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## **IMPACTS OF OIL PRODUCT DEMAND AND CO<sub>2</sub> PRICE UNCERTAINTIES ON INVESTMENT IN BIOMASS PRE-TREATMENT UNITS TO SUPPLY SECOND GENERATION BIOFUEL UNITS: THE FRENCH CASE STUDY.**

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### **OVERVIEW**

The development of second generation biofuels leads to study its biomass supply in terms of quantities and return on investment for the producers. In this context, we analyse the investment in biomass pre-treatment units to supply the Biomass To Liquid (BTL) units which are integrated to the refining industry. Torrefaction is a crucial pre-treatment step to make this process economically attractive. Biocoal pellets produced by the torrefaction process could be a substitute of coal and have also strong appeal for other additional markets: the steel industry and electricity generation. Thus, we study how could be developed such industry which is a key step between the biomass supply and several major players: refining industry, power and steel industries.

### **METHODS**

First, we estimate the level of production reach by the torrefaction units. The demand of oil products, clean steel and green electricity will lead the biocoal demand. Then, we study the influences of the fuel price and price CO<sub>2</sub> quota on the level of investment. In a second step, we assume the demand in biocoal pellets from BTL units is uncertain. Indeed, the refinery could be supplied by a mix of pet coke or coal and biomass. The percentage of incorporation will depend of the BTL unit profitability related to the oil price. We study the consequences of uncertain demand on the level of production of the torrefied units.

Then, we analyze the interactions between this biofuel supply and the refining industry which provides the oil products derivatives. For this purpose, we use the aggregated refining model (named OURSE) integrating torrefaction units in the supply of oil products. The OURSE model has been used in order to furnish a BTL units demand in pre-treated biomass. Designed to simulate the world oil product supply for the POLES (Prospective Outlook for the Long-term Energy System) model of the European Commission, OURSE is a world wide multi-areas refining model able to stimulate, so quantify the world and European refining industry of changes in the oil product demand. The oil product demand forecast has been determined through a technico-economic model. The other outlets of torrefaction units (as steel and power demands) are represented by two simplified equations of demand.

### **RESULTS**

We have use figures from the litterature to characterize the different sources of biomass and to build the model of the torrefaction unit. The calibration run of the OURSE model has been done for year 2005 according to refining capacities of each aggregated area considered, but also to their crude oil prices and availabilities and their oil product demand and specifications. Two scenarios have been considered: a reference scenario with a business as usual evolution of the automotive fuel demand and an environmental scenario with carbon taxes and a lower oil automotive fuel.

Preliminary results seem to point out that that investment in torrefaction units and biofuel processing units could be strongly affected by uncertainties on automotive fuel demand, raw material and oil prices.

## CONCLUSIONS

In this paper, we have carried out a study on the impact of oil demand and CO<sub>2</sub> price uncertainties on the level of investment in biomass pre-treatment industry. This is a key step between the biomass suppliers and several major players. Moreover, to reach renewable energy target fixed to 20% by the European Union for 2020, significant investments into biomass based technology will be necessary. Through a modelling approach, we analyze how pre-treatment market could emerge regarding the behaviour of refining, steel and power generation industries.

Three main issues raise from this study:

- The development of BTL production is clearly linked to the growth of diesel oil product demand, high fuel prices and CO<sub>2</sub> taxation;
- The price variability for both raw material and oil prices could increase the investment risk in torrefaction units;
- Consequently, the use of long term contract for the raw material prices or the output of the torrefaction units could be very helpful to develop the biofuel supply (pre-treatment and BTL units).

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