

USDA Foreign Agricultural Service

GAIN Report

Global Agricultural Information Network

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POLICY

Voluntary Public

Date: 2/6/2015

GAIN Report Number: NL5004

EU-28

Post: The Hague

EU Bio-Based Economy and Its Inputs

Report Categories:

Biofuels

Grain and Feed

Oilseeds and Products

Sugar

Wood Products

Trade Policy Monitoring

Approved By:

Mary Ellen Smith

Prepared By:

Bob Flach

Report Highlights:

This report presents a brief overview of the current status and potential of the EU bio-based economy. It also includes the estimated biomass requirements for the production of biofuels, bio-plastics, bio-chemicals, and bio-pharmaceuticals. Key for the further development of the bio-based economy is an abundant supply of sustainably produced biomass.

Introduction

The use of biomass for purposes other than food and feed is not a new development. Common examples are timber, paper, tires, clothing and paints. While global demand for biomass is anticipated to grow, *new* opportunities will be in the markets where biomass could replace coal and petroleum as an input. These new markets include bio-energy, bio-plastics, bio-chemicals, and bio-pharmaceuticals. Replacing fossil fuels and concerns regarding climate change are the main drivers for the production of bio-energy in Europe. Creating higher value for agricultural commodities has rallied support for other bio-based products. Due to the competitive fossil fuel prices, bio-energy is dependent on government support, while the production of bio-chemicals and bio-pharmaceuticals is already economically viable without subsidies.

The Nova Institute published a [comprehensive overview](#) of the use of biomass and its growth markets. In this report an overview is given of the policies related to the bio-based economy and the required inputs for the EU production of bio-energy, bio-plastics and bio-chemicals.

In addition to innovative conversion technologies, the key for the further development of the bio-based economy is an abundant supply of sustainably produced biomass. A threat to the development of this sector is emerging sustainability requirements. The bio-based economy is a new and developing sector that will either flourish or perish depending on government intervention. Failure to recognize a range of programs or systems to ensure sustainability will hinder its development.

Policies for the bio-based economy

EU policies for the bio-based economy

On February 13, 2012, the European Commission (EC) adopted a new strategy entitled "[Innovating for Sustainable Growth: a Bioeconomy for Europe](#)". The main goal of the strategy is to reduce the EU's dependency on fossil resources, for more information see the [Bioeconomy website of the EC](#). The EC funds bio-refinery research and commercialization by the [Horizon 2020 program](#). This financial instrument has a budget of Euro 80 billion for the period 2014-2020.

As part of the Horizon 2020 program, the [Public-Private Partnership on Bio-based Industries \(PPP\)](#) came into force on June 27 2014. The PPP is a joint undertaking between the EU and the [Bio-based Industries Consortium \(BIC\)](#). The BIC has 70 industrial members and over 100 related organizations such as universities, technology platforms and sector associations. The goal of the program is to convert biomass into common consumer products through innovative technologies by bio-refineries. The budget of the program is nearly Euro 3.7 billion, Euro 2.7 billion of private investments and Euro 975 million of EU funds. One of the targets of the program is to replace at least 20 percent of petroleum-based chemicals and materials with bio-based and biodegradable ones by 2020, and 30 percent by 2030. In contrast to biofuels there is no supportive harmonized EU legislation for the production and marketing of bio-based materials and chemicals.

U.S. policies for the bio-based economy

On April 26 2012, President Obama announced the development of a [National Bio-economy Blueprint](#). The goal of the Blueprint is to “strengthen bioscience research as a major driver of American innovation and economic growth” through five strategic objectives; (1) support of research, (2) commercialization of technologies, (3) reform of regulations, (4) training and (5) identification of public-private partnerships. The U.S. Government also imposed a program for preferred procurement. The U.S. Farm Bill requires federal agencies to purchase bio-based products designated by the [USDA BioPreferred® program](#). Through this program, the USDA certifies and awards labels to bio-based products to increase consumer recognition. The program aims to spur economic development, create new jobs, provide new markets, and reduce the reliance on petroleum. The BioPreferred® program is now featured on more than 1,940 products sold in stores across the country with companies in over 40 countries on six continents participating in the program.

In addition to the BioPreferred® program, the 2014 U.S. Farm Bill provides loan guarantees for bio-refinery projects and funds for biomass research and development. Also in the 2014 U.S. Farm Bill, U.S. Congress mandated an in-depth study of bio-based products and economic impacts, including research on job creation and economic value, the first federally sponsored economic report of its kind targeting the bio-based products industry. For more information see the USDA Report “[Why Biobased?](#)”.

Theoretical analysis of the EU biomass demand

Demand for biomass for the production of liquid biofuels

The current EU use of agricultural biomass for the production of liquid biofuels is estimated at about 32 MMT (see table further below). In 2020, it is forecast to have increased to 48 MMT for the production of conventional biofuels only. Considering the 10 percent mandate and the 7 percent cap on the blending of conventional biofuels, 3 percent of the transport fuel use will have to consist of advanced biofuels. Because the definition of advanced biofuels is not defined yet, it is not possible to determine the volume of biomass needed for the production of these advanced fuels. But it is likely to consist of mainly waste oils and fats and agricultural and food processing residues. The objective of the Bio-based Industries Consortium (BIC) is to supply 25 percent of the EU transport energy needs by sustainable advanced biofuels.

Demand for biomass for the production of bio-power and heat

The EU is the world’s largest wood pellet market, with a consumption of about 17.5 MMT of pellets in 2013 (see table below). Based on the European Commission (EC) mandates and Member State incentives, the demand is expected to pass the 20 MMT in 2015. Consumption forecasts for 2020 range from 50 to 80 MMT (AEBIOM). Markets for pellets range from small scale residential to large scale power plants. Another potential market is the chemical sector which can apply biomass for generating process energy. Future consumption will however, depend on a range of market factors and in particular Member State incentives. For more information see FAS GAIN Reports NL3001, NL3019,

NL3036, NL4018 and NL4040.

Demand for biomass for the production of bio-plastics and bio-chemicals

In the petroleum based economy, petroleum is converted into a wide range of intermediary chemicals and end products. Biomass can either be converted into new functional materials and chemicals or converted into drop-in intermediates, replacing so-called platform chemicals. The latter pathway would employ the existing infrastructure, and could progressively green the chemical sector. For most of the biomass conversion pathways vegetable oils and in particular sugar play a central role. Sugar is the preferable input for the production of short chain chemicals, while vegetable and animal oils and fats are the best input for chemicals which consist of long chains, such as lubricants and paints.

In a [study](#) of the Wageningen University (Dutch language only) the biomass use of the chemical industry is calculated if petroleum would be replaced. Based on the equations of this study, a replacement of 20 percent of the petroleum based chemicals and materials in 2020 would require 34 MMT of biomass and for a replacement of 30 percent in 2030 at least 50 MMT. In this scenario, 18 MMT of polymers and 17 MMT of intermediate chemicals are produced.

-Bio-polymers and bio-plastics

Other studies have made estimates based on the industries' strategies and investment plans, such as the study [Bio-based Polymers in the World](#) of the Nova Institute. According this study, the current EU production of bio-based polymers is about 320,000 MT, of which most starch blends. The Nova institute forecast the EU production to increase to about 1.2 MMT in 2020, with the biggest share for starch blends, polyethylene terephthalate (PET) and polylactic acid (PLA). Companies such as Coca Cola, Heinz, Ford Motors, Nike and Proctor & Gamble have signed the Plant PET Technology Collaborative (PTC), intended for development and use of 100 percent bio-based PET in their products. Another anticipated growth market is the production of Natural Fiber Composites (NFC) and Wood Plastic Composites (WPC).

-Bio-chemicals

The chemical industry commonly applies agricultural feedstocks for producing a wide range of products, such as cosmetics, lubricants, paints and linoleum. The main feedstock for the oleo-chemical sector is palm and soya oil. The Nova institute reports that about 10 percent of the carbon feedstock for the EU chemical companies is derived from biomass. The concept of the bio-based economy is that this share must increase at the expense of fossil feedstocks. At this moment, such data is not collected. The Joint Research Centre (JRC) of the EC is developing a methodology how to collect and monitor data on the use of biomass for the production of bio-chemicals in the EU Member States.

Below is a table with estimated biomass use for the production of liquid biofuels, bio-power and heat, bio-polymers and bio-chemicals.

<p style="text-align: center;"><i>Indicative EU Feedstock demand for the Bio-based Economy</i> (1,000 MT)</p>

	2013	2020	2030
Liquid Biofuels	Current blend rate: 3.5% of gasoline 5.6% of diesel grains: 10,000 fats & oils: 9,600 sugar beets: 11,700	Target blend rate: 10% of transport fuels 7% cap on conv. biofuels grains: 14,250 fats & oils: 17,300 sugar beets: 16,500 biomass: unknown	Target blend rate: 25% of transport fuels (all advanced biofuels) biomass: unknown
Power & Heat	wood pellets: 17,500	wood pellets: 50,000	wood pellets: unknown
Bio-Polymers & Bio-Chemicals	Biomass: about 1,000	Biomass: 34,000 20% replacement	Biomass: 50,000 30% replacement

Based on: FAS Biofuels Annual, EU Energy and Transport and GHG Emissions Trends to 2050, AEBIOM Statistical Report, Wageningen University Report no 1376, and the Bio-based Industries Consortium (BIC).

Source and logistics of the biomass

Adequate volumes of biomass, a reliable supply chain, and free trade are essential for a further development of the bio-based economy. If supply is limited, feedstock prices will rise, which will affect the viability of the sector. While there is a benefit to converting biomass close to the feedstock supply, logistical hubs guarantee a sufficient availability of feedstock from alternative sources, the presence of other processing sectors to plug into, and an easy access to the end markets.

Both the Netherlands and Belgium aim for the development of biomass hubs, in particular in the seaports of Rotterdam and Ghent. In the proximities of these ports a strong agricultural processing and chemical industry is present (see FAS GAIN Report NL2037). In the Netherlands and Belgium, the annual use of biomass for the production of biofuels and bio-electricity is estimated at respectively nearly 5 MMT and 1 MMT. The Benelux use of wood pellets has the potential to rise to 5 MMT between 2016 and 2020. Such hubs are also present in other EU Member States, such as the United Kingdom (see the recent FAS GAIN Report about the UK Wood Pellet Market).

The use of biomass for the production of bio-polymers and bio-chemicals is limited so far. In the Netherlands the production of bio-polymers is estimated at about 50,000 MT mainly from potato waste. However, due to the proximity of other processing industries it is possible to plug into the existing infrastructure. The Dutch chemical sector is [reportedly](#) planning to invest Euro 1 billion in the infrastructure and facilities to convert sugar beets in functional bio-chemicals. One of the drivers for this development is the abolishment of the EU sugar quota in 2017. Another opportunity is the connection of bio-ethylene production to the existing conventional ethylene pipeline. This pipeline currently connects the major petro-chemical hubs in Northwestern Europe. Because ethylene is a platform chemical this link could green the EU plastics industry in a very effective way.

Opportunities for transatlantic cooperation

The full potential of the bio-based economy can only be realized with the exchange of resources. The

further development of the bio-based economy depends on strategic partnerships either at a technical level or vertically through the biomass supply chain. An example is the joint venture between Poet and the Dutch chemical company DSM aiming to expand commercial cellulosic bioethanol production in the United States. EU based universities and private companies have developed a range of conversion technologies which could be applied in other continents ([FAS Biofuels Annual NL4025](#)).

Besides sharing knowledge about innovative conversion pathways, cooperation through the biomass supply chain is important for expanding the bio-based economy. The EU biofuels sector is sourcing biomass from the United States, of which 3.8 MMT of wood pellets (with a value of \$730 million) and about 170,000 MT of waste oils and fats (\$150 million) in 2014. Given the mandates for biofuels and renewable energy and the goals for replacing petroleum-based chemicals and materials, the EU will likely have to source more inputs from third countries. The EU bio-based economy could benefit from supplies from North America such as pelletized agricultural residues and by-products from the corn refining industry.

Countries like the Netherlands, Belgium and the United Kingdom recognize the opportunities to source these renewable inputs from third countries. The Netherlands Enterprise Agency, a Dutch governmental body, estimates 90 percent of the required 3.5 MMT of wood pellets will have to be sourced outside the Netherlands, predominantly from outside the EU. The agency started a program, [Biologik NL](#), to determine the required logistical infrastructure which can most efficiently ship the biomass from these sources to the hubs in the Dutch seaports.

The availability of the biomass is, however, threatened by restrictive sustainability requirements which fail to recognize third country sustainability practices. The EU import of U.S. corn for the production of bioethanol is restricted by sustainability requirements laid down in the EU Renewable Energy Directive (RED). The same directive is also limiting the import of soybeans for the production of biodiesel. If this approach is extended to biomass, the EU will also jeopardize its supply of wood pellets from North America.

FAS The Hague comments:

The EU is a leader in developing and supporting the bio-based economy and greening of their energy supply. The bio-based economy is a new and growing industry that has broad support on both sides of the Atlantic. However, as this sector is in its infancy, regulators need to take care not to stifle its development with overly burdensome requirements. Just as important as the exchange of production technologies is cooperation on how best to preserve and produce a reliable source of inputs.

Sufficient biomass availability from multiple sources can only be assured with the commoditization of biomass. While product quality standards are primarily determined by the users, a range of sustainability criteria is being established by different organizations and third party certifiers. The need for third party certification is a fundamental difference in the EU and North American approach. Failure to recognize that sustainability can also be effectively guaranteed through national programs which are based on existing national laws and regulations jeopardizes the reliable supply of biomass. Forestry is strictly regulated in the United States. These laws have regulated the sustainability of the forest landscapes and supported an increase of the forest acreage for more than fifty years. This demonstrates that local production methods and laws form a sound basis for ensuring sustainability.

Related reports from FAS Post in the European Union:

Country	Title	Date
United Kingdom	UK Wood Pellet Market	01/22/15
Netherlands	Dutch Proposal for Biomass Sustainability Criteria	01/08/15
Belgium	Belgian Power Sector Resumed Firing of Biomass	11/21/14
EU	EU Biofuels Annual 2014	07/08/14
Belgium	Flanders Stopped Co-firing Pellets	05/27/14
Italy	Biofuels Overview 2014	04/16/14
Romania	Romania revises down the biofuel mandates	01/21/14
Spain	Biodiesel Standing Report	12/13/13
Spain	Spain's Bioethanol Standing Report	11/29/13
Denmark	The Market for Wood Pellets in Denmark	11/08/13
Netherlands	Dutch Roadmap for Sustainable Energy	09/25/13
France	Limiting First-Generation Biofuels - TTIP Sensitive Issue	05/01/13
France	France and the Bio-economy or Green Economy	04/23/13
France	France Chooses Agro-Ecology for a More Sustainable Agriculture	01/25/13
Benelux	The Market for Wood Pellets in the Benelux	01/07/13
Poland	Renewable Energy and Biofuel Situation in Poland	01/02/13

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<http://gain.fas.usda.gov/Pages/Default.aspx>