BIOMASS PRODUCTION AND FEEDSTOCK DIVERSIFICATION FOR ADVANCED BIOFUELS: THE BECOOL PROJECT

M. Christou[1], E. Alexopoulou[1], A. Monti[2], W. Zegada-Lizarazu[2], A. Parenti[2], J. Carrasco[3], C.S. Ciria[3], L. Pari[4], A. Suardi[4]
[1]Center for Renewable Energy Sources and Saving (CRES), 19th km Marathonos Avenue, 19009, Pikermi, Greece, Tel: +30 210 6603300, Fax: +30 210 6603301, email: mchrist@cres.gr
[2]UNIBO, University of Bologna, Italy
[3]CIEMAT, Centro de Investigaciones Energeticas Medioambientales y Tecnologicas, Madrid, Spain
[4]CREA, Consiglio per la Ricerca in agricoltura e l'analisi dell'Economia Agraria

ABSTRACT: The main objective of the BECOOL project "Brazil-EU Cooperation for Development of Advanced Lignocellulosic Biofuels" is to strengthen EU-Brazil cooperation on advanced lignocellulosic biofuels. The project covers the whole value chain, from biomass production, to logistics and conversion. In the BECOOL project, credible, cost-effective and sustainable value chains for several biomass types will be evaluated. The streamline along each value chain, from the raw material to the final energy product/carrier, will be identified, taking into account cultivation, harvesting, logistics and conversion technologies.This paper is focused on the implemented biomass production and diversification strategies.
Keywords: biomass assessment, perennial crops, crop rotations, biomass logistics

1 INTRODUCTION

Europe and Brazil (along with the United States) account for the lion's share of today's biofuel production and consumption, however the investment on biofuels is global and a massive mobilization of biomass resources can be expected on the short term. The obvious question thus arises as to how and where feedstock demand can be satisfied. Nearly all of the 100 billion litres of biofuels used today consist of bioethanol and biodiesel produced from maize, sugarcane, rapeseed and soybean. Therefore, identifying complementary strategies to develop advanced lignocellulosic feedstocks in a sustainable and affordable way, without reducing food/feed crops and land is an urgent challenge.

The main objective of the BECOOL project "Brazil-EU Cooperation for Development of Advanced Lignocellulosic Biofuels" is to strengthen EU-Brazil cooperation on advanced lignocellulosic biofuels. The project covers the whole value chain, from biomass production, to logistics and conversion.

2 BIOMASS RESOURCES

Biomass supply chain is a complex system depending on the availability of biomass year around, identification of suitable crops to meet the required quantities, unpredictable yields, different agronomic techniques, harvesting, handling and storage systems, regulations, public perception and acceptance by the rural community, laws and regulations, etc.

In the BECOOL project, credible, cost-effective and sustainable value chains for several biomass types will be evaluated. The streamline along each value chain, from the raw material to the final energy product/carrier, will be identified, taking into account cultivation, harvesting, logistics and conversion technologies.

This paper is focused on the implemented biomass production and diversification strategies.

2.1 Agricultural/forest and process residues for advanced biofuels

There are a number of studies carried out in the EU (i.e., EUBIONET, BEE, Biomass futures, S2BIOM, BIORAISE,etc) that quantified the actual and potential biomass availability in/and outside Europe. This task reviews the existing data focusing on lignocellulosic feedstocks of potential interest for advanced biofuels in Europe and Brazil (e.g. cereal residues, pruning and forest residues, bagasse, lignin rich, etc). Information will include biomass quantities, availability, relevant analytical characteristics, existing harvesting and logistic options, market prices, cost and supply curves. The inventory will cover Southern EU regions, so as to allow synergies with the Brazilian partners. Scaling up scenarios ofresults achieved will be also drawn utilizing EUROSTAT/BIORAISE or other databases to estimate thepotential increase of lignocellulosic feedstocks from implementing the BECOOL cropping systems in selected regions.

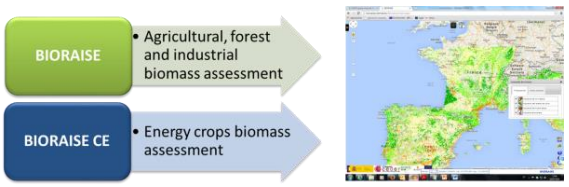

Figure 1: BIORAISE model

2.2 Dedicated annual lignocellulosic crops

Conventional cropping systems generally leave soil uncovered for many months between two main food crops.

Using soil more intensively (i.e. increasing the Land Equivalent Ratio – LER) through growing lignocellulosic crops as intermediate crops would allow to diversify crops, while increasing the annual quantity of lignocellulosic feedstock without reducing food crops land.

Dedicated annual lignocellulosic crops (sunn hemp, fibre sorghum, kenaf and hemp) will be introduced alongside the conventional ones in innovative cropping rotation systems that will enable to increase biomass feedstock availability by at least 50% without negatively impacting food production, soil quality, and customary land uses (fig.2) These crops are most promising taking into account their potential yield,beneficial effects in the rotation (e.g. sunn hemp is a leguminous species), and growing season length. The selected crops are oftropical origin so as to be able to grow also in Brazil. As such, crops and rotation

schemes can only be used in SouthEurope, thus trials will be carried out in Greece, Italy and Spain.

The performance of such innovative cropping systems will be quantitatively and qualitatively evaluated.

Figure 2: Dedicated annual lignocellulosic crops

2.3 Dedicated perennial lignocellulosic and short rotation forestry - SRF

Perennial lignocellulosic crops can grow on marginal lands without competing against food crops. This task will concentrate on perennial herbaceous (miscanthus, switchgrass, giant reed) and woody crops (eucalyptus) that can be of interest for marginal/idle lands in Europe and Brazil (fig. 3). Existing stands of perennial lignocellulosic crops under marginal conditions will be used. Historical and new data from annual harvests will be collected to estimate long term yields. Existing and new field trials will be used in this work.

Figure 3: Dedicated perennial lignocellulosic crops

Nonetheless, there are large plantations inRomania (~50,000 ha of switchgrass), Finland (~20,000 ha of reed canary grass), Sweden (~10,000 ha of willow), theUK and Germany (~20,000 ha of miscanthus and poplar), Italy (~2,000 of giant reed, cardoon and miscanthus), where perennial crops are used mainly as solid biomass for heat and power production or for construction materials. However, these fields do not occupy marginal/idle lands. In BECOOL these crops will be tested on marginal/idle lands to ameliorate land abandonment and degradation problems.

2.4 Harvesting logistics

The harvesting logistics depend on several factors such as biomass morphological characteristics, bulk density, moisture content and storability of feedstock etc.

2.4.1 Agricultural residues

Agriculture residues represent a considerable source of lignocellulosic biomass that does not affect food production. Commonly, the harvest of cereal residues (e.g. straw) are well developed, while residues like chaff and husk (that are discharged below the straw by the combine), or pruning still remain largely underutilized.

The aim of this sub-task is to set up and optimize mechanical solutions, partially developed in previous projects, to increase the efficiency ofrecovering of agricultural residues (i.e. reducing biomass losses).

2.4.2 Dedicated annual and perennial crops, including eucalyptus

Harvesting and handling of specialist annual and perennial lignocellulosic crops have not been sufficiently investigated thus large room exists to reduce yield gaps.

Although there is evidence that eucalyptus may yield biomass ata competitive cost if the harvesting operations are optimized, however, efficient harvesting of eucalyptus remains a challenge and cost-effective harvesting machinery has yet to be improved even in leading eucalyptus producing country such as Brazil. Field drying, baling or comminution, densifying processes will be addressed to enhance the quality and quantitative of harvested feedstocks, while reducing transport, handling and storage costs. Data on the performance of the selected machineries (e.g. not recovered biomass) and the operational costs (fuel and time) will be collected.

Demonstration activities will be also organized in order to increase framers' awareness on technological progress and market opportunities.

3 ACKNOWLEDGMENTS

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