MODELLING BIOMASS FOR ENERGY USES: RESULTS FOR FRANCE

Overview

This paper presents the results obtained with a bottom-up model (Markal-TIMES) that allow us to propose a mix of technologies to fit the bio energies demands for France. This is the next step of our study presented in the IAEE conference in Vienna in October 2009. The Centre for Applied Mathematics is working with the French Petroleum Institute (IFP), the National Institute for Agronomical Research (INRA) and the Foundation for Construction Wood and Furnishing (FCBA) to develop a prospective model for biomass valorisation as energy in France. The aim of this project is to determine what can be the mix of biomass to use, the mix of technologies employed and what can be the potential of biofuel production for France until 2050.

Methods

The FCBA and INRA, as specialists, provide the most pertinent regional cut-out for all kind of products for France. IFP characterize the most promising biofuel production technologies that can appear during the modelling horizon. Finally we integrate all these specifications in our optimization model representing the biomass chain. Hence, we assess the technological mix able to fit the biofuel demand and give the corresponding agricultural products and wood associated productions in each zone for the studied time horizon.

All the potential that have been evaluated in this study are the potential that are not in competition with food uses.

To achieve these simulations, several scenarios have been adopted to represent what will be the demand of biofuel during this time horizon. The first one is the business as usual one and the others have been established to assess the limits of what is thinkable.

These scenarios have been evaluated to show the effect of some politics drivers on the bio products development: First the amount of energy that must be produced by bio products. Secondly what is the effect of a developpement of cogeneration or a development of biofuel production on the localization of the bioressources? Finally some of these scenarios included different choices: include or not the biofuel for air transportation.

Results

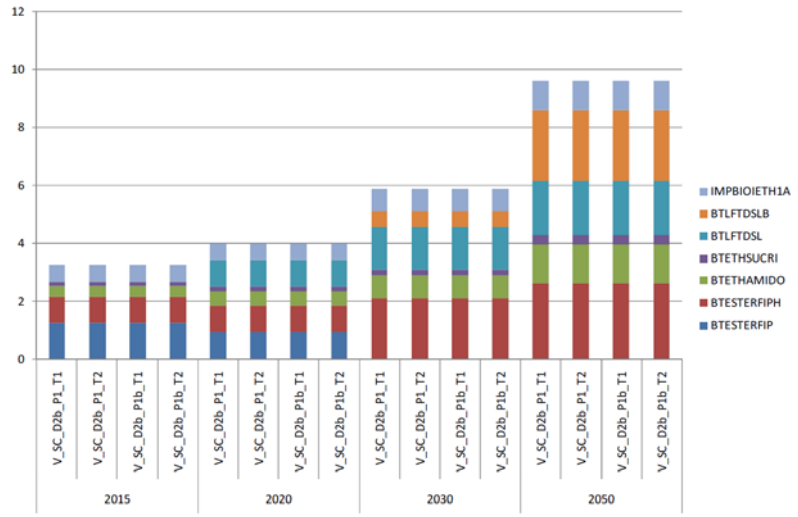
We present for the scenarios established, the repartition of the kinds of biomass available in the time horizon studied regarding the different options that have been chosen in each zone represented. These results show what is possible to produce for biofuels uses, without competition with food uses. We show that depending on the constraints of volume, some importations are necessary. We can evaluate what is the resources' utilization in each zone that has been modelled, which technology is the best way of producing the biofuels. This kind of results is fundamental to assess the feasible potential in a spatial constraint.

Then, some results on the coproducts have been analysed (for electricity, heat production or several co-products). All these results show the limits of the politics' effects on bounding the biofuel production if we don't want to see a competition in uses.

On the following figure, we can appreciate the mix of technologies uses depending of the reachable resource in the studied zone. A comparison between four scenarios is presented.

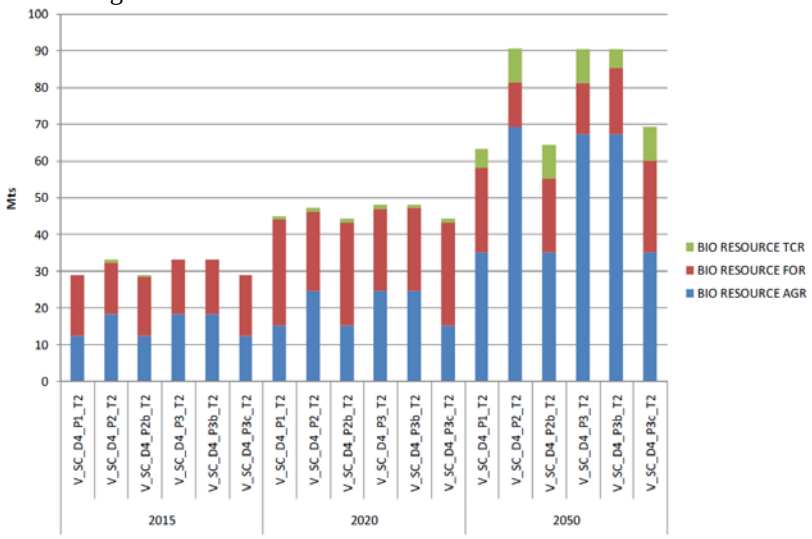
It is interesting to notice the modification of the technology mix during the time horizon to fit the demand and the local biomass production.

These results are available for several constraints and some of them show several mixes of technologies and their associated costs.



One the next figure is presented the mix of the biomass kind (Agricultural products, wood and SRC (Sort Rotation Coppice)) for the biofuel production in a specific zone (one of the ninth) for six different scenarios.

This kind of result is interesting to evaluate the specificity of each production's zone and to assess the best technology to transform this biomass. Moreover, it is interesting to notice the evolution of the different sharing between the three biomass categories.



Conclusions

The results obtained with our bottom-up model show the limits of several constraints that can be imposed to biofuel production regarding the real potential in a specific zone of France. It is important to assess what is really possible to produce regarding the real available land fields and the real kind of biomass that can be produced on it. Some scenarios shows that considering the fixed amount of biofuel imposed to be produced lead to some biomass importations. It gives to the policy makers some bounds that can't be assess without this kind of modelling. The diversity in the scenarios chosen can enhance some particularity (development of cogeneration or electricity production) to reach the imposed objectives.

References

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