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Assessing EU Biofuel Policy with MIRAGE-BIOF Current Landscape and New developments

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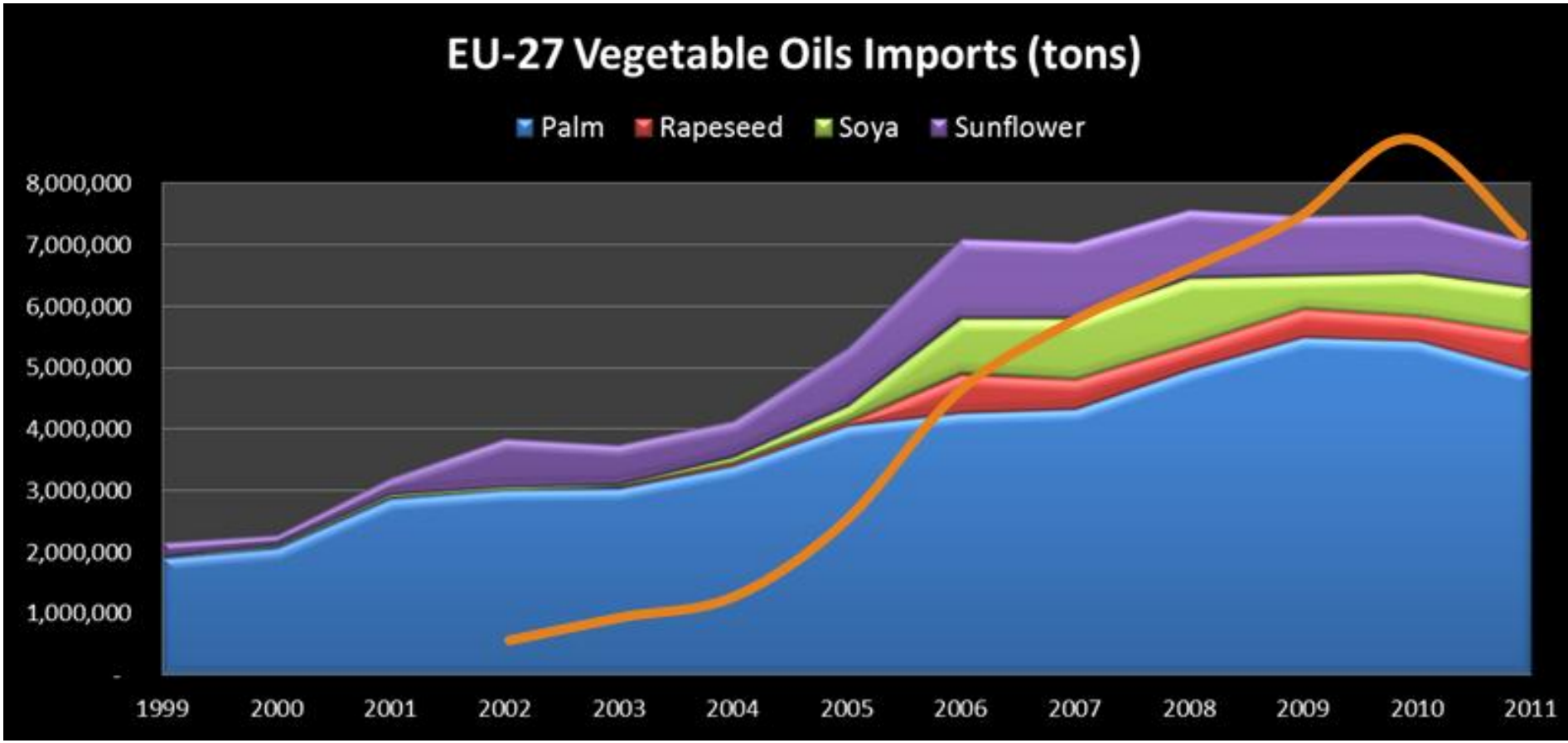
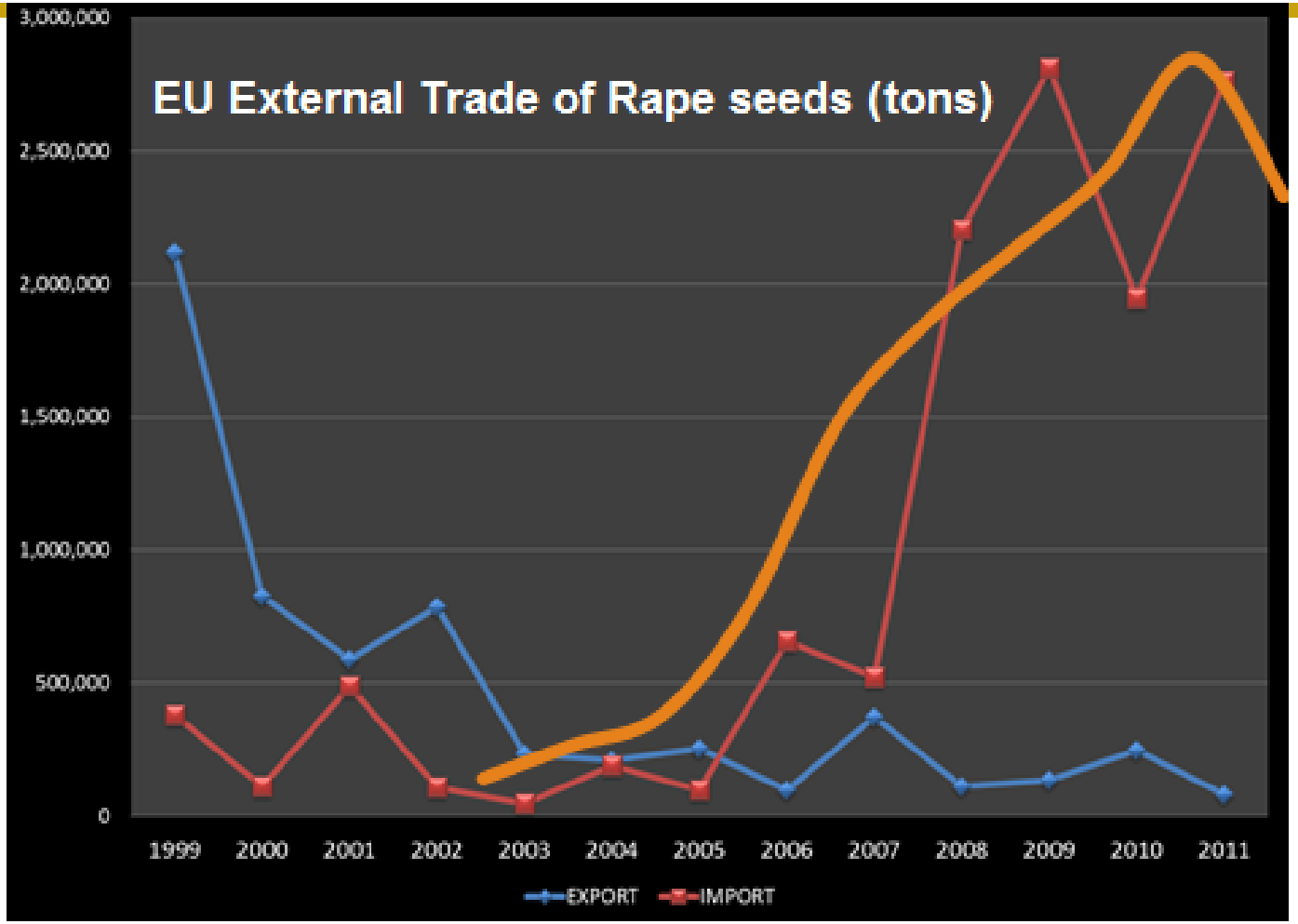
SETTING THE STAGE

And why each market is different, and iLUC for the same commodity can differ from one country/region to another



Orange line = EU Biodiesel production – different scale

EU Rapeseed trade



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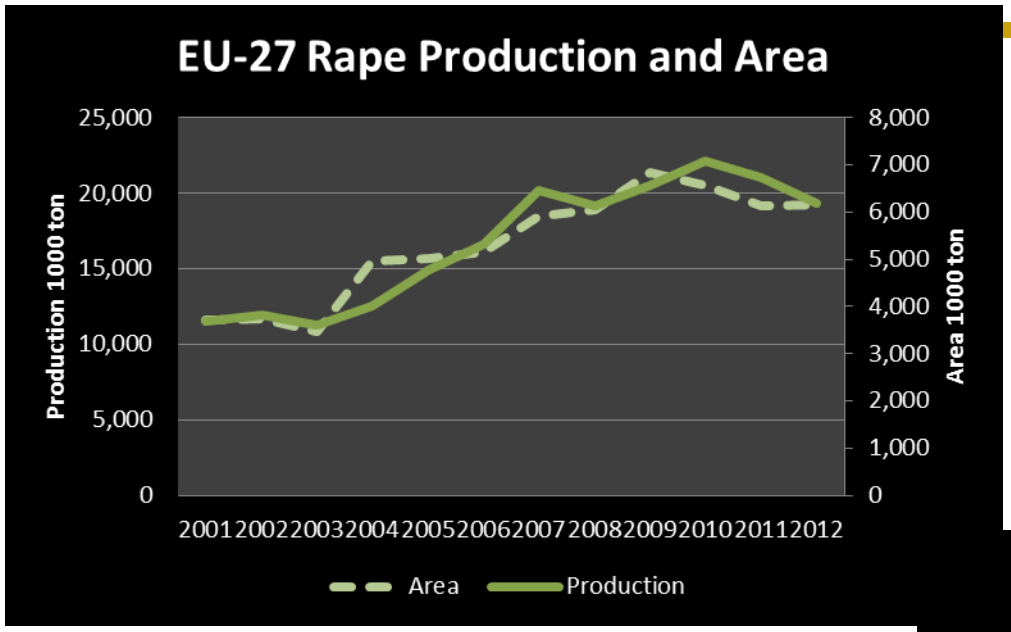
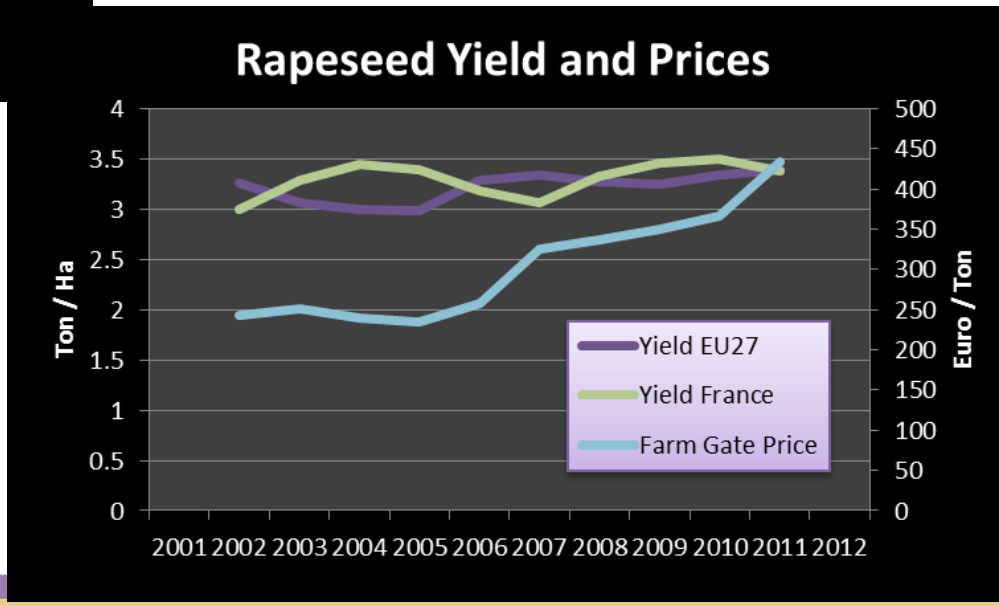




THE MIRAGE-BIOFUELS MODEL

Modeling Biofuels in MIRAGE

- MIRAGE-Biof model
  - Global CGE model. First version of MIRAGE 2001, First version of MIRAGE-Biof 2008
  - Recursive dynamic set-up. Baseline from 2008 to 2020.
  - See :Laborde and Valin (2012, Climate Change Economics)
- Modified model and data components
  - Improvement in demand system (food and energy)
  - Improved sector disaggregation
  - New modeling of ethanol sectors
  - Co-products of ethanols and vegetable oils
  - New modeling of fertilizers and livestocks (extensification/intensification)
  - Land market and land extensions at the AEZ level
  - Extension in Managed and Unmanaged (pristine) Land
- Specific Database to reconcile values, volume and prices

SIMULATION DESIGN

Baseline

- Sugar reform (still a source of numerical problems)
- End of the Land Set Aside
- EU trade measures vs US Biodiesel
- No change in trade policy for Ethanol
- Some restrictions on Brazilian exports to the US in the baseline:
  - Partially capture the change in the real exchange rate real/USD
  - Avoid too much confusion between corn and sugar cane ethanol for the central scenario
- Stronger Brazilian domestic consumption: but still large export supply response
- Modification of initial profitability in Argentina
- Yield changes: Aglink Cosimo

Scenarios

- Compare to the baseline

- Biofuel mandate:
  - Member states Action Plan
- Trade policy options:
  - Status Quo
  - Full Liberalization in the EU of Ethanol and Biodiesel

Sensitivity Analysis

- With different model closures/calibration
  - On linearity/non linearity issue
    - Estimation of crop LUC at a “half mandate”, at a full mandate
      - But still weak on Ethanol: no saturation effects
  - On food consumption
    - Endogenous vs Fixed to Baseline level
  - On Co-products: with or without
  - Monte Carlo simulations on selected parameters
  - But in reality, much more uncertainties (see **Box 2**, 25 items related to LUC, but even more regarding net emissions…)
    - About the land (amount, location, carbon values)
    - About future technologies
    - Both behavioral and technical uncertainties
- MonteCarlo Simulations on selected family of parameters

2011 REPORT OF THE EC

The LUC domino effect

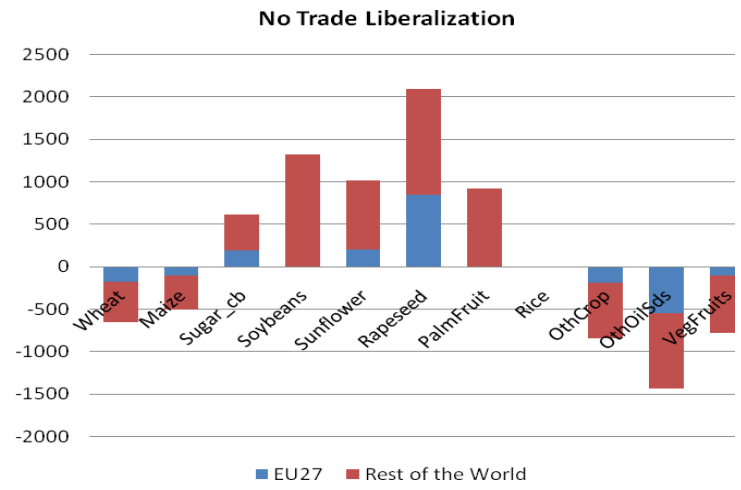
Agricultural inputs for the additional EU biofuel consumption
97,640 Ton

Additional Agricultural production of Energy crops
101,688 Ton

Area for Energy Crops
4,800,703 Ha

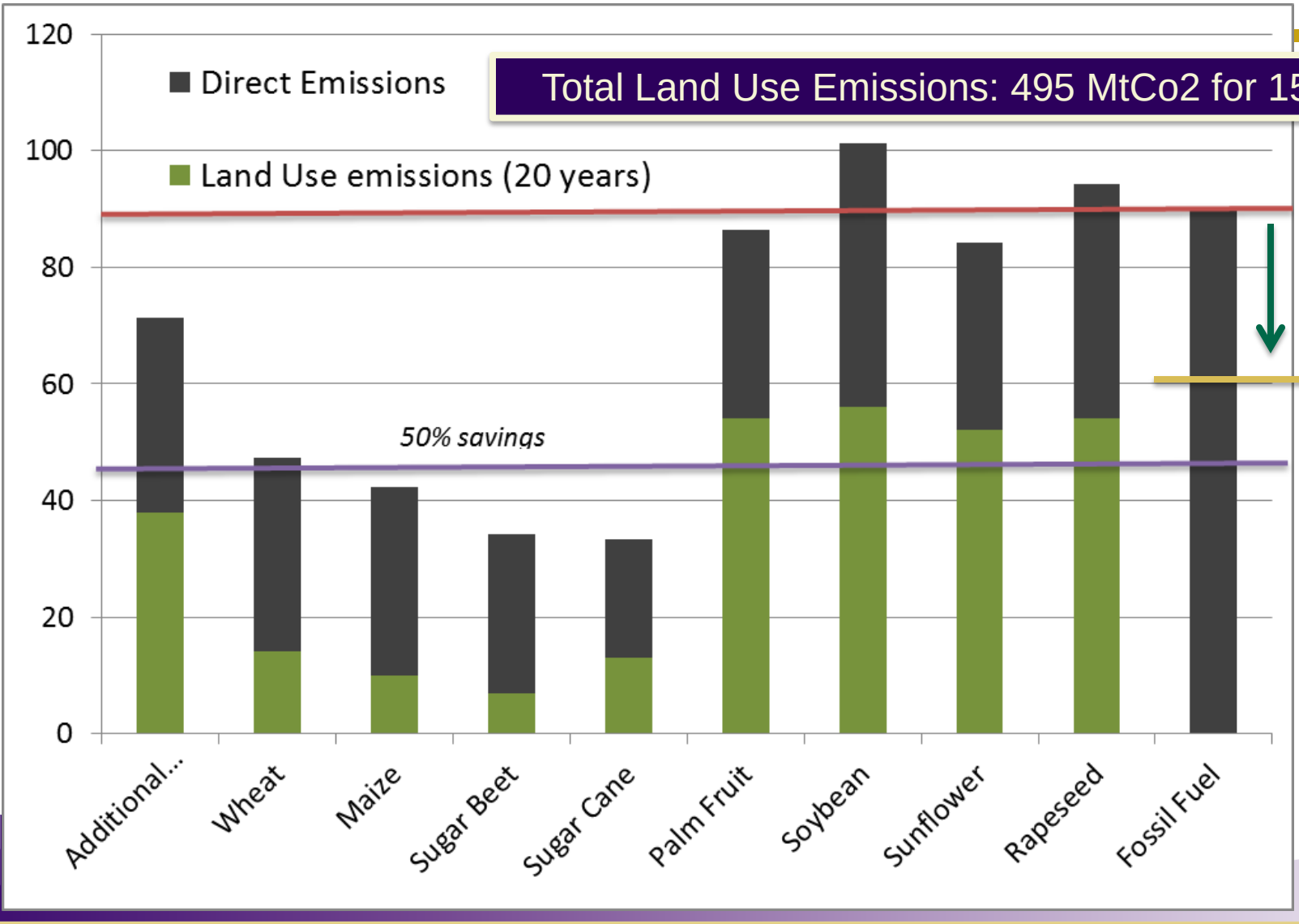
Cropland area
1,738,156 Ha
(=60% of Belgium or 10% of France's arable land)

Land taken from pristine environments
340,000 Ha

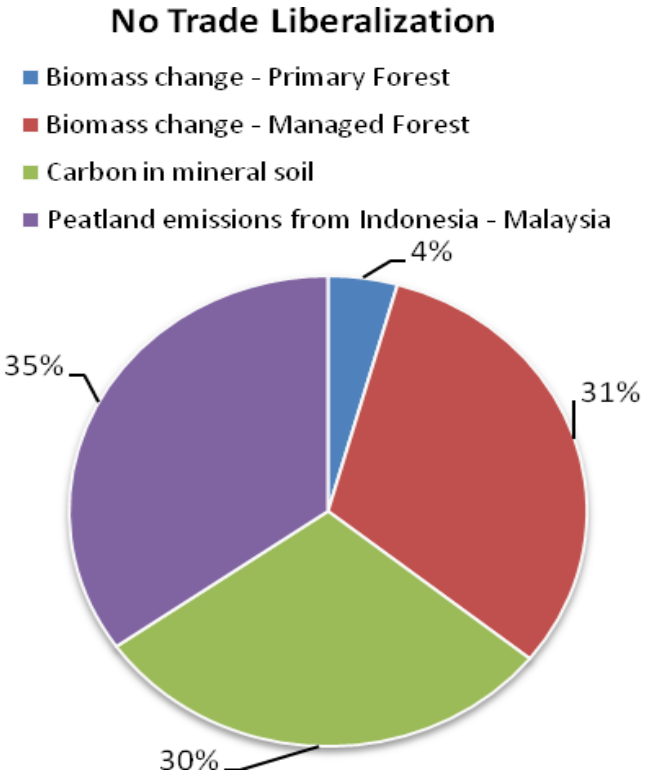


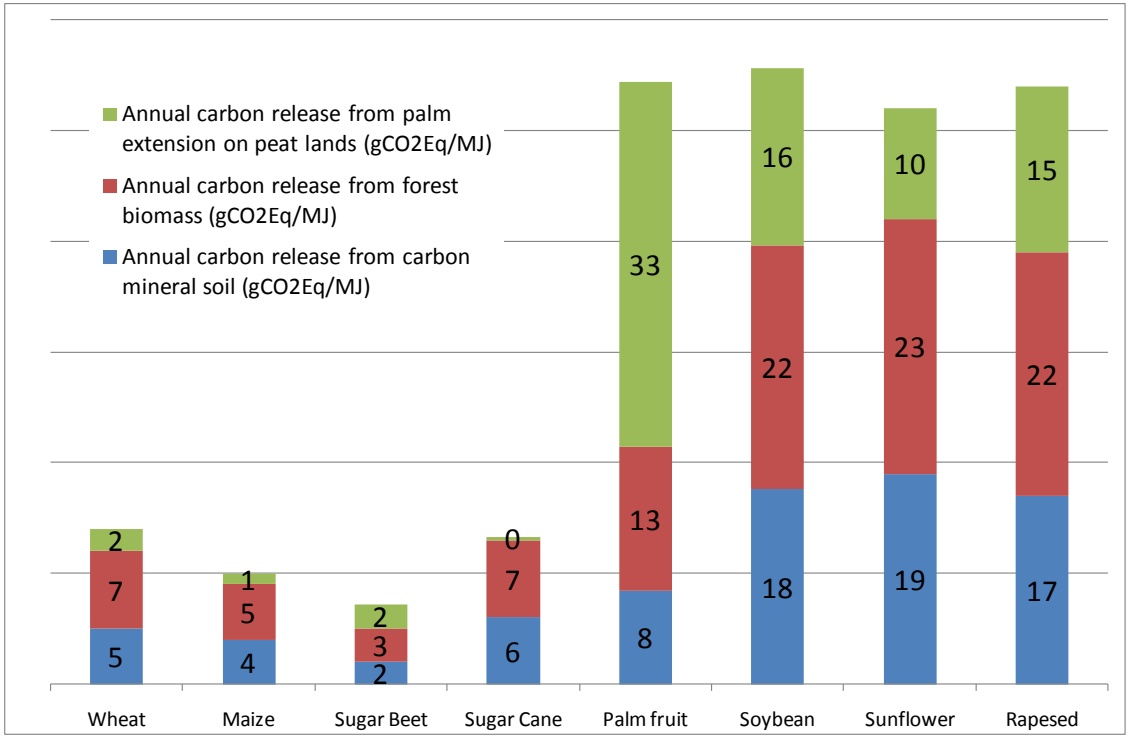
Change in Cropland (additional mandate)

Emissions grCO2/MJ – 20 years time horizon



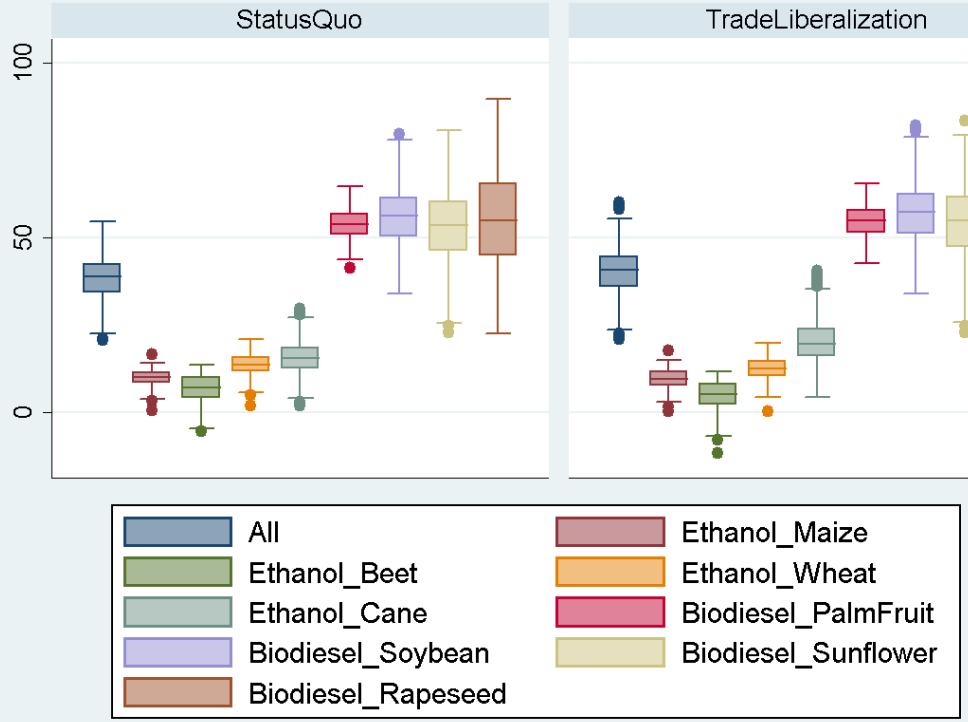
Emissions Sources

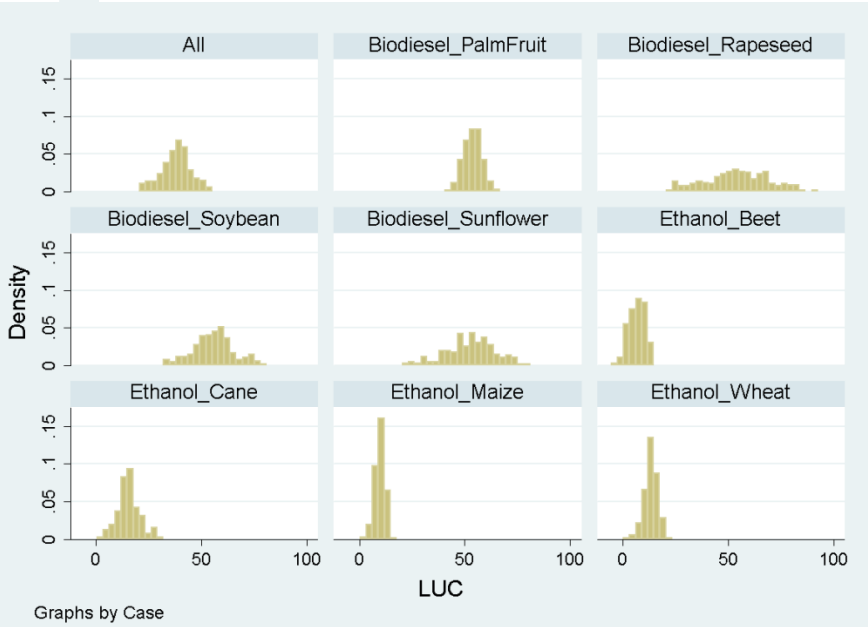




Origin of LUC CO2 emissions (additional mandate)

Sensitivity Analysis



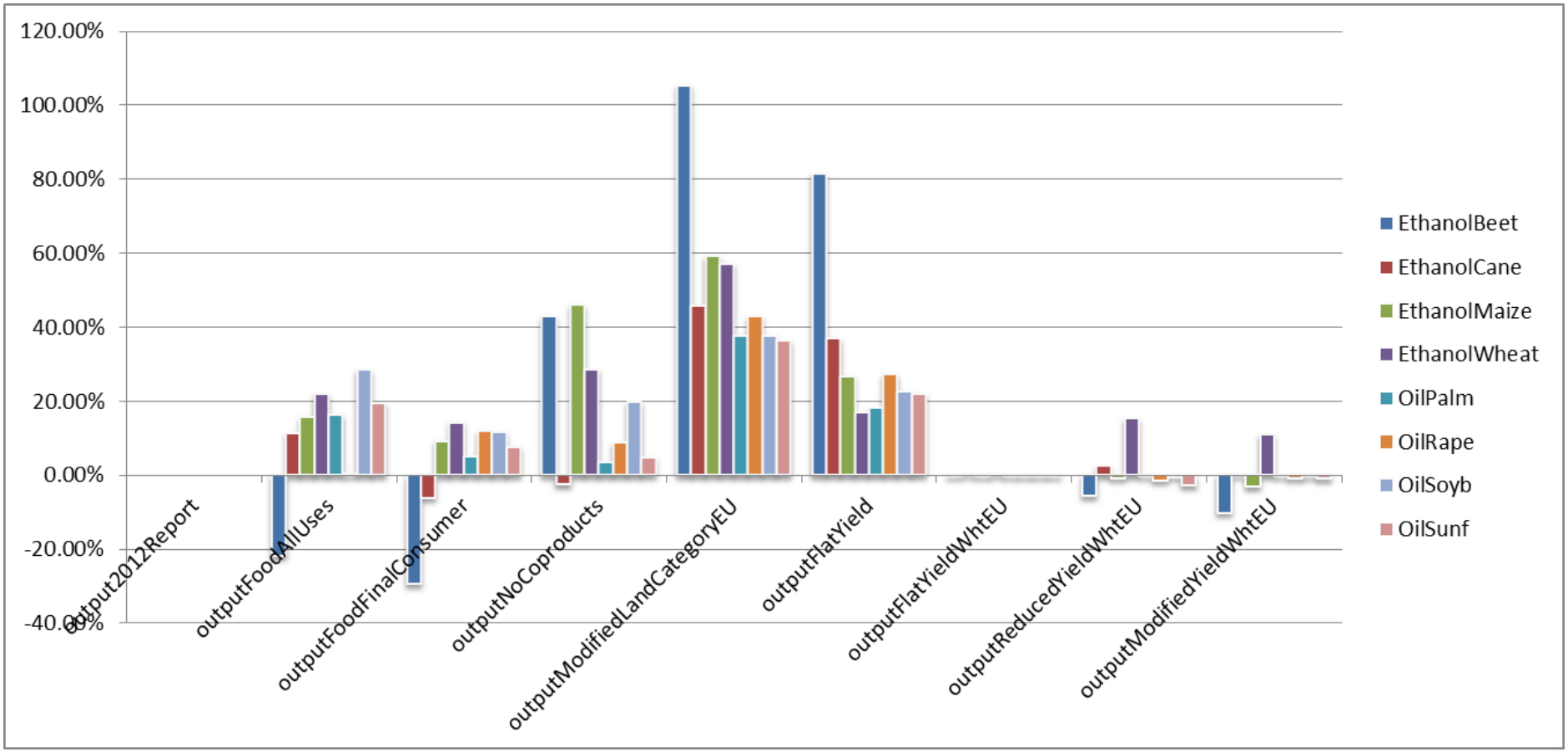


NEW SENSITIVITY ANALYSIS FOR JRC 2013

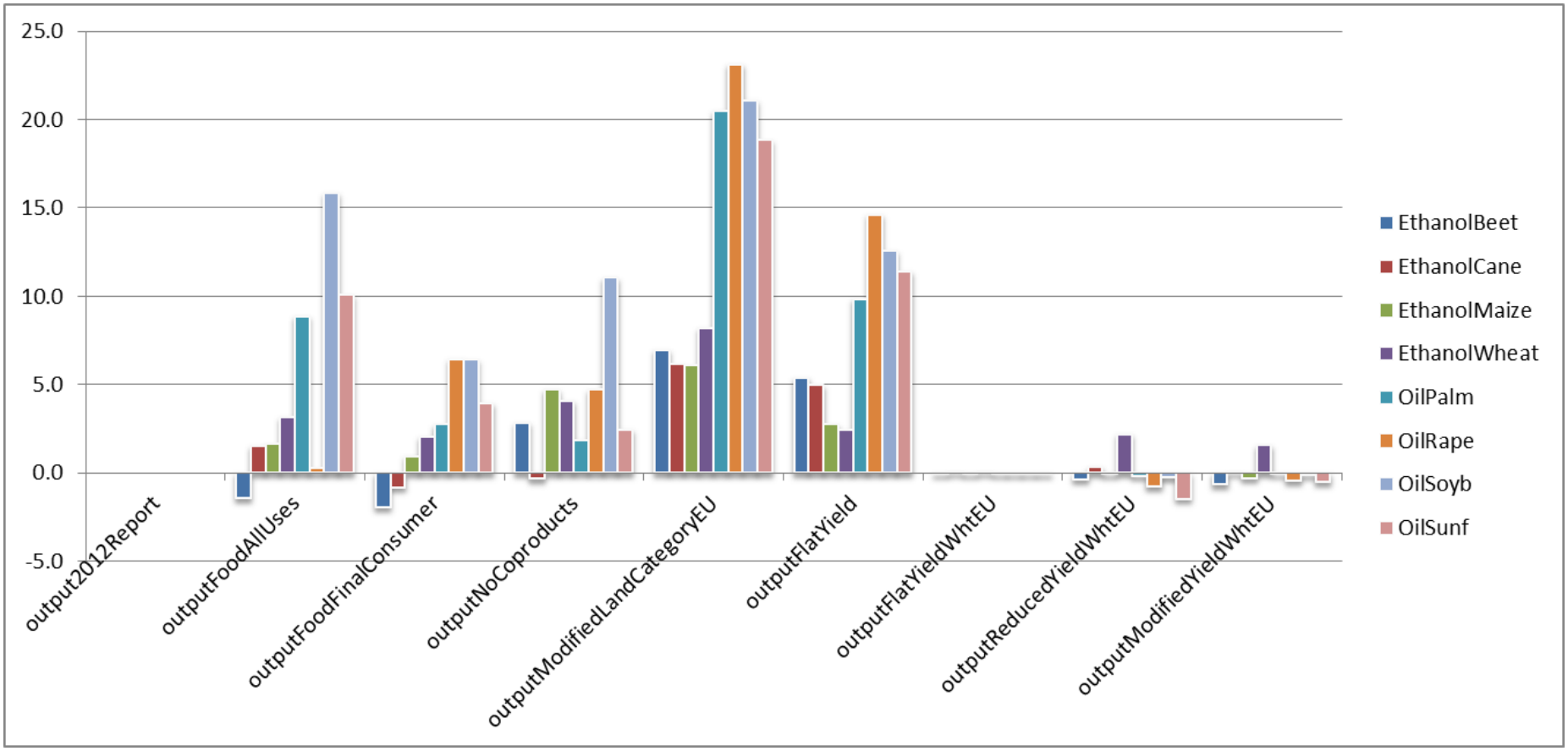
New scenarios

Scenario Name	Description
output2012Report	2012 Central value report
outputFoodAllUses	Food consumption is maintained constant in final and intermediate uses[1]
outputFoodFinalConsumer	Food consumption is maintained constant for final consumers
outputNoCoproducts	Use of coproducts from marginal biofuel are not permitted to affect the economy
outputModifiedLandCategoryEU	Reorganization of land category to avoid extension of major crops into "otheroilseeds" (olive tree etc.)
outputModifiedYieldWhtEU	EU Wheat yield corrected in the baseyear. After technical progress, it leads to 5.8 Ton by Ha in 2020.
outputFlatYield	No exogenous Yield increase for all crops, for all regions between 2009 and 2020.
outputFlatYieldWhtEU	No exogenous Yield increase for WHEAT in the EU for all regions between 2009 and 2020.
outputReducedYieldWhtEU	EU Wheat yield corrected to reach 5.64 T/Ha in 2020 (decrease of yield from 2004 to 2020, to reach Aglink target)

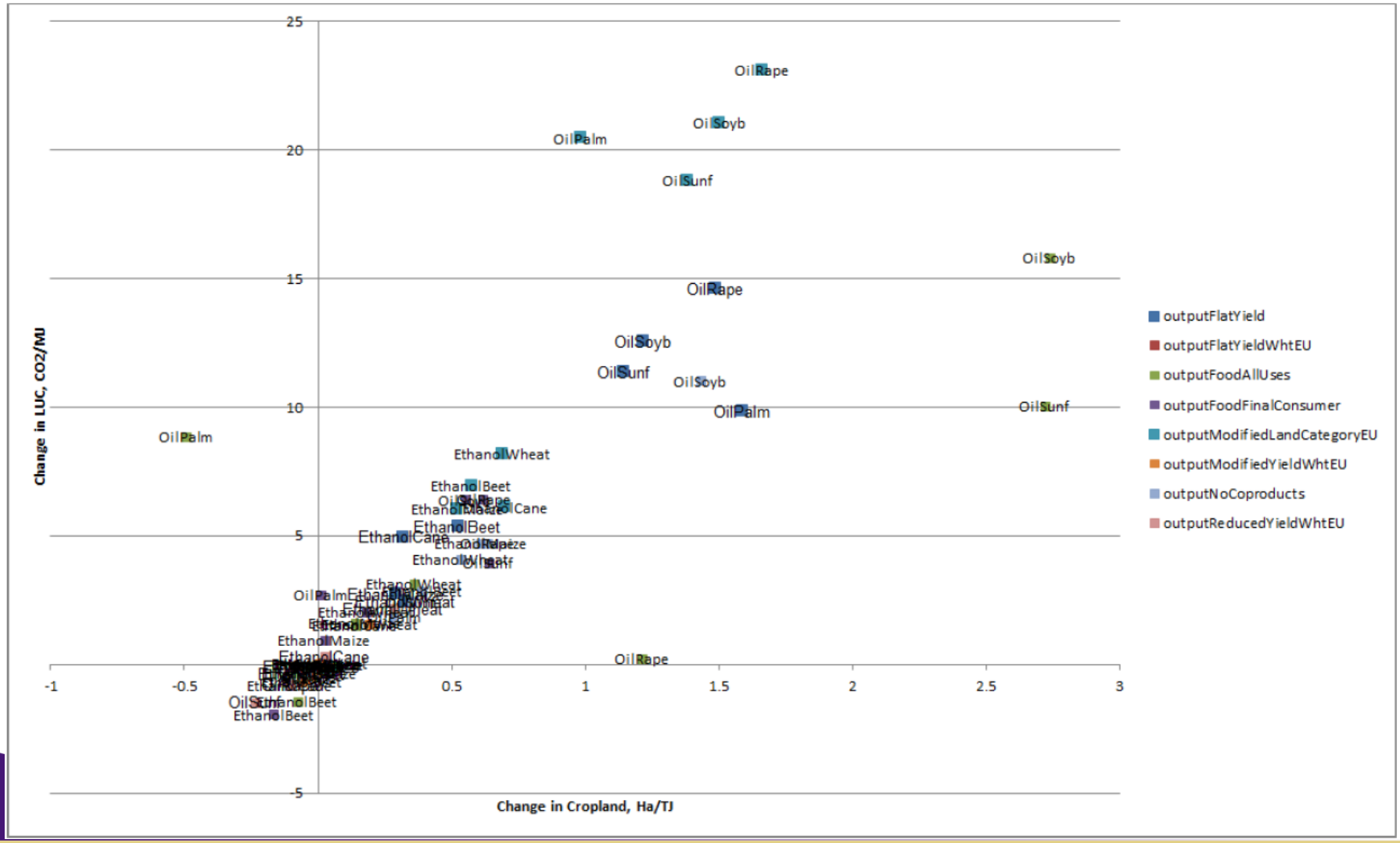
Relative changes – GrCO2/MJ (compared to the 2012 report)



Absolute changes – GrCO2/MJ (compared to the 2012 report)



Changes in Emissions and Changes in Cropland area (compared to the 2011 report)



2ND GENERATION CROPS 2013 FOR JRC

- Meeting EU target will necessitate other sources of feedstocks
  - => **lignocellulosic biomass** is considered

- dedicated energy crops : e.g. Miscanthus
- crops residues : e.g. wheat straw, corn stover
  - Focus on Cellulosic Ethanol, Biochemical pathway

Modelling Choice

What are initial use of crops residues ?

- Option 1 : Crop residues (Wheat Straw or Corn Stover) stay on field as a SOIL FERTILIZER
  - Sub-option A: No replacement: Yield decrease → iLUC
  - Sub-option B: Replacement with mineral/chemical fertilizer. Increase in Fertilizer price → iLUC

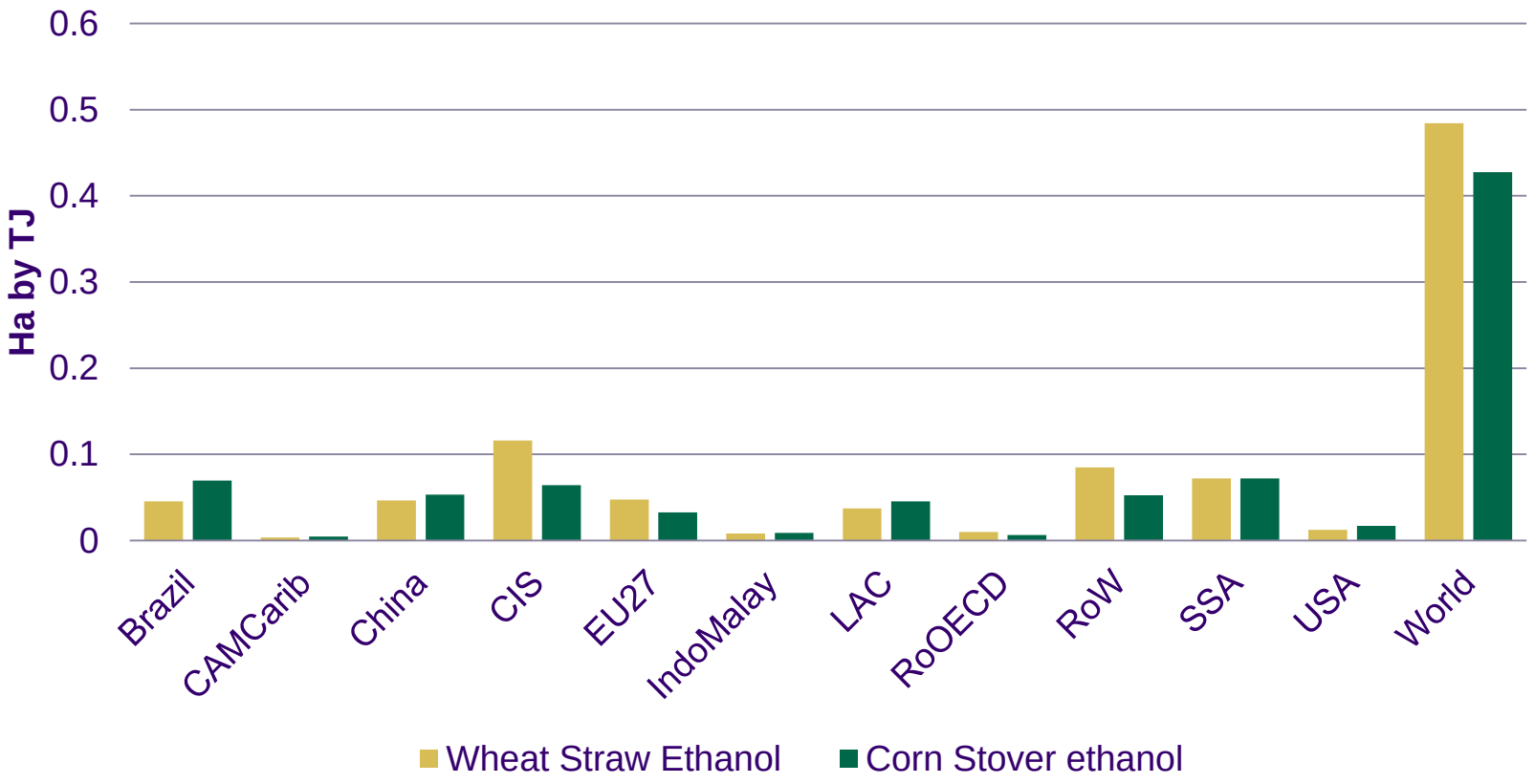
- Option 2 : Off-field use of Crops residues : livestock (feed, litter, …) => too many uncertainties are surrounding this option

How to integrate crops residues in the model ?

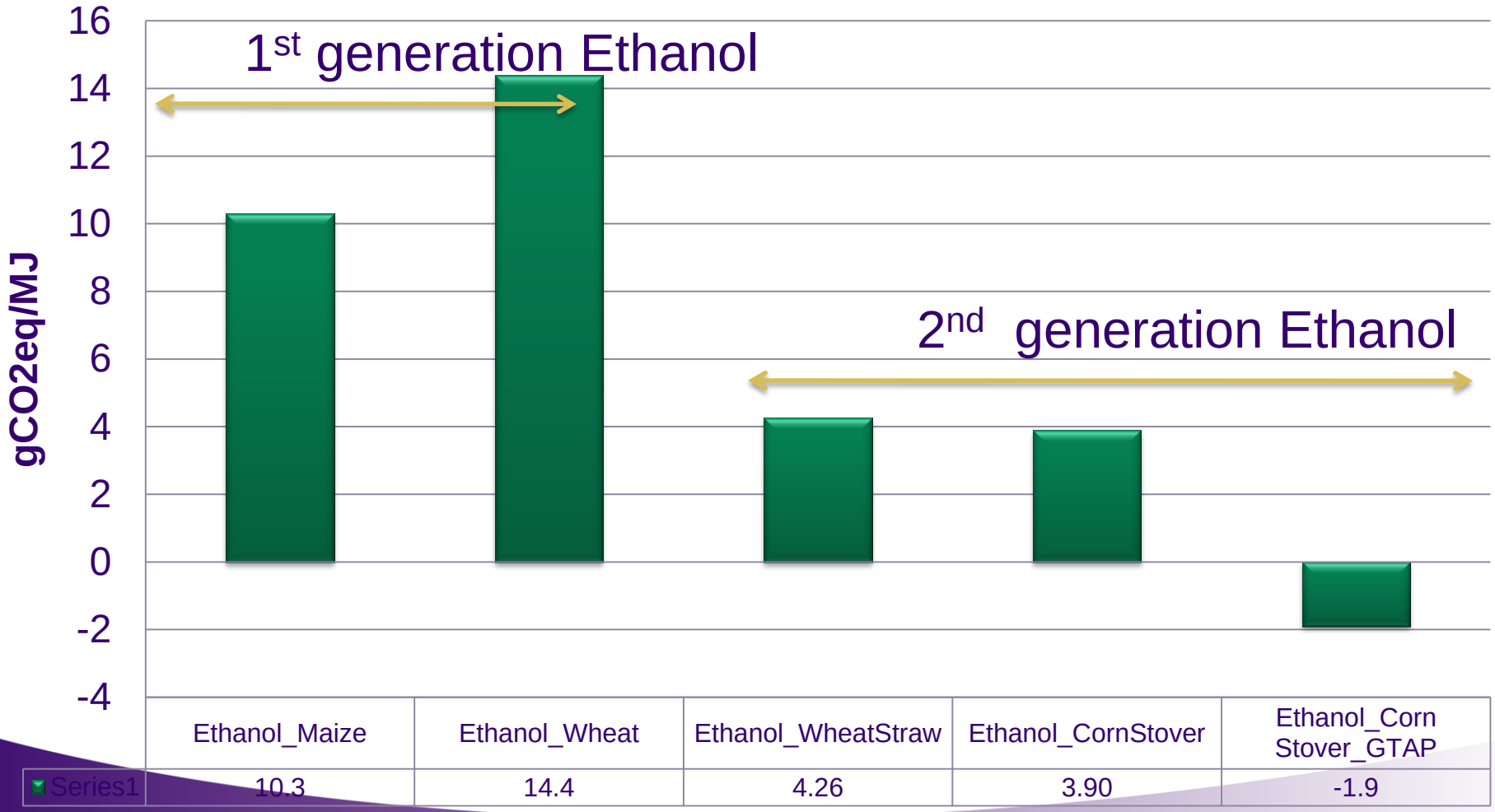
- We assume a removal rate of 30% for the EU grain harvested area supplying 2nd generation plants
  - Avoid to define a yield/residue removal function
- We account for the technical constraint of carrying biomass

- Assumption about conversion yields, crop yield: ratio straw/grains…

Cropland Expansion in Ha by TJ

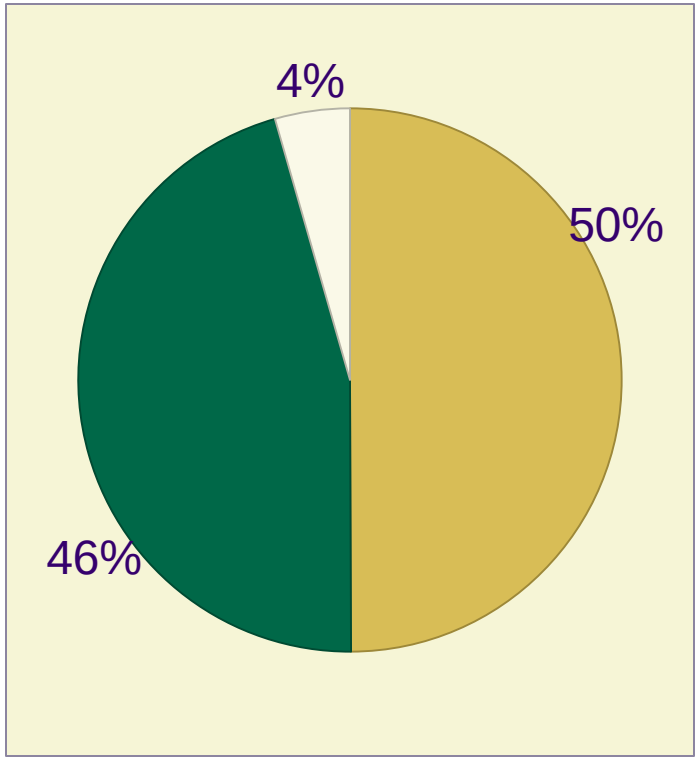


Annual LUC of EU consumption, 20 years

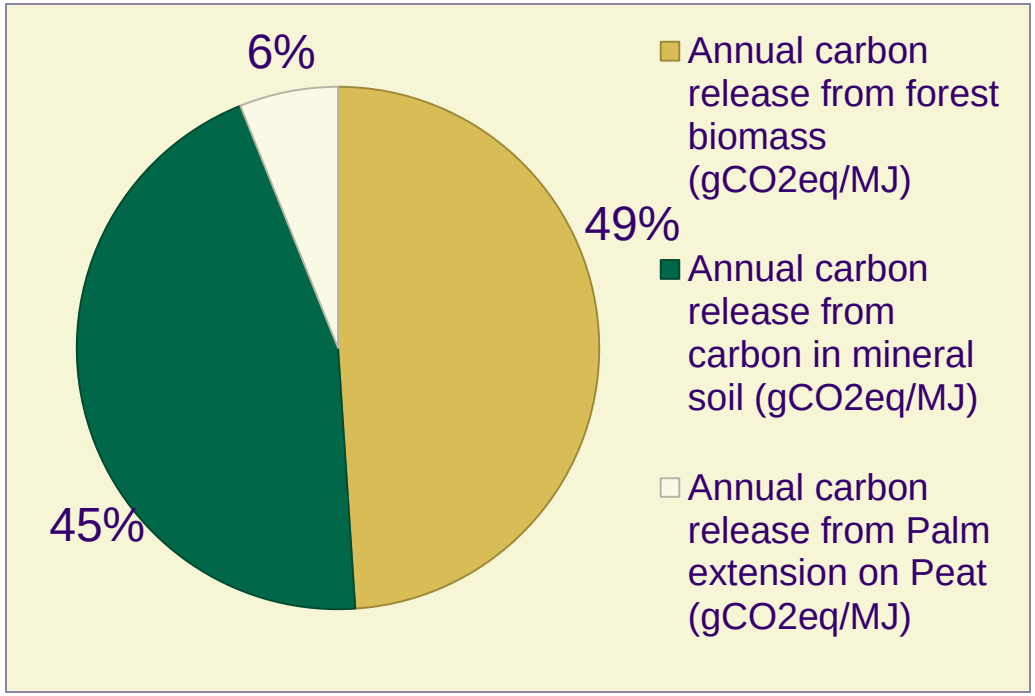


	Ethanol_Maize	Ethanol_Wheat	Ethanol_WheatStraw	Ethanol_CornStover	Ethanol_Corn Stover_GTAP
Series1	10.3	14.4	4.26	3.90	-1.9

EU Crop Residues specific LUC emissions Breakdown by source of emissions



Wheat straw



Corn Stover

Concluding Remarks

- New second generation pathways and closure
- New Econometric estimation for key Parameters (especially on the vegetable oil markets, Land reallocation decision in the EU)
- Multicropping, crop rotation in the model: effects on land productivity, effects on crop residues management

- Linkages with GIS model or land use microeconometrics models.