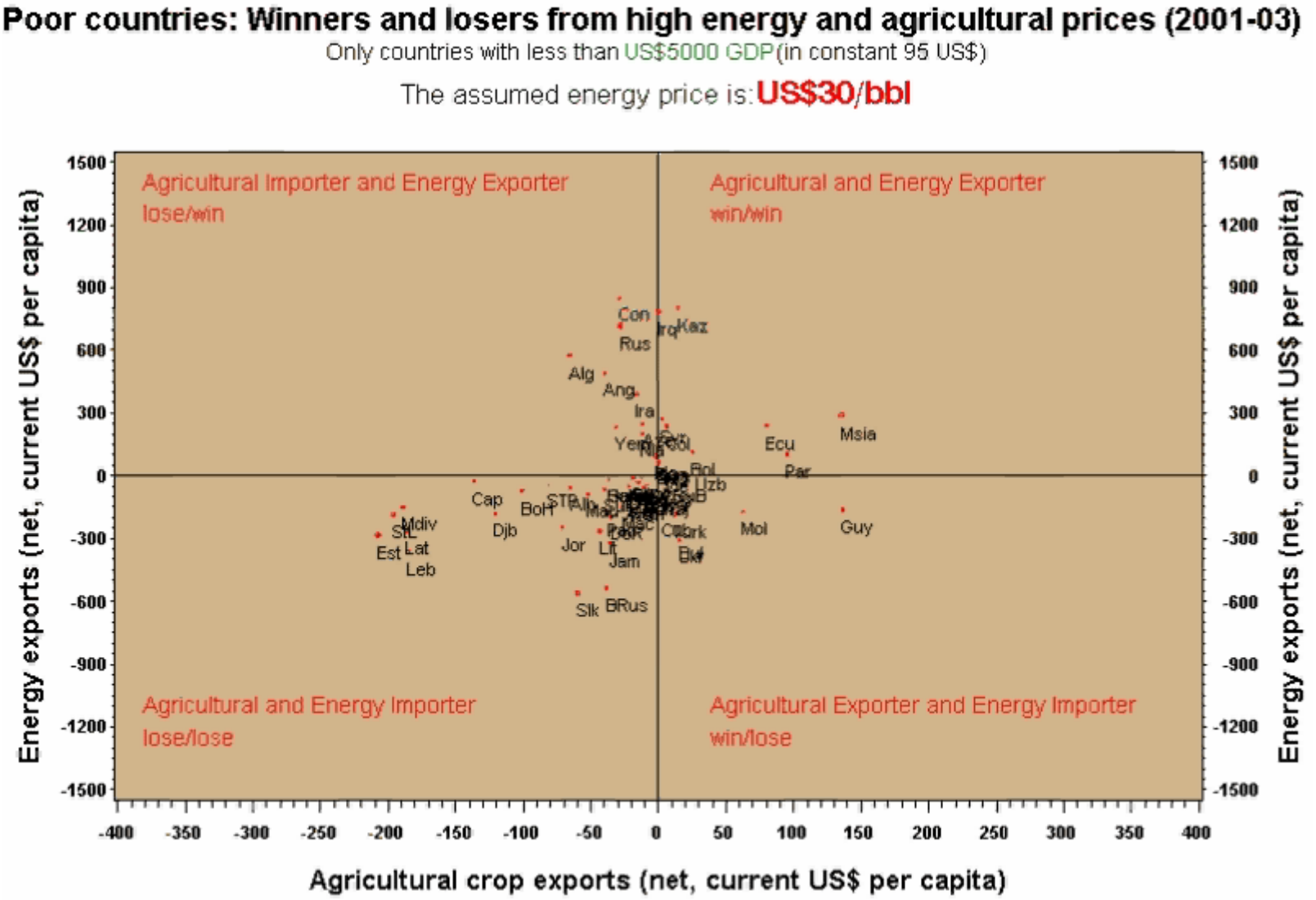
Bioenergy can affect all four dimensions of food security



International food security: Boom or bust for trade balances through an increased link between energy and food prices



Data: FAO, OECD-IEA and US-EIA

Summary, Conclusions, Outlook

1. Potential: differentiate between theoretical, technical and economic potential
   - The technical bioenergy potential was about 225 EJ in 1990 and about 400 EJ in 2050. It could cover about 50% of energy needs.
   - The economically viable potential is less than half of the technical potential (less than 25% of global energy needs).
   - Energy markets are “large” compared with agricultural markets; create (perfectly) elastic demand for competitive agricultural produce.
2. Competitiveness: availability is inversely related to competitiveness
   - Rising fossil fuel prices have made a number of agricultural feedstocks economically viable sources of energ supply, however, there are significant differences in the competitiveness across countries and feedstocks.
   - Crop residues, waste oils, animal and municipal wastes, etc. are the most competitive feedstocks but there potential is limited.
   - Integrated biofuel systems based on multi-feedstock input systems and multi-product output systems (e.g. biofuels and chemical byproducts) to provide improved competitiveness compared to current “one-feedstock one-product” systems;
   - Future: Butanol, Ligno-cellulosic feedstocks and synfuels
3. Energy prices above US$30-35/bbl directly affect agricultural prices:
   - There are numerous channels of prices transmission; own price and cross price effects on the supply side, substitution on the demand side.
   - Energy prices create a floor price for agricultural produce; bioenergy demand as a new intervention system;
   - The price links between agriculture and energy markets rises with rising energy prices, as more feedstocks become competitive energy sources.
   - However, agricultural prices will not rise faster than energy prices.
   - Paradigm shift possible with an end to falling real prices, but neo-Malthusian scenarios are unwarranted.
4. Impacts on food security
   - Winners and losers depending on the trade balance and net effects on energy and food prices;
   - Food availability likely to decline, access to food to improve; rural-urban shift in food security
   - Improvements depend on land ownership, institutional support, creation of rural employment, land and labou intensity of bioenergy use and technologies;
   - Policy challenge: harness benefits for agriculture (renaissance) without harming food security.
5. Research needs and open questions
   - What impacts on land prices, rents, the environment, biodiversity, etc.?
   - How WTO compatible are current support for and protection of ag-bioenergy fuels and feedstocks?
   - Is there need for new companion policies, institutional settings, etc.? New role for co-operatives?