



## Research paper

## Balancing growing global bioenergy resource demands - Brazil's biomass potential and the availability of resource for trade



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## ABSTRACT

Based on the general acceptance that greenhouse gases from biomass can provide a low carbon energy source, bioenergy pathways are being increasingly included in many countries renewable energy and emission reduction strategies. As a result demand for biomass is rising fast with several regions forecast to encounter major resource stresses over the coming decades. The bioenergy strategies of many countries rely heavily on future imported resource to balance their bioenergy resource demands. Applying a Biomass Resource Model to evaluate and forecast the types and potential availability of different categories of biomass resources from Brazil – a case study of a country with extensive biomass resources and export potential. This research evaluates Brazil's biomass potential to 2030, and analyses the levels of resource that may be available to export. The research finds that Brazil has extensive biomass resources that are potentially sufficient to both balance Brazilian total primary energy demand by 2030 and for Brazil to increasingly become a major exporter of resource for energy end uses. The paper also discusses the potential impact for global biomass trade, if countries such as Brazil were to adopt energy strategies that resulted in greater domestic use of their available biomass. The research's analysis shows that if the Brazilian Government were to adopt strategies to utilise a greater proportion of its resource for domestic energy, Brazil could export up to >25.8% less biomass by 2030 compared to forecast export levels based on Brazil's current policy framework.

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## 1. Introduction

Energy from biomass currently contributes approximately 10% of global energy supply, two thirds of this bioenergy is generated in developing countries, and the remaining in the industrialised world [1]. Bioenergy is such an attractive energy option for all stages of development due to its flexibility and potential for integration with all stages of development strategies [2], and the general acceptance that bioenergy can deliver energy with less greenhouse gas emissions than from fossil fuel energy pathways [3].

The IEA/IRENA Global Renewable Energy Policies and Measures Database [4] confirms that more than 60 countries currently have national targets or policies supporting renewable energy. In countries such as those in Europe, biomass is expected to play a major role in contributing over 50% towards their renewable energy targets [5].

Despite widespread global demand, biomass is unevenly

distributed with some of the regions with the greatest demand having comparatively low resource availability [6–9]. Trade has an important role to play, with biomass being described as the most important renewable energy carrier worldwide [10]. The short-term trend is that countries and regions with strong economies and development will increase their use of imported biomass resource, whilst less developed countries will continue their development largely reliant on fossil fuels [11].

As a result of recent energy policies Europe has become the prime market for the trade of biomass for energy [12]. More than 30% of biomass resources currently consumed in Europe are imported [13], and demand is forecast to rise by almost 50% between 2010 and 2020 [14]. Demands for biofuels are expected to rise sharply driven by Europe's ambitious biofuel mandates, and the demand for fuels such as wood pellets are forecast to increase three-fold by 2020 as Governments offer renewable energy subsidies [15].

In summary developed countries and regions are set on a journey of increasing reliance on bioenergy pathways to meet their energy demands. As their renewable energy policies are implemented and targets met, more and more of the biomass resource

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required to generate this energy will have to be imported.

Undertaking analysis using a Biomass Resource Model, this paper sets out to analyse the potential availability of biomass resources from Brazil - a key biomass exporting country. The paper also explores what may happen if scenarios arise where 'biomass rich' countries or regions start to adopt policies to use a greater extent of their biomass resource to meet domestic demands rather than exporting to the international market.

## 2. Global trade of biomass

The following section provides further details of the current major flows of biomass resource around the world and explores how this trade may further develop.

### 2.1. Supply & demand regions

The key forces driving the global trade of biomass resources for the bioenergy sector are the prices of fossil fuels (especially oil), the implementation of policy mandates aimed at reducing greenhouse gas emissions and increasing policy and financial mechanisms supporting bioenergy pathways [16].

Fig. 1 highlights the major biomass trade flows around the world. Brazil is the major exporter of bioethanol, predominately to Europe, the United States and Japan [17]. The United States, Argentina, Indonesia and Malaysia are the largest exporters of biodiesel, mainly to Europe [17]. The major exporters of wood pellets are Canada, the United States, Russia and the Balkan States, with Europe once again being the largest importing region [18–20].

### 2.2. Trade hub Europe

Driven by the renewable energy and greenhouse gas reduction targets of EU States, Europe is the key trading hub and demand region for each of the major categories of traded biomass resources. With all major biomass trade flows headed towards Europe, this may present both positive and negative issues for the bioenergy sectors of specific European States. Being part of the central hub of biomass trade with increasingly established trade routes will likely

present resource opportunities for the growth of the bioenergy sector. However the competition for resource throughout Europe is only likely to intensify, with European countries having to increasingly compete with their neighbours who each have their own equally large(r) and growing demands for resources.

### 2.3. Key trade flows – biofuels

By 2030 global demand of biofuels are forecast to rise by 2.1 EJ and 1 EJ respectfully for bioethanol and biodiesel based on 2000 levels. Driven by biofuel mandates Europe is forecast to represent 74% of the total global biodiesel demand in 2030 and 13% of the bioethanol demand [15].

The United States and Brazil are the two leading producers of bioethanol – these dominating by representing over 85% of the global market [21]. Brazil is the largest exporting country with the United States and Europe being the greatest importers followed by Canada and Japan [16]. The UK and Sweden are amongst the largest importers of bioethanol in Europe, of which 32% (in 2009) was estimated to be utilised to power the transport sector [16].

Driven by the biofuels mandates the Europe has the world's most developed biodiesel industry producing two thirds of global production [16]. Germany, France, Spain and Italy are the leading producers [22], with rapeseed oil produced in Europe being the major feedstock that represents two thirds of total demand for production. Imported feedstocks such as soybean oil, palm oil and to a lesser extent further rapeseed oil representing the final third [23]. Other major biodiesel producers include the United States, Argentina, and Brazil. With more than 95% of global biodiesel exports being directed toward Europe [24], Germany and France consuming almost half of this amount [21].

### 2.4. Key trade flows – wood pellets

The global wood pellet market has also been growing exponentially, with levels currently comparable to that of both bioethanol and biodiesel in terms of traded volumes [16].

Driven by mandates and incentives to increase renewable energy generation and reduce carbon emissions, Europe is the world's

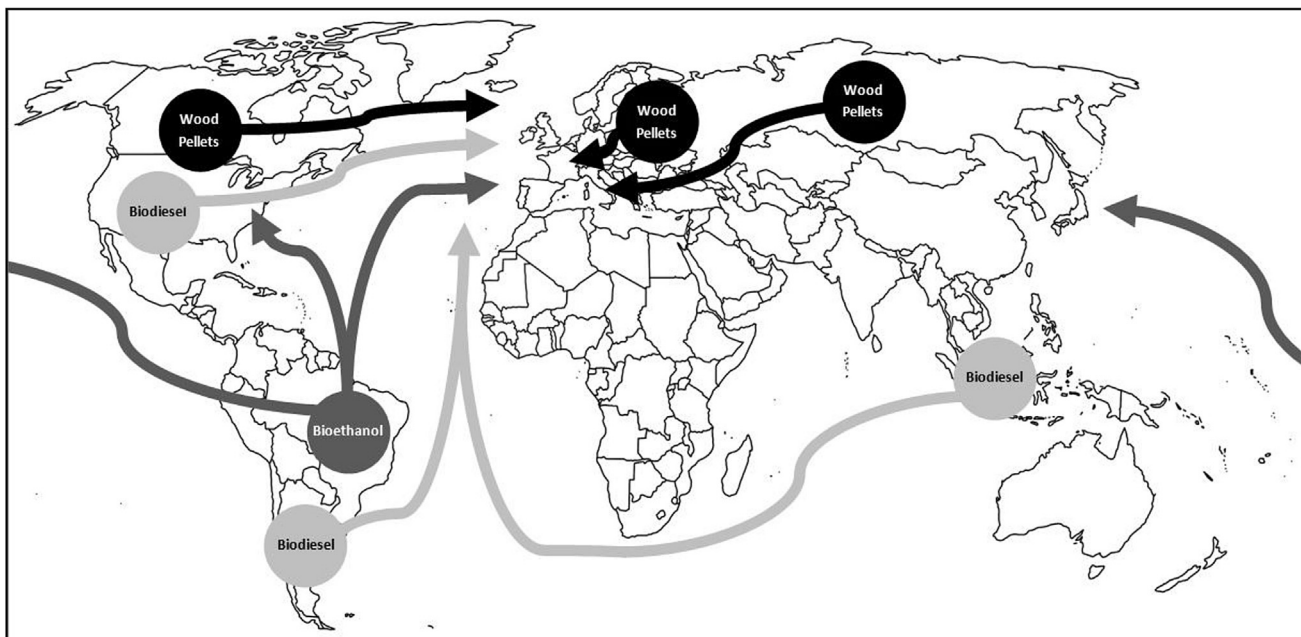


Fig. 1. Major global trade flows of biomass resources for energy end uses.

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