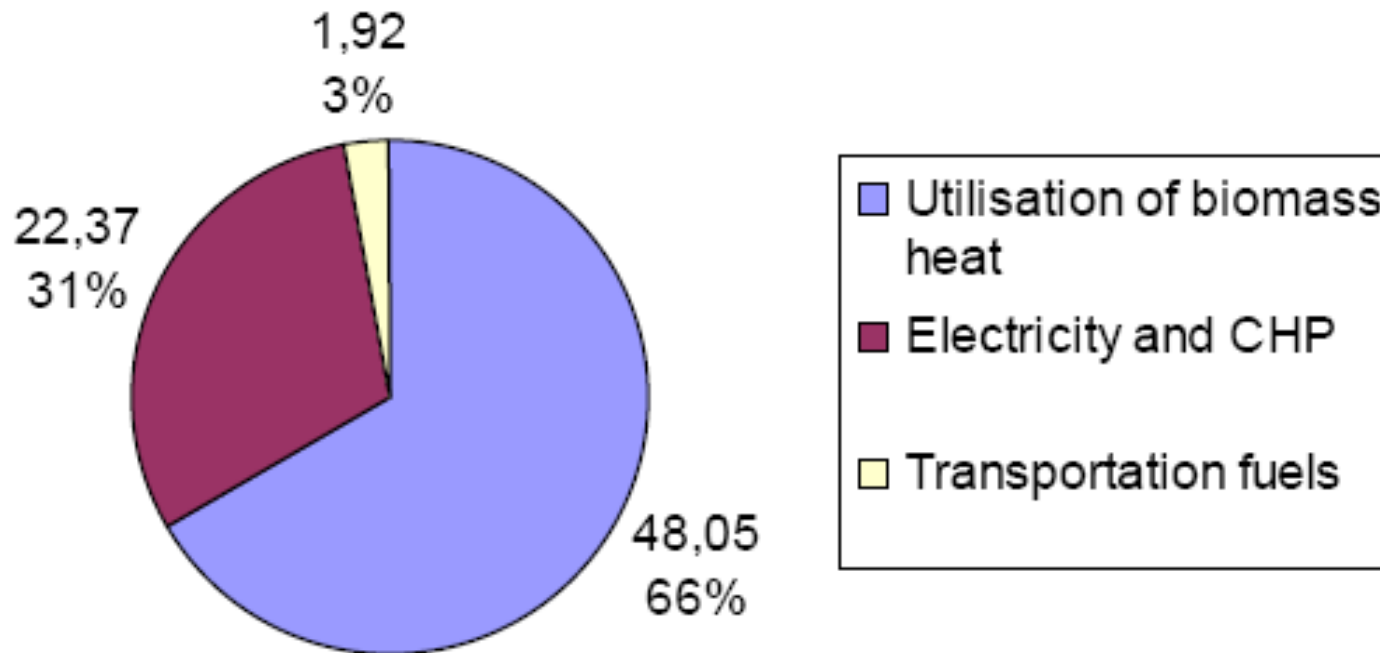


Uses of biomass in energy 2004, EU25 – in Mtoe



Endenergie/ha

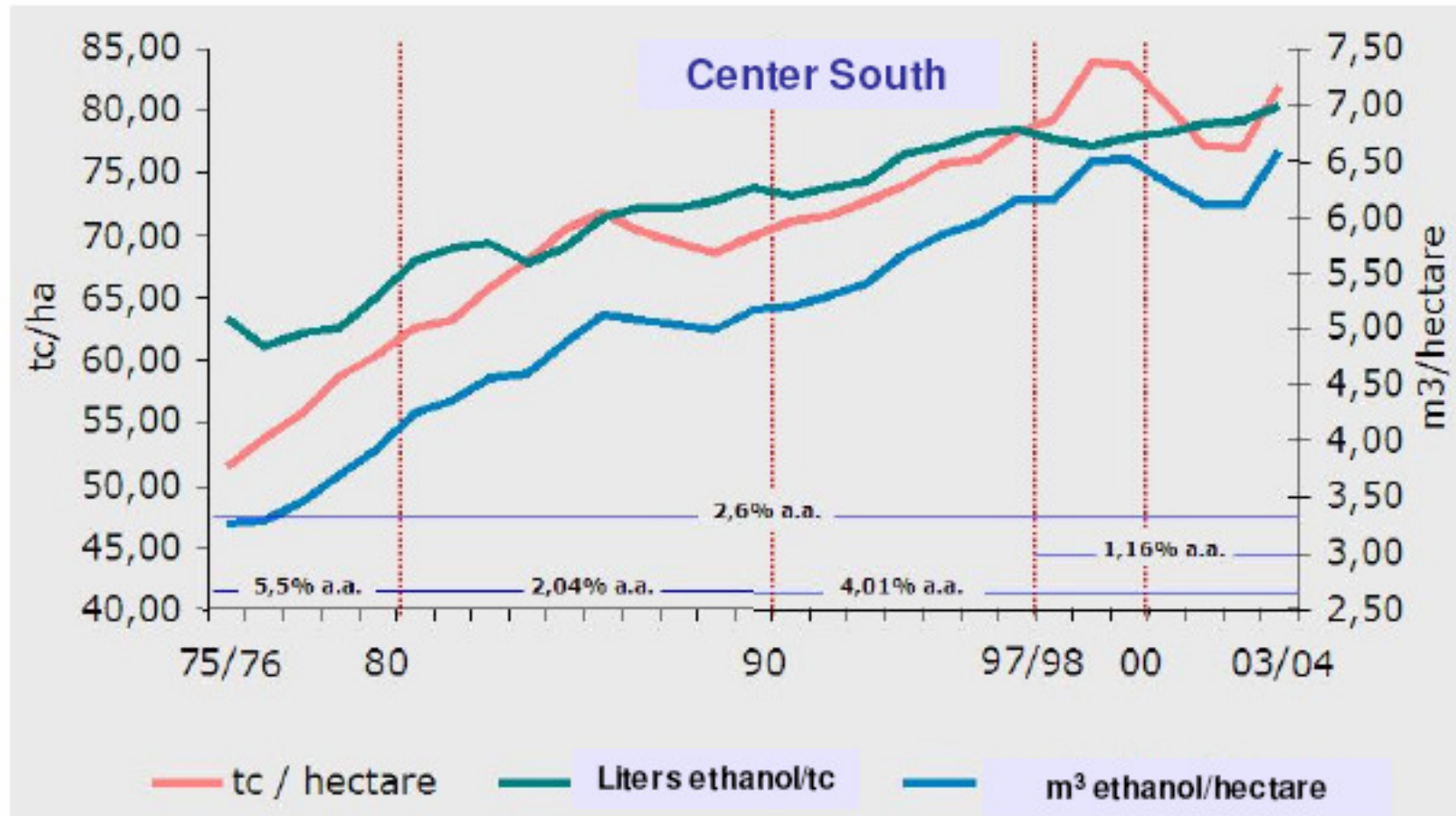
auf Basis Durchschnittserträge 2002 -2004, EU 25, toe/ha

ranking	Produkt	Kultur	Ertrag/ha	toe/ha
1	Brennstoff	Miscanthus	12 t TS	4.8
2	Biogas	Silomais	40 t	4.0
3	Brennstoff	Weide	9 t dry matter	4.0
4	Wärme&Strom	Weide	9 t d. m.	2.4 (2 - 4)
5	2.te Gen. Treibst.	Weide	9 t d.m.	1.8
6	Ethanol	Körnermais	7.7 t	1.5
7	Ethanol	Weizen	5.9 t	1.1
8	Biodiesel	Raps	3.0	1.0

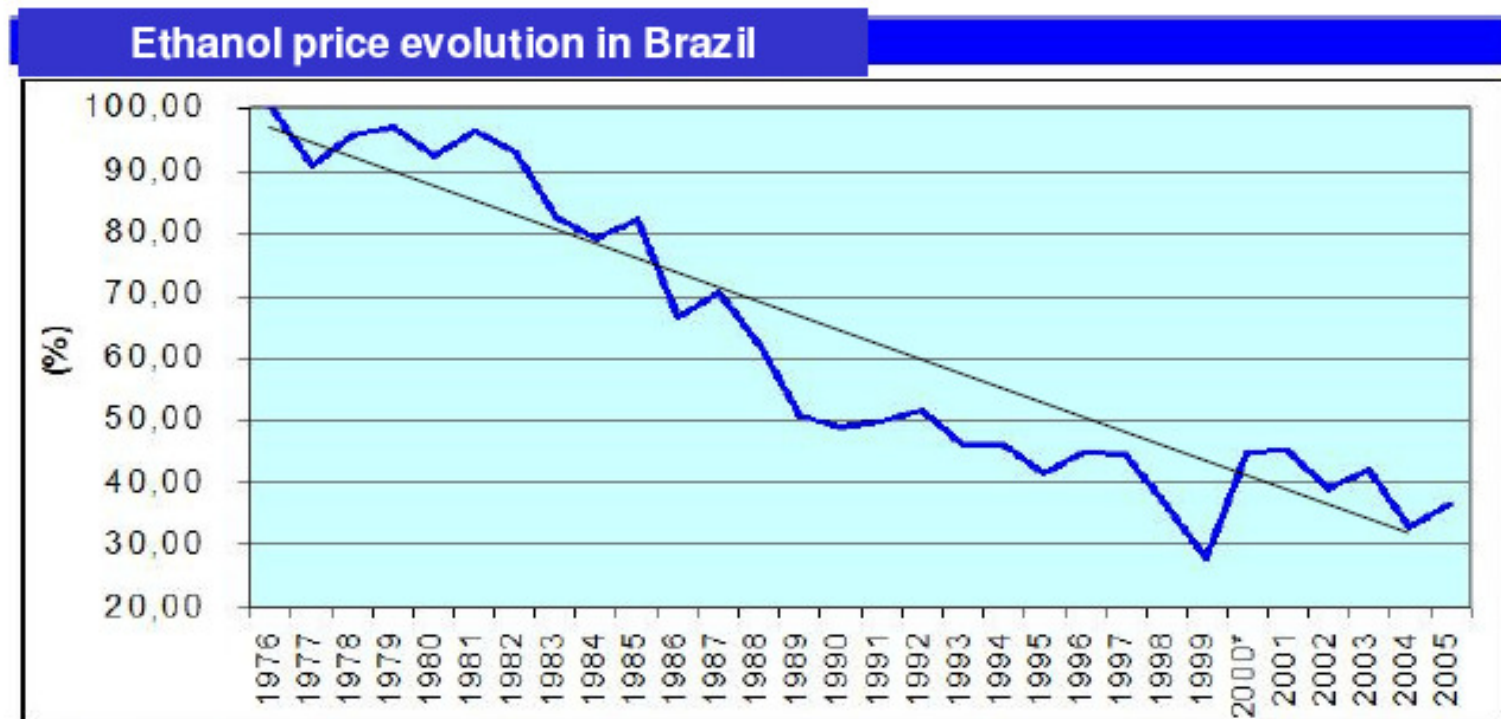
Liquid fuel for transportation – 1st and 2nd generation

Source: AEBIOM – european association for biomass

Brazil - Sugar cane and processing gains in productivity



ETHANOL PRODUCTION COST



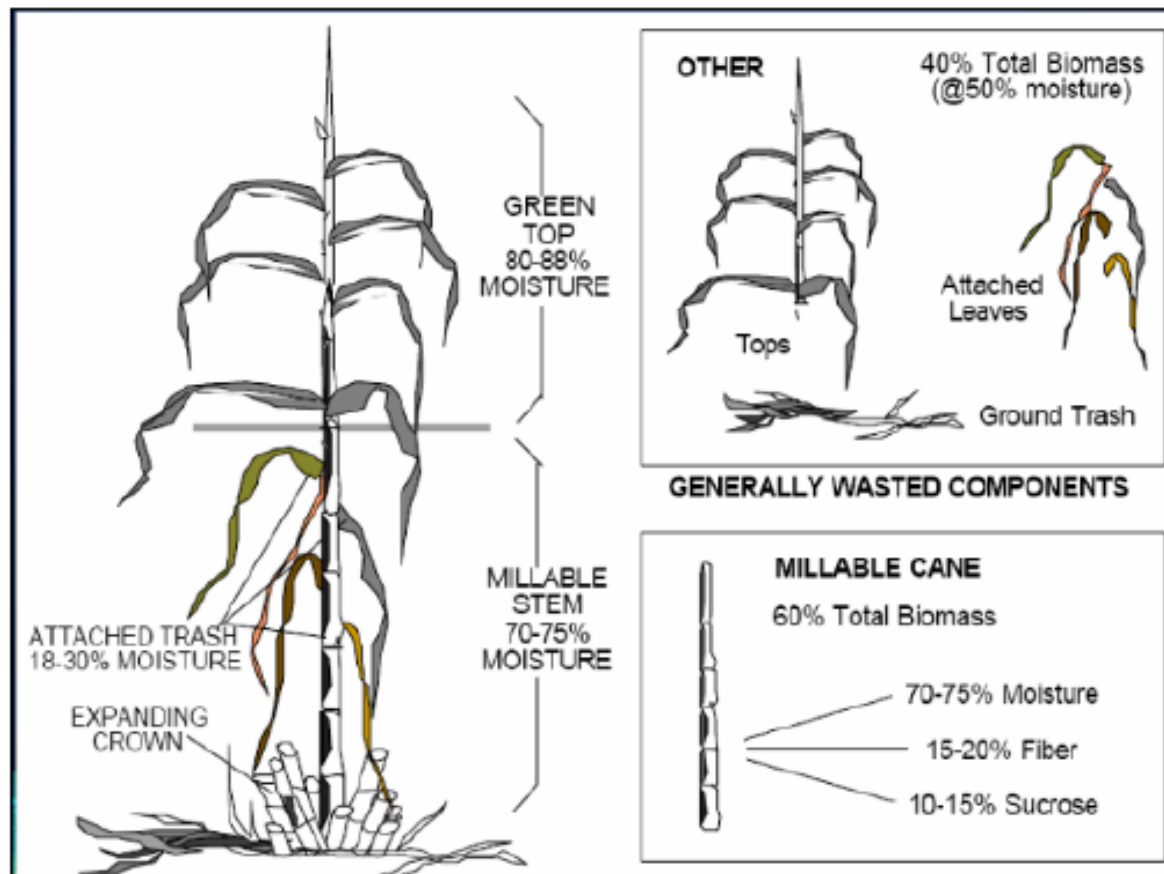
DEFLACIONADOS PELO IGP-DI - valores de julho de 2005

- Preços aos produtores sem impostos

- 1976 = base 100

(*) - momento de excesso de oferta

BAGASSE IS A POWDER OF LIGNO-CELLULOSE PRODUCED AFTER THE STEM OF THE SUGARCANE IS CRUSHED AND WHASHED



Bagasse is the best feedstock:

- **Already paid for**
- **Already at the mill**
- **No transportation cost**
- **30% of the total biomass**
- **Currently used to produce electricity and steam**

BRAZIL COULD INCREASE ETHANOL PRODUCTION TWO FOLD IF ALL THE BAGASSE WERE CONVERTED INTO ETHANOL

TODAY: SUCROSE ONLY

2005 Harvest:

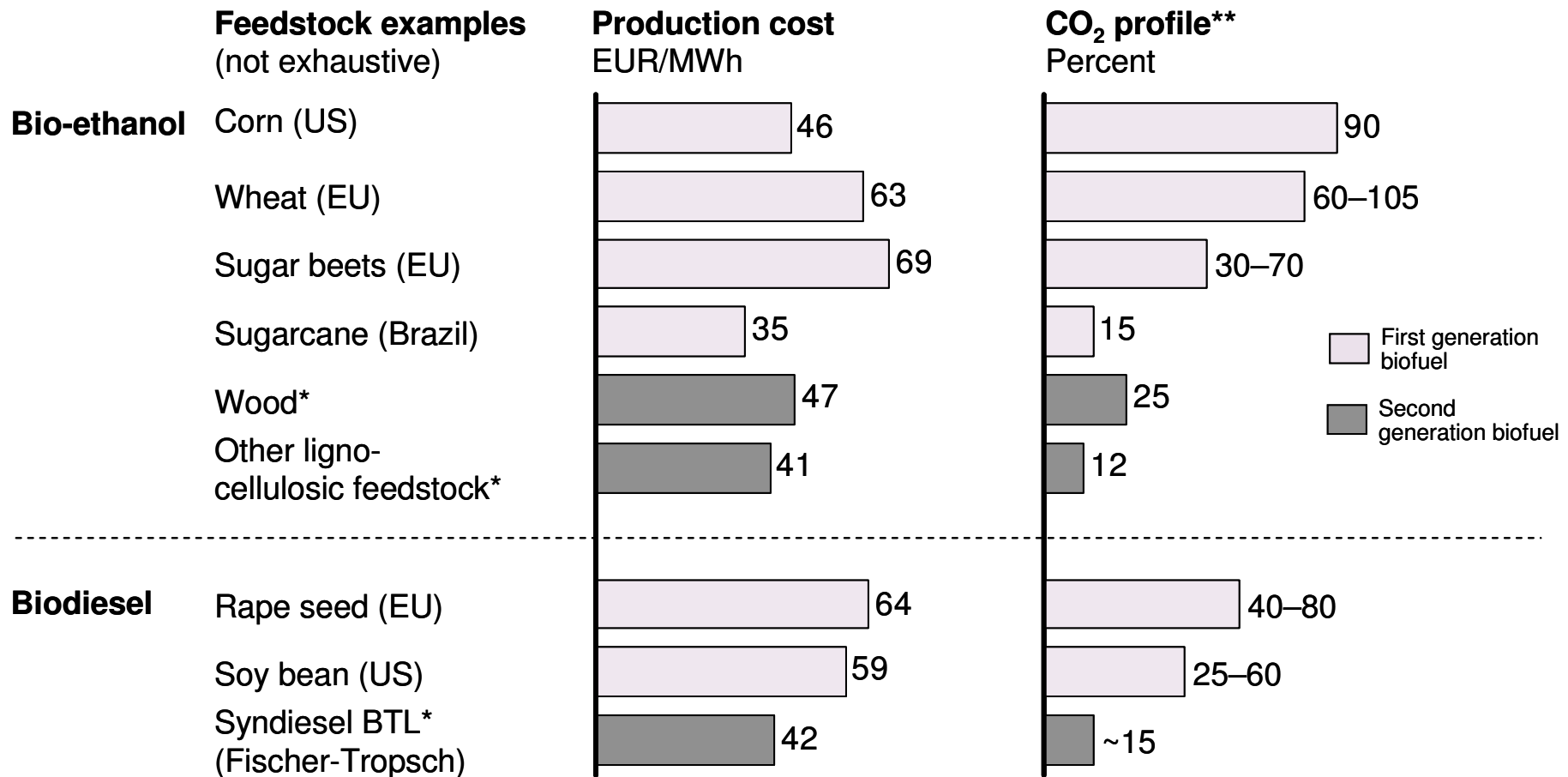
- 436 million tons of cane produced in ~5 million ha
- 55% used for sugar, 45% used for ethanol production
- 17 billion liters of ethanol produced

BAGASSE POTENTIAL

2005 Harvest:

- 122 million tons of bagasse
- 25 billion liters of ethanol
- 6,6 billion additional liters if 30% of the straw is collected
- Lignin can provide all the energy for the process

2nd generation – reduction of production costs and CO₂



* Expected cost in 2020

** Percentage of CO₂ release for the corresponding fossil fuel (well to wheel)

Source: McKinsey; Eucar/Concawe/JRC well-to-wheels study, 2003, 2005



Gasoline

Bad

A non-renewable fossil fuel produced by refining crude oil; emits large quantities of CO₂ upon combustion.



Biodiesel

Good

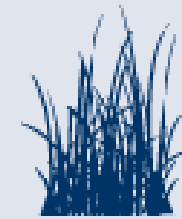
A renewable alternative to petroleum diesel produced from animal fat or vegetable oil.



Corn-derived Ethanol

Transitional

The main source of ethanol in the U.S. But growing corn is energy-intensive and requires large amounts of fertilizer made with fossil fuel.



Cellulosic Ethanol

Potentially Great

Production results in the same ethanol that corn produces, but the feedstocks, especially switchgrass, are inexpensive and easy to grow and the process of refining them is environmentally friendly.

Net Energy Balance *

N/A

3.20

1.34

2.62

Reduction in Greenhouse Gas Emissions

None
(1 gallon produces 19 lbs of CO₂)

67.7%

21.8%

91%

Cost (per gallon)

\$3.10

\$2.90 average

\$2.55 (E85)

\$2.55 (E85)

Gallons/Acre

n/a

Varies by feedstock
Rapeseed: 127

328

Varies by feedstock
Switchgrass: 1000