THE THIRD BERKELEY CONFERENCE ON THE BIOECONOMY

THE CURRENT SITUATION OF BIOFUEL: ECONOMICS, POLICY, TECHNOLOGY, AND RESEARCH

June 24-25, 2010

The Environmental Regulations of Biofuels in Europe

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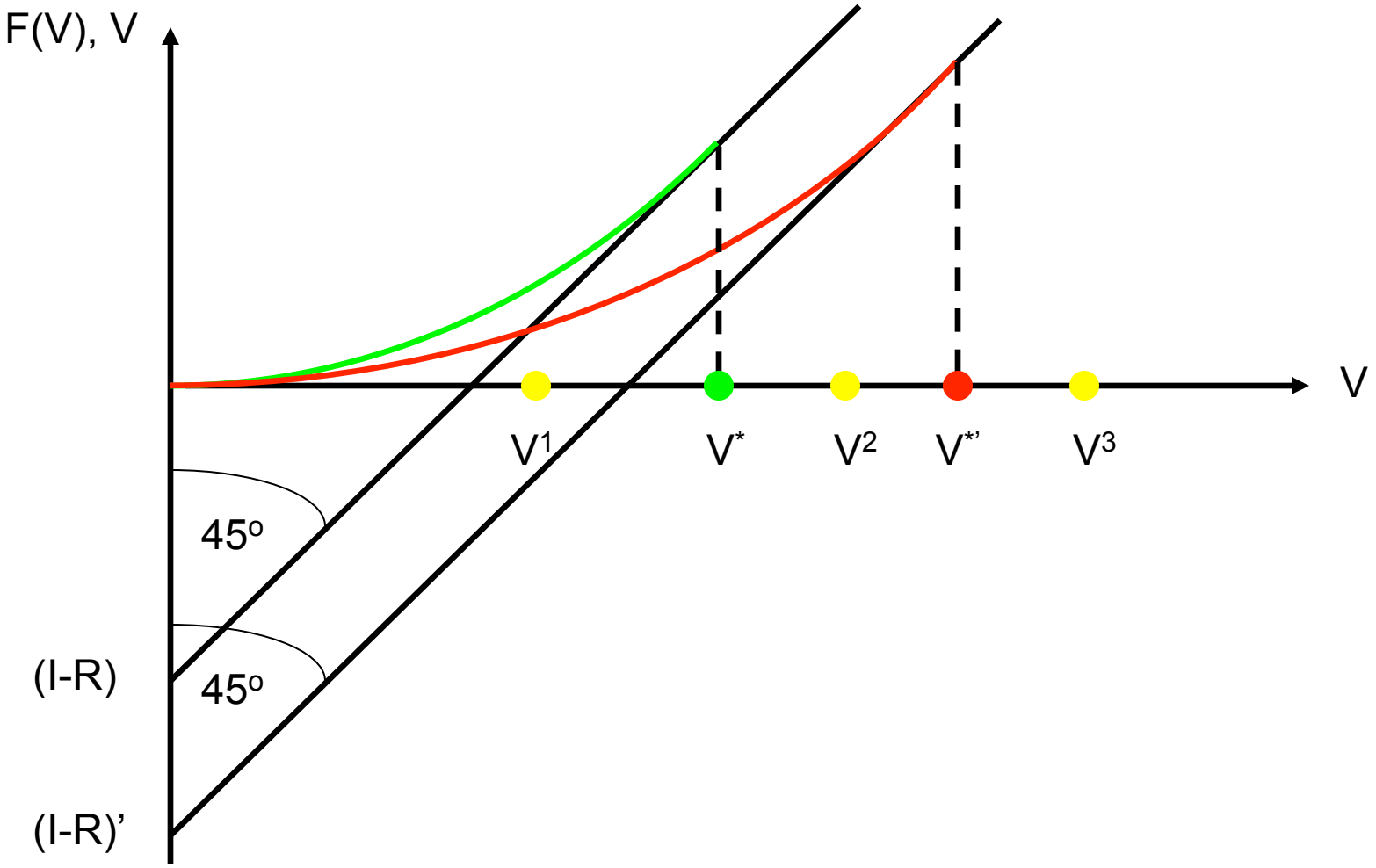
Outline

- Theoretical Framework
- Biofuel Production in the EU
  - targets and policies
  - production and sources
- Environmental Regulations of Biofuels in the EU
  - overview EU bioenergy/biofuel regulations
  - environmental regulations for biofuels
- Assessment and Conclusions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EU renewable energy policy

- mainly driven by reduction in GHG emissions as part of the Kyoto Protocol commitments and commitments beyond 2012

- other reasons
  - security of energy supply
  - promoting technological development and innovation
  - providing opportunities for employment

EU renewable energy policy

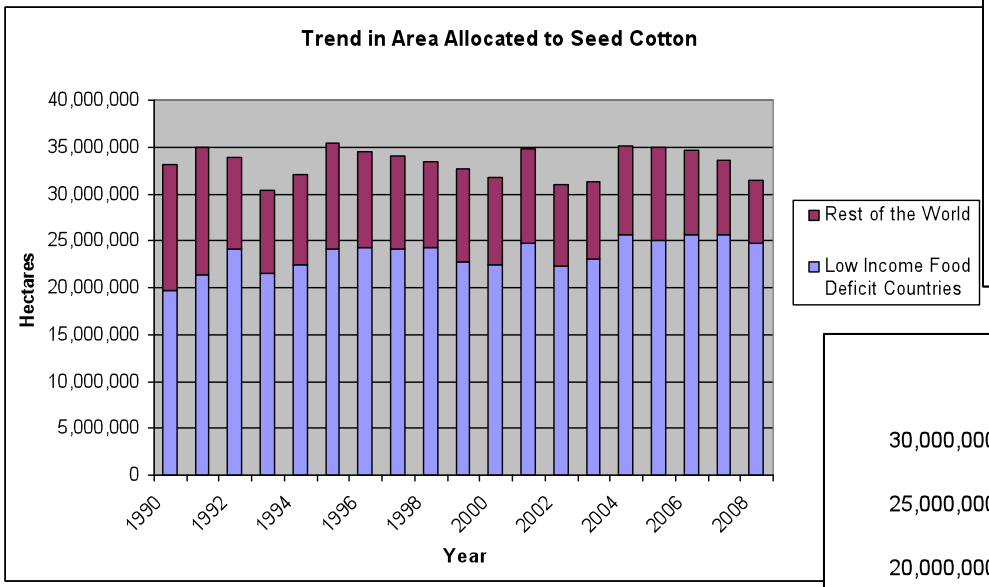
- early on concerns have been raised, including
  - food security impacts of renewable energy
  - environmental sustainability of renewable energy production

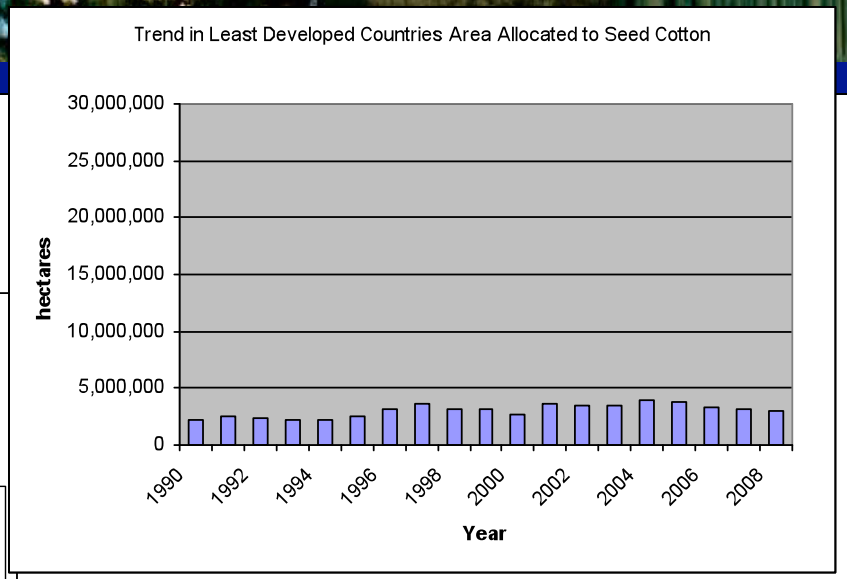
EU renewable energy policy

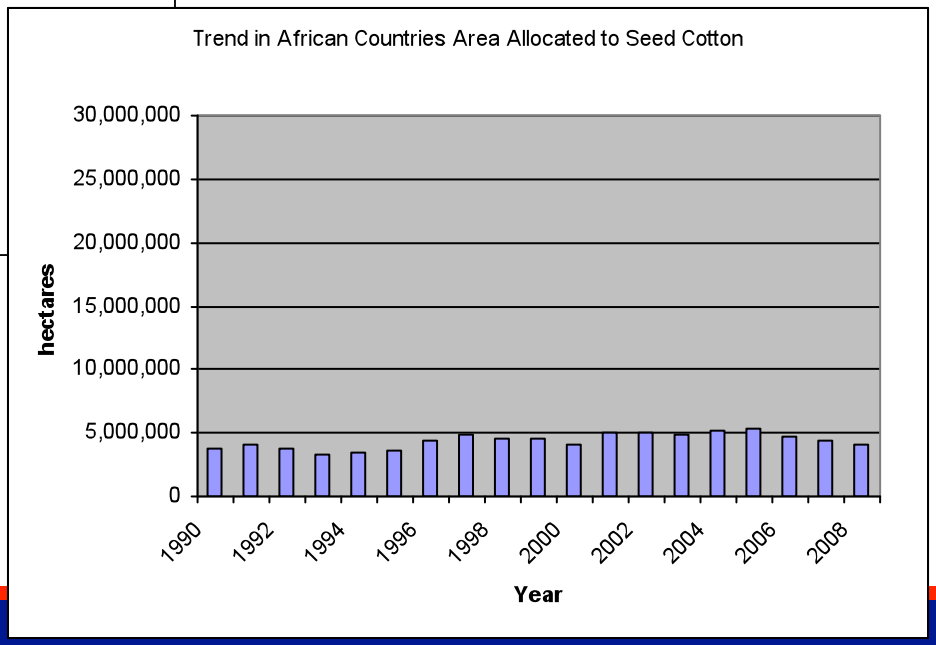
- some issues have been fueled by commonly held myths

1. myth: biofuel is a non-food item endangering food security requiring special regulations

Trends in Area Allocated to Seed Cotton







Source: FAOSTAT, 2010

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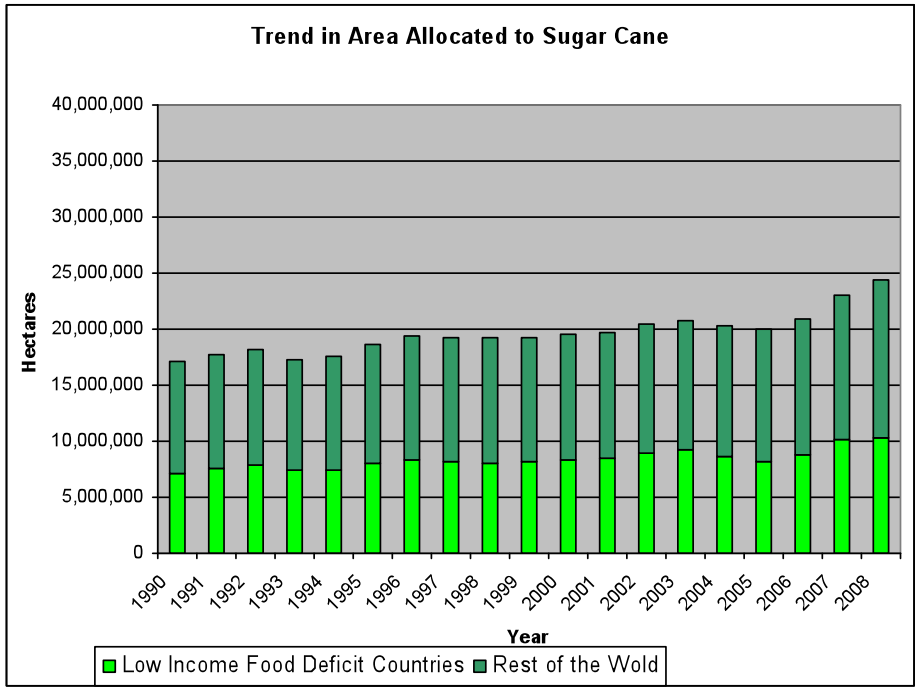
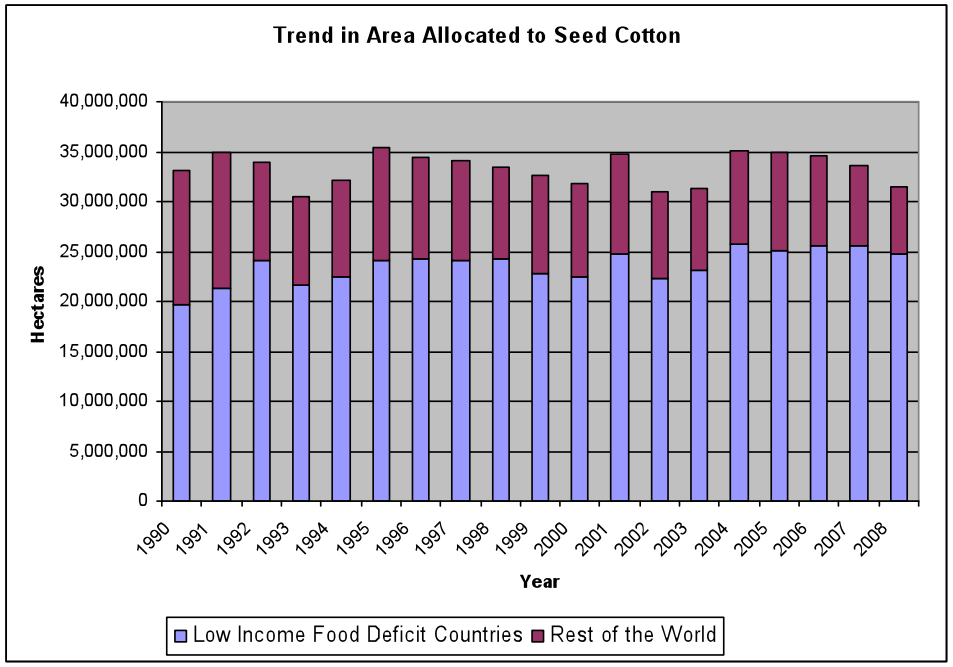
Area Allocated to Sugar Cane and Seed Cotton





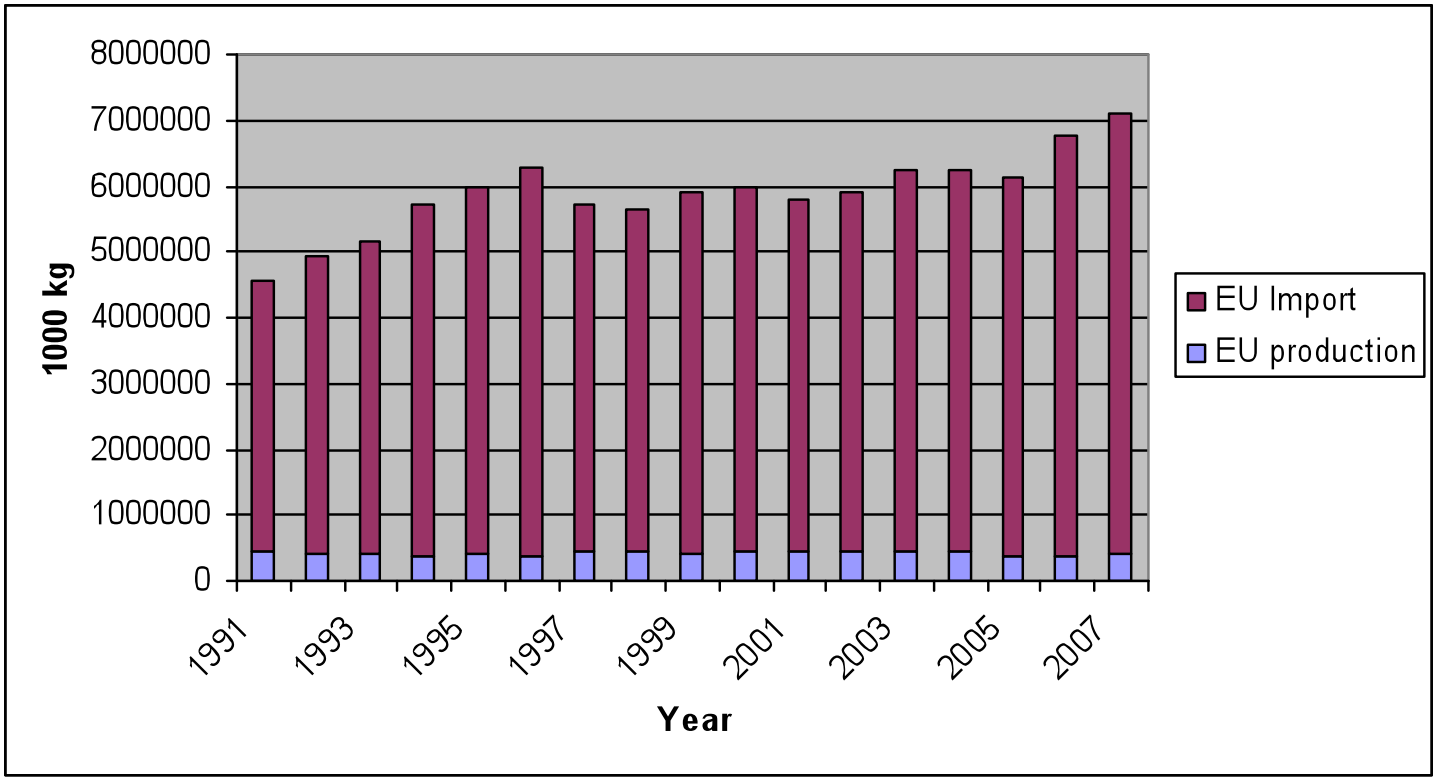
Source: FAOSTAT, 2010

EU renewable energy policy

- some issues have been fueled by commonly held myths

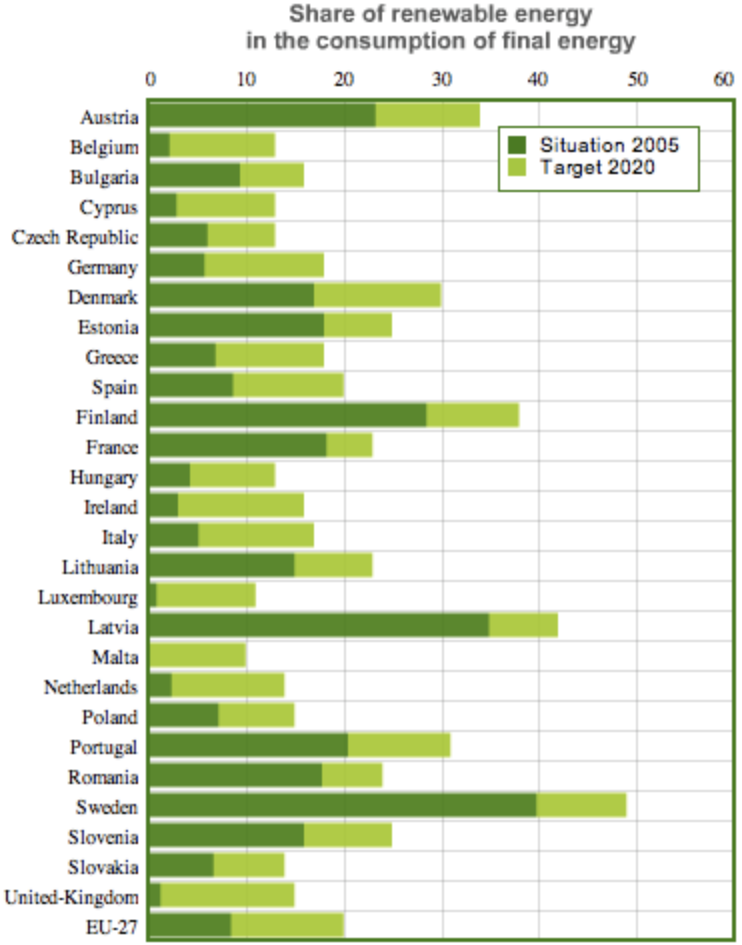
1. myth: biofuel is a non-food item endangering food security
2. myth: achieving renewable energy targets requires production in EU member states

Trend in Banana Production and Import in the EU



Renewable Energy Targets by 2020 of EU Member States

Country		Share of renewable energy 2005	2020
AT	Austria	23.3	34.0
BE	Belgium	2.2	13.0
BG	Bulgaria	9.4	16.0
CY	Cyprus	2.9	13.0
CZ	Czech Republic	6.1	13.0
DE	Germany	5.8	18.0
DK	Denmark	17.0	30.0
EE	Estonia	18.0	25.0
EL	Greece	6.9	18.0
ES	Spain	8.7	20.0
FI	Finland	28.5	38.0
FR	France	18.3	23.0
HU	Hungary	4.3	13.0
IE	Ireland	3.1	16.0
IT	Italy	5.2	17.0
LT	Lithuania	15.0	23.0
LU	Luxembourg	0.9	11.0
LV	Latvia	34.9	42.0
MT	Malta	0.0	10.0
NL	Netherlands	2.4	14.0
PL	Poland	7.2	15.0
PT	Portugal	20.5	31.0
RO	Romania	17.8	24.0
SE	Sweden	39.8	49.0
SI	Slovenia	16.0	25.0
SK	Slovakia	6.7	14.0
UK	United Kingdom	1.3	15.0
EU-27	**EU 27**	**8.5**	**20.0**



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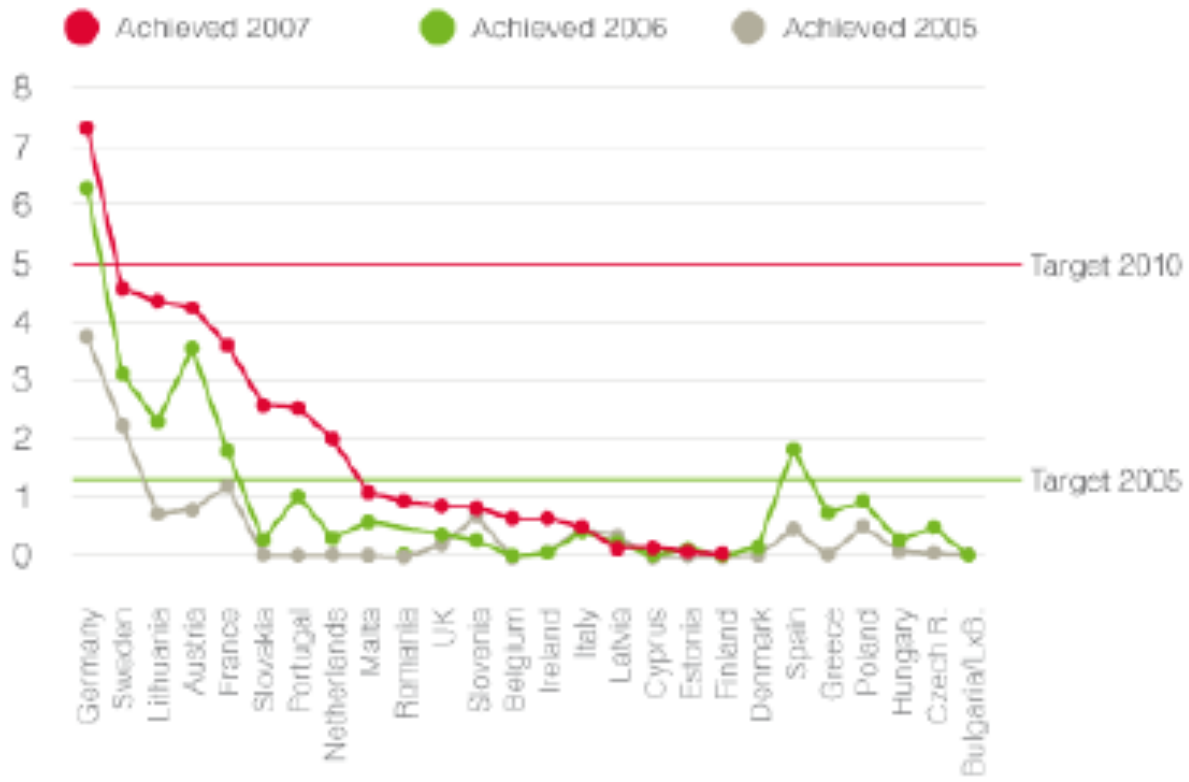
EU fuel blending targets

- 2% by energy content in 2005
  - 3 out of 25 member states reached the 2005 target (Germany, Austria, Sweden)
- 5.75 % by energy content for 2010
  - achieved by Germany (since 2007), Austria and France (since 2008)
- 10% by energy content for 2020

  Energy content: petrol, diesel, biofuels consumed in road and rail transport, and electricity.

EU biofuel use in transport (2007)

- 75% biodiesel (6.1 Mtoe)
- 15 % bioethanol (1.24 Mtoe)
- 10% pure vegetable oil

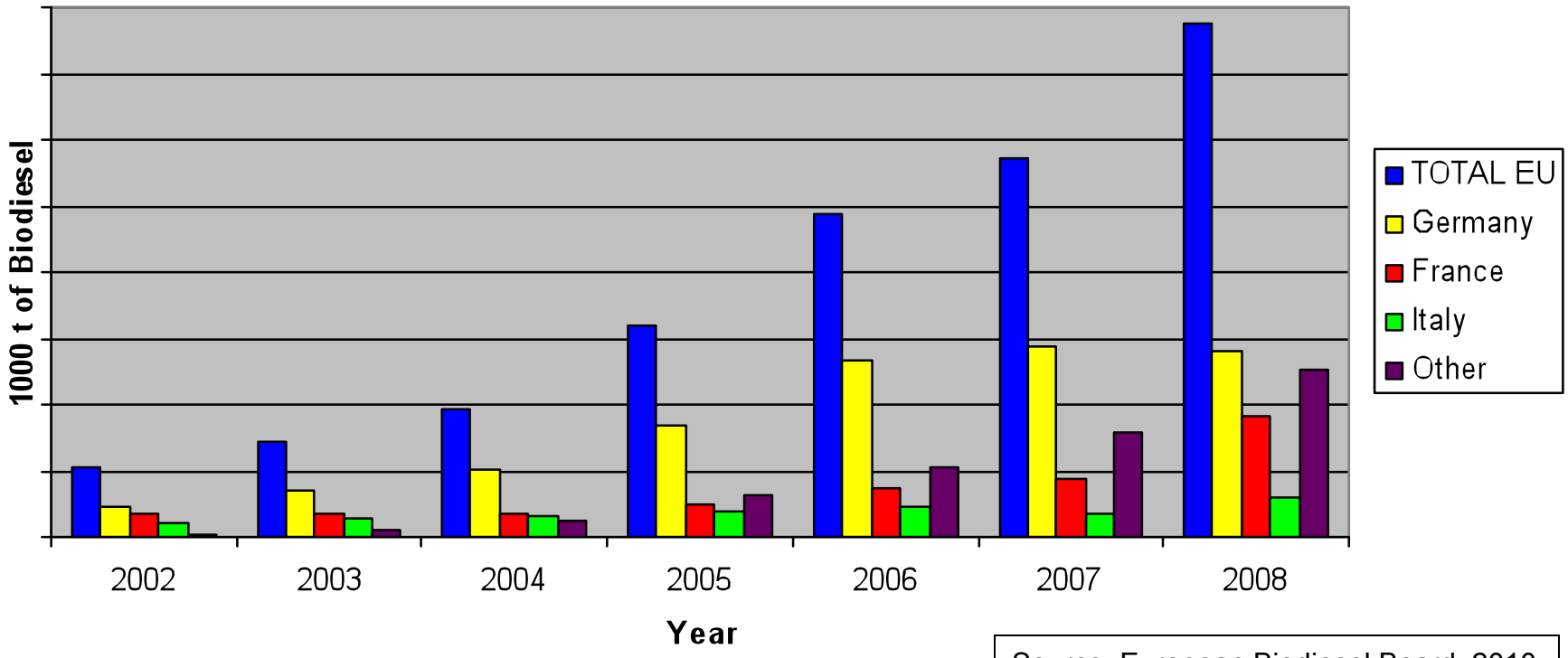


*Greece, Denmark, Spain, Hungary, the Czech Republic, Poland, Belgium, Luxembourg and Bulgaria did not yet submit their report for 2007.

Source: Member State reports

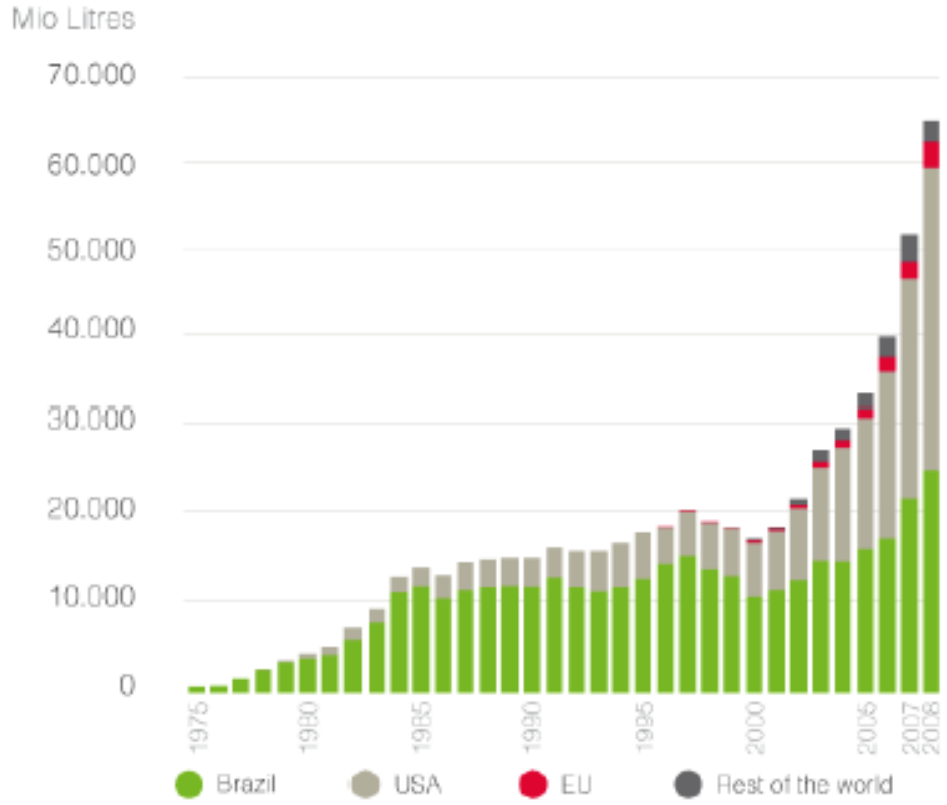
Biofuels Target: reference value 2010

Evolution of Biodiesel Production in the EU (2002 - 2008)



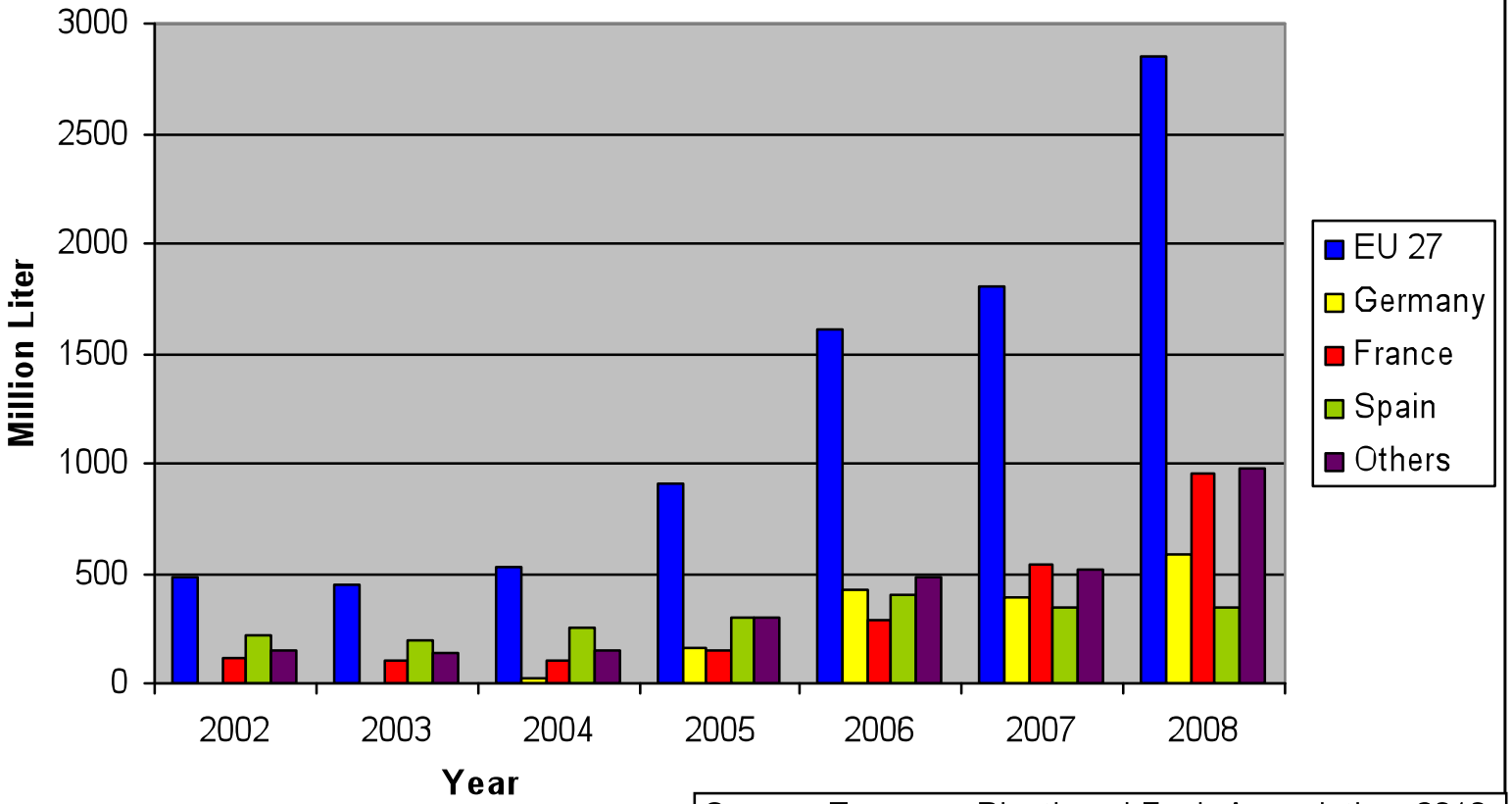
Source: European Biodiesel Board, 2010

Trends in Global Ethanol Production for Fuel



Source: European Biodiesel Board, 2010

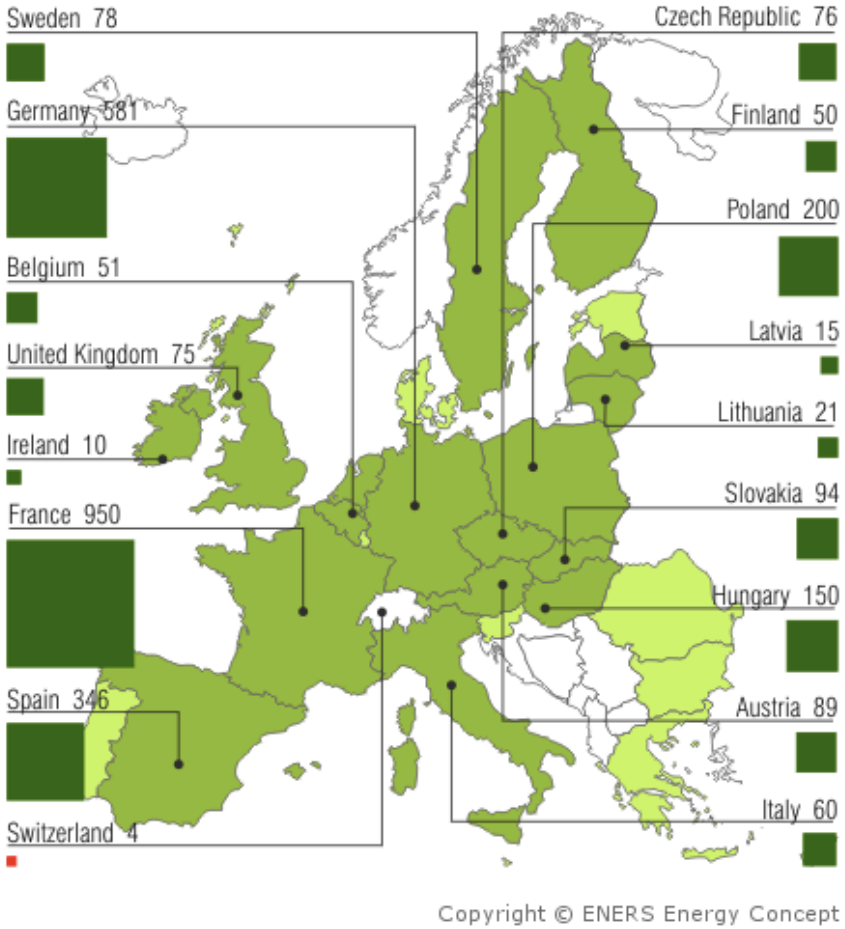
Evolution of Fuel-Bioethanol Production in the EU (2002-2008)



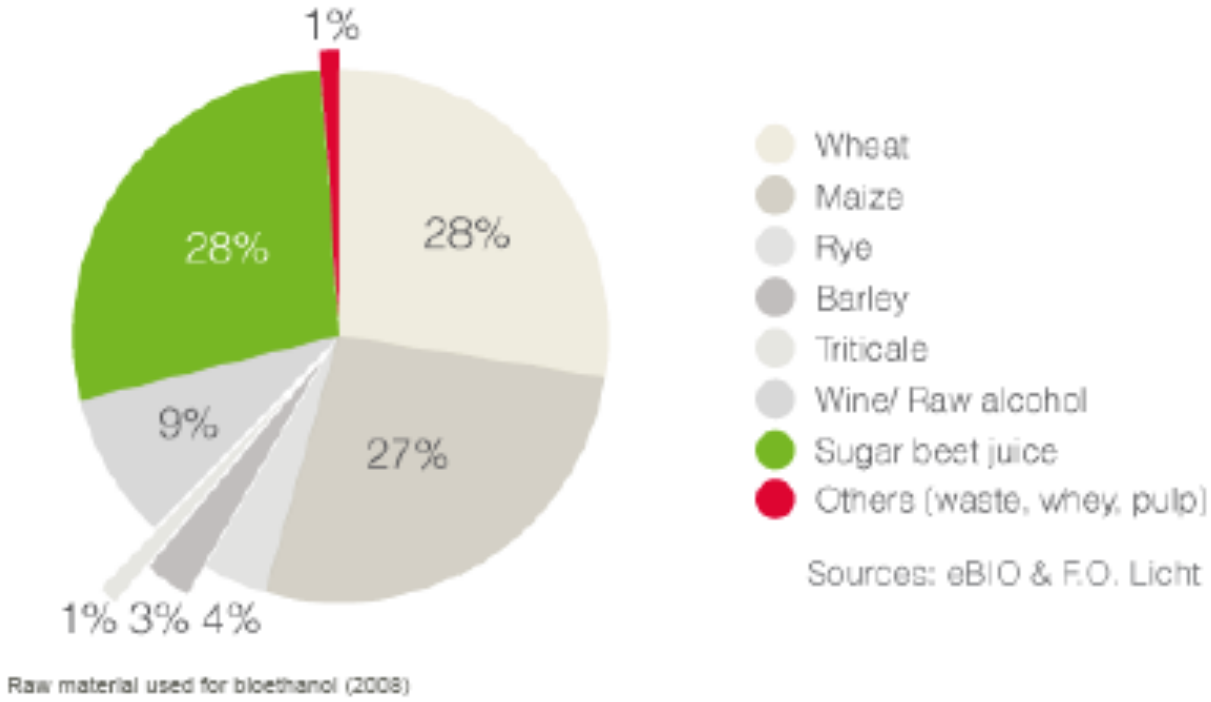
Source: European Bioethanol Fuel Association, 2010

Production of fuel-bioethanol in the EU-27 and Switzerland in 2008

Country		Production [Ml/yr]
AT	Austria	89
BE	Belgium	51
BG	Bulgaria	0
CY	Cyprus	0
CZ	Czech Republic	76
DE	Germany	581
DK	Denmark	0
EE	Estonia	0
EL	Greece	0
ES	Spain	346
FI	Finland	50
FR	France	950
HU	Hungary	150
IE	Ireland	10
IT	Italy	60
LT	Lithuania	21
LU	Luxembourg	0
LV	Latvia	15
MT	Malta	0
NL	Netherlands	9
PL	Poland	200
PT	Portugal	0
RO	Romania	0
SE	Sweden	78
SI	Slovenia	0
SK	Slovakia	94
UK	United Kingdom	75
EU-27	**EU 27**	**2'855**
CH	**Switzerland**	**4**

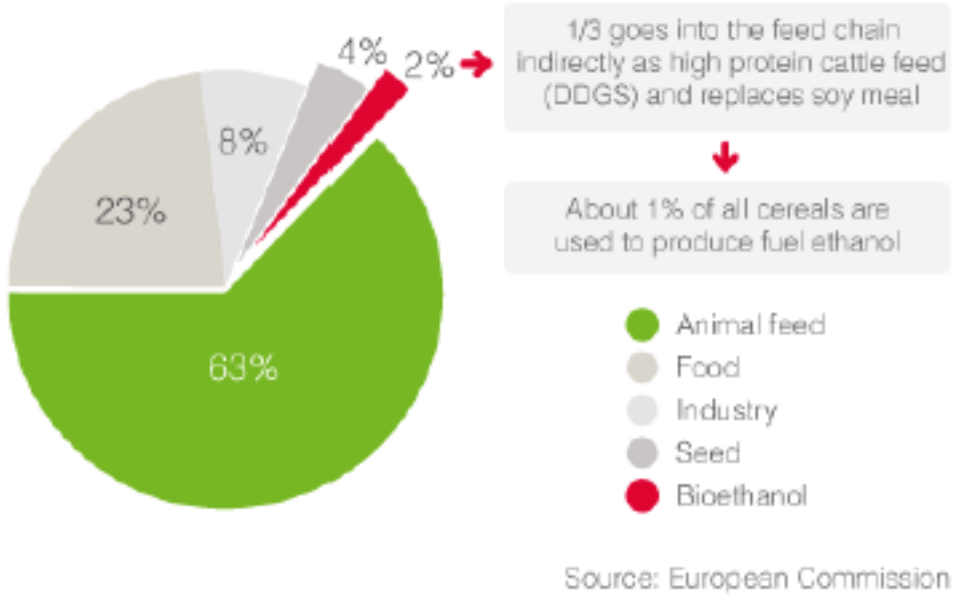


“In 2008 the preferred raw material was grain and, more in particular, wheat and maize. The second most important ethanol feedstock after grain is sugar beet juice and a smaller share is produced from raw alcohol. In 2008 we also saw an increasing volume of fuel ethanol being produced from other feedstock such as wood pulp, whey and food waste.” (European Bioethanol Fuel Association, 2010)



Raw material used for bioethanol (2008)

“If we look at the bigger picture of grain use in the EU it becomes immediately clear that bioethanol production is only a marginal consumer of grain. Almost 69% of Europe’s cereals go to the animal feed sector whereas approximately only 2% of all cereals is destined for the bioethanol. Of this extremely small share about one third goes back to the animal feed sector as a high protein animal feed called DDGS. This by-product replaces imported soya meal.” (European Bioethanol Fuel Association, 2010)



Cereal end-use in the EU (Harvest 2008/09 - estimate)

EU environmental policies and biofuels

- basis Directive 2009/28/EC on the promotion of the use of energy from renewable sources
- key points: targets, national action plans, considering externalities
  - greater mobilization of existing timber reserves, development of new forestry systems
  - biofuel production be sustainable
    =>national support schemes fulfill sustainability criteria

EU environmental policies and biofuels

- sustainability criteria
  - not have the effects of encouraging the destruction of biodiverse lands;
    - forest lands, grass lands => identified by EC
  - not take place in areas designated for nature protection purposes;
  - not take place in areas for the protection of threatened or endangered ecosystems or species;
  - not include peatlands;
  - conversion of forest land to oil palm plantation explicitly excluded.

EU environmental policies and biofuels

- sustainability criteria
  - net GHG-emission needs to be considered;

    => land conversion has to result in GHG emission savings

    - until 2017, 35%; 50%, 2018; 60% after 2018;
  - net GHG-emission saving calculation:

    Saving = $(E_F - E_B)/E_F$

    E_F: total emission from the biofuel or bioliquid;

    E_B: total emission from the fossil fuel comparator.

EU environmental policies and biofuels

- sustainability criteria
  - net GHG-emission saving calculation:

$$E_{F,B} = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee}$$

- e_{ee}: emission from the extraction or cultivation of raw material;
- e_l: annualised emissions from carbon stock changes caused by land-use ch.
- e_p: emissions from processing;
- e_{td}: emissions from transport and distribution
- e_u: emissions from the fuel in use
- e_{sca}: emission saving from soil carbon accumulation via improved agr. mang.
- e_{ccs}: emission saving from carbon capture and geological storage;
- e_{ccr}: emission saving from carbon capture and replacement;
- e_{ee}: emission saving from excess electricity from cogeneration.

EU environmental policies and biofuels

- sustainability criteria
  - net GHG-emission saving calculation:
    - GHG emissions expressed in grams of CO_{2e} per MJ of fuel at point of use;
    - maybe adjusted to km/MJ to account for differences in fuels.
    - e_l annualised emissions from carbon stock changes caused by land-use change: $(CS_R – CS_A) * 3.664 * 1/20 * 1/P - e_B$
    - CS_R, reference stock level; CS_A, actual stock level
    - e_B, bonus of 29g CO_{2e}/MJ for restored degraded land (for up to 10 years);

EU environmental policies and biofuels

- **sustainability criteria**
  - land use within the EU has to be in line with EU agr. env. policy;
  - bilateral agreements, to promote sustainable production

    => need to consider indirect land use effects!
  - promotion should encourage agricultural productivity and the use of degraded land;
  - co-products need to be considered for GHG emission effects;

EU environmental policies and biofuels

- sustainability criteria
  - tax relief and subsidies allowed;
  - traceability and transparency of biofuel production and sustainability assessment;
  - revision after 2020;
  - includes certification schemes for biofuel imports.

Assessment and Conclusions

- directive only applies to biofuels accounted for the targets;
- calculation for GHG emission very detailed,
    - considers opportunity costs,
    - but time not properly considered (no discounting);
- assessing indirect land use change difficult,
    - requires perfect foresight, ignores other problems (institutional issues);

Assessment and Conclusions

- certification scheme MAY impose problems with WTO.
- rationale for biofuel policy questionable:
  - Why sustainability criteria for biofuels and not for other products?

Thank You!

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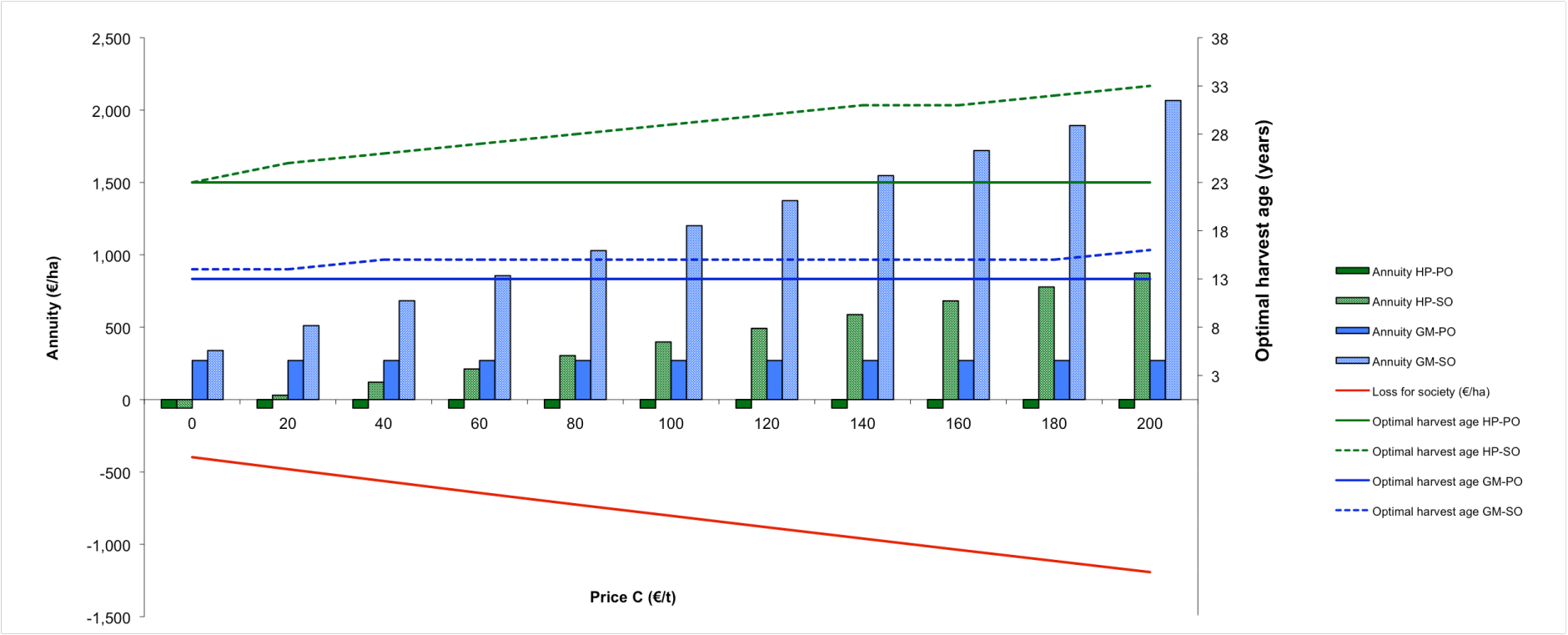

Figure 1. Comparison of the poplars. Optimal harvest age, annuity and loss for society from private and social point of view. HP-hybrid poplar, GM-genetically modified poplar, PO-private optimum, SO-social optimum.

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