
Introduction

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The need for security and diversification of energy supply, the necessity for independence from fossil fuels, the uncertainty surrounding oil prices, and the rising concerns on environmental degradation and climate change effects are challenges that have prompted the international community to address seriously the promotion and use of renewable energy sources. Bio-energy emerges as a solution that may meet a significant amount of the world's constantly increasing energy demand. Biomass is converted via the basic pathways into solid, liquid and gaseous biofuels that can be used for electricity, heat and mobility.

Biofuels for the transport sector (e.g. bioethanol, biodiesel, bio-methane) are today a subject of intense discussion and their role is still somewhat ambivalent. On the one hand, they are an instrument to cope with the dependence from fossil fuels and a key to low-carbon economies. The fact that while burnt, they approximately emit as much CO₂ as the biomass absorbs for its growth makes them a powerful means to decrease the contribution of the transport sector to the GHG effect. In addition, the implementation of bio-energy projects at local and regional scales has been associated with regional growth strategies and the creation of new jobs. On the other hand, biofuel production from crops (conventional biofuels, e.g. bioethanol from sugar and starch, biodiesel from oil seeds) is criticised for increases in food prices and in food insecurity that affects primarily the population of developing countries. Furthermore, land use changes and intensification of cultivation following the increasing demand for biofuels may cause new GHG emissions and affect the biodiversity, the soil quality and the natural resources in a region.

Nowadays, production alone is not enough; sustainability of production is the key, hereby meaning the implementation of pathways that are technically efficient, economically affordable, environmentally friendly and socially acceptable. This background highlights the fact that the assessment of biofuel production chains is a complex task. On the one hand, the wide variety of feedstock options (e.g. sugar and starch crops, oil seeds, agricultural by-products, forestry residues, biowaste) and on the other hand, the various conversion pathways, result in a large number of biofuel options, each of which has different economic, environmental and social impacts along the entire chain of production.

The world is witnessing a sudden growth in production of biofuels, especially those suited for replacing oil like ethanol and biodiesel. Issues concerning land availability, biomass production and supply, biomass conversion, biofuel distribution and final use combined with specific policy frameworks in various countries make it clear that there is a large volume of information relevant to the assessment of production pathways. Therefore, a management system to assist in the efficient handling of this information is a *sine qua non* for sustainable energy policy.

This special issue brings together recent ideas on the economics of biofuel policy. It also offers a very interesting synthesis of contributions from the environmental, economic, and policy literature in different countries in the world (Brazil, Cuba, Europe) on the possible effects of these types of biofuels. Another motivation is to identify gaps in understanding and to recommend areas for future research work. The seven papers included in this volume lead to several key conclusions. The transport sector is a significant contributor to GHG emissions in most countries, representing 23% (worldwide) of CO₂ emissions from fossil fuel combustion. In Europe the transport sector is responsible for 20% of all GHG emissions which contribute to climate change. In this context, agriculture has provided a substitute for vehicular transportation fuel. Biofuels production from agricultural biomass may become a promising option for playing a relevant role in the future renewable energy sources panorama, given the opportunity to achieve multiple goals such as security of supply, reduction of greenhouse gas emissions, and an alternative market for agricultural products and diversification of energy sources.

Renewable energy may create positive externalities, insofar as it reduces GHG emissions and it reduces the import of energy, thus leading to a decline in the resource dependency on policies in foreign countries. In other words, the production of biofuels is a positive externality. In general, an internalisation process is required by governments so to avoid market failures.

This Special Issue is structured as follows: the first three papers address the potential and the impact of biodiesel energy and its different appearances. The second set of three papers concern the biogas and bio-methane production in different contexts in the world. Finally, the last paper analyses the energy from forest biomass. We will now offer a concise summary of each contribution.

The first paper evaluates the environmental impact at a micro-scale level, in terms of GHG emissions, from the production to the use of rapeseed biodiesel using the life cycle assessment methodology (LCA).

The second contribution aims to highlight and to discuss the impacts of the National Program for Production and Use of Biodiesel – PNPB in Brazil as an alternative of ethanol by sugarcane. The Brazilian policy goal is to promote the social inclusion and local development by family farmers as oilseeds suppliers of biodiesel production. Next, the third article explores the impact of EU biodiesel prices on diesel and rapeseed oil prices using an operational statistical model.

The next part of this special issue addresses biogas and bio-methane.

The fourth contribution aims to sketch out the potential of a new energy initiative in the Dutch transport sector, which can be considered as a decentralised initiative, called ‘green gas’. Next, article five aims to assess the competitiveness of dairy farms biogas plants located in Western Paraná (Brazil) that uses the reverse logistics of animal waste (manure). And then, the next article proposes an empirical analysis of biogas production by the anaerobic digestion of rice-harvesting wastes in Cuba.

Finally, article seven highlights the optimisation of bio-energy chains related to forestry energy alternative and shows that the establishment of a bio-energy district can make a positive contribution to territorial development.

The various contributions in this special issue offer a panoramic overview of the promising potential of biofuel for achieving a more sustainable development. Much more experimental field work is needed to fully appreciate and adopt the various appearances of alternative types of biofuel supply.