The Role of biomass in the energy system - linkages between the European energy system modell TIMES PanEU and the agricultural sector model ESIM

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ETSAP-UCC Workshop:

Methodologies linking energy systems models and economic models

February 4 – 5, 2014

University College Cork

Introduction

- Biofuels and bioenergy in general might be one important GHG emission reduction option in the energy system.
- Potential supply and price of biomass has an impact on future energy demand.
- Demand for biomass for energy production has an impact on agricultural markets.
- Relationship between agricultural and energy prices is expected to strengthen further.

Objective

- Assessing the effects of European environmental policies taking interrelations between agricultural and energy markets into account.
- Establishing a consistent modeling system between an energy system model and an agricultural sector model.
- Endogenizing demand and supply reactions of energy from biomass

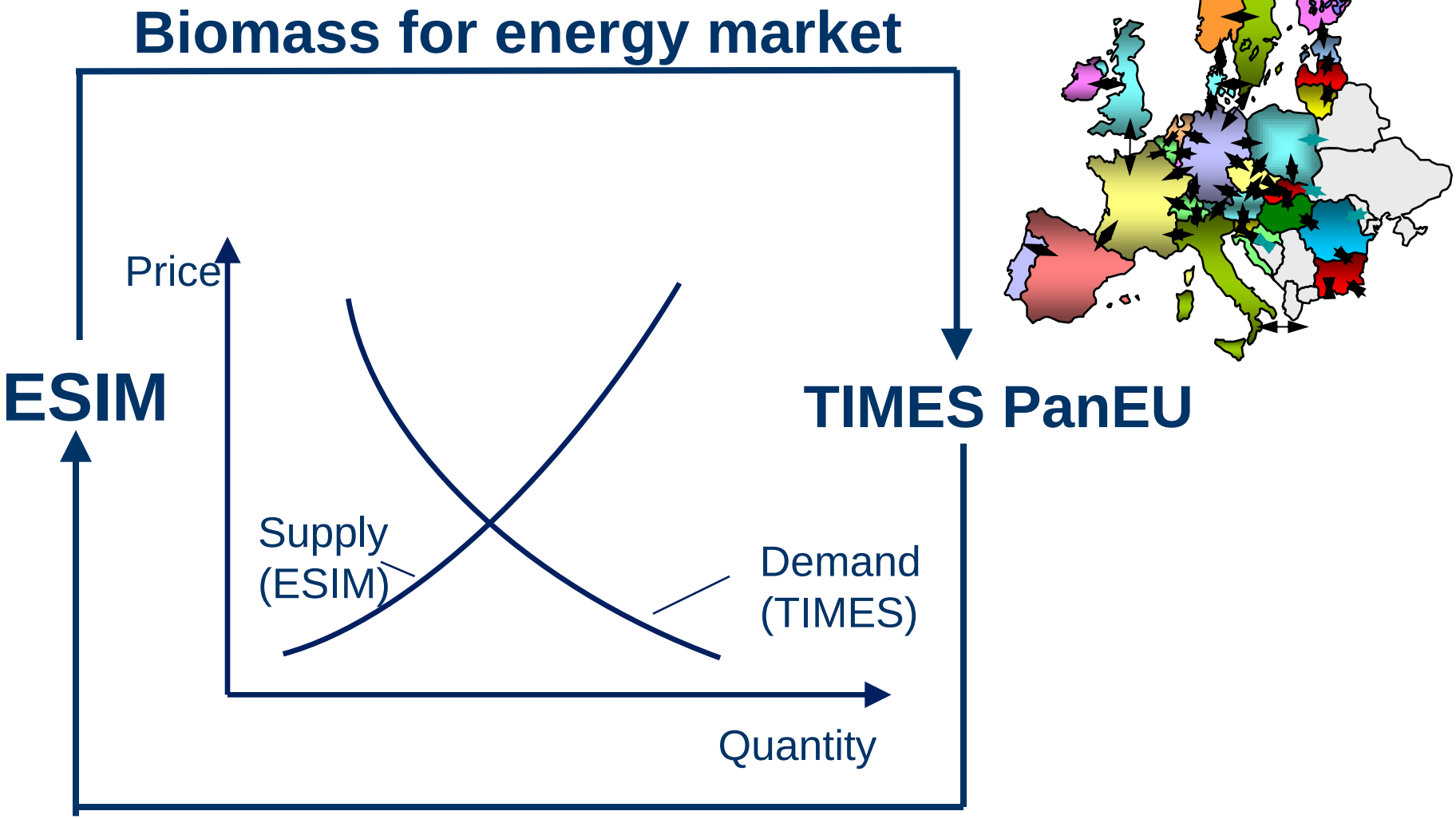
TIMES PanEU

- Technology oriented bottom-up partial equilibrium model
- 30 region model (EU 28, No, CH, IS)
- Energy system model
  - SUPPLY: reserves, resources, exploration and conversion Country specific renewable potential and availability (onshore wind, offshore wind, ocean, geothermal, biomass, biogas, hydro)
  - Electricity: public electricity plants, CHP plants and heating plants
  - Residential and Commercial: End use technologies (space heating, water heating, space cooling and others)
  - Industry: Energy intensive industry (Iron and steel, aluminium copper ammonia and chlorine, cement, glass, lime, pulp and paper), food, other industries, autoproducer and boilers
  - Transport: Different transport modes (cars, buses, motorcycles, trucks, passenger trains, freight trains), aviation and navigation
- Country specific differences for characterisation of new conversion and end-use technologies
- Time horizon 2010 - 2050
- GHG: CO2, CH4, N2O, SF6 /Others pollutants: SO2, NOx, CO, NMVOC, PM2.5, PM10

European Simulation Model (ESIM)

- Comparative static partial equilibrium multi-country model for the agricultural sector
- Isoelastic supply functions (separate for yield and area) and demand functions
- 32 regions (EU Member States; USA, Croatia, Turkey, Western Balkans, RoW)
- Product coverage:
  - 15 crops
  - 21 processed products
  - 6 animal products
  - Pasture, set-aside

Model coupling



Product Mapping

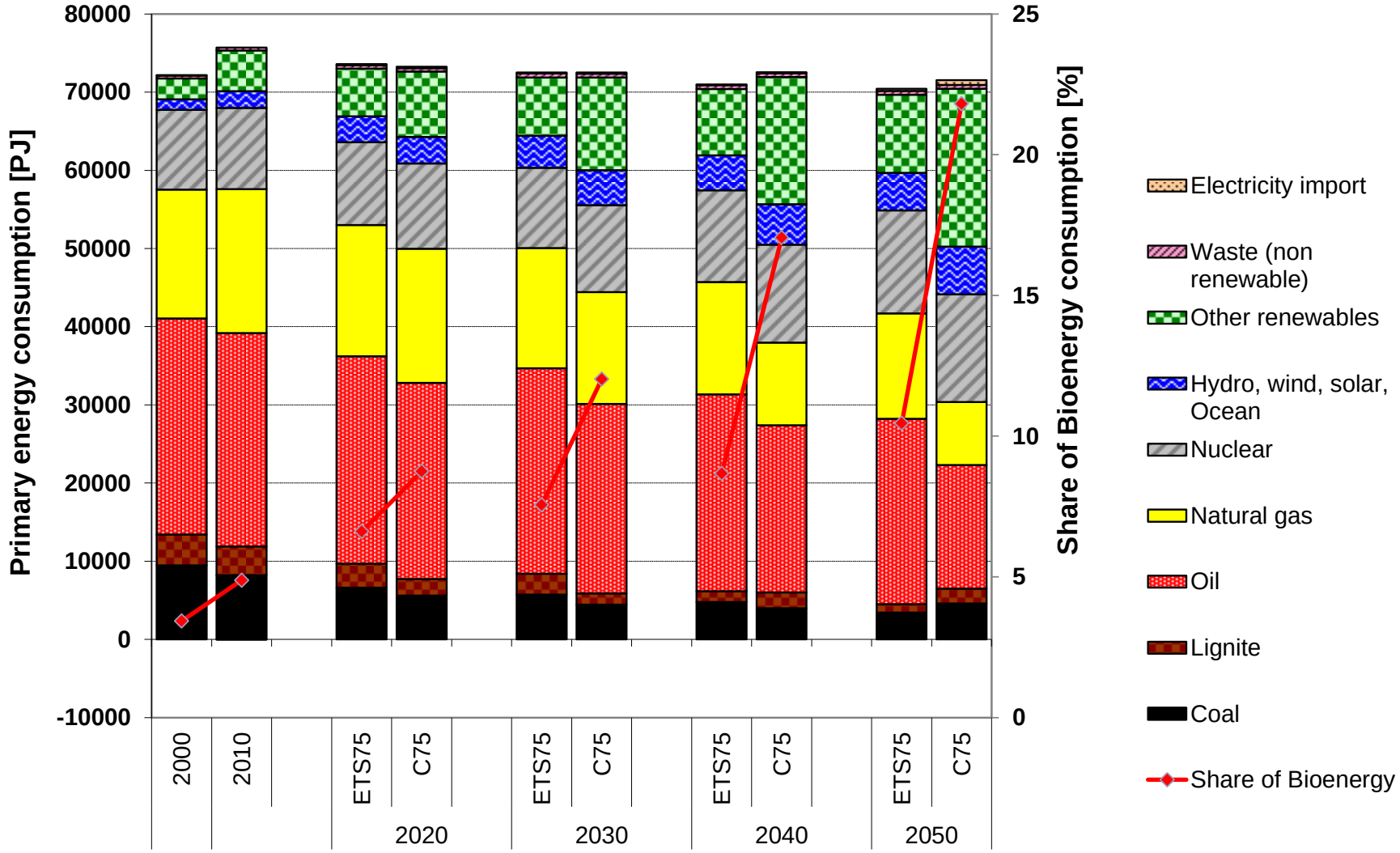
TIMES PanEU	ESIM
Oilseeds	Rapeseed, Sunflower, Soybeans
Starchy Crops	Corn, Wheat, Triticale, Rye, Barley, Grass, Silage maize,
Sugar Crops	White sugar
Woody Crops	Area (woody crops not explicitly modeled in ESIM)

Source: own compilation

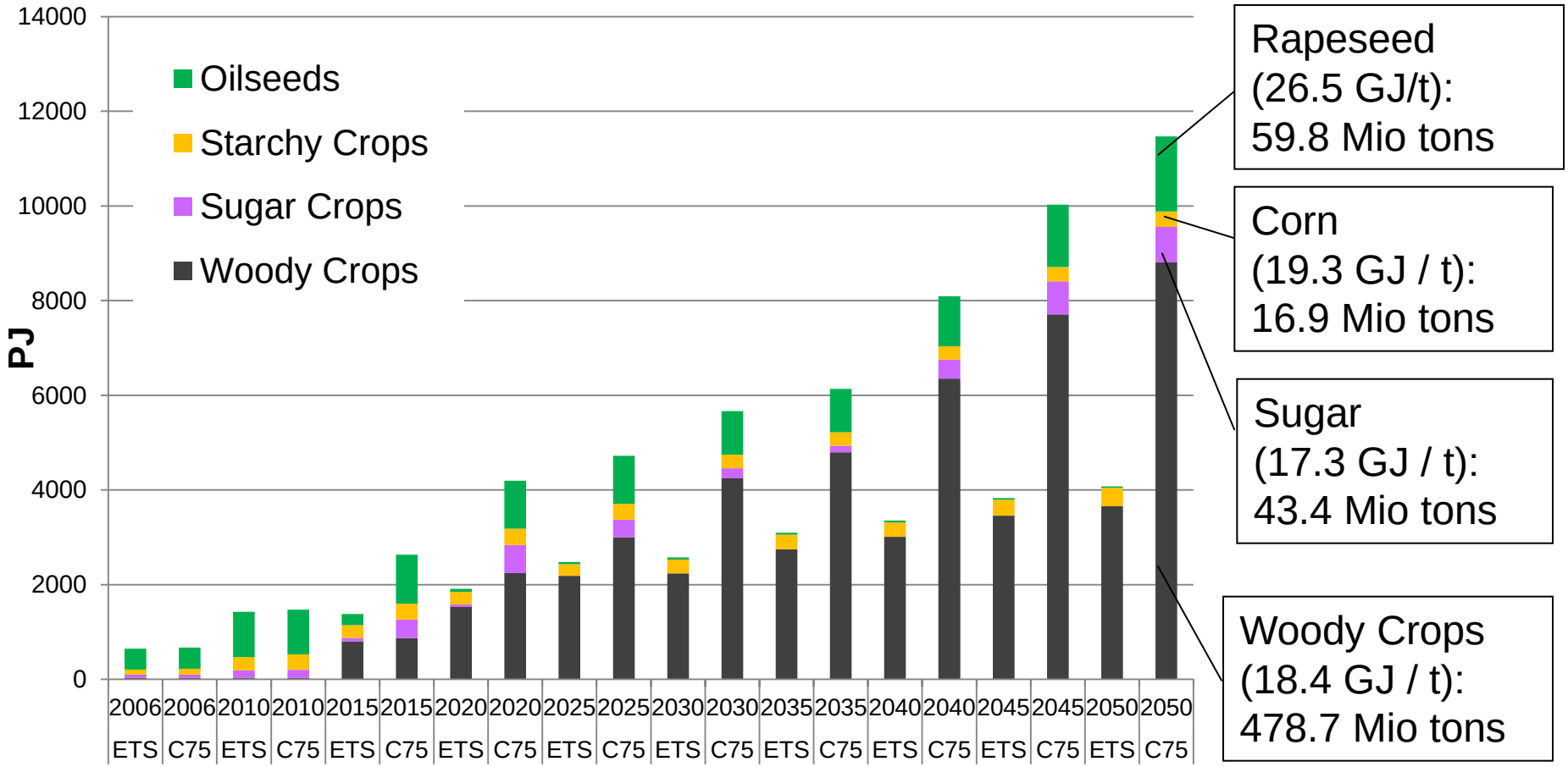
Scenario analysis

- **Scenario ETS75 with a GHG reduction target for the current EU emission trading system**
    - **-21% till 2020 (compared to 2005) (III. Phase of ETS)**
    - **- 75% GHG emissions in 2050 (compared to 2005)**
    - **Abolition of all EU biofuel mandates from 2015 on**
- **Scenario C75 with a stronger GHG reduction target including the whole energy system**
    - **-20% till 2020 and -75% less GHG emissions in 2050 compared to 1990**
    - **Limitation of area available for woody biomass to 30% of agricultural area covered in ESIM**

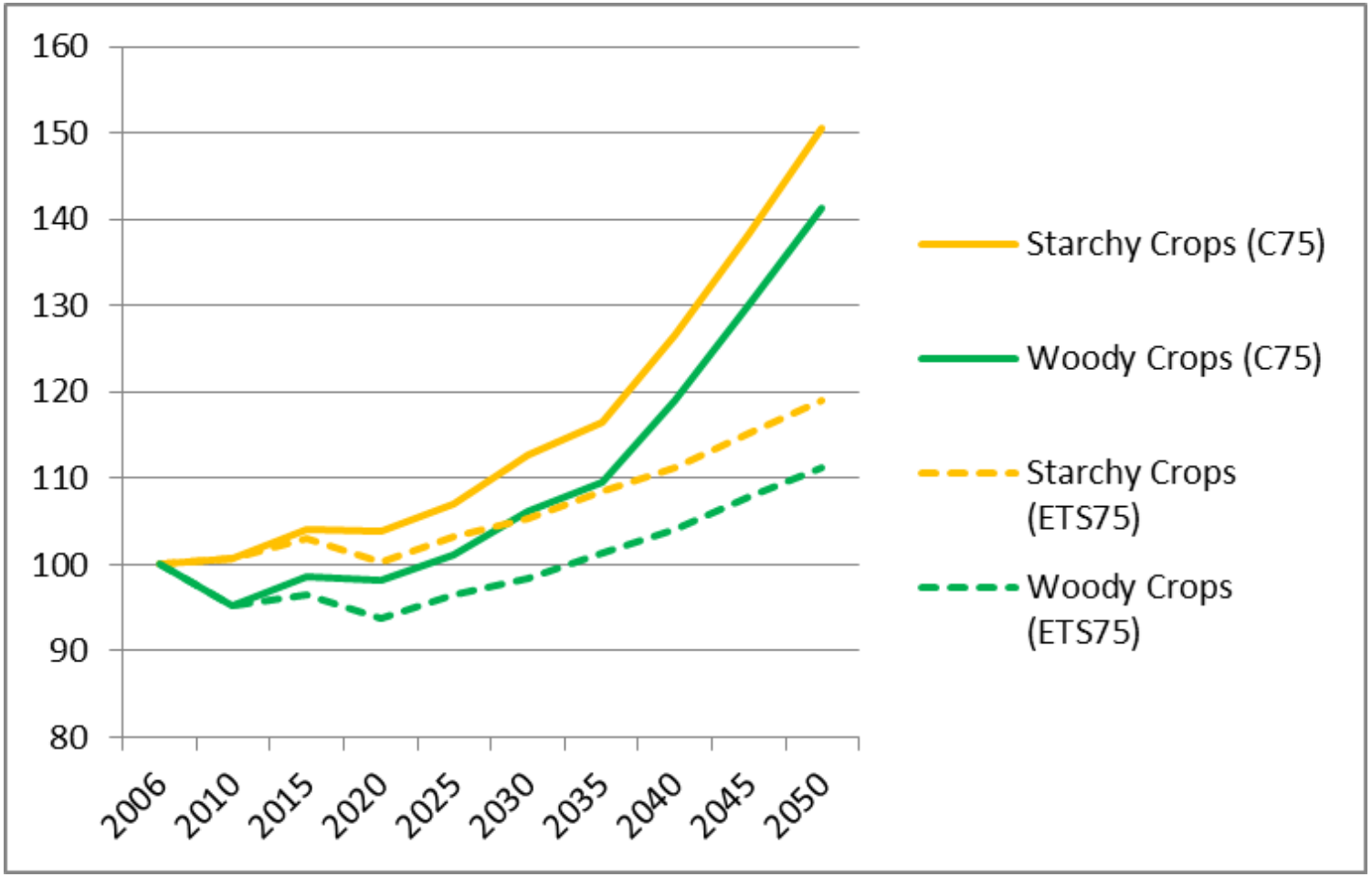
Primary energy consumption in the EU28



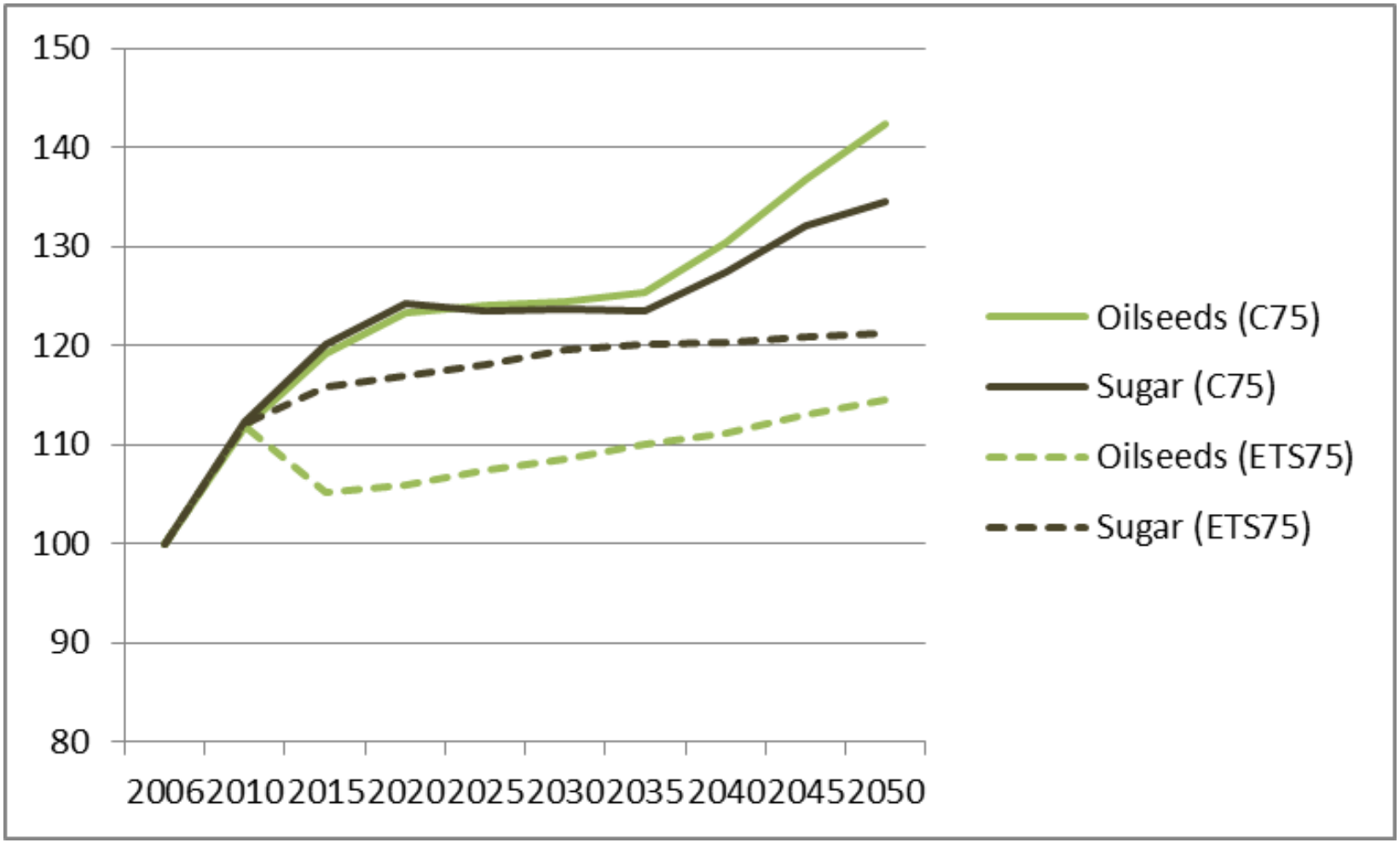
Energy crops demand in the EU28



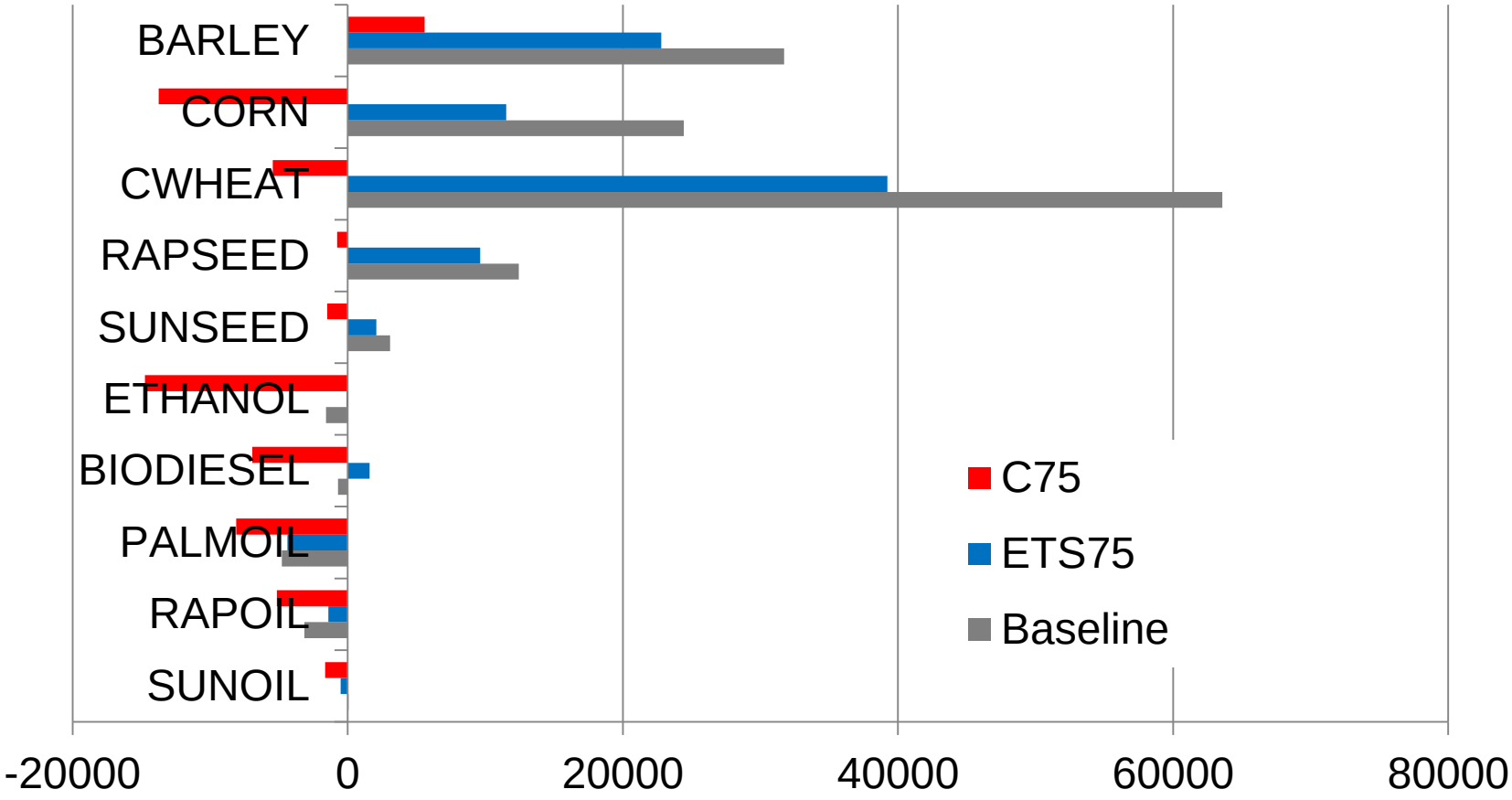
Comparison of real price index for starchy and woody crops in the EU28 (2006 = 100)



Comparison of real price index for oilseeds and sugar in the EU28 (2006 = 100)



Net exports of selected products in the EU28 in 2050 in kt



Conclusions

- The chosen GHG mitigation scenarios, which do not take into account direct and indirect land use effects as well as emissions from higher production intensity in agriculture, result in:
  - Strong price effects
  - Enormous net trade effects
- Price changes for biomass effect demand from the energy sector
- A convergence after 3 to 4 iterations can be observed within the model coupling.
- Further work focus on detail modelling of bioenergy in both models (biogas, Lignocelluloses,…)….

- **Thank you for your attention !**