



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

BIOFUEL AND POLICY ALTERNATIVES: A FARM LEVEL ANALYSIS

ADELE FINCO, MONICA PADELLA, ROMINA SPINOZZI, ANDREA BENEDETTI

Dep. SAIFET, Agricultural Economics, University Politecnica Marche, Italy

a.finco@univpm.it



Paper to be considered for special issue of AgBioForum: Yes

Paper prepared for presentation at the 14th ICABR Conference

“Bioeconomy Governance: Policy, Environmental and Health Regulation, and Public Investments in Research”

Ravello, Italy, June 16-18, 2010

Copyright 2010 by author(s). All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Abstract

Within the past years, there has been a significant movement in political consensus towards an energy future with a substantially larger renewable energy component both in Europe and Italy. The biofuel industry has been experiencing a period of extraordinary growth, fueled by a combination of high oil prices, and ambitious blending mandates, tax exemptions and import protection.

The major drivers are the reduction of greenhouse gas emissions and fossil fuel use, increased awareness of fossil fuels' contribution to global climate change, the desire to promote economic revitalization in rural areas and the possibility to create new markets for agricultural products.

This paper examines the history of European and Italian biodiesel policy and evaluates the economics of biodiesel production in today's market environment in Italy. The aim is to shed light on the prospective of the industry and to understand the impacts of policy alternatives.

The study is motivated by the increase in biodiesel production capacity realized in Italy in the past years, in contrast with the actual scenario, emerged from Italian plant managers interviews.

We develop an analysis at the firm level to review factors which have contributed to the boom in biodiesel production. The analysis is built upon the work developed by Tyner and Taheripour for ethanol (2008). It's based on a break-even comparison for combinations of rapeseed and biodiesel prices which keep a representative biodiesel plant at the zero profit condition. The aim is to examine the profitability of Italian biodiesel industry in 2004-2009.

Keywords: biodiesel, firm-level analysis, break-even analysis

1. Introduction

Bioenergy is among the renewable energy sources often considered to play a key role in the short run to reduce carbon emissions, improve global energy efficiency and exploit less carbon intensive energy sources. It has the potential to address the full range of energy markets, including transportation, heat and electricity. Bioenergy is generated from organic substances usually referred to as biomass and, among them, biofuels are derived from energy crops (Ledebur et al, 2008).

Interest in biofuels has grown rapidly in recent years in response to the rising costs of fossil fuels and increasing public concern about environmental issues such as climate change.

In the developing countries, biofuels also offer the prospect of increased energy independence for nations that have historically been dependent on fossil fuel imports. Furthermore, biofuels are said to give secondary economic benefits by providing alternative markets for impoverished agricultural communities. As a result of these factors, many countries have initiated biofuel programs for the production of biodiesel (from oil crops), ethanol (from starch or sugar-bearing crops) and electricity and industrial heat (from various biomass resources, including wood and crop residues).

Despite these recent trends, some research findings indicate potential problems with biofuel systems. One of the major criticisms directed at biofuel programs is that they divert valuable agricultural resources from food production. This effect arises not just from the direct use of food crops but even when non-edible, dedicated energy crops are used for making biofuels, agricultural resources such as land and fresh water that could be put to use for food production become allocated to fuel production. This so-called “food versus fuel” dilemma has ethical, political and economic implications (Cruz Jr et al, 2009).

This study shows the principle measures adopted by EU and Italian government during the recent years trying to explain how each measure have influenced biodiesel production.

Moreover, the present study presents a firm level analysis focusing on biodiesel derived from agricultural feedstocks and the profitability of the biodiesel industry from 2004 to 2010 through a break-even analysis.

In particular, paragraph 2 provides an overview of policy history at a European and Italian level; paragraph 3 regards facts and trends related to biofuels. It examines production, use and trade in Europe and Italy of the biodiesel market.

Paragraph 4 presents the methods of the analysis of a representative biodiesel Italian plant showing production costs and profitability, while paragraph 5 looks at the impact on the different components of the biodiesel price. Finally, paragraph 6 contains the break-even analysis and the results that are the combination of rapeseed and biodiesel prices which keep a representative biodiesel plant at zero profit condition. The aim is to examine the profitability of the Italian biodiesel industry and show the impact of policies. The final paragraph presents the conclusion.

2. European and Italian Biodiesel Policy History

In most countries, biofuels remain highly dependent on public support policy. Many different forms of support are provided at various stages of biofuel production but the major categories of support are budgetary support measures, either as tax concessions for biofuel producers or as direct support to biomass supply, biofuel production capacities, specific infrastructure or equipment for biofuel users or mandatory blending measures (OECD, 2008).

Some of these measures directly affect the public budget, while blending or use mandates generally are neutral for public budgets. Trade restrictions, mainly in the form of import tariffs, protect the less cost efficient domestic biofuel industry from competition from lower-cost foreign suppliers and result in higher domestic biofuel prices.

In the European Union (EU), the biofuel expansion experienced in recent years originates in the incentives set up by Member States within a global framework provided by the EU.

The development of biofuels was supported to abate GHG emissions and to increase agricultural income through tax exemptions, mandatory blending and import barriers. Without incentives increases would certainly have been much more limited (Bureau et al, 2010).

Several measures of the agricultural policies like the Common Agricultural Policy (CAP) in Europe as well as of the energy policies directly and indirectly stimulate the production of renewable energy from the agricultural sector. At the EU level, three political decisions have had a fundamental role in biofuels expansion: the CAP, the 2003 Directives and the last Directive of 2009.

The 1992 CAP reform provided incentives to produce crops for energy use. Farmers were allowed to grow nonfood crops on set-aside land. In 2003, a new premium for energy crops grown outside set-aside land was implemented. However, the last reform of the CAP (2009) ended the subsidies for the production of energy crops.

A more ambitious biofuel policy at the EU level has launched in 2003. The major event was the adoption of two directives aimed at promoting the use of biofuels. The Commission’s Biofuels Directive (2003) sets a 2% market share (measured in energy content) as reference value in 2005 for biofuels and 5.75% share in 2010. As Table 1 shows, substantial difference in Member States’ efforts is observable and doubts remain in place if the overall 2005 reference value has really been achieved. Globally biofuels only accounted for 1% of the EU transport fuel market in 2005 which is half the target of 2%.

Table 1 - Market shares and targets for biofuels in EU-25 (in percentage)

The target fixed by the biofuels use Directive (Dir. 2003/30/EC) were not mandatory and there was not penalty for noncompliance. The only constraint was an annual report to the European Commission by the Member States indicating its progress in achieving European targets

(European Commission, 2007). Furthermore, the energy taxation directive (Dir. 2003/96/EC) has allowed Member States to grant tax reductions and exemptions on biofuels¹.

This framework gives Member States different instruments and many degree of freedom to implement policies.

Summarizing, even if no subsidies are directly provided, the two most widely-used approaches to support the development of the biofuel market in Europe are, first, the tax exemption that represents an indirect subsidy of biofuels and second, the direct governmental obligation to blend the mineral fuel with predefined amounts of biofuel. This induces the fuel distributing companies to buy biofuels and stimulate their production via increasing demand for these products.

Many Member States rely initially on fuel tax exemptions subject to State aid control. In doing so, however, budgetary problems arose. For this reason, some Member States has recently turned to implement biofuels blend obligations increasing the quota (Ledebur et al, 2008).

Furthermore, public support for biofuels has recently been questioned and several reports produced by the Commission , NGOs and international institution (Oecd, 2008, Fao, 2008, World Bank, 2008) have criticized biofuels.

Some negative effect like the indirect land use change and concerns relative to the overall environmental effect of biofuels and potential competition for land with food production have triggered erosion in the public image of biofuels and have led to the adoption of the Renewable Energy Directive (RED, Dir. 2009/28/EC).

The last important step of the European policy on biofuels was the 2008 Climate and Energy Package and the adoption of the RED as a piece of the Package². The RED expanded the target to “renewable fuels”, including electricity and hydrogen, rather than a strictly biofuel target. Moreover the final compromise introduce sustainability criteria: minimal GHG savings have to be achieved and so biofuel must provide at least 35% carbon emission savings compared to fossil

¹ The blending of biofuels in fossil fuels is also constrained by the Fuel Quality Directive 98/70/EC.

² In addition to Directive 28/2009, it includes a Directive on the EU Emissions Trading System, a decision on the effort sharing between Member States for CO2 reduction, a Directive on the geological storage of carbon dioxide and a revision of the fuel quality Directive.

fuels in 2010 and this level will rise to 45% by 2013 and 50% by 2017 and some types of land are unfit to grow biofuel crops and social standards have to be met. Moreover, the European Commission has been asked to come forward with proposals by the end of 2010 to limit indirect land use change. The Parliament and the Council will then have to make a decision based on these proposals before 2012.

At national level, the Italian government combines three instruments to develop biofuels: the first is a tax reduction of the excise on fuels (tax cuts are granted for a limited quantity), the second is a mandatory blending rate (3% in 2009 in energy content) and the third is the market share that must be reached of biofuels on the total fuel consumption.

The Italian policy history is summarized in Table 2.

Table 2 - Biodiesel Italian policy history

The reduction of excise duty have been recently changed by the Italian Law of 23 December 2009 n.191 that assigns 18 thousand tons of biodiesel to be distributed among biodiesel plants. The limited quantity was 250 thousand tons until 2009.

The new law doesn't contain the distinction between the national "agrifuel chain" as Law n.296 of 27 December 2006, in which 250 thousand tons of biodiesel was divided in: 70.000 tons assigned to the "agrifuel chain" with national and EU contracts for oil production with rapeseed, sunflower and soybean and 180.000 tons from "non agrifuel chain" assigned to biodiesel companies (Rosa, 2009). The Companies participate to the assignment of the 70.000 ton of the agrifuel chain by exhibiting the cultivation contracts signed with producers.

Nowadays, for 18.000 tons there is the reduced excise duty, instead of the full excise duty applied to gasoil of 423 €/mc, that corresponds to a 80% reduction with respect to the full duty.

This decision will have strong consequences on the profitability of Italian biodiesel plant as we will show in the next paragraphs.

3. Biodiesel production in Europe and in Italy

The production and use of biofuels, mainly ethanol based on cereals and sugar crops and biodiesel based on vegetable oils such as rapeseed, have grown rapidly over the past few years and are expected to double in the decade to come.

The world biofuels production reached 62 billion liters in 2007 and the 84% is represented by ethanol production (Table 3).

The United States and Brazil are the largest ethanol producers with 51% and 36% of global ethanol output in 2007, respectively, while the European Union accounts for about 60% of global biodiesel production. A large number of other countries’ governments have begun, or are considering promoting biofuel production and use (OECD, 2008).

Table 3 - Biofuel production by country (2007)

The main EU ethanol producers include France, Germany, Spain, Poland and Hungary.

EU ethanol output reaches 2.7 bln liters in 2008, up from 2.2 bln in 2007 (Figure 1). The main driver of this growth is output expansion in France, Germany and East Europe where, after initial technical problems, the major fuel ethanol plants reached their bounds of capacity (Labebur, 2008).

Figure 1 - EU ethanol production in 2008 (in millions of litres)

The EU is the world major player in production of biodiesel with a share of 60% of total production (Figure 2). Business interest in biodiesel has also grown in the U.S. (16.5%), in Indonesia (4%), Malaysia (3.2%) and Brazil (2.2%).

Figure 2 - EU biodiesel production in 2008 (in tons)

In the EU-27, the increase in production of biodiesel is the major task of the EU to 2010 that has been stimulated by the incentive measure adopted by Member States as underlined in paragraph 1. In 2008, 7.7 mln tons of biodiesel have been produced equivalent to a 35.7% increase between 2007 and 2008 and in contrast to 1.0 mln tons in 2002 (Figure 3).

The EU market leader is Germany, with biodiesel production at about 2.8 mln tons in 2008, that represents 36.7% of total European production, followed by France (23.6%) and Italy (7.7%).

For the coming years, it is expected a redistribution of the quota among the countries due to contribute of Netherland, Spain, U.K and Eastern countries while the Italy's growth ratio will be slower due to the already existing over capacity and difficulty to procure feedstock at lower costs.

The lower oil cost and feedstock costs combined with the new laws discourage the increase in biodiesel production without further incentives (Rosa, 2009).

Figure 3 - EU biodiesel production (in tons)

European biodiesel industry has suffered from biodiesel imports from the United States over the last few years. According to European Biodiesel Board (EBB), American biodiesel imports reached 1.5 million tons in 2008 (equivalent to 16.3% of European biodiesel consumption for transport), compared to more than 1 million tons in 2007 and less than 100,000 tons in 2006.

The strong increase in American biodiesel imports depends on U.S. government subsidies. EBB submitted a complaint to the European Commission in 2008 in order to prevent the situation causing further harm to European industrialists. They were awarded the case by the Commission in 2009, through the approval of the temporary imposition (of six months maximum) of antidumping and anti-subsidy rights on American biodiesel imports.

Regarding consumption, in 2008 the total biofuel consumption was 7.9 mln toe with a growth of 28.5% compared to 2007 (Table 4). The biodiesel consumption represents 78.5% of the total biofuel consumption, compared to 17.5% for bioethanol and 4% for vegetable oil.

Table 4 - Biofuels consumption for transport in the European Union in 2008 (in toe)

Biodiesel consumption increased from 5,899 ktoe to 7,900 ktoe between 2007 and 2008, equivalent to an increase of 33.9%. The slowdown of European growth in 2008 is partly explained by the significant reduction in biofuel consumption in Germany, whereas in previous years this country widely contributed to the strong growth of consumption in the European Union (EurObserv'ER, 2009).

Figure 4 - Biodiesel production and consumption in Italy (thousands of tons)

Italy is the third country in order of magnitude after Germany and France for biodiesel production. Nevertheless the area cultivated to oil crops for biodiesel production was very limited in relation with consumption: 45,000 Ha in 2006, 35,000 in 2007 and 12,000 in 2008 mainly dedicated to rapeseed and sunflower crops. The 70% of the total biodiesel production is represented by rapeseed oil mostly imported from EU, the 20% is from soybean oil most from domestic production; the 80% of imported oil are from rapeseed and sunflower the rest is palm oil (Rosa, 2009).

Italy imports a large amount of rape and soybean oil processed in biodiesel and re-exported into EU countries; the quantity of biodiesel production was, in 2008, 670 thousand tons, an increase of 42% compared to 2007 (Figure 4).

In 2009, the Italian biodiesel production, including imports, from other countries is 1.1 mln tons not much greater than the domestic consumption of 1.0 mln ton (Assocostieri³) (Figure 5).

Figure 5 - Production and consumption in Italy in 2009 (thousands of tons)

³ Assocostieri is the National Association of mineral oils deposits (www.assocostieri.com).

4. Biodiesel plant economics

In Italy, according to Assocostieri, biodiesel active plants in 2009 are 15, with a total capacity of 2.2 mln tons (Table 5).

The first step of our study was to interview all biodiesel plants in order to collect data regarding biodiesel production, raw materials used, costs and profits of the plants.

Table 5 – Biodiesel plant in Italy in 2009

The data obtained have been integrated into a spreadsheet that demonstrates the importance and sensitivity of various factors on the profitability of a biodiesel plant. The accuracy and the veracity of the spreadsheet have been confirmed with plant managers interviewed.

The spreadsheet was tested with managers of “new” biodiesel plants being established in Italy. The conclusion is that the spreadsheet is a very good representation of the “state of the art” biodiesel plant.

The Excel spreadsheet is designed for users to enter data that describe their operation and estimate the profitability of their proposed or established biodiesel plant.

The output that results from data input and the formulas embedded in the spreadsheet is measures of cost and profitability.

The measures typically considered in analyzing the success of a biodiesel plant include the following: Total Cost per ton, Total Processing Cost and Net Margin achieved per ton (Tiffany et al, 2003).

The representative plant considered in the study has a capacity of 150.000 tons and produces 150.000 tons of biodiesel.

The major characteristics of the plant are summarized in Table 6.

Table 6 - Principle characteristics of the representative biodiesel plant

Vegetable oils usually used by a biodiesel plant, is represented by a blend consisting of rapeseed oil, soybean, frying oil and palm oil in different percentages in relation to the season.

For simplicity, we have assumed that our plant uses only rapeseed oil for biodiesel production because it corresponds to the oil used with highest percentage and it's the oil with the best characteristics for the biodiesel production.

The total production cost of biodiesel is presented in Table 7 with all its components in order to obtain the production cost per ton of biodiesel.

Table 7 - Total production cost of biodiesel

The spreadsheet was used to identify the most important parameters associated with financial success. According to Table 7, the biomass cost is the cost that has the greatest weight on total production costs: it represents 80% of the total cost. This means that the market trend commodities prices highly influences the result of biodiesel industry.

Table 8 - Net margin of biodiesel plant

Table 8 shows the net margin of the representative plant. It realizes a negative economic result because revenues don't cover production costs. This result depends on the biodiesel price that the refineries fix and that is not connected with the production costs as we will show in the next paragraph.

5. Biodiesel price components

In Italy, a biodiesel market doesn't exist. As a consequence, we don't have a biodiesel price on Platts as for diesel and gasoline.

Refineries, that buy biodiesel from the producers, determine the biodiesel price and consequently the price may not cover the production costs that the biodiesel producers have.

There are two components that influence the value of biodiesel: the diesel price on Platts and an “additive value”.

The “additive value” is determined by the refinery industry and it depends on vegetable oils price and the contractual power of the biodiesel plant.

The “additive value” should correspond to the difference between the production costs and diesel price on Platts that biodiesel producers call the “business margin” (Figure 6).

Figure 6 - Business Margin of the representative biodiesel plant

According to the data given by biodiesel plants, nowadays, the “additive value” corresponds to about 66% of the “business margin”.

It also depends on the tax excise reduction fixed by Italian government. In fact, biodiesel producers sustain that when the limited quantity defiscalized was 250,000 tons the additive value was higher than today (18,000 tons).

6. Breakeven analysis

In the second step of the study, we develop a break-even analysis which measures profitability of the representative biodiesel plant described above at all combinations of rapeseed oil and biodiesel prices (Tyner et al, 2008b).

Then we compare the break-even line with the actual observations to examine factors which caused the surge in biodiesel industry in recent years.

The break-even line presents combinations of all rapeseed oil and biodiesel prices which keep the biodiesel plant considered at zero profit condition.

In Figure 7, we determine the relationship between profit of the plant and rapeseed oil price. For different rapeseed oil prices the biodiesel plant will realize different profits as it is showed in the graph.

Figure 7 - Relationship between profit and rapeseed oil price for the representative biodiesel plant

According to our data, the rapeseed oil price which determines the zero profit condition is 577 €/ton. The fact is that nowadays rapeseed oil price is higher than this value and it corresponds to about 700 €/ton.

Figure 8 shows the profit that the plant could realize according to the different biodiesel prices. Obviously, to higher biodiesel prices correspond higher profits. The biodiesel price that satisfy the zero profit condition is 750 €/ton.

Figure 8 – Relationship between profit and biodiesel price for the representative biodiesel plant

Combining the relationship between the rapeseed oil and biodiesel prices that satisfies the zero profit condition, we realize the break-even line shown in Figure 9.

In the upper side of the line, the biodiesel plant realizes profit otherwise in the opposite side, the plant realizes loss.

We now examine factors which cause the boom in biodiesel industry adding actual combinations of the rapeseed oil and biodiesel prices to the break-even graph.

Figure 9 compares the break-even line with the actual observations from 2004 to 2010.

We underline that biodiesel plants use a blend of vegetable oils and consequently the price has probably been lower than the rapeseed oil price that has been used in the graph. Taking into account this, our results reflect what is actually happened in the Italian biodiesel industry.

Figure 9 shows that producers realized profit margins from biodiesel production from 2004 to 2008 encouraging a rapid investment in biodiesel industry during these years.

The contribution of the measures adopted at European and Italian level, which we have shown before, was fundamental for the rapid growth of the sector and the diffusion of plants. In particular, tax exemption of the excise had influenced these results.

In 2009, the scenario changed. The economic crisis that has lowered diesel prices and led to a rise in commodities prices and reduced the resources available from the state have had as a consequence the reduction of the limited quantity with lower level of taxation.

At present biodiesel producers register loss and difficulties to continue the production.

Figure 9 - Break-even line for the representative biodiesel plant

Recently, the biodiesel price has lowered and as a result the profitability of the industry has declined significantly.

In conclusion, policies have had and have a fundamental role in the biodiesel sector and the state should adopt measures to help plants.

7. Conclusion

This study set out to provide a comprehensive survey of Italian biodiesel plants in order to understand the consequences of the EU and national policy for biodiesel in the last years.

Although data limitations prevented us from identifying and quantifying all the subsidies now supporting biodiesel industries, we believe we have in large measure satisfied that goal.

By constructing an integrated picture of the measures adopted that have influenced biodiesel expansion at both the European and Italian levels and examining a wide number of Italian biodiesel plants, we have assembled a more comprehensive assessment of the production costs and profit of a representative biodiesel plant.

The picture that emerges of European biodiesel markets shows that the level of support to biodiesel is significant in the EU, and strongly linked to volumes produced or consumed and in total, subsidies provided for biodiesel are currently approximately € 2.4 billion (€ 0.50 per litre) according to Oecd (OECD, 2008).

At national level, the policies adopted by the Italian government have been effective from 2004 to 2008; during that period biodiesel plants realize profit margins as the break-even analysis shows.

However, the increased price of vegetables oil and the economic crisis have negative impact on biodiesel production. It is important to note that biodiesel production is largely driven by the diesel price and the vegetable oils prices. But Italian biodiesel industry also depends on policy measures adopted at national level. The recent law that has changed tax exemption has diminished the profitability of the biodiesel plant that today realizes losses.

References

- Banse, M., Sorda, G. (2009). Impact of Different Biofuel Policy Options on Agricultural Production and Land Use in Germany. Gewisola, 2 October 2009.
- Banse, M., Meijil H.v.,Tabeau A., Woltjer, G. (2008). Will EU biofuel policies affect global agricultural maret?. *European Review of Agriclctural Economics*, 35(2), 117-141.
- Bureau, J.C., Guyomard, H., Jacquet, F., Trèguer, D. (2010). European Biofuel Policy: How Far Will Public Support Go? (Chapter 23). *Handbook of Bioenergy Economics and Policy*, Khanna M., Scheffran J., Zilberman D. Editors. Springer.
- Cruz Jr, J.B., Tan, R.R., Culaba, A.B., Ballacillo, J.A. (2009). A dynamic input-output model for nascent bioenergy supply chains. *Applied Energy*, 86(1), 86-94.
- EurObserv'ER (2009). Biofuels Barometers. *Le Journal des Energies Renouvelables*, 192.
- European Commission (2007). Biofuels Progress Report. Member States' reports on the implementation of Directive EC 2003/30 for 2005.

Food and Agriculture Organization of United Nations (2008). The State of Food and Agriculture 2008, Rome.

Kutas, G., Lindberg, C., Steenblik, R. (2007). Biofuels: at what cost? Government support for ethanol and biodiesel in the European Union. One of a series of reports addressing subsidies for biofuels in selected OECD countries. Prepared for The Global Subsidies Initiative (GSI).

Ledebur, O.v., Salamon, P., Zimmermann, A., Leeuwen, M.v., Tabeau, A., Chantreuil, F. (2008). Modelling Impacts of some European Biofuel Measures. 107th EAAE Seminar *Modelling of Agricultural and Rural Development Policies*. Sevilla, Spain.

Malagoli, C., Nigro, G., Forghieri, P. (2006). Biodiesel: aspetti economici, territoriali ed ambientali. *Estimo e Territorio*, n. 10.

Nonhebel, S. (2005). Renewable energy and food supply: will there be enough land?. *Renew Sust Energy Rev*, 9, 191–201.

OECD (2008). Economic assessment of biofuel support policies. Directorate for Trade and Agriculture, OECD, Paris.

Rosa, F. (2009). The Profitability of Biodiesel Chain with Different Organizations.

Tiffany, D.G., Eidman, V.R. (2003). Factors Associated With Success Of Fuel Ethanol Producers, University of Minnesota, Department of Applied Economics.

Tyner, W. E., Taheripour, F. (2007a). Future Biofuels Policy Alternatives. Biofuels, Food, and Feed Tradeoffs, St. Louis, MO.

Tyner, W. E., Taheripour, F. (2007b). Renewable Energy Policy Alternatives for the Future. *American Journal of Agricultural Economics*, 89(5), 1303-1310.

Tyner, W. E. (2007). Policy Alternatives for the Future Biofuels Industry. *Journal of Agricultural & Food Industrial Organization*, 5(2).

Tyner, W. E., Taheripour, F. (2008a). Policy Options for Integrated Energy and Agricultural Markets. *Review of Agricultural Economics*, 30(3), 387-396.

Tyner, W., Taheripour, F. (2008b). Biofuels, Policy Options, and Their Implications: Analyses Using Partial and General Equilibrium Approaches. *Journal of Agricultural & Food Industrial Organization*, 6(2), Article 9.

World Bank (2008). Rising food prices: policy options and World Bank Responses. Washington D.C.

Table 1 - Market shares and targets for biofuels in EU-25 (in percentage)

EU Member State	Market share for 2005	Targets for 2005	Targets for 2010
Austria	0.93	2.5	5.75
Belgium	0	2	5.75
Cyprus	0	1	5.75
Czech Republic	0.05	3.70	5.55
Denmark	n.a.	0.1	n.a.
Estonia	0	2	5.75
Finland	n.a.	0.1	5.75
France	0.97	2	7
Germany	3.75	2	5.75
Greece	n.a.	0.7	5.75
Hungary	0.07	0.6	5.75
Ireland	0.05	0.06	n.a.
Italy	0.51	1	2.5
Latvia	0.33	2	5.75
Lithuania	0.72	2	5.75
Luxembourg	0.02	0	5.75
Malta	0.52	0.3	n.a.
Netherlands	0.02	2	5.75
Poland	0.48	0.5	5.75
Portugal	0	2	5.75
Slovakia	n.a.	2	5.75
Slovenia	0.35	0.65	5
Spain	0.44	2	5.83
Sweden	2.23	3	5.75
United Kingdom	0.18	0.19	5
EU-25	1	2	5.75

Source: European Commission, 2007

Table 2 - Biodiesel Italian policy history

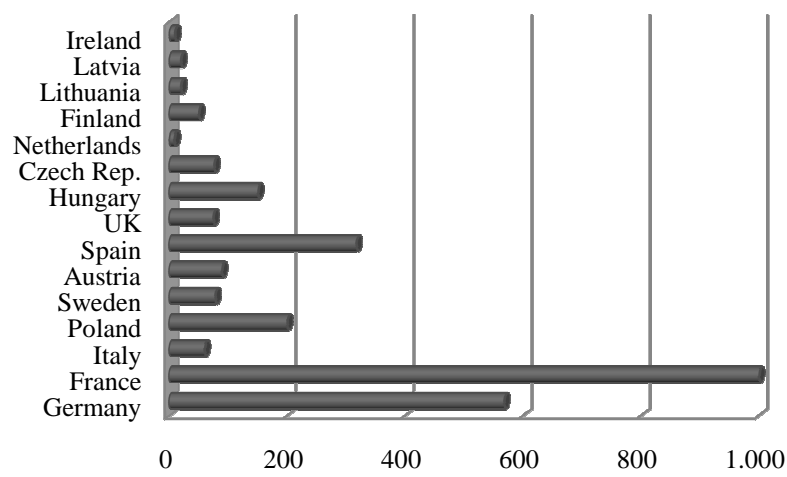
1995	Tax exemption of the excise for 125.000 tons
2001	Tax exemption of the excise for 300.000 tons
2005	Market share for biofuels: 1% in 2005 and 2.5% in 2010. Tax reduction of the excise for 200.000 tons Mandatory blending rate: obligation to blend the mineral fuel with predefined amounts of biofuel not more than 5%.
2006	Tax reduction of the excise 200.000 tons; 20.000 tons assigned to the “agrifuel chain” with national and EU contracts for oil production. Mandatory blending rate for biofuels derived from the “agrifuel chain”: 1% of diesel and gasoline of the previous year. The percentage must increase of one point each year until 2010.
2007	Tax reduction of the excise 250.000 tonns (20%): 70.000 tonns assigned to the “agrifuel chain” with national and EU contracts for oil production and 180.000 ton from “non agrifuel chain”. Market share: 1% in 2005; 2,5% in 2008; 5,75% in 2010.
2008	Minimum mandatory blending rate for 2009: 3% of the total consumption of diesel and gasoline of the previous year on the basis of energy value.
2009	Mandatory blending rate: 7%
2010	Tax reduction of the excise: 18.000 tons Market share: 3,5% in 2010; 4% in 2011; 4,5% in 2012

Table 3 - Biofuel production by country (2007)

Country	Ethanol		Biodiesel	
	Million litres	%	Million litres	%
United States of America	26.500	51,0	1.688	16,5
European Union	2.253	4,3	6.109	59,9
Brazil	19.000	36,5	227	2,2
Canada	1.000	1,9	97	1,0
China	1.840	3,5	114	1,1
India	400	0,8	45	0,4
Indonesia	0	0,0	409	4,0
Malaysia	0	0,0	330	3,2
Others	1.017	2,0	1.186	11,6
World	52.010	100,0	10.205	100,0

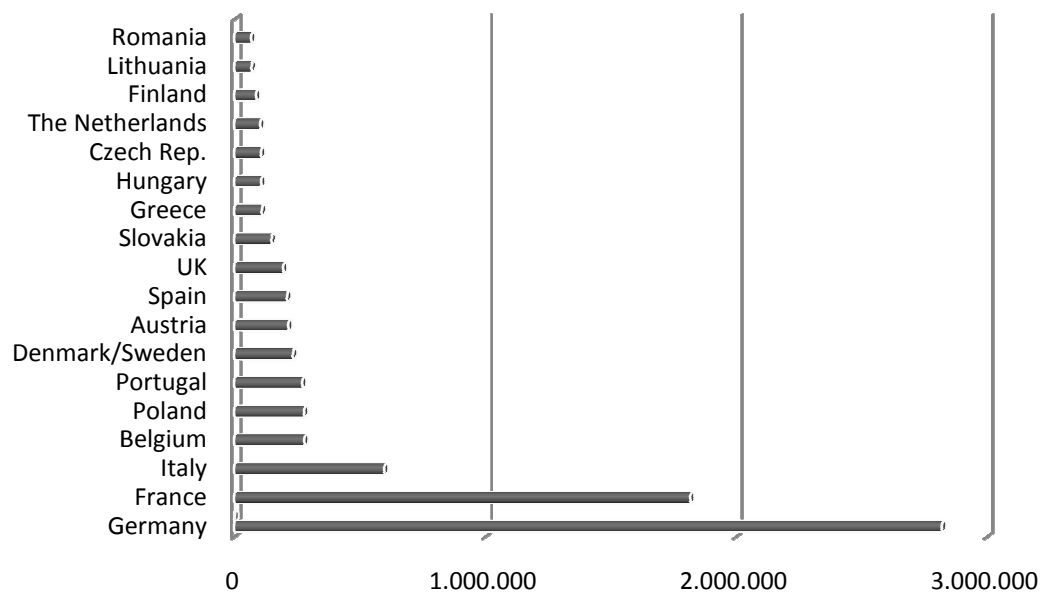
Source: based on F.O. Licht, 2007 and data from the OECD Ag link-Cosimo database

Figure 1 - EU ethanol production in 2008 (in millions of litres)



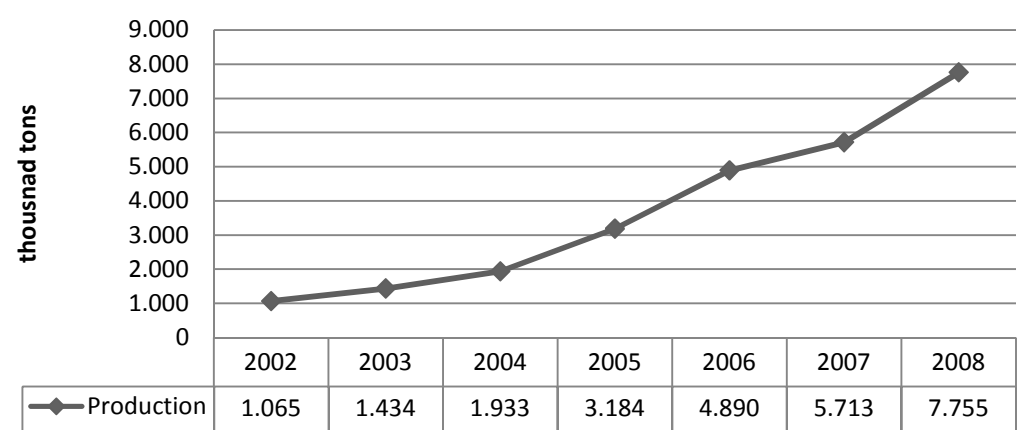
Source: EurObserv'ER, 2009 (EBIO data)

Figure 2 - EU biodiesel production in 2008 (in tons)



Source: European Biodiesel Board

Figure 3 - EU biodiesel production (in tons)



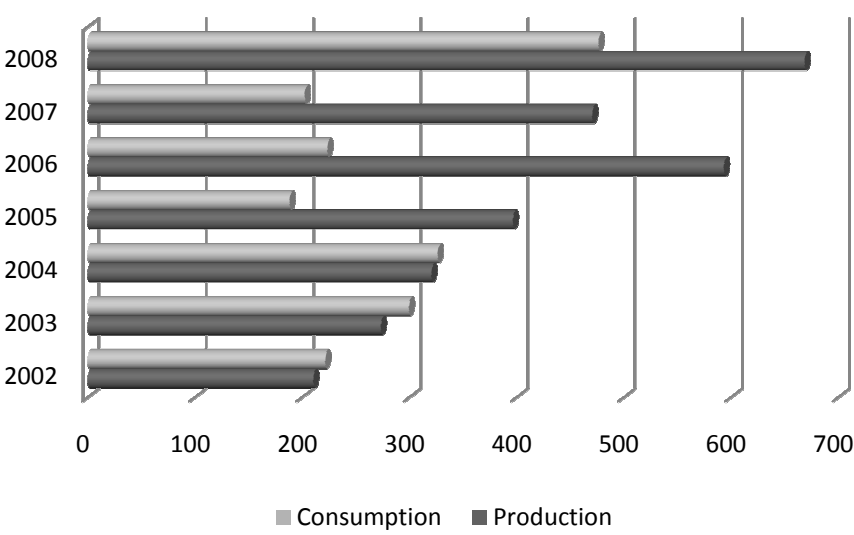
Source: European Biodiesel Board

Table 4 - Biofuels consumption for transport in the European Union in 2008 (in toe)

Country	Consumption
Germany	2.477.983
France	2.020.690
Spain	519.000
United Kingdom	691.335
Netherlands	202.000
Sweden	129.888
Austria	186.645
Italy	557.280
Portugal	132.849
Poland	340.560
Belgium	86.149
Slovakia	53.070
Greece	75.680
Lithuania	45.764
Luxembourg	41.447
Romania	60.200
Hungary	81.000
Czech Republic	75.783
Finland	11.441
Ireland	40.000
Bulgaria	29.412
Slovenia	22.255
Cyprus	14.180
Estonia	2.777
Latvia	1.927
Malta	964
Total EU-27	7.900.279

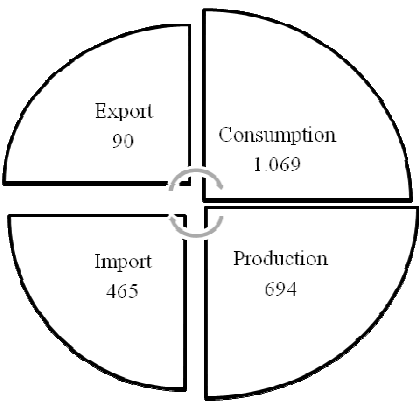
Source: EurObserv'ER, 2009

Figure 4 - Biodiesel production and consumption in Italy (thousands of tons)



Source: Assocostieri

Figure 5 - Production and consumption in Italy in 2009 (thousands of tonnes)



Source: Assocostieri

Table 5 – Biodiesel plant in Italy in 2009

BIODIESEL PLANTS	LOCATION	CAPACITY (ton)
ALCHEMIA ITALIA SRL	Rovigo (RO)	15.000
CAFFARO BIOFUEL SRL	Torviscosa (UD)	60.000
CEREAL DOCKS SPA	Vicenza (VI)	150.000
COMLUBE SRL	Castenedolo - Brescia	120.000
DP LUBRIFICANTI SRL	Aprilia (LT)	155.520
F.A.R.	Cologno Monzese (MI)	100.000
FOREDBIO SPA	Nola Marigliano (NA)	70.000
ECO FOX SRL	Vasto (CH)	131.370
ITAL BI OIL SRL	Monopoli (BA)	190.304
ITAL GREEN OIL SRL	San Pietro di Morubio (VR)	365.000
GDR BIOCARBURANTI	Cernusco sul Naviglio (MI)	50.000
MYTHEN SPA	Ferrandina (MT)	200.000
NOVAOL SRL	Livorno (LI)	250.000
OIL.B SRL	Solbiate Olona (VA)	200.000
OXEM S.p.A.	Mezzana Bigli (PV)	200.000
Total		2.257.194

Source: Assocostieri

Table 6 - Principle characteristics of the representative biodiesel plant

Capacity plant (ton)	150,000
Plant cost (€)	20,000,000
Factor of debt (60%)	12,000,000
Interest rate (%)	5

Table 7 - Total production cost of biodiesel

	€	%
Annual Rate of Depreciation	1,554,048	1.19
Management and Maintenance Plant Cost	12,000,000	9.19
Biomass cost (rapeseed oil)	103,500,000	79.28
Other costs	1,500,000	1.15
Processing Cost	9,750,000	7.47
Transportation costs	2,250,000	1.72
Total production cost	130,554,048	100.00
Production cost per ton (€/ton)	870	

Table 8 – Net margin of biodiesel plant

Biodiesel sales (ton)	150.000
Biodiesel Price (€/ton)	750
Glycerin sales (ton)	15.000
Glycerin Price (€/ton)	80
Net margin (€)	-16,854,048
Net margin per ton (€/ton)	-112

Figure 6 - Business Margin of the representative biodiesel plant

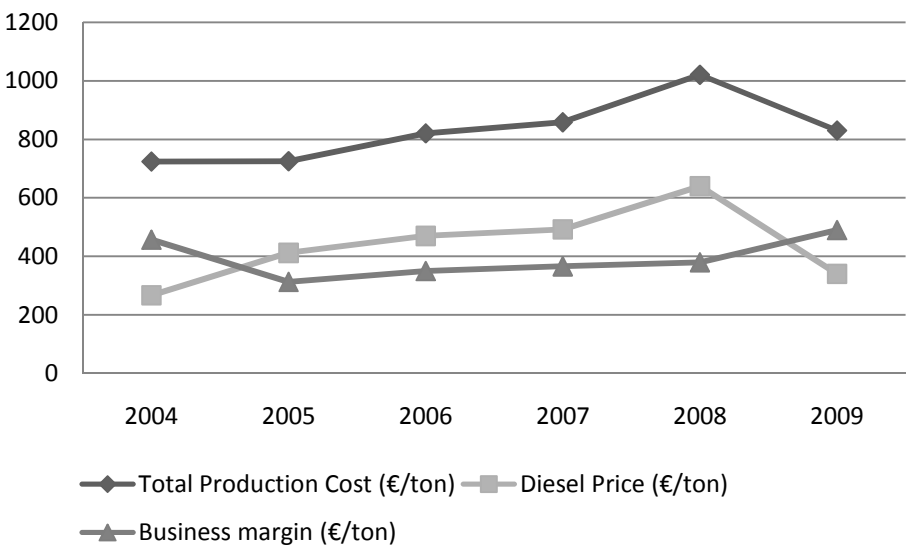


Figure 7- Relationship between profit and rapessed oil price for the representative biodiesel plant

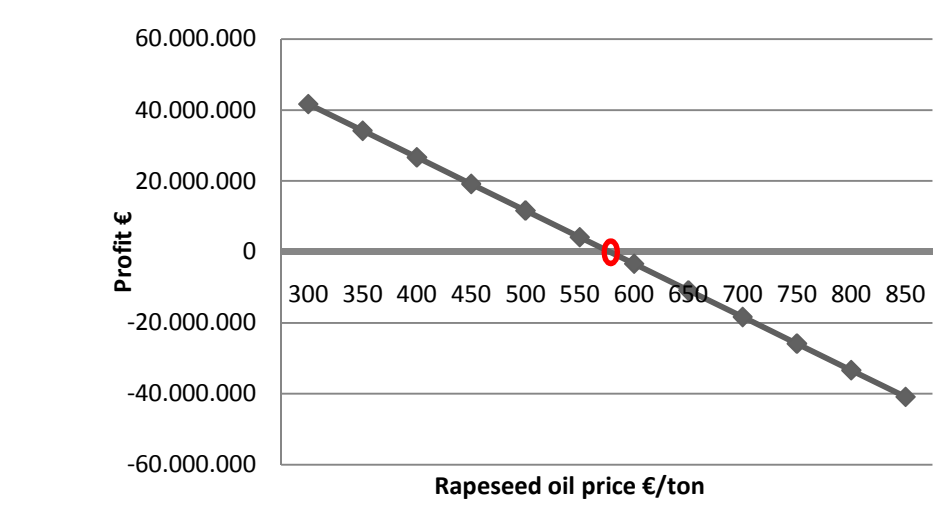


Figure 8 - Relationship between profit and biodiesel price for the representative biodiesel plant

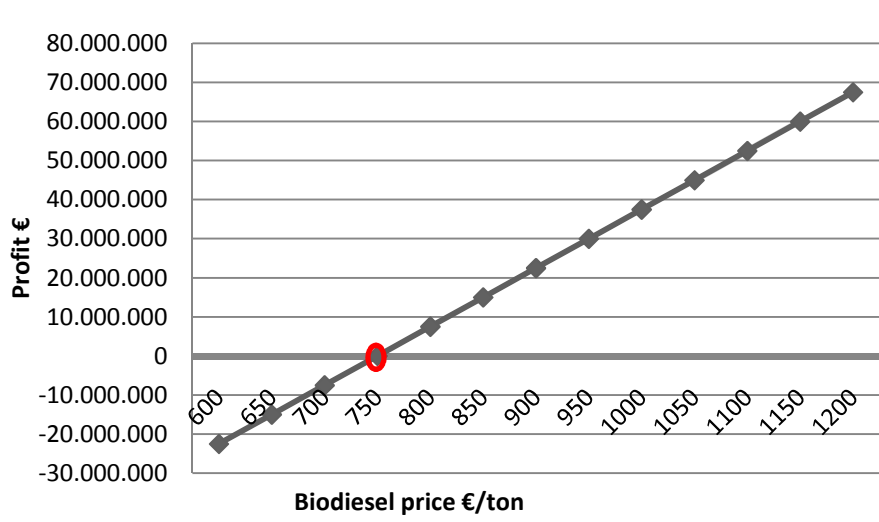


Figure 9 - Break-even line for the representative biodiesel plant

