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MASTERARBEIT

Sustainable Perspectives of the Austrian Biofuel Market

**Responses on the directive 2009/28/EC of the European parliament on the promotion of
the use of energy from renewable sources**

angestrebter akademischer Grad

Master of Science (MSc)

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Wien, im	April 2010

Acknowledgements

First I like to thank my adviser Prof. Dr. Harald Wilfing for his forethought and expertise. Although his challenging working practises sometimes do not seem feasible they finally very much helped to create this work in its present form and do have a lasting impact on the author's working habit.

I also like to thank Dr. Karen Kastenhofer, Philipp Withalm, Tobias Friedl and Gregor Petri for in-time comments and remarks.

Furthermore I like to thank my family for their unlimited support. May all our wishes come true.

I am very grateful for countless coffee breaks and inspiring talks at the department for Chemical Ecology and Ecosystem Research of the University of Vienna.

To my friends: Thank you pack for real friendship.

Last but not least, I like to thank all participants for their attendance and cooperation.

...mit der Biodieselerzeugung kann man nicht die Welt retten

(Ök.-Rat Karl Totter)

*...die zweite Generation Biotreibstoffe ist eine Chance, die erste Generation ist
bestenfalls eine Übergangslösung*

(Dr. Franz Fischler)

*...man braucht nicht die Biokraftstoffe um die Welt zu retten aber es wird vieles auf die
Biokraftstoffe abgeschoben*

(Dr. Walter Böhme)

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1 Abstracts

1.1 English

Sustainable Perspectives of the Austrian Biofuel Market

Responses on the directive 2009/28/EC of the European Parliament and of the Council concerning: “The promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC”

This master thesis deals with the question how directive 2009/28/EC will affect specially selected stakeholders of the Austrian biofuel industry and its agricultural and political surrounding.

A striking point of directive 2009/28/EC is to establish a 35 percent saving of greenhouse gas emissions from biofuels compared to its fossil counterpart. After 2017, this rate has risen up to 50% for the existing and up to 60% for the newly built plants.

After a detailed pre-analysis of the current Austrian market situation a guided interview manuscript was formulated and applied to appropriate stakeholders with political, agricultural and economic backgrounds.

Based on a qualitative analysing procedure, this work seeks to determine possible impacts on the Austrian biofuel industry, as well as any problems, needs and demands.

Future developments of the Austrian biofuel segment as well as statements and ideas of various agricultural lobbyist groups regarding to the 50% savings potential demand will also be contemplated. .

Finally this work tries to combine agricultural, industrial and political statements on future demands, the status of the market and funding policies reaching the 2017 goals and looks beyond.

1.2 German

Nachhaltigkeitsperspektiven auf den österreichischen Biotreibstoffmarkt

Reaktionen auf die Richtlinie 2009/28/EG des europäischen Parlaments und des Rates betreffend der Förderung der Nutzung von Energie aus erneuerbaren Quellen und anschließenden Aufhebung der Richtlinien 2001/77/EG und 2003/30/EG

Diese Master Arbeit beschäftigt sich mit der Frage, wie sich Direktive 2009/28/EC der europäischen Kommission vom 23.04.2009 auf besonders ausgewählte Stakeholder der österreichischen Bio-Treibstoff-Industrie und deren politischen und landwirtschaftlichen Umfeld auswirkt.

Ein wichtiger Punkt diesbezüglich ist eine 35%ige Einsparung von Treibhausgasen zu erzielen bei der Produktion von Biokraftstoffen im Vergleich zum direkten fossilen Pendant. Nach 01.01.2017 wird diese Quote bei bestehenden Anlagen auf 50% und bei neu errichteten Anlagen auf 60% angehoben.

Nach einer ausführlichen Voranalyse der gegenwärtigen österreichischen Marktsituation wurde ein Manuskript für ein Leitfadeninterview formuliert und auf Stakeholder mit geeignetem politischem, landwirtschaftlichem und wirtschaftlichem Hintergrund angewandt.

Basierend auf einer qualitativen Auswertungsmethode versucht diese Studie die Auswirkungen von Richtlinie 2009/28/EG auf den österreichischen Biotreibstoffmarkt herauszufinden wie auch die Probleme, Ängste und Wünsche der Teilnehmer. Auch wird versucht Einblick auf die zukünftige Entwicklung zu geben und Aussagen von Landwirtschaftsvertretern, bezüglich des 50% Einsparungszieles, einfließen zu lassen.

Abschließend versucht diese Arbeit Aussagen von industrieller, landwirtschaftlicher und politischer Seite bezüglich zukünftiger Bedürfnisse zu vergleichen um die 2017 Ziele zu erreichen und darüber hinaus zu blicken.

2 Introduction

In the European Union (EU), the road transport sector consumes more than 30% of the total energy input.¹ Up to 98% it depends on fossil fuels which have to be imported on a large scale and are extremely affected by oil market disturbances according to the article. Concerns about steady security of fossil energy supplies and negative impacts on the environment forced investigations on sustainable and renewable energy sources for the transport sector. According to experts, these energy sources have to include a net energy profit, they have to be environmentally friendly, competitive and produced in large quantities without creating a shortage for food production.¹

The implementation of higher rates of alternative produced transport fuels could counteract expectations that 90% of the increase of CO₂ emissions between 1990 and 2010 come from the road transport sector. This is one of the main reasons why the EU fails to meet the Kyoto targets.¹

2.1 European Policy on Biofuels since 2003

In search for sustainable energy sources, the European Union declared biofuels an important factor.² After 2001, the European Commission published its second directive referring to biofuels and their use on a larger scale in 2003.² This directive did not include compelling rates and created a Europe-wide inhomogeneous biofuel system. Some countries implemented biofuel rates at 3%, others, like Germany, raised their biofuel rates up to 5.75%. In 2007, the European Commission (EC) presented its Strategic Energy Review including the Renewable Energy Road Map and its long term goals for renewable energy sources in the EU.³ The 2007 Strategic Energy Review finally lead to the directive 2009/28/EC of the European Parliament on the promotion of the use of energy from renewable sources.

This directive shall establish a general binding target of a 20% share of renewable energy sources in energy consumption and a minimum 10% binding target for biofuels in transport diesel and petrol till 2020.

In this regard the EC gives a lot of attention to sustainability criteria for the production of biofuels and imported crops and will set different binding sustainability criteria to ensure an environmentally friendly production of biofuels in the EU and third party countries.

¹ Biofuels in the European Union, A vision for 2030 and beyond; The European Communities, 2006

² RICHTLINIE 2003/30/EG DES EUROPÄISCHEN PARLAMENTS UND DES RATES zur Förderung der Verwendung von Biokraftstoffen oder anderen erneuerbaren Kraftstoffen im Verkehrssektor (08.05.2003).

³ http://ec.europa.eu/energy/energy_policy/doc/03_renewable_energy_roadmap_en.pdf

The most striking point is to establish a 35 percent saving of greenhouse gas emissions from biofuels compared to its fossil counterpart. After 2017, this rate rises up to 50% for existing and up to 60% for newly built plants.

According to the directive which was agreed and laid down in the European Parliament's legislative resolution of 17 December 2008 of the European Commission, Rape Methyl Ester (RME), which only saves around 45% compared to its fossil counterpart, will no longer be counted for the 10 percent target in 2017.

These points are enacted in Article 17, "Sustainability criteria for biofuels and other bio-liquids" and Article 18, " Verification of compliance with the sustainability criteria for biofuels and other bio-liquids" of the directive on the promotion of the use of energy from renewable sources, as agreed and laid down in the European Parliament's legislative resolution at 17 December 2008. (P6_TA-PROV (2008)0609)⁴

„With effect from 1 January 2017, the greenhouse gas emission saving from the use of biofuels and bio-liquids taken into account [...] shall be at least 50 %. From 1 January 2018 that greenhouse gas emission saving shall be at least 60 % for biofuels and bio-liquids produced in installations in which production started on or after 1 January 2017.“

2.2 The Implementation of Biofuel Goals in Austria

On the part of the Austrian Federal policy this issue has a diminishing relevance. The government program of Mr. Wolfgang Schüssels second legislation period, published in 2002, mentions concrete goals and plans whereas later government programs (Gusenbauer and Faymann) only give a general approach.⁵

Attention is only given to the prominent position of agriculture and its opportunities because under continuation of existing policy, agriculture benefits twofold.

First it is authorized to grow energy crops under given circumstances ("cross-compliance regulations," "good agricultural practice"⁶ on set-aside land (EU-wide, 3.8 million hectares).⁷ Second, as a by-product, a protein feed arises during production of bio-ethanol. In the only Austrian bio-ethanol plant "Pischelsdorf", operated by "Agrana", 180.000t of protein feed arise per year which

⁴ http://ec.europa.eu/energy/strategies/2008/doc/2008_01_climate_action/2008_0609_en.pdf

⁵ Vgl. Regierungsprogramme Schüssell, Gusenbauer, Faymann, <http://www.bka.gv.at>

⁶ Amtsblatt der Europäischen Union (2003); VERORDNUNG (EG) Nr. 1782/2003 DES RATES, OJ 270, 21.10.2003, S.56-58.

⁷ Lebensministerium: Biokraftstoff aktuell: <http://umwelt.lebensministerium.at/article/articleview/66083/1/1467>

corresponds to 130,000 tonnes of soy grist and could replace over 20 percent of Austriann import demand on soybeans.⁵ This reference also reflects the influence of various agriculturally interesting groups.

Meanwhile the European commission repealed its regulation on set-aside land.⁸

Despite diminishing relevance of biofuels in governmental programs the reality looks different. In Austria, we have got an increasing share of biofuels blended to all types of transport diesel and petrol. Their share increased as follows:

- 2,5% since October 2005
- 4,3% since 2007
- 5,75% since October 2008
- 7% since 2009

Till 2020, Austria will try to increase this share up to 10%.⁹

However, these ambitious goals can only be reached by a parallel increase of agricultural efficiency, reclamation of former fallow land and an increase of import rates of raw materials.¹⁰

All these factors cast a damning light on the ecological use of biofuels and their production chain so the purpose of the thesis at hand is to find out how the biofuel industry really describes sustainability and if these points agree with the ideas of the European Union.

This work also seeks to determine the impact of the directive 2009/28/EC on the Austrians biofuel industry, their problems, fears and demands. The future development of the Austrian biofuel segment as well as the statements and ideas of various agricultural lobbying groups regarding the demand to save 50% of greenhouse gas emissions from biofuels compared to their fossil counterpart will also be added.

Finally this work tries to combine agricultural, industrial and political statements on future demands, the status of the market and the funding policies for reaching the 2017 goals and looks beyond.

⁸ As at November 2009

⁹ Stichwort Biokraftstoffe, Zahlen und Fakten; Lebensministerium, November 2009

¹⁰ OECD, Stefan Tangermann (2008); *Weltweiter Rohstoffhunger: Brot als Luxus?*, <http://www.clubofrome.at/2008/rohstoffe/ergebnisse.html>

3 Objectives

This work seeks to determine some possible impacts of a recently decided European sustainability directive towards an established branch of industry. The focus of this work centres on the following points.

3.1 Main Objectives

1. What possible economical impact will the implementation of a European sustainability directive have on the production and the processing of biofuels in Austria?
2. What level of interest do biofuel- and raw material producers have in integrating sustainable criteria¹¹ within the production process?
3. Which capacity do biofuel- and raw material producers have to integrate sustainable criteria within the production process?
4. How do the three pressure groups – agriculture, politics and biofuel producers – interact? How do they influence each other?

3.2 Secondary Objectives

- a. What impacts and effects on long term industrial planning and investments are generated by an ever-changing political attitude?
- b. Which criteria do biofuel producers have to fulfil in order to obtain federal fundings because of a new market situation?

¹¹ What is sustainability? Which criteria sustainable produced biofuels have to fulfill? In this case to answer these questions I used the definitions of the sustainable directive 2009/28/EC mentioned in Article 17 "Sustainability criteria for biofuels and other bioliquids".

4 Research Questions

To analyze the Austrian biofuel segment, a guided interview manuscript was designed.¹² Within this guided interview all questions were designed to answer the following research questions. —

Main Research Question:

Will any changes be triggered in the direction towards a sustainable development in the Austrian biofuel segment due to the implementation of the European sustainability guideline? ¹³ —

Sub-Research Questions:

1. How do biofuel producers, biofuel processors, raw material producers and politicians responsible for biofuels define sustainability or sustainably produced biofuels and are these ideas in line with the demands of the European Union?
2. Which level of interest do Austrian biofuel producers have in using any different technologies because of sustainable guidelines on the part of the European Commission?
3. Which level of capacity do Austrian biofuel producers have for using any different technologies because of sustainable guidelines on the part of the European Commission?
4. Does the Austrian funding policy offer any incentives to adopt new sustainable technologies on a large scale?
5. Which level of interest do Austrian farmers have in changing existing production methods and types of products due to European sustainability demands?
6. Which level of capacity do Austrian farmers have in changing existing production methods and types of products due to European sustainability demands?

¹² Cf. chapter 6.1

¹³ In this regard sustainable changes will be seen in terms of sustainable directive 2009/28/EC

5 Identification of Stakeholders

5.1 Pre-work

As mentioned above, this work tries to find out which possible consequences the directive 2009/28/EC will have on political, agricultural and industrial behaviour. To identify agricultural and industrial stakeholders, the biofuel market area has to be analyzed in order to select all appropriate stakeholders and to investigate their state of knowledge concerning directive 2009/28/EC.

For this purpose, the investigated supply chain will be divided into three segments and then each segment will be considered separately. It is important to exclude all different biofuel supply chain stakeholders to analyze their proper demands and fears and how they interpret the role of other stakeholders. The sub-division into 3 segments turned out to be the most appropriate working method because they represent all the members involved in the biofuel production chain.

These 3 sub-divisions were identified as:

1. Biomass producers
(Farmers and their corresponding lobbyists)

2. Biomass processors
(There is only one company in Austria processing biomass to vegetable oil for biofuel purpose. The other companies directly use vegetable oil or other raw materials to process biofuels)¹⁴
—

3. Biofuel producers
(As mentioned by ARGE Biokraft)¹⁵
—

¹⁴ Firma Novaoil, Bruck an der Leitha

¹⁵ <http://www.biokraft-austria.at>

In a second step, all relevant Austrian biofuel stakeholders have to be selected for the following interviews. This was done by using a pre-questionnaire which included four important points. Firstly this questionnaire should reveal the stakeholders' knowledge on the subject. Secondly Austria's main biofuel supply chain stakeholders should be filtered out and, thirdly, possible political contacts should be identified. Finally biofuel experts who are not involved in the production process or dedicated to political activities but do have professional qualifications concerning this topic should be identified to compare their answers with the data gained for later discussion and interpretation.

To identify all appropriate stakeholders, several Austrian biofuel experts were selected after a detailed environmental analysis based on internet- and telephone research.

Therefore selected contacts were:

- Bauernbund¹⁶ (DI Schlerizko)
- Bio Diesel International (DI Heinrich Sigmund)
- Biofuels Austria (Dr. Andreas Stepniczka)
- AEA¹⁷ (Mag^a. Bettina Emmerling)
- Accenture Austria (Dr. Martin Dusek)
- Ökosoziales Forum¹⁸ (Dr. Franz Fischler)
- Ministry of life (Dr. Thomas Wiederstein)

5.2 Pre-questionnaire

It has to be said in advance that the pre-questionnaire's analysis was also necessary to improve the author's knowledge about the Austrian biofuel market situation and his knowledge on biofuels in general. The pre-questionnaire's answers helped to define the groups of stakeholders and how to design the guided interview questionnaire to fulfil the conditions of the objectives.¹⁹

¹⁶ „Bauernbund“ and „Landwirtschaftskammer“ are lobbies for Austrian farmers

¹⁷ „AEA“ stands for Austrian Energy Agency

¹⁸ „Ökosoziales Forum“ is an Austrian NGO

¹⁹ The Pre-questionnaire is attached in Appendix A

5.3 Analysis of the Prequestionnaire and Selection of the Participations

To identify all Austrian biofuel stakeholders involved, the pre-questionnaires were carefully analysed. This was done by revising all pre-questionnaires and noting all the names, organisations and companies mentioned. Some persons were also considered which did were not part of the interviews but were additionally mentioned.

The evaluation of the questioning showed that to identify agricultural and economic stakeholders, the focus has to be laid on biomass producers, biomass processors and biofuel producers as had been assumed in advance.²⁰

Furthermore, other appropriate political stakeholders could also be identified by this approach.

Summing up I had to concentrate on three different groups.

- 1.) Biomass producers or rather their corresponding interest groups

These groups and the contacts were:

Bauernbund	Dr. Johannes Abentung
	Johann Moitzi
Biomasseverband	DI Gregor Grill
Landwirtschaftskammer	DI Alexander Bachler
Verband österreichischer Land-und Forstbetriebe	DI Felix Montecuccoli

Table 5.3.1.: Biomass producers or rather their corresponding interest groups

²⁰ Cf. chapter 5.1

2.) A group of political decision makers

In this regard, my contacts were spokespersons on environmental, agricultural or energetic tasks from political parties and the federal ministry of agriculture, forestry, environment and water management (ministry of life[Mol])

These parties or institutions and the contacts were:

Lebensministerium (Ministry of life)	Dr. Heinz Bach
	DI Sonja Schantl
ÖVP (Austrian Peoples Party):	NA ²¹ Hermann Schultes
SPÖ (Austrian Labour Party)	NA Petra Bayr
FPÖ (Austrian Freedom Party)	NA Norbert Hofer

Table 5.3.2.: Political parties and institutions

All parties were contacted via telephone or email but unfortunately only the Austrian Peoples Party, the Austrian Labour Party and the Austrian Freedom party agreed to my requests for an interview. As a consequence, only the replies of these parties and the replies of these public servants from the ministry of life could be used for further interpretation and discussion.

²¹ NA stands for member of parliament

3.) Biomass processors and Biofuel producers listed by ARGE Biokraft

	plant locationt	Raw material	Biodiesel- / Bioethanol production capacity t/a	contact person
1.1	Bruck/Leitha, Navaol Austria GmbH	rape	25000	Marc Breuss
1.2	Enns, Oberösterreichische Biodiesel GmbH	rape	110000	Dr. Christoph Walla
1.3	Gaishorn, StyrianBioFuels GmbH	rape	60000	DI Christian Soos
1.4	Hohenau, ABID Biotreibstoffe AG	rape	50000	Dr. Manfred Krutka
1.5	Krems, Biodiesel Krems GmbH	soy, used edible fat, rape	55000	Ing. Peter Mittermair
1.6	Mureck, SEEG regGenmbH	rape, used edible fat	9000	ÖK-Rat Karl Totter
1.7	Schönkirchen, BIOIL	used edible fat	20000	Dr. Claudia Ötsch Mag. Stefan Lazar
1.8	Wien-Lobau, BioDiesel Vienna GmbH	rape, sunflower	140000	Ewald-Marco Münzer
1.9	Biodiesel Zistersdorf GmbH	used edible fat, plant oil	20000	Ing. Johann Pribitzer
2.1	Pischelsdorf	wheat, corn, sugar beet	190.000 t	Mag. Andreas Schröckenstein

Table 5.3.3.: Biomass processors and biofuel producers

As mentioned in chapter 5.1, a fourth group of participants was added. This group contained experts on the biofuel market but they were neither directly involved in growing raw materials, processing or production of biofuels nor in politics.

These stakeholders were also interviewed under the same circumstances but their answers were not analyzed like the ones of the other three groups. The statements of these people had some influence on the final interpretation and conclusion after the analysis of all data gained.

The members of this fourth group are:

DI Dr. Reinhard Thayer (*ARGE BIODKRAFT*)

DI Dr. Walter Böhme (*OMV AG*)

Dr. Franz Fischler (*Ökosoziales Forum, FFC*)

DI Dr. Reinhard Thayer is currently the managing director of *ARGE BIODKRAFT* a biofuel interest group situated in the *Wirtschaftskammer Austria* and very well knows about the problems and needs of Austrian's biofuel industry.

DI Dr. Walter Böhme is the head of the innovation management department of the business division *Refining & Marketing* of the *OMV AG* which is Austria's biggest buyer of biofuels produced in Austria. By currently managing biofuel related projects, Dr. Walter Böhme very well knows today's energy problems and the tasks biofuel producers have to fulfil in order to get purchasing contracts.

Finally Dr. Franz Fischler is part of this group of biofuel experts. He is currently the president of the *Ökosoziales Forum* which is a platform and think tank to develop the ideas of an eco-social market economy and he is also head of a bioethanol interest group called *FFC*. These characteristics and his long-time mandate of being Austrian minister for agriculture and forestry and European commissioner of agriculture gives him a lot of expertise concerning the problems of European agriculture and energy supply.

To sum up, I interviewed the spokespersons of ten biofuel producers, four agricultural interest groups, three governmental parties as well as two state officials and three external biofuel experts.

6 Analysing Methods

6.1 Guided Interview Manuscript²²

Based on internet and literature research as well as talks with the supervisor of the work at hand and other experts like Karen Kastenhofer, I decided to design a guided interview manuscript as general data source. According to Schmidt (2002) the guided interview manuscripts' function is to operate like a checklist without a rigid order of questions.²³ It does not contain any pre-formulated answer possibilities. Instead, the stakeholders should use their own words to answer the questions.

The structure of the guided interview looks as follows:

- i) First, general questions were asked. This part contained questions about the size of the company meaning economic data like the number of employees, the kind of products, the variety of raw materials used, etc...
- ii) The second part contained questions about the development of the company and the market with the implementation of a European sustainability directive. This part also included questions about the acceptance of sustainability, personal opinion, impacts on price development, impacts on the company, growth opportunities for the branch, ecological and social benefits, etc...
- iii) The third part of the manuscript contained questions about 2nd generation biofuels, growth opportunities as well as risks or fears, federal funding and, finally, consequences of the world market for the European and Austrian market.

The main focus of the guided interview was laid on points (ii) and (iii) which was divided into sub-clusters to answer the main research question and its sub units.²⁴ Therefore, it was important to create a specially adapted guided interview manuscript for each group of stakeholders. This was necessary to compare all different views of the different groups of stakeholder on the same topic.

The questioning of agriculture interest groups and biofuel consultants²⁵ excluded point (i).

²² The guided interview manuscript is attached in Appendix A

²³ Schmidt, Ch. (2002): Wie führe ich ein gutes Leitfadenterview?, <http://www.uni-hindesheim.de>

²⁴ Please refer the guided interview manuscript in Appendix A

²⁵ Group four of investigated research groups

6.2 Interview Settings

During the interview phase, Hermanns(1992) suggests to direct the interviewee's attention to some critical points.²⁶ The informant reflects events he or she has perceived in form of a story or a monologue.

Thus it is the interviewers' role to persuade the informant to reveal all relevant information on the topic in form of a continuous statement. This situation occurs, according to Hermanns, via a "narrative-generating" starting question.²⁷

The interviewer must not interrupt the informant with thematic or evaluative questions. Normally the informants' monologue is followed by adding some forgotten information.

Now the interviewer is to ask additional questions indicated by gaps or hints. These questions should not be answered by "Yes" or "No". So it is the interviewer's task to avoid questions in a suggestive way. If contradictions occur, it is necessary to re-ask the informant.

When this final interrogative round is concluded and the participant does not add other ideas, the process of the data elevation can be considered as finished.

6.3 Transcription Process

After recording the interviews, it was necessary to transcript them for analysis. For this purpose, Flick (1995) recommends a certain degree of accuracy during transcription.²⁸ According to Hopf and Schmidt, it is also very important to "re-listen" to the interviews and compare them with all transcripts to avoid transfer mistakes.²⁹

In my case, it was very useful to work with a computer program called "f4".³⁰ This program allows to listen and write simultaneously and therefore speeds up the transcription process.

²⁶ cf. Hermanns,H.,(1992), p.118.

²⁷ cf. Hermanns,H.,(1992), p.119.

²⁸ cf. Flick,U.,(1995), p.192 f.

²⁹ cf. Hopf and Schmidt,(1993).

³⁰ www.audiotranskription.de

6.4 Analysing Method of the fully transcribed Guided Interview Manuscript

In addition to the above mentioned tripartite structure of the guided interview manuscript, it also contained another specification. Questions were designed to utilize a qualitative method of analysis.

Usually quantitative questions can be analysed by use of statistic programs like “SPSS” whereas qualitative questions require another method of analysis. In this case, “Die Analyse von Leitfadeninterviews”³¹ a method developed by Christiane Schmidt in the early 90s was useful.³²

This method is characterised by its partial structure containing 5 elements. According to *Schmidt*(2005) these elements are called:

- 1.) Material orientated forming of categories for analysis
- 2.) Assembling of these categories to a coding main thread
- 3.) Coding of material
- 4.) Quantified overview of material³³
- 5.) Interpretation of causes

1.) The working process starts by determining categories for analysis by reading and re-reading through all transcribed interviews. The objective is to find out all subjects and mentioned aspects of each transcript regarding the main or secondary objectives. During the formation process, presumptions constantly occur and have to be joined together with the data found in the material. A simple transfer of used phrases is not allowed. Instead, a wide range of used formulations is desirable to create an overviews compilation. This is important to add new aspects, to delete ones that are not useful, and simply helps to organize further work. It is not this parts’ task to compare statements of interviews given but it is useful to note similarities or differences.

Another important point is to be aware of important information sometimes not following direct questions. As mentioned above, direct questions should be avoided but sometimes they are necessary in cases of potential misunderstanding or miscommunication.

This first process ends by merging all written subjects and aspects and formulating different categories.

³¹ The analysis of guided interviews

³²Schmidt, Christiane (2005): Analyse von Leitfadeninterviews. In: Qualitative Forschung. Ein Handbuch. Hg: Flick, Uwe. 4.Auflage, Rowohlt, Reinbek bei Hamburg, S. 447 – 456.

³³ This part contains a quantitative summary of all found data

2.) Now all found categories have to be joined together to create a main connecting thread of categories which should reflect all aspects and give answers to the objectives. It is divided into main categories and sub-clusters called expressions.

This main connecting thread will later be used on all transcribed interviews to look up passages matching with one or more categories. This process is called “coding”.

3.) By using the main connecting thread, all interviews now will be estimated and categorized. All other gained categories, formulated out of the interviews, now will be used on the interviews. In order to compare dominant trends the amount of information now has to be decreased. The loss of data depends on how subtly the analysing categories are differentiated.

If one finds a passage in the interviews matching with one category, it is important which expression of this category suits most. The expression will be noted. According to Schmidt, only one of these expressions can be used. In my case some categories offer more than one possible expression because of the huge variation of possible answers and the general complexity of this case.

4.) After noting all expressions found in the different categories, the results will be arranged in tabular form. Technically spoken, this is an overview of frequencies of selected categories and expressions. A quantified overview of material allows further analysis and shows possible correlations.

5.) Finally Schmidt recommends a consolidated cause interpretation as last step of analysis. This step could lead to new hypotheses, new considerations or, as in my case, brings all data found more into line with my research questions. This will be done by selecting all striking expressions, comparing them with other expressions in order to answer the research questions. But instead of using numbers or tables to demonstrate any results found, I used a semi-quantitative method to identify trends as final step.

The analysis of the guided interview manuscript was followed by interpretation and conclusion where all gained data was confronted with the expertise of the biofuel consultants as mentioned above.

6.5 Rating of Mentions – A semi-quantitative Approach

To rate and to analyse given expressions a semi-quantitative approach was chosen to identify certain trends. Unfortunately the search for an appropriate approach turned out to be a complicated undertaking. According to Chevallier et al. (2004), there is no reliable semi-quantitative scoring system available for general tasks.³⁴ Also the method of “Quasi – Statistiken” recommended by Barton & Lazarsfeld (1979) which uses formulations like “most of”, “some” or “commonly used” to indicate correlations and frequency distributions³⁵ did not offer satisfactory results.

So a unique semi-quantitative scoring system was designed which combines quantitative numeration with the significance of expressions mentioned on each investigated topic.³⁶

The system looks as follows:

There were three different groups of participants selected for the interview procedure as mentioned above: biofuel producers, agricultural interest groups and politicians. The biofuel producers’ group contained 10 participants, the agricultural group 4 and the political group 4 as well. The distribution of participants generated the following semi-quantitative scoring system:

If **0% - 39%** of the participants used an expression on its respective category, this expression was not counted as significant.

If **40% - 49%** of the participants used an expression on its respective category, this category had some influence on the interpretation.

If **50% - 100%** of the participants used an expression on its respective category, this category was seen as a trend and had a significant influence on the data interpretation.

³⁴ Chevallier et. al,(1994),In Hepatology, August 20(2):349-55.

³⁵ cf. Barton and Lazarsfeld,(1979), p.70.

³⁶ cf. Chapter 7.1.3ff.

These values were generated by the following formula:

$$P = \frac{x}{n} \times 100$$

P.....Percentage rate

x.....rate of expression usage

n.....number of participants

Negative trends were noted as well and indicated by a “-“.

7 Results

In advance of the analysis of the three different guided interview manuscripts the word “*sustainability*” and how the European commission defines it should be clarified. In this regard, all definitions mentioned in Article 17 "Sustainability criteria for biofuels and other bioliquids" of the sustainable directive 2009/28/EC were used.³⁷ The definitions used are:

- Greenhouse gas emission saving
- Nature conservancy of woods, grasslands and wetlands
- General conservation of ground, water and air
- Agriculture has to be carried out in accordance with the minimum requirements for good agricultural and environmental conditions³⁸
- Protection of workers, especially no forced labour, no child labour and equal remuneration of men and women workers for work of equal value
- Impact of the European biofuel policy on the availability of food at affordable prices

In order to compare these definitions with the answers of the participants they had to be simplified and standardized by separating them into two categories. One category was described by ecological tasks (Greenhouse gas emission saving, Nature conservancy and good agricultural practice). The other category contained social tasks (Protection of workers, availability of food at affordable prices).

Now it was possible to use these two categories on the answers of the participants. This was done to answer the research question: “How do biofuel producers, biofuel processors, raw material producers and biofuel related politicians define sustainability or sustainably produced biofuels?”

Finally, as mentioned in chapter 6.4, I started by listing all categories and expressions found and I tried to give a quantitative overview of the material (cf.6.4.). Each category and its expressions were treated on its own.

³⁷ Directive 2009/28/EC, p.36-38.

³⁸ OJ L 30, 31.01.2009, p.16.

7.1 Biomass Producers or rather their corresponding Interest Groups

This group contained 4 participants as mentioned in chapter 5.3. They are consultants, directors or presidents of their company or interest group. Their answers revealed doubts as well as perspectives on the future development of growing crops for biofuel purposes.

The interview analysis³⁹ revealed 7 categories:

- Sustainability or sustainably produced biofuels (including raw materials)
- Rape and its future usage
- 50% greenhouse gas emission saving goal
- Energy problem in general
- 2nd generation biofuels
- Federal funding
- Consequences of worldwide biofuel production

7.1.1 Sustainability or sustainably produced Biofuels (Including Raw Materials)

Category	Expressions used by Participants	mentioned	Percentage Rate
Sustainability	According to forest law	III	75%
	Circulation economy	I	25%
	According to cross compliance	I	25%
	According to Brundtland report	II	50%

Table 7.1.1.: Sustainability or sustainably produced Biofuels (Including Raw Materials)

This category dealt with the question in which way the participants were aware of sustainability. In the case of mentioning the *Brundtland report* the participants referred to one phrase. It was:

*“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*⁴⁰

³⁹ Cf. Chapter 6.4

⁴⁰ UN Document A/42/427, (1987): Our Common Future, Chapter 2: Towards Sustainable Development, <http://www.un-documents.net/ocf-02.htm>

The Austrian forest law tells us the following:

“Nachhaltige Waldbewirtschaftung im Sinne dieses Bundesgesetzes bedeutet die Pflege und Nutzung der Wälder auf eine Art und in einem Umfang, dass deren biologische Vielfalt, Produktivität, Regenerationsvermögen, Vitalität sowie Potenzial dauerhaft erhalten wird, um derzeit und in Zukunft ökologische, ökonomische und gesellschaftliche Funktionen auf lokaler, nationaler und globaler Ebene, ohne andere Ökosysteme zu schädigen, zu erfüllen.“⁴¹

As table 7.1.1 shows, the forest law and the Brundtland report which talk about ecological, economical as well as social aspects were used most frequently. By using these explanations the participants indirectly had the same idea about sustainability as what directive 2009/28/EC is talking about. The participants were not directly talking about greenhouse gas emission savings or good agricultural practice but they touched these topics on a higher level.

7.1.2 Rape Methyl Ester (RME) and its Future Usage

Category	Expressions used by Participants	mentioned	Percentage Rate
Rape	Rape will stay because of its positive effects on the rotation of crops and there are no alternatives for production of standardised biofuels	II	50%
	By-products have to be counted as well	I	25%

Table 7.1.2.: Rape and its future usage

As mentioned in chapter 2.1, Rape Methyl Ester (RME) will no longer be counted for the 10% target after 2017. This category tried to find out and define possible other solutions but the participants delivered unexpected answers. 50% of the participants thought that rape will stay because of its positive effects on the rotation of crops. Another aspect was that rape guaranties standardized production of biofuels especially during the winter because of RME’s low CFPP⁴² value.

The CFPP value describes the point of thickening of biofuels when their ester structure crystallizes and starts to plug filters or engine injectors because of certain temperatures.

⁴¹ Lebensministerium, (1975): Das Forstgesetz, <http://www.lebensministerium.at/article/articleview/19480/1/5563>

⁴² Cold Filter Plugging Point

Typical values are:⁴³

Biodiesel from rape: -12°C
 Biodiesel from used edible fat: -3°C
 Biodiesel from palmoil: +15°C

Because of its high CFFP value biodiesel from palmoil is not ready for use in Austria with its average change of temperature during the year from -10°C in winter till +35°C in summer.⁴⁴

If there are possibilities to lower the use of fertilizers and rape becomes certificated, there will not be any objection to use rape for biofuel purposes.

7.1.3 The Goal to save 50% of Greenhouse Gas Emissions

Category	Expressions used by Participants	mentioned	Percentage Rate
50% Goal	By reduction of fertilizer	III	75%
	Introduce world wide cross compliance	II	50%
	Certifications will be introduced	I	25%
	Greenhouse gas emission savings possible via use of new technology, new soil processing and harvesting methods	II	50%

Table 7.1.3.: The 50% saving Goal of Greenhouse Gas Emission

This question centred around one topic. Which role is agriculture able to play to reach the 50% greenhouse gas emission saving goal within the whole biofuel lifecycle. The common answer was to reduce the use of fertilizers during the growing period directly followed by the introduction of world wide cross compliance⁴⁵ and the progress of technology and working methods.

These approaches are positive ideas but no participant offered an explanation how to realise them.

Summary: 75% By reduction of fertilizers during growth
 50% Introduction of word wide cross compliance
 50% Progress of technology and working methods
 – No explanation how to realise them

⁴³ <http://www.petrotec.de>

⁴⁴ Cf. www.wetter.at, historical climate data of Austria, 2008.

⁴⁵ Amtsblatt der Europäischen Union (2003); *VERORDNUNG (EG) Nr. 1782/2003 DES RATES*, OJ 270, 21.10.2003, S.56-58.

7.1.4 The Energy Problem in General

Category	Expressions used by Participants	mentioned	Percentage Rate
Energy problem in general	Certifications will be introduced and have to consider the hole life cycle	I	25%
	Solution is an europeanwide cooperation, especially usage of Eastern Europe soils	III	100%
	circulation economy	II	50%

Table 7.1.4.: The Energy Problem in General

This category was chosen to give an overview what could be done on the part of agriculture for the future development in general. The expressions used influenced the interpretation of all data combined.

All participants mentioned a European wide cooperation to solve future energy problems especially concerning growing crops for biofuel purposes. In this regard all participants directly mentioned the capacities of Eastern European soils which simply have to be industrialized like Western European soils. As far as industrialization is concerned the participants thought about better infrastructure and better developed growing and harvesting methods.

An expression mentioned by 50% of the participants was that the so-called circulation economy which tries to focus more on regional production and consumption without huge import and export rates has to be pushed forward. In the case of biofuel production all raw materials used should have a catchment radius of less than 30km. In some cases this isn't possible because of a limitation of raw material in the catchment radius so it has to be expanded beyond regional boundaries. In this case certifications should guarantee sustainably produced and transported raw materials.

Summary:

- 100% European wide cooperation, focus on Eastern Europe
- 50% Extension of circulation economy could solve the problem
- Only one participant mentioned certifications as possibility

7.1.5 2nd Generation Biofuels

Category	Expressions used by Participants	mentioned	Percentage Rate
2. Generation	Usage of the hole plant	I	25%
	Is already being done	I	25%
	Will not play a part till 2020, first the 1st generation has to work properly	I	25%

Table 7.1.5.:2nd Generation Biofuels

As table 7.1.5 shows all participants had different answers to the question what future 2nd generation biofuels will look like. In fact this is a huge lack of knowledge because no one was able to explain exactly what 2nd generation will look like. Many technologies, like *BTL*⁴⁶, are on their marks but no one can tell which will win through the others.

Summary: – No one exactly knows what 2nd generation biofuels will look like

7.1.6 Federal Funding

Category	Expressions used by Participants	mentioned	Percentage Rate
Funding	No direct funding for agriculture	II	50%
	Possible raise of ÖPOOL funding to reduce fertilizers	I	25%
	Promotion of food production promotes energy crop production	I	25%
	An operating market is more important	II	50%

Table 7.1.6.: Federal Funding

Table 7.1.6 indicates also indicates that the topic federal funding does not bring about a consistent opinion by the participants. Only two expressions were used twice. Two participants mentioned that according to their opinion there will not be any direct federal funding for agriculture to adapt new technologies or working methods to reach the goal of 50% greenhouse gas emission saving.

⁴⁶“BTL” stands for **B**iomass **T**o **L**iquid

In the same breath, they also mentioned that agriculture does not need any funding to do so. Agriculture needs an operating market with guaranteed funding and stable prizes.

Summary: 50% No federal funding to adapt new technologies or working methods
50% An operating and stable market is more important

7.1.7 Consequences of Worldwide Biofuel Production

Category	Expressions used by Participants	mentioned	Percentage Rate
Consequences of worldwide biofuel production	Prices were forced by weather catastrophes, investment funds and increase of world population	III	100%
	Problems because of food distribution matters	I	25%
	Worldwide biofuel production stimulates European production	II	50%

Table 7.1.7.: Consequences of worldwide biofuel production

That topic “simply” tried to find out which consequences a worldwide biofuel production would have on prices of crops and which consequences would occur for the Austrian home market. As table 7.1.7 indicates all participants did not blame biofuels for the 2007 and 2008 crop price increase. They blamed weather catastrophes like the heat waves in Australia, investment funds at the CBOT⁴⁷ in Chicago and a steady increase of the world population. They also got upset because of newspaper articles⁴⁸ and the attitudes of some NGOs discrediting biofuels. In their opinion, some NGOs, newspapers and other activists do overact.

Another interesting point mentioned by the participants was that a worldwide biofuel production would stimulate our European production. 50% of the participants thought that non-European production only starts with a simultaneous increase of demand. If there is an increase of demand in their own country, these formerly export orientated countries will stop to export biofuels to Europe which will boost European production to fulfill its biofuel goals.

Summary: 50% Weather catastrophes, investment funds and a steady increase of the world population forced up prices of crops
25% Worldwide demand of biofuels stimulates European production

⁴⁷ Chicago Board Of Trade

⁴⁸ E.g. “Biodiesel ist nachhaltiger Unsinn”, Die Zeit, 38/2004.

7.2 Political Decision Makers

In this regard I tried to reach political decision makers of each party as well as civil servants from the ministry of life. My aim of research was to find out how and in which way political decision makers will react on directive 2009/28/EC and on the biofuel development in general to compare their answers with answers of the other groups. All in all I was able to talk to two civil servants within one interview and to three members of parliament.

The categories found were:

- Sustainability or sustainably produced biofuels (including raw materials)
- The goal to save 50% of greenhouse gas emissions
- Federal funding
- 2nd generation biofuels
- Consequences of worldwide biofuel production

7.2.1 Sustainability or sustainably produced Biofuels (Including Raw Materials)

Category	Expression used by Participants	mentioned	Percentage Rate
Sustainability	Next generation	I	25%
	Sustainable production	I	25%
	Saving of greenhouse gas emissions	I	25%

Table 7.2.1.: Sustainability or sustainably produced biofuels (including raw materials)

As table 7.1.2 clearly indicates, the political decision makers did not have unisonous ideas what sustainably produced crops for biofuel usage exactly look like. Maybe a political party's structure affects the way how each department has its own idea what sustainability should look like

Because of single mentions only, this category was skipped for later comparison.

7.2.2 The Goal to save 50% of Greenhouse Gas Emissions

Category	Expressions used by Participants	mentioned	Percentage Rate
50% goal	By reduction of fertilizers	I	25%
	By-products have to be counted as well	I	25%

7.2.2.: The Goal of Saving 50% Greenhouse Gas Emissions

The participants did not have a common opinion on this topic due to the fact that most of the participants are not agriculture experts per se. In fact only one participant was able to give answers to this topic.

Because of single mentions only, this category was skipped for later comparison.

7.2.3 Federal Funding

Category	Expressions	mentioned	Percentage Rate
Funding	Production of biological fuels	I	25%
	For agriculture the ELER and ÖPOOL program	I	25%
	Within the scope of the national energy strategy	II	50%
	Increase of blending rates is not necessary because the market regulates pricing	I	25%

Table 7.2.3.: Federal Funding

This topic tried to investigate how political decision makers think how to support raw material and biofuel producers because of possible negative impacts of directive 2009/28/EC. The participants answered in differing ways because of their different attitude towards the topic. Some talked about federal funding programs like ELER⁴⁹ or ÖPOOL⁵⁰ whereas two participants turned their attention to the *national energy strategy*⁵¹ where all future federal energy activities are described.

Summary: 50% The *national energy strategy* describes the federal funding policy on biofuels

⁴⁹ http://europa.eu/legislation_summaries/agriculture/general_framework/160032_de.htm

⁵⁰ www.lebensministerium.at

⁵¹ <http://www.energiestrategie.at>

7.2.4 2nd Generation Biofuels

Category	Expressions used by Participants	mentioned	Percentage Rate
2 nd generation	What exactly is 2 nd generation?	I	25%
	Promoted via environmental funding	I	25%
	Research funding	III	75%
	Dependent on the oil prize	I	25%
	Will only come with a simultaneous increase of efficiency	I	25%

7.2.4.: 2nd Generation biofuels

This category was designed to find out how 2nd generation biofuels should be promoted. Surprisingly the group of political decision makers had the same problem as the group of agriculture experts. In this group, too, no one was able to describe what 2nd generation biofuels will exactly look like. In fact, one participant even mentioned this problem.

There was just one eye catching expression concerning the promotion of biofuels. 75% of the participants thought that research funding is essential to enhance biofuels. They did not know which new technology finally will win through but until then it is necessary to invest in research activities to find out.

Summary: 75% Research funding is necessary to enhance 2nd generation biofuels
 – No one knows what 2nd generation biofuels will exactly look like

7.2.5 Consequences of Worldwide Biofuel Production

Category	Expressions used by Participants	mentioned	Percentage Rate
Worldwide Influence	Worldwide production will raise production in Austria and Europe	II	50%
	There were more virtually traded crops at stock exchanges than actually produced	I	25%

Table 7.2.5.: Consequences of worldwide biofuel production

For the same reason as mentioned above, (7.1.7), two participants think that worldwide production will raise production in Austria and Europe.

Summary: 50% Worldwide production will raise production of biofuels in Austria and Europe

7.3 Biomass Processors and Biofuel Producers

This group contained 10 participants, mainly from the upper management level. Strictly speaking there were 3 managing directors, 3 plant managers and 4 board members distributed over 9 biodiesel and 1 bioethanol production facility.

The group Biomass Processors and Biofuel Producers took up the most prominent position in this investigation because this group has to react directly to all new regulations concerning directive 2009/28/EC. How the participants react to new developments, what they think possible cooperation with agriculture and politics should look like and what they think about future development it was to be found out.

The categories found were:

- Annual production
- Type of in use/used raw material
- Delivering/ delivered to
- Sustainability or sustainably produced biofuels
- 50% emission saving goal
- Problems of 1st generation biofuels
- Changes of 1st generation biofuels
- 2nd generation biofuels
- Federal Funding
- Promotion of biofuels (situation of the market)
- Energy problem in general
- Consequences of worldwide biofuel production

7.3.1 Annual Production⁵²

Category	Expressions used by Participants	mentioned
Annual production	0 - 10.000t/a	I
	10.000 - 49.999t/a	I
	50.000 - 99.999t/a	III
	≥100.000t/a	III
	Out of order	II

Table 7.3.1.: Annual production

As table 7.3.1 shows there are three big Austrian players in the biofuel segment with capacities of about 100.000 tons per year. There are also three medium sized production facilities with capacities from 50.000t/a to 99.999t/a followed by smaller facilities. Attention has to be given to the expression *out of order* because there are two production plants in Austria ready for re-commissioning which are still shut down. Reasons for this circumstance are bad planning, increased prices of raw materials and an artificially created oversupply of biofuels by the state according to the participants.⁵³

7.3.2 Type of In Use / Used Raw Materials

Category	Expressions used by Participants	mentioned	Percentage Rate
Type of in use /used raw material	Rape	IIIIIIII	80%
	Sunflower	II	20%
	Used edible fat	IIIIII	70%
	Animal fat	I	10%
	Soya	IIII	50%
	Others	II	20%

Table 7.3.2.: Type of in use / used raw materials

Table 7.3.2 illustrates the dependency of the Austrian biodiesel industry on rape, soya and used edible fat. According to Directive 2009/28/EC, biodiesel from rape (RME), which only saves around 45% compared to its fossil counterpart, will no longer be counted for the 10 percent target after 2017.

⁵² As at October 2009

⁵³ More detailed information is given in Interpretation and Conclusion

Also the commonly used expression *used edible fat* raises questions. According to Mr. Hermann Baier, managing director of *Firma Ölwert*⁵⁴, Austrian used edible fat potential lies around 30.000 to 40.000 tons per year including domestic and food industrial sources. This is not enough to satisfy the needs of Austrian biodiesel producers. Like soya they have to import used edible fat in great quantities which cast a damning light on sustainable production.

Animal fat takes the same line. Actually it does not play an important role but there is a raising demand for it. According to Mr. Baier the Austrian potential of animal fat lies around 43.000 t/a. This is still by far too little to be a real substitute for rape.

The category *others* contains two different sorts of crops, corn and wheat, which are only used by a single Austrian bioethanol plant.

7.3.3 Delivering / Delivered to

Category	Expressions	mentioned
Delivering /delivered to	Additional market	III
	B100	III
	Both	III

Table 7.3.3.: Delivering / delivered to

Table 7.3.3 indicates that 6 of 10 participants were committed to supply only one of two possible customer groups. Three biofuel producers decided to supply the additional market, mainly *OMV*, and three others decided to supply the B100 market which means 100% biofuels especially for carrier companies. The rest is trying to supply both markets. Maybe that is a possibility to survive because the two companies which had to shut down just supplied one market. On the other hand, the participants said that the B100 market is dead because in Germany B100 is not exempted from petroleum tax anymore and it was feared that this recurs in Austria as well. Without tax reliefs B100 is not able to survive.

⁵⁴ <http://www.oelwert.at>

7.3.4 Sustainability or sustainably produced Biofuels

Category	Expressions used by Participants	mentioned	Percentage Rate
Sustainability	Sustainable development only from an economical point of view	II	20%
	Ecology is the main component but other components shall not be forgotten	III	30%
	To think about next generations	III	30%
	Waste is a resource	II	20%
	Others	II	20%

Table 7.3.4.: Sustainability or sustainably produced biofuels

In this stakeholder group sustainability was defined in a different way than before. Now economy played a far more important role than before. The participants also had ecological points of view like seeing waste as a resource for further usage or decreasing primary energy input for the methylation process. The participants also thought about saving greenhouse gas emissions and certificated raw materials to guarantee sustainable production as well as protecting soils and forests to meet the needs of future generations but nothing happens without an eye on economical matters of concern.

According to some participants certificated raw materials should guarantee intelligent growing and harvesting. Certificates also should exclude child labour and finally should guarantee better prices for the end product because of better quality and the security to comply with all points just mentioned.

On the other hand, there were two participants who defined sustainable development just from an economical point of view by mentioning investors' related interest or healthy business circumstances. Social or ecological aspects were skipped.

Summary: 30% Ecology, especially greenhouse gas saving and certificates are the main component without forgetting about social and economical aspects
 30% To think about the needs of future generations
 20% To see waste as a resource
 20% Economy is the main component

7.3.5 The Goal to Save 50% of Greenhouse Gas Emissions

Category	Expressions used by Participants	mentioned	Percentage Rate
50% emission saving goal	No clear opinion on topic		
	Right now not possible, Necessity to buy pollution certificates	I	10%
	Additional costs will occur but can be counterbalanced within business performance, Additional cost are running costs	II	20%
	Additional costs will occur and can not be counterbalanced within business performance	IIII	40%
	The change of raw materials will bring a better CO ² balance	IIII	40%
	Increase of recycle processes will conserve energy	II	20%
	Rate is already fulfilled due to mainly using used edible fat	IIII	30%
	Plant optimisation is necessary to fulfill the rate, E.g. optimisation of process energy or conversion to multi feed stock technology	IIIIII	50%
	Closed energy and production cycles guarantee 50% goal	I	10%
	Competitors who are not able to fulfil the goal should shut down production, Mean to clean the market	IIII	30%
	Other	I	10%

Table 7.3.5.: The goal to save 50% of greenhouse gas emissions

This category tried to find out how biofuel producers will react on directive 2009/28/EC. Will they change production processes and will there be enough money to do so it was to be found out.

40% of the participants thought that a change of raw materials will bring a better CO² balance.

As started above, most of the producers are strongly dependant on rape and there is not a sufficient amount of used edible fat in Austria for everybody.

50% of the participants thought that plant optimisations like an optimisation of process energy or a conversion to multi feed stock technology⁵⁵ will bring a better CO² balance. An increase of recycle processes will help to decrease greenhouse gas emissions as well.

⁵⁵ Multi feedstock technology allows the use of different raw materials like crops together with used edible fat and animal fat

Talking about finances, 60% of the participants thought that additional costs will occur but only 20% thought that these costs can be counterbalanced within the business performance. The others said that additional capital is necessary to cope with these additional standards.

Three participants said that they already fulfil the rate because of the use of raw materials emitting less greenhouse gas. In this case they talked about used edible fat and sugar based raw materials⁵⁶ for bioethanol production.

Surprisingly three participants mentioned a point I had not expected. They thought that directive 2009/28/EC is a means of cleaning the market and of excluding out of date technology which is not able to fulfil the new standards.

Summary:

50%	Plant optimisation is necessary to fulfil the rates
40%	A change of raw materials will bring a better CO ² balance
40%	Additional costs can not be counterbalanced within business performance
30%	Directive is a means of cleaning the market
30%	Rate is fulfilled already
20%	Additional costs can be counterbalanced within business performance
20%	Increase of recycle processes within the plant will lower CO ² emissions
–	One participant mentions pollution certificates as temporary solution

⁵⁶ To look up in please consult appendix B

7.3.6 Problems of 1st Generation Biofuels

Category	Expressions used by Participants	mentioned	Percentage Rate
Problems of 1 st generation	Crop failures are the biggest problem for biofuels	I	10%
	New raw materials like Algae or Jatropha are still visions of the future	III	40%
	There is not enough used edible fat for everybody	II	20%
	It will not work without rape in our regions	II	20%
	The 1 st generation will never be sustainable	I	10%
	Future planning not possible right now		

Table 7.3.6.: Problems of 1st generation biofuels

This category as well as the following one tried to take a closer look on actually in-use 1st generation biofuel technology to find out about their problems and further development.

As table 7.3.6 clearly indicates 40% of the participants thought that new raw materials like Algae or Jatropha⁵⁷ are still visions of the future and not worth planning seriously.

Two participants thought that there is not enough used edible fat for everybody and the consumption of biodiesel produced without rape will never be possible in Central Europe.

Summary:

- 40% Algae and Jatropha are visions of the future
- 20% Not enough used edible fat produced for everybody
- 20% Rape is essential for biodiesel in Central Europe

⁵⁷ (*Jatropha curcas L.*), plant with oleaginous seeds, primarily grows in southern hemisphere

7.3.7 Changes of 1st Generation Biofuels

Category	Expressions used by Participants	mentioned	Percentage Rate
Changes of 1 st generation	Extension of range of raw materials. Especially used edible fat and animal fat	IIII	50%
	Certificates will guarantee sustainable production, CO ² reduction and will determine the price of the product	III	30%
	Palmoil is no alternative	III	30%
	Certificates will be expensive and far to bureaucratic	III	30%
	Jatropha is a chance	II	20%
	In use technology will be developed further	IIIII	60%

Table 7.3.8.: Changes of 1st generation biofuels

As mentioned above, this category tried to investigate in which way the production of 1st generation biofuels will change according to the participants. Will they follow a sustainable pathway into the future? In this case the most frequently used expression was that already in-use technology will be further developed and not dropped because of turning attention on currently badly developed technologies.

This expression was directly followed by another commonly used expression used by 50% of the participants who talked about the extension of the range of raw material, of used edible fat and animal fat. As mentioned above, this usage is fraught with problems.

Three participants thought that palm-oil is no alternative to in-use raw materials because of its bad CFPP value whereas 2 participants thought that Jatropha will have a chance to come through in about 5 years.

Finally there were contradictory statements concerning certificates. Three participants thought that they will be useful and guarantee sustainable production and reduce greenhouse gas emissions whereas three other participants mentioned that certificates will be expensive and far too bureaucratic.

Summary:

- 60% 1st generation technology will not be dropped but further developed
- 50% Extension of range of raw materials especially waste products
- 30% Certificates will guarantee sustainable production
- 30% At the same time certificates will be expensive and far too bureaucratic
- 30% Palm-oil will not be used in Central Europe

7.3.8 2nd Generation Biofuels

Category	Expressions used by Participants	mentioned	Percentage Rate
2 nd generation	No own projects	II	20%
	A lot of technologies, like BTL, do work in the laboratory but do not work in reality because they are not geared to market requirements and lack effectiveness, 5 to 10 years of further development will be necessary	IIIIIIII	80%
	Research funding is necessary	IIIIII	60%
	Joint ventures between universities and companies should be founded	II	20%
	No one really knows what exactly how 2 nd generation biofuels will look like	IIII	40%
	Is an increase of efficiency and use of sustainable raw materials	II	20%
	There will be a gradual development and no fast change of technologies	IIII	40%
	No need for direct funding, A stable state of the market is more important	II	20%
	The higher the oil price the faster the implementation of new technologies	II	20%
	Costs are too high		
	Would be implemented immediately but is still not geared to market requirements	I	10%

Table 7.3.8.: 2nd Generation biofuels

In the last couple of years, there was a steady increase of activities concerning the development of so called 2nd generation biofuels. Oil multinationals like *BP* invested millions of Euros to obtain new and better resources for biofuel production.⁵⁸ Others like *CHOREN*⁵⁹ have been looking for new technologies to produce biofuels mostly by using waste or by-products to increase the greenhouse gas emitting performance.

This category tried to find out what the participants think about this topic.

The most common expression used by 80% of the participants was that new technologies are far away from being fully developed. Although they work in laboratories it is not possible to adapt them to market conditions with its complex sales and distribution system. According to one participant, for

⁵⁸ <http://www.wirtschaftsblatt.at/home/263849/index.do>

⁵⁹ <http://www.choren.com>

example, the input-output ratio of biomass to bioliquid lies about 7 units biomass to 1 unit biofuel. This fact leads to a tremendous logistic expense.

The 2nd most commonly used expression was the necessity of increasing the rates of research funding to develop new technologies directly followed by the expressions that there will be no fast technological revolution but a gradual development of in-use technologies and the expression that no one really knows what 2nd generation biofuels will look like as has been mentioned above with regard to the other participant groups.

Some expressions were not used that frequently but are nevertheless, quite interesting. Two participants thought that there is no need for direct funding to establish 2nd generation biofuels. In fact, a stable market is more important. This expression had also been used before.

Two participants thought that high oil prices will expedite the implementation of 2nd generation biofuels just as joint ventures between universities and companies would do so.

Two participants thought that 2nd generation biofuels ought to bring an increase of efficiency and push on sustainably produced raw materials.

Finally, two participants said that they do not have projects of their own to develop 2nd generation biofuels but in fact no one really does have any projects because it is not up to the producer to develop new technologies. There are universities and special companies like *BDI*⁶⁰ to do this.

Summary:	80%	Many new technologies work in a laboratory but not in reality
	60%	Research funding is necessary to promote 2 nd generation biofuels
	40%	No immediate chance of in-use technologies but gradual progress
	40%	Nobody really knows what 2 nd generation biofuels will look like
	20%	Joint ventures between universities and companies should be founded
	20%	No need for federal funding, stable market circumstances are more important
	20%	High oil prices expedite the development of new technologies
	20%	2 nd generation biofuels are an increase of efficiency and will proceed sustainably produced raw materials
	–	Nobody has in-house projects to develop 2 nd generation biofuels

⁶⁰ <http://www.biodiesel-intl.com>

7.3.9 Federal Funding

Category	Expressions used by Participants	mentioned	Percentage Rate
Federal Funding	No interest in federal funding but in stable conditions	I	10%
	There is no federal funding to reconstruct biofuel production facilities because of ecological purposes	IIII	50%
	There is investment funding and research funding	III	40%

Table 7.3.9.: Federal Funding

This topic was designed to find out if the participants think they will receive money to reconstruct their production facilities to adapt them for the requirements of directive 2009/28/EC. Half of the participants said that there will not be any direct funding on this special topic but, instead, there will be investment and research funding, in general with regards to this topic.

Summary: 50% No direct federal funding for reconstruction because of ecological necessities
 40% There will be investment and research funding with regard to this special topic

7.3.10 Promotion of Biofuels (Market Situation)

Category	Expressions used by Participants	mentioned	Percentage Rate
Promotion of biofuels (situation of the market)	Realistic goals have to be given	I	10%
	Future planning not given because other lobbies interfere with political decisions or there is an overcapacity of biofuels	IIIIII	60%
	Increase of blending rate is not exactly the ideal solution because of logistic problems	II	20%
	Increase of blending rate is a solution because B100 died, in order to reach the Kyoto goals and to save CO2 emissions	IIIIIIII	90%
	Funding system and laws have to be the same in all European countries	III	30%
	Elements for future planning like purchase quotas or tax benefits more important than federal funding	IIIIII	60%
	Tax situation is ok	I	10%
	Federal funding should not desperately try to rescue a branch of industry	I	10%
	For trucks B20 or B30 would be useful, for cars B10	I	10%

Table 7.3.10.: Promotion of biofuels (market situation)

Do biofuel producers need any modified market circumstances or does the state have to give any incentives to improve their situation? This is the question which this category tried to get an answer to. Table 7.3.10 clearly indicates a fundamental wish to increase the blending rates of biofuels for different reasons. One reason is the self-made end of the hard established B100 market and the following search for new delivery areas. Other reasons are based on ecological tasks like saving greenhouse gas emissions to reach the Kyoto goals.

On the other hand, two participants thought that an increase of blending rates would lead to tremendous logistical problems.

A slight negative market sentiment is revealed by the expression that there is no chance for future planning because of the interference of other lobbies on political decisions and the home-made overcapacities of biodiesel in Austria.

Another frequently used expression concerning a stable market situation also talked about the higher importance of purchase quotas and tax benefits compared to federal funding to reconstruct production facilities due to directive 2009/28/EC.

Finally, three participants thought that the law and funding systems should be the same in the whole of Europe to implement stable market conditions.

- Summary:
- 90% Increase of blending rates would counteract the market retirement of B100 and would help to reach the Kyoto goals
 - 60% Purchase quotas and tax benefits are more important than federal funding
 - 60% Future planning not given because of interference of other lobbies on political decisions and home-made overcapacities of biofuels
 - 30% Funding systems and laws have to be similar all over Europe
 - 20% Increase of blending rates not ideal because of logistical problems

7.3.11 The Energy Problem in General

Category	Expressions used by Participants	mentioned	Percentage Rate
Energy problem in general	Solution would be a European wide thinking	II	20%
	The cultivation of rape ought to rescue the European agriculture	II	20%
	Directive 2009/28/EC is exactly the right thing to solve the problem	I	10%
	Below the radius of 500km the electro car will be generally accepted, for distances beyond that and long-distance haulage energy in liquid form will still be necessary	II	20%
	Biofuels are a lengthy process	I	10%
	Biofuels are the transition to solar age	I	10%
	The mix of energies is the solution		

Table 7.3.11.: The energy problem in general

Table 7.3.11 shows that the participants did not agree about energy challenges and problems in general. Only three expressions were used twice.

One expression dealt with about the increased cultivation of rape to rescue the European agriculture. Another expression reflected the implementation of electro cars for distances less than 500km. For distances more than 500km as well as long-distance haulages energy in liquid forms will still be necessary.

Another expression used twice was in favour of thinking European wide to solve energy problems.

Summary: 20% European wide thinking could solve energy challenges
 20% Extension of cultivation of rape ought to rescue European agriculture
 20% Below a radius of 500 km the electro car will be generally accepted, for Distances above and long-distance haulages liquid fuels will still be necessary

7.3.12 Consequences of Worldwide Biofuel Production

Category	Expressions used by Participants	mentioned	Percentage Rate
Consequences of worldwide production	B99 must not be repeated, i.e. an over subsidized product distorts the market	III	40%
	Stimulates Austrian and European production and reduces worldwide raw material and product exchange	IIII	60%
	The big producers will survive, the small ones not	I	10%
	Vegetable oil exchange will be intensified	I	10%
	WTO will not interfere unless unfair moves like B99	II	20%
	Europe is important for Austrian farmers, but the rest of the world	I	10%
	Prices were not forced up by biofuels but rather by crop failures, investment funds and the increase of world population	IIII	60%
	WTO should prevent crop speculations and market distortions	II	20%

Table 7.3.12.: Consequences of worldwide biofuel production

As in chapter 7.1 and 7.2 I wanted to know what the participants think about worldwide biofuel production. Not surprisingly, the participants mentioned more or less the same expressions like the other participant groups.

The most commonly used expressions were:

- a) Price force ups of crops occurred because of crop failures, speculations by investment funds and the increase of the world population and not because of biofuel activities and
- b) Worldwide production will stimulate the European production and will reduce worldwide raw material and product exchange.

But there were also concerns about worldwide production illustrated by the category *B99⁶¹ must not be repeated*. Over subsidized products distort the market and should not be allowed.

Finally a small number of participants thought that the WTO should be more active by preventing crop speculations and market distortions like B99. On other points of worldwide competition the WTO will not interfere.

Summary:	60%	Worldwide production stimulates Austrian and European production and will reduce worldwide raw material and product exchange
	60%	Biofuels did not force up prices. This happened because of crop failures, investment funds and a steady increase of the world population
	40%	Over subsidized products like B99 should not come on the market anymore
	20%	The WTO should prevent crop speculations and market distortions like B99

⁶¹ B99 contains 99% biodiesel and 1% fossil diesel. It is an over subsidized product from the USA which was sold cheaper on the European market than European products because of mentioned federal funding. For European producers it was very hard to compete.

7.4 Synopsis of Results

All investigated data and identified trends were now joined together and ready for further interpretation and combination. As mentioned above, statements of biofuel experts were also included.

By using the expressions *according to forest law* and *brundland report*, the participants indirectly had the same idea about sustainability as directive 2009/28/EC. It not also deals with the environment as well as social aspects but also with future generations and social welfare. Not surprisingly, the biofuel producers added economical components such as well balanced financial balances or seeing process waste as resources. In my opinion these additions rounded off the understanding for sustainable development in a very sophisticated way

Regarding the discussion on rape and its future usage, the participants thought that rape will stay because of its positive effects on crop rotation and there are no alternative raw materials to produce standardised biofuels especially in winter. But to keep rape as raw material the use of fertilizers has to be reduced to reach the 50% greenhouse gas emission saving goal. Also the implementation of new technologies, new soil processing and harvesting methods could help to save emissions.

The problem is that this switch-over is very expensive and there will be no direct funding for it. Here certificates could be very useful. According to Walter Böhme, a certificated end product guarantees, on the one hand, a sustainable production and, on the other hand, would obtain higher prices which finally would benefit the farmers concerned.

Yet, there were also concerns about this certification system. It must not be too expensive and has to be implemented worldwide to avoid competitive disadvantages for European farmers. It is a political task to implement a tool to save greenhouse gas emissions without additional bureaucratic expenses. Reinhard Thayer also thought that certificates would be expensive, especially for biofuel producers but there are no alternatives for sustainably produced raw materials.

In this context, it is important to begin to implement a standardised system throughout Europe. Especially, the Eastern European countries have to catch up with industrialising their agriculture but this would guarantee a sufficient amount of sustainably produced raw materials for the European biofuel production.

As mentioned above, there will be no direct funding for farmers to switch over to new production and processing technologies but there are programs to fund agriculture like *ÖPOOL* or the *environmental*

funding. These programs should be developed further by integrating switch-over funding and combined with the certification system.

However, there was an agreement on worldwide development. Most of the participants agreed that worldwide biofuel production will stimulate Austrian and European production and was not responsible for the increase in prices of crops 2007 and 2008. This was the result of crop failures, investment funds and higher demands because of the steadily growing world population.

Alexander Bachler mentioned that biofuels act as easily available scapegoats and Gregor Grill added that these small amounts of crops used for biofuel production do not have any influence on the pricing of crops.

A better communication system would be advantageous between agriculture, politics and the biofuel production industry.

Concerning the biofuel industry I found a tremendous dependency on rape, soya and used edible fat. Each of these raw materials has its unique problems. Rape and soya are not easy to handle because of their negative ecological footprints and not enough used edible fat is produced to cover the general demand. That's why most of these raw materials have to be imported on a large scale to meet the demand at a qualitatively level. From an ecological point of view this does not make sense at all.

Another interesting result was that more than half of the Austrian biofuel producers deliver to one customer group. Maybe this is one of the reasons why some Austrian biofuel producers have financial problems.

However, more disturbing was the fact that more than $\frac{1}{3}$ of the biofuel producers currently are not able to pay for technology switch-overs to comply with the demands of directive 2009/28/EC. Because of no federal funding according to most of the participants, biofuel producers will have to be creative to find investors or funding programs to overcome this crisis. The majority of producers thought that it is possible to survive by a change of raw materials or optimization of plants. However, as mentioned above, problems arise concerning new raw materials.

Almost incidentally the participants used an expression pointing at this problematic topic. They as well as Walter Böhme thought that directive 2009/28/EC is an indirect means of cleaning the market. In other words they thought it is necessary to get rid of market participants using out of date technologies and they rejected any federal funding keeping them artificially alive. But is this really necessary? After comparing all the aspects mentioned I rather believe it because further development

of new technologies takes a lot of time and money. If the state utilizes this money to grant funding for companies using out-of-date technologies, there will be a lack of capital to invest in research and development. This, however, is exactly what is necessary to enhance biofuel technologies.

Most of the participants thought that 2nd generation biofuels need 5 to 10 years to reach marketability and therefore research funding has to be increased. It is the governments' duty to develop strategies to implement intelligent funding programs for further development. The fact that most of the producers are trying to advance their in-use technology also shows that rapid technology leaps can not be expected.

It is also important to define 2nd generation biofuels because currently no one really knows what they will look like. Further investigation is necessary to canalise future research funding. In this regard, well developed joint ventures between universities or other research institutes and companies would also expedite the process.

Beside research funding, stable market conditions, too, have to be implemented which allow economically worthwhile action and exclude over-subsidized products.

Increasing the blending rates of biofuel to transport diesel and petrol would be a means to realise this. From an economical point of view, this would not have any bad impacts on the production industry but further investigation on ecological and social impacts has to be done. Furthermore fixed purchase quotas would be a possibility to guarantee stable market conditions without distorting the market.

8 Answers to Research Questions

To analyse the Austrian biofuel segment a guided interview manuscript was designed.⁶² Within this guided interview all questions were designed to answer the sub-research questions and the main research question in further consequence.

Trends were noticed and combined to answer the sub-research questions. If the majority of the sub-research questions can be answered in a positive or negative way, the main research question, too, will be seen as positively or negatively answered.

Sub-Research Questions:

1. *How do biofuel producers, biofuel processors, raw material producers and politicians responsible for biofuels define sustainability or sustainably produced biofuels and are these ideas in line with the demands of the European Union?*

By using the expressions *according to forest law* and *brundland report* the participants indirectly had the same idea about sustainability as what directive 2009/28/EC points out. Furthermore the biofuel producers added economical components like financial balances which completed the sustainable perception of this topic. Due to the fact that the participants had the same idea about sustainability as what directive 2009/20/EC points out, this sub-research question can be seen as positively answered.

2. *Which level of interest do Austrias biofuel producers have in changing in-use technology because of sustainable guidelines on the part of the European Commission?*

As Austrian biofuel producers willingly try to fulfil the demands of directive 2009/28/EC this sub-research question can be see as a positive trend towards sustainability criteria. Currently some producers do not exactly know how to respond to European demands because of several different technical or financial problems, but most of them think that they are able to cope with these challenges.

⁶² Cf. chapter 6.1

3. *Which level of capacity do Austrian biofuel producers have in changing in-use technology because of sustainable guidelines on the part of the European Commission?*

Due to the fact that currently most of the questioned biofuel producers do have financial or structural problems this research question has to be answered negatively. Although most of the participants think that they are able to cope with these challenges the capacity for doing this is very low.

4. *Does the Austrian funding policy offer any incentives to adopt new sustainable technologies on a large scale?*

Due to a lack of direct funding for raw material and biofuel producers to react to European demands and the general lack of government sponsored research programs this sub research question has to be seen as negatively answered according to the participants.⁶³ Most of them said that an increase of research funding is necessary to enhance biofuels but there is a crucial lack of knowledge how this can be done.

5. *Which level of interest do Austrian farmers have in changing existing production methods and types of products due to European sustainability demands?*

As most of the participants think that greenhouse gas emission savings are possible via new technologies, different soil processing and harvesting methods, and the implementation of a certification system this sub-research question can be seen as positively answered.

6. *Which level of capacity do Austrian farmers have in changing existing production methods and types of products due to European sustainability demands?*

According to the participants farmers, are easily able to switch between soil processing and harvesting methods. They are also able to change crop rotation in case of new economical circumstances. Furthermore, there are loan programs like *ELER* or *ÖPOOL* which help to adopt ecological demands. Due to these facts this sub-research question can be answered positively.

⁶³ At the time of the writing of this master thesis there are current negotiations which finally could repeal these statements. In this regard please refer to: Lebensministerium(2009) :“Energierstrategie Österreich“ , <http://www.lebensministerium.at/article/articleview/76735/1/26601>.

Main Research Question:

*Will there be any sustainable changes in the Austrian biofuel segment after the implementation of a European sustainability guideline?*⁶⁴

Due to the fact that the Austrian biofuel industry is forced to adopt new technologies or has to utilize sustainably produced crops to achieve greenhouse gas emission savings because of the demand of directive 2009/20/EC there will be sustainable changes in the Austrian biofuel segment. This assumption is also supported by the fact that biofuel producers willingly try to meet the demands of directive 2009/28/EC that Austrian farmers are able to produce crops in a more sustainable way that politicians, in general, are willing to promote biofuels via research funding. To sum up, the main research question can be seen as positively answered.

⁶⁴ In this regard sustainable changes will be seen in terms of sustainable directive 2009/28/EC

9 Discussion

9.1 Discussion

The Austrian biofuel industry has a long way to overcome to fulfill European sustainability demands. It will be a hard and stressful task to combine future ecological tasks with economic challenges. Nevertheless most of the Austrian biofuel producers look favourably upon directive 2009/28/EC. After all it stands for ecological progress and sustainable development. The only problem is that currently most of the smaller Austrian biofuel producers do not have any idea how to raise funds for any necessary reconstruction work due to financial distresses. In light of this fact, the following question arises: “Is it wise to implement a directive that has been decided upon top-down and does not meet the needs of small or medium sized biofuel producing companies?”

In this special regard, Bräuninger et al., (2008) recommend the possibility for implementing a certification system which guarantees social and ecological sustainability within the biofuel production chain in combination with a simultaneous increase of the biofuel blending quota. This process would increase the price of the product which makes the production more attractive for biofuel producers.

Generally speaking it is necessary to mention the oppressive mood prevailing within the biofuel production industry. As recent as in 2005 (Henke, 2005) scientists talked about biofuels as an option to reduce agricultural surpluses on a global scale. Now, five years later, biofuels are only marginally mentioned (Austrian Energy Strategy, 2010) and within that, the focus lies on bioethanol. This does not mean that the Austrian policy decided to stop biodiesel production. Existing quotas will persist but the expansion of production will decrease. In fact, we have to wait until 2017 when the blending rate of biodiesel to fossil diesel will be raised up to 10%. The blending rate of bioethanol to fossil petrol will be raised up to 10% by 2012 according to the Austrian Energy Strategy.

But there are positive news, too, for Austrian biofuel producers. Most of them think that higher blending rates of biofuels to fossil fuels and diesel as well as a higher oil price could help to survive financial shortages. Actually there is the idea for an “ecologisation” of the Austrian tax system presented by the Austrian ministers of environment and economy (“The Austrian Energy Strategy”, 2010). This ecologisation of the tax system includes a simultaneous increase of the petroleum tax which positively stimulates the development of more efficiency and new biofuel technologies (Austrian Energy Strategy, 2010, p.74).

Furthermore the aim is to reduce the CO₂ emissions of each vehicle down to 95g CO₂/km by 2020 (Austrian Energy Strategy, 2010, p.64). Ecologically and socially certificated biofuels could play a big part within this process.

But are there enough raw materials for this ambitious raise of biofuel blends up to 10% compared to fossil fuels as proposed by the European Commission and enacted by the European parliament (The European Parliament: "Promotion of the use of energy from renewable sources", 2008). Now, how does this biofuel policy affect the world market? According to Austrian politicians and biofuel producers, biofuel production does not influence world market prices of crops and oil seeds because of the small amounts of crops used for biofuel production. In this case major nature disasters, speculations on crops at stock markets and an increase of the world population were blamed for forcing up crop prices.

However, these explanations mentioned above contradict the explanations given by certain scientists or NGOs. In this special regard Rajagopal et al., (2007), think that biofuels have massive effects on land use, food prices and biodiversity.

"Biofuel is a land and water intensive technology. Production of biofuels takes land away from its two other primary uses—food production and environmental preservation. As farming expands to produce energy crops, soil erosion may worsen, application of chemical pesticides and fertilizers may expand and biodiversity may suffer on shrinking environmental lands. A positive net energy balance, therefore, is not sufficient for sustainability."

(Rajagopal et al., 2007, p.2.)

According to this study, steady technical innovations at crop cultivation, an increase in productivity and further development of new biofuel technologies are necessary to increase the usage of biofuels in general. The Austrian biofuel stakeholders have the same idea of further biofuel progress but are not sure what future biofuel technologies will look like or rather which technology will finally become widely accepted. However, there is agreement upon the fact that further development of biofuel technologies can only be reached by a simultaneous increase of the research and development (R&D) quota. Recommendations presented in the Austrian Energy Strategy (Energy Strategy, 2010, p.39) take the same line.

There is also a need for discussion concerning the new raw materials Many producers think about using used edible fat to meet the needs of directive 2009/28/EC. However there are studies (BTL Wieselburg, 2003) which talk about a realistic collection quota of used edible fat in Austria which centres around 41.000 tons per year and does not even come close to meet the demands of all Austrian

biofuel producers. Another leading expert, Mr. Hermann Baier, managing director of *Firma Ölwert*⁶⁵, says that the Austrian used edible fat potential lies at around 30.000 to 40.000 tons per year including domestic and industrial sources. This is not enough to satisfy the needs of Austrian biodiesel producers. Like soya, they have to import used edible fat in great quantities which cast a damning light on sustainable production and the usage of this, in fact, very sustainable raw material due to neutral CO₂ calculations.⁶⁶ Animal fat takes the same line. Actually it does not play an important role but there is a raising demand for it. According to Mr. Baier, the Austrian potential of animal fat lies at about 43.000 t/a, which is still by far too little to be a real substitute to rape.

The topic “food vs. fuel” has to be further discussed. After analysing all aspects mentioned, it appears that there are different perceptions. First there is an Inner European perception created by this work’s participants who talk about productive Eastern Europe soils to deliver enough and primarily cost-efficient raw materials for the European biofuel industry. And secondly, there is a global perception with a different point of view. In this case Banse et al., (2008), take a strong position towards this discrepant problem:

“Domestically produced biofuel feedstock will only partially meet EU demand and the EU will incur a higher agricultural trade deficit. Biofuel crop production and land use will expand in land-abundant countries due to increased exports to the EU. The resulting higher feedstock prices will reduce biofuel consumption outside the EU. However, at a global level, biofuel use increases and crude oil demand decreases, leading to a decline in the world price of oil. The expansion of agricultural land use on a global scale, and especially in landabundant South America, may indicate a decline in biodiversity” (Banse et al., 2008, p.135.)

That means that there will be an increase of crop imports into the EU from non OSZE countries which makes it even more difficult to guarantee certificated raw materials. In this regard, Luigi Ponti and Andrew Paul Gutierrez (Ponti & Gutierrez, 2009) ask:

“[...] how will the EU reach its biofuels policy targets without accessing the bioenergy cropland in developing countries and especially Africa (i.e., the biopact) and consequently undermining fragile societies and ecosystems?” (Ponti & Gutierrez, 2009, p.501.)

Finally I would like to mention that in the scientific discourse the main focus is put on questions concerning new technologies, agriculture problems and plant-specific topics. (cf. OECD-FAO Agricultural Outlook: 2007-2016, 2007; Msangi *et al*, 2006) Therefore, only a few papers can be compared to this master thesis.

⁶⁵ <http://www.oelwert.at>

⁶⁶ Bioenergie Kreislauf Mureck: „Von der Pfanne in den Tank“, http://www.seeg.at/data/Seiten_22-31.pdf

Because of different and discrepant ideas concerning this area of conflict there is a huge need for further investigation. However, the following recommendations for the national focus can be derived from the generated results.

9.2 Recommendations

Based on all the data gained during the investigation and discussion process this sub-chapter aims to summarise all aspects investigated and tries to give recommendations for future planning and action. The recommendations address different parties and the order will be kept as usual. Most of the recommendations can be seen as long term solutions to guarantee stable market conditions.

9.2.1 Politics

- The implementation of a certification system should not be deceptive and should take greenhouse gas emissions caused by growing and proceeding of crops into account as well as transport emissions caused by freight haulage
- The certification system should be linked to governmental funding programs like “*ÖPOOL*” to be more attractive for farmers
- Governmentally sponsored research programs should be fostered to optimize the research of new technologies and raw materials
- The government should install research groups to find out what exactly 2nd generation biofuels will look like to canalize research funds
- Intelligent laws and governmental funds should guarantee stable market conditions for biofuel producers whereas outdated products should not be kept alive via federal funds
- Outdated technologies which are not able to fulfill the demands of directive 2009/28/EC should not get further subventions
- Biofuel market capacities should be premeditated to avoid misdirected investments which created biodiesel over-capacities in recent years
- Blending rates should be increased to create stable market conditions whereas some aspects like sustainable growth of raw materials and distribution problems have to be premeditated
- Purchase quotas could be implemented and tax benefits should be kept to create stable market conditions
- Because stock speculations can be partly blamed for the 2007 and 2008 crop prize increases, the governments should think about the implementation of regulative tools to control them

9.2.2 Biofuel Industry

- Biofuel producers should expand their delivery area and should not commit themselves to produce exclusively B100 or biofuels for the addition market
- Before biofuel producers reconstruct their facilities to fulfill European sustainability demands they should think about the future ecological footprint when using raw materials which may have to be transported around the world
- Biofuel producers should intensify research co-operations with biofuel technology developers to speed up R&D projects
- Biofuel producers which are not able to accomplish necessary sustainability changeovers due to financial problems should better shut down production. As the biofuel market is strongly affected by price fluctuations caused by economical as well as emotional aspects, no one should rely on the increase of the oil price.
- In cooperation with representatives of agriculture and politics the biofuel industry should found a unique mouthpiece for better public communication to avoid misunderstandings

10 Summary

This master thesis deals with the question how directive 2009/28/EC will affect specially selected stakeholders of the Austrian biofuel industry and its agricultural and political surrounding. In this regard a lot of attention is given to sustainability criteria for production of bio-fuels and imported crops and the directive will set different binding sustainability criteria to ensure environmentally friendly production of bio-fuels in the EU and third party countries.

A striking point of directive 2009/28/EC is to establish a 35 percent saving of greenhouse gas emissions from biofuels compared to its fossil counterpart. After 2017, this rate will rise up to 50% for existing and up to 60% for newly built plants.

Beside the main research question of how directive 2009/28/EC will affect Austrian biomass and biofuel producers, this work tried to determine how Austrian biomass and biofuel producers as well as biofuel related politicians think about sustainability, future technology development, federal funding policy and worldwide crop price development.

To analyse the Austrian biofuel market all appropriate stakeholders had to be selected. Therefore the Austrian biofuel production chain was divided into subclusters called biomass producers, biomass processors and biofuel producers. To identify potential stakeholders within these groups and to improve the author's knowledge about the Austrian biofuel market in general, a prequestionnaire was designed and given to appropriate Austrian biofuel experts and consultants who were identified in advance.

Subsequently a guided interview manuscript was formulated and applied to appropriate stakeholders with political, agricultural and economic backgrounds in the form of an interview.

Based on a qualitative research procedure developed by Christiane Schmidt all the interviews, taken in this manner, were analysed. With the help of a semi-quantitative approach, trends were identified and used to answer all research questions formulated in advance.

Thus, it could be shown that the Austrian biofuel producers have the same idea about sustainability as directive 2009/28/EC is talking about. They also look favourably upon the implementation of the directive because it stands for ecological progress and sustainable development. There are only financial concerns towards the implementation.

In this regard many biofuel producers and scientists think that the implementation of a certification system which guarantees social and ecological sustainability within the biofuel production chain in

combination with a simultaneous increase of the biofuel blending quota could help to counteract financial shortages. This process would increase the price of the product which makes the production more attractive for biofuel producers.

Concerning the question of federal funding to adapt new sustainable technologies on a large scale most of the participants think that there will be none. In this regard the Austrian Energy Strategy (Austrian Energy Strategy, 2010) takes the same line. There is also agreement upon the fact that further development of biofuel technologies can only be reached with a simultaneous increase of the research and development quota.

However, there are contradictions concerning the question for worldwide product and price development within the discussion “food vs. fuel”. According to Austrian politicians and biofuel producers, biofuel production does not influence world market prices of crops and oil seeds because of the small amounts of crops used for biofuel production. But these explanations mentioned contradict the explanations given by certain scientists or NGOs who think that biofuels have massive effects on land use, food prices and biodiversity.

There are also contradictions concerning new sustainable raw materials for biofuel production which also reveals a huge need for further investigation.

Finally, based on all data generated, recommendations for the national focus were derived and presented.

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12 Appendices

12.1 Pre-questionnaire

Fragebogen zur allgemeinen Beurteilung der Biotreibstoffsituation in Österreich

- 1.) Wie beurteilen Sie die momentane (allgemeine) Biodiesel-, (Bioethanolsituation) in Österreich?
- 2.) Gehen die Bundesländervorstellungen konform mit jenen des Bundes?
(in Bezug auf Art der Rohstoffe, Unterstützung der Landwirte, Verteilung & Vertrieb, Preispolitik)
- 3.) Werden weiterhin Kraftstoffe der 1. Generation gefördert und beworben oder gibt es, in Landwirtschaft und Industrie, Tendenzen Richtung 2. Generation?
Ist die 2. Generation mittlerweile wirtschaftlich rentabel, ist sie technologisch ausgereift?
- 4.) Ist Ihnen das Proposal

COMMISSION OF THE EUROPEAN COMMUNITIES (2008) DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources 2008/0016 (COD)⁶⁷

bekannt?

(Im Speziellen:

Art. 15 & 16: *Environmental sustainability criteria for bio fuels and other bio liquids*”, und

“Verification of compliance with the environmental sustainability criteria for bio fuels and other bio liquids“)

- 4b.) Wenn ja; welche Auswirkungen könnte eine EU – Verordnung zu mehr Nachhaltigkeit auf den heimischen Biodiesel- und Bioethanolmarkt haben?
- 5.) Welche Auswirkungen könnte die aktuelle Finanzkrise auf den Bioethanol- und Biodieselmart haben?
- 6.) Gibt es unterschiedliche Handlungsrichtungen bzw. Auslegungen der Regierungsprogramme Gusenbauer und Faymann?

Vielen herzlichen Dank für Ihre Zeit!

⁶⁷ Proposal 2008/0016 (COD) of directive 2009/28/EC, p.61, Brussels 2008

12.2 Guided Interview Manuscript

For the purpose of an overall understanding the guided interview manuscript was written and the interviews were conducted in German.

Interview - Leitfaden

Nachhaltige Perspektiven des österreichischen Bio-Treibstoffmarkts

1.) Fragen zur nachhaltigen Entwicklung bei den Biotreibstoffherstellern

Allgemeine Fragen:

- a) Name des Unternehmens/Organisation
- b) Anzahl der Angestellten und davon Leiharbeiter
- c) Funktion des Interviewpartners im Unternehmen/Organisation
- d) Angestellt seit:
- e) (Im Falle eines Treibstoffherstellers): Art der erzeugten Produkte, Jahresproduktion

Fachfragen „Entwicklung“:

(1. Subhypothese)

- a) Was verstehen Sie / Ihr Unternehmen / Ihre Organisation / Ihr Interessensverband unter nachhaltiger Entwicklung?
- b1) *Eine neue Richtlinie über erneuerbare Energie, Teil des EU-Klimapakets, sieht eine 35% Einsparung an Treibhausgasemissionen bei Biokraftstoffen gegenüber fossilen Kraftstoffen vor. 2017 wird diese Quote auf 50% bei bestehenden und auf 60% bei neu konstruierten Anlagen angehoben. RapsMethylEster kann, dieser Aufstellung entnehmend und nach momentanen Stand der Technik, ab 2017 nicht mehr für das 10% Ziel angerechnet werden.*

Mit welchen Problemen sehen Sie sich durch die Implementierung des EU- Klimapakets in Zukunft konfrontiert?

Welche Maßnahmen könnten diese Probleme in Zukunft lösen bzw. vermeiden?
- b2) Rechnen Sie für Ihr Unternehmen / Ihre Organisation / Ihrem Interessensverband mit Mehrkosten durch die Implementierung des EU-Klimapakets und der damit verbundenen Umstellung von Produkten und Technologien?
- b3) Glauben Sie, dass diese Mehrkosten im Rahmen Ihrer Betriebsleistungen auffangbar sind?
- b4i) Glauben Sie, dass eine Erhöhung der Beimischrate sinnvoll wäre?
- b4ii) Wie müsste Ihrer Meinung nach die politische Reaktion aussehen?
- c1i) Werden Sie versuchen auf andere Rohstoffe zurückzugreifen?

c1ii) *Sollte Palmöl als Alternative genannt werden:*

Wie sehen Sie die ökologische Aspekte des Anbaus und die hohe Methanausgasung des, nach der Ölpressung, übrig gebliebenen organischen Mülls?

- c2) Werden Sie versuchen neue Technologien aufzugreifen?
- c3) Sollten die, von ihnen angesprochenen 2nd Generation Biofuels nur dann gefördert werden, wenn sie ein gewisses Einsparungslevel an Treibhausgasemissionen erreichen?
- c4) Welche ökologischen und sozialen Vorteile, bzw. Nachteile, sehen Sie bei der von Ihnen vorgeschlagenen Variante?
- d1) Inwiefern werden sich Ihrer Meinung nach die Weltmarktpreise für Rohstoffe ändern wenn andere Länder, insbesondere die Vereinigten Staaten von Amerika, verstärkt auf die Erzeugung von Biotreibstoffen umsteigen?
- d2) Welche Auswirkungen erwarten Sie für den heimischen-, den EU-Binnen- und den Weltmarkt?
- d3) Wie glauben Sie wird sich die *WTO*, die Welt Handels Organisation, verhalten?

Fachfragen „Österreichischen Förderpolitik“

(2. Subhypothese [Teil1])

- a) Bietet Ihnen / Ihrem Unternehmen / Ihrer Organisation / Ihrem Interessensverband der Staat Förderungen um auf die, von Seiten der EU, erzeugten Neuerungen entsprechend zu reagieren?
- b) Fühlen Sie sich von der Regierung, auf Grund ständig wechselnder Orientierung, im Stich gelassen oder bietet Ihnen der Staat, trotz verschärften Auflagen genug Planungssicherheit für größere Investitionen?
- c) Wie sehen Sie das Verhältnis von Anpassungskosten zu Förderungen?
- d) Wie müssten Fördermaßnahmen, von Seiten des Staates, aussehen um Biotreibstoffe der 2. Generation gezielt zu fördern und wirtschaftlich wettbewerbsfähig zu machen?

2. Fragen zur landwirtschaftlichen Entwicklung

(3. Subhypothese)

Allgemeine Fragen

- a) Name des Unternehmens/Organisation
- b) Anzahl der Angestellten und davon Leiharbeiter
- c) Funktion des Interviewpartners im Unternehmen/Organisation
- d) Angestellt seit:

Fachfragen

- a) Was verstehen Sie / Ihr Unternehmen / Ihre Organisation / Ihr Interessensverband unter nachhaltiger Entwicklung?
- b) Welche Art und welche Mengen an Produkte liefert Sie/ Ihr Interessensverband, zur Weiterverarbeitung zu Biokraftstoffe, ab?
- c) Die Europäische Union wird mit der Implementierung des EU-Klimapakets auch Einfluss auf bisherige Landnutzungs- und Rohstoffgenerierungsmethoden ausüben. Mit welchen Problemen sehen Sie / Ihr Unternehmen / Ihre Organisation / Ihr Interessensverband sich konfrontiert bzw. sehen Sie Ihre Aufgaben als erfüllt an?
- d) Wie reagieren Sie / Ihr Unternehmen / Ihre Organisation / Ihr Interessensverband auf eine mögliche, bevorstehende Streichung von Raps als Rohstoff für die Biotreibstoffproduktion?
- e) Welche Änderungen für den Biotreibstoffmarkt werden diese Veränderungen, Ihrer Meinung nach mit sich bringen?
- f1) Sehen sich Sie / Ihr Unternehmen / Ihre Organisation / Ihr Interessensverband vom österreichischen Staat, mittels Förderungen ausreichend unterstützt die bevorstehenden Umstellungen zu bewältigen?
- f2) Falls nicht, wie müsste, Ihrer Meinung nach die Unterstützung aussehen?
- g1) Inwiefern werden sich Ihrer Meinung nach die Weltmarktpreise für Rohstoffe ändern wenn andere Länder, insbesondere die Vereinigten Staaten von Amerika, verstärkt auf die Erzeugung von Biotreibstoffen umsteigen?
- g2) Welche Auswirkungen erwarten Sie für den heimischen-, den EU-Binnen- und den Weltmarkt?
- g3) Wie glauben Sie wird sich die *WTO*, die Welt Handels Organisation, verhalten?

3. Fragen an politische Entscheidungsträger

(2.Subhypothese [Teil2])

Allgemeine Fragen

- a) Name des Unternehmens/Organisation
- b) Anzahl der Angestellten und davon Leiharbeiter
- c) Funktion des Interviewpartners im Unternehmen/Organisation
- d) Angestellt seit:

Fachfragen:

- a) Wie sehen momentane Fördermaßnahmen für die Biotreibstoffbranche aus?
- b) Mit der Implementierung der neuen Richtlinie über erneuerbare Energie, Teil des EU-Klimapakets, werden viele Landwirte und Industriebetriebe vor schwierige Aufgaben gestellt. Mit welchen Förderungen gedenken Sie die Unkosten der Umstellung in Wirtschaft und Landwirtschaft zu unterstützen und warum diese Fördermaßnahmen in Ordnung gehen; auch in Bezug auf EU- und Wettbewerbsrecht?
- c) Mit welchen Maßnahmen werden Biokraftstoffe der zweiten Generation gefördert?
- d) Sollten, Ihrer Meinung nach 2. Generation Biotreibstoffe nur dann gefördert werden, wenn sie, genauso wie die 1. Generation Biotreibstoffe, ein gewisses Einsparungslevel an Treibhausgasemissionen erreichen?
- e1) Inwiefern werden sich Ihrer Meinung nach die Weltmarktpreise für Rohstoffe ändern wenn andere Länder, insbesondere die Vereinigten Staaten von Amerika, verstärkt auf die Erzeugung von Biotreibstoffen umsteigen?
- e2) Welche Auswirkungen erwarten Sie für den heimischen-, den EU-Binnen- und den Weltmarkt?
- e3) Wie glauben Sie wird sich die *WTO*, die Welt Handels Organisation, verhalten?

12.2 Tables

Table 1:

Rules for calculating the greenhouse gas impact of biofuels, bioliquids and their fossil fuel comparators

A. Typical and default values for biofuels if produced with no net carbon emissions from land-use change

Biofuel production pathway	Typical greenhouse gas emission saving	Default greenhouse gas emission saving
sugar beet ethanol	61 %	52 %
wheat ethanol (process fuel not specified)	32 %	16 %
wheat ethanol (lignite as process fuel in CHP plant)	32 %	16 %
wheat ethanol (natural gas as process fuel in conventional boiler)	45 %	34 %
wheat ethanol (natural gas as process fuel in CHP plant)	53 %	47 %
wheat ethanol (straw as process fuel in CHP plant)	69 %	69 %
corn (maize) ethanol, Community produced (natural gas as process fuel in CHP plant)	56 %	49 %
sugar cane ethanol	71 %	71 %
the part from renewable sources of ethyl-tertio-butyl-ether (ETBE)	Equal to that of the ethanol production pathway used	
the part from renewable sources of tertiary-amyl-ethyl-ether (TAEE)	Equal to that of the ethanol production pathway used	
rape seed biodiesel	45 %	38 %
sunflower biodiesel	58 %	51 %
soybean biodiesel	40 %	31 %
palm oil biodiesel (process not specified)	36 %	19 %
palm oil biodiesel (process with methane capture at oil mill)	62 %	56 %
waste vegetable or animal (+) oil biodiesel	88 %	83 %
hydrotreated vegetable oil from rape seed	51 %	47 %
hydrotreated vegetable oil from sunflower	65 %	62 %
hydrotreated vegetable oil from palm oil (process not specified)	40 %	26 %
hydrotreated vegetable oil from palm oil (process with methane capture at oil mill)	68 %	65 %
pure vegetable oil from rape seed	58 %	57 %
biogas from municipal organic waste as compressed natural gas	80 %	73 %
biogas from wet manure as compressed natural gas	84 %	81 %
biogas from dry manure as compressed natural gas	86 %	82 %

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⁶⁸ DIRECTIVE 2009/28/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, April 2009

Table2:

Greenhouse gas emissions from the production and use of transport fuels, biofuels and bioliquids shall be calculated as:

$$E = eec + el + ep + etd + eu - esca - eccs - eccr - eee$$

where

<i>E</i>	=total emissions from the use of the fuel;
<i>eec</i>	=emissions from the extraction or cultivation of raw materials;
<i>el</i>	=annualised emissions from carbon stock changes caused by land-use change;
<i>ep</i>	=emissions from processing;
<i>etd</i>	=emissions from transport and distribution;
<i>eu</i>	=emissions from the fuel in use;
<i>esca</i>	=emission saving from soil carbon accumulation via improved agricultural management;
<i>eccs</i>	=emission saving from carbon capture and geological storage;
<i>eccr</i>	=emission saving from carbon capture and replacement; and
<i>eee</i>	=emission saving from excess electricity from cogeneration.

13 Curriculum Vitae

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Juli, August 2007: *BIO-AUSTRIA* Wien
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August, September 2005: „*Meeresschule*“ Pula, Kroatien

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Akademische Laufbahn:

Okt. 2009: Fixierung der Masterarbeit mit dem Thema:
„Sustainable Perspectives on the Austrian bio-fuel market“

2006 - 2009: Beendigung des Studiums mit Spezialisierung auf die
Themengebiete „Umweltmanagement“ und „renewable energies“.

2007: Projektarbeit mit der Fachgruppe Stadtökologie zur Untersuchung
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2005 - 2006: Auslandsstudium der Ökologie und Umweltmanagement an der
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2003 - 2005: Biologiestudium; Abschluss des ersten Abschnittes
anschließender Schwerpunkt Ökologie

2001 - 2002: Ableistung des Präsenzdienstes
Erwerbung der Führerscheinklasse C

-2001: Oberstufengymnasium Marianum Wien
Abschluss mit gutem Erfolg

Zusatzqualifikationen:

Sprachen:	Deutsch:	Muttersprache
	Englisch:	schriftlich und mündlich fortgeschritten
	Spanisch:	mündlich fortgeschritten
	Französisch:	4 Jahre Schulerfahrung
EDV-Kenntnisse:	Betriebssysteme:	Windows 98, 2000, XP, Vista, 7 Apple MAC - OS X Leopard
	Programme:	Microsoft Word, Excel, Access, PowerPoint, Visio, Outlook
Kurse & Spezialvorlesungen:		CSR, EMAS, ISO 14001; CMAS ** Ausbildung zum Abfallbeauftragten
Führerschein:		Klasse A, B & C