

GCAM Community Meeting
December 2015

NEOMA
BUSINESS SCHOOL

CHAIRE de
BIOECONOMIE INDUSTRIELLE

Impacts of energy prices on the competitiveness of bio-based products to 2050 using GCAM

Pierre-Alain SCHIEB

Mohamed Majdi CHELLY

Chair in Industrial Bio Economy

*

Contents

NEOMA
BUSINESS SCHOOL

CHAIRE de
BIOECONOMIE INDUSTRIELLE

Context

Scenarios description

Main results

Expectations of the GCAM Community Meeting

*

GCAM Community Meeting : December 2011

Contents

NEOMA
BUSINESS SCHOOL

CHAIRE de
BIOECONOMIE INDUSTRIELLE

Context

Scenarios description

Main results

Expectations of the GCAM Community Meeting

*

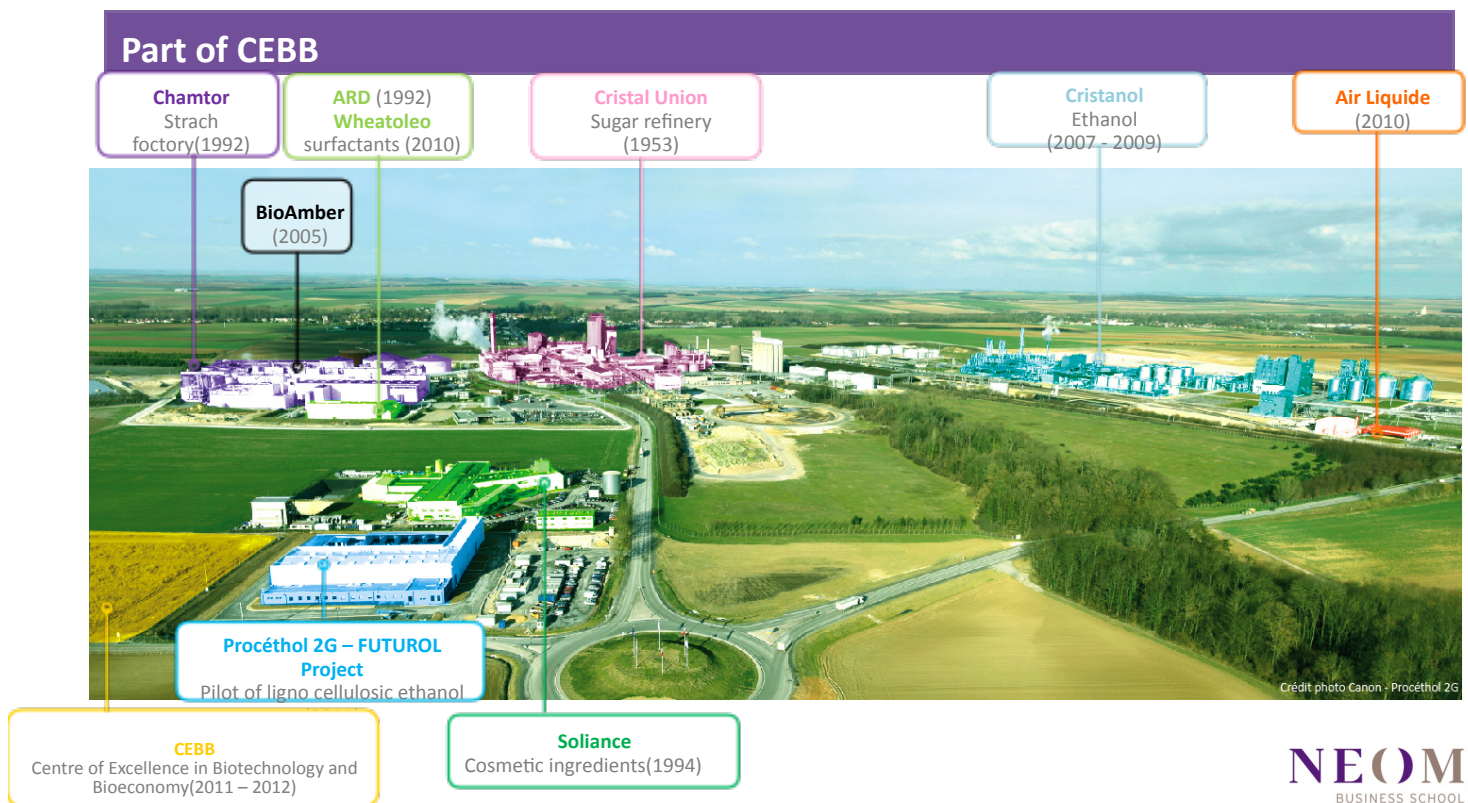
GCAM Community Meeting : December 2014

Context

The objectives of the Chair in Industrial Bioeconomy

- Understand economic drivers, identify promising markets and appropriate business models,
- Communicate about the potential of industrial bioeconomy and train future managers in the sector ;
- Is part of a whole network (with Chair of AgroParisTech & Chair of Ecole centrale) involved with the knowledge chain and development of new technologies ;
- These 3 chairs liaise closely with an industrial cluster (the Reims-Pomacle site with demonstrators, company creation, and the support of local authorities) ;
- All of this makes up a very original group, almost unique in Europe.

Context



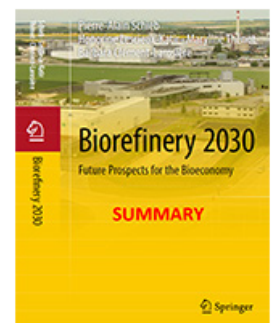
acts of energy prices on the competitiveness of bio-based products to 2050 using GCAM

*

Context

Research

- A case study of the Pomacle-Bazancourt site ;
- The development of economic and business models for industrial bioeconomy and its components ;
- The study of promising markets for industrial bioeconomy ;
- Impacts of energy prices on the competitiveness of bio-based products ;
- Training, initially through an elective in the NEOMA Business School Grande Ecole Master programme.



Contents

NEOMA
BUSINESS SCHOOL

CHAIRE de
BIOECONOMIE INDUSTRIELLE

Context

Scenarios description

Main results

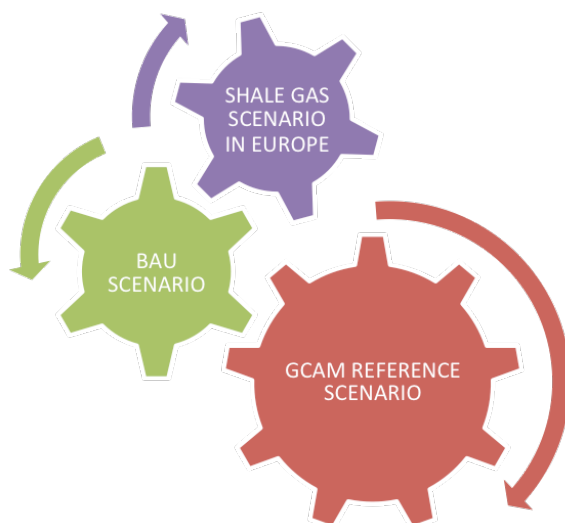
Expectations of the GCAM Community Meeting

*

GCAM Community Meeting : December 2011

Scenarios description

Methodology



GCAM REFERENCE SCENARIO

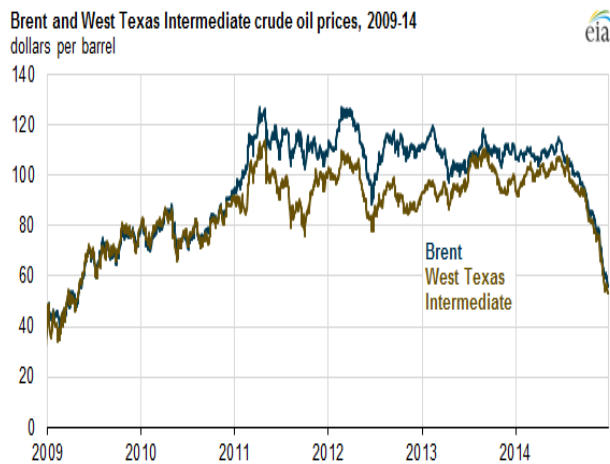
- Consists on running GCAM without any changes ;
- To identify the impacts of changing energy price parameters compared to a starting situation.

Scenarios description

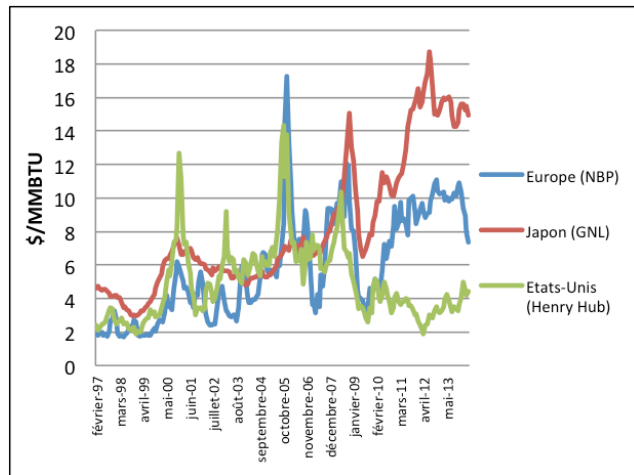
Methodology

BAU SCENARIO

- Adjusting oil and gas prices between 2005 -2015 based on historical prices



Oil prices evolution between 2009 and 2015
Source: EIA



Wholesale gas prices evolution in different markets
Source: World Data Bank

Scenarios description

Methodology

SHALE GAS SCENARIO IN EUROPE

Method 1 : Modifying supply curves of natural gas in Europe

Total Company: shale gas reserves in Europe are estimated between 3000 and 12000 billion m³ => 1 % to 3 % of unconventional gas reserves in the world (380 000 billion m³ according to IEA).



No impacts on gas prices => No significant impacts on other sectors of the model.

Method 2 : Reducing gas prices by modifying « Price Input Module »

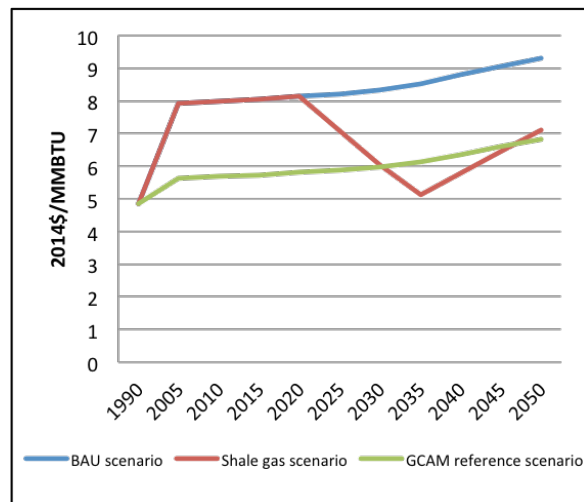
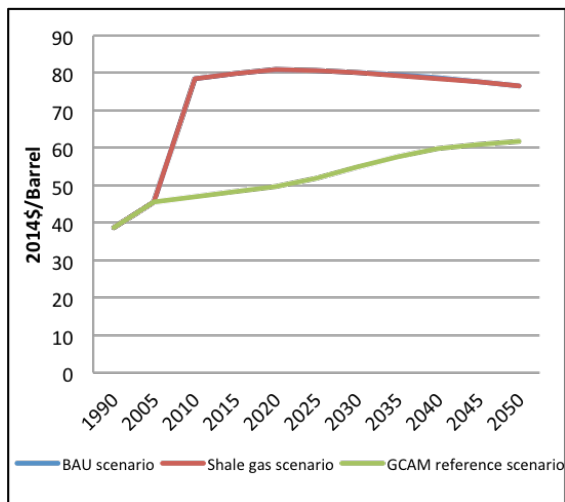
The assumption used in the modeling of this scenario consists on reducing wholesale gas prices in Europe from 8 \$/MMBTU to about 5 \$/MMBTU between 2020 and 2035.



NEOMA
BUSINESS SCHOOL

Scenarios description

Methodology



Scenarios of evolution of oil prices (left curve) and natural gas prices in Europe (right curve) between 1990 and 2050 using GCAM

Contents

NEOMA
BUSINESS SCHOOL

CHAIRE de
BIOECONOMIE INDUSTRIELLE

Context

Scenarios description

Main results

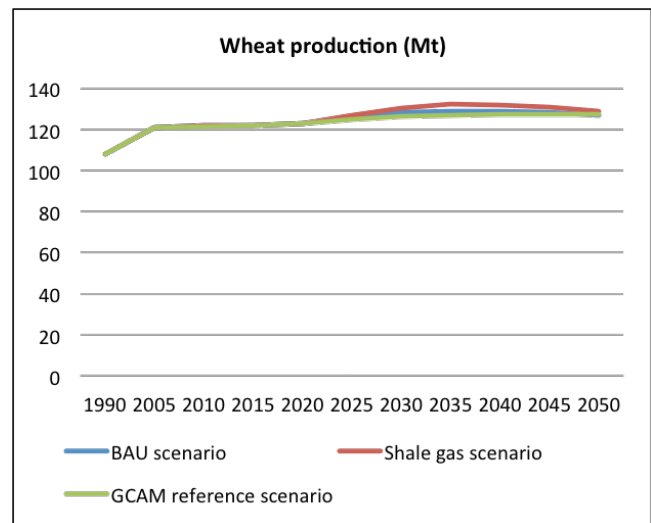
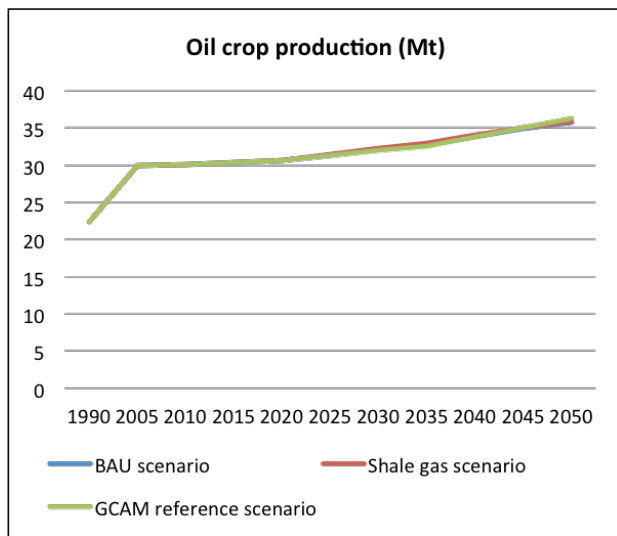
**Expectations of the GCAM Community Meeting /
Questions**

*

GCAM Community Meeting : December 2014

Main results

Crops production in Western Europe

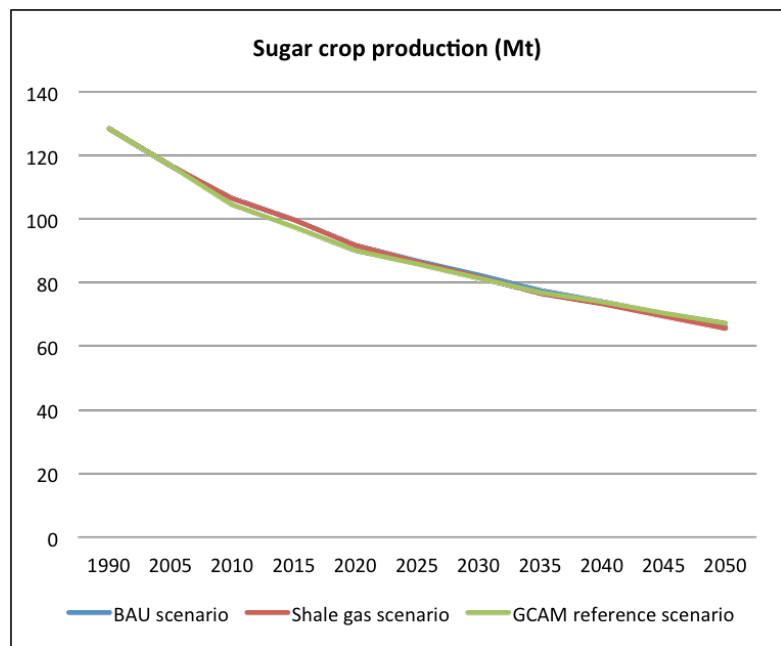


- No significant impacts on crops production.

Main results

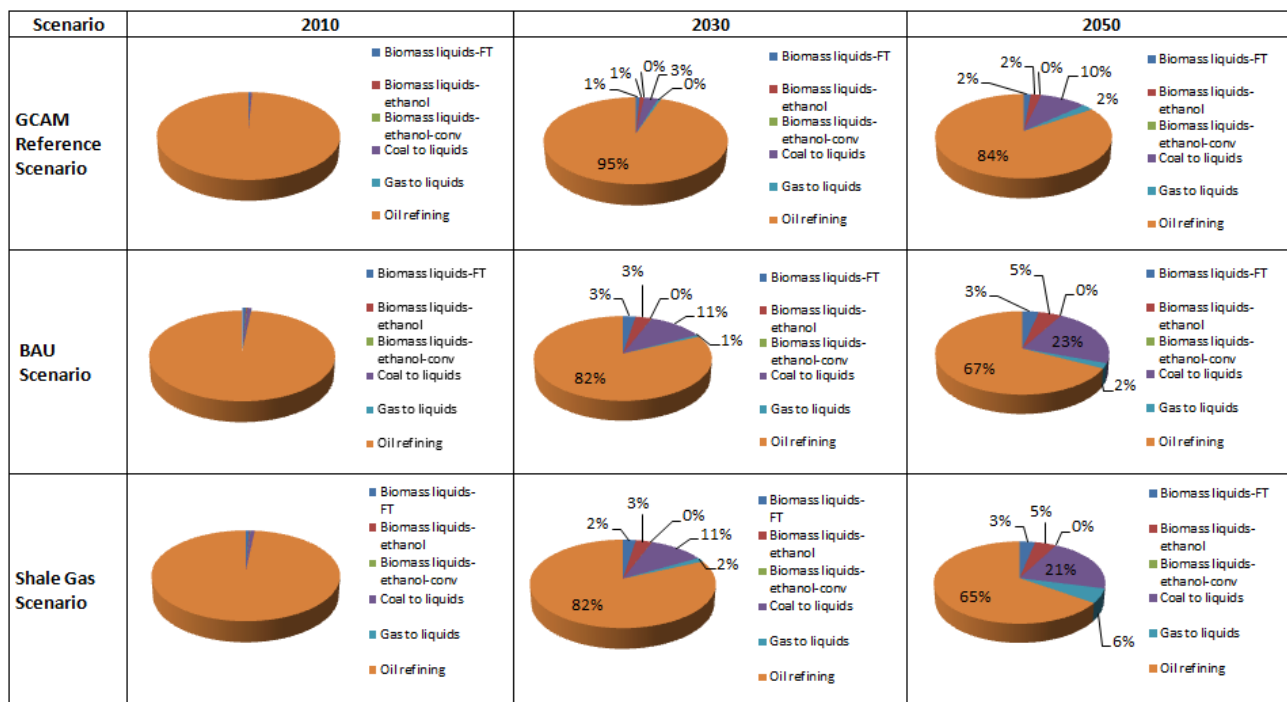
Crops production in Western Europe

- Experts indicate that Europe will be a net exporter of sugar after the reform of the European common agricultural policy.



Main results

Refined liquids production by technology in Western Europe

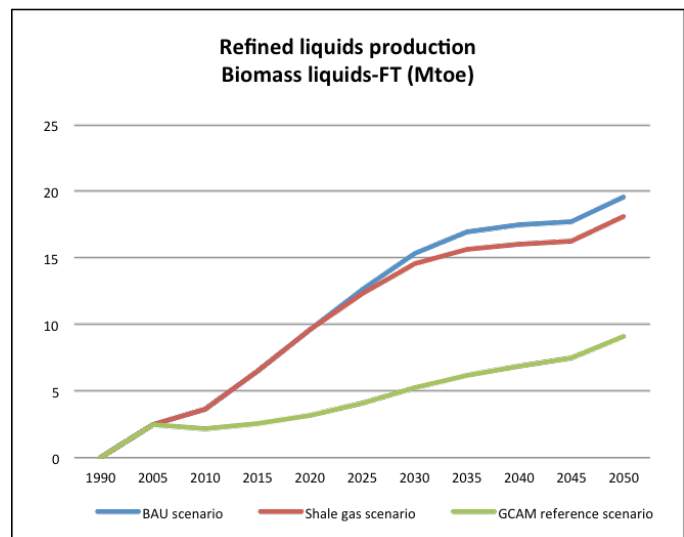
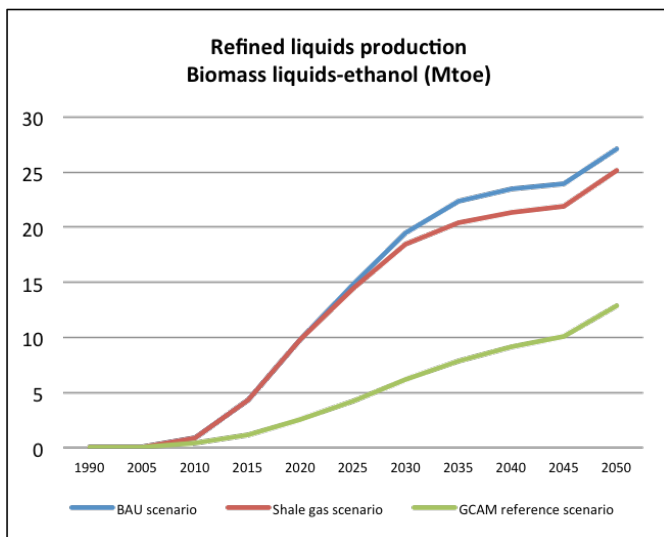


acts of energy prices on the competitiveness of bio-based products to 2050 using GCAM

*

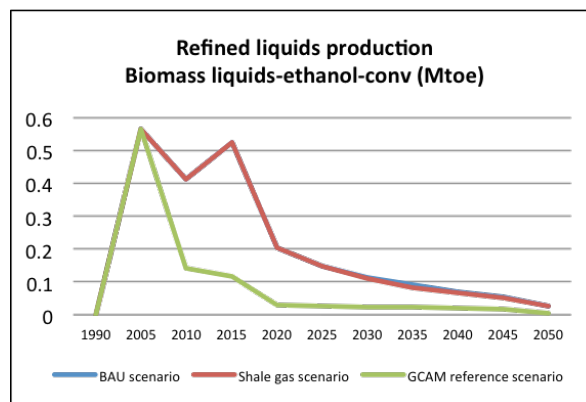
Main results

Biofuels production in Western Europe



Main results

Biofuels production in Western Europe



	Crop Input (kg)	Dedicated Bioenergy Input (GJ)	Natural Gas (GJ)	Electricity (GJ)	Cost (2008\$/GJ)
Corn Ethanol	112	-	0,32	0,03	7,67
Sugar Ethanol	582	-	-	-	9,18
Soybean Biodiesel	146	-	0,03	-	2,51
Fischer-Tropsch	-	1,96	-	-	8,88
Cellulosic	-	2,06	-	-	7,64

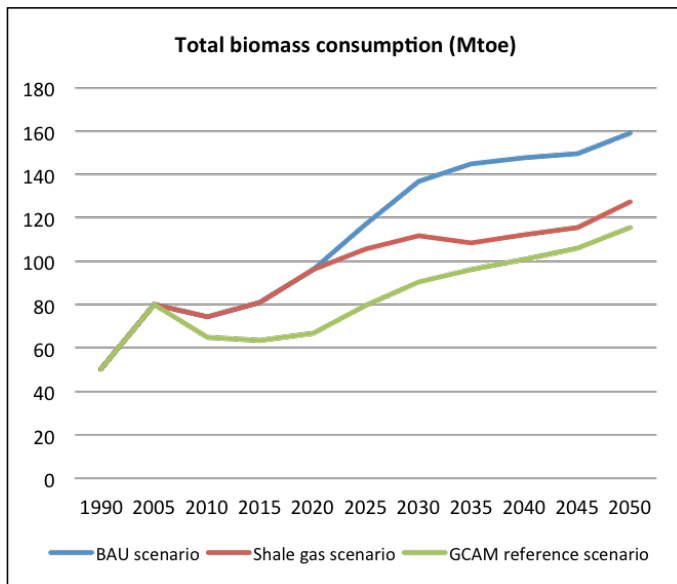
GCAM Refining technologies in GCAM, inputs per GJ of refined liquid output

acts of energy prices on the competitiveness of bio-based products to 2050 using GCAM

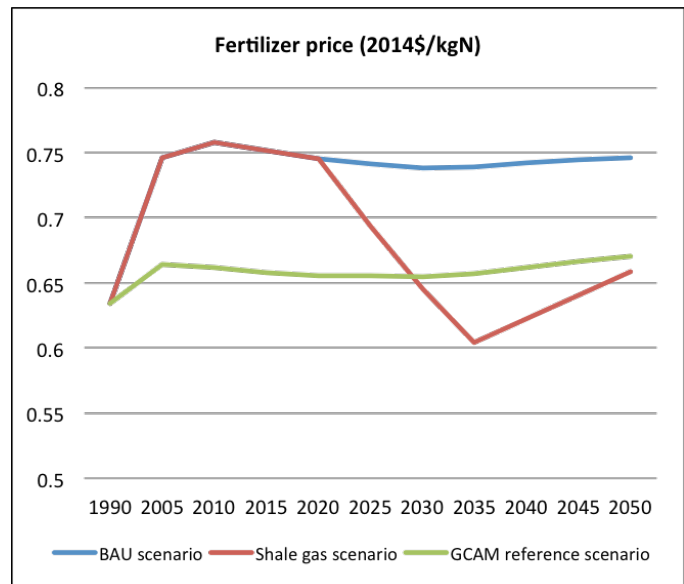
*

Main results

Biomass consumption in Western Europe



Fertilizer prices in Western Europe



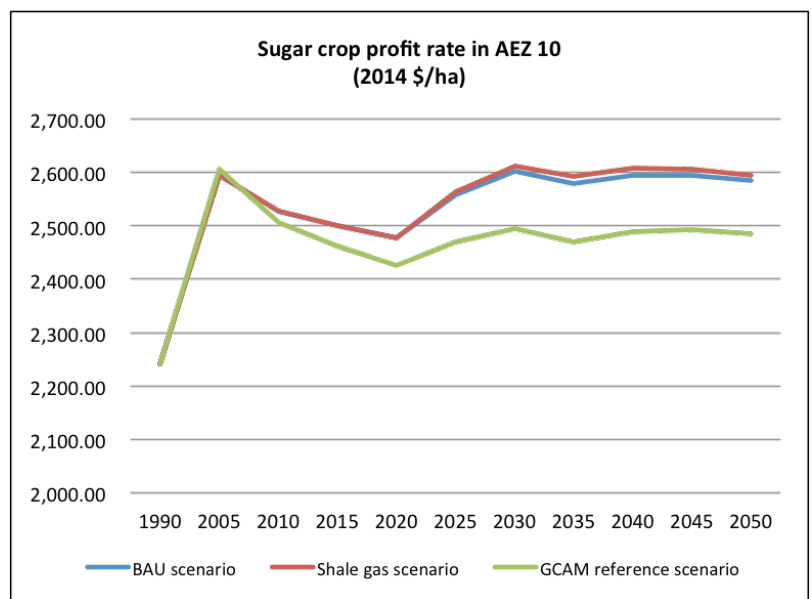
Main results

Profit rates (Western Europe AEZ 10)

Price of sugar beet in Europe: ~ 26 €/t,

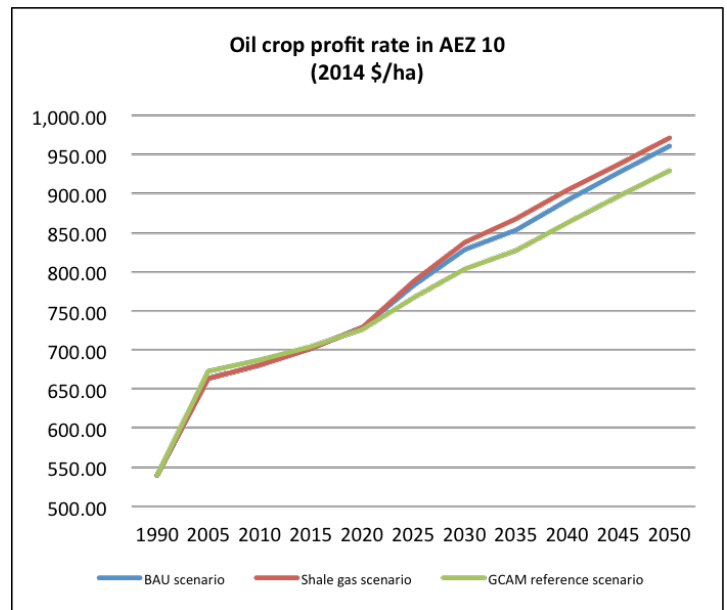
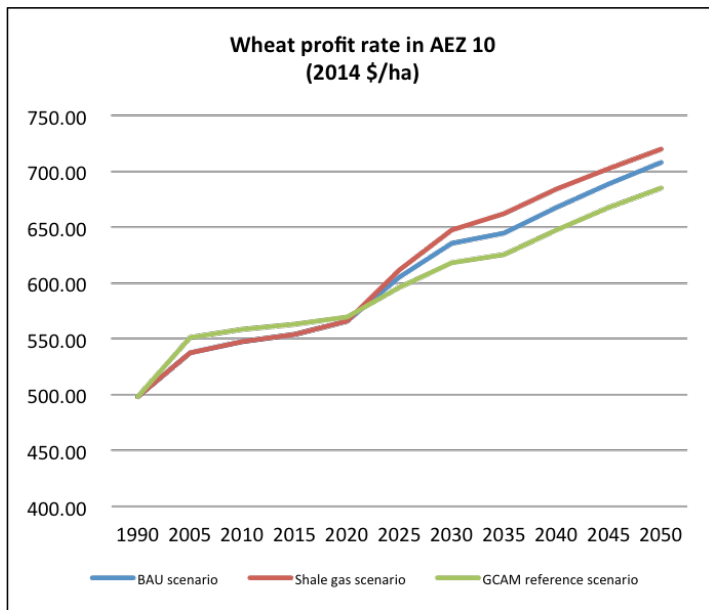
Sugar beet yield: ~ 75 to 80 t/ha,

=> **Revenue** : ~ 1950 to 2100 €/ha



Main results

Profit rates (Western Europe AEZ 10)



Contents

NEOMA
BUSINESS SCHOOL

CHAIRE de
BIOECONOMIE INDUSTRIELLE

Context

Scenarios description

Main results

**Expectations of the GCAM Community Meeting /
Questions**

*

GCAM Community Meeting : December 2014

Expectations of the GCAM Community Meeting / Questions

Comparison with other teams /models

4th Foresight Exercise of the SCAR (Standing Committee on Agricultural Research)

BIO-MODESTY Scenario

- Low growth in demand for biomass for materials and energy ;
- Total demand of biomass in the world in 2050 is estimated at 18.2 billion tons of dry matter.

BIO-BOOM Scenario

- 23.9 billion tons of biomass in 2050 ;
- Increase in demand for non-food biomass conversion.

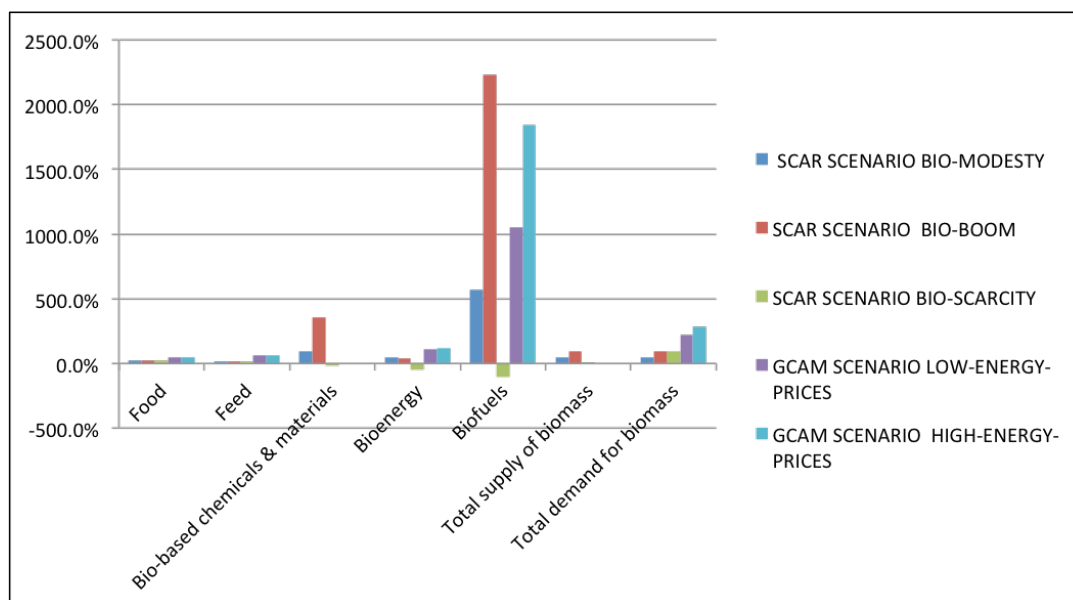
BIO-SCARCITY Scenario

- Quantities of biomass that could be produced are limited to 13 billion tons ;
- Based on approach "Food Processing First", the amount of biomass available for non-food uses (biomaterials, bioenergy) will be lower than today (zero for biofuels).

Expectations of the GCAM Community Meeting / Questions

Comparison with other teams /models

Comparison between SCAR and GCAM scenarios



Evolution of global demand for biomass by sector between 2010 and 2050

Expectations of the GCAM Community Meeting / Questions

Feedback on results validity / Questions

- Endogeneity of energy prices versus « Price Input Module » (« severanceTax » for oil prices and « input-cost » for natural gas) ?
- Biofuels 1st G production in Europe, especially sugar beet ethanol that will drop or cancel by 2030 according to GCAM ?
- Crop yields like wheat are expected to increase in Europe according to GCAM ?
- Profit rates of some crops in Europe such as wheat and sugar crops are overestimated by GCAM and do not reflect reality ?
- Main recent changes in GCAM (version 4.0 versus version 3.2) ? Feasibility of these scenarios using GCAM 4.0 ?
- Other models that could be compared to GCAM ? (same databases ?)
- Suggestion for further steps ?

Thanks for your attention.



<http://chaire.neoma-bs.fr/bio-economie-industrielle/>

NEOMA
BUSINESS SCHOOL

acts of energy prices on the competitiveness of bio-based products to
2050 using GCAM

*