Biofuels – At What Cost?

Mandating ethanol and biodiesel consumption in Germany

JANUARY 2012

Prepared by:

Anna Rauch and Michael Thöne, FiFo Institute

For the Global Subsidies Initiative (GSI) of the International Institute for Sustainable Development (IISD)
Geneva, Switzerland

GSI Global Subsidies Initiative

www.globalsubsidies.org

iisd International Institute for Sustainable Development
Institut international du développement durable

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LIST OF ACRONYMS

ADAC	Deutsche Automobil-Club e.V.
BDB[e]	Bundesverband der deutschen Bioethanolwirtschaft e.V.
BFT	Bundesverbandes Freier Tankstellen e.V.
BLE	Federal Office for Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung)
BMELV	Federal Ministry of Food Agriculture and Consumer Protection (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz)
BMF	Federal Ministry of Finance (Bundesministerium der Finanzen)
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit)
BtL	Biomass to Liquid
BUND	Friends of the Earth Germany (Freunde der Erde)
BVP	Bundesverband für Pflanzenöl e.V.
CAP	common agricultural policy
C.A.R.M.E.N.	Centrales Agrar- Rohstoff- Marketing- und Entwicklungs-Netzwerk e.V.
CEN	European Committee for Standardization
DAT	Deutsche Automobil Treuhand GmbH
DECC	Department of Energy and Climate Change
Destatis	The Federal Statistical Office Germany (Statistisches Bundesamt Deutschland)
DNR	Deutscher Naturschutzring EU-Koordination
EBB	European Biodiesel Board
EEA	European Environment Agency
EID	Energie Informationsdienst
ETBE	Ethyl tert-butyl ether
EC	European Commission
EU	European Union
FAME	fatty acid methyl ester
FAZ	Frankfurter Allgemeine Zeitung
FNR	Agency for Renewable Resources (Fachagentur Nachwachsende Rohstoffe e.V.)
GJ	gigajoule

GHG	greenhouse gas
GWh	Gigawatt hour
GBP	Pound Sterling
ILUC	indirect land use change
ISCC	International Sustainability and Carbon Certification
KfW	Kreditanstalt für Wiederaufbau
kg	kilogram
Ktoe	kilo tonnes of oil equivalent
l	litre
Mtoe	million tonnes of oil equivalent
MWV	Association of the German Petroleum Industry (Mineralölwirtschaftsverband e.V.)
NREAP	national renewable energy action plan
R&D	research and development
RED	Renewable Energy Directive
REDcert	Gesellschaft zur Zertifizierung nachhaltig erzeugter Biomasse mbH
SPS	Single Payment Scheme
T	tonnes
T&E	Transport & Environment
toe	tonne of oil equivalent
UK	United Kingdom
UFOP	Union zur Förderung von Oel- und Proteinpflanzen e.V.
VDB	Verband der Deutschen Biokraftstoffindustrie e.V.

CONVERSION FACTORS

1 litre ethanol = 0.789 kg

1 m^3 biodiesel = 0.78 toe

1 m^3 ethanol = 0.51 toe

1 Euro = 0.85784 GBP

Diesel: 0.03587 GJ/l

Biodiesel: 0.03265 GJ/l

Petrol: 0.03248 GJ/l

Ethanol: 0.02106 GJ/l

Energy content of diesel is 1.09862 times that of biodiesel

Energy content of biodiesel is 0.9102 times that of diesel

Energy content of petrol is 1.54226 times that of ethanol

Energy content of ethanol is 0.6484 times that of petrol

LIST OF ENGLISH – GERMAN TRANSLATIONS

Acceleration of Growth Act	Wachstumsbeschleunigungsgesetz
Biofuel Quota Act	Biokraftstoffquotengesetz (BioKraftQuG)
Biofuels Promotion Restructuring Act	Gesetz zur Änderung der Förderung von Biokraftstoffen
Biofuel Sustainability Ordinance	Biokraftstoff-Nachhaltigkeitsverordnung (Biokraft-NachV)
Directive on the Properties and Labelling of the Quality of Fuels	Verordnung über die Beschaffenheit und die Auszeichnung der Qualitäten von Kraft- und Brennstoffen
Energy Tax Act	Energiesteuergesetz (EnergieStG)
Federal Immission Control Act	Bundes-Immissionsschutzgesetz (BImSchG)
Mineral Oil Duty Act	Mineralölsteuergesetz (MinöStG)

1. EXECUTIVE SUMMARY

This study considers the way in which Germany aims to meet the mandatory 10 per cent target for renewables in the transport sector set by the Renewable Energy Directive 2009/28/EC (RED) to be achieved by all European member states by 2020. In order to help meet this target over the last years, European countries have provided extensive support to the biofuels sector through government policy.[1]

This study focuses solely on Germany's biofuel policy[2] and aims to estimate some of the costs associated with the increasing use of biofuels, assuming there are no changes to the EU-wide goal of achieving 10 per cent renewable energies in the transport sector. The study analyzes the costs associated with government support measures and does not set out to assess the environmental benefits biofuels may be able to deliver, or the potential negative externalities that can occur from their use. A solid understanding of the costs associated with government policy is fundamental for evaluating its effectiveness, and this study hopes to support this notion. There are two major instruments employed by European policy-makers to stimulate the biofuel market: tax incentives (or subsidies) and regulatory provisions. The instruments chosen by the government determine who bears the costs of the policy. Stimulating the biofuels market by providing tax exemptions or subsidies generally allows some transparency in terms of the cost to the fiscal budget or taxpayer. Imposing regulatory provisions—such as mandatory blending requirements—guarantees biofuels a certain market share and does not directly affect government on-budget expenditure. Mandatory blending requirements shift the costs of increased biofuel use towards the private sector—the producers and consumers of biofuel. Findings from this project aim to highlight those policy interventions in the transport fuels market, such as blending mandates, that are associated with a wide range of costs, though these costs are often challenging to quantify.

Key findings

In the initial phase of government support to biofuels, Germany granted extensive tax exemptions for biofuels in order to stimulate market growth. Government support for biofuels led to rising costs in the public budget. In 2006 the fiscal costs resulting from the tax exemptions for biofuel and heating oil made from biomass peaked at €2,144 million. Since 2007 there has been a trend in Germany to move from the use of tax incentives towards regulatory measures like mandatory blending requirements. As a result, there are currently lower direct fiscal costs associated with the German government's biofuel support policies, because Germany employs a mix of policies to stimulate the biofuels market: it combines a mandatory blending requirement with tax exemptions or reduced excise tax rates for pure biofuels (outside the quota), and a quota trade system.

Presently, there is political consensus in the German government to achieve the RED 10 per cent target for renewables in transport mainly through the use of mandatory biofuel blending requirements applied to the mineral oil industry. While there is less pressure on the fiscal budget resulting from the changes in Germany's biofuel support schemes, the German government should recognize mandatory blending requirements constitute a less visible form of subsidization. The German government needs to assess whether mandatory blending targets are the best policy option available to them given the potential costs and impacts mandates impose on the economy.

[1] See e.g. Jung et al. (2010) for more information on the RED and an overview of the European Union's biofuel support schemes.

[2] A related study by Charles and Wooders (2011) focuses on the U.K. biofuels market.

In Germany, three types of biofuel can be marketed: biodiesel, ethanol and pure vegetable oil, with biodiesel being the most widely consumed. In 2009 the share of biodiesel consumption in relation to total biofuel consumption equaled 77 per cent (by energy content). Biodiesel production capacity and production levels are considerably higher than production levels of ethanol or vegetable oil. In 2009 biodiesel and ethanol production amounted to 2.54 million tonnes and 0.59 million tonnes, respectively. The shift away from supporting the biofuels industry through the use of tax incentives and the adoption of mandatory blending requirements had a negative impact on the markets for biodiesel and vegetable oil. At present, the biodiesel market is characterized by overcapacity production and ongoing company insolvencies (an estimated 14 biodiesel companies have gone bankrupt since 2008). The level of biodiesel consumption in 2010 (2.6 million tonnes) was far below the 2007 figure (3.3 million tonnes). Raising consumption of biodiesel in the form of blends (such as B7) could not compensate for the decline of pure biodiesel (in the form of B100) consumption.

The use of vegetable oil as fuel decreased after the introduction of partial taxation, which increased its sale price. As a consequence, vegetable oil represented only 3 per cent of the total biofuel consumed in Germany in 2009.

In recent years, ethanol has become increasingly important. Since the introduction of mandatory blending requirements in 2007, the consumption of ethanol blended with petrol has risen sharply, from 88,000 tonnes in 2007 to 1,023,000 tonnes in 2010. Ethyl tert-butyl ether (ETBE) and E85 (an ethanol blend with up to 85 per cent of ethanol) only accounted for a small share of the ethanol market (12 per cent) in 2010. This brief market review illustrates how sensitive biofuel costs (and competiveness) are to changes in public policy and its related instruments.

Key costs

What are the costs associated with Germany' biofuel policy, assuming there are no changes to the EU-wide strategic goal of 10 per cent renewables in the transport sector? To identify and estimate the potential value of these additional costs is challenging. Despite the challenges of poor data availability, this study examines six potential cost areas resulting from the German government's support policies for biofuels.

1. Funding for research and development

Germany's government grants fund research and development (R&D) supporting the biofuels sector through the Agency for Renewable Resources (FNR), which is funded by the Federal Ministry for Food, Agriculture and Consumer Protection (BMELV) under the Renewable Resources aid scheme. Since the launch of the Renewable Resources aid scheme up to June 2010, around €50 million has been provided for 90 biofuel R&D projects.

2. Higher production costs for biofuels (in 2020)

To meet the 10 per cent target of renewable energy in the transport sector by 2020 there are additional costs for consumers resulting from the higher production costs for biofuels vis-à-vis fossil fuels. The additional production costs of biofuels in 2020 are estimated to be between €1,374 million and €2,153 million. These costs are being shifted almost completely to the private sector through mandatory blending requirements. Due to the lack of transparency in the transport fuel market, it is difficult to determine if producers or consumers bear the costs. However, given the oligopolistic market structure and the inelasticity of demand, at least in the short term, it appears likely consumers are paying for the costs via higher prices for transport fuel.

3. Administering government policies regulating the German biofuels industry

Due to the large number of government agencies and ministries that administer and supervise the various policy instruments related to the biofuel industry and road transport issues, an accurate estimate for these costs could not be generated. A qualitative description of the most important governmental agencies and their duties are provided as part of the study. Policy-makers should recognize that there are administrative costs associated with implementing and monitoring complex government biofuel policies.

4. German Single Payment Scheme and the production of biofeedstocks

Biofuel feedstock production benefits from agricultural subsidies under the Single Payment Scheme (SPS). Payments to farmers under the SPS scheme are independent from production and thus do not incentivize the cultivation of feedstock for biofuel production more than any other crop. It does, however, reduce the cost of producing the feedstock for biofuel producers and increases their competitiveness in relation to fossil fuels. The subsidies for farmers growing feedstock for biofuels are estimated to be around €372 million in 2009 and 2010.

5. The costs of implementing sustainability criteria

Since 2011 only those biofuels that meet certain sustainability criteria count toward the German biofuel quota and are eligible to receive tax incentives. Implementing sustainability criteria appears to be an attempt to ensure a positive impact by biofuels in relation to the environment. However, it is also linked to additional costs for biofuel companies and fuel retailers. The production of sustainable biofuels is most likely more expensive than uncertified biofuels. The actual cost of certification depends on a variety of factors, including the number of facilities along the supply chain. Costs may also vary with respect to the certification system adopted and the certifying bodies involved. How much the costs associated with certification are, is a controversial topic. A number of estimates appeared in the literature. The head of meó Norbert Schmitz[3] considers the costs of certification not to be substantial. The Bundesverband für Pflanzenöl e.V. (BVP) estimates that the cost for the certification of biofuels are 2 to 3 cents per litre of vegetable oil for a commercial vegetable oil processing mill (producing around 1 million litres per year) with average certification cost of between €2,000 and €3,000. In 2009 the former State Secretary of the BMELV, Gert Lindemann, anticipated certification costs to be around 1 to 2 per cent of the cost of the raw material.

6. Additional E10 handling expenses for service station operators, fuel retailers and mineral oil companies

The introduction and distribution of biodiesel blends (B5 and B7), lower-level ethanol blends (E5), higher-level blends (E85) and pure biofuels (B100 and vegetable oil) have been associated with additional handling costs for fuel retailers. These costs were difficult to estimate as there was insufficient documenting of the associated handling costs incurred by retailer or an aggregated cost estimate encompassing all fuel retailers generated during this time. This study consequently focuses on the costs associated with the launch of E10, as more information was available in the public domain. E10 is an ethanol blend with up to 10 per cent bioethanol that has been available at German service stations since the beginning of 2011. Fuel retailers had to modify their service stations in order to provide E10. Cash points and signage had to be changed and petrol pumps and nozzles relabelled in order to accommodate the introduction of a new fuel. Upstream companies refining E10 were required to make some adjustments to production facilities; however, adjustments were not significant, as the technical equipment for producing biofuel blends had been commercially available since the introduction of E5. As at production refineries and fuel depots, new storage tanks were not required, as E10 replaced Super E5. The estimated cost of introducing E10 to service station operators was estimated to be between €15 million and €133 million. The Association of the German Petroleum Industry (MWV) estimated the total cost of introducing E10 came to hundreds of millions of Euros.

[3] The meó company developed the certification scheme called International Sustainability and Carbon Certification (ISCC).

The principal costs that the study sought to quantify and highlight are found in Table 1.

TABLE 1. SUMMARY OF AREA INVESTIGATED

Area	Financial cost	Explanation
Funding for R&D	€50 million since the launch of the aid scheme	Since the launch of the "Renewable Resources" aid scheme up to June 2010 around €50 million have been provided for 90 R&D projects related to biofuels.
Higher production costs for biofuels (for 2020)	Additional production costs range from €1,374 million to €2,153 million in 2020	Biofuel production costs compared to fossil fuels are generally higher. Meeting the 10 per cent renewable energy target results in additional costs imposed on the economy as increasing quantities of biofuels (which are more expensive on a per litre basis relative to fossil fuels) are used in the transport sector. There are considerable uncertainties relating to the underlying assumptions used to calculate these future costs.
Government costs for implementing and monitoring biofuel policies	Unknown	Developing, implementing and monitoring biofuel policies are associated with costs to the government. No estimate provided due to lack of data.
Agricultural subsidies provided to the producers of biofeedstock under the SPS	€372.25 million in 2009 €372.52 million in 2010	Estimates derived using the national average SPS payment per payment entitlement. Agricultural subsidies reduce the costs of the feedstock for biofuel producers and increase biofuels competitiveness in relation to fossil fuels. Initial calculations highlight the size of energy-crop-related SPS payments.
Costs of certification schemes for sustainable biofuels	A controversial issue subject to differing estimates	Certification costs depend on the facilities used along the biofuel supply chain and may differ with respect to the certification system used or the certification body.
Additional expenses for fuel retailers and mineral oil companies to handle E10	Between €15 million and €133 million for service station operators	Service station operators are required to change cash points and signage. Petrol pumps and nozzles had to be relabelled. According to the MWV, the total costs amounted to hundreds of millions of Euros for the mineral oil industry. A wide range is provided given the lack of information on the actual costs incurred by fuel retailers

Externalities

A number of issues linked to the support of biofuels are commonly discussed in the media and among stakeholders. These can include the effect of increased biofuel use on food prices—the food or fuel debate. German and European biofuel policy might involve further non-monetary costs potentially linked to the growth of the industry, for example, the indirect impact increased feedstock production may have on biodiversity. Furthermore, the low carbon footprint biofuels supposedly have is increasingly being disputed. The evaluation of the overall impact of the European and German government's biofuel policies is, however, beyond the scope of this study. This study aims to make a significant contribution to the German biofuel debate by highlighting some of the costs associated with the increasing use of blended biofuels. A proper assessment and evaluation of the costs and benefits associated with public policy becomes possible by assessing the impacts of current and future policies.

2. INTRODUCTION

This study examines how Germany aims to meet the Renewable Energy Directive 2009/28/EC (RED) mandatory 10 per cent target for renewables in transport, to be achieved by all European member states by 2020. The RED does not provide any further guidance concerning the type of energy to be used. Thus, member states are free to meet this target using a range of options, such as conventional biofuels, advanced biofuels, increased energy efficiency or the use of renewable electricity for transport purposes. The RED target may act as a significant driver supporting the production of conventional biofuel.[4] As conventional biofuels are currently expensive to produce, they are not able to compete against fossil fuels (such as petrol or diesel) without government support.[5] Consequently, all European countries have provided extensive backing through public policy in order to foster and promote biofuel production and consumption in Europe.[6]

This study discusses some of the costs resulting from Germany's biofuel policy, assuming there are no changes to the EU-wide strategic goal of achieving 10 per cent renewables in the transport sector. The paper provides an estimate of the costs for the areas analyzed whenever possible. The areas investigated are the following:

- The cost-competitiveness of biofuels: production costs for biofuels are generally higher than the fossil fuels they are supposed to replace
- The monitoring costs incurred by government agencies and ministries for biofuel policies
- The cost of subsidies to farmers growing biofuel feedstocks provided under the Single Payment Scheme (SPS)
- The cost of implementing sustainability criteria: costs associated with producing sustainable biofuels and through the use of certification schemes
- Funding for research and development (R&D) projects for the biofuel sector
- The additional costs to service station operators, fuel retailers and the mineral oil industry, drawing on the introduction of E10 in Germany as an illustrative example

Aside from these costs, German and European Union (EU) biofuel policies may have a range of positive and negative externalities that are not addressed in this paper. The main motives for promoting biofuels as a EU-wide strategic objective have been reducing greenhouse gas (GHG) emissions, improving energy security in a sustainable way and stimulating the use of renewable energies (Jung, et al., 2010).[7]

The effectiveness and efficiency of public policy varies, depending on how governments intervene in the liquid fuels market. Governments determine by their choice of policy tool which actors will be responsible for the resulting economic costs generated from introducing the policy. The budgetary impact on the German government from supporting the biofuels industry through the provision of tax exemptions or direct fiscal subsidies can be calculated. Imposing regulatory provisions—such as mandatory blending requirements—guarantees biofuels a certain market share and does not directly affect the government budget like tax exemptions or direct payments would.

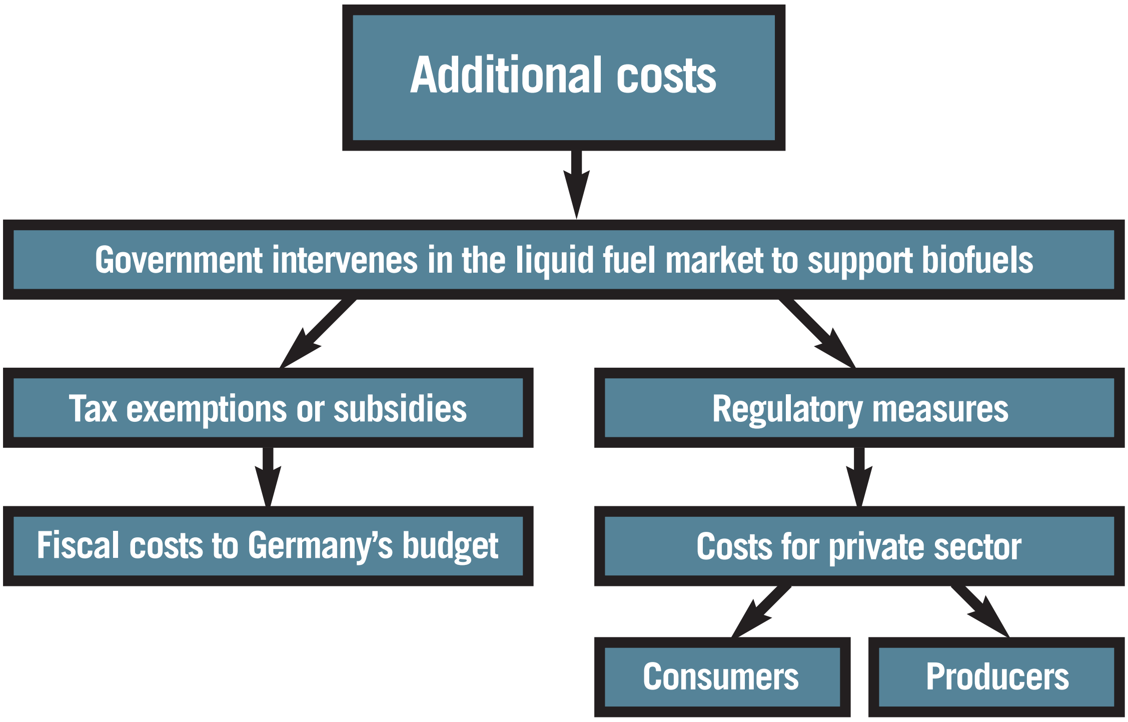
[4] Kretschmer (2011) surveyed the National Renewable Action Plans (NREAPs) of all European member states and identified that member countries are planning to achieve the 10 per cent target of renewables in transport by principally using conventional biofuels. According to Kretschmer's (2011) estimates, conventional biofuels amount to 92 per cent of the total predicted biofuel use in 2020. This equates to an 8.8 per cent share of conventional biofuel from total energy in transport by 2020.

[5] Note: Brazilian ethanol obtained from sugar cane is an exemption. It is competitive without public support (Ninni 2010, page 134).

[6] See Jung et al. (2010) and Kutas, Lindberg and Steenblik (2007) for an overview.

[7] See BirdLife (2010) and Kretschmer (2011)

FIGURE 1. PUBLIC SUPPORT SCHEME FOR BIOFUELS



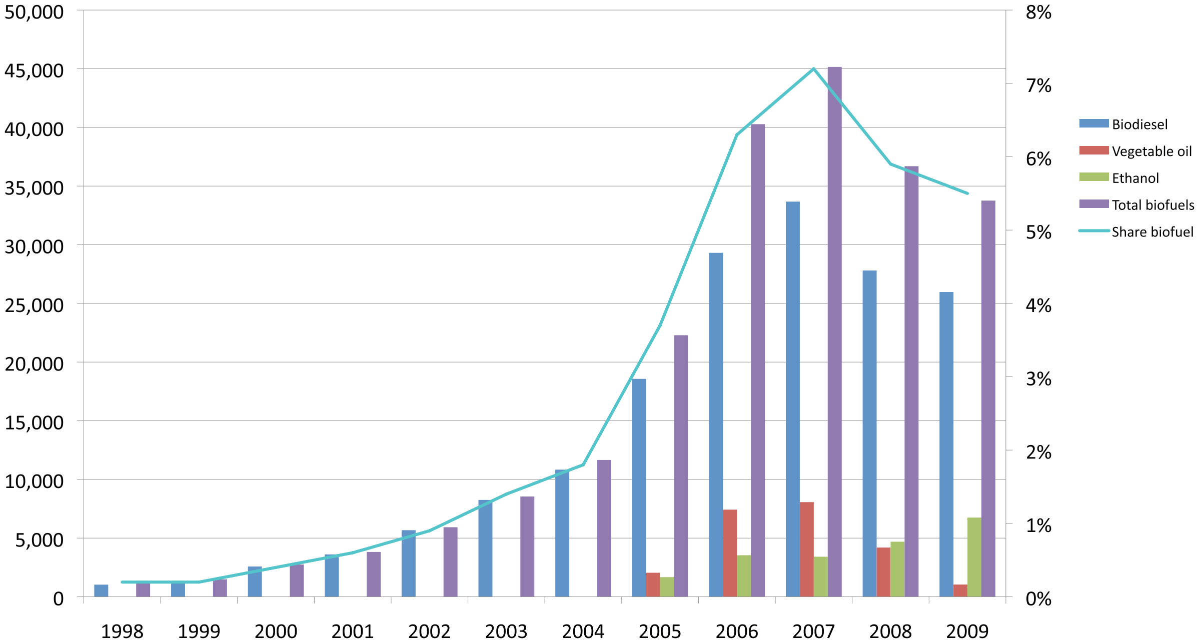
Mandatory blending requirements shift the costs towards the private sector, namely consumers and producers. In Germany, there has been a movement away from tax incentives and towards regulatory measures—such as mandatory blending requirements—(see Chapter 4). Even though mandatory blending requirements do not burden the public purse, they result in a number of costs. The study highlights that policy interventions have a number of related costs, though they are sometimes hard to identify, unclear and difficult to measure. When governments implement regulatory measures, such as market price support measures, that do not burden the fiscal purse, their effects are easily overlooked by government and poorly monitored over time.

This study is organized as follows: Chapter 3 provides an overview of the current trends in the biodiesel, bioethanol and vegetable oil markets. Using examples drawn from the market for pure biofuels (B100 and vegetable oil), the relationship between government policies and the responsiveness of the market to the policy is highlighted. Chapter 4 provides an overview of biofuel support schemes in Germany. Chapters 5 to 9 analyze the areas outlined in the introduction section and provide an estimate of costs when possible. Chapter 10 provides a set of conclusions for policy-makers.

3. GERMAN BIOFUEL MARKET

In 2007 Germany was positive about reaching the goal of 10 per cent of renewables in transport by 2020, as it had already reached a renewable energy mix (biodiesel, ethanol and vegetable oil) of 7.2 per cent renewable transport fuels. This represented the peak in terms of the share of biofuels in the transport fuel mix; shortly afterwards, the overall percentage share of biofuels fell. In 2009 the share of biofuels in Germany's transport sector amounted to only 5.5 per cent (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety [BMU], 2010, p. 17). The explanation for this decrease was the low level of consumption of pure biodiesel (B100) and vegetable oil due to changes in tax policy (see Chapter 4). Only ethanol consumption increased at a constant rate due to rising quantities consumed as part of E5 blends (see Figure 8).

FIGURE 2. TREND IN BIOFUEL CONSUMPTION (END ENERGY USE IN GWH) AND SHARE OF THE TRANSPORT SECTOR (%)

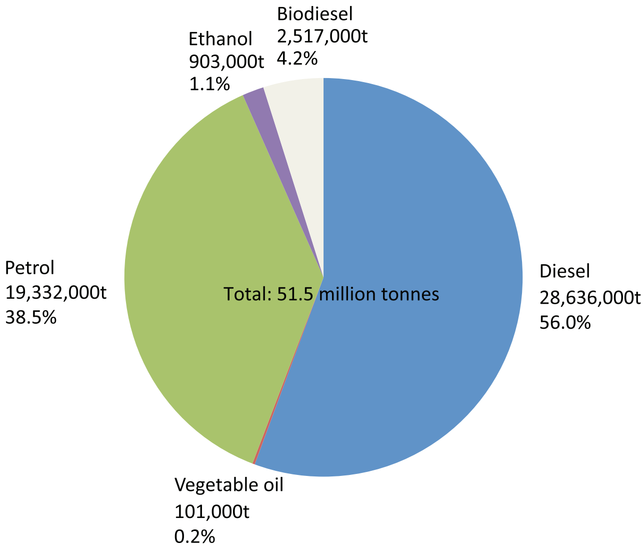


Note: In 2006 biodiesel figures comprise both vegetable oil and biodiesel, as they were surveyed jointly until August 2006. Source: BMU (2010)

In 2010 the market for biofuels improved with a slight increase in biodiesel consumption (0.07 million tonnes) and continuing growth in ethanol consumption (0.26 million tonnes) between 2009 and 2010 (Verband der Deutschen Biokraftstoffindustrie e. V. [VDB], 2011a, 2011d). However, the market for vegetable oil continued its downward trend, with consumption reaching only 65,000 tonnes in 2010 (BMELV, 2011c). The most important biofuel for the German market—of biodiesel, vegetable oil and bioethanol—is biodiesel, due to the significant quantities produced and consumed domestically.[8] In 2009 biodiesel consumption equaled 2.52 million tonnes, while bioethanol and vegetable oil amounted to 0.9 and 0.1 million tonnes respectively. While biodiesel is consumed in pure form (B100) or as a blend (B5 and B7), ethanol is primarily consumed as a blend with petroleum (Fachagentur Nachwachsende Rohstoffe e.V. [FNR], 2011a). Vegetable oil can only be consumed in pure form (Federal Government of Germany, 2010c).

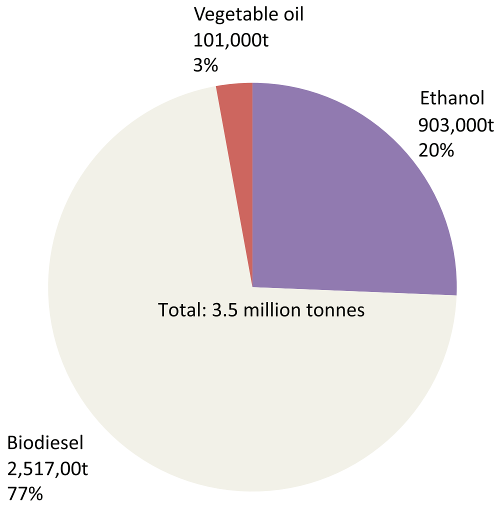
[8] Further potential biofuels would be biobutanol, biomethane, biomethanol, hydrogen from biomass, BtL and ceetol (Federal Government of Germany, 2010c).

FIGURE 3. PRIMARY FUEL CONSUMPTION IN 2009



Source: FNR (2011a)

FIGURE 4. BIOFUEL CONSUMPTION IN 2009



Note: shares in energy content. Source: FNR (2011a)

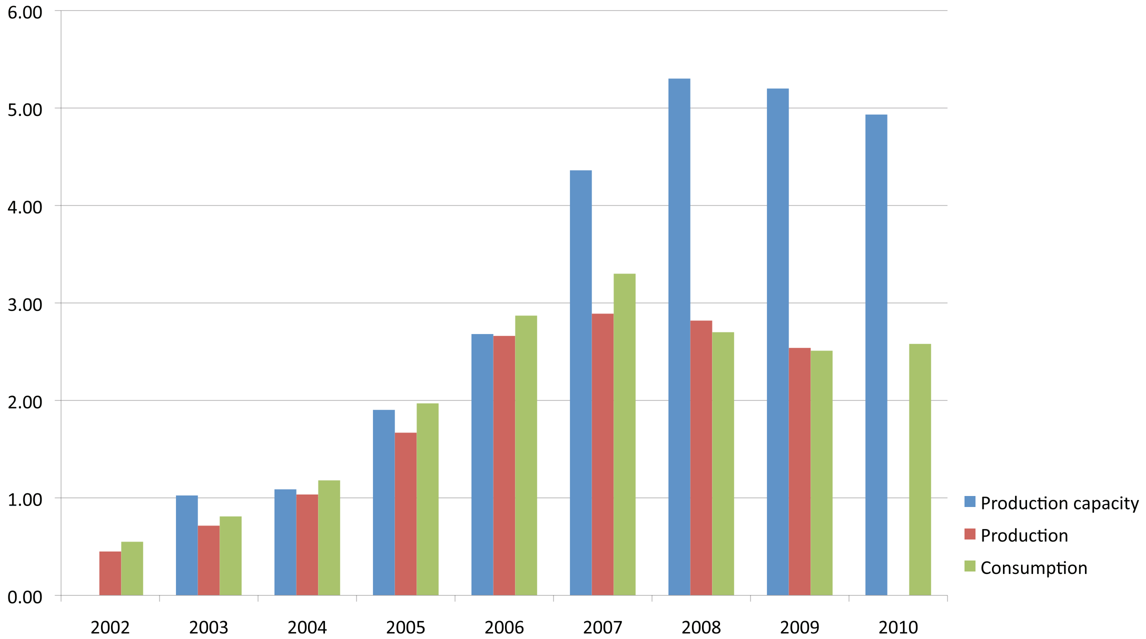
According to the BMU, the total financial turnover of Germany's biofuel industry from biofuel sales amounted to €3.15 billion in 2009 (BMU, 2010, p. 25).

3.1 BIODIESEL MARKET

Germany is Europe's leading biodiesel producer. In 2009, Germany accounted for 28 per cent of the EU's biodiesel production, even though it was only using around 51 per cent of its installed domestic production capacity (European Biodiesel Board [EBB], 2011; VDB 2011d).[9] In 2010 production of biodiesel was around 53 per cent of installed capacity (VDB, 2011d). Up until 2006, biofuels enjoyed major tax incentives in order support their introduction in Germany (for details on German biofuel policy, see Chapter 4). Due to these incentives, the consumption of biodiesel—in particular in pure form (B100)—grew rapidly until 2007, encouraging German biodiesel companies to expand their production capacities.

[9] Note: Different sources provide differing figures for production capacity. For example, the Federal Government of Germany (2010c, page 3) reports that 40 per cent of capacity was utilized.

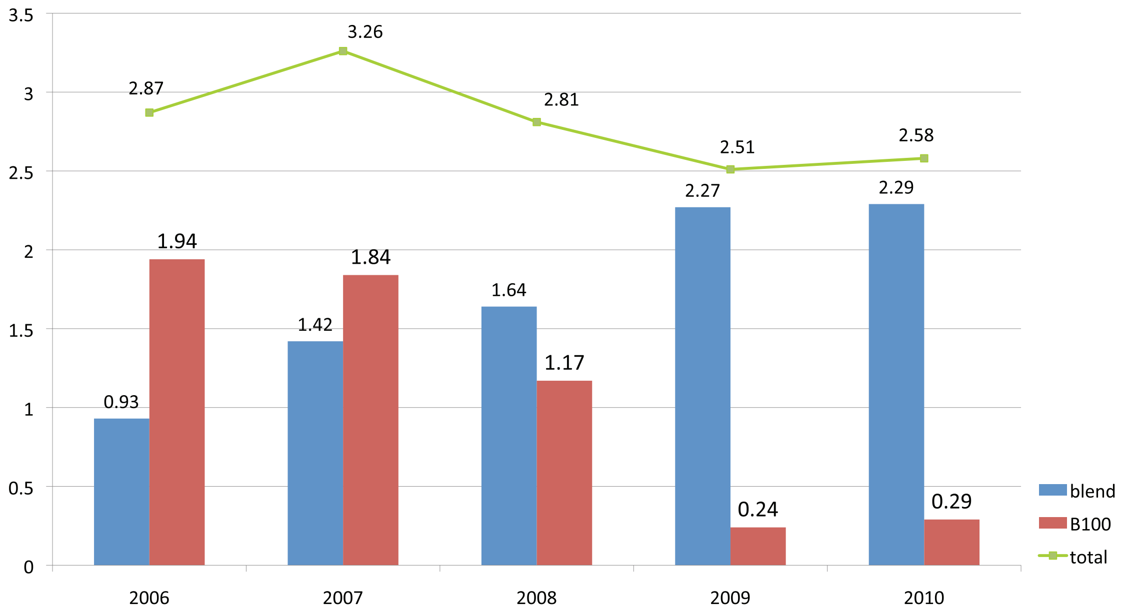
FIGURE 5. BIODIESEL MARKET (IN MILLION TONNES)



Source: EBB (2011); VDB (2011e, 2011f)

In 2005 filling up with biodiesel was seen as a cost-cutting measure by motorists. Union zur Förderung von Oel- und Proteinpflanzen e.V. (UFOP) reported a wholesale price difference between pure biodiesel (B100) and diesel of €0.18 per litre (UFOP, 2005, p. 5). Changes in Germany's biofuel policy and rising feedstock prices reduced the price competitiveness of pure biodiesel (B100) in relation to diesel and triggered a reduction in biodiesel consumption between 2007 and 2009 (see Figure 5).

FIGURE 6. BIODIESEL CONSUMPTION (IN MILLION TONNES)



Source: VDB (2011d)

In 2006 pure biodiesel (B100) accounted for 67 per cent (1.94 million tonnes) of biodiesel consumed in the domestic market, but only accounted for 11 per cent (0.29 million tonnes) in 2010 (Figure 6). VDB repeatedly emphasizes the negative impact of the rising (but still reduced) tax rates on the sale of biodiesel (VDB, 2011d, 2011e). The introduction of a blend with 7 per cent biodiesel (B7) increased the amount of bio-content across all blends being consumed, but could not compensate for an overall reduction in renewable energy use due to the declining use of pure biodiesel (B100) (VDB, 2011d). In 2010 biodiesel consumption grew slightly. Rising mandatory blending quotas and fossil-fuel prices could provide an explanation for this shift.

Box 1: Biodiesel use in Germany

In Germany, biodiesel either can be used in pure form or blended with normal diesel. The blending of fossil diesel with up to 5 per cent of biodiesel by volume has been authorized since 2004 with the availability of a B5 blend. In February 2009 a higher B7 blend was introduced. This blend is a mixture of diesel with a maximum amount of 7 per cent biodiesel by volume. Since all diesel-engine cars can run on B7, it is the new standard fuel for diesel-engine cars in Germany (BMU, 2009). The Fuel Quality Directive 2009/30/EC also encourages the creation of a standard for higher levels of biodiesel blends, calling for the European Committee for Standardization (CEN) to develop a standard for B10 use.

Biodiesel is created through a chemical process that converts vegetable oil and animal fats into fatty acid methyl ester (FAME). Hence, vegetable oil is an important feedstock for biodiesel. In Germany, vegetable oil is also used in an unmodified form as a transport fuel (see Chapter 3.2). Biodiesel and "vegetable oil" should be considered separate fuels. Biodiesel is mainly derived from vegetable oil, while "vegetable oil" is also referred to as a fuel in its own right. In Germany, biodiesel is commonly made from rapeseed oil. The land that could potentially be used for the cultivation of non-food rapeseed is limited due to crop rotation and land utilization. Therefore, a maximum of around 2 million tonnes of biodiesel per year can be produced from domestic rapeseed feedstock. In order to operate at full capacity, German biofuel producers need to import greater quantities of vegetable oil (Federal Government of Germany, 2010c).

Most of the biodiesel sold in Germany is produced domestically. However, small amounts of biodiesel are imported and exported. Detailed statistics on import and export flows are not available; however, anecdotal evidence suggests the amount of biodiesel exported is roughly equal to the amount imported (Federal Government of Germany, 2010c).

In Germany, as well as the rest of Europe, the market for biodiesel is characterized by overcapacity and company insolvencies. German consumers are free to select the cheapest fuel retailer (Federal Government of Germany, 2010c), resulting in cutthroat competition among German biodiesel producers (UFOP, 2009). Large-scale production plants with capacities of 50,000 tonnes per year or more provided 95 per cent of Germany's biofuel production in 2010 (Federal Government of Germany, 2010c). The following table provides a list of production plants in Germany.

TABLE 2. BIODIESEL PLANTS IN GERMANY IN 2010

Company	Location	Capacity (tonnes per year)
ADM Hamburg AG - plant in Hamburg	Hamburg	580,000
Cargill GmbH	Frankfurt/Main	300,000
ADM Mainz GmbH	Mainz	275,000
NEW Natural Energie West GmbH	Neuss	260,000
Bio-Ölwerk Magdeburg GmbH	Magdeburg	255,000
Verbio Diesel Schwedt GmbH & Co. KG (NUW)	Schwedt	250,000
ecoMotion GmbH	Lünen	212,000
BIOPETROL ROSTOCK GmbH	Rostock	200,000
Louis Dreyfus commodities Wittenberg GmbH	Lutherstadt Wittenberg	200,000
Verbio Diesel Bitterfeld GmbH & Co. KG (MUW)	Greppin	190,000
BIOPETROL SCHWARZHEIDE GmbH (former Biodiesel Schwarzheide)	Schwarzheide	150,000
Rheinische Bioester GmbH	Neuss	150,000
Vesta Biofuels Brunsbüttel GmbH & Co. KG	Brunsbüttel	150,000
EOP Biodiesel AG	Falkenhagen	130,000
ADM Hamburg AG - plant in Leer	Leer	120,000
BIO-Diesel Wittenberge GmbH	Wittenberge	120,000
KL Biodiesel GmbH & Co. KG	Lülsdorf	120,000
MBF Mannheim Biofuel GmbH	Mannheim	100,000
Südstärke GmbH	Schrobenhausen	100,000
Vital Fettrecycling GmbH - plant in Emden	Emden	100,000
DBE Biowerk GmbH	Tangermünde/Regensburg	99,000
Emerald Biodiesel Ebeleben GmbH	Ebeleben	90,000
Petrotec GmbH	Südlohn	85,000
Bioeton Kyritz GmbH	Kyritz	80,000
TECOSOL GmbH	Ochsenfurt	75,000
LubminOil	Lubmin	60,000
G.A.T.E. Global Atern. Energy GmbH	Halle	58,000
EAI Thüringer Methylesterwerke GmbH (TME)	Harth-Pöllnitz	55,000
Biowerk Oberlausitz GmbH	Sohland	50,000
Biowerk Sohland GmbH	Sohland	50,000
ecodasa GmbH	Burg	50,000
Emerald Biodiesel Neubrandenburg GmbH	Neubrandenburg	40,000
Rapsveredelung Vorpommern	Malchin	38,000
BKN Biokraftstoff Nord AG (former Biodiesel Bokel)	Bokel	35,000
Ullrich Biodiesel GmbH/IFBI	Kaufungen	35,000
Nehlsen GmbH	Grimmen	33,000
KFS-Biodiesel GmbH	Cloppenburg	30,000
HHV Hallertauer Hopfenveredelungs- gesellschaft mbH	Mainburg	7,500
Rapsol GmbH	Lübz	6,000
LPV Landwirtschaftliche Produkt- Verarbeitungs GmbH	Henningsleben	5,500
BKK Biodiesel GmbH	Rudolstadt	4,000
Delitzscher Rapsöl GmbH & Co. KG	Wiedemar	4,000
Osterländer Biodiesel GmbH & Co. KG	Schmölln	4,000
SüBio GmbH	Themar	4,000
Vogtland Bio-Diesel GmbH	Großfriesen	2,000
Total 2010		**4,962,000**

Source: UFOP (2011)

Since the introduction of partial taxation for pure biodiesel (B100) and the subsequent contraction of demand for pure biodiesel, there has been a run of insolvencies for companies owning biodiesel production plants. Table 3 highlights that both small and large companies had to declare insolvency.[10]

The massive overcapacity in biodiesel production was co-financed using public money, as public funding was available and drawn on by companies to support the construction of biodiesel plants (UFOP, 2007; Frankfurter Allgemeine Zeitung [FAZ], 2005, Trechow 2008). The insolvent small-scale biodiesel plant BioWerk Kleisthöhe GmbG, for example, received around €1.4 million of public funding (Bensmann, 2007). The over-investment in the biodiesel market consequently lead to a massive waste of public funds. However, there were some early warnings of the biofuel bubble: financial expert Tobias Janßen had already stated back in 2006 that the "KfW [Kreditanstalt für Wiederaufbau] is financing the white elephants for tomorrow." To illustrate the number of investments in production facilities, Janßen identified a planned flagship project in eastern Germany that had a production capacity of 200,000 tonnes and anticipated construction costs of €40 million, of which €28 million were supposed to be paid by the KfW. Already in 2006 Janßen warned there was greater production capacity planned in Germany than there was available domestic rapeseed feedstock. And importing rapeseed—as noted by Jansen—was not lucrative (Sohn & Löbker, 2006).

TABLE 3. CONFIRMED INSOLVENCIES IN THE BIODIESEL SECTOR

Company	Location	Capacity (tonnes per year)	Start of insolvency proceedings
Biodiesel Schwarzheide GmbH	Schwarzheide	100,000	2004
Campa Süd GmbH & Co. KG	Straubing	150,000	2008
BioWerk Kleisthöhe GmbH	Uckerland	5,000	2008
Thüringer Methylesterwerke GmbH & Co. KG	Harth-Pöllnitz	55,000	2008
Kartoffelverwertungsgesellschaft Cordes & Stoltenburg GmbH & Co. KG	Schleswig	15,000	2008
Campa Biodiesel GmbH & Co. KG	Ochsenfurt	150,000	2008
ecodasa AG	Burg	50,000	2009
KL Biodiesel GmbH & Co. KG	Lülsdorf	120,000	2009
Campa Biodiesel GmbH & Co. KG	Ochsenfurt	150,000	2009
BDK Biodiesel GmbH Kyritz	Kyritz	80,000	2009
Premicon Biodiesel GmbH Co. Lubmin KG	Lubmin	60,000	2009
DBE Biowerk GmbH	Tangermünde/Regensburg	99,000	2010
Emerald Biodiesel Ebeleben GmbH	Ebeleben	100,000	2010
Emerald Biodiesel Neubrandenburg GmbH	Neubrandenburg	40,000	2010
EOP Biodiesel AG	Falkenhagen	132,000	2011

Source: FNR (2011f), insolnet (2011) for start of the insolvency proceeding.

[10] Insolnet is an information service for insolvency proceedings in Germany. It claims to provide key data for all insolvencies relating to German firms since 1999. This study drew on a list of biodiesel production plants available at FNR (2011f) and UFOP (2011) and checked against the Insolnet insolvency database (2011).

Four firms from those listed in Table 3 were taken over by other firms and are effectively still in existence. They were: EOP European Oil Products Biodiesel AG, BDK Biodiesel GmbH Kyritz, Campa Biodiesel GmbH & Co. KG and Thüringer Methylesterwerke GmbH & Co. They are still listed in Table 2, but under different names.

Box 2: Overview of insolvencies and corporate restructuring in the German biodiesel industry

2007: The Marina-Biodiesel GmbH & Co. KG was liquidated and bought by 3B Biofuels to avoid insolvency (Jensen & Bensmann, 2008).

2008: The Campa company declared insolvency but resumed production after being bought by a consortium of farmers called VNR. However, in December, 2008 Campa declared insolvency again (Hogan, 2008) and were later bought by TECOSOL (TECOSOL, 2011). In December 2008, insolvency proceedings against the Thüringer Methylesterwerke GmbH & Co.'s biodiesel plant and oil mill were instituted. According to the insolvency administrator, Florian Stapper (2011), new investors associated with a Lichtenstein investment company and affiliated with the Moscow Industrial Bank are going to purchase the company.

2009: BDK Biodiesel GmbH Kyritz declared bankruptcy (Brinkmann & Partner, 2009), but in June, Bioeton S.A. and associates of BDK founded BEK Bioeton Kyritz GmbH and bought BDK's FAME producing production facility (Bioethon S.A., 2009). Lubmin Oils GmbH, a Glencore affiliate firm, took over the insolvent Premicon Biodiesel GmbH's plant in Lubmin (Verkehrsrundschau, 2009). Glencore acquired the majority share of Biopetrol Industries AG, including two plants in Germany and one in the Netherlands (Hornby, 2009). The Louis Dreyfus Commodities Group took over the Swiss-German biodiesel maker Gate Global Alternative Enery Holding (Hogan, 2009).

2010: While able to break even, the EOP Biodiesel AG was not able to reach an agreement about financing with its bank and filed for bankruptcy. In spring 2011 the German Bio Fuel GmbH, founded by former EOP executives, announced it would take over the plant in Pritzwalk (Hogan, 2010; Bihler, 2011).

A number of biodiesel producers, while not insolvent, have stopped production. In March 2011 VDB (2011d) reported that half of Germany's 49 biodiesel plants either stopped production or their holding companies were declared insolvent. For example, in March 2011 Biopetrol Industries announced production would end at its biodiesel plant at Schwarzheide from June 2011 due to over-capacity and low earning levels. The reason was its geographical position: Schwarzheide could only supply a saturated local market while the company's two other plants were located close to ports and had the potential to export their production. CEO Maarten Roelf said, "We are confident that the European biodiesel market will pick up in the years to come, but unfortunately not quickly enough to allow us to use all our plants economically in the short term" (Hogan, 2011). UFOP (2009, p. 2) already stated in its biodiesel report for 2008/2009 that further investments in developing biodiesel plants "make little sense." Currently, there are no plans to build new biodiesel plants in Germany. Another sign of the downturn in the market for pure biodiesel is the number of fuelling stations selling B100 has shrunk from 1,900 to below 200 (VDB, 2011d).

3.2 VEGETABLE OIL MARKET

Besides being an important feedstock for biodiesel, pure vegetable oil can be used in an unmodified form as a transport fuel if a vehicle's engine is adapted to accommodate its specific properties. During recent years, the cost competiveness of vegetable oil as a renewable fuel decreased sharply after the introduction of partial taxation. Pure vegetable oil consumption in Germany amounted to 840,000 tonnes and 401,000 tonnes in 2007 and 2008, respectively. In 2009 and 2010 it shrank to around 100,000 and 65,000 tonnes respectively (FNR, 2011d; Federal Government of Germany, 2010c; BMELV, 2011c). Thus, only 3 per cent of the total biofuel consumed in 2009 was pure vegetable oil (see also Figure 2 for the trend in vegetable oil usage).

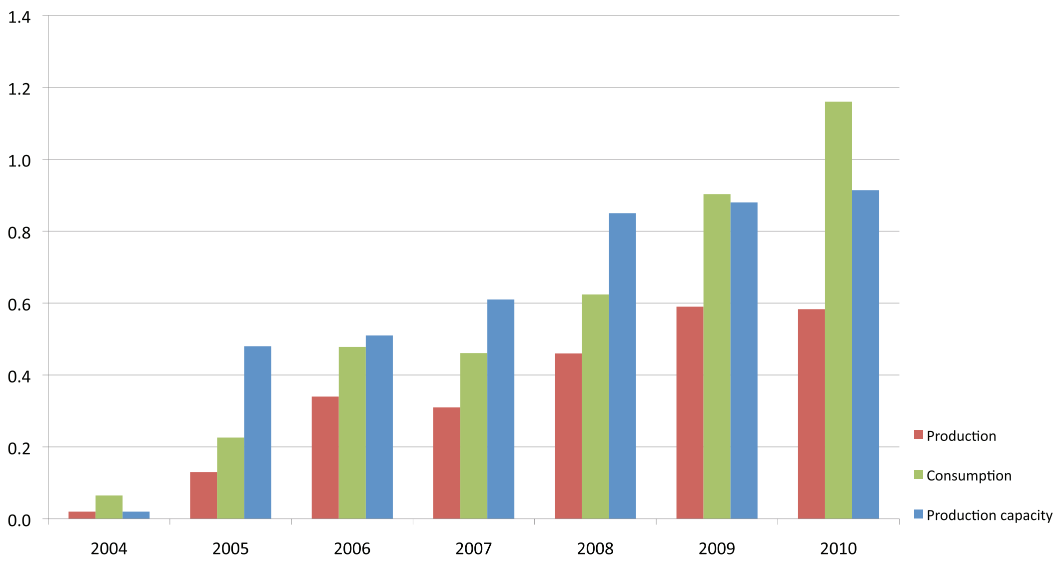
The common domestic feedstock for vegetable oil is rapeseed, as the German climate provides favourable and efficient conditions for its cultivation. Sunflowers are an alternative feedstock to rapeseeds, but producing sunflower oil does not provide real commercial returns (FNR, 2011d). Because soy and palm oil are cheaper to produce than other feedstocks, they are principally used by biodiesel producers (FNR, 2011d).[11] Only vegetable oil in pure form may be used as fuel (being blended with fossil fuels is prohibited in Germany) (Federal Government of Germany, 2010c). The use of pure vegetable oil is only cost-efficient for motorists after travelling distances of 100,000 kilometres or more. This is due to the initial costs to motorists of retrofitting their vehicles to use vegetable oil and more frequent engine oil changes. Its use is also constrained by the limited number of petrol stations (400 in Germany) that supply vegetable oil. Consequently, most of the vegetable oil consumed is used for utility vehicles in the agricultural sector. The profitability of filling up with vegetable oil is currently limited given the small gap in prices between vegetable oil and diesel with which it competes (FNR, 2011d).

3.3 ETHANOL MARKET

In 2009 ethanol accounted for only 20 per cent of the biofuels used in Germany's transport sector, while biodiesel accounted for 77 per cent. However, the importance of ethanol has increased in recent years. The common domestic ethanol feedstock crop is wheat, rye or sugar beets. Other more advanced techniques using lignocellulose processes, which rely on wood as a feedstock, are still at the pilot stage (Federal Government of Germany, 2010c). In the transport sector, ethanol can be either a compound of Ethyl tert-butyl ether (ETBE), low-blend ethanol petrol (E5 and E10) or a high-blend ethanol petrol (E85).

[11] Soy and palm oil are only approved as a blend with rapeseed oil or after additivation.

FIGURE 7. ETHANOL MARKET (IN MILLION TONNES)



Note: Conversion by authors: 1 litre corresponds to 0.789 kg.
Source: VDB (2011a, 2011f); Federal Government of Germany (2005, 2006b, 2007b, 2010c), ePURE (2011a)

The bioethanol industry is relatively new in Germany. Ethanol has only been produced industrially since 2005 (VDB, 2011f). Since 2004 the quantities of ethanol produced have grown annually, except between 2006 and 2007 and 2009 and 2010, when production levels decreased slightly. In 2009 Germany was behind France as the second largest fuel ethanol producer in Europe and one of the top six ethanol-consuming European countries. The European fuel ethanol industry is relatively small in size when compared to the Brazilian or American ethanol industries or the European biodiesel industry (ePURE, 2011b). In 2003 there was no ethanol consumed in Germany (Federal Government of Germany, 2004). Between 2007 and 2010 ethanol consumption grew sharply to 1.16 million tonnes in 2010. During recent years, ethanol consumption in Germany exceeded the amount of ethanol produced domestically. As a consequence, ethanol has to be imported. The estimated net ethanol imports for 2009 came to 311,000 tonnes (Federal Government of Germany, 2010c). In 2010 imports of ethanol increased further as domestic production stagnated and domestic consumption levels increased. According to the VDB (2011f), a German biofuel industry organization, the domestic ethanol industry is facing hard economic times due to a glut of imported ethanol and rising feedstock prices, which has reduced the domestic industry's capacity to compete. Consequently, the German ethanol industry was only producing at 64 per cent of its capacity in 2010, in spite of rising domestic consumption of ethanol. According to ePURE (2011a), ethanol production capacity was 1,159 million litres (914,451 tonnes).

TABLE 4. ETHANOL PLANTS IN GERMANY IN 2010

	Company	Production capacity (tonnes per year)	Feedstock
1	CropEnergies AG (Zeitz)	284,040	Cereals, sugar juice
2	Verbio AG (Schwedt)	181,470	Cereals, sugar juice
3	Fuel 21 (Klein Wanzleben)	102,570	Sugar juice
4	Verbio AG (Zörbig)	98,625	Cereals
5	Prokon (Stade)	94,680	Wheat
6	SASOL (Herne)	59,964	Raw alcohol
7	Danisco (Anklam)	44,184	Sugar juice
8	KWST (Hannover)	31,560	Raw alcohol
9	Wabio	9,468	-
10	Müllermilch (Leppersdorf)	7,890	Diary products
	Total production – Germany	**914,451**	

Note: Conversion by authors: 1 litre corresponds to 0.789 kg. Source: ePure (2011a)

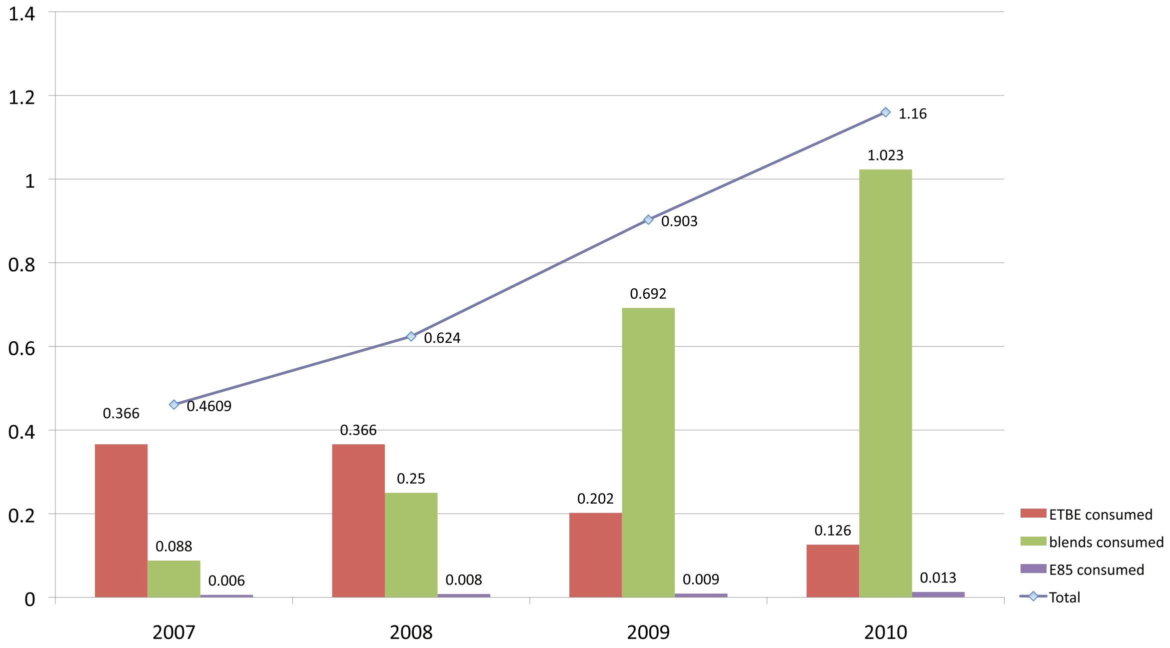
No company insolvencies for the ethanol sector were identified during this study. Table 5 lists ethanol production capacity for two facilities currently under construction: ESP Chemie GmbH and WABIO Bioenergie. The ESP Chemie GmbH had its completion ceremony in September 2010 (ESP Chemie, 2011) and WABIO Bioenergie reportedly started production in Bad Köstritz in 2007 according to their company website's homepage (WABIO, 2011). WABIO reportedly has plans to expand production and identified more than 100 sites for potential WABIO centres in Thuringia, Saxony-Anhalt, Saxony and Berlin/ Brandenburg (WABIO, 2011).

TABLE 5. ETHANOL PRODUCTION CAPACITY UNDER CONSTRUCTION

	Company	Production capacity (tonnes per year)	Feedstock
1	Wabio Bioenergie (Bad Köstritz)	6,627.6	Waste
2	ESP Chemie GmbH	7,890.0	-
	Total production – Germany	**14,517.6**	

Note: Conversion by authors: 1 litre corresponds to 0.789 kg. Source: ePure (2011a)

FIGURE 8. ETHANOL CONSUMPTION (IN MILLION TONNES)



Source: VDB (2011a)

E85 is blended with up to 85 per cent ethanol. Not all cars can run on E85. There are so-called flexible fuel vehicles, which are especially designed to run on petrol and biofuel blends containing a maximum of 85 per cent ethanol. While the usage of E85 is common in some countries, such as Sweden, the United States and Brazil, it is not the case for Germany (FNR, 2011e). Despite the strong growth in ethanol consumption between 2009 and 2010, only around 1 per cent of the ethanol consumed in 2010 was from E85—even though the use of E85 benefits from major tax incentives with the biogenic share completely tax-exempt (until 2015). According to Centrales Agrar- Rohstoff- Marketing- und Entwicklungs-Netzwerk e.V. (C.A.R.M.E.N, 2011), the Bavarian coordination center for renewable resources, E85 is considerably cheaper than petrol based on a comparison of the per-litre pump price. Pump prices for E85 are reasonably stable compared to the price of petrol (C.A.R.M.E.N., 2011). In 2007 ETBE fuel accounted for the majority of ethanol consumption, with a market share of 79 per cent, though this has decreased recently. In 2010, the market share of blended ethanol fuels increased to 88 per cent of the ethanol market, with ETBE accounting for around 10 per cent of the ethanol market.

The consumption of ethanol as an ethanol blend has increased sharply since the introduction of the quota system in 2007, with included rising mandatory blending targets. Until the end of 2010, only blends with up to a maximum 5 per cent ethanol were permitted in Germany—the so-called E5 blends (DIN EN 228). There was no obligation to label E5 blends at the pump, allowing the two standard German petrol brands—Super and Super Plus—to contain up to 5 per cent ethanol without informing the customer they contained a bio-element (Deutsche Automobil-Club e.V. [ADAC], 2011).

4. GERMAN BIOFUEL POLICY

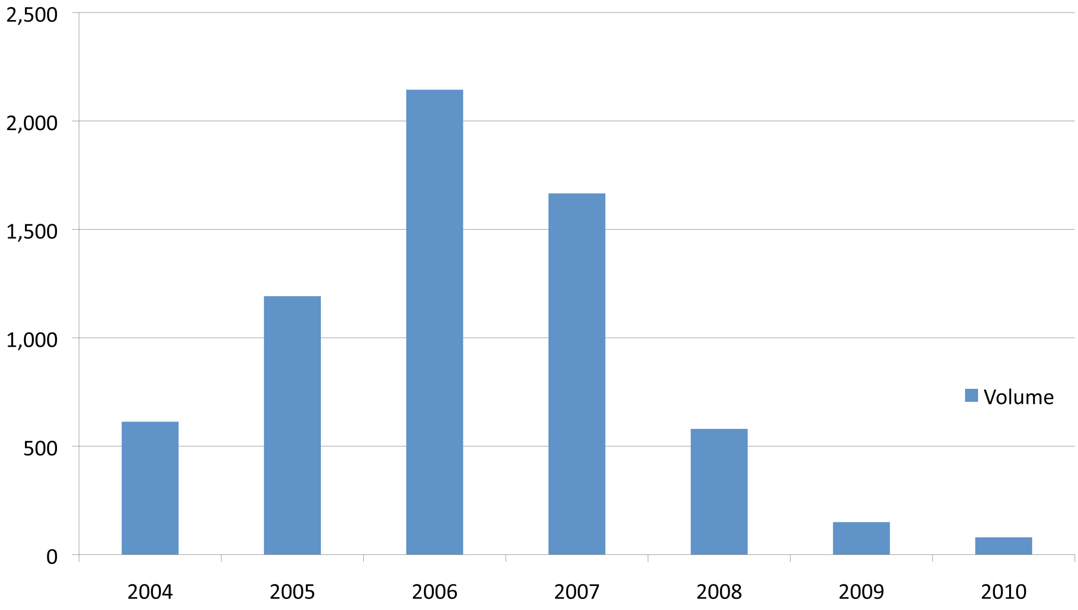
In this section, recent trends relating to the support of the German biofuel industry are examined. European states, including Germany, use various measures at the national and subnational levels to support the biofuels industry. The most commonly used instruments are tax exemptions and mandatory blending targets (see Jung, et al., 2010). Germany uses both instruments, but focuses on mandatory biofuel blending quotas applied to the mineral oil industry.[12]

4.1 GOVERNMENT SUPPORT VIA TAX EXEMPTIONS

In the initial phase of government support to biofuels, the German government granted extensive tax exemptions for biofuel in order to ease their introduction to the fuels market. The objectives for supporting the biofuels industry were to reduce GHG emissions and help improve long-term security of energy supply (Federal Government of Germany, 2007a, p. 42). With an **amendment to the Mineral Oil Duty Act** on January 1, 2004, full tax relief was provided for all biofuels and heating oils obtained from biomass—blended or in pure form—until 2009. Until that point, only biofuels and heating oils from biomass in pure form were tax-exempt (Federal Government of Germany, 2004).

Due to the substantial fiscal support provided to the pure biodiesel market (B100), the industry's production base expanded significantly. Consumption proved to be responsive to the price elasticity of biodiesel (see Chapter 3 for a discussion regarding the biofuel market).

FIGURE 9. TAX EXEMPTIONS FOR BIOFUELS AND HEATING OIL MADE FROM BIOMASS (IN MILLION EUROS)



Source: Federal Government of Germany (2006a, 2007a, 2010b)

Government support for biofuels led to rising costs to the government's budget. In 2006 the fiscal costs resulting from the tax exempted for biofuel and heating oil made from biomass peaked at €2,144 million (Figure 9).

[12] The mandatory blending targets concern firms that market petrol and diesel and that are referred to as the mineral oil industry.

4.2 GOVERNMENT SUPPORT VIA MANDATORY BLENDING TARGETS AND PARTIAL TAX REDUCTIONS AND EXEMPTIONS

The adoption of the **Energy Tax Act** meant a change in the policies adopted by the German government. From August 1, 2006 onwards, the German government introduced a partial tax on vegetable-based fuel (Federal Government of Germany, 2006b). With the implementation of the **Biofuel Quota Act** on January 1, 2007, Germany adopted a mandatory biofuel blending target for the mineral oil industry. The regulatory provision largely replaced the use of tax exemptions (Federal Government of Germany, 2008a). This shift in focus for Germany's biofuel support policies reduced the fiscal burden, as mandatory blending targets do not involve direct government payments to the biofuels industry. They are, however, a significant form of market intervention, as they force the mineral oil industry to sell a minimum share of biofuels. Mandatory blending targets also assure a certain market share for biofuel producers and investors (Federal Government of Germany, 2010a, p. 3). Germany plans to achieve the 10 per cent goal of renewables in transport set by RED mainly through the mandatory blending targets (Duft, 2010).

4.2.1 MANDATORY BLENDING TARGETS

The Biofuel Quota Act obliges mineral oil companies to distribute a rising minimum share of biofuels through introducing mandatory blending quotas for biofuel with fossil fuel. Germany employs a hybrid quota system: it grants a tax relief for pure biofuels if they are not used to meet the quota. The biofuels used to fulfill the quotas are levied with the statutory tax rate—except second-generation biofuels, which are tax-exempt (Federal Government of Germany, 2010a, p. 93). Mineral oil companies are free to reach the quota by either blending diesel or petrol or by using pure biofuels. Recently biomethane was recognized as counting towards the petrol quota and the total quota, if it meets the requirements of the Fuel Quality Regulation. Mineral oil firms can also delegate their quota requirement to third parties, which places biofuels in the market (Federal Government of Germany, 2009).

The quota is set in relation to the energy content of the fossil fuel concerned (petrol or diesel), plus that of the biofuel replacing it. The method of measurement considers the differences in energy content between the different fuels.

TABLE 6. GERMAN QUOTA SYSTEM

Year	Quota: diesel	Quota: petrol	Total quota
2007	4.40%	1.20%	-
2008	↓	2.00%	-
2009	↓	2.80%	5.25%
2010	↓	↓	6.25%
2011	↓	↓	↓
2012	↓	↓	↓
2013	↓	↓	↓
2014	4.40%	2.80%	6.25%
2015		decarbonisation 3.0%	
2017		decarbonisation 4.5%	
2020		decarbonisation 7.0%	

Source: FNR (2011c)

There are individual quotas for petrol and diesel: the quota for diesel has been set at 4.4 per cent since 2007, while for petrol, it was raised to 2.8 per cent until 2009. Since 2009 an additional overall quota is in place, which exceeds the individual minimum quotas for diesel and petrol. The overall quota for 2009 was 5.25 per cent, rising to 6.25 per cent between 2010 and 2014. The current energetic evaluation will be replaced by a benchmark figure, which refers to the biofuel's net GHG reductions in 2015. The net quota is set at 3.0 per cent, 4.5 per cent and 7 per cent in 2015, 2017 and 2020, respectively (FNR, 2011c; Federal Government of Germany, 2010d). Post-2013, the amount of biofuels necessary to meet the mandatory quotas directly depends on the GHG emission savings of the biofuels consumed in relation to fossil fuels.[13] What does this imply for the RED goal? Federal Government of Germany (2010a, p. 12) assumes that the 2020 goal of 7 per cent decarbonization corresponds to approximately 12 per cent in energetic evaluation (Federal Government of Germany, 2010a, p. 12).

The penalties for not meeting the quota are €43 per giga joule (GJ) for petrol (€0.9 per litre) and €19 per GJ for the diesel quota and the total quota (€0.6 per litre) (the shortfall is measured in energy contents) (Federal Government of Germany, 2010a; FNR, 2011c).[14]

4.2.2 TAX RELIEF FOR PURE BIOFUELS NOT USED TO MEET THE QUOTA

All biofuels—in blended or pure form—that are used to meet the quota are subject to standard excise taxes on fuel, except for second generation biofuels. In Germany, there are different fuel duties for petrol and diesel. For petrol, the fuel duty is 65.45 cent per litre and for diesel, it is 47.04 cent per litre (Energy Tax Act §2). Blended fuels are only supported via the quota system and are no longer subject to tax reliefs.

Only second-generation biofuels (BtL, lignocellulosic ethanol), biogas and bioethanol (in the form of E85) enjoy a full tax exemption. The exemption will remain in place until 2015, when it will lapse. There is also a partial tax exemption granted for pure biodiesel (B100) and vegetable oil outside the quota until 2012.

TABLE 7. REDUCED EXCISE TAX RATES FOR BIODIESEL AND VEGETABLE OIL

	Biodiesel cent/litre	Vegetable oil cent/litre
August 2006	9.00	0.00
2007	9.00	2.15*
2008	14.90	9.90
2009	18.30	18.25
2010-2012	18.60	18.50
from 2013	45.03	45.03

Note: *due to fictive quota.
Source: FNR (2011b)

[13] To provide an indication of how to convert the net quotas to energetic quotas, it is best to refer to the RED regulations regarding the GHG emission savings of biofuels.
For 2014–2015: net quota of 3 per cent: a) GHG emission saving of 35 per cent: 3/0.35=8.57 b) GHG emission saving of 50 per cent (alternative): 3/0.5=6
For 2017: net quota of 4.5 per cent and GHG emission saving of 50 per cent: 4.5/0.5=9
From 2018 to 2019: net quota of 4.5 per cent GHG emission saving of 60 per cent: 4.5/0.6=7.5
From 2020 onwards: net quota of 7 per cent GHG emission saving of 60 per cent: 7/0.6=11.6.

[14] The quotas and tax exemptions outlined have already been revised and are therefore different to the ones originally anticipated by the Federal Immission Control Act and the Energy Tax Act. This was due to a change in 2009 with the adoption of the **Biofuels Promotion Restructuring Act** and the **Acceleration of Growth Act** (Federal Government of Germany, 2010d).

Due to the introduction of a partial taxation for pure biodiesel (B100) and vegetable oil, their consumption declined, while the consumption of blended ethanol and biodiesel increased. Since 2010 the reduced excise tax rates for pure biodiesel (B100) and vegetable oil are set at 18.60 cents per litre and 18.50 cents per litre, respectively. Due the way the reduced tax rates are calculated, they can be sensitive to changes in the quotas.

4.2.3 QUOTA TRADE SYSTEM

Mineral oil companies are free to delegate their quota requirements to a third party that supplies biofuels to the market. This system is called the quota trade system and is an instrument that reduces the fiscal burden (due to the tax exemption) on the government. Mineral oil firms can buy the rights for pure biofuels (from biofuel producers) that have already been sold into the market. Since tax exemptions are only granted for pure biofuels—for example, pure biodiesel—in excess of the quotas, tax exemptions that have already been granted to the producers of pure biofuels have to be paid back to the government. Thus, the active quota trade system reduces the costs of tax exemptions for pure biofuels. Elmar Baumann, the managing director of VDB, emphasizes that it has been common practice for the mineral oil industry to offset the sale of large quantities of pure biodiesel (B100) with the quota (VDB, 2011c). In 2010, for example, the entire volume of pure biodiesel (B100) sold in the domestic German market was used to meet the mandatory blending targets (VDB, 2011b). The sale of pure biofuels therefore supports the mineral oil industry in meeting the quotas and helps them avoid penalties applied via the quota trade system.

4.3 FUNDING FOR R&D

Germany grants funding for R&D across the biofuels sector through the Renewable Resources Agency and is funded as part of the "Renewable Resources" aid scheme from the Federal Ministry for Food, Agriculture and Consumer Protection. Since the launch of the "Renewable Resources" aid scheme, around €50 million have been provided for 90 R&D projects related to biofuels through to June 2010 (Federal Government of Germany, 2010d).[15]

In 2009 funding BtL (biomass to liquid) fuels were the focal point of support. In light of rising requirements with regard to sustainability and the increasing market penetration, there was an increase in funding of R&D projects on conventional biofuels. In fiscal 2009, 40 R&D projects for biofuels were funded (including provision of biofuel feedstock) with around €25 million provided in grants (Federal Government of Germany, 2010d).

[15] For more information on R&D grants, see also Federal Government of Germany (2009, 2008a, 2007b, 2006b, 2005, 2004).

5. ADDITIONAL COSTS OF BIOFUEL PRODUCTION

Biofuels are currently not cost-competitive in relation to fossil fuels. Consequently, European member states provide extensive financial support to foster and promote their production and use. It is unlikely a market for biofuels in Germany would exist in a competitive and unregulated transport fuel market. This section discusses the additional costs of biofuels that society will incur due to the RED target of 10 per cent renewables in the transport sector in 2020. The following box illustrates how the RED target is calculated.

Box 3: How to calculate the 10 per cent target of renewables in transport

Article 3 of the RED defines how the target is to be calculated:

$$10\,\% = \frac{\text{all energy types from renewables in all forms of transport}}{\text{the total amount of energy consumed in transport (petrol, diesel, biofuels consumed in road and transport, electricity)}}$$

Source: Directive 2009/28/EC.

The Federal Government of Germany has frequently recognized the higher production costs for biofuels as part of a number of assessments looking at the impacts of introducing new policies and laws relating to biofuels (see e.g., Federal Government of Germany, 2008b, p. 3; Federal Government of Germany, 2010e, p. 3). However, these government assessments have not provided an estimate of the costs associated with new policies, such as biofuel blending mandates.

This study aims to provide an estimate of the associated costs for the year 2020, though there are a number of uncertainties affecting the calculation.

The additional production cost is defined as (Charles & Wooders, 2011, p. 24):

Cost of producing biofuels to the volume of the mandate *minus*
the cost of purchasing petroleum products with equivalent energy content

The following information is required to calculate the additional production costs:

- The volumes of biodiesel and ethanol required to meet the 10 per cent target
- The cost of purchasing petroleum products and producing biofuels

Germany's national renewable energy action plan (NREAP)[16] from July 2010 is used as a data source for estimating the volumes of biodiesel and ethanol required to meet the mandate. Using the information provided in Table 8, it is estimated that Germany will need to consume around 1.8 billion litres of bioethanol and 3.8 billion litres of biodiesel to reach 10 per cent of renewables in transport in 2020.[17]

[16] Please see Federal Government of Germany (2010a) for more on simulation scenarios, underlying database, assumptions and restrictions.

[17] The study uses the volume of biodiesel and ethanol in transport fuels for 2019 as the basis for additional cost calculations for 2020. The authors believe that using data for 2019 to estimate consumption figures for 2020 is justified, as there is only a slight difference in total end energy consumption in the transport sector between 2019 and 2020 (see Federal Government of Government, 2010a, Table 1, p. 9). It should be noted that Germany's NREAP assumes the share of renewables in transport will increase significantly from 9.7 per cent in 2019 to 13.2 per cent in 2020.

TABLE 8. EXPECTED CONTRIBUTION FROM RENEWABLES IN TRANSPORT (IN KILOTONNES OF OIL EQUIVALENT [KTOE])

	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Ethanol	144	639	1,187	1,145	1,103	1,060	996	950	978	936	896	857
of which imported	0	189	724	670	614	558	482	423	438	384	331	278
Biodiesel	1,598	2,790	2,300	2,325	2,086	2,108	2,074	2,070	2,987	2,969	2,949	4,443
of which imported	0	1,459	942	941	675	671	610	579	1,470	1,426	1,379	2,846
Electricity from renewables	169	219	245	272	307	338	374	416	463	513	576	667
Others (biogas, BtL, plantoil, lower level)	177	102	105	108	18	26	35	49	67	91	124	173
Others (biogas, BtL, plantoil, upper level)	177	102	105	108	18	26	35	49	67	121	184	261
Sum (lower level)	2,087	3,749	3,837	3,850	3,513	3,532	3,479	3,484	4,495	4,510	4,546	6,140
Sum (upper level)	2,087	3,749	3,837	3,850	3,513	3,532	3,479	3,484	4,495	4,540	4,605	6,229
Share of renewables in transport	**3.9%**	**7.3%**	**7.5%**	**7.6%**	**7.0%**	**7.0%**	**7.0%**	**7.1%**	**9.3%**	**9.4%**	**9.7%**	**13.2%**

Note: An estimate of the total contribution expected from each renewable energy technology in Germany to meet the binding 2020 targets. For the indicative interim trajectory for the share of energy from renewable resources in the transport sector 2010–2020 (ktoe) and the share of renewables in the transport sector, see Federal Government of Germany (2010a) for full tables and explanatory comments. Source: Federal Government of Germany (2010a, Table 3, p. 15 and Table 12, p. 119)

This study takes the projected future costs of biofuel and fossil-fuel production provided by Charles and Wooders' U.K. study (2011) (Table 9). Charles and Wooders (2011) draw on the U.K.'s Department for Transport's (DfT) Impact Assessment for the U.K.[18] The DfT's Impact Assessment uses a world biofuel model with links to commodity markets to estimate future biofuel production costs under four crude oil price scenarios for the U.K. (see Charles & Wooders, 2011).[19]

[18] Data for the DfT's Impact Assessment is based on a projection of energy prices from the U.K.'s Department of Energy and Climate Change (see Charles & Wooders, 2011, pp. 24–31 for more information).

[19] The calculation ignores that fuel consumption depends on properties such as combustion properties and octane rating as well. For example, ethanol contains more energy per litre than petrol, while ethanol has better combustion properties and a higher octane rating (ADAC, 2011).

TABLE 9. PROJECTED FUEL PRODUCTION COSTS AND BIOFUELS PRICES IN 2010 AND 2020 (IN EURO PER LITRE)[20]

		2010	2020			
			low	central	high	highhigh
Fossil fuel price	Petrol	0.42	0.37	0.47	0.67	0.81
	Diesel	0.45	0.40	0.51	0.74	0.90
Biofuel price	Ethanol	0.58	0.51	0.53	0.59	0.65
	Biodiesel	0.84	0.81	0.86	0.97	1.12
Spread (volume)	Ethanol - petrol	0.16	0.14	0.06	-0.08	-0.16
	Biodiesel - diesel	0.38	0.40	0.34	0.24	0.22
Spread (energy, per litre of conventional fuel)	Ethanol - petrol	0.48	0.41	0.34	0.24	0.19
	Biodiesel - diesel	0.48	0.49	0.43	0.34	0.34

Note: Conversion by the authors 1 Euro = 0.85784 GBP. Source: Charles & Wooders (2011, p. 29)

The final two rows in Table 9 provide the incremental production costs per litre of ethanol and biodiesel per litre of petroleum displaced. In 2020 bioethanol is forecasted to be between 19 cents and 41 cents more expensive than petrol. Biodiesel is forecasted to be between 34 cents and 49 cents more expensive than diesel.

To calculate the additional production costs for the year 2020 provided in Table 10, the following formula is applied:

volumes required to meet the 10 per cent goal in 2020 *times* the differences in production costs between fossil fuels and biofuels in 2020.

It is estimated that the additional production costs of biofuels in Germany for 2020 will be between €1,373 million and €2,153 million (see Table 10).[21]

TABLE 10. ADDITIONAL PRODUCTION COSTS OF BIOFUELS TO MEET RED TARGET IN 2020 (IN MILLION EUROS)

low	central	high	highhigh
2,153.13	1,881.59	1,439.88	1,373.51

Note: The energy content of biodiesel is 0.9102 that of diesel and ethanol is 0.6484 that of petrol. Source: author's calculation

The estimate provided depends on a number of underlying assumptions and therefore should be viewed as indicative. The actual amount of biofuel needed in 2020 to meet the target in 2020 may change, as well may the composition of the biofuels that might be used. The price projections could be affected by a number of unforeseen factors—for example, a spike in oil prices occurring—affecting the difference in production costs between fossil fuels and biofuels.

Reaching the renewable energy target also depends on a number of uncertainties. For example, the level of biofuel consumption may be dependent on public acceptance of the product, which may be influenced by increased public awareness about the potential negative externalities resulting from increasing levels of biofuels consumption (the food or fuel debate and the actual carbon emissions savings provided).

[20] The price spread adopted for this report between fossil fuels and biofuels in 2010 is considered a reasonable assumption for Germany. See ADAC (2011) for ethanol and petrol production costs. See Federal Government of Germany (2010c) for further information on the production costs of diesel and biodiesel.

[21] Note the estimate ignores the production costs related to the use of biogas, BtL and vegetable oil.

6. ADMINISTERING GOVERNMENT POLICIES REGULATING GERMANY'S BIOFUELS INDUSTRY

There are several government agencies that administer and supervise the various policy instruments regulating road transport issues and the biofuel industry. Due to the lack of budgetary information on how these agencies break down their budgetary costs, this paper does not quantify the various agencies' running costs associated with the administration of biofuel policies. The major federal ministries and agencies concerned are as follows:

- the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV)
- the Federal Ministry for the Environment, Nature Conversion and Nuclear Safety (BMU)
- Federal Ministry of Finance (BMF)

The Federal Office for Agriculture and Food (BLE) approves and supervises the certification systems and the bodies that administer them. The biofuel quota body—which belongs to the main custom office in Frankfurt (Oder)—is responsible for supervising companies' compliance with the biofuel quota (German Customs Administration, 2011a). The main custom offices are responsible for administering the tax relief policies for biofuel producers (German Customs Administration, 2011c). The FNR is in charge of research projects related to the use of renewable resources. The FNR generates and provides information on renewable energy for academics, the public, politicians, the media and the biofuels industry (FNR 2011h).

7. GERMANY'S SINGLE PAYMENT SCHEME AND THE PRODUCTION OF BIOFEEDSTOCKS

In 2005 Germany "decoupled" the direct aid provided to its farmers from production and introduced the SPS. Consequently, the majority of Germany's agricultural subsidies are independent from production, allowing farmers to tailor the production of crops to market conditions. Until 2008 European farmers benefited from two types of subsidy measures that incentivized the cultivation of feedstocks for biofuel production: non-food set-aside requirements and the energy crop-scheme (Jung, et al., 2010, p. 51ff).[22] The set-aside rate was set at 0 per cent in 2008 due to changes in the cereal market situation. In the course of the Common Agricultural Policy's (CAP) "Health Check" in January 2009 the set-aside requirements were abolished (Jung, et al., 2010; see European Commission [EC], 2009 for more on the CAP reform). The Energy Crop Premium was granted to farmers for the last time in 2009.[23]

The level of payments made to farmers under the SPS in Germany depends on the area of land under cultivation by the farmer and the number of payment entitlements they are assigned (which differ in value). Germany uses a combination of a historical model and regional model to determine the payment entitlements for individual farmers. Payment entitlements depend on the payments obtained by the farmer during a reference period (historical model) and the number of eligible hectares farmed in the first year of implementing the scheme (regional model) (see BMELV, 2011c, 2011d for detailed statistics for 2010). Between 2010 and 2013 Germany will migrate the current system to the regional model (BMELV, 2011a, 2011b; EC, 2010a).[24]

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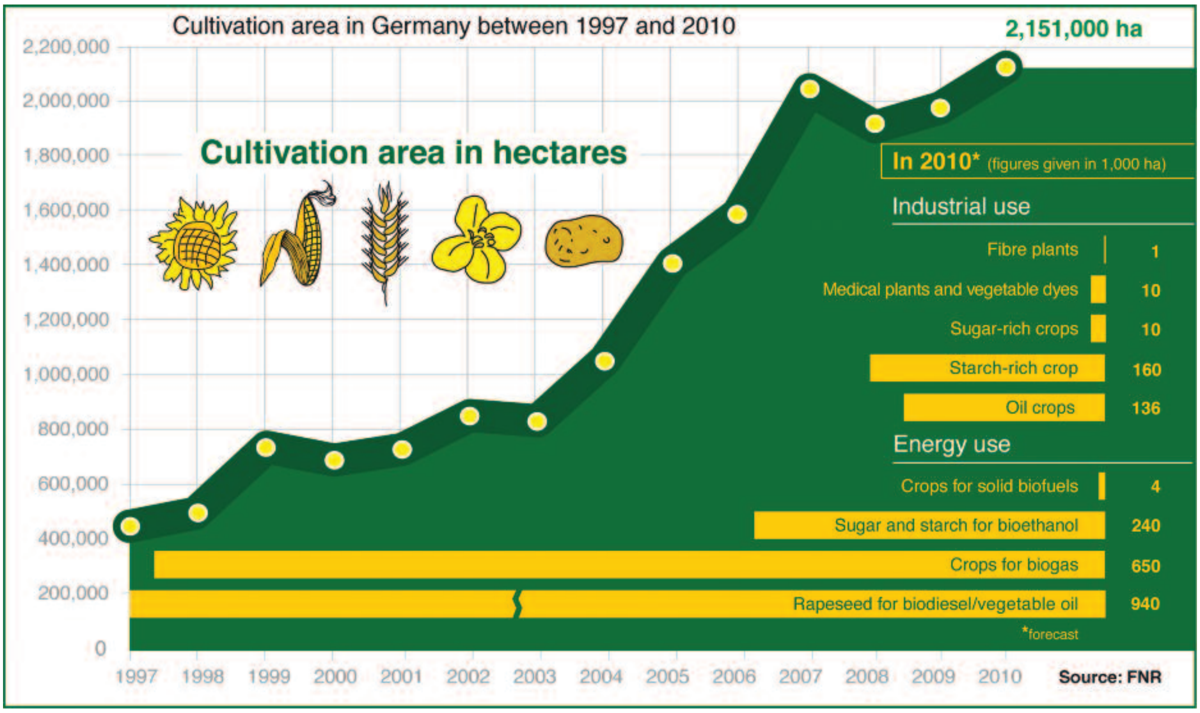
[22] For an estimate of the costs associated with the set-aside requirements and energy crop scheme, see Jung et al. (2010, p. 52).

[23] See EC (2011) for CAP Policy after 2013.

[24] From 2013 onwards, the values of the payment entitlements only differ between the federal states (see BMELV, 2011b and 2011d for more on the conversion to the regional model). The target values of payment entitlements were computed in 2009 and are between €258.96 per hectare (Saarland) and €359.44 per hectare (North Rhine-Westphalia). The calculative average for the whole of Germany amounts to €339.23 per payment entitlement. However, there were changes due to further decoupling from production. Thus, the estimated values of payment entitlements are between €296 (Saarland and Rhineland-Palatinate) and €344 (Lower Saxony). The estimated average for whole Germany amounts to €366 per payment entitlement (BMELV, 2011d).

Due to the fact that the direct payments are available independently from production and from the type of crop grown, this form of support does not favour one feedstock more than another, or favour the production of a crop for either the food or energy market. The decision whether to cultivate biofuel feedstock or not, thus, is independent from the direct payments provided under the SPS. The payments under the SPS subsidize the agricultural sector by reducing fix costs. SPS payments decrease the costs of producing biofuel feedstock, as they decrease the costs of producing crops for the food market. They help increase the competitiveness of biofuels in relation to fossil fuels by lowering the costs of production.

FIGURE 10. CULTIVATION OF RENEWABLE FEEDSTOCK IN GERMANY (IN HA)



Source: FNR (2011a)

In the last two decades, the cultivation of renewable feedstock has increased enormously in Germany (Figure 10). However, there is currently a limited amount of agricultural area not already in use (Federal Government of Germany, 2010a, p. 97ff). The total area of cultivated agricultural land in Germany equaled 16.70 million hectares in 2010 (Destatis, 2011). The FNR estimates the area cultivated for biofuel feedstock production in 2010 to be 1,180,000 hectares.[25]

[25] The land area cultivated for the production of plants used for biogas and for solid fuels in 2009 was 530,000 and 3,500 hectares, respectively. In 2010 the area of cultivated land for growing plants for biogas and solid fuels productions was estimated to be 650,000 and 4,000 hectares, respectively (FNR, 2011a).

TABLE 11. AGRICULTURAL AREA USED FOR THE CULTIVATION OF BIOFUEL FEEDSTOCK IN GERMANY (IN HA)

Commodity	2009	2010*
Rapsoil for biodiesel/ plantoil	942,000	940,000
Plants for bioethanol	226,000	240,000
Total	**1,168,000**	**1,180,000**

Note: *estimate. Source: FNR (2011a)

In 2009 there were a total of 16,991,398.62 payment entitlements in Germany with a total value of €5,760,912,409 (BMELV, 2009a, 2009b); in 2010 there were 16,973,686.47 payment entitlements in Germany with a total financial value of €5,761,818,815 (BMELV, 2010b, 2010d).

The study provides an estimate for the financial value of SPS payments for the cultivated agricultural area on which biofeedstocks are cultivated. It helps answer a basic research question concerning how the SPS envelope of funds is distributed between crops. It also helps policy-makers get a better sense of the area of cultivation used to grow certain crops and for which markets those crops are destined. This information is important given the current interest in monitoring land-use patterns and food-commodity prices. As previously indicated, when interpreting the subsidy estimate, keep in mind that the SPS payments are independent from production and the type of crop grown (see discussion about incentives above).

To simplify the calculation, the level of direct payments provided for biofuel feedstocks in Germany is calculated using the national average of SPS payments per payment entitlement per year. The total subsidy for 2009 and 2010 is calculated as follows:[26]

number of hectares used for cultivating biofuel feedstock *times* the national average payments per payment entitlement *minus* correction for modulation[27]

TABLE 12. SUBSIDIES TO FARMERS GROWING BIOFEEDSTOCK

Year	Payments per payment entitlement (in Euros)	Hectares	Total subsidy (in Euros)
2009	339.05	1,168,000	372,249,776
2010	339.46	1,180,000	372,523,404

Source: FNR (2011a), BMELV (2010a, 2009a)

The subsidies provided to farmers growing feedstock for the biofuels sector amounted to €372.25 million in 2009 and €372.52 million in 2010.[28]

[26] Underlying assumption: for each hectare of cultivated land for biofeedstock there is a payment entitlement. Occasionally, a situation may occur when the farmer cultivates more land than they possess in equivalent payment entitlements, but this is rare.

[27] The term modulation refers to the following: the total value of the payment received by each farmer is reduced by a certain amount. The following progressive rate system is applied: payments up to €5,000 are exempt from modulation. Amounts between €5,000 and €300,000 are subject to a reduction of 7 per cent, 8 per cent, 9 per cent and 10 per cent in 2009, 2010, 2011 and 2012, respectively. Amounts above €300,000 are reduced by 11 per cent, 12 per cent, 13 per cent and 14 per cent, respectively in those same years (Council Regulation (EC) No 73/2009). The following correction is applied: a reduction of 6 and 7 per cent in 2009 and 2010, respectively.

[28] When interpreting these overall subsidy figures, it should be noted that this is an initial estimate as the values of the SPS payment entitlement may differ from case to case.

8. THE COSTS OF IMPLEMENTING SUSTAINABILITY CRITERIA

In order to be eligible for financial support and to count towards the targets set by the RED, biofuels need to comply with sustainability criteria introduced by Article 17 of the RED. Only biofuels not made with feedstock cultivated on land with high biodiversity values (i.e., undisturbed forests) or land with a high carbon stock, including wetlands and continuously forested areas or peat land, are considered sustainable under the provisions of this criteria. Most importantly, sustainable biofuels must achieve at least 35 per cent GHG emission savings compared with fossil fuels. From 2017 and 2018 onwards, these savings have to reach 50 and 60 per cent, respectively (see Jung, et al. 2010, p. 26ff. for more detailed information). The Biofuel Sustainability Ordinance enshrines the sustainability criteria stated in the RED into German law (FNR, 2011g). It came into force on November 2, 2009. As of January 1, 2011 only biofuels meeting the requirements of the Biofuel Sustainability Ordinance count towards the German mandatory blending targets and can receive tax exemptions and partial tax reductions (BLE, 2010, p. 10).[29] In order to ensure biomass is produced according to the European and German sustainability criteria, biofuels must be certified as being produced in such a way as to meet these criteria.

In Germany, there are currently two certification schemes—International Sustainability and Carbon Certification (ISCC) and the Gesellschaft zur Zertifizierung nachhaltig erzeugter Biomasse mbH (REDcert)—both officially recognized by the BLE (VDB, 2011g). All facilities that form part of the production and supply chain—starting with farms or plantations producing biofeedstocks, through to vegetable oil processing mills and refineries—must be certified by one of the two certification systems. The use of a mass balance system enables certifiers to trace the production process for certified biofuels back along the supply and production chain (for more detailed information, see BLE [2010] and VDB [2011g]). Each actor along the length of the supply chain has to provide a GHG balance figure in order to prove the production of the biofuels have complied with the emission-saving targets set for the whole supply chain. For example, a plantation has to consider GHG emissions from the cultivation, harvesting and handling of the feedstock. This can include the use of fertilizer, electricity and fossil fuel (ISCC, 2011). Some NGOs, such as Friends of the Earth Germany or Greenpeace Germany, are critical of the Biofuel Sustainability Ordinance, since the current certification methods do not take into account indirect land-use effects (ILUC) (BUND, 2010; Greenpeace, 2011).[30]

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[29] See BLE (2010, p. 10) for the sustainability requirements before that date.

[30] The term indirect land-use change (ILUC) refers to when existing agricultural land switches from being used for its current purpose to being used for the cultivation of biofeedstock. This can lead to the unintended release of carbon emissions as displaced farmers move to other areas to continue agricultural activity, often clearing forests or other high-value environmental areas in order to develop new agricultural land.

Environmental and conservation organizations such as Transport & Environment (T&E) and Birdlife International have analyzed the negative impacts of ILUC on reducing GHG emissions levels (BirdLife European Division [2009] and Kretschmer [2011] for studies, and EEA Scientific Committee [2011] for a brand new report). These organizations have called on the EU to review their biofuel strategy and to reassess the contribution of biofuels in helping prevent or reduce climate change.

In 2010, the EU undertook a public consultation on "ILUC and biofuels" to address the issue and seek advice on concrete policy options (EC, 2010b). In September 2011 it appeared the EU was set to maintain their current strategy (T&E, 2011).

The Federal Ministry of Finance provides an estimate for bureaucratic costs to the private sector associated with the 18 sustainability-reporting requirements in its draft law for the Biofuel Sustainability Ordinance. On an *ex ante* basis, the Ministry estimated the net financial burden to the private sector resulting from the sustainability reporting requirements. These costs were estimated at €6.43 million, of which €26,000 are one-time costs (no information was provided on the temporal distribution of these costs). As part of its draft law, the Federal Ministry of Finance recognized that introducing sustainability requirements might be linked with an increase in the market price for biofuels: given that producing sustainable biofuels is generally more expensive than producing non-sustainable ones, and that certification itself will incur costs. The compliance of the Biofuel Sustainability Ordinance is supervised by private certification bodies. However, the BLE approves and controls the certification systems and certifying bodies itself, resulting in further administrative costs to the government (BMF, 2009).

The costs of certification per litre of biofuel basis differs from case to case, but differences are—according to the head of meó Norbert Schmitz—not substantial (Agrarheute, 2010). This point of view is supported by Dr. Helmut Aniol, of Anklam oil mill, who thought that sustainability certification was not linked to significant costs for companies (Holler, 2010). A more detailed estimate for costs is provided by the BVP, which estimated certification fees to be on average 2 to 3 cents per litre for vegetable oil for a commercial vegetable oil processing mill (producing around 1 million litres per year), with an average certification cost of €2,000 to €3,000 (BVP, 2010). In 2009 former State Secretary at the BMELV Gert Lindemann anticipated certification costs to be around 1 to 2 per cent of the costs of biofuel feedstock (Awater, 2009).

9. ADDITIONAL EXPENSES FOR SERVICE STATION OPERATORS, FUEL RETAILERS AND THE MINERAL OIL INDUSTRY TO HANDLE E10

Since the beginning of 2011, E10—a blend with up to 10 per cent ethanol—has been available in Germany. In this section, the costs and problems associated with introducing a new biofuel blend are analyzed and discussed, drawing on the E10 experience as an example. Analysts must consider the additional expenses incurred by service station owners, fuel retailers and the mineral oil industry responsible for delivering E10 to consumers to understand a broader view of the issues involved with introducing blended biofuels or raising biofuel blends. The introduction and distribution of biodiesel blends (B5 and B7), lower concentration ethanol blends (E5) and pure biofuels (B100, vegetable oil and E85) have also been associated with additional costs incurred by fuel retailers. However, these costs are hard to estimate, as they were incurred in the past and there is little available data. The future costs for retailers and the mineral oil industry to handle the quantity of biofuels necessary to meet the 10 per cent target for renewables is also hard to forecast.

The introduction of E10 to the German domestic transport fuels market did not go as planned by the government. A lack of information on the product, uncertainties surrounding the compatibility of E10 with motorist's vehicles and unclear regulations concerning vehicle guarantees led to a consumer boycott of the product in Germany. As a result, the roll-out of E10 has slowed down and, in March 2011, E10 was available at approximately only half of German fuel retailers (dpa-AFX, 2011c).

Box 4: The E10 disaster

E10 was poorly received by the German population. To illustrate, two months after its introduction, the police in Schleswig-Holstein—a German federal state—refused to put E10 in their police vehicles. This, despite the fact that most of the police fleet of 160 cars came from Volkswagen, who provide information assuring drivers of the compatibility of their vehicles with E10. According to Focus Online, there is good consumer information regarding the compatibility of various Volkswagen models with E10, with only few models not E10 compatible. However, Jessica Wessel—spokeswoman of the Schleswig-Hohlstein's police office—argued that "Before we completely bring the functioning of our fleet to stand still or risk greater repairs, we prefer to play safe" (Focus Online, 2011).

At the European level, the launch of E10 blends was made possible through the adoption of the Biofuel Quality Directive EC/2009/30 on April 23, 2009, which amends Directive EC/98/70.[31] However, up to that point in time, only a few European countries had decided to introduce E10. France, for example, successfully introduced E10 in April 2009, avoiding any issues associated with vehicle compatibility and prices through a well-organized and promoted public launch (Vierhout, 2011; Bundesverband der deutschen Bioethanolwirtschaft e.V. [BDB^e], 2011).[32] Germany intended to introduce E10 around the same time as France, but the plan was put on hold in April 2008 (dpa-AFX, 2011a). Two years later, on December 8, 2010, the Directive on the Properties and Labelling of the Quality of Fuels (10th BImSchV) went into effect and authorized the introduction of the E10 blend.

The big difference between blends, such as E5 blends and E10, is that not all cars are compatible with E10 blends, while all vehicles can run on E5 blends. In the worst case scenario, a non-compatible vehicle running on E10 may end up with a damaged engine (BDB^e, 2011). However, theoretically vehicle compatibility with E10 is not a major issue. In Germany, 93 per cent of all gasoline-driven cars and 99 per cent of the cars produced by German companies can run successfully on E10 (Verband der Automobilindustrie [VDA], 2011).[33]

Fuel retailers had to modify their equipment at service stations in order to provide E10. Cash points and signage had to be changed and petrol pumps and petrol nozzles relabelled. In order to prevent costumers from filling up with the wrong fuel, a round sticker had to be placed on the nozzle of E10 pumps, informing the customer they are using "Super or Super Plus E10 sulfur-free." Additional information had to be made available at the fuel dispenser— communicating to the motorist that the fuel "Contains up to 10 per cent ethanol" and asking "Is your car E10 compatible? Get producer information! In case of doubt fill up with Super or Super Plus" (ADAC, 2011).

Refineries had to make some adjustments too. The technical equipment for producing blends had been available to refining companies since the introduction of E5 (BDB^e, 2010). The real cost of service station conversions is difficult to determine. Deinhard Dittert—the head of the Bundesverband Freier Tankstellen e.V. (BFT)—estimates that the E10 conversion costs come to many thousands of Euros per service station (BFT, 2011). Exact costs are difficult to calculate but Table 13 provides some illustration.

[31] The basis for using E10 is the Biofuel Quality Directive EC/2009/30 and not the RED EC/2009/28, which is often accidently cited the relevant directive.
[32] E10 has been available for quite some time in Australia, New Zealand and the USA (BDB^e, 2011).
[33] The Deutsche Automobil Treuhand (DAT) (2011) provides a list of E10 compatible vehicles on the Internet.

TABLE 13. CONVERSION COST (IN EUROS)

Service stations	14,744	
Estimated costs of conversion per service station	1,000	9,000
Estimated total costs of conversion	14,744,000	132,696,000

Source: Author's calculation using Energie Informationsdienst {EID} (2011) and assumption made by the authors.

Using the calculation made by Deinhard Dittert allows a rough estimate of the conversion costs based on the 14,744 service stations in Germany (EID, 2011): the cost of conversions are estimated to be between €15 million and €133 million.[34] The range of this estimate is broad, given the lack of information available for calculating the conversion costs. This broad estimate is generally supported by a statement from Esso's spokeswoman Gabriele Radke. While there was not a lot of detail in the statement, the conversion costs for the whole mineral oil industry was thought to be in the millions of Euros (Bild, 2011c). The Association of the German Petroleum Industry (MWV) also noted the cost for introducing the E10 blend was in the hundreds of millions range, however, a breakdown of the underlying costs was not provided (MWV, 2011c).

The Directive concerning the Properties and Labelling of the Quality of Fuels changed the private sector-government reporting requirements relating to bureaucratic costs incurred as a result of the Directive. Consequently, the Federal Government of Germany (2010e) provided an *ex ante* estimate of these costs, which included a one-time cost for service station operators of around €129,500 for buying and placing information stickers, as well as complying with other related duties for supplying information to customers. The future costs for procuring replacement materials linked to signage—for example, stickers advising motorists of the fuels they were using— were *ex ante* estimated to be around €6,475 annually.

Before the introduction of E10, German service stations commonly had just two E5 blends in stock: Super, which is an E5 blend with a 95 octane rating, and Super Plus, which is an E5 blend with a 98 octane rating. When introducing the E10 fuel, service stations replaced Super with E10. Thus, there were no costs for installing new storage tanks. The service stations and fuel retailers only retained one E5 blend—Super Plus (with 98 octane)—which is more expensive than Super. As E10 requires up to 10 per cent ethanol content, service station operators gradually filled up their tanks for Super with E10 or rather Super E10 with 95 octane.[35] According to the MWV (2011d) the reason for this switch is due to restrictions in production possibilities and in the numbers of tanks available in refineries, fuel depots and service stations. To provide three different petrol-based fuels would have incurred significant additional costs for the costumers (MWV 2011d).[36]

Even though the pump price for Super Plus E5 was above the pump price for Super E10, 7 out of 10 German consumers preferred to pay the higher price in February 2011 (dpa-AFX, 2011b). In March 2011 61 per cent of the German people were supporting a halt to the introduction of E10 and only 32 per cent were supporting a continuation of the roll out (Infratest dimap, 2011).

[34] Note: Due to the failed market introduction of E10, not all German fuel retailers provide E10 yet.

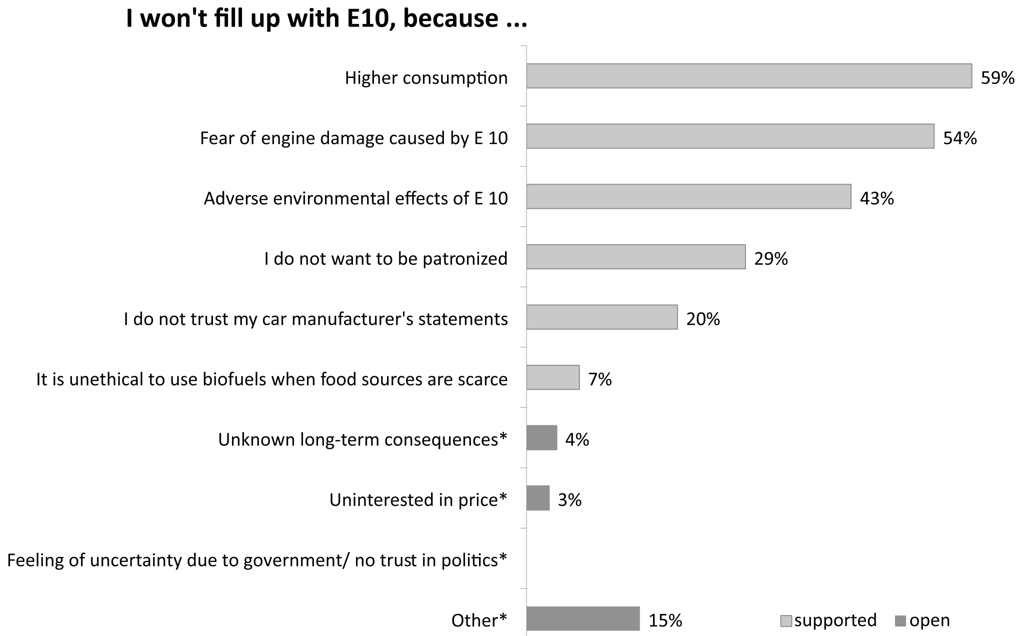
[35] The ADAC online editorial office did spot tests to determine whether service stations that were officially already providing E10 to consumers were, in fact, really doing so (while noting E10 only demands up to 10 per cent ethanol). ADAC found that 12 out of the 13 service stations tested still provided Super (E5), but had relabelled their pump nozzles as providing Super E10 (Luca & Vigl, 2011).

[36] The mineral oil firms bypassed a provision in the Directive on the Properties and Labelling of the Quality of Fuels, which obligated them to provide E10 in addition to providing E5 blends. The mineral oil industry interpreted the Directive on the Properties and Labelling of the Quality of Fuels in a different way than the German government (see MVW [2011b] for their position). In March 2011 Environment Minister Norbert Röttgen emphasized that the German government suggested that service stations should maintain both E5 blends in stock when providing E10 (Röttgen, 2011).

Box 5: A survey of the reasons why E10 was opposed

According to a survey by the MWV in April 2011, 75 per cent of German motorists were informed about the compatibility of E10 with their vehicles (n=1.031). However, only 22 per cent of the motorists filled up with E10 the last time they refuelled their vehicle. Only 30 per cent of those who confirmed that E10 was compatible with their vehicle were positive about refuelling with E10 in future. Twenty-three per cent were undecided, while the remaining 47 per cent were sure they would not use E10 in future. The main reasons for refusing to fill up with E10 (n=322) were higher transport fuel consumption, fear of engine damage and the adverse environmental effects of E10 (MWV, 2011a).

FIGURE 11. REASONS FOR E10 REFUSAL



Note: *Multiple answers. Source: MWV (2011a)

However, while some opposition to blended biofuels from motorists exists, the quota system makes the introduction of E10 very important for the mineral oil industry. According to the MWV, the quotas could only be met through the use of E10 (MWV, 2010). This is why the head of MWV, Klaus Picard, asked for public support by publically demanding in *Bild*—a major German yellow press paper—for the abolishment of quota-related penalties that the mineral oil companies might incur in 2011 and for “fair taxation” of E10. This was in case the industry did not meet the quotas (Bild, 2011a, 2011b).[37] [38] However, for the moment there is no reason to believe that the German government is seriously considering these demands.[39]

[37] An industry association anticipates penalties of up to €456 million for 2011 (around 2 cents per litre) (Hawranek & Neubacher, 2011).

[38] The anticipated penalties were the subject of an explosive discussion between German Minister for Environment Norbert Röttgen and the head of MWV, Klaus Picard, at the “petrol summit.” It was reported by participants that VDI-Nachrichten Klaus Picard was unwilling to deny that an additional charge of 2 cents per liter had been included in the price for E10 petrol in order to pay for possible penalties related to not reaching the legally mandated quota (Trechow, 2011).

[39] See Spiegel Online (2011) for the statement provided by the spokesmen of the German Federal Minister of Finance Wolfgang Schäuble, and Buchsteiner (2011) for an interview with Federal Minister of Food, Agriculture and Consumer Protection Ilse Aigner.

10. CONCLUSION

In order to foster and promote the use of renewable energies, the German government—as other European member states have—intervenes in the market for transport fuels. The common public-support schemes for biofuels in Europe and Germany are tax exemptions and mandatory blending requirements. The biofuels industry created through government support would likely be unable to sustain itself, or at least not to the extent it has, without government intervention to reduce the cost of producing biofuels and help to ensure for it a share of the transport fuels market.

The study promotes the notion that it is important to identify and estimate the costs of biofuels, as they involve significant public funding. These costs can include higher production costs for biofuels; the costs of government agencies to supervise and monitor biofuel-related activities and policies; the costs of subsidies for growing biofuel feedstock; or the costs of infrastructure conversion and upgrading, paid for by service station operators, fuel retailers and the mineral oil industry. This study sought to improve the understanding of the costs associated with reaching the 10 per cent target of renewables in transport.

Having identified a number of additional costs to society linked to the German government's biofuel strategy, the next step should be to identify who is responsible for meeting these costs. In Section 4, recent trends and developments in the German biofuels support scheme were summarized. It was noted that direct fiscal costs related to German biofuel policies were reasonably low, as Germany employs a mix of policies to stimulate the biofuels industry. It combines a mandatory blending target with tax exemptions or reduced excise tax rates for pure biofuels outside the quota and provides a quota trade system. However, there are some administrative costs for the government to implement and monitor biofuel-related activities, as well as the subsidies paid to farmers growing biofuel feedstock as part of the SPS scheme. Since the mandatory blending requirements shift the costs to the private sector—the consumers and producers of biofuels—it is the private sector that is burdened with the majority of the costs. Due the lack of market transparency, it is difficult to determine exactly if the producers or the consumers pay for the additional costs resulting from Germany's domestic biofuel policies. Given the biofuel industry's oligopolistic market structure and inelasticity of demand for biofuels—at least in the short term—it seems likely that consumers will be the ones who pay for these additional costs through higher transport fuel prices.

If Germany wishes to continue its current support policies, the government should increase the transparency of information and data for the transport and biofuel markets. In several draft laws (for example, in Federal Government of Germany, 2008b), the German government refers to the fact that the price effect of raising the quota is *ex ante* challenging to determine. The effects of mandatory blending requirements on the costs of producing biofuels and their market price is unclear and difficult to control. This is a disadvantage to analysts and policy-makers wanting to help improve the sustainability of current biofuel policies. To use mandatory blending targets instead of tax exemptions or subsidies does have one advantage for the government's budget in that it relieves the public purse. Hence, not all taxpayers pay for the burden of supporting the biofuels industry; instead, any additional costs are passed onto the private sector and those motorists using the fuels.

It is important that mandatory blending requirements be recognized as a support mechanism for the industry, as they secure a share of the transport fuels market for biofuel producers. As mandatory blending requirements do not involve significant direct costs for the government, there is less incentive for the government to monitor their impacts or to remove the mandate in the future.

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* **The FiFo Institute for Public Economics, University of Cologne** (Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln) was founded in 1927. It is an independent, non-profit institute pursuing economic research and policy consultancy in fiscal and budget policy, taxation and fiscal relations.

THE GLOBAL SUBSIDIES INITIATIVE (GSI) OF THE INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT (IISD)

The International Institute for Sustainable Development (IISD) launched the Global Subsidies Initiative (GSI) in December 2005 to put a spotlight on subsidies – transfers of public money to private interests – and how they undermine efforts to put the world economy on a path toward sustainable development.

Subsidies are powerful instruments. They can play a legitimate role in securing public goods that would otherwise remain beyond reach. But they can also be easily subverted. The interests of lobbyists and the electoral ambitions of officeholders can hijack public policy. Therefore, the GSI starts from the premise that full transparency and public accountability for the stated aims of public expenditure must be the cornerstones of any subsidy program.

But the case for scrutiny goes further. Even when subsidies are legitimate instruments of public policy, their efficacy – their fitness for purpose – must still be demonstrated. All too often, the unintended and unforeseen consequences of poorly designed subsidies overwhelm the benefits claimed for these programs. Meanwhile, the citizens who foot the bills remain in the dark.

When subsidies are the principal cause of the perpetuation of a fundamentally unfair trading system, and lie at the root of serious environmental degradation, the questions have to be asked: Is this how taxpayers want their money spent? And should they, through their taxes, support such counterproductive outcomes?

Eliminating harmful subsidies would free up scarce funds to support more worthy causes. The GSI's challenge to those who advocate creating or maintaining particular subsidies is that they should be able to demonstrate that the subsidies are environmentally, socially and economically sustainable – and that they do not undermine the development chances of some of the poorest producers in the world.

To encourage this, the GSI, in cooperation with a growing international network of research and media partners, seeks to lay bare just what good or harm public subsidies are doing; to encourage public debate and awareness of the options that are available; and to help provide policy-makers with the tools they need to secure sustainable outcomes for our societies and our planet

www.globalsubsidies.org

The GSI is an initiative of the International Institute for Sustainable Development (IISD). Established in 1990, the IISD is a Canadian-based not-for-profit organization with a diverse team of more than 150 people located in more than 30 countries. The GSI is headquartered in Geneva, Switzerland and works with partners located around the world. Its principal funders have included the governments of Denmark, the Netherlands, New Zealand, Norway, Sweden and the United Kingdom. The William and Flora Hewlett Foundation have also contributed to funding GSI research and communications activities.

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