

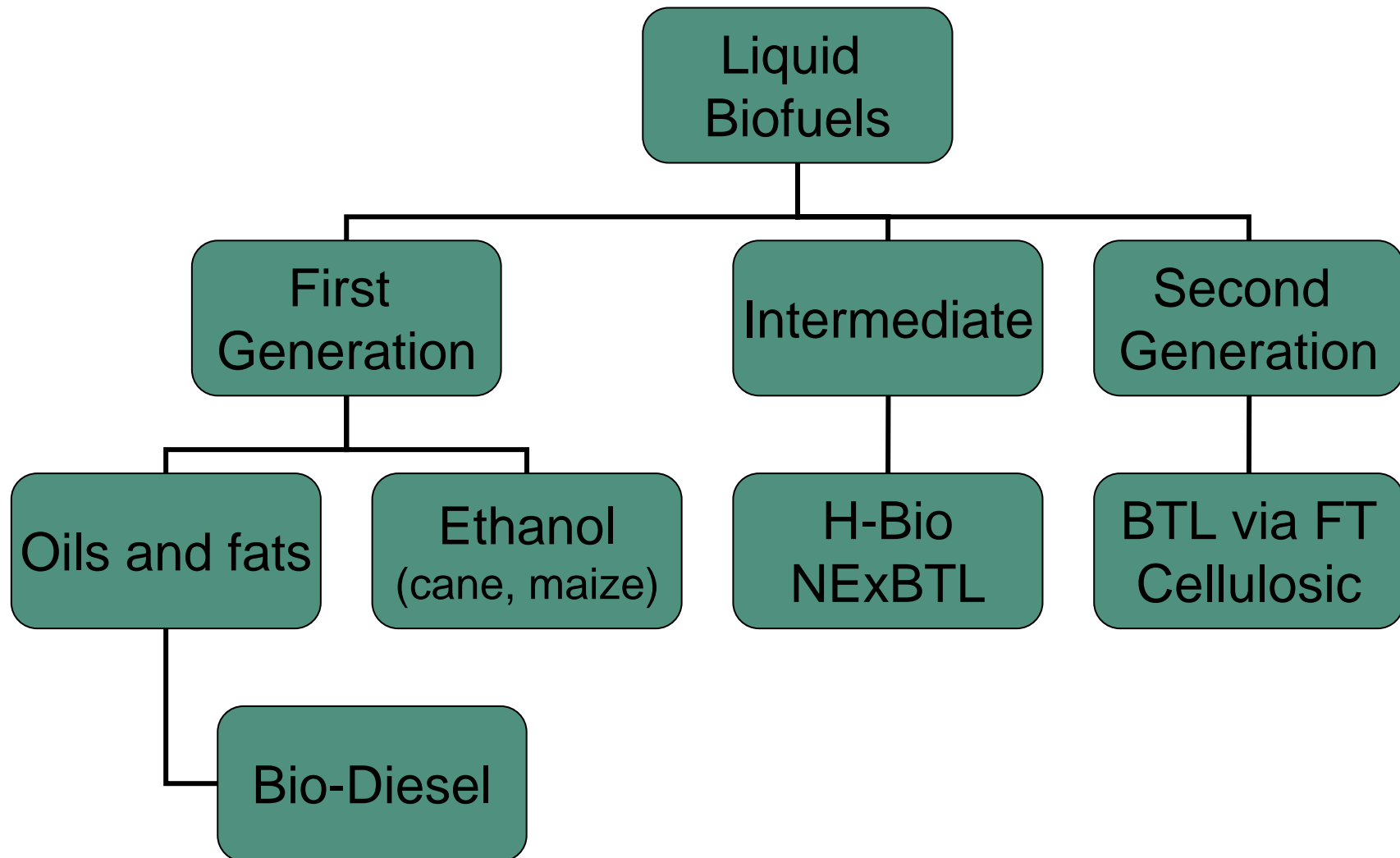
# CDM Opportunities in Biofuels Sector

**Dr. Venkata R. Putti**

Team Leader, Carbon Finance Assist, The World Bank

International Conference on Biofuels in Africa  
Ouagadougou, Burkina Faso, 27-29 November, 2007

# Liquid Biofuels



# BioFuels: Ethanol & Bio-Diesel

---

---

- Ethanol is produced from fermentation of various sugars from carbohydrates found in agricultural crops and cellulosic residues from crops or wood (sugar, molasses, corn, beets)
- Bio-Diesel is produced from the “transesterification” of vegetable oil from oil bearing plants (rapeseed, soybean, sunflower, jatropha, palm oil)
- Ethanol is a commercial fuel, bio-diesel is emerging

# Main Drivers of Biofuels

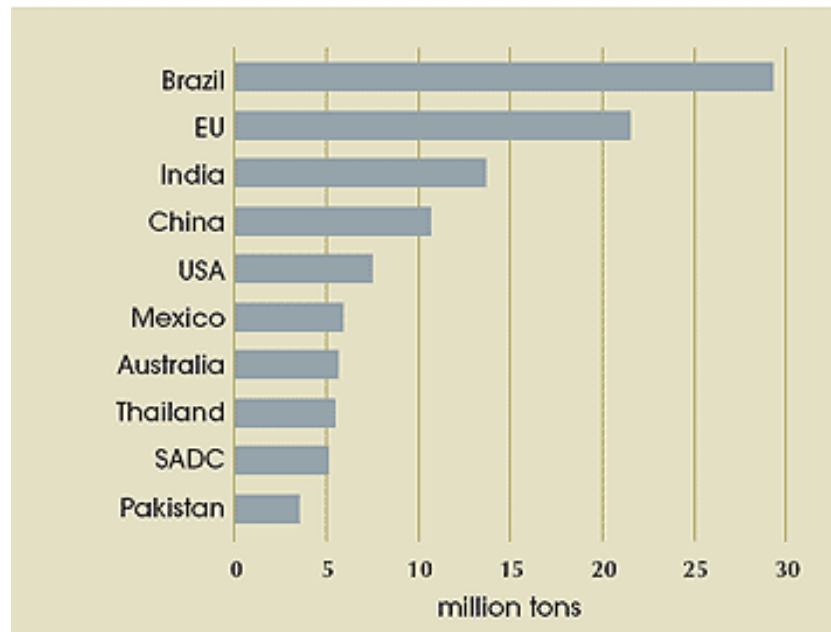
---

---

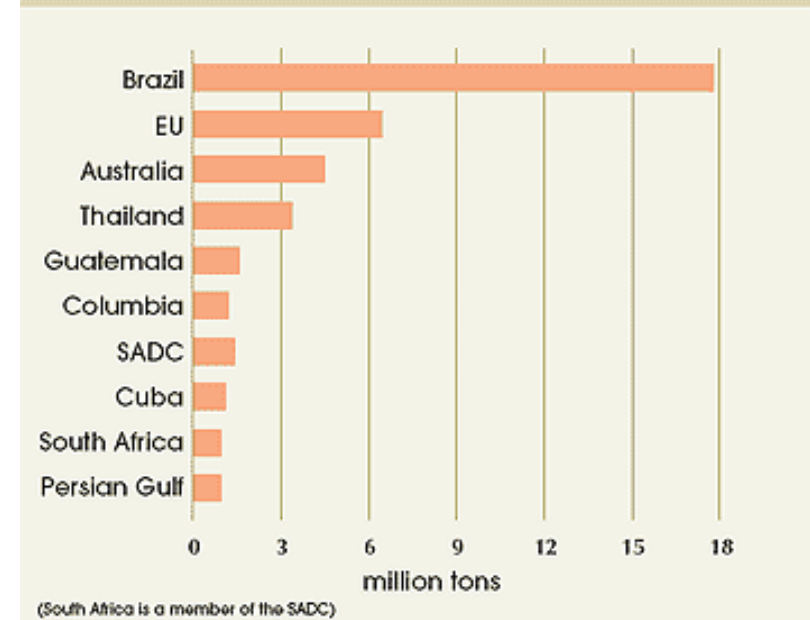
- International oil market
  - Insulate from price fluctuations, energy diversification, energy security, self-sufficiency
- An “inconvenient” externality
  - Industrial country dependence on oil for transport, their largest source of CO<sub>2</sub>
  - Few low-carbon alternatives for transport
- Potential availability of large quantities (2<sup>nd</sup> generation)
- Support to farmers, new employment, rural development
- Local environment benefits (Lead and MTBE replacement, etc.)

# Top Sugar Nations

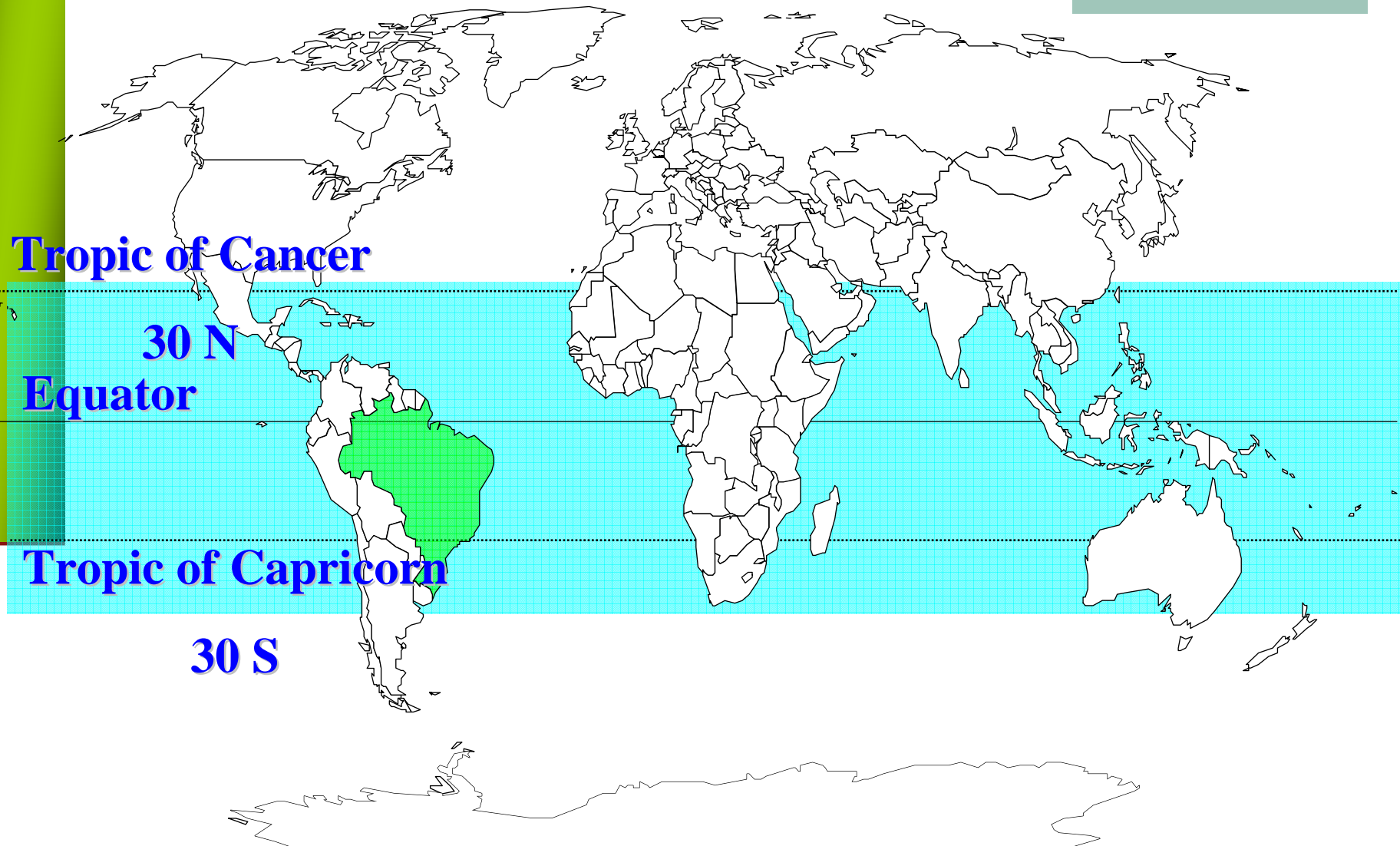
TOP SUGAR PRODUCERS 2004/05 est.



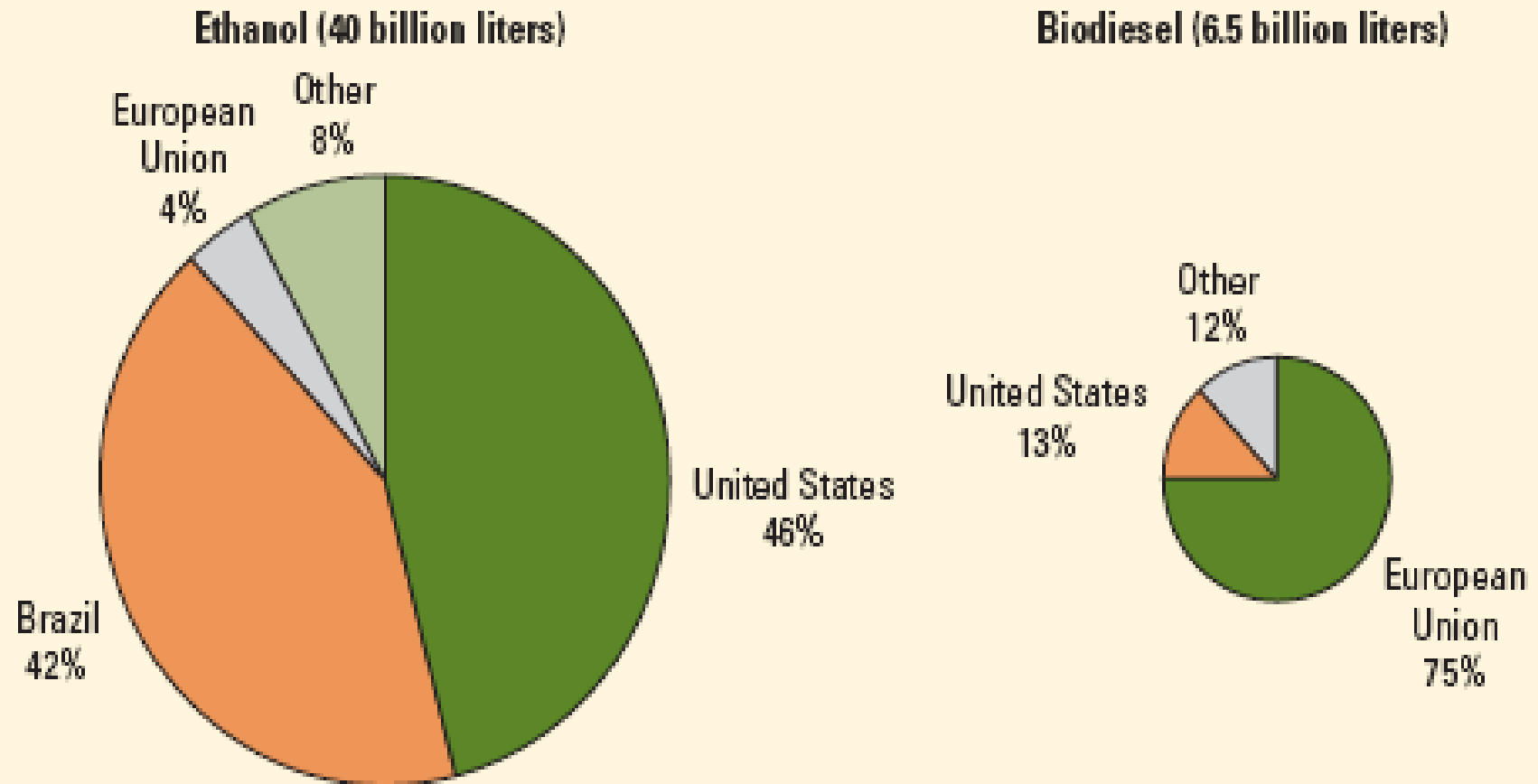
TOP SUGAR EXPORTERS 2004/05 est.



# Almost 100 Countries Grow Sugarcane



# Production of Biofuels (2006)



Source: F.O.Licht Consulting Company, personal communication, July 17, 2007.

Note: Percentages of global production of fuel ethanol and biodiesel in 2006.

# Active Ethanol-Blending Programs

---

---

- Brazil (E-20 / E-25 and for FFV any blend)
- USA (E-10 and for FFV E-85)
- Canada (E-10 and for FFV E-85)
- Sweden (E-5 and for FFV E-85)
- India (E-5)
- Australia (E-10)
- Thailand (E-10)
- China (E-10)
- Colombia (E-10)
- Peru (E-10)
- Paraguay (E-7)

# Biofuels in Africa

## Experience

- Ethiopia (E)
- Kenya (E)
- Madagascar (E, BD)
- Malawi (E)
- Mali (E, BD)
- Mauritius (E)
- Mozambique (E)
- South Africa (E, BD)
- Zimbabwe (E, BD)

## Active Interest

- Benin (E, BD)
- Burkina Faso (BD, E)
- Gambia (E)
- Guinea Bissau (E, BD)
- Nigeria (E)
- Senegal (E, BD)
- Swaziland (E)
- Zambia (E, BD)

# Factors in Brazil's Success

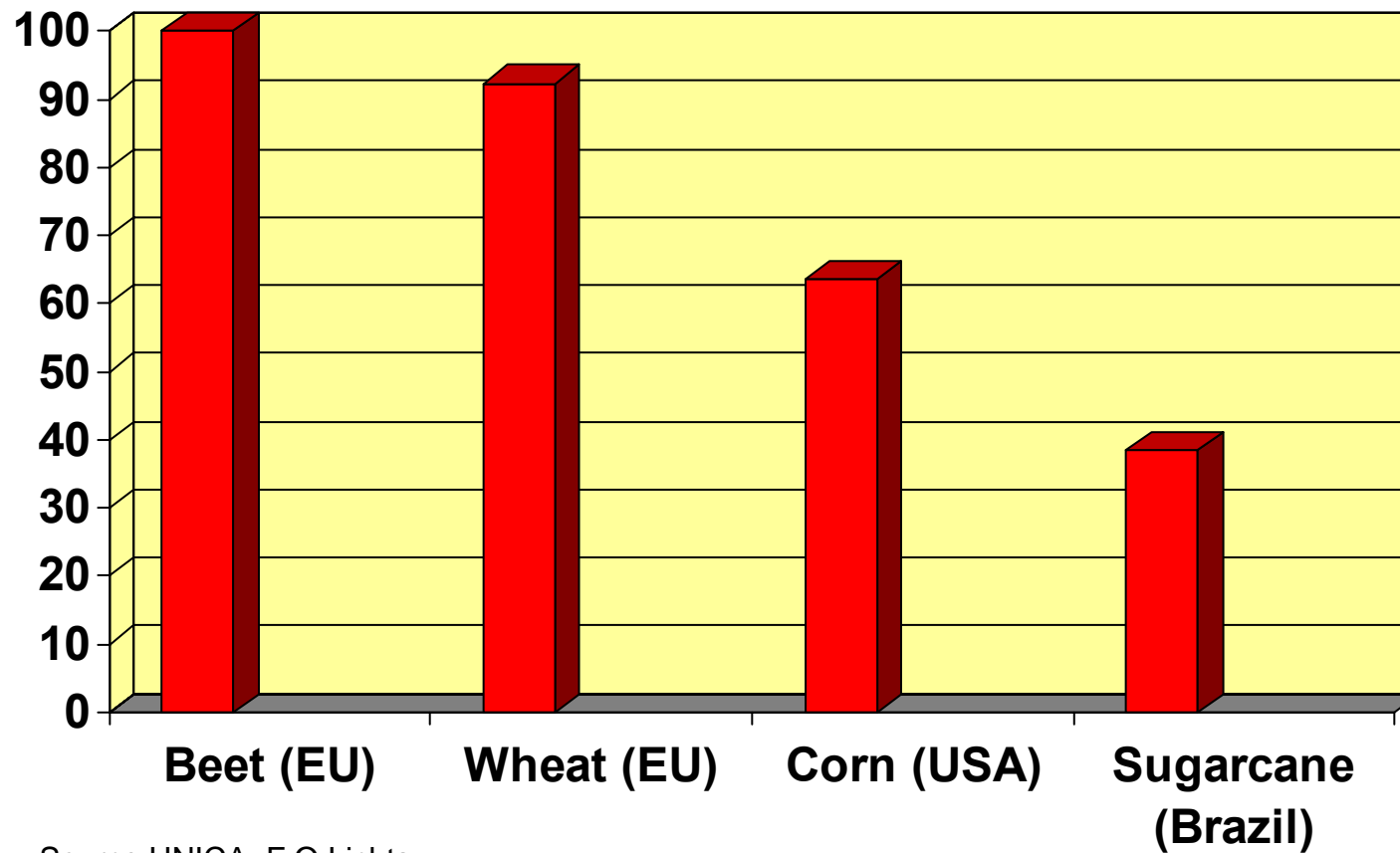
---

---

- Between 1975-2000 sugarcane yield per hectare increased by 33%, sugar content of cane 8%, ethanol yield from sugar 14%, fermentation productivity 150%
- Modern sugar production and processing and high level of managerial skills
  - More than 500 commercial varieties of cane (each plant processes around 15 varieties)
  - Hybrid sugar mill/distillery complexes
  - Planting, harvesting, and plant operations are computerized
- Use of bagasse for plant energy and surplus electricity sales
- Favorable climate, available land, good soil, and sufficient rainfall (no irrigation) in Center-South
- Least-cost producer of sugar and ethanol

# Least-cost Producer

Index



Source: UNICA, F.O.Lichts

# Issues with Biofuels

---

---

- Non-sugar feedstocks
  - Scaling-up issues (e.g. cassava)
  - Environmental sustainability (e.g. palm oil)
  - Dependent on subsidies (e.g. corn in USA)
- Impact on food production and prices
- Water and land use issues
- Energy balance issues

*Vary country to country, need to contextualize the debate*

# Biofuels for Carbon Mitigation

---

---

- Full life-cycle assessment, from “well-to-wheels”
  - ...depends on type of crop, amount and type of fertilizer, energy used in the cultivation process, energy inputs into processing, transportation to refineries and product markets; alternative land uses
  - Sugar cane (Brazil) up to ~80-90 percent GHG reduction
  - Maize (U.S.) ~ wide range of estimates, at most ~20-30 percent GHG reduction
  - Biodiesel from palm oil (Malaysia) ~40 percent if no land use change occurs

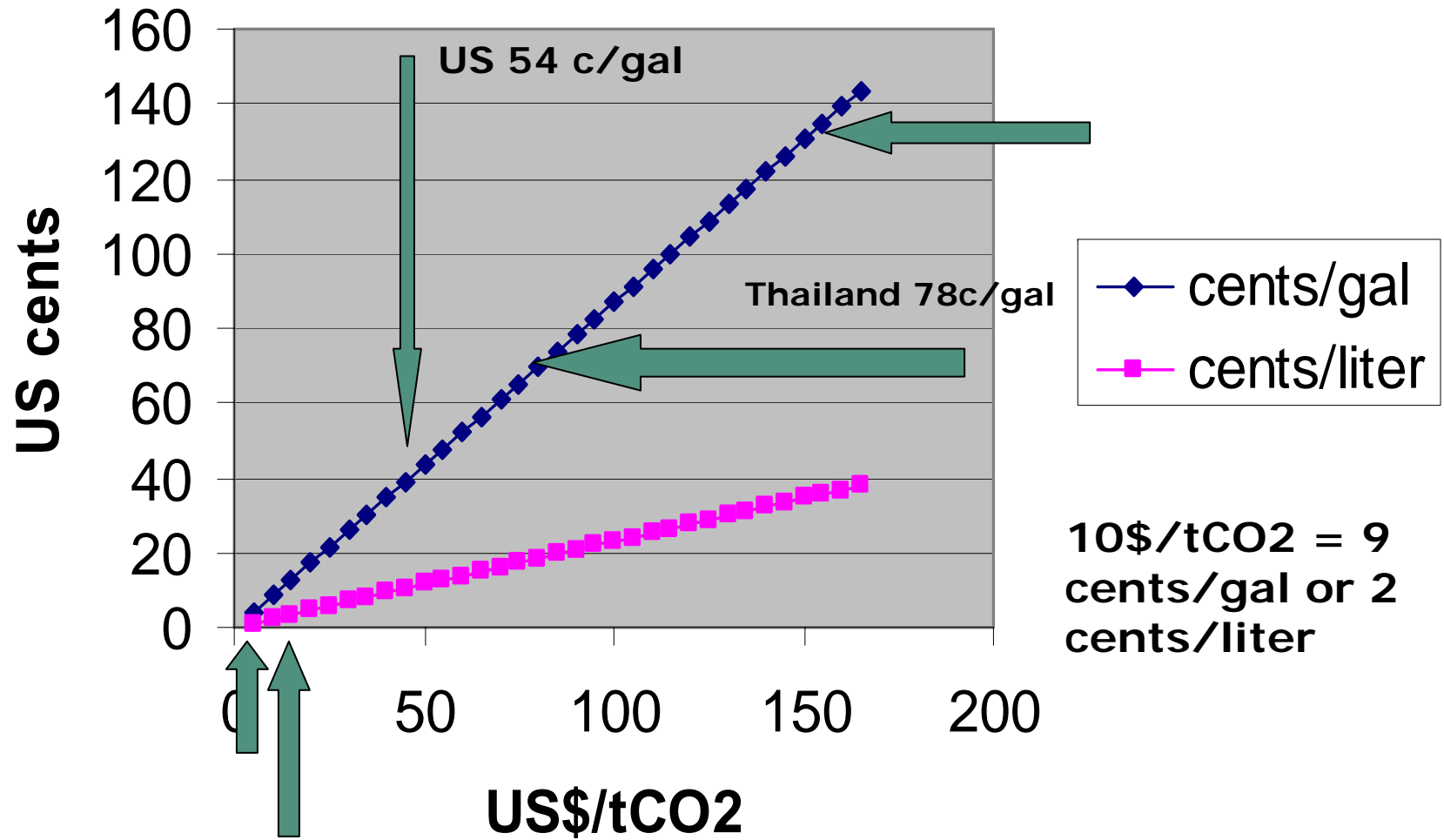
# GHG Reduction vs. Crop Subsidy

---

---

- GHG emission reduction: at \$8-20 per tonne of CO<sub>2</sub>-equivalent, expect about \$0.01-0.04 per liter
  - Much smaller than tax reductions provided to biofuels today
- Calculations on US subsidy per ton of CO<sub>2</sub> equivalent (IISD)
  - \$520 in 2006 for maize to ethanol
  - \$118–147 for cellulosic ethanol if the current subsidy structure is maintained

# Carbon Prices for Biofuels



# Scale is An Issue

---

---

- City Transit operates 463 buses that consume 60,000 to 65,000 liters of diesel daily at US\$0.49/l
- A 7.7% displacement of 60,000 to 65,000 liters equals 4,620 to 5,005 liters.
- The carbon reduction for the activity is based on 0.0027 liter/ton of CO<sub>2</sub> equivalent (t/CO<sub>2</sub>e) for diesel emissions and would result in an annual reduction between 4,553 to 4,932 tons of CO<sub>2</sub>e.
- But annual fuel savings would be US\$ 419,385 to 438,365.

# CDM Pipeline in Biofuels

Source: UNEP-RISOe Database

Project	Host/ Buyer	CERs/ year	Initial Rating	Final Rating	Status
Bio-diesel from Jatropha/ Pongamia trees and waste oil (NM 108)	India	26,000	C/B	C	X
85000 lt ethanol/day from molasses for 10% blend (NM 82)	Thailand/ Denmark	53,000	B	C	X
Methyl-ester Bio-diesel from sunflower on unused land (NM 129)	Thailand/ Japan	33,000	C/B	C	X
10% Palm-oil Methyl-ester added to diesel (NM 142)	Thailand/ Japan	218,000	B	C	X
Production of Waste Cooking Oil based bio- diesel for use as fuel (AM47)	China	123,000	A	A	√

# CDM Pipeline in Biofuels

Project	Host/ Buyer	CERs/ year	Initial Rating	Final Rating	Status
B/line Meth for production of sugar cane based anhydrous bio-ethanol for transport using LCA (NM 82/185)	Thailand/ UK	40,000	B		=
B/line meth for bio-diesel production from imported/ domestic biomass-derived oil using LCA (NM 223)	S. Africa/ Denmark	205,000	C	C	X
BD from crude palm oil / Jatropha oil / oil from other oil crop for consumption replacing liquid fossil fuel (NM 224)	India	60,000	C	C	X
BD from oilseeds in dedicated plantations on severely degraded land (captive fleet within the boundary is the consumer) (NM 228)	Brazil	335,000			WIP

# Methodological Issues

---

---

- Double counting
  - CERs claimed by both producers and consumers
  - Biofuels are exported to Annex I countries
- Leakage
  - Emissions from producing/processing BF
  - increased demand for BF could reduce the supply leading to increase in fossil-fuel consumption
- Risk of overestimation of CERs (if BFs are not used as fuel)
- Need for strict monitoring protocols

# Recent Guidance from CDM EB

---

---

- No biofuel production exported to Annex I is eligible
- Types of Project Activities
  - Consumers of bio-fuels claim CERs from displacing fossil fuels with biofuels
  - Producers claim CERs, provided
    - Consumers, to whom the biofuel is sold, are included in the project boundary, and
    - Emission reduction from use of biofuel are estimated based on monitored consumption by the consumers included within the project activity

# Recent Guidance from CDM EB

---

---

## ■ Monitoring

- Needs a framework with elements (e.g. Electronic loggers) used to verify without doubt the actual amount of biofuel consumed by consumer for fossil fuel displacement.
- The consumption shall correspond to the production and be used for CER computation
- Estimate of leakage should be provided (measurable and attributable to CDM project activity)

# Recent Guidance from CDM EB

---

---

## ■ Cultivation, Harvesting and Preparation

*Emissions associated with the production of biomass used to produce the biofuel shall be accounted for when calculating emission reductions achieved by the blended biofuel project activity. However, in the case that it can be demonstrated that the project activity is using biomass originating from a registered A/R project activity (i.e. through contractual agreement for procurement of biomass), emissions related to the production of the biomass need not be accounted for.*

# Conclusions

---

---

- Country-specific challenges for viability of biofuels (economic, technical, social, environmental)
- Mitigation potential varies with sources, methods
- Poor track record in CDM so far; pipeline limited to +5 countries (and Thailand)
- High transaction cost in developing projects
- New EB guidance may help; but still need for simplification
- Program of Activities (POA) could be an option; methodological development needs to be through “learning by doing”