Bioenergy in a globalising world: issues of Sustainable Development, Trade and Policy

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A Conflict of Interests
Energy security and Climate security

According to the Intergovernmental Panel on Climate Change (IPCC) a global emissions reduction by 30%-50% should be reached in the timeframe 2030-2050, to drive the stabilization of CO2 concentration at a safe level (450-550 ppmv) by the end of the century, to avoid irreversible changes in the climate system.

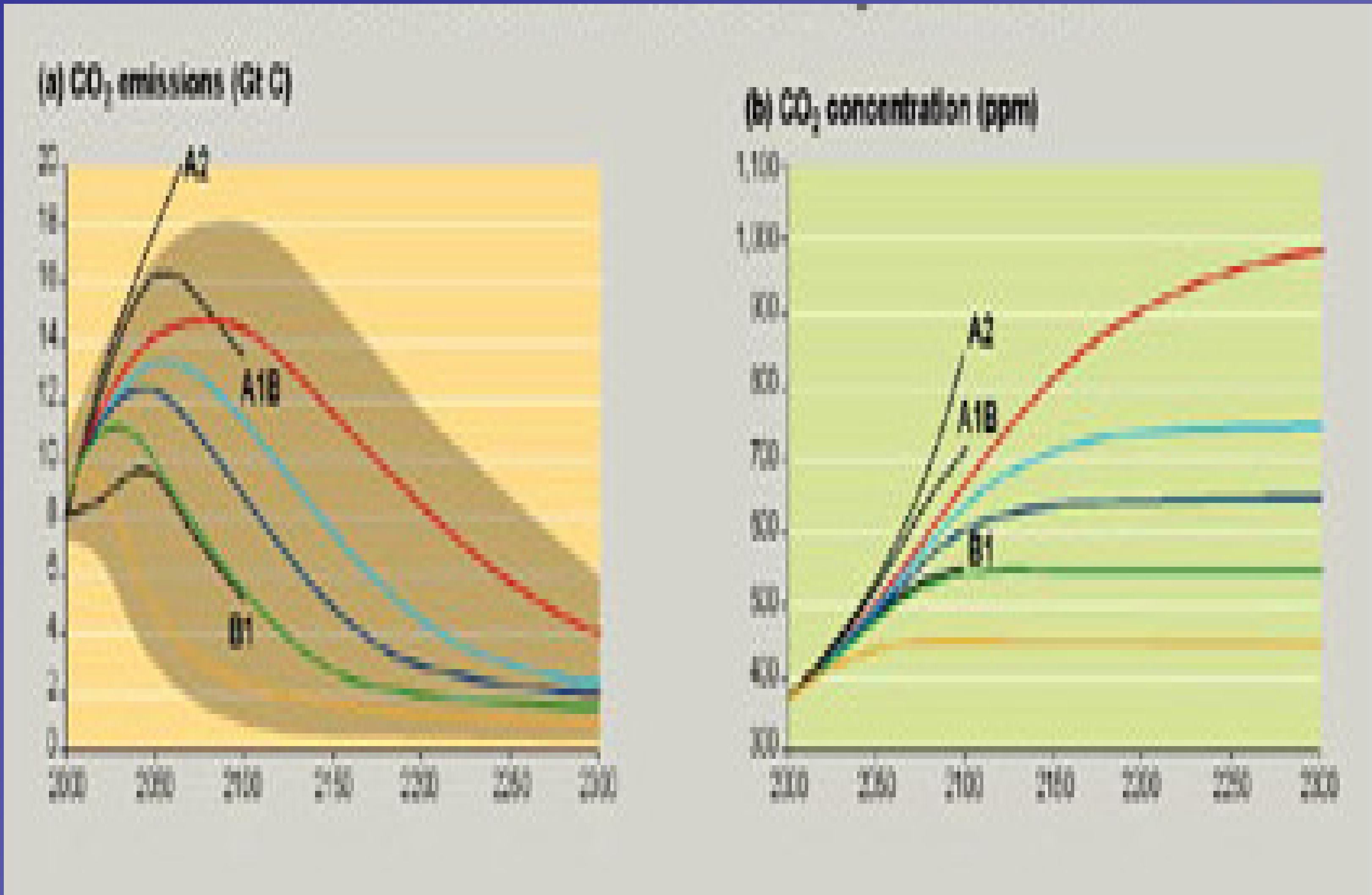
According to the Reference Scenario in the World Energy Outlook 2006, world energy consumption will increase about 55% in the next 25 years, driven by economic and population growth. In 2030, some 55% of the world energy demand is expected from developing countries, compared to 40% now.

The world energy system will continue to be dominated by fossil fuels.

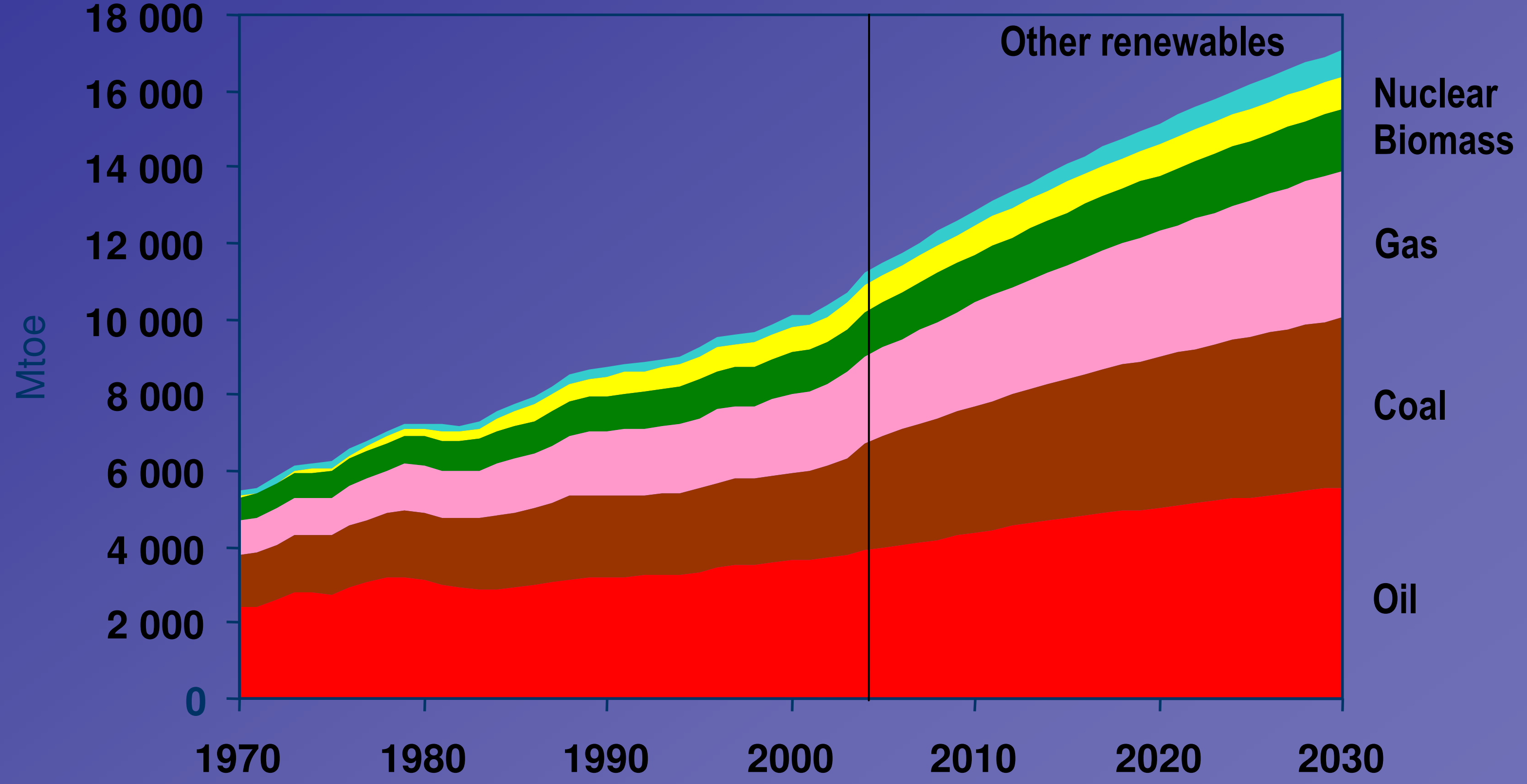
The world's rising demand for energy will drive the increasing of the global CO2 energy related emissions by 2030 of about 50%-60%

The global challenge of stabilizing CO2

(IPCC)



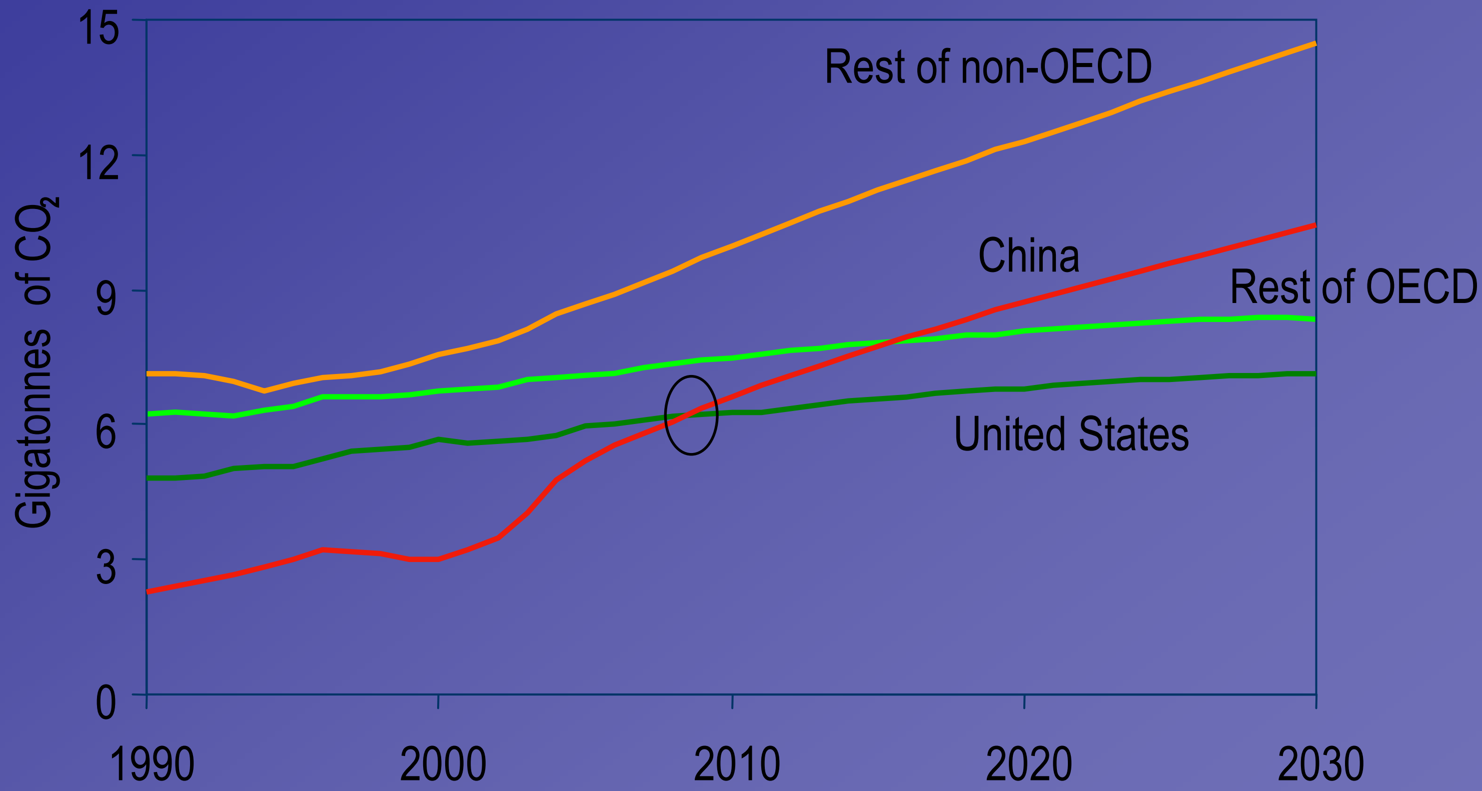
The Reference Scenario: World Primary Energy Demand



Global demand grows by more than half over the next quarter of a century, with coal use rising most in absolute terms

Source: WEO 2006, IEA

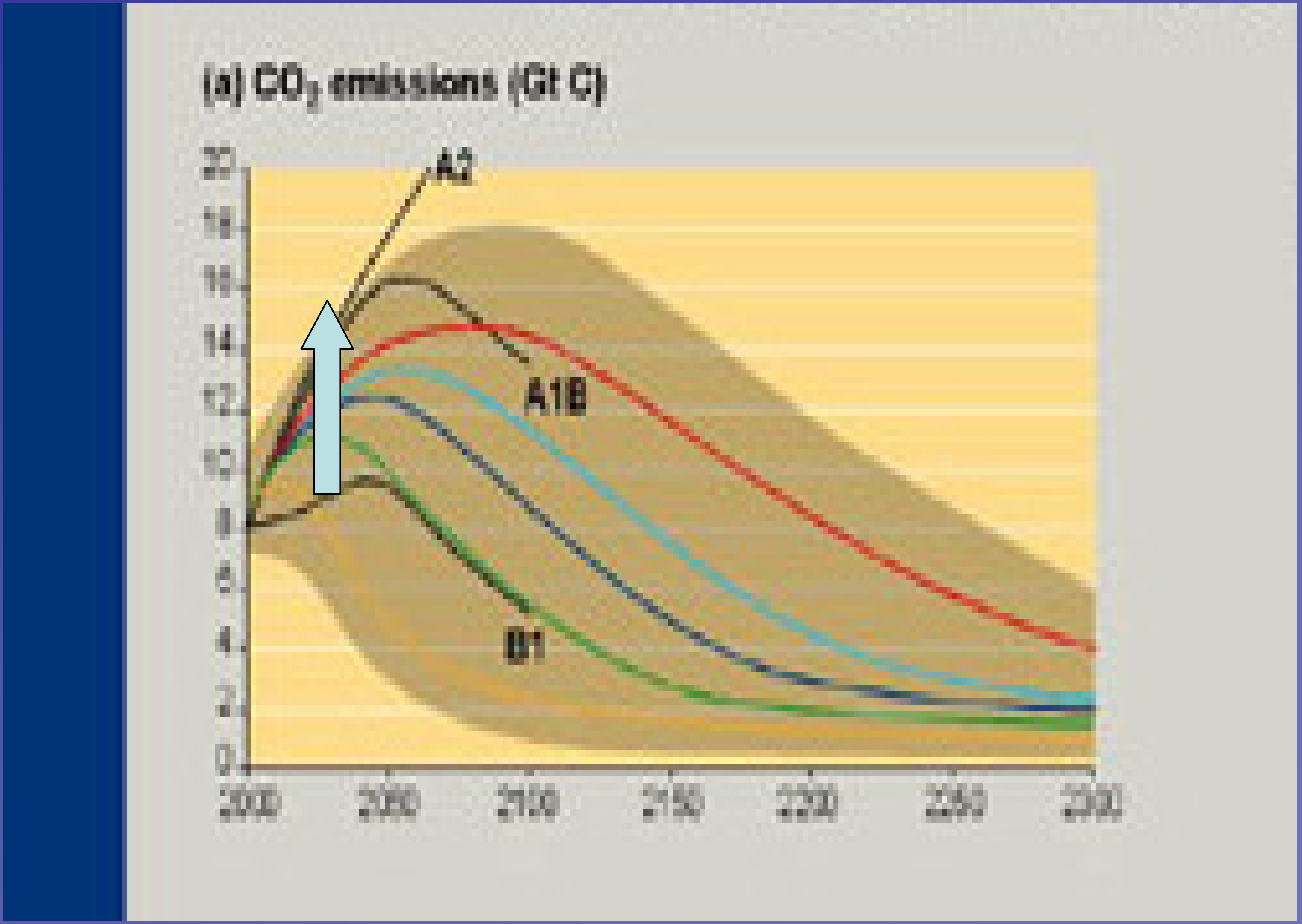
Reference Scenario: Energy-Related CO2 emissions by Region



Global emissions increase of about 60% in the next 25 years, and non OECD countries overtake OECD countries before 2010 .

Source: WEO 2006, IEA

The emissions trend : A2/A1B scenarios



The challenge of stabilising CO_2

Stabilizing CO_2 request a global strategy to develop and to disseminate radical changes in the energy technologies and in the global energy system in

- *research & innovation, and energy policies, to reduce the "carbon intensity" of the economy through the development and dissemination of the new renewable and energy efficiency technologies, hydrogen and carbon sequestration, such as a new generation of nuclear power;*
- *making the new clean and safe energy sources and technologies available and cost effective in the emerging economies and in developing world, to address both energy security and emissions reduction*.

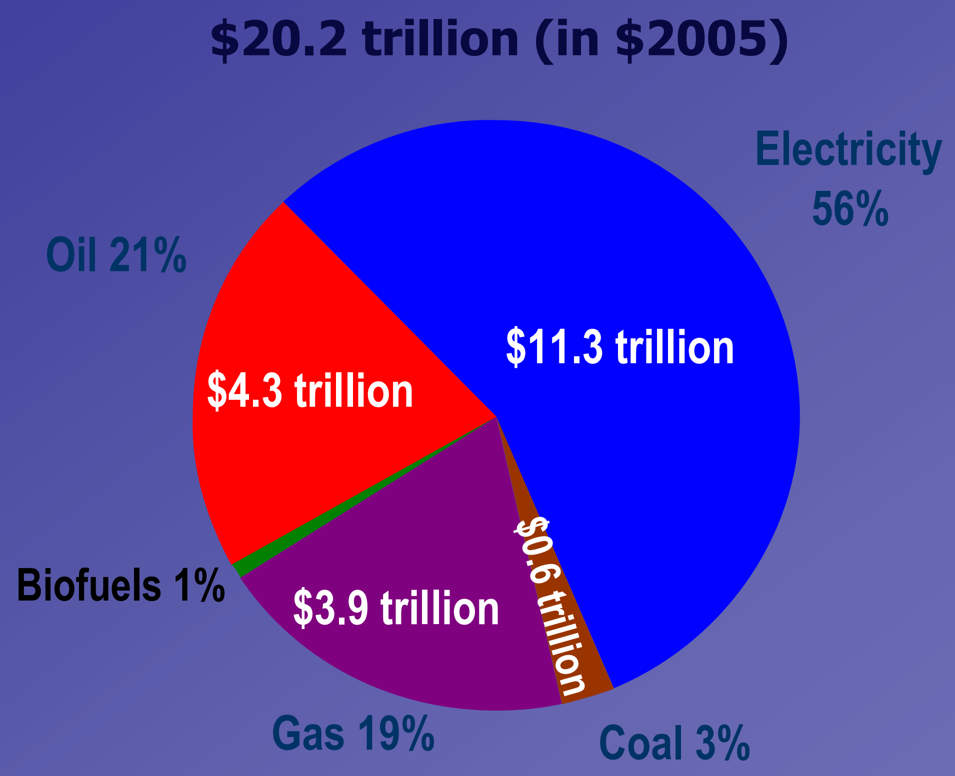
Considering the IEA estimated dimension of the investments in the global energy system in the next 20-30 years (20 trillion $)

THE TIMING FOR THE DEVELOPMENT OF THE NEW CLEAN ENERGY SOURCES AND TECHNOLOGIES

- ***to supply the increasing energy demand;***
- ***to orient the trend of the future of global emissions***

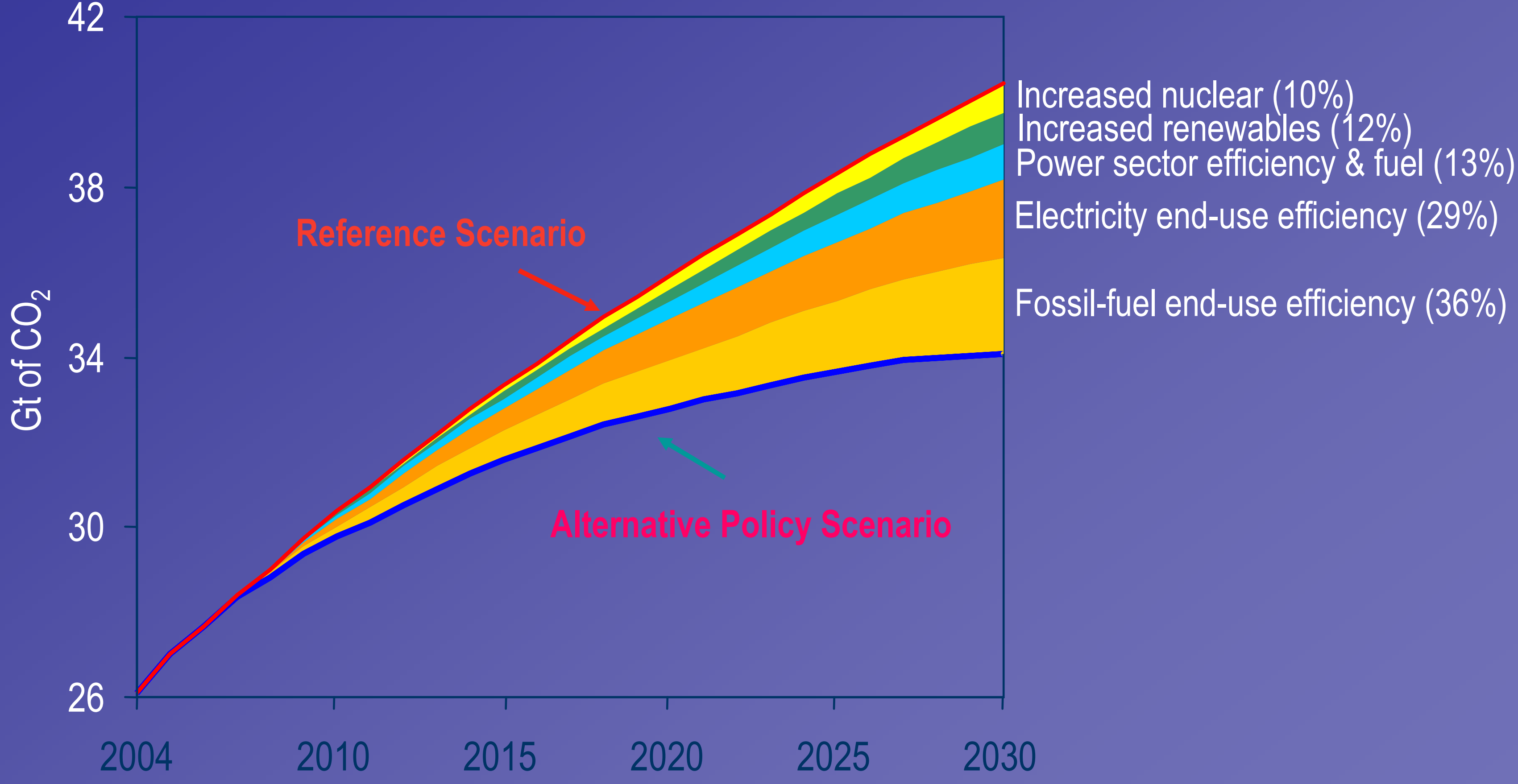
IS NOW !

Reference Scenario: Cumulative Investment, 2005-2030



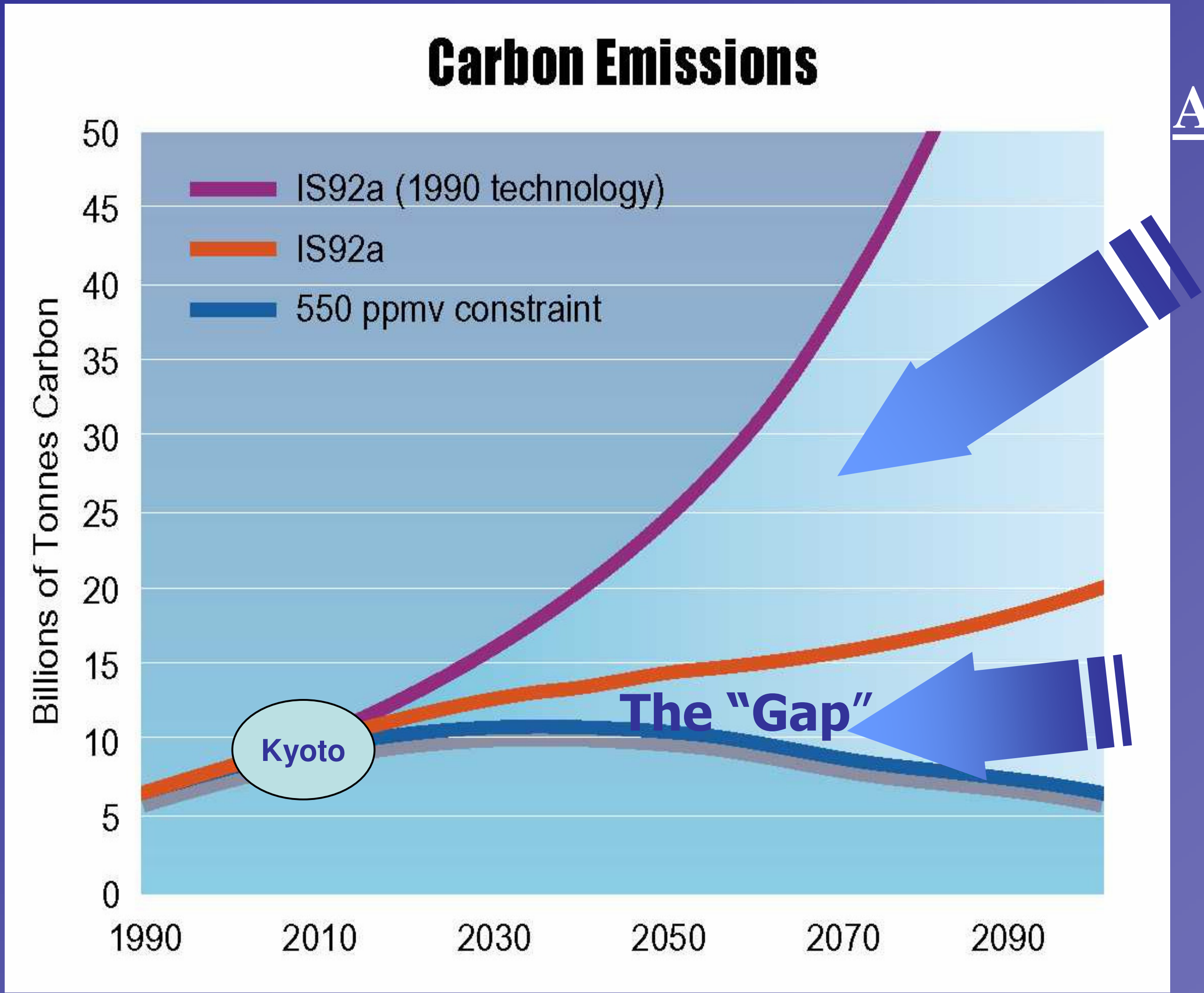
Source: WEO 2006, IEA

The Alternative Policy Scenario:
Key Policies for CO_2 Reduction



Source: WEO 2006, IEA

Stabilizing CO_2
Base Case and "Gap" Technologies



Assumed Advances In

- *Fossil Fuels*
- *Energy intensity*
- *Nuclear*
- *Renewables*
- *Biofuels*

Gap technologies

- *Carbon Capture and Sequestration*
- *Hydrogen*
- *"New Nuclear"*
- *"New Renewables"*

Source: Jae Edmonds, PNNL/Univ MD

BIOENERGY
a key role to meet the short term Kyoto targets and the long term stabilizing CO2

To be effective in approaching CO_2 stabilization, the long term global strategy and measures should be designed and should start immediately.

The challenge is to combine the short term measures to meet Kyoto targets with the long term strategy to develop radical changes in the global energy system, in order to avoid a "conflict of interests" between the short term investments for meeting the "administrative" obligations under Kyoto and the investments for the long-term emissions reduction.

The trade-off between the current and the future measures is a key issue in the complicate game of the post Kyoto regime.

Bioenergy is "carbon neutral", effective to reduce the net carbon emissions.

Bioenergy can help to meet the increasing energy demand in the short term.

Bioenergy can play a key role in "decarbonizing" the future global energy system

BIOENERGY TO REDUCE THE CARBON INTENSITY

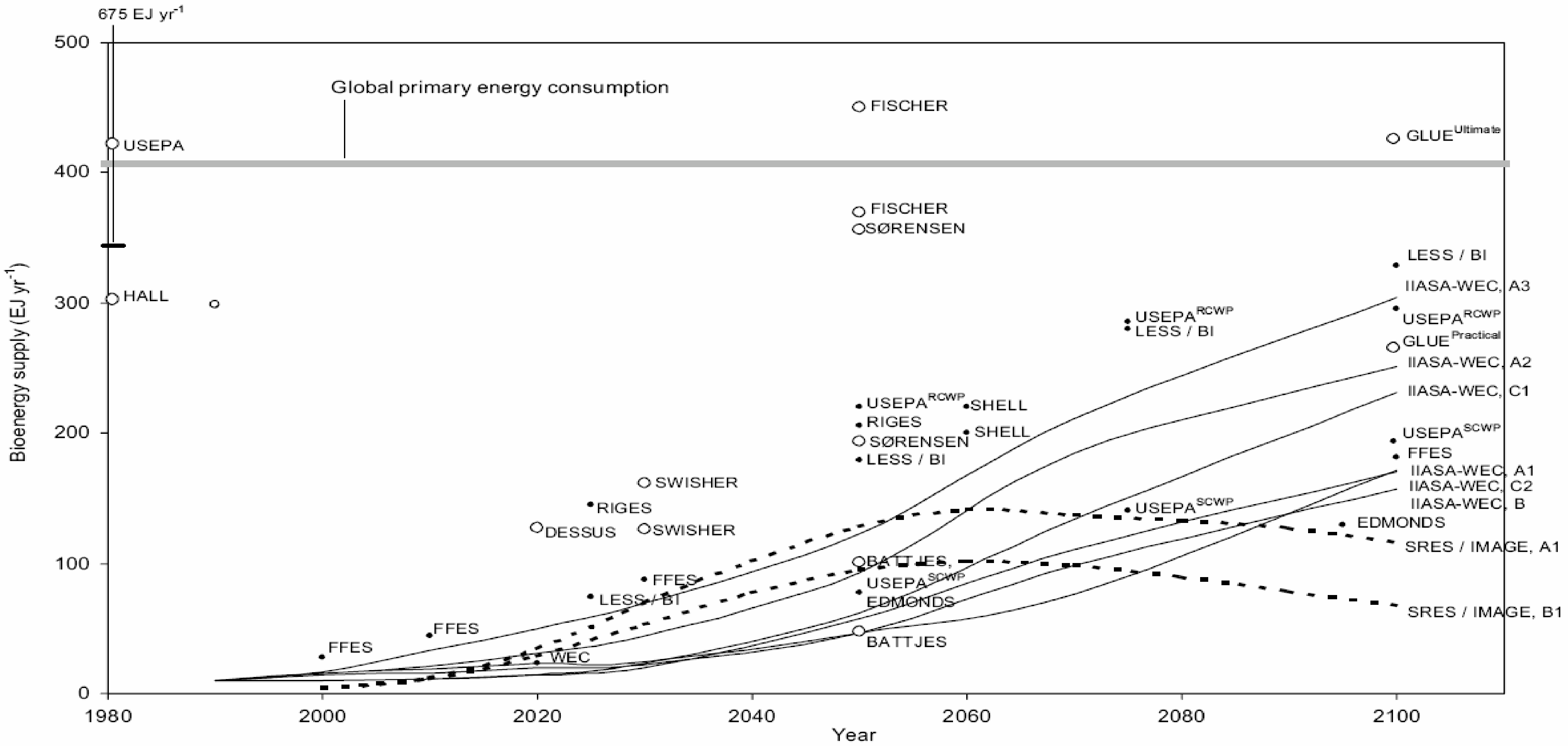
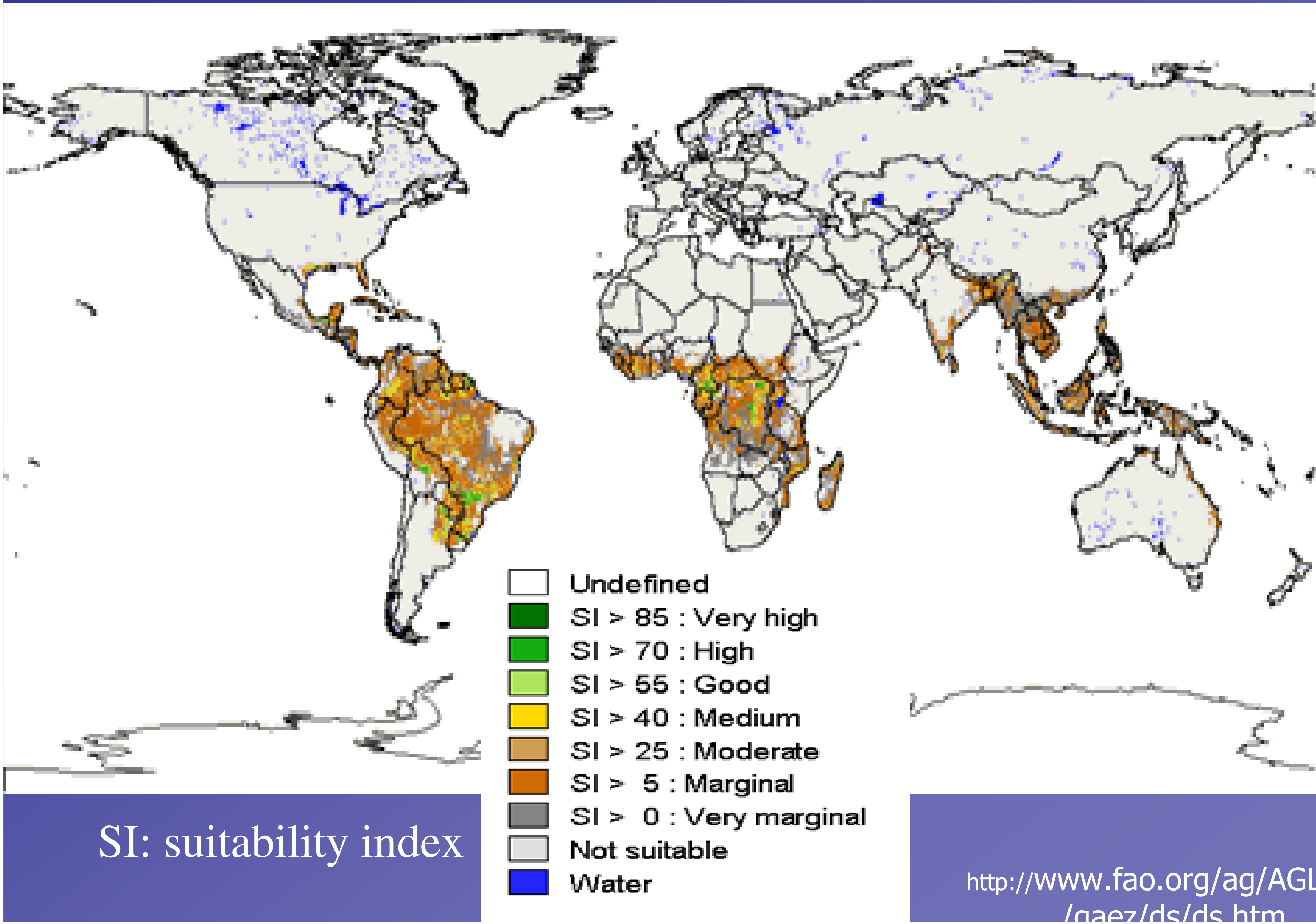


Fig. 2. Potential biomass supply for energy over time. Resource-focused studies are represented by hollow circles and demand-driven studies are represented by filled circles. USEPA and HALL, who do not refer to any specific time, are placed at the left side of the diagram. IIASA-WEC and SRES/IMAGE are represented by solid and dashed lines respectively, with scenario variant names given without brackets at the right end of each line. The present approximate global primary energy consumption is included for comparison. (The global consumption of oil, natural gas, coal, nuclear energy and hydro electricity 1999–2000 was about 365 EJ yr^{-1} [43]. Global biomass consumption for energy is estimated at 35–55 EJ yr^{-1} [44–46].)

Stabilization of GHG concentration at 450 ppm in 2100 will require ~400 EJ biomass energy

Berndes et al., Biomass and Bioenergy (2003)

Sugarcane potentials

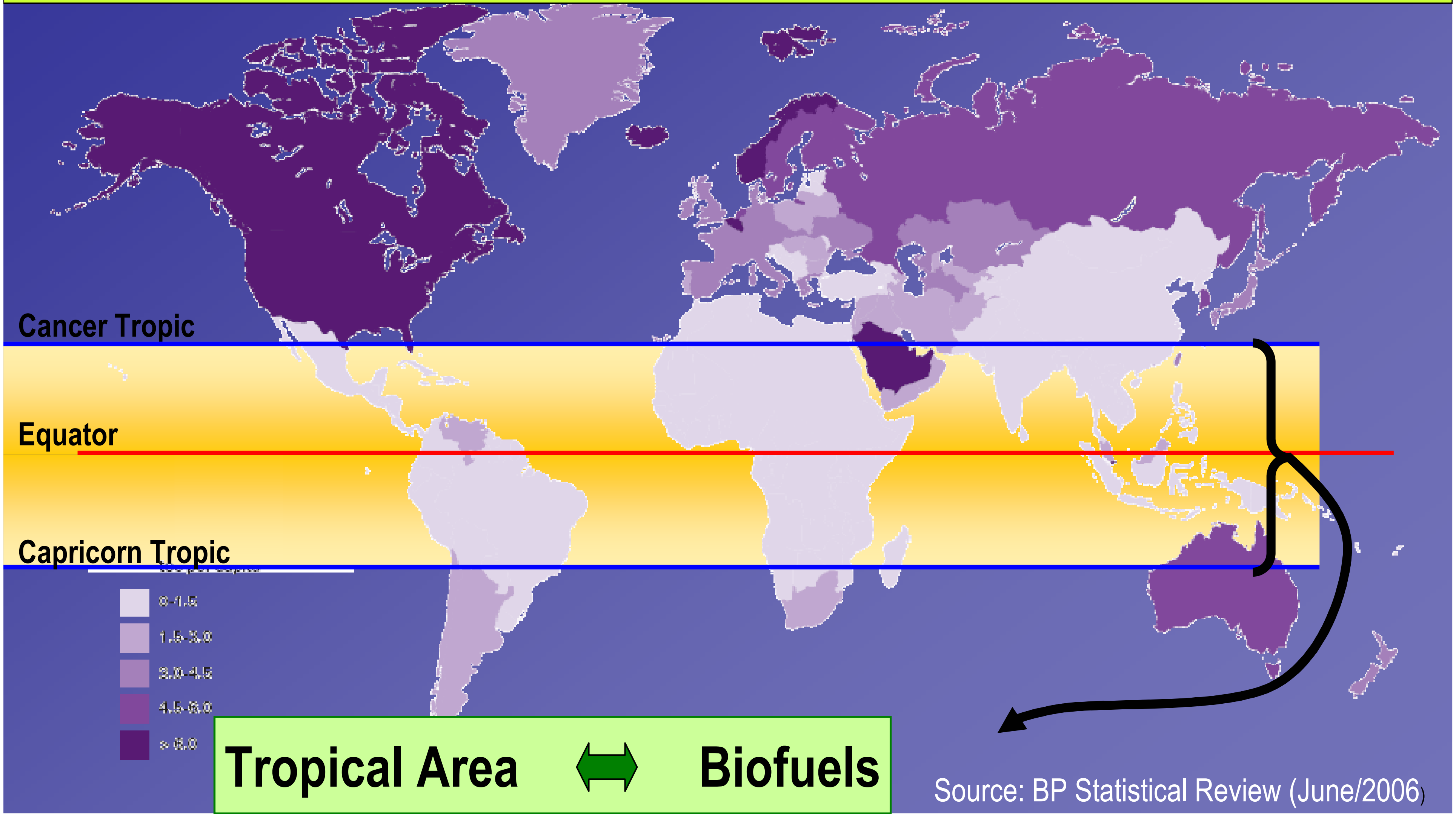


SI: suitability index

http://www.fao.org/ag/AGL/agll/gaez/ds/ds.htm

WORLD ENERGY CONSUMPTION

The greater consumption per capita is outside the tropics!



Tropical Area ⟺ Biofuels

Source: BP Statistical Review (June/2006)

A NEW GEOGRAPHY OF THE GLOBAL ENERGY

Bioenergy can change the geography of the global energy market

- increasing
  - the diversity of geographic and fuel sources;
  - the energy security;
  - the economic role of developing countries;
  - the development of fuels and technologies towards a low carbon economy
- challenging the oil economy

TOWARDS THE BIOFUEL COMMODITY

According to 2006 IEA Alternative Scenario, biofuels are expected to make a significant contribution to meeting global road-transport energy needs.

They account for 7% of the road-fuel consumption in 2030 in that scenario, up from 1% today. In the Reference Scenario, the share reaches 4%.

In both scenarios, the U.S., the European Union and Brazil account for the bulk of the increase and remain the leading producers and consumers of biofuels.

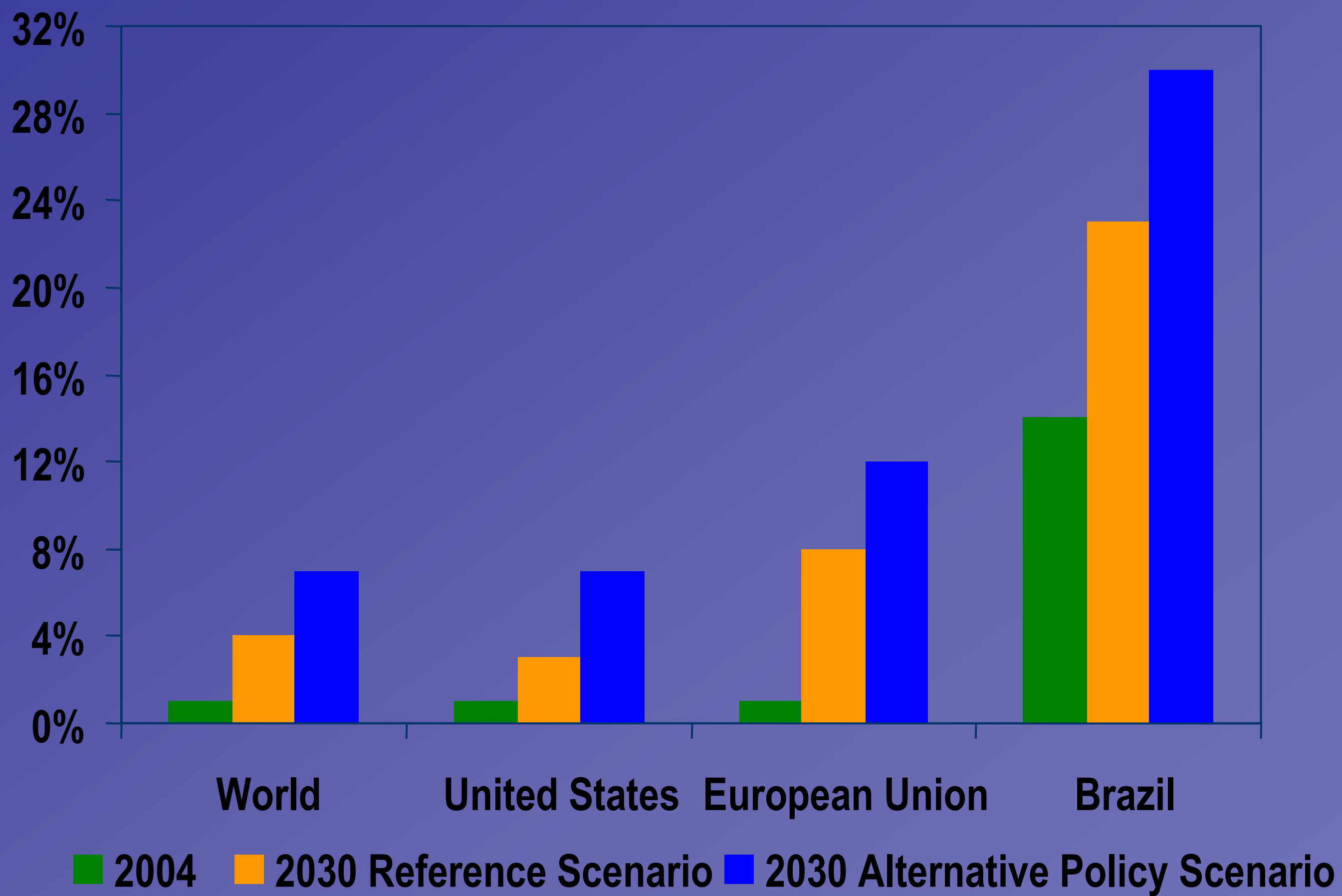
Ethanol is expected to account for most of the increase in biofuels use worldwide, as production costs are expected to fall faster than those of biodiesel – the other main biofuel.

Nevertheless,

- further cost reductions are needed in the context of WTO rules;
- biofuel environmental and social sustainability criteria should be identified and agreed.

Source: WEO 2006, IEA

The Alternative Policy Scenario Share of Biofuels in Road-Transport Fuel Consumption



Biofuels are set to play a much larger role in meeting world road-transport fuel demand

Source: WEO 2006, IEA

Are biofuels a sustainable option? 1

THE PALM OIL CASE IN INDONESIA

According to a recent research of "Wetlands International" and "Delft Hydraulics", the expanding production of palm oil in Indonesia to meet the increasing demand of biofuels in Europe was created by draining and burning the peat land, as well by razing huge tracts of the Southeast Asian rain forest in combination with overuse of chemical fertilizers.

Peat is an organic carbon storage sponge. Peat land is 90 per cent water. Draining and burning the peat land releases about 2 billion tons of carbon/year, equivalent to 8% of annual global emissions from the use of fossil fuels.

This driven Indonesia the third-leading emitter of green house gases after USA and China.

In the case of palm oil from Indonesia the production of biofuels can produce more harmful emissions than the fossil fuels they replace.

Are biofuels a sustainable option? 2

Food versus Fuel

The increasing demand for agricultural land for energy crops production would provide opportunities for sustained increase in agricultural commodity prices. This may result in significant resource transfer to rural areas in developing countries, bringing opportunities for improvements in the standards of living.

In the short term, however, higher commodities prices may negatively affect access to food for poor people in developing countries, especially net-food importing developing countries.

The increasing use of land for energy crops production is raising concerns about land availability for all needed purposes, such as food, feed, energy, grazing and conservation.

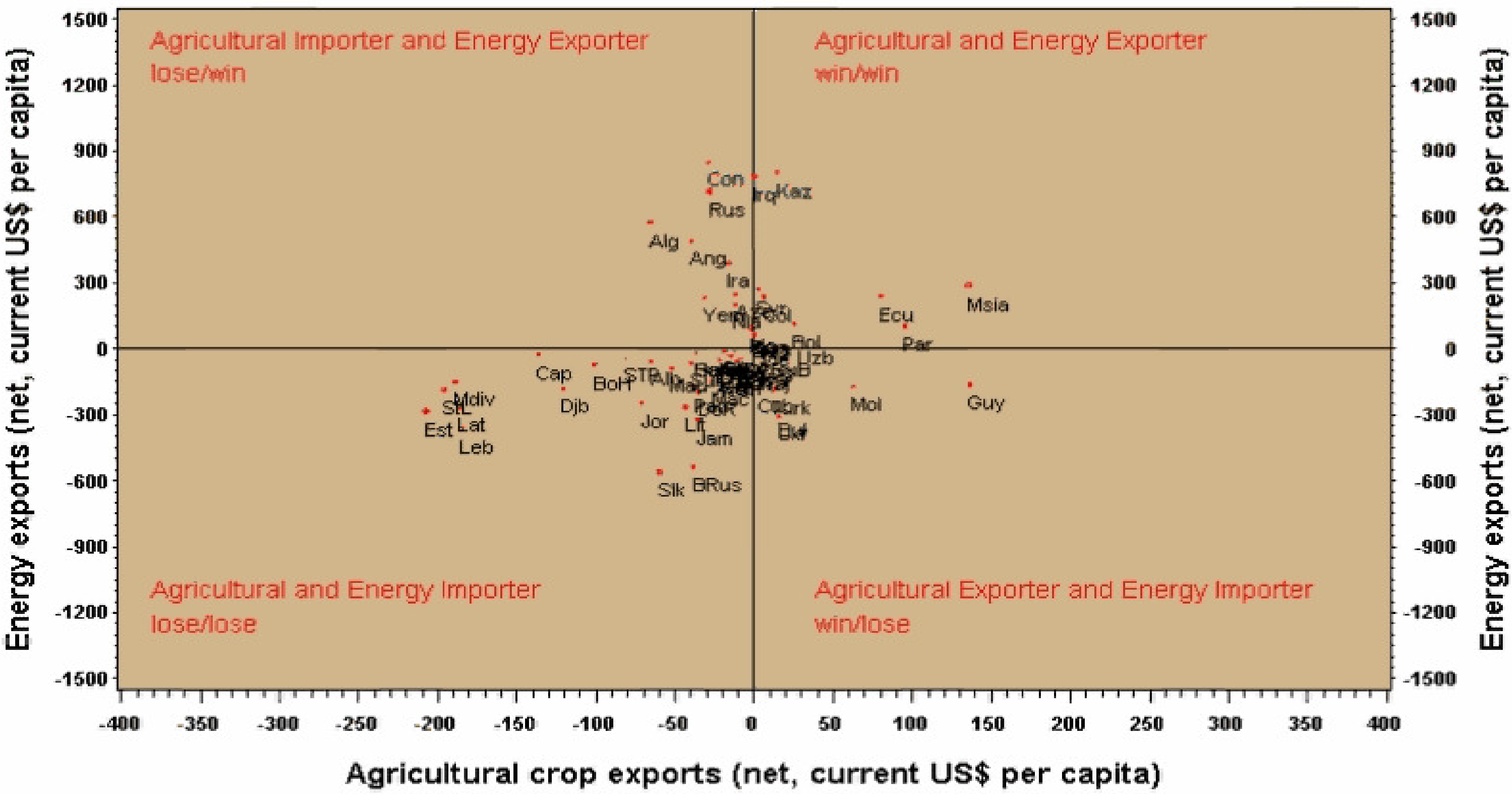
On the other hand, some argue that there is room for land availability expansion at the global level which would allow accommodating competing demands for land use.

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

Poor countries: Winners and losers from high energy and agricultural prices (2001-03)

Only countries with less than US$5000 GDP (in constant 95 US$)

The assumed energy price is: **US$30/bbl**



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

Are biofuels a sustainable option? 3

USA : Cost to displace GHG emissions, using biofuels subsidies

		Ethanol		Biodiesel		Cellulosic ethanol (hypothetical case)[1]	
	Units	Low	High	Low	High	Low	High
Subsidy per metric ton of CO2-equivalent emission reduced							
Displacement ratio		-21%	32%	NQ	NQ	88%	88%
Estimate for 2006	$/tonne	NA	520	NQ	NQ	118	147
Annualized estimate, 2006-2012	$/tonne	NA	545	NQ	NQ	124	164
mt CO2e on market for same cost		NA	33-142	NQ	NQ	8-32	9-43

NA = not applicable.
NQ = not quantified.
Displacement ratios from Farrell *et al.* (2006b).

Source: Doug Koplow, *Biofuels—At What Cost?: Government Support for Ethanol and Biodiesel in the United States*, Global Subsidies Initiative of the International Institute for Sustainable Development, Geneva.

Biofuels : a sustainable option

Biofuels can help in reducing emissions if produced in appropriate way.

Life cycle analysis, labelling and "certification of origin" of biofuels should be introduced in the global energy market.

Labeling and certification should be used to ensure sustainable development, environmental gains and promote social equity. However, sustainability criteria should not represent a way for Government to "protect" their domestic market against developing countries export opportunities. Unnecessary trade barriers should be avoided taking into consideration of certification capacity building in developing countries.

How to create the biofuel commodity

- **Domestic regulations and standards for biofuel development**, e.g. European Directive on biofuels, the US Energy Policy Act, the Brasilian National Alcohol and the Biodiesel Programme, the Renewable Energy Law of the People's republic of China, the White Paper on Renewable Energy of South Africa.

- **Preferential Trade Arrangements**, e.g. Generalised System of Preference (GSP plus incentive scheme), including Everything but Arms (EBA), The Cotonou Agreement with African, Caribbean and Pacific Countries, the Caribbean Basin Initiative (CBI); the Euro Mediterranean Agreement.

- **WTO negotiations**, e.g. Doha Development Agenda (environmental goods and services) .

Towards an international trade in biofuels

Today

Most biofuels are produced and consumed in domestic markets, and there is only a small amount of international trade in biofuels:

- Brasil has experimented an exportable surplus in ethanol;
- A limited trade of biodiesel in the European Union market.

In the next future

•Energy security and diversification in fuel imports;

•Mandatory targets and incentives for biofuels in EU, USA, Japan, China;

•Kyoto Protocol commitments;

• Market development for agricultural commodities and potentiality for rural development;

point toward the likelihood of more international trade in biofuels.

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.
11.) 15-60 EJ: most biomass fuels are not traded on world markets, estimates of consumption are highly uncertain.

Source: Alex Muller, FAO

Brazil
a succesfull policy towards a biofuel commodity

- ~~Ethanol price lower than gasoline price~~
- ~~Guaranteed remuneration to the producer~~
- Tax reduction for hydrated ethanol cars

The only remaining incentive nowadays

- ~~Loans for ethanol producers to increase their capacity~~
- ~~Gas stations were obligated to sell ethanol~~
- ~~Maintenance of strategic safety stocks~~

Source: **Antonio Simões Director – Dep. of Energy – Ministry of External Relations of Brazil**

Different national approaches to ethanol incentives (US cents/liter)

Country	Production incentive	Reduced excise tax	Import tariff (MFN)[1]	Exceptions from tariff
Australia	—	28.9¢ Value of rebate on excise tax	28.9¢ Effective rate because excise tax not rebated	**None**
Brazil	—	30¢ (Sao Paulo)	—	**Mercosur**
Canada	**up to 16.4¢ (variable rate, QB)**	**up to 15.1¢ (BC)**	4.3¢	**NAFTA, CAFTA, Chile**
EU	—	**up to 70.9¢ (Ger)**	24.1¢	**EFTA, GSP (not incl. Brazil)**
Switzerland	—	57.8¢	27.7¢	**EU, GSP (incl. Brazil)**
USA	13.5¢ + state	**up to 8.4¢ (MO)**	**2.2% + 14.3¢**	**NAFTA, CBI**

1. Undenatured ethyl alcohol for use as a fuel.

Source: Global Subsidies Initiative

Selected countries biofuel profiles (source UNCTAD)

Country	Biofuel production (2005)	Leading feedstock	Blend mandate/goals	Remarks
U.S.	15B (Ethanol) 2090M (biodiesel)	Corn Soybeans	Yes (28.35B liters by 2012)	Energy security large motivation. 2007 State of the Union President address
EU	950M (Ethanol) 2.3B (2004) biodiesel	Cereals and sugar beets Rapessed	Yes (2% by 2005 not met) and 5.75% by 2010.	climate change, energy supply, diversify agriculture, improve rural areas
Brazil	16B (Ethanol)	Sugarcane	Yes (20-25%ethanol. 2% biodiesel, 5% in 2013)	World's largest ethanol producer and exporter,
China	3.6B (Ethanol)	Mais, cassava, rice	Yes (in certain provinces)	Increase in vehicle ownership and environmental concerns drive need for alternative fuels
India	1.6B (Ethanol)	Molasses	Yes (5%ethanol in certain states, 20% biodiesel by 2012)	World second largest sugar producer
South Africa	390M (Ethanol)	Sugarcane, maize, sweet sorghum	Yes (since 2006 voluntary blending targets)	National biofuel strategy by 2007 linked to lead phase out

EU Preferential Trade Arrangements

Code 2207 (denatureted and undenatured alcohol) import under preferential conditions 2002-2004 (in hl) by duty regime enjoyed by the exporting country in the EU:

	2003	2004	% of total trade 2002-2004
GSP normal (***Generalised System of Preference***)	182 940	288 364	9%
GSP+ (Latin America, Sri lanka, Georgia, Mongolia and Moldova). SD and Good Gov.	1 569 005	1 412 896	47.5%
Cotonou (ACP s)	268 784	154 663	9%
EBA (LDCs) (***Everything But Arms***)	86 247	18956	1.5%
Others	103 597	122 768	4%
Total preferential	2 210 573	1 997 646	70%
Total MFN (***Most Favoured Nations***)	494 771	1 124 699	30%
Grand Total	2 705 344	3 122 345	100%

WTO and biofuels

- **Classification : the lack of classifications makes it difficult to get precise biofuel trade statistics, but may impede also efforts to liberalise tariffs on biofuels.**
- **Brazil asks for the classification of ethanol as "fuel commodity", in order to exempt it from the importation tariffs. Nevertheless ethanol is both, fuel, food and environmental good.**
- **Doha Development Agenda: paragraph 31 (iii) calls for "the reduction, or, as appropriate, elimination of tariff and non tariff barriers to <u>environmental goods and services</u>" .**

  Before the suspension of the Doha negotiations on July 2006, the environmental goods negotiations focused on how to define "environmental goods" and criteria to identify them.

  According to some countries, the definition of environmental goods cover, inter alia, renewable energy products, which could include ethanol and biodiesel and related products.

Global Bioenergy Partnership

The G8 commitment in Gleneagles:

"We (the G8) will promote the continued development and commercialisation of renewable energy by: […] d) launching a Global Bioenergy Partnership to support wider, cost effective, biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent"

Global Bioenergy Partnership

1. Update the inventory of existing networks, initiatives and institutions dealing with bioenergy;
2. Identify gaps in knowledge or areas of weak understanding;
3. Carry out scoping of feasibility studies for market building activities;
4. Establish mechanism for raising awareness and dealing with issues of international relevance and gaps in technology and policy;
5. Formulating standard guidelines to measure the greenhouse gas emission reductions through the promotion and use of biofuels

THE TASK OF GLOBAL BIOENERGY PARTNERSHIP

Bioenergy and Trade

- to suggest the classification of bioenergy in the WTO rules (agricultural, industrial or environmental goods)
- to assess the wide range of government measures – tax, incentives, high tariffs, subsidies, trade barriers;
- to evaluate the role of a stable long term carbon price in the global energy market

Bioenergy production, biodiversity protection and food security

- to agree on, apply and disseminate
  - a set of internationally acceptable minimum criteria to reduce environmental and socio-economic risks throughout the entire life-cycle while making use of the potential of bioenergy to address energy security and climate change;
  - an international certification / labeling scheme to certify that the bioenergy production is not affecting biodiversity and food security