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# ***BIOMASS FOR ENERGY USES: ASSESSMENT METHODOLOGY FOR FRANCE***

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## **Overview**

Fossil fuels scarcity and environmental issues are good drivers to question the future limits to the use of these energies and study renewable energies alternatives. Biomass is a credible option either as biofuels incorporated at different rates in the traditional fossil fuels or combustible for large (industry or electricity production) or small scale uses. There is nevertheless real debates on land use competition for organic resource as well as biofuels production routes. The Center for Applied Mathematics is working with the French Petroleum Institute (IFP), the National Institute for Agronomical Research (INRA) and the Fondation for Construction Wood and Furnishing (FCBA) to develop a prospective model for biomass valorization as energy in France. The aim of this project is to determine what can be the mix of biomass to use and what can be the potential of biofuel production for France until 2050.

This paper presents the methodology adopted to represent several agricultural and wood products that can be used for combustion and biofuel production on the French available land until 2050. Then with this detailed representation of the resources, all the technological ways of production of biofuel are considered to minimize the total discounted cost of meeting given biomass development targets. For this purpose, we implement a bottom-up model that allows us to propose a mix of technologies to fit the bioenergies demands for France.

## **Methods**

The first important point is to be able to represent the most realistic potential for all agricultural products and wood usable for biofuel production. The country is first divided in several zones that can represent the diversity of the cultures. As biomass is first used for local usages, it is important to represent local potential with different transportation costs depending on their length that can reduce the potential for a given production site.

The FCBA and INRA, as specialists, provide the most pertinent regional cut-out for all kinds of products for France. IFP characterizes 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.

To achieve these simulations, three 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 two other scenarios have been established to assess the limits of what is thinkable.

## **Results**

First, we present the way of representing all the biofuel chain from the landfills to the end-use of biofuels. This result is represented in a Reference Energy System (RES) that is the aim of the model. Hereafter is represented one part of this RES concerning the biofuel production step.

