Kirsten Selbmann[1]
Felix Kaup*

Biofuels in Germany – Historical Trends and Impact Factors Set Course for Prospective Design of Policies

For presentation at the *SGIR 7th Pan-European International Relations Conference, Stockholm, 9–11 September 2010*
Section 10 – Energy Resources and Social Change

Draft version, not to quote.

Abstract
Within the ongoing quest for an increasing replacement of fossil energy, biofuels are currently seen as a solution to partly substitute conventional fuels like gasoline and diesel. Although the capacity of fuel-converted-biomass is and should be limited, biofuels today represent the sole option for a larger scale substitution of mobility oriented energy carriers. Thus a multitude of impact factors with respect to biofuels determine the policies and strategic approaches of governments and societies. For the case of Germany the exertion of influence by different stakeholders and discourses will be analytically traced along historical-political events that resulted in the current biofuel policies. The analytical depiction of biofuel technologies, regulatory measures and their implementation allows for prioritization and hierarchization of relevant impact factors and exertions of influence. It shows, e.g., that the origins of biofuel industries was first of all a result of adaptations towards supranational market shifts and only in the second place a strategical concept of supporting renewable energy. That twofold approach of concentrating on both the historical development of the biofuel industry in Germany and the impact factors will not only allow to illustrate today's "lock-in" situation within the biofuel sector but also to deduce possible future scenarios.

Structure:

1&* Potsdam Institute for Climate Impact Research, Research Domain III – Sustainable Solutions. Project: Biofuel as Social Fuel. felix.kaup@pik-potsdam.de

1 Historical Summary

Expecting a world population of over 9 billion people by 2050[2] and thus a continuous increase in energy demand, political, scientific and economic stakeholders and societies in general are being challenged in developing less energy intensive ways of consumption. Especially if it comes to the finite energy sources (these include fossil ones but as well nuclear energy) and resources lower consumption patterns have to be identified and implemented.

Renewable energies offer the possibility of substituting finite energies and thereby reducing CO_2 emissions and conserving the finite resources for higher value purposes than a mere energy conversion. Biomass to energy conversion is on a national (German) and a global scale by far the largest and most utilized within the renewable energies[3]; furthermore biomass is a very promising energy carrier with a high potential to reduce CO_2 emissions, substitute fossil energy and a multitude of possible additional benefits. Due to its characteristics of advantageous storage and transportation abilities (whereas other renewable energies as wind and solar energy are directly converted into electricity and are subject to weather fluctuations) biomass energy especially in liquid form (as most biofuels) is high valued and plays a large part in most of the future energy scenarios.

Since biomass and biofuels are as well subject to intensive scientific debates and heated public discussions this paper picks up historical developments, future potentials and current debates to analyze the emergence of the biofuel sector in Germany, the exertion of influence of the involved stakeholders and possible future scenarios.

Green movement in Germany

Two main factors appear crucial to explaining why biofuels gained momentum in Germany. On the one hand, the revised Common Agricultural Policy (CAP) of the European Union facilitated general regulations in order to cultivate not just for food, feed and fiber but as well for fuel whereas on the other hand the development of a "Green Conscience" among civil movements towards political parties in Germany led to a strong emphasis on ecological and environmental issues over the last 40 years, partially mirrored by the implemented legislation.

2 The United Nation Population Division states in its 2008 revision of the "World Population Prospects" that the medium variant projection for the world population by 2050 is 9,15 billion whereas 7,94 for the low and 10,46 for the high projection (UN 2008).

3 The proportion of renewable energies of the total primary energy consumption reached 10,1% in 2009 in Germany, whereof 7,0% were derived from biomass (BMU 2010). On a global scale the biomass proportion of the total primary energy consumption sums up to 10% thereby representing the largest part of the 12,2% renewable energies in total (WBGU 2008).

Germany as a densely populated country in the middle of Europe surrounded by other industrialized neighbors already felt in the late 70ties the negative effects of the ruthless environmental exploitation throughout the last decades. Acid rain, forest decline and an increasing pollution of air and water were environmental damages that occurred and posed questions about the anthropogenic effects on the environment and the planet itself.[4] Realizing the consequences of our actions first environmental movements were born in the mid 70ties willing to protest against the sole primacy of economic reasoning. Nature conservation organizations as the BUND (Coalition for Environment and Nature Conservation) or Anti-Nuclear Energy Initiatives as the BBU (Federal Association of Civil Initiatives for Environmental Conservation) were funded (Brand 2008; Rucht 2008) and created awareness in the German society. This consolidated network of alternative projects and civil initiatives was a grassroots democracy movement that led to the foundation of the Green Party (Die Grünen). The beginning of the 80ties showed distinct tendencies of institutionalization of the West-German ecology movement.[5] In 1983 "Die Grünen" moved into the German parliament and stabilized themselves as the fourth German party. Ecological modernization became a central concern and an innovative perspective of societal and economical development (Jänicke 1993).[6]

At the beginning of the 90ties within the process of reunification of East and West Germany environmental and ecological debates were not as prevalent any more since traditional economic issues of growth and costs arguments came into the fore again. Social and economical implications lay in the focus of governmental action and investment promotion programs were dominant issues evaluating and financing the demands in East Germany. Perceptible amelioration of the ecological situation in Germany happened only by the decommission and/or modernization of industrial facilities[7] and by excluding lignite as an energy carrier in the "Neue Länder" (the five new federal states). Nevertheless the rise of new and global environmental challenges as deforestation, desertification, the ozone hole,

4 The reports of the "Club of Rome" and their "Limits to Growth" in 1972 explained the limited resources and the closed system that can lead to an ultimate carrying capacity (Meadows et al. 1972). In 1973 the first "Oil Crises" marked an incidence where the depletion of natural resources was palpable but as a first reaction rather led to an extension of nuclear energy than a development of alternatives. Environmental issues were seen as rather having a negative effect on economic growth and development than being part of the governmental strategy.

5 Due to the Chernobyl catastrophe in 1986 a new ministry the *"Federal Ministry for Environment, Nature Conservation and Nuclear Protection"* was created.

6 Environmental - friendly behavior was widely accepted within the day-to-day life and even industries were starting to think about integrated environmental protection.

7 State-owned industries during the socialist government such as Bitterfeld (Chemical Industry) and Schwedt (Petrochemistry) had de jure environmental standards but they were not enforced. Still most of the decommissions during reunification were rather economically motivated than based on ecological reasoning.

overfishing and climate change, i.a. had to be encountered with a more integrated approach of preemptive environmental policies and protection services (Brand 2008).

The general principle of a sustainable development that emerged in the mid 90ties gave a fitting framework for a needed conceptual reorientation. The linkage of ecologic, economic and social development aspects led to a long term strategy of securing resources under the proposition of inter-generational justice. Although the concept of sustainable development has remained a very general and vague principle it enables an approach of integrating government and civil society (Brand 2008). In 1998 the first proposal for a national strategy for sustainable development was formulated. It took the German government another four years to present the German Strategy for Sustainable Development compiling 21 key indicators to give a comprehensive overview of the most important developments and to function as a performance review (Bundesregierung 2002).[8]

The vital awareness of necessary changes within environmental politics of the German public and society created an environment that helped and pushed the government to pass and implement legislation encompassing solid nature conservation and environmental protection measures as well as incentives for utilizing alternative energy technologies. Already in 1991 the so called "Electricity Feed-in Law" (Stromeinpeisungsgesetz StrEG) gave small and medium size energy producers access to the German grid which had been prevented before by the large energy enterprises. In 2000 the renowned "German Renewable Energy Act" (Erneuerbare Energien Gesetz EEG) was enacted which stood model for similar energy laws that were implemented all around the globe (Lagniß et al. 2009). Nevertheless in order to understand and analyze the development of the German bioenergy sector it is necessary to have a closer look into the development of agriculture and the European agricultural policies.

Agricultural Policies

In order to understand today's situation and the agricultural set up where Non-Food rapeseed is cultivated it is necessary to look into the historical development of the European agricultural policy. Ecological motives as well as a longing for self-supply and an increasing independence may have been important reasons for promoting and supporting a possible substitute for fossil fuels but it must be acknowledged that the structural or rather institutional conditions were the decisive factor. The Common Agricultural Policy (CAP) of the European

8 The German government has targeted the submission of a progress report every two years disclosing the results of national politics and the fields of further need for action. Federal and state governments as well as municipalities and the industry are to present results and implemented changes on the 21 key indicators (Diefenbacher et al. 2004).

Union was determinant for cultivating Non – Food crops. The conclusion of the European Economic Community (EEC) treaties in 1957 constituted the foundation of the common agricultural market. The crucial agrarian competences were adjudicated to European bodies and thereby separated from national policy and sovereignty (Brocks 2001). In the early sixties the European Community still was a net importer of agricultural products so that the establishment of a self-sufficient domestic supply was the primary target of the community. Price support systems for agricultural goods were introduced and guaranteed by the European Community (Akalpler 2006). If the set administered prices at the domestic market were undercut governmental bodies made "intervention purchases"[9] as an instrument to still guarantee the set prices which referred to the production volume of the European agriculture. The higher the output volume the more payments the farmers received. Thus an intensification of cultivation followed further fostered by the factor of technological advancements. Soon the continuously increasing production volume of agricultural goods met stagnant European markets. The infamous "butter mountains" and "milk lakes" resulted from the volume focused policies.[10] Those production surpluses were then offered on the world market at significantly reduced prices. Consequently the market ordinance of the Common Agricultural Policy led to exports of subsidized agricultural commodities which exacerbated the Non-European competitors. Furthermore the highly intensified agriculture had perceptible impacts on the environment. Due to increasing use remnants of pesticides and fertilizer could be found in the products and the groundwater. Those effects in combination with increasing expenses made a reform of the CAP an absolute necessity.

In 1992 the ordinance of the CAP reform came into effect and was supposed to be an answer to the above mentioned problems of the production and volume focused policies (Tarditi & Zanias 2001).[11] The price support systems as well as the intervention purchases were significantly reduced. In order to absorb the farmers loss of income that was accompanied by the reform arable area payments and compensatory direct payments were introduced, shifting the system from primarily volume- to area-related payments. With respect to the rise of

9 The intervention purchases retracted the production surpluses from the market in order to warehouse and resell them when regional or world market conditions are suitable, or destroying the products in the unfavorable case. Thereby the reduction of the market volume stabilized the producers prices (Ackrill 2000).

10 Furthermore the destruction of the agricultural surpluses led to a bad reputation of the European agriculture due to the peoples lack of understanding when destroying highly subsidized foods while in other parts of the world people were starving.

11 Additionally the CAP reform was supposed to strengthen the position of the EU in the coming GATT (General Agreements on Tariffs and Trade) negotiations (Uruguay Round in 1994). Still the unity of European markets, prioritization of the community and financial solidarity stayed the three principal elements of the CAP (European Commission 1996).

biofuels, the most important modification within the CAP reform was the introduction of set-aside areas.

Requirement for the arable area payments to the farmer was the partial conversion of agricultural area into set-aside area with the objective to prevent and limit production surpluses and the recovery of natural habitat. The set-aside quota was annually stipulated by the EU and constituted between 5% and 15% of the total agricultural area. Arable area payments with a distinct premium were also assigned for those set-aside areas. The importance for the development of biofuels was the fact that the farmers were allowed under the requirement of only producing Non-Food crops to cultivate renewable materials on those set-aside areas without loosing the EU payments. Regarding oil crops as rape seed this led to a different treatment of rape seed for food and for Non-Food purposes. As long as the farmer had guaranteed off-take agreements the rape seed cultivated on the set-aside areas for Non-Food purposes could be sold and the arable area payments would still be settled. Thus the set-aside quota introduced by the CAP reform in 1992 can be considered as the first strong impetus for the development of biofuel production and industry in Germany (Brocks 2001). It was rather the agro-political decision of preventing agricultural surpluses by directing the production to alternative uses than elaborating concepts of emission and energy issues (Nitsch 2003).

Within the GATT agreements in 1994 (Uruguay Round) and improved market access for many agricultural products the European Union and the United Stated of America agreed on limiting the oil seed cultivation in Europe (Spero & Hart 2009).[12] The so called "Blair-House Accord" further regulated the amount of rape seed cake that was to be produced in Germany and the EU. Thus biofuel development was also subject to international trade negotiations although the strongest impacts on the emerging bioenergy industry came from national and EU level.

Biofuel Policies

The 1992 German Mineral Oil Tax Law (MinöStG) considered only mineral oil based fuels as those on which to impose the respective taxation. Consequently, pure biofuels were exempted until 2004. With the amendment of §2a in January 2004, biofuels were included in the Mineral Oil Tax Law, but were explicitly guaranteed a tax privilege (which basically was a tax exemption) until the end of 2009. Yet it included the clause of an annual revision of §2a if

12 The total adjudicated area for Europe aggregated to 5,484 Mio ha. whereas Germany was limited to 929 000 ha reduced by the set-aside area or at least 10%.

the tax privilege should result in an over compensation of biofuels (MinöStG 2004). Slowly the sector began to professionalize and it was the ambition of early investors and companies by running various test in cars, trucks and agricultural machinery to produce continuously a reliable quality of biodiesel. By 1997 the DIN 51606 fuel standard for biodiesel was established comprising mandatory quality parameters. The national standardization led to warranties by the car manufactures which was decisive for most end consumers (Thuijl & Deurwaader 2006). In 1999 the leading biodiesel producers and distributors founded the *"Working Group Quality Management Biodiesel e.V."* (AGQM) in order to further guarantee the compliance with the standard parameters directly at the petrol stations (AGQM 2010).[13] This regulatory framework and the continuous interest of investors and companies to expand the biofuel sector in Germany led to a biodiesel peak production capacity of almost 5 Mio tons in 2008. As shown in Figure 1 this large capacity was never met since a new biofuel legislation was introduced in 2007 after a change of government by the end of 2005.[14]

The introduction of the Energy Tax Law (EnergieStG) in August 2006 and the Biofuel Quota Law (BioKraftQuG) beginning of 2007 marked a turnaround in Germany's hitherto successful biofuel sector development[15]. The annually rising taxation of biodiesel and vegetable oil resulted in an immediate fall in demand of those fuels used by vehicles running on pure biofuels, mostly hauler trucks and other large scale machinery. The Biofuel Quota Law mitigated the negative impact of the new legislation since the production capacities could partially be used for the mandatory blending but the pure biofuel sector rapidly declined (Biofuels Barometer 2010)[16].

Figure 1 presents the overall production and the production capacities of biodiesel in Germany and clearly shows the rapid expansion of the sector and as well the effects of a

13 For example stocking biodiesel can result in quality problems during storage if the fuel is exposed to high temperatures or additional water. This leads to an increasing biodiesel degradation rate (Leung et al. 2006). On the other hand the biodegradability can be a positive characteristic when problems with leakage or spillage occur or when operated in environmental sensitive areas.

14 Investors did not expect a renunciation of the Mineral Oil Tax Law §2a that guaranteed a tax privilege until 2009. The clause that there would be an annual revision of over compensation induced by §2a was not expected to come into effect. Furthermore large-scale investments as the concession and realization of a biodiesel plant are mostly subject to long planning and implementation periods. Therefore some investors were already in the process of setting up a new biodiesel plant when the the legislation came into effect. Because in 2005 the German government announced an overcompensation for biodiesel and vegetable oil and therefore declared a change of legislation necessary (Deutscher Bundestag 2005).

15 The intention of the Energy Tax Law was to successively increase the tax for biodiesel and vegetable oil and reach the same tax level as the mineral oil tax in 2013. The Biofuel Quota Law regulates the mandatory blending of biodiesel and ethanol with the fossil fuels. When implemented it was planned to reach a 10% mandatory blending of biofuel by 2020. The current blending ratio in Germany is 6,25% in 2010 (BMU 2008).

16 This led to an adaptation of the Energy Tax Law. In 2009 the German government adjusted the law by suspending the incremental taxation. Between 2009 and 2012 there will be no further tax increase. From 2013 on the levied taxes correspond to those of fossil diesel (UFOP 2010).

changing legislation. Not only had the biofuel industry to deal with a new and less supportive legislation in 2007 but various reports and studies from NGOs and research institutes indicated that biofuels and bioenergy were not the panacea as which the biofuel industry liked to present their sector. During the early years of the expanding sector, the ecological benefit of biodiesel and vegetable oil were often promoted as "zero-emission", justified by the characteristic of rape seed as a renewable primary product.[17]

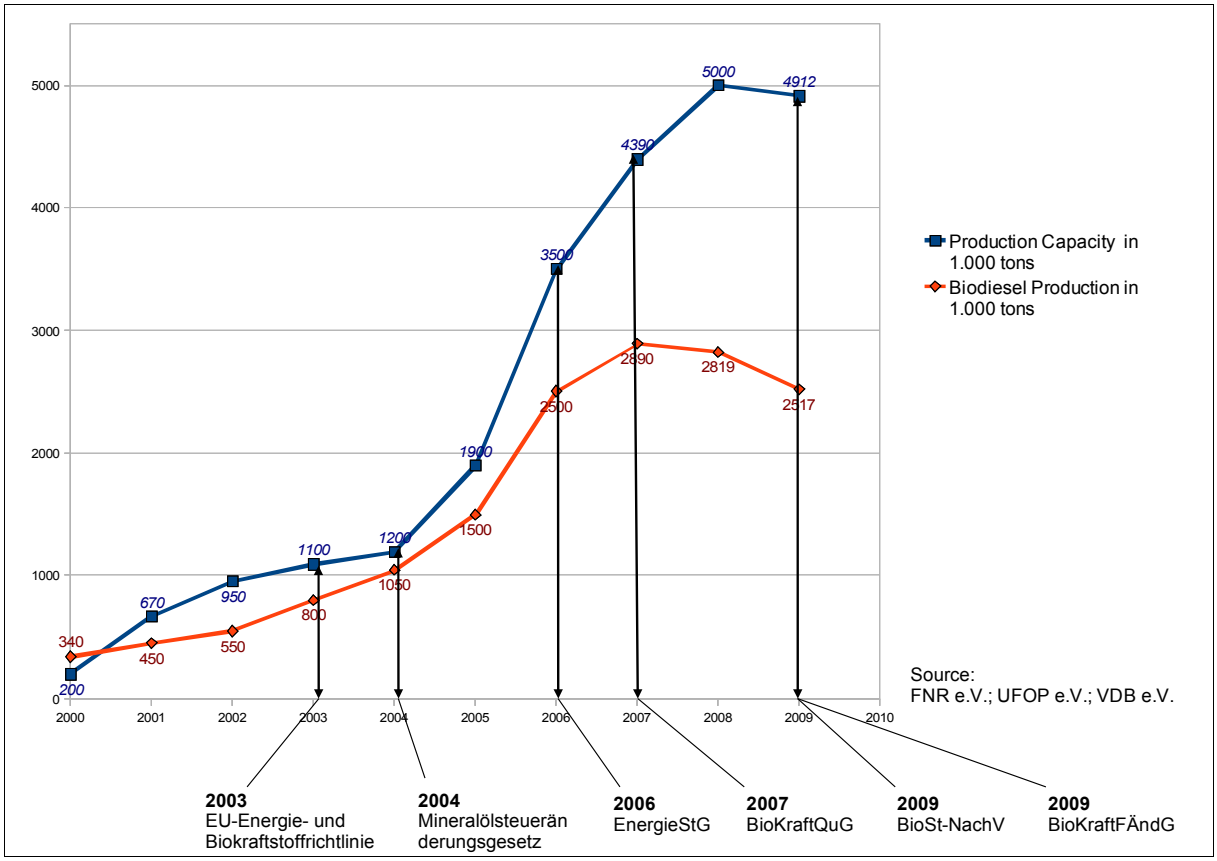

Figure 1

Due to media coverage especially during the end of 2006 and 2007 highlighting biofuels' adverse effects such as deforestation, famine and inefficiencies, public opinion grew resentful towards the industry (this aspect will be resumed in the following sections). Those incidents caused by allegedly clean and green energies were not to be tolerated by the government and the public as well as by the industry itself trying to constitute their good intentions (Searchinger et al. 2009).[18] These intensively led and still ongoing debates about pro and

17 After the first couple of years of successful use and the sharply increasing production capacities and production of biodiesel in Germany (see Figure 1) it became clear that biodiesel had to be held accountable for CO_2 emissions as well. The direct energy input during cultivation, production and distribution had to be considered as part of the biofuel value chain therefore emitting CO_2 along the life cycle.

18 It has to be noted that the news and reports causing this public outcry were not all based on consistent facts. But the anger was righteous since the implications and effects of biofuels production are far reaching. Recently land-use-change (LUC) and indirect land-use-change (iLUC) effects of biofuels on CO_2 reduction potentials were demanded to be included into the GHG (greenhouse gas) calculation by NGOs, scientific and governmental institutions (ifeu 2009; Fritsche & Wiegmann 2008). Those claims resulted in the below

contra of the bioenergy/biofuel sector resulted in the latest legislative measures called the *Biofuel Sustainability Ordinance* (BioKraft-NachV) and the *Biomass Electricity Sustainability Ordinance* (BioSt-NachV). These ordinances list the sustainability requirements for a alternatively produced fuel to be classified as a biofuel (BioKraft-NachV 2009)[19]and biomass for the production of electricity and heat (BioSt-NachV 2009). Furthermore, it stipulates that from 2011 on it is mandatory for the German biofuel sector to get their products certified (if they want to be granted the existing tax and blending privileges) by an independent organization in order to proof that their goods originate from sustainable cultivation and production processes. There are currently two certification systems (*ISCC System GmbH and REDcert GmbH* i.G) that are approved by the executing government agency *(BLE – Federal Agency for Agriculture and Alimentation)*. How successful and effective the certification schemes will be yet remains to be answered.

2 Stakeholder

The stakeholders involved in the process of developing the biofuel sector in Germany and those who influenced legislation and public perception are manifold and therefore this paper does not claim to present all actors within the bioenergy sector. But the diverse policies, opinions and positions of some of the most important ones will be described and their exertions of influence presented. Basically it can be distinguished between four groups of stakeholders: governmental institutions, the private sector (companies and associations), scientific institutions and NGOs. It will be shown that the stakeholders with references to the biofuel sector increased considerably between 2000 and 2010, which can be explained with the growing relevance of the sector (not only within the four groups of stakeholders but as well in the public awareness). Furthermore, it is interesting to show that during the development of the sector some of those stakeholders altered and adjusted their positions. Figure 2 the development of stakeholders between 2000 and 2010. It shows the augmentation of actors within the important years of the biofuel sector.

The private sector

Stakeholders of the private sector were among the first movers realizing that the production of biodiesel and vegetable oil was becoming a promising venture, combining the characteristics

mentioned certification schemes.

19 Indicators and/or requirements are for example: High Conservation Value (HCV) areas where cultivation of energy crops is strictly prohibited; the calculation of GHG reduction potentials of the various biofuels from different energy crops and the compliance with a certain sustainable agrarian cultivation.

of a diesel substitute with ecological and economic advantages. The increasing mineral oil tax for fossil fuels reaching 65,45 €ct/l for petrol and 47.04 €ct/l for sulfur-free diesel (EnergieStG §2 2006) in 2003 was one of the decisive factors for investments in biodiesel production[20]. As mentioned in the preceding section biodiesel and vegetable oil were promoted as "zero- or low-emission" fuels, helping to fulfill the CO_2 reduction goals of the German government in the mobility sector (BioKraftQuG 2006).[21]

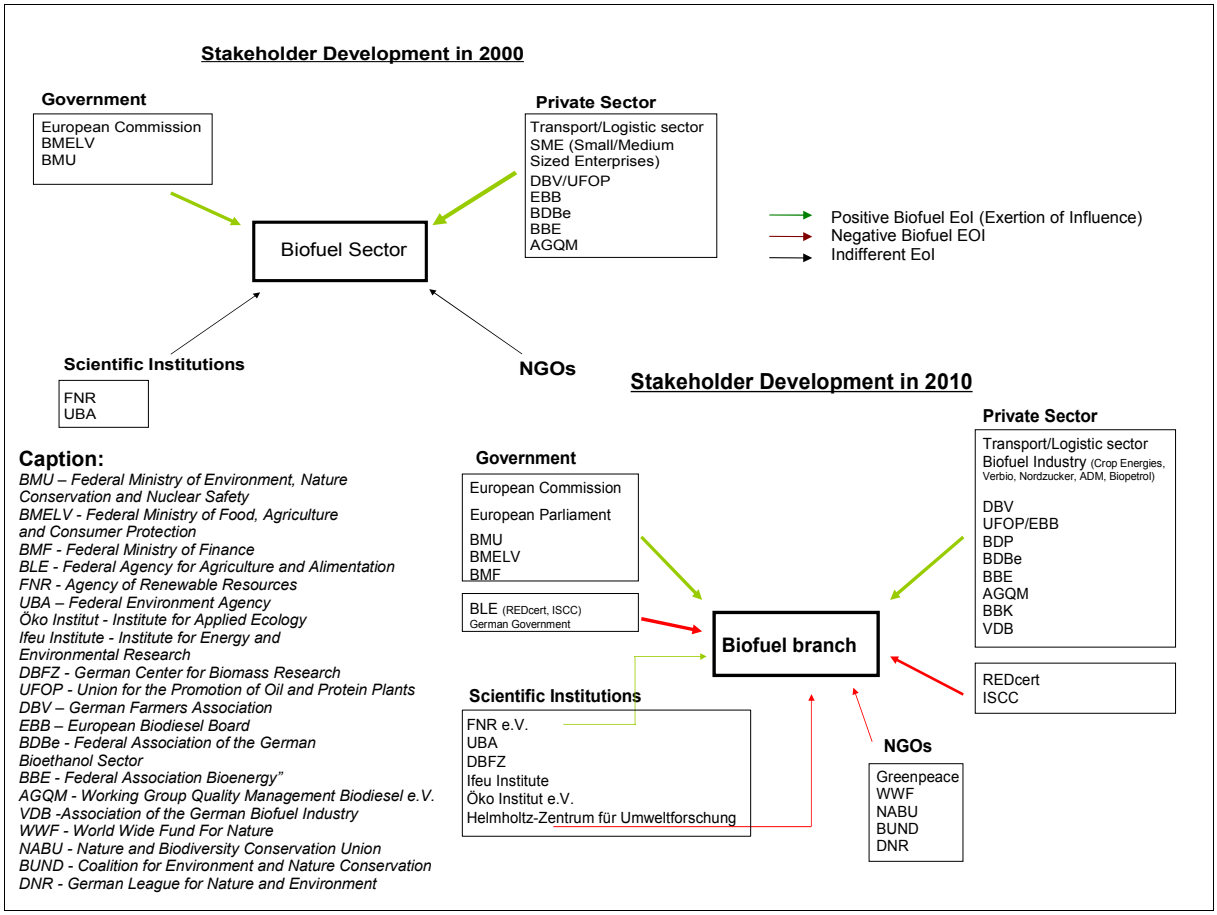

Figure 2

The oldest commercial biodiesel production plant (Ölmühle Leer) began to operate in 1991 with a capacity of less than 1.000 t/p.a. and reached industrial scale in 1994 (80.000 t/p.a.). It is now owned by *Archer Daniels Midland (ADM)*, one of the largest companies within the sector of cereal and oil seeds processing.[22] Although *ADM, Biopetrol* and *VERBIO* nowadays

20 The current taxation levels are the same if petrol and diesel are sulfur-free. If the fuel contains sulfur the taxation on petrol is 66,98 €ct/l and 48,75 €ct/l on diesel (EnergieStG 2006).

21 In 2007 the "Renewable Energy Roadmap" of the European Commission stated a minimum target of 10% for biofuels in transport by 2020 (Bolter 2007). The *Biofuel Quota Law* in its version from 2006 stated a successive increase in the mandatory blending ratio of biofuels until an 8% blending in 2015. In 2009 the *Law of Altered Support for Biofuels* modified the blending ratio to a fixed 6,25% between 2010 and 2014 (BioKraftFÄndG 2009).

22 Entrepreneurs Claus Sauter and Georg Pollert constructed their first biodiesel plant in 2001 making the company VERBIO one of the leading biofuel producers in Europe, with an overall capacity of 450.000 t/p.a. biodiesel and 300.000 t/p.a. bioethanol (www.verbio.de). In 2002 the biodiesel plant in Schwarzheide followed, the first of three biodiesel plants in Europe owned by Biopetrol with a overall capacity of 750.000

being the three largest biodiesel producers in Germany (FNR 2010), it can be stated that the biodiesel/biofuel sector started off as entrepreneurial ventures by small and medium sized enterprises. Those enterprises are part of the so-called "Mittelstand" (medium sized enterprises that are privately established and run) which is the backbone of the German economy (Kayser 2006). According to the *"Federal Association of Bio Energy"* (BBE e.V.) more than 100.000 people were employed or worked within the bioenergy sector in Germany in 2009 (BBE 2009). The sector as well as the renewable energies in general became a strong driver of the German economy[23].

Soon the private sector founded and organized its own interest and lobbying groups in networks with the objective to gain weight in order to participate in the political processes. The first constituted association was the *"Federal Association of the German Bioethanol Sector"* (BDBe 2010) in 1982 with an agenda more on the alcohol and food sector rather than biofuels at the time. The *"European Biodiesel Board"* (EBB 2010) instituted in 1997 today represents over 70 members in most of the European countries. The *"Federal Association Bioenergy"* (BBE e.V. 2010) with more than 150 members was established in 1998 to represent companies from the biogas and biomass conversion sector rather than the biofuel and mobility industry. The *"Association of the German Biofuel Industry"* (VDB e.V. 2010) founded in 2001 is representing 24 large-scale biodiesel producers that combine over 80% of Germany's biodiesel production and is chaired by Claus Sauter representing one of the largest biofuel companies in Germany. The alliance of those biomass/bioenergy associations with the German farming societies and associations was only natural. For the agricultural sector the demand for biomass and bioenergy was a blessing not only offering alternative markets for the products but as well showing the importance of agriculture by providing food, feed, fiber and fuel. The *"Society of German Farmers"* (DBV e.V.) and the *"Federal Society of German Plant Breeders"* (BDP e.V.) showed their commitment in the alternative utilization of agricultural crops already in 1990 when they established the *"Union for the Promotion of Oil and Protein Plants"* (UFOP e.V.) (Thuijl & Deurwaader 2006).[24] The UFOP e.V. started the so called "rapeseed revolution" in order to strengthen the rural areas by promoting the use of vegetable oil for energy purposes. The three German bioenergy associations representing the

t/p.a. (www.biopetrol-ind.com).

23 The total turnover of the bioenergy sector in 2009 adds up to 11,4 billion € of which 3 billion € are new investments. The Federal Association of Bio Energy estimates a total turnover of around 20 billion € p.a. in 2020 (BBE 2009).

24 All stakeholders participating in the production, processing and marketing of oil and protein plants were gathered under the roof of the UFOP e.V. The Union seeks to optimize agricultural production; they promote research and operate public relations as well as national and international lobbying.

majority of the bioenergy sector together with the German farmer societies built a strong entity with the objective to convince politics and the public of their possibilities and benefits.

Scientific Institutions

Within the development of the Green Movement in Germany as already described in the first section the first scientific institutions explicitly for environment related research were established. In 1974 the *"Federal Environmental Agency"* (UBA) was founded. Its basic statutes are to provide scientific support to the federal government, to implement environmental legislation and to inform the public on matters of environmental protection. The UBA conducts research in their in-house laboratories but also commissions research projects to scientific institutions. The UBA has always held a skeptical position on the conversion of biomass into fuel and favors the conversion into biogas, electricity and heat (UBA 1993).

In 2008 the *"German Center for Biomass Research"* (DBFZ) was instituted. The research center is affiliated with the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). The scientific mandate is to support the efficient integration of biomass into a sustainable allocation of energy; this includes technological, social, ecologic and economic research along the value chain of biomass to energy conversion. Additionally the DBFZ is asked to provide decision support for political processes (DBFZ 2010).

The*"Öko-Institut"* founded in 1977 and the *"Institute for Energy and Environmental Research"* (ifeu) established in 1978 are two private research institutes that are renowned for their scientific work within the bioenergy sector. Vision of the *"Öko-Institute – Institute for Applied Ecology"* is to develop strategies for the implementation of global, national and regional sustainable development. One of the first research projects on bioenergy in 2004 was a mass flux analysis of a sustainable energetic utilization of biomass (Öko-Institut 2004). Their bioenergy projects comprise for example balancing of GHG emissions, strategies of biomass applications as well as sustainability standards (Fritsche 2006). More than 40 scientist from various disciplines founded the ifeu – Institute that is mostly commissioned by public authorities. Current and completed projects comprise ecological balancing, life cycle assessments, comparison of different conversion technologies and CO_2 mitigation effects of biofuels (ifeu 2010; Quirin 2004).

The *"Agency for Renewable Resources"* (FNR e.V.) was founded in 1993 by the *Federal Ministry of Food, Agriculture and Consumer Protection* (BMELV) as a initiative of the German government to coordinate research, development and demonstration projects and

offer support in the field of renewable primary products. In 2000, the FNR started the "Market Launch Program - Biogenous Lubricants and Transportation Fuels" which since then supported the use of biogenous oils and biodiesel in areas of special environmental relevance (ifeu 2005). Only one year later, in 2001 the "100-tractors program"was initiated in order to show the environmental soundness and technological feasibility of diesel engines converted to pure vegetable oil operation. During the program, more then a 100 tractors were converted to biodiesel and vegetable oil operation and were technically supervised by a research team until autumn 2005 (Hassel &Wiechmann 2005).

Government:

Within the German government even as a new coalition came into power in 2005 there were mainly three ministries that determined the biofuel and bioenergy policies in Germany. The *Federal Ministry of Food, Agriculture and Consumer Protection* (BMELV), the *Federal Ministry for the Environment, Nature Conservation and Nuclear Safety* (BMU) and the *Federal Ministry of Finance* (BMF). When the biofuel issue gained momentum in the end of the 90ties almost only positive effects were attributed with the development of a biofuel sector in Germany.

The BMELV saw the biofuel potential first of all in creating and securing employment in agriculture and rural areas. A new value creation in a sector that often has been considered only as a beneficiary of subsidies. Local and regional energy production and consumption, agriculture as a circular flow economy. Biofuels as the only alternative in securing a sustainable mobility. Furthermore the cultivation of areas with energy crops that are not being used for the production of foods (BMELV 2005). The security of energy supply in the mobility sector and diversification of energy sources was adduced as another reason for the support of biofuels as well as the reduction of fossil oil imports and development and strengthening of a new industrial sector.

Those benefits of biofuel promotion were seen likewise at the BMF, nonetheless it was a requirement for the ministry that did not levy taxes in the early stages of promoting the biofuel sector that the creation of a viable, competitive and self-sustaining industry would be achieved. The beginning of biodiesel and vegetable oil taxation and mandatory blending in 2007 marked an adjustment towards regulatory instruments and the assumption of a competitive advantage already accomplished by the biofuel industry (BMF 2008).

Though the aforementioned benefits of biofuels were acknowledged by the BMU as well, the ecologic advantages although they were overemphasized during early promotion of the sector

were of utmost importance to all three ministries. The GHG and CO_2 reduction potential[25] and the ample raw material basis (including biomass residues) showed promising effects concerning the mitigation of climate change and environmental protection especially the so called 2nd generation of biofuels[26] (BMU & BMELV 2007).

Within the continuous development of the biofuel sector the far reaching effects that biofuels have on agriculture, biodiversity and land use change became more obvious. Stakeholder of the private sector, scientific institutions and NGOs tried to influence government, the ministries and political decisions according to their findings of the effects the bioenergy sector evoked. The BMELV, BMU and BMF responded to those statements and research results by adapting their policies. From 2005 on the positioning of political institutions and the stipulated legislation clearly shows that the ministries were more cautious and concerned regarding the support of the biofuel sector[27] as described in Section 1 *"Biofuel Policies"*. Still BMELV and BMU explicitly state the chances that lie in biofuels and bioenergy and the necessity to continue the path towards a sustainable and CO_2 mitigating energy consumption and production (BMELV 2010/BMU 2010).

NGOs

During the early development of the biofuel sector in Germany NGOs were only marginally involved in the examination and evaluation of the industry. Although agriculture always was one focal point of the most prominent NGOs as for example Greenpeace and WWF *(World Wide Fund For Nature)* on a global level and the BUND (*Coalition for Environment and Nature Conservation*) and NABU *(Nature and Biodiversity Conservation Union)* on a national level other issues as genetically modified crops and the excessive use of pesticides and herbicides were attached to more importance. When the biofuels and bioenergy sector started to expand rapidly in 2004 and 2005 (see Figure 1) the NGOs became more alert and considerate about this development[28]. Especially the import and utilization of palm oil in the production of biodiesel and as fuel for stationary electricity production was heavily criticized

25 The avoided CO_2 emissions by utilization of biofuels in Germany were calculated with 8,7 Mio tons in 2006. The avoided CO_2 emissions by biomass conversion in the electricity and heat sector were more than 30 Mio tons in 2006 (BMU 2007).

26 The 1st generation of biofuels are classified as the existing and at an industrial scale produced fuels by processing agricultural crops as corn, sugar cane, rape seed and soy i.a. The 2nd generation of biofuels require more advanced technologies and processing, use a wider range of biomass resource therefore enable a higher yield per hectare and thus a higher GHG reduction potential (Banse et al. 2008)

27 The necessity of certification schemes and the reliability of positive effects induced by biofuels for instance led to the Biofuel Sustainability Ordinance trying to guarantee as sustainable cultivation and processing of energy crops (Scarlat & Dallemand 2008).

28 In 2004 the NABU already criticized the trend of converting biomass into liquid fuel rather then substitute heating oil in the stationary electricity sector and thereby reducing more CO_2 per energy unit (NABU 2004).

since tropical rain forests were and are under threat due to the increasing demand from food, fiber and fuel industries (Koh & Wilcove 2008)[29]. Additionally criticized were the trends towards mono-cultures, the loss of biodiversity and rising food prices due to increasing biofuel production. The so-called "Food vs. Fuel" debate is still ongoing discussing the issues of higher food prices induced by an expanding biofuel industry. This debate peaked in 2007/2008 when world market prices for food commodities increased. The dispute is exemplary for the intransigent positions stakeholders and the public have taken alike (Runge & Senauer 2007; Daschle 2007).

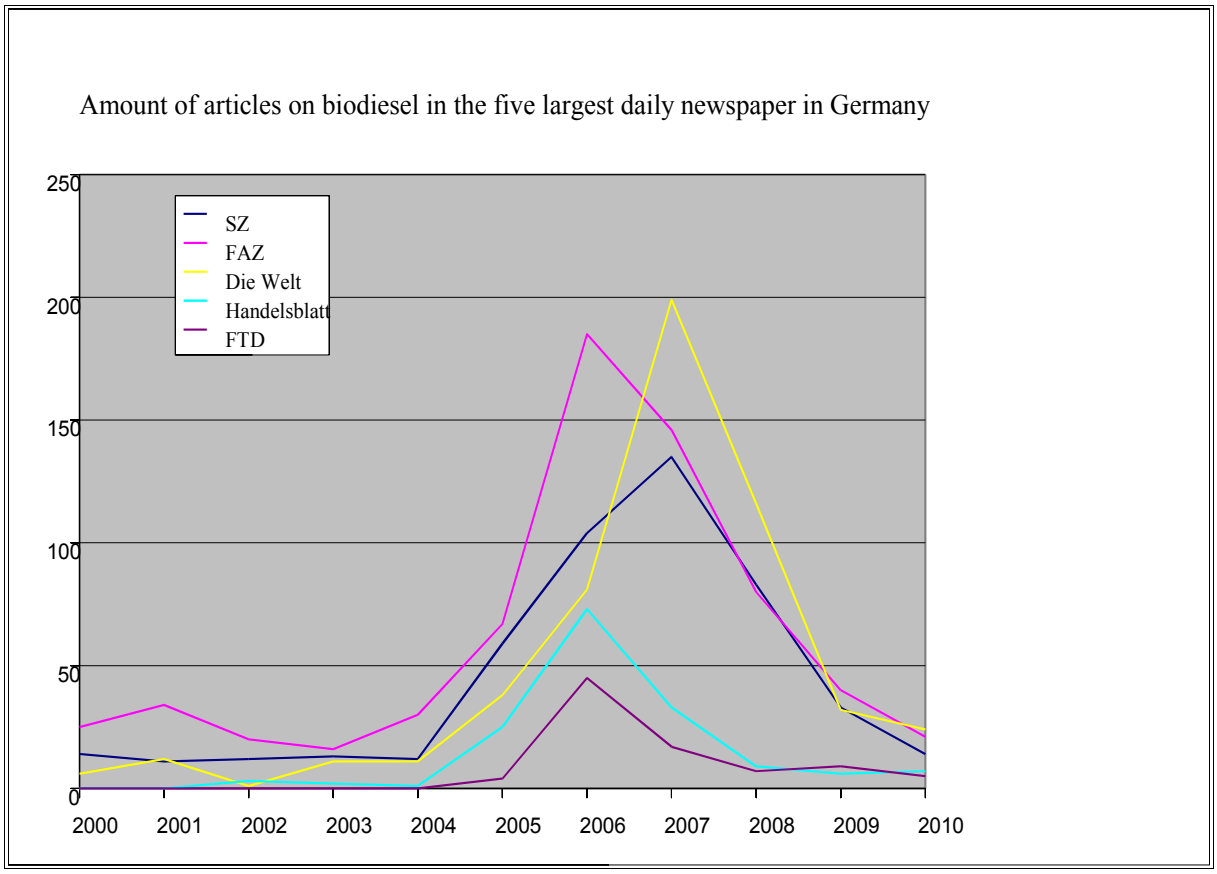

Figure 3

In order to demonstrate the multitude of debates and discussions that slowly arose in 2005 and were heatedly carried out by NGOs, scientific and governmental institutions as well as by the

29 Between 1990-2005 the oil palm cultivated are increased by more then 3 million hectares in Indonesia (56% of the expansion onto forest area (Koh&Wilcove 2008). Cultivating oil palms for biodiesel production on areas that have been cleared of rain forest is increasing the CO_2 emission directly linked to that biodiesel massively. It would take 60 to 270 years of cultivation for biodiesel production to pay back the initial release of CO2 (Greenpeace 2007). As a reaction to those developments initiatives as the Round Table on Sustainable Palm Oil (RSPO) founded in 2004 and the Round Table on Sustainable Biofuels (RSB) founded in 2007 were instituted by NGOs (Greenpeace, WWF) and the private sector in order to mitigate the negative effects and create standards for the growth and use of sustainable biofuels. Other NGOs still argue that those initiatives are rather a greenwashing tool then problem-solving entities (Zhou 2010).

public in 2006 and 2007 Figure 3 shows the amount of articles on biodiesel that were published by the five largest nationwide daily newspapers in Germany[30].

It is evident that those years marked a shift within the perception of the biofuel sector. The studies and reports of NGOs and scientific institutes were adopted and reviewed by the media in Germany. Biofuels became an important issue not only for the aforementioned stakeholder that already did analyses, market surveys and research within the biofuel and bioenergy sector but as well to a larger public. To what extent that upswing in media coverage influenced and urged the government to adapt their policies can only be speculated. The following chapter on discourses within political processes will address this issue more detailed.

3 Exertion of Influence – Discourses

For an analytical reconstruction of policy processes concerning biofuels and an investigation of relevant impact factors it is pertinent to scrutinize the discursive level of such political processes as well. The reasons are as follows:

(1) Environmental, energy and technology policies are usually characterized by conflicts concerning basic concepts like "sustainability", "precaution" or "progress" as parameters of general principles of societal future management (cf., Feindt & Oels 2005, p. 162; Keller 2005, p. 275). Those can no longer be prescribed by a top-down approach but have to be continually renegotiated, i.e., they are objects of continued controversies regarding their importance, their interpretation, and their implementation (cf., Hajer & Versteeg 2005, p. 176; Selbmann 2010, p: 192ff.).

(2) Environmental, energy and technology policies can be further characterized by numerous actors – e.g., experts, representatives of environmental and consumer associations, NGOs, social movements, economy and politics – that claim an own description of a problem or a topic, i.e., the formulation of what they regard as a problem or topic for themselves. Then, they try to enforce their individual interpretation in the debate (Hajer & Versteeg 2005, p. 177).[31]

30 The articles were published in: Süddeutsche Zeitung (SZ 448.537 circulation); Frankfurter Allgemeine Zeitung & Frankfurter Allgemeine Zeitung Sonntagszeitung (FAZ - 771.298 circulation); Die Welt & Welt am Sonntag (688.790 circulation); Handelsblatt (145.467 circulation); Financial Time Deutschland (FTD 103.036 circulation). All data according to Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V. (IVW 2010). In 2004 only 54 articles on biodiesel were published in the above mentioned newspapers altogether. In 2005 already 193 articles were published. Peaking with 488 articles in 2006 and 530 articles in 2007.

31 In this regard, Hajer (1995, p. 44) defines a discourse "as a specific ensemble of ideas, concepts, and categorizations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities". Similar to Hajer, Keller (2005, p. 15) refers in his concept of discourse to events, statements, actors and practices, in which knowledge is updated, distributed, attacked, denied and rejected.

Within this struggle of actors for interpretative predominance the role of mass media is of special importance as a discourse directed to the general public can solely become a public discourse if it is conveyed by mass media. Mass media are not only the stage for discourses but also actor (i.a., Gerhards 1992) because they function as a filter and selective booster for public debates due to their special access conditions and attention structures (i.a., Kepplinger 1989; Weiß 1989). In turn, actors – and especially challenging actors like NGOs – adapt to those conditions and structures by using rhetorical strategies to reach maximum presence in the media (see Figure 3). This results in a specific dynamic of public conflict-discourses (cf. Gerhards & Neidhardt 1991; Keller 1997).

(3) The implementation of a policy to regulate the production and use of biofuels is discursively embedded, too, i.e., due to a polarization of actors' positions public discourses conveyed by mass media emerge that establish cross-connections between the different (scientific, economic, political etc.) special discourses. These public discourses address chances and risks of biofuel production and use for society, environment, health and economy.

(4) According to Hajer (1995, pp. 65ff.) and Keller (2005, pp. 249f.), those actors that similarly position themselves in a discursive controversy constitute a so called discourse coalition.[32] They are characterized by a high level of flexibility as well as they feature a substantially minor liability in actors' relationships than networks. Actors that operate as discourse coalitions build up their – although fragile – identity on shared situation and problem definitions. Thereby, the actors can thoroughly pursue different interests.

The positioning of actors of a discourse coalition is subsumed under the term *story line*[33] that summarizes the common perceptions of a topic or problem and determines its scope, causes, persons responsible as well as implications of action. While story lines reduce the complexity of a problem or topic, respectively, it is easy for other actors to associate. With the help of story lines discourse coalitions then try to impose their specific problem interpretation on other discourse coalitions (ibid., pp. 62f.). New story lines are able to challenge established points of view and practices and can – if generally accepted –induce political change (ibid., pp. 56ff.; id.: 2003, p. 281).

(5) Consequently, discourse coalitions compete with each other in argumentative contentions for hegemony in the discourse. The latter is initially reached under the condition that one

32 Discourse coalitions form themselves "if previously independent practices are actively being related to one another, if a common discourse is created in which several practices get a meaning in a common political project" (Hajer 1995, p. 65).

33 Hajer (1995, p. 56) defines story line as "a generative sort of narrative that allows actors to draw upon various discursive categories to give meaning to specific physical or social phenomena".

discourse coalition succeeds in dominating the discursive space around a problem.[34] In addition, the discourse coalition has to achieve a translation of its story line into definite policies and institutional arrangements.[35] If this second condition is not met, a discourse coalition – despite its dominance in the discursive space – won't be successful in terms of substantially resolving problems (Hajer 1993, p.48). Therefore, such controversies always imply negotiations on policies and institutional frameworks. As a result of discourses, regulations can be revised, laws can be adopted or new institutions can be established (Hajer & Versteeg 2005, p. 182). Accordingly, discourses play a key role in political change processes as they do have a structuring effect on the outcome of political decision-making and implementation processes (Hajer 1995, pp. 85f.).

After this introduction into the role and significance of discourses in general as well as in the context of areas of conflicts in environmental, energy and technology policies in particular, at this point the public-political discourse concerning biofuels since the formation of a biofuel policy in Germany will analytically be traced in brief. Its aim is to reveal discourse dynamics over time by means of the emergence of discourse coalitions and the evaluation of their dominance as well as the characterization of their story lines and their impacts. Such an investigation of changes of constellations of dominant and challenging discourse coalitions in the public-political discourse concerning biofuels shall give further insight into both continuity and change of biofuel policy in Germany and relevant impact factors. What seems to be continuity on the level of political institutions and measures can already be changing on the level of discourses. In the interplay with the already reconstructed course of biofuel policy and the identified changes in the actors' constellation a differentiated description and explanation of the inner functioning of the stagnating, reform-oriented, or changing path of biofuel policy is feasible.

The dominant discourse coalitions

I. Discourse Coalition of Energy Securers

The discourse coalition of energy securers was constituted in the second half of the 1990s. Reflecting the energy crises of the 1970s and in face of rising energy prices the coalition aims to prevent future energy crises by achieving energy independence and, consequently, energy

34 Such dominance is expressed in a way that "central actors are persuaded by, or forced to accept, the rhetorical power of a new discourse (condition of discourse structuration)" (Hajer 1993, p. 48).

35 That implicates that „the actual policy process is conducted according to the ideas of a given discourse (condition of discourse institutionalization)" (Hajer 1993, p. 48).

security. Biofuels – that have gradually entered the market since the end of the 1990s – received recognition by the energy securers as one possible alternative to fossil energy carriers (e.g., oil, gas or coal). Furthermore, the highest priority should be given to the security of energy supply due to an increased energy demand in emerging countries, geostrategic interests and the fact that oil production is often located in politically instable regions of the world.

Besides energy security this discourse coalition expects positive economic developments by the promotion of biofuel production and use. This could mean economic expansion and thus new employment opportunities what would cause positive effects for the business location Germany. As a result Germany could become a market leader in this field and gain a pioneering role; technological innovations could be exported or strategic partnerships could be agreed upon. Thus, the story line of the discourse coalition of energy securers can be summarized as *"biofuels can help to achieve energy independence and security and at the same time foster economic expansion and trade"*.

Consequently, the discourse coalition calls for political exertion of influence by promoting research, development and investments concerning biofuel technologies in order to faster meet the objectives due to technological progress. Accordingly, it are the Federal Ministry of Economics and Technology (BMWi) and Federal Ministry of Finance (BMF) that have the ability to significantly steer the whole process. The sub-discourse of the discourse coalition of energy securers significantly impacts biofuel policy although its level of dominance also gradually correlates with the oil price.

II. Discourse Coalition of Agrarian Promoters

The discourse coalition of agrarian promoters understands biofuel production as a chance for agriculture. On the one hand, the production of biofuels could generate employment opportunities; on the other hand, it could stimulate agricultural subsidies for farmers, a significant growth in the agrarian sector, structural transformation and a revitalization process ("rape seed revolution"). Beyond those considerations multinational enterprises see substantial business potential within the sectors of agricultural chemistry and green biotechnology (WBGU 2008, pp. 24f.).

As the objective of independence from oil and gas is also named in the context of agricultural policy, there is partial congruency between the story line of the discourse coalition of agrarian promoters and the story line of energy savers. This understanding strengthens both sub-discourses in terms of perception and assertiveness.

The claims for political support of investment as well as research and development concerning biofuels are crucial to this discourse coalition. Especially since the former privileges have been restricted by the EU in 1992, the call for new rural developmental opportunities and markets (e.g., biofuel production) became more vociferous. The story line of the discourse coalition of agrarian promoters thus states that *"biofuels stimulate a revitalization process in agriculture and positively affect the entire economy"*.

In face of a gradual introduction of biofuels to the market agricultural and farming associations were established to take up the interests and concerns of farmers and producers of biofuels, e.g., the German Plant Breeders' Association (BDP). Also already existing associations like the German Farmers' Association (DBV) started to focus on issues concerning biofuel production and use. But above all the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) appears as a dominant actor of this discourse coalition as well as the associated Agency for Renewable Resources (FNR). The BMF plays an important role, too, as it approves or withdraws tax incentives.

The discourse coalition of agrarian promoters primarily became visible with the change of government in 1998; the governing coalition of the SPD (Social Democratic Party of Germany) and Alliance '90/The Greens started to support the implementation of a biofuel policy. Until 2006 the sub-discourse of the agrarian promoters gained more and more dominance, but with the adoption of the Energy Tax Law (EnergieStG) in 2006 and the Biofuel Quota Law (BioKraftQuG) in 2007 during the government of the SPD and the Christian Democratic Union of Germany (CDU)/Christian Social Union of Bavaria (CSU) as well as the appearance of critical sub-discourses that focused on negative ecological, social and economic impacts of biofuel production, the discourse coalition lost at least partially of its dominance. Nevertheless, due to the fact that the German biofuel production has not been criticized as much as biofuel production in developing and emerging countries since 2006 concerning social standards etc. the agrarian promoters were able to almost stabilize its discursive hegemony in 2009 and their story line remained unchanged.

III. Discourse Coalition of Ecological Modernizers

With the accession to office of the government of SPD and Alliance '90/The Greens in 1998 – which soon gave high priority to climate and energy policy –, the discourse coalition of ecological modernizers formed up and appeared in the public biofuel discourse. It consisted, inter alia, of representatives of the Federal Ministry of Environment, Nature Conservation and Nuclear Safety (BMU), the Alliance '90/The Greens, the SPD, science and the "green

business" sector. Also the Federal Ministry of Education and Research (BMBF) and the Federal Ministry of Transport, Building and Urban Development (BMVBS) are part of this discourse coalition as they steer future developments by research or investments and regulations, respectively. Under the government of the CDU/CSU and the SPD, that took power in 2005, this discourse coalition even gained more dominance as the Stern Report, that was published in 2006, exposed the economic benefits of a preventive climate protection policy. Shortly after, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) was released and predicted a rise of the globally averaged temperature between 1,1 °C and 6,4 °C by the end of the 21st century what will lead to dramatic long-term consequences for the environment due to greenhouse gas emissions (IPCC 2007). Even though the discourse coalition lost dominance in the course of the economic crisis in 2009/2010 and the failure of the Copenhagen Summit in December 2009, its problem interpretation still is of high relevance for the national climate and energy policies.

The story line of the discourse coalition states that *"biofuels contribute to climate and resource protection in the context of an ecological industrial policy"*. As fossil energy carriers harmful to the climate are gradually substituted by climate-friendly bioenergy, especially carbon dioxide emissions could notably be reduced and therefore climate protection targets of the EU and the German government could be met. Thus, Germany could continue to consolidate its pioneering role with regard to an ambitious and effective climate policy in international comparison. Furthermore, it becomes viable to spare finite resources like fossil oil and natural gas via a long-term conversion of energy systems towards a low carbon economy, inter alia, by means of bioenergy.

Further impacts on the environment and social aspects are no objects of this sub-discourse what illustrates its orientation on the so called concept of "ecological modernization" nationally. A "globally sustainable development" is only the main objective of this discourse coalition in the international climate discourse. As it advocates there for justice especially for developing and emerging countries with regard to emission reduction targets and damages as a result of the global climate change, primarily caused by western industrialized countries, it tries to reconcile ecological as well as economic and social matters.

On the national level this discourse coalition, however, stands in the public-political discourse for a – in opposite to the scientific discourse – simplified concept of ecological modernization. According to this, the objective of government's climate and energy policy – and thus also of biofuel policy – should be an environmentally compatible, in the best case, environmentally friendly production and consumption structure that avoids short- and mid-

term welfare losses by environmental damages and secures long-term welfare profits. By means of encouragement of both ecologically advantageous as well as economically profitable innovation processes and the growing importance of "green lead markets", environmental protection – understood as climate and resource protection – and economic growth should be equally achieved (cf. Weidner 2008, pp. 13f.). Therefore, preventive climate and energy policy is in particular interpreted as an ecological industrial policy that should have a macroeconomically modernizing effect.

Concerning biofuel policies this discourse coalition stood for the implementation of the biofuels directive (2003/30/EG) of the EU. The uncritical increase of the biofuel proportion in petrol by appropriate political measures and promotion of green technology was only suspended in April 2008 due to massive criticism concerning the significant ecological, economic and social implications of the production and use of first generation biofuels.

IV. Discourse coalition of promoters of developing and emerging countries

The discourse coalition of promoters of developing and emerging countries was established at the beginning of the 21st century. It states that the expansion of biofuel production could induce positive economic processes in developing and emerging countries as well as generate benefits for their overall development. Additionally, it could reduce the dependence on energy imports and lower relating costs. Especially ambitious emerging countries, e.g., Brazil, India and China could meet their stated objective to become independent from imports of fossil fuels in the energy sector.

Beside these energy-political and economic objectives there are agricultural and development policy issues, too. The discourse coalition argues that biofuel production could induce positive socioeconomic developments in predominantly agrarian-oriented developing and emerging countries especially with regard to employment opportunities. Due to the export orientation of the biofuel sector it diagnoses an enormous growth potential and expects significant development successes in the sense of a catch-up development. Examples for this constellation represent African developing countries that foster small-scale biofuel production to induce rural and regional development. In consequence of good natural conditions for biofuel production, appropriate regional climate, the availability of potential agrarian land as well as low labor costs the discourse coalition supposes arising comparative advantages on the world market, global marketing opportunities as well as strategic trade partnerships with demanding industrialized countries (WBGU 2008, p. 25).

Accordingly, the story line of this discourse coalition expresses that the *"expansion of biofuel production could induce energy security and positive socioeconomic processes in developing and emerging countries"*. Development policy organizations in Germany, e.g., the German Association for Technological Cooperation GmbH (GTZ) as well as the Federal Ministry for Economic Cooperation and Development (BMZ), shape the discourse of this discourse coalition. Not solely securing the access to energy is understood as an essential feature for development but also meeting the Millennium Development Goals until the year 2015. This discourse coalition initially rarely referred to negative effects of biofuel production, e.g., for farmers, the local population or the environment in developing and emerging countries but is, especially since 2006, becoming more and more critical.

The depictions clarify that the topic of biofuels encompasses many different policy fields. Energy, agricultural, environmental, technology and development policy represent policy fields where the political regulation of biofuels is of relevance with regard to the solution of their specific problems. The four presented discourse coalitions dominated their policy fields until 2005/2006 insofar as no other discourse coalition and thus no competing interpretation of the topic existed. Consequently, their sub-discourse in the respective policy field was translated into specific political measures. The partly overlapping story lines of the four discourse coalitions were all positively disposed towards the production and use of biofuels. Hereafter, biofuel policy in general was characterized by a positive public-political perception of biofuels. It also became clear that in the second half of the 1990s especially economic, geostrategic and agricultural-political concerns as well as questions regarding energy security shaped the biofuel policy discourse. Concerns regarding the protection of climate and of finite resources as well as development policy aspects became an issue against the background of the support of an ecological industrial policy at the end of the 1990s or at the beginning of the 2000s, respectively.

The challenging discourse coalitions

From the year 2005 on discourse coalitions began to form that were critical of an expansion of production and use of biofuels. Point of departure was the publication of studies from institutions close to politics that refer to (potentially) negative, primarily ecologic and economic but also social implications of first generation biofuels. Moreover, these discourse coalitions addressed aspects in relation to biofuels that were ignored by the already existing discourse coalitions. The three discourse coalitions that will briefly be introduced below

competed with the established ones and challenged them with their new interpretations. For all new created discourse coalitions it is characteristic that they – to a large extent – were constituted by representatives of non-governmental organizations, corresponding associations, and social movements. In order to make their problem interpretation heard and to evoke social response they used discursive strategies as problematization, dramatization and scandalization of specific aspects of the biofuel topic to achieve a mass medial distribution of their respective sub-discourse.

V. Discourse coalition of (radical) justice demanders

The discourse coalition of justice demanders represents a sub-discourse that radically challenges the pro-biofuel sub-discourses. It especially pillories the problems resulting from the production and use of biofuels and thus states that biofuels cannot be socioeconomically sustainable. As the story line of the justice demanders summarizes that *"biofuels are catalysts of social inequity"* they refer to biofuels as agrofuels. For that reason representatives of this discourse coalition claim for a strong regulation of biofuel production, for a moratorium concerning the latter or even for an end of political support of biofuels.

According to this discourse coalition, dangers and negative impacts of biofuel production mostly occur in developing and emerging countries, which, e.g., are: rising food prices and threats to food security, living and working conditions, destruction of structures of agricultural smallholdings, disregard for land use rights, displacement, wage dumping, social riots or risks to health. The justice demanders understand small farmers in developing and emerging countries as the victims of biofuel production while international major corporations are its profiteers.

The discourse coalition was most notably constituted by representatives of movements and organizations critical to globalization, e.g., Attac. It was established in the course of the worldwide rise of food prices and the following food crisis in 2007/2008. The (radical) justice demanders ascertained a competition between the production of food and biofuels in developing and emerging countries as many farmers would concentrate on the profitable business of biofuels instead of agrarian food production. In this context, the so called "tank vs. table"-discourse emerged that was dominated by this discourse coalition. Part of the discourse was the old antagonism between the rich north and the poor south and the expressed fear of an increase of dependencies to the disadvantage of the south.

VI. Discourse coalition of environmentalists

In its assessment of biofuels the discourse coalition of environmentalists goes beyond the common arguments of the climate protection sub-discourse. It rather represents a contradictive sub-discourse to that of those actors that (over)emphasize the positive environmental effects of biofuel production. The story line of the environmentalists' discourse coalition claims that *"biofuels have to be ecologically sustainable."* This expectation is not just limited to a positive climate balance but aimed at all environmental aspects, e.g., the (agro)biological diversity or natural resources.

The discourse coalition was established in the middle of the current decade (ca. 2006, peak: 2008) after the publication of studies and surveys that analyzed the ecological implications of first generation biofuels and thereby observed negative impacts to the environment as well as negative climate and energy balances. According to the environmentalists, the production of biofuels is ecologically more problematic than the production of fossil energy carriers as it is harmful to the climate and moreover evokes negative ecological side effects as it, e.g., fosters deforestation, the cultivation of monocultures as well as the intensification and industrialization of agriculture. This leads to an increase of overexploitation of resources and flood risk, a destruction of grassland, a deformation of landscape and competition for land use. These problems and side effects are especially identified and highlighted in developing and emerging countries.

The position of environmentalists includes the claim for mid- and long-term solutions and concepts that ensure ecological sustainability and in this way rejects short-term solutions, e.g., the uncritical political support of biofuels based on insufficient knowledge about possible ecological consequences in the long run. Actors that constitute this discourse coalition are environmental protection organizations and NGOs, e.g., Friends of the Earth Germany (BUND) and Greenpeace. Furthermore, the BMELV, the BMU and subordinated authorities like the Federal Environment Agency (UBA) support the development and implementation of standards for an ecologically sustainable biofuel production (see sustainability standards in the Biofuel Sustainability Ordinance, BioKraft-NachV 2009). Generally, these actors of the discourse coalition call for instruments and certification systems that ensure an ecologically sustainable biofuel production like, e.g., the "Ökosiegel" for the management of plantations. The objectives are a technological optimization, investments in research concerning "green" biofuels (second generation biofuels) and a compliance to sustainability standards.

While this part of the environmentalists is signified by a moderate approach concerning solutions for ecological problems resulting from biofuel production the other part of this discourse coalition is more radical. Organizations like "Save the Rain Forest e.V." ascribe

problems such as the destruction of rain forests and the endangerment of endemic species to the expansion of the biofuel production. For this reason they generally reject the latter.

VII. Discourse coalition of sustainability promoters

The discourse coalition of sustainability promoters partially coincides with the discourse coalitions of environmentalists, of (radical) justice demanders, and of ecological modernizers. It generally supports biofuel production and use and therefore represents a more moderate position. Within that coalition, actors of different social sectors, e.g., industry, agriculture, politics, science, and NGOs can be found. Its story line states that *"biofuels are an alternative to fossil energy if their production and use is economically, ecologically and socially sustainable"*. Justice and sustainability are understood as interlinked and deeply embedded in the global context.

The discourse coalition of sustainability promoters was established at the same time as the radical justice demanders in the course of the "tank vs. table" discourse in 2007/2008 by representatives of research institutes and advisory boards, e.g., the German Advisory Council on Global Change (WBGU), the Roundtable on Sustainable Biofuels and several NGOs. It understands certification schemes for biofuels as potential instruments to secure both a globally and locally sustainable production and use of biofuels. As all actors relevant for biofuel production and use, e.g., those along the value chain of biofuels should equally participate in the process of development and implementation of certification schemes for biofuels, a multi-stakeholder approach should be applied. Additionally, the discourse coalition understands further research on all potential impacts of biofuel production and use as a crucial base for future political decision-making concerning its expansion.

The discourse coalition of sustainability promoters currently dominates not only the public discourse but also political regulation as strong efforts are made, e.g., to establish different certification schemes on national and EU-level like the ISCC System and REDcert. The critical voices of the other challenging discourse coalitions weren't able to prevail against the persuasive story line of the sustainability promoters and a strong discourse coalition where different actors of several sectors are united.

Table 1 summarizes the different coalitions, their story lines as well as central elements and features of their sub-discourse.

Discourse coalition	Establishment	story line	problem positioning	biofuels	risks	claims	actors	positioning by other actors
energy securers	second half of the 1990s (peak: 2005/6)	biofuels can help to achieve energy independence and security & at the same time foster economic expansion	pro biofuels	are an alternative to fossil energy carriers		political exertion of influence by investments, research & development	BMWi, BMF	solely consideration of economic aspects
agrarian promoters	end of the 1990s (esp. since 1998; peak: 2005/2006)	biofuels stimulate a revitalization process in agriculture & positively affect the entire economy	pro	a chance for agriculture; generate employment opportunities and rural development		political support of investment in biofuel production	agricultural and farming associations (e.g., DBV, BDP), BMELV, BMF, FNR	another way to justify further subsidies
ecological modernizers	1998 (peak: 2006/2007)	biofuels contribute to climate and resource protection in the context of an ecological industrial policy	pro	contribute to climate protection & reduction of greenhouse gas emissions; indirectly catalyze macroeconomical modernization		expansion of biofuel production by promotion of green technologies; conversion of energy systems towards a low carbon economy; fair climate policy on the global level	BMU, BMBF, BMVBS, Alliance ‘90/The Greens, SPD, "green business"sector	companies are interested in a green image & disregard social & ecological implications of production & use of biofuels; profit-maximizing interests instead of sustainability
promoters of dev. & emerg. countries	early 2000s (peak: 2005)	expansion of biofuel production could induce energy security & positive socioeconomic processes in developing & emerging countries	pro	catch-up development; see: energy securers & agrarian promoters		expansion of biofuel production; strategic partnerships with industrialized countries	BMZ, GTZ	biofuel production in dev. and emerg. countries is highly questionable due to serious ecological & socioeconomic problems, e.g., rising food prices

(radical) justice demanders	2007 (peak: 2008)	biofuels are catalysts of social inequity; "tank vs. table"	anti biofuels	are "agrofuels" as they cause socioeconomic problems & reinforce dependencies between North & South	socioeconomic risks; biofuels contribute to, e.g., food insecurity, competition for land use, worsening living & working conditions	strong regulation, moratorium, or end of political support	anti-globalization movements and organizations	social inequity & food insecurity are caused by ,e.g., population growth, harvest fluctuations etc.
environ-mentalists	2006 (peak: 2008)	biofuels have to be ecologically sustainable	anti	first generation biofuels evoke negative ecological effects	ecological risks; biofuels contribute to, e.g., loss of (agro)biological diversity, deforestation, monocultures & overexploitation	strong regulation, mid- and long-term solutions (certification), investment in research and technical optimization to guarantee ecological sustainability	environmental protection organizations (BUND Greenpeace), BMU, UBA	environmentalists are blocking economic progress, induced by biofuel production and use
sustainabili ty promoters	2007 (peak: 2008)	biofuels are an alternative to fossil energy if their production and use is economically, ecologically and socially sustainable	pro/anti	are only a solution for current energy problems if they meet the requirements of global sustainability	potential social, ecological & economic risks (see environmentalists & justice demanders) have to be examined by further research	political measures and instruments to guarantee justice and sustainabilit in its three dimensions; certification schemes; multi-stakeholder approach	research institutes, advisory boards, WBGU, Roundtable on Sustainable Biofuels, ISCC & REDcert GmbH	a limitation of certification schemes to biofuels is questionable as, e.g., all food & non-food products could be certificated as well

Table 1

The new challenging discourse coalitions focus on the negative ecological and socioeconomic implications of biofuel production and use. In respect of political consequences to be drawn, their story lines in part differentiate significantly. The discourse coalition of (radical) justice demanders and parts of the discourse coalition of environmentalists generally refuse biofuels or call for a moratorium on the production and use of biofuels until biofuels, corresponding technologies and political as well as economic instruments are developed that minimize or exclude negative implications. The other part of environmentalists as well as the discourse coalition of sustainability promoters adopt a rather moderate position with regard to the future of biofuel production and use by devoting themselves to political solutions that try to meet the requirements of ecological or global sustainability in its three-dimensionality, respectively. Due to societal connectivity of their problem interpretation, especially the discourse coalition of sustainability promoters managed to dominate the discursive space and finally to translate the story line into policies. Thus, its sub-discourse is shaping today's biofuel policy and influences the sub-discourses of the energy securers, agrarian promoters, ecological modernizers and promoters of developing and emerging countries that are still dominant in their particular policy field.

While from the second half of the 1990s to 2005 biofuel policy was characterized by an exclusively positive perception of biofuels that facilitated a non-constraining promotion of its production and use without societal or political obstructions, from 2005 on an opposition formed up that became more and more concerted and perceptible until its societal resonance became most considerable in 2007/08. As the challenging discourse coalitions incipiently faced problems to erode the consolidated hegemony of the four dominant discourse coalitions, the discourse coalition of sustainability promoters and parts of the discourse coalition of environmentalists finally succeeded in making their voice heard on the discursive level as well as taking effect on the political one.

Based on these findings it can be deduced that the current biofuel policy path in Germany is already partially locked-in but still open to change. The (potential) benefits of the promotion of biofuel production and use are emphasized; however, this positive perception of biofuels is critically refracted and subject to conditions. Future biofuel

policy will be judged by its ability to meet the expectations of a sustainable development in the field of biofuels. If it is not succeeding in offering promising and viable approaches for globally sustainable biofuel production and use, the latter can rapidly be questioned in general.

4 Conclusions

Looking into the biofuel and bioenergy sector it can be stated without any doubt that it was a roller-coaster ride for such a young industry. It started slowly in the 1990ies and took off at the beginning of the 21st century only to face major adaptation processes a few years later. The evolvement of the bioenergy sector can be divided into three fundamental time periods. The first one between the 1990ties and 2005/06 was characterized by almost a euphoria concerning biofuels and bioenergy as the relevant actors solely focused on expected and intended advantages and the policy on biofuel/bioenergy was embedded into a positive societal perception of the latter. In contrast to the aforementioned period of time in the second period between 2006/07 and 2008/09 suddenly the admonishers shaped the perception of and policy on biofuels and bioenergy as, not at least in face of a worldwide food crisis, a huge amount of studies and reports referred to its far reaching negative effects. The last episode from 2008/09 till today can be named as the distinguished period since pro and cons have already been disputed and nowadays it is rather an argument on requirements and approaches[36] than on the fundamental issues of the sector itself.

Based on an examination of the historical-political development of the biofuel sector it can be deduced that the *Green Movement* in Germany certainly favored the stipulation of renewable energies and bioenergy policies nonetheless the ecological primacy compelled politics and the bioenergy sector towards clear-cut modifications for the sake of a sustainable development. However, stakeholders of the agricultural sector, farmers, associations and politics alike were and still are among the heavy promoters and supporters of biofuel and bioenergy since biomass conversion offers a new and highly demanded range of products. But biofuel policy will have to face the task to balance the

36 What are the certification criteria to be discussed? What are the needed standards and indicators to guarantee sustainable cultivation and production? What policies should be pursued? It is to assume that the societal and political intention to use biofuels and bioenergy in an efficient and sustainable manner will remain.

substitution of fossil fuels, development of the most efficient CO_2 reduction technologies, demands from industry and agriculture and the overall acceptance of the public.

The private industry, scientific and governmental institutions as well as NGOs will continue to constitute the four most relevant group of stakeholders within the bioenergy sector. Unless legislation alters once again private enterprises are not likely to be venturing into the biofuel sector but biogas and other bioenergy applications still are of interest. Scientific institutions will even more diligently focus on CO_2 balances and reduction potentials, certification schemes and criteria as well as new technologies since bioenergy still offers impressive and needed performances when substituting fossil energies. Governmental institutions and politics in general may become increasingly hesitating concerning decisions on the promotion of selected technologies and industries. However those negative experiences and set backs should not be an excuse for not further promoting renewable and biomass energies but prolongate the elapsed time of nuclear power plants in Germany. Meanwhile NGOs still need to be watchdogs for undesirable developments in the bioenergy sector and cooperate with the other stakeholders and the media in order to confine negative effects whereas the media and the public will follow up on new developments, studies and discussions.

Concluding this analysis it can be stated that stakeholders within the bioenergy sector should be called into a closer cooperation. Thus national and international standards and criteria for a sustainable development of biomass cultivation and conversion technologies must be stipulated creating planing reliability by consistent policies. It has to be noted that biofuels and bioenergies are still based on emerging technologies and major GHG reduction potentials can be realized by further investing and promoting research and development within that sector. Nonetheless biofuels and bioenergies are only a partial solution when considering mobility and the energy sector and the required incremental substitution of fossil energies.

References

Ackrill, R.(2000): The Common Agricultural Policy. Sheffield.

AGQM. Arbeitsgemeinschaft Qualitätsmanagement Biodiesel e.V. (2010): AGQM – Kompetenz in Sachen Biodiesel.

Akalpler, E. (2006): The Impact of the Support System of the CAP on Free Trade in the Light of the Turkey's EU Membership, Dissertation, Vienna University of Economics and Business.

Banse, M. et al. (2008): The Impact of First and Second Generation Biofuels on Global Agricultural Production, Trade and Land Use. Paper submitted for the 11th Annual GTAP Conference, Helsinki, Finland, June 12-14, 2008.

Biofuels Barometer (2010): EUROBSERV'ER – July 2010.

Bolter, I. et al. (2007): Biofuels in the European Union. An overview on the EU biofuel policies. IEA Task 39.

Brand, K.W. (2008): Bewegungen, Proteste und Themenfelder: Umweltbewegung, in: Roth, R.; Rucht, D.: Die sozialen Bewegungen in Deutschland seit 1945.

Brocks, F. (2001): Die staatliche Förderung alternativer Kraftstoffe: Das Beispiel Biodiesel, Frankfurt am Main.

Bundesministerium der Finanzen (2008): Die Förderung von Biokraftstoffen seit 2004. Monatsbericht des BMF. Februar 2008.

Bundesministerium der Justiz (BMJ 200): Gesetz zur Änderung der Förderung von Biokraftstoffen (BioKraftFÄndG). 15.07.2009.

Bundesministerium der Justiz (BMJ 2006): Gesetz zur Einführung einer Biokraftstoffquote durch Änderung des Bundes-Immissionsschutzgesetzes und zur Änderung energie- und stromsteuerrechtlicher Vorschriften (Biokraftstoffquotengesetz – BioKraftQuG). 18.12.2006.

Bundesministerium der Justiz (BMJ 2006): Energiesteuergesetz (EnergieStG). Ausfertigungsdatum 15.07.2006.

Bundesministerium der Justiz (BMJ 2009): Verordnung über Anforderung an eine nachhaltige Herstellung von Biokraftstoffen (Biokraftstoff-Nachhaltigkeitsverordnung-BioKraft-NachV). 30.09.2009.

Bundesministerium der Justiz (BMJ 2009): Verordnung über Anforderung an eine nachhaltige Herstellung von flüssiger Biomasse zur Stromerzeugung (Biomassestrom-Nachhaltigkeitsverordnung - BioSt-NachV). 23.07.2009.

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV 2005): Biokraftstoffe. Strategie für die Mobilität von morgen.

Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV 2010): Warum brauchen wir Biokraftstoffe? http://www.bmelv.de/ 13.08. 2010.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU 2007): Entwicklung der Erneuerbaren Energien im Jahr 2006 in Deutschland. 21.02. 2007.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU 2010): Entwicklung der Erneuerbaren Energien in Deutschland im Jahr 2009. 18.03. 2010.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU 2010): Gesetz zur Änderung der Förderung von Biokraftstoffen (Entwurf und Begründung). 22.10.2008.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU 2007) & Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz (BMELV): Roadmap Biokraftstoffe. 14. November 2007.

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (BMU 2010): Strom und Kraftstoff aus Biomasse müssen nachhaltig erzeugt sein. http://www.bmu.de/. 22.Februar 2010.

Bundesregierung (2002): Perspektiven für Deutschland. Unsere Strategie für eine nachhaltige Entwicklung.

Bundesverband BioEnergie e.V. (BBE 2010): BBE Mitglieder. http://www.bioenergie.de/ 12.08.2010.

Bundesverband BioEnergie e.V.(BBE 2010): Umsatz und Beschäftigung. Marktdaten 2009. http://www.bioenergie.de/. 11.08.2010.

Bundesverband der Deutschen Bioethanolwirtschaft e.V. (BDBe 2010): Die Mitglieder des BDBe. http://www.bdbe.de/Mitglieder.html. 12.08.2010.

Daschle, T. (2007): Food for Fuel? Foreign Affairs. September/October 2007. New York.

Deutsches BiomasseForschungsZentrum (DBFZ 2009): Das DBFZ. http://www.dbfz.de/. 12.08.2009.

Deutscher Bundestag 15. Wahlperiode (2005). Drucksache 15/5816. Unterrichtung durch die Bundesregierung. Bericht zur Steuerbegünstigung für Biokraft- und Bioheizstoffe. 21.06.2005.

Diefenbacher, H. et al. (2004): Indikatoren nachhaltiger Entwicklung in Deutschland. Ein alternatives Indikatorensystem zur nationalen Nachhaltigekeitsstrategie. FEST, Reihe B, Nr. 30.

European Biodiesel Board (EBB 2010): EBB membership. http://www.ebb-eu.org/members.php. 12.08.2010.

European Commission (1996), in: Directorate – General for Economic and Financial Affairs: European Economy, The CAP and enlargement. economic effects of the compensatory payments.

Fachagentur Nachwachsende Rohstoffe e.V. (FNR 2010): Biodieselanlagen. Region Deutschland. http://www.nachwachsenderohstoffe.de/. 11.08.2010.

Feindt, P. H. & Oels, A. (2005): Does Discourse Matter? Discourse Analysis in Environmental Policy Making, in: Journal of Environmental Policy & Planning, 7 (3), September, S. 161-173.

Fritsche, U. & Wiegmann, K. (2008): Treibhausgasbilanzen und kumulierter Primärenergieverbauch von Bioenergie-Konversionspfaden unter Berücksichtigung möglicher Landnutzungsänderungen. WBGU (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderung). Berlin.

Ford Runge, C. & Senauer, B. (2007): How biofuels could starve the poor. Foreign Affairs. May/June.

Fritsche, U et. al. (2006): Sustainability Standards for Bioenergy. Öko-Institut e.V.

Gerhards, J. (1992): Dimensionen und Strategien öffentlicher Diskurse, in: Journal für Sozialforschung, 3/4, S. 307-316.

Gerhards, J. & Neidhardt, F. (1991): Strukturen und Funktionen moderner Öffentlichkeit: Fragestellungen und Ansätze, in: Stefan Müller-Doohm & Klaus Neumann-Braun (Hrsg.): Öffentlichkeit, Kultur, Massenkommunikation. Beiträge zur Medien- und Kommunikationssoziologie, Oldenburg: BIS, S. 31-89.

Greenpeace International (2007): How the palm oil industry is cooking the climate. Amsterdam

Hajer, M. A. (1995): The Politics of Environmental Discourse. Ecological Modernization and the Policy Process, Oxford University Press, Oxford.

Hajer, M. A. (2003): Argumentative Diskursanalyse. Auf der Suche nach Koalitionen, Praktiken und Bedeutung, in: Reiner Keller; Andreas Hirseland; Werner Schneider, et al. (Hrsg.): Handbuch Sozialwissenschaftliche Diskursanalyse (Band 2: Forschungspraxis), Opladen: Leske+Budrich, S. 272-298.

Hajer, M. A. & Versteeg, W. (2005): A Decade of Discourse Analysis of Environmental Politics. Achievements, Challenges, Perspectives. Special Issue: Does discourse matter? Discourse, power and institutions in the sustainability transition, in: Journal of Environmental Policy & Planning, 7 (3), September, S. 175-185.

Hassel, E. & Wiechmann, V. (2005): Ergebnisse des Demonstrationsvorhabens „Praxiseinsatz von serienmäßigen neuen rapsöltauglichen Traktoren“. Universität Rostock.

Informationsgemeinschaft zur Feststellung der Verbreitung von Werbeträgern e.V. (IVW 2010): Auflagenliste. 2. Quartal 2010.

Institute for Energy and Environmental Research Heidelberg (ifeu 2005): Final report. Biodiesel initiatives in Germany. May.

Institute for Energy and Environmental Research Heidelberg (ifeu 2010): Referenzliste Energie. http://www.ifeu.de/index.php?bereich=ene&seite=refene. 12.08.2010.

Institute for Energy and Environmental Research Heidelberg (ifeu 2009): Synopse aktueller Modelle und Methoden zu indirekter Landnutzungsänderung ILUC. Kurzfassung.

IPCC (2007): „Klimaänderung 2007: Zusammenfassungen für politische Entscheidungsträger“, 4. Sachstandsbericht des IPCC (AR4). Bern/Wien/ Berlin.

Jänicke, M. (1993): Über ökologische und politische Modernisierung, in: Zeitschrift für Umweltpolitik und Umweltrecht, Nr. 2.

Kaup, F. (2006): Nachhaltiger Energieträger Biodiesel? Ökonomische, ökologische und gesellschaftliche Bewertung eines alternativen Treibstoffs. Diplomica.

Kayser, G. (2006): Praxishandbuch des Mittelstandes. Daten und Fakten. Wie ist der Mittelstand strukturiert?

Keller, R. (1997): Diskursanalyse, in: Ronald Hitzler & Anne Honer (Hrsg.): Sozialwissenschaftliche Hermeneutik, Opladen: Leske+Budrich, S. 309-333.

Keller, R. (2005): Wissenssoziologische Diskursanalyse. Grundlegung eines Forschungsprogramms, Wiesbaden: Verlag für Sozialwissenschaften.

Kepplinger, H. M. (1989): Künstliche Horizonte. Folgen, Darstellung und Akzeptanz von Technik in der Bundesrepublik Deutschland, Franfurt am Main, New York: Campus.

Koh, L.P.; Wilcove, D.S. (2008): Is oil palm agriculture really destroying tropical biodiversity? Conservation Letters Volume 1, Issue 2.

Lagniß, O. et al. (2009): Advanced mechanisms for the promotion of renewable energy—Models for the future evolution of the German Renewable Energy Act, Energy Policy Volume 37, Issue 4, April.

Leung, D.Y.C. et al. (2006): Degradation of biodiesel under different storage conditions. Biosource Technology Volume 97, Issue 2, January.

Meadows, D. et al. (1972): The limits to growth.

Mineralölsteuergesetz (MinöStG 2004) vom 21. Dezember 1992. Stand 01. Januar 2004.

Naturschutzbund Deutschland e.V. (NABU 2004): Synthetische Biokraftstoffe als Alternative zum Erdöl. http://www.iwr.de/news.php?id=6736. 03. November 2004.

Nitsch, M. (1991): Treibstoff aus Raps, Ein energie- und landwirtschaftlicher Irrweg, in: Das Solarzeitalter, Band 3.

Öko-Institut e.V. Institute for Applied Ecology (2004): Stoffstromanalyse zur nachhaltigen energetischen Nutzung von Biomasse.

Quirin, M. et al. (2004): CO_2 mitigation through biofuels in the transport sector. Status and perspectives. Ifeu-Institute for Energy and Environmental Research Heidelberg.

Rucht, D. (2008): Bewegungen, Proteste und Themenfelder: Anti-Atombewegung, in: Roth, R.; Rucht, D.: Die sozialen Bewegungen in Deutschland seit 1945.

Scarlat, N. & Dallemand, J.F. (2008): Biofuels certification schemes as a tool to address sustainability concerns: status of ongoing initiatives. European Commission, Joint Research Centre, Institute for Energy.

Searchinger, T. et al. (2009): Climate Change. Fixing a critical climate accounting error. Science Volume 326. 23.10.2009.

Spero, J.E. & Hart, J.A. (2009): The politics of international economic relations.

Stern, N. (2006a): The Economics of Climate Change. The Stern Review. Cambridge: Cambridge University Press (www.hmtreasury; gov.uk/independent_reviews/stern_review_economics_climate_change/stern review_index.cfm (20.07.2010).

Tarditi, S. & Zanias, G. (2001): Common Agricultural Policy, in: Competitiveness and Cohesion in EU Policies. Edited by Ronald Hall et al. Oxford.

Union zur Förderung von Oel- und Proteinplfanzen e.V. (UFOP 2010). Information: Energiesteuergesetz 2010. 23. April 2010.

Umweltbundesamt (UBA 1993) Texte 4/93: Ökologische Bilanz von Rapsöl, bzw. Rapsölmethylester (Ökobilanz Rapsöl), Berlin.

United Nations (UN 2008), Department of Economic and Social Affairs: World Population Prospects. The 2008 revision. Vol.1. Comprehensive Table.

van Thuijl, E. & Deurwaarder, E.P. (2006): European Biofuel Policies in Retrospect. Energy research Center of the Netherlands (ECN).

Verband der Deutschen Biokraftstoffindustrie (VDB 2010) e.V.: Mitglieder. http://www.biokraftstoffverband.de/de/verband/mitglieder/ab.html. 12.08.2010

Weidner, Helmut (2008): Klimaschutzpolitik: Warum ist Deutschland ein Vorreiter im internationalen Vergleich? Zur Rolle von Handlungskapazitäten und Pfadabhängigkeit, Discussion Paper SP IV 2008-303, Wissenschaftszentrum Berlin für Sozialforschung.

Weiß, Hans-Jürgen (1989): Öffentliche Streitfragen und massenmediale Argumentationsstrukturen. Ein Ansatz zur Analyse der inhaltlichen Dimension im Agenda Setting-Prozess, in: Kölner Zeitschrift für Soziologie und Sozialpsychologie, Sonderheft 30, S. 473-489.

Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen (WBGU 2008): Welt im Wandel – Zukunftsfähige Bioenergie und nachhaltige Landnutzung. Berlin.

Zhou, R. (2010): Greenwashing the palm oil industry. http://www.aidwatch.org.au/news/png-greenwashing-the-palm-oil-industry.07.03.2010.