The role of scientific uncertainties in the policy making process of biofuels

Margot Gels, 20050134

Thesis Supervisor: Mrs. Weijerman

Date: 16 December 2009

The Hague School of European Studies

The Hague University of Professional Education

Executive summary

It is said that environmental problems are research dependent. Science is in these cases needed to identify a phenomenon such as climate change. New technologies can be characterized both by scientific uncertainties and research dependence (Yearley, 1996). An example of this is the case of biofuels. A few years ago, biofuels were thought to be a sustainable solution for the greenhouse gas emissions in the transport sector and the dependence of oil. After that, they became questioned because of adverse environmental impacts and emission savings (Environmental Audit Committee, 2008a).

In the beginning of 2008, the European Commission proposed a directive on renewable energy, which included a binding target of 10% for biofuels. The European Parliament and the European Council agreed on an outcome in December 2008 (Europa, 2008). This paper traces the process of the policy making of biofuels in order to research the influence of scientific criticism. In order to complete this research, literature is reviewed and a lot of desk research has been done. The hypotheses which derived from extensive research, regard the influence of scientific criticism.

To start with, a short introduction to climate change is given, since that is the reason for the existence of biofuels. Secondly, the meaning of biofuels for the transport sector is explained and what role the European Union plays in the biofuel issue. In this section the reasons for scientific concerns regarding biofuels are also given. After that, an explanation of the influence of science in politics is given. Two views on the influence of science are outlined in order to see what the influence of scientific critique could have on policy-making processes. The fourth chapter is about the policy making process of the biofuel policy specifically.

The outcome implies that the scientific criticism was not able to affect the outcome of the policy but definitely had some impact on the different institutions of the European Union.

Table of Contents

Introduction

I chose to write about this topic because I find the biofuel issue very interesting. It is a controversial topic with many different views. Also, I was wondering how a binding target could be set in a policy while there were so many scientific doubts and concerns towards this topic. Therefore I decided to investigate the influence of this scientific critique on the biofuel policy. Since I chose to write about the scientific approach towards biofuels, no extended explanations about other concerns, such as the rise of food prices etc. is given.

We depend on science to identify environmental problems and also for obtaining the knowledge of how to deal with them. Extensive research takes time and a lot of technologies that intend to fight climate change are still in a pilot or research phase (Jasanoff, 1987. p 190). Several solutions have already been introduced. However, the consequences on a longer time scale are still unknown. Consequently, possible solutions to climate change are often characterized both by scientific uncertainty and research dependence. New technologies are often included in legislation despite the uncertainties, due to the urge of solving the problem. According to Corell (1999, p.26), it is important to investigate how, and from what source, authority and legitimacy are gained when policy decisions are made under conditions of scientific uncertainty. Also, it is important to investigate if increasing scientific uncertainties can affect the policy-making process or even lead to changes in the eventual policy.

Making policy involves negotiations, value based choices, compromises between different interests and the ability to publicly ratify decisions (Jasanoff, 1987. p 190). Climate change and environmental problems in general are known for their research dependence since they cannot be seen or sensed. Therefore, scientists are needed to inform us about their regulation. The discussion is directed by the findings of scientists. Science has already led to acknowledgement of climate change. It has been accepted that this phenomenon is caused by human activity. Protocols are set up to adjust them. These events showed the influence of science on the political scene (Corell, 1999, p. 23).

Several years ago, biofuels were seen as a sustainable kind of renewable energy for transport. Nowadays, they are said to have uncertain greenhouse gas balances, to be expensive and to increase pressure on natural resources (Environmental Audit Committee, 2008a). The European Commission proposed a target of 10% of transport energy to come from biofuels, despite the scientific uncertainty regarding the benefits and costs. This proposal provoked criticism and concerns from the beginning. Some criticism derived from scientists, arguing that the effects of climate change were too uncertain. They recommended a suspension of the target of 10% (Thomsen, 2007). The central question of this thesis is what role scientific uncertainty played in the policy making of biofuels and whether or not it affected the result. To find an answer to this question, different subtopics have been investigated. In order to give some background

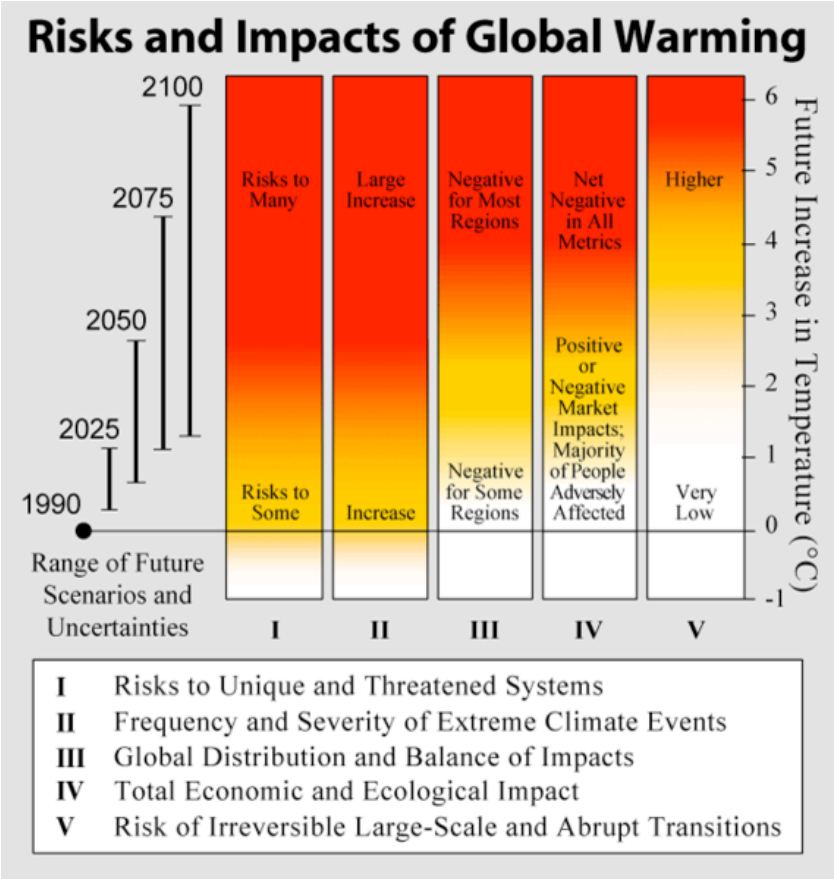
information on why biofuels came into existence, a short introduction to climate change is given in the first chapter. The second part explains the role of biofuels in the transport sector and in the European Union. It also explains why there are reasons for scientific concerns towards the biofuel policy. In the third chapter, two different views on scientific influence on politics are explained. Also, an explanation of how to actually measure scientific influence is given. In the fourth chapter, the whole policy making process is traced and explained.

1. Climate Change; a short introduction

Climate change is one of the biggest environmental issues of our time. Climate change is a threat to the economy, safety, health the food production and many other dimensions. For example:

- The changing weather patterns can damage the food production, because of the increase of unpredictability of precipitation.
- The sea levels are rising. During the 29th century, sea levels rose around 15 centimetres because of the melting of glacier ice and the expansion of warmer seawater. Scientists predict that sea levels will rise up to 59 centimetres during the 21st century. This will threaten coral reefs, wetlands and coastal communities.
- The ice in the arctic seas is melting. Melting of ice can lead to changes in circulation of the ocean. The surface of the oceans is also warming, this already have caused the death of 25% of the coral reefs in the world in the last half of the century.
- Climate change causes heavier rainfall, which causes floods in many regions. An increase of extreme droughts is also a result of climate change.
- Ecosystems are changing. Because of a rise of temperatures, many species are likely to extinct.
- Hurricanes are increasing in strength and frequency since the 1970.
- There will be more frequent heat waves and warmer temperatures affect the health of mankind. There have been more allergy attacks as the pollen season is getting longer and there already have been more deaths due to the increasing heat waves.
- Seawater becomes more acidic. Carbon dioxides dissolve into the ocean. There could be impact on marine life and coral reefs (Giovanni, 2008, JRC).

Graph 1: The increasing risks and impacts of climate change.



(Giovanni, 2008, JRC)

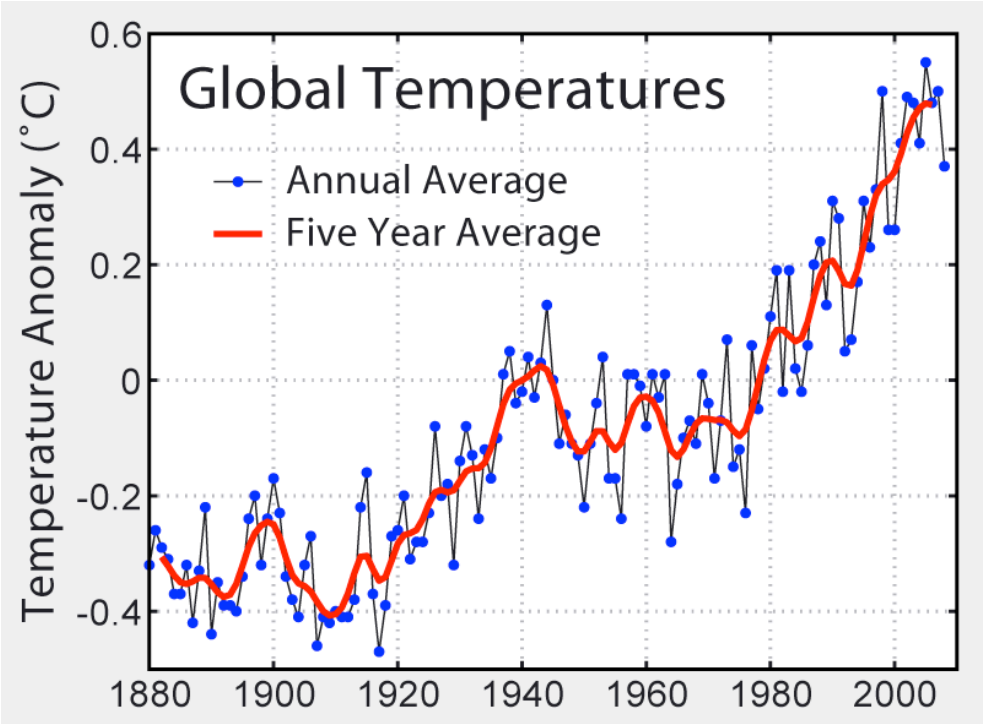
Since the 19th century, during the industrial revolution, mankind has contributed significantly to climate change. For the many industrial activities, there was a large-scale use of fossil fuels. All these new industries created many new jobs. Therefore, people moved from rural areas to the city. This phenomenon is even still taking place today. Land that had a lot of vegetation was cleared in order to make way for new houses. Natural resources were extensively used for construction, transport, consumption and industries. All of this contributed to an increase of greenhouse gas emissions. Fossil fuels such as coal, oil and gas was needed to run cars and other vehicles and the generation of electricity for households and industry (Europa, 2008). The sector of energy is responsible for 75% of the carbon dioxide emissions, 20% of the methane emissions and a large amount of nitrous oxide. Without a doubt, the most important greenhouse gas in our atmosphere is carbon dioxide, which leads to the warming of the earth. Another important greenhouse gas in our atmosphere is methane. 25% of methane emissions come from livestock. In daily live, everyone contributes to climate change. For example, through electricity, the generation of large quantities of waste, like plastic and the use of timber, which is used for the construction of houses. Also a growing population contributes to climate change since the land that is available for agriculture is limited. Therefore, high-yielding qualities of crop are needed.

This means that many fertilizers are necessary in order to keep the land fertile. The use of Fertilizers causes nitrous oxide emissions. However, the transport sector contributes most to the amount of greenhouse gases in our atmosphere. Cars, trucks and buses are the main ways of transportation for people and goods. Most of these vehicles run on diesel or petrol which ar both fossil fuels (Giovanni, 2008, JRC).

Climate change because of greenhouse gas emissions is happening and has never been more present than before. The most dangerous changes in climate could still be avoided if the hydrocarbon energy systems will be transformed and if programmes to prevent environmental disasters will be rationally initiated (EEA, 2006).

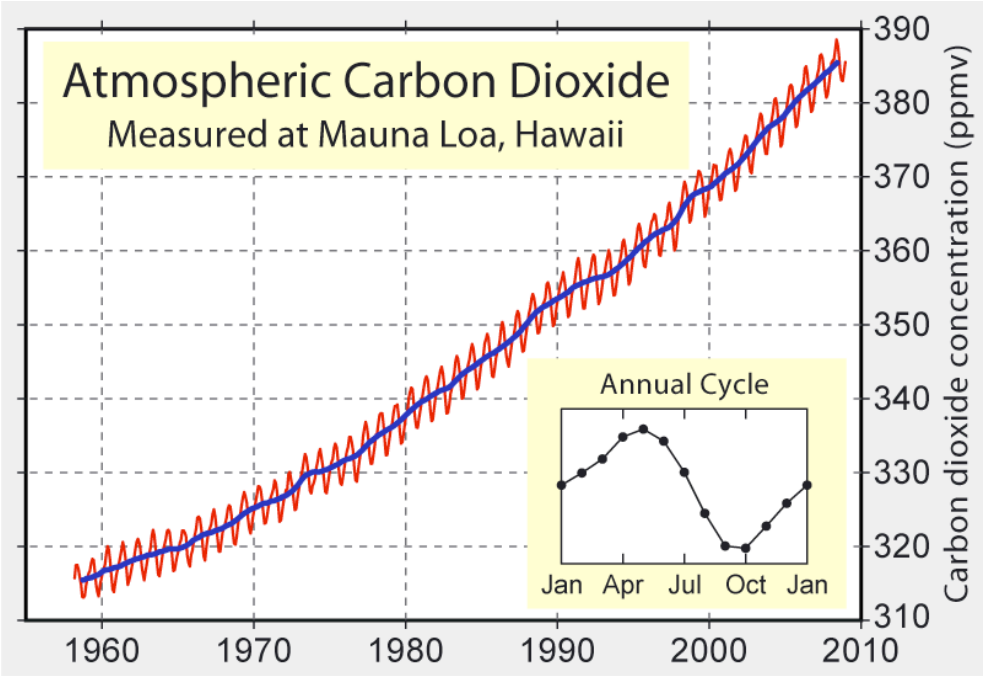
On the graphs below an interrelation between the increase in temperature and the increase in carbon dioxide emissions can be seen.

Graph 2: An increase of the global temperatures



(Giovanni, 2008, JRC)

Graph 3: An increase of carbon dioxide in the atmosphere



(Giovanni, 2008, JRC)

2. Biofuels for the transport sector

Biofuels are defined as liquid, gaseous or solid fuel obtained from biological material. Biofuels are mostly used to power vehicles. Industries of biofuels are expanding in America, Asia and Europe. It derived from certain fossil fuel or living organisms, which includes animals and plants. For example, crop residues, manure and garden waste are all sources of biofuel. This kind of renewable energy is based on the carbon cycle (AEA Technology plc., 2008). The biofuels that are already available are first generation biofuels, which are made from waste oils and rapeseed. Bioethanol is made by the fermentation of sugar beat, sugar, maize or wheat. In the warmer regions, sugar cane provides more energy efficient bioethanol. A big advantage of these first generation biofuels is that they can be transported and distributed through the normal existing infrastructure. A disadvantage is that they compete with the food production (AEA Technology plc., 2008).

Another kind of renewable energy is biogas. Biogas is made from anaerobic digestion of organic waste and wet manure and avoids methane release while saving greenhouse gas emissions. The by-product is used as a fertilizer for agricultural purposes. However, to use biogas for the transport sector is very expensive, as the gas has to be purified and require special fuel pumps and vehicles (Environmental Audit Committee, 2008a).

Second generation biofuels issue significantly less greenhouse gas than first generation biofuels and can be made form many forms of biomass, which decreases the competition with the food production. However, these fuels are still in a very early stage of development (AEA Technology plc., 2008).

2.1 The European Union and biofuels

Both first and second generation biofuels have been discussed as an alternative within the European Union. The European Commission identified hydrogen, biogas and biofuels in 2001 as the main alternatives. These alternatives were believed to be achieved a 20% substitution of fossil fuels by 2020. In 2003, legislation followed. The European Commission came up with a directive which was named: Directive 2003/30/EC and required all the Member states to set indicative targets for the alternative use of biofuels. The targets of the European Commission were 2% by 2005 and 5,75% by 2010 (Europa, 2008). As the emissions of transport rose in 2006 to 21%, it was obvious that only half of the target for 2005 had been reached. Since the targets of the directive of 2003 were voluntary and the implementation had failed, the Commission proposed a directive with a binding target (Commission, 2006a).

In 2007, the European Commission proposed another directive which was called Directive 2001/77/EC (OJ L 283, 27.10.2001). This directive is about the promotion of electricity, which is produced from renewable sources from the internal market of the European Union. The proposal sets a target of 21% that indicates the produced electricity from renewable energy sources in the EU electricity consumption by 2010. This target concerns all the Member States and encourages the use of support schemes in each country. It also eliminates administrative barriers. With the existing efforts and policies, it is expected that a target of 19% will be reached by 2010 rather than 21% (Commission, 2006a).

In the beginning of 2008, the European Parliament and the Council proposed a directive on the promotion of the use of energy from renewable sources. For a long time already, the EU Community recognizes the need to promote renewable energy sources since its exploitation contributes to the mitigation of climate change by reducing greenhouse gas emissions, sustainable development, greenhouse gas emissions, economic growth, creating jobs and the security of development of a knowledge based industry. The aim of this proposal for a directive is to establish a binding target of 20% share of renewable energy sources and a 10% binding target for biofuels in the transport sector in all Member States (Commission, 2008). The European Commission presented a Strategic European Energy Review on the 10th of January as a respond to the call of the European Council in 2006. The Renewable Energy Road Map, which is a part of this review, sets out a vision for renewable energy sources in the European Union. The review proposes that the EU should set a binding target of 20% for the share of renewable energy of the consumption of energy in the European Union, as well as the binding target of 10% for the share of renewable energy sources in the transport sector (General Secretariat of the Council, 2008a.). On the 14th of February 2007, the European Parliament stated in the resolution on climate change that policies on energy are crucial elements of the global strategy of the European Union. Energy efficient technologies and renewable energy sources play an important role in this. The European Parliament approved the proposal of a binding target in order to increase the level of renewable sources in the European Union (European Parliament, 2008). Moreover, the Parliament called on the European Commission in its review to present a proposal for a directive on renewable energy sources by the end of 2007. The Parliament especially referred to the importance of setting binding targets for the shares of renewable energy at an EU and national level (European Parliament, 2008). The Council affirmed the commitment to the development of renewable energy source within the EU beyond 2010 (General secretariat of the Council, 2008c).

2.1.2 The general context of the proposal

The European Union and the rest of the world are uncertain about the future of renewable energy (Thomsen, 2007). Climate change caused by greenhouse gas emissions need to be tackled urgently and effectively. Studies have shown that the awareness and knowledge of the problem is growing. These studies also stressed the need for immediate action. An effective approach to climate policy is necessary since the energy production is a main source of greenhouse gas emissions. The dependence of the EU on the import of energy implies higher prices and threatens the security of supply. On the other hand, investment in renewable energy, new technologies and energy efficiency has many advantages regarding the European Union's strategy for growth and jobs. Climate change causes rising energy prices, and a growing dependence on conventional fuels. This put more pressure on the European Union to come up with an ambitious policy on renewable energy on a European, but also on a Member State level. Sources of renewable energy do not rely on the availability of contemporary sources in the future (EEA, 2008a). The decentralised nature of the renewable energy sources ensures a less vulnerable economy in the European Union to energy supply. Therefore, they play a highly significant role of a future of sustainable energy (AEA Technology plc., 2008). In order for renewable energy sources to become the first step towards the objective of reducing greenhouse gas emissions and increasing the security of energy supply, a new sort of EU promotion of renewable sources is needed. So, it is necessary that the existing regulations of the European Union will be expanded. Also, it is important that the Member States take measures in order to increase the share of renewable energy. A new policy for the promotion of renewable energy in the EU helps the economic community with stability. Therefore, the community has to make investment decisions in the innovation and renewable energy sector (Commission, 2008).

2.2 The reasons for scientific concerns

The benefits and costs of first generation biofuels are linked to which crop is grown, how it is grown and where it is grown. Also on what source of energy is used during the production of the fuel and if the by products are used as food for animals or not. Risks on the environment can involve a threat to water resources, involve soil erosion and biodiversity. These problems can be solved to a certain degree by sustainability criteria, which regulate for example where biofuels could be grown (AEA Technology plc., 2008). The ability of biofuels to decrease greenhouse gas emissions is also questioned. Fertilization that leads to nitrous oxide emissions can for a part negate carbon dioxide savings. Biofuels that are imported could contribute to an increase of greenhouse gas emissions, since the crops for biofuels displace crops for food, which can

possibly lead to carbon rich and sensitive lands being farmed. This is indirect land use change and cannot be well researched yet. There is also no consensus on how to measure it, which makes it slightly impossible to regulate. What is actually questioned is the choice to use a confined supply of biomass for the transport sector and not the benefit of biofuels (Korhola, 2007b). There is consensus on higher greenhouse gas emissions savings being achievable through alternative uses of biomass. However, scientific uncertainty regarding climate effects, environmental risks and methodology for adjusting causes of concern, are leading to diverse conclusions. Several experts and scientists, who are mostly non-environmental argue that the emissions of the transport sector must be tackled, while others claim that biofuels are not the right solution. In the following parts of this paper however, it is only the possible influence on climate and environment related uncertainty that is important (Thomsen, 2007).

3. The influence of science in the policy making process of biofuels

Before decisions are made and implemented, the process of policy making starts with the creation of an agenda and the specification of the alternatives of policies. The agenda can be influenced by several factors, for example, the occurrence of a problem. Political and economic factors can be a great influence, such as the support from societal groups and the voting community. Science has a primary role in the process of policy making. Politicians turn to the community of experts and scientists for research and possible solutions. However, legislation in the field of the environment may somehow be different (George, Bennet, 2005, p. 78). To some, it means the politicalization of science. Others argue that the dependence on science implies that it exerts a great influence on how policies are created in order to solve the current environmental problems (Yearley, 1996).

There are two main views on the influence of science and scientific uncertainties, which will be described below.

3.1 View 1: science as an autonomous authority

Traditionally, politics and science were two different subject manners. Politics being based on values and science being based on facts. Science is generally seen as a source of information, which is value-neutral. Therefore, it is a reliable source for policy makers to consult when rational decisions need to be taken. According to this traditional view, science has a kind of authority, since scientists are seen as people who have a lot of technical knowledge, based on accepted methods and objective data (George, Bennet, 2005, p. 90-106). Governing systems are able to legitimize policies by referring to scientific evidence. Many public institutions trust the expertise of scientists and see science as an important source for policy making. Science has a certain status through its advisory role, but if the autonomous character would be jeopardized its cognitive authority may be threatened due to too much involvement in politics. Basically, this first view of two separate realms has come under pressure. According to this theory, scientific advice for policy making can be problematic in the case of a lack of scientific consensus and uncertainties. As for the community of scientists, the lack of scientific consensus or public disagreement on the interpretation of information, can threaten the view of science since scientific evidence could be influenced by political interests. Significant uncertainties make scientists unable to assist in the policy making process. Legislative decisions become difficult to legitimize when they appear guided by interests instead of rationality and knowledge (Jasanoff, 1987. p 104). The

precautionary principle states that if a certain situation would arise in which legislation is necessary despite of scientific uncertainties, a lack of evidence should not be a reason for refusing regulations (Ayala Sender, 2008, p 270-283).

Based on this view, it could be hypothesized that scientific uncertainties are a great challenge for the biofuel policy. A reference to the urge to act on climate change only would not defend nor legitimize a policy that has been openly questioned and criticized by the scientific community. The proposal for a directive would in this case lack legitimacy. As an answer to the criticism, the Council and the European Parliament would be inclined to change the proposal. Voiced scientific uncertainties would thus influence the policy making process. It would also lead to changes in the directive, which will make it substantially different than the original proposal for a directive.

3.2 View 2: science is an ally amongst many others

Situations that are characterised by high political decisions that have intense value disputes and big uncertainties question the neutrality and superiority of scientific assistance and advise. Since truth is something that comes from controversy and debate, science cannot offer it. Instead of being two different realms, politics and science can in this case be seen as mutually constructed. Science may be seen as an ally amongst many others, rather than the most important one (Londo, Deurwaarder & van Thuijl, 2008, p. 36-40). However, scientists are perceived as entrepreneurs and not as allies out of the lack of verifiable truths. Yet, science is still used to legitimize political decisions. Non-governmental organisations, such as Greenpeace, increasingly draw on science. A reconstruction and deconstruction of knowledge claims of political interest groups and other public officials are the result. They all have a stake in the determination of how relevant science is interpreted in policies. Because of this, science is becoming a reservoir from which various actors select and present scientific scenarios that prevent or promote policy changes. In that way, legitimacy is connected with a reconstruction of plausible scientific theories for proposed policies, because these theories are only validated by informal negotiations (Thomsen, 2007). Eventually the scientific evidence that is presented to the public is a creation of the policy making process. As political answers to problems seem more neutral when leaving criticism to point at the uncertainties of science, politicians may even picture issues more technical than political. When it comes to political consensus, it is more likely that legislative goals are pursued independently of scientific knowledge. Therefore, science risks being reduced to a role where it only legitimizes already favoured policy. In this case, scientific uncertainty is not really an obstacle in the policy making process. A lack of scientific consensus can actually be an advantage since there will be more views of experts to rely on. And so, scientific evidence is not seen as an authority but more something that is possible to be framed into legitimizing policies. As for the scientific community,

controversies will open new fields of work and increases the demand of experts. Scientists who can politicise their results of scientific research actually gain authority instead of losing it (Londo, Deurwaarder & van Thuijl, 2008, p. 156 -189).

The hypothesis based on this view is that scientific uncertainties regarding biofuels do not affect the policy making process in a substantial way. Politicians and decision makers would not change a favoured proposal because of scientific criticism when there are other experts with claims that construct plausible scientific support of the policy. If there is a significant amount of supportive groups, it would be unlikely that science would have a lot of influence, since other sources and allies of legitimacy are then available.

3.3 Measurements of the influence of science

Influence involves affecting conducts of another by giving reasons for action. If it appears successful, it will alter the actions of the receiver from what would have happened without any additional information. However, the influenced actor is able to ignore the information and can choose freely. The influence of non state actors could be an opportunity to present verbal or written information to negotiators or politicians (Yearley, 1996). It is also an opportunity to offer scientific advice. However, the information may be ignored. References to the given information which is supplied during the process of policy making is a more certain indication of the information that was taken into consideration. It can cause discussions for policy changes, changes in the goals and formulation of the policy and a change of the complete orientation of the proposed text (Ayala Sender, 2008, p 90-121).

The same reasoning can be applied for the biofuel policy, stating that for scientific uncertainties to have successful influences, it is to be expected that there will be a contribution to a result that is different than the original proposal. The changes should be more important than minor adjustments. What is least expected is an actual change of the 10% target to a lower target (see section 2). A change in the orientation of the policy however, is more likely. Both of those hypotheses assume that scientific criticism on this policy is known. It can be verified through the evidence of scientific sources that supplied information or scientific advice to several EU institutions. For the first hypothesis to be true, scientific information should have been seriously considered and should have been found problematic. In order to make a difference, reference to scientific uncertainties, which are voiced by the scientific community as reasons for changing policy strategies would support this hypothesis. For science to succeed in influencing policies, it is expected that its arguments lead to substantial changes in the policy proposal.

So, according to the first view, the influence of science would lead to substantial changes in the original proposal for a directive. According to the second view, scientific uncertainties regarding biofuels do not affect the policy making process in a substantial way simply because science is not seen as an autonomous authority.

4. The process of the biofuel policy

As a result of the failed legislation on biofuels of 2003, a binding target entered the European Commission's agenda. An extended public consultation by the Commission in 2006 indicated that the majority supported the promotion of biofuels and a fixed mandatory target as the favored opinion of all the given options. The Member States were all positive as well as the industrial stakeholders. The agricultural sector was also very positive since they saw a chance to secure subsidies in the future. NGOs were not as positive and had a more sceptical view. They argued that the promotion of biofuels would not necessarily achieve the policy objectives. The EU suggested a thorough assessment of the sustainability of biofuels and indicated a preference for a set target (EEA, 2006).

According many critics, it was hard for NGOs to be critical to biofuels due to the lack of scientific evidence at this stage. The first results of EEA reports did not indicate reasons for doubt. In 2006, an EEA report claimed that 15 or 16 % of the energy demand in 2030 could be covered by energy retrieved from environmental EU recourses. The outcome got a lot of political and media attention since the number was surprisingly high (EEA, 2006). In 2005, 2006 and the beginning of 2007 there was a lot of enthusiasm for biofuels. Therefore, it was not surprising that the European Commission suggested a development for a directive for renewable energy, including a 10% target (EEA, 2008a). The question however is, if the objections, which emerged, would have any effect on the legislative process.

The heads of state had endorsed the proposal for a directive at the European Council in March 2007. There they agreed that:

> The binding character of this target is appropriate subject to production being sustainable, second-generation biofuels becoming commercially available and the Fuel Quality Directive being amended accordingly to allow for adequate levels of blending." (European Council 2007 p. 14)

In September that year, the European Parliament presented a report that supported the 10% biofuel target. The report called on the European Commission to propose a directive. Because of this, it seemed that there was political consensus on the high mandatory biofuel target. Both the European Parliament and the council mentioned the need for a sustainable transport sector but there was no referral to any concerns or uncertainties (Europa, 2008). Only, the European Parliament showed concerns about the balance between energy and food production. The European Commission issued a second consultation procedure. This time about the creation of a sustainability scheme needed to implement the 10% biofuel target (Commission, 2006a). By the end of 2007, a more critical voice appeared. Questions came up from several MEPs whether the

biofuel policy was still realistic and in line with the criteria of sustainable development. The MEPs referred to a report of the OECD (Organisation for Economic Cooperation and Development), which was called 'Biofuels: is the cure worse than the disease? And a science article from a scientific magazine magazine called: 'Carbon Mitigation by biofuels or by saving and restoring forests?'. According to these publications, first generation biofuels were as harmful to the climate as fossil fuels, while second generation biofuels are still in the stage of research and early development (European Parliament, 2008).

4.1 The European Commission's proposal for a directive

A report by the Environmental Audit Committee of the British House of Commons claimed that the EU environment Commissioner Stavros Dimas had admitted that the European Commission had not foreseen the problems that the biofuel policy had caused. The report indicated the following:

> The (British) Government should seek to ensure that EU policy changes to reflect the concerns raised in this report. This means implementing a moratorium on current targets until technology improves, robust mechanisms to prevent damaging land use change are developed, and international sustainability standards are agreed. Only then might biofuels have a role to play. In the meantime, other more effective ways of cutting emissions from road transport should be pursued.'(Environmental Audit Committee 2008a p. 3)

As a response to that, Andris Piebalgs, the Commissioner of Energy disagreed with that conclusion. It was argued that the 10% biofuel target would stimulate the development of second generation biofuels and the only alternative to biofuels were fossil fuels. The uncertainty of investing in a technology that is not completely developed yet and may not be more efficient in the future, was not seen as a problem (Pielbalgs, 2008). On the 23rd of January 2008, the European Commission presented the proposal for a directive on renewable energy to the Parliament in Strasbourg. The proposal is a part of the package on energy and climate measures, with a goal of 20% emission reduction and renewable energy by 2020 (Europa 2008b). At the same time, experts and scientists showed their concerns to the EU institutions. The JRC (Commission's Joint Research Centre's) prepared a report as a contribution to the proposal and was called 'Biofuels in the European Context: Facts and Uncertainties'. This report stated the following:

> The uncertainties of the emissions due to indirect effects, much of which would occur outside the EU, mean that it is impossible to say with certainty that the net (greenhouse gas) effects of the biofuels programme would be positive.'(De Santi 2008 p. 22).

The report stated that second generation biofuels would most likely not be competitive by the year 2020 and that biomass would save more emissions and fossil fuel in other sectors than the

transport sector. Classification was furthermore regarded as an insufficient solution, since an effective classification scheme should apply to all countries and include food products to avoid displacement effects. This would eventually lead to a shortage of this products (Giovanni, 2008, JRC). It is possible that all the critique had its influences because it is known that there was internal controversy within the European Commission. The environment DG was very sceptical while the Energy and Transport DGs were in favour of the policy (EEA, 2008a). The proposal suggested several sustainability criteria such as the 35% saving of biofuels emissions compared to fossil fuels. Several requirements to biodiversity were also adopted in the proposal so that land with high biodiversity like protected areas and forests would not be used (Commission, 2008). The responses of the Parliament in Strasbourg were also sceptical. The rapporteur of ITRE (Committee on Industry Research and Energy), Claude Turmes, accused the European Commission of not having the courage to drop the biofuel target, holding scientific evidence showing that crops for biofuels have a very bad CO2-balance (Turmes, 2008).

4.3 Legitimization of the biofuel policy

The oil dependence and the growing greenhouse gas emissions were the main reasons for the persistence of the 10% biofuel target, but also because of the fact that biofuels cannot be developed without special requirements due to the high costs. The proposed directive on renewable energy is based on an extended impact assessment and stakeholder consultation. Some experts that were consulted are mentioned in the reports. However, only one report was about biofuels, and only regarded the impact of food prices (AEA Technology plc., 2008). References to research experts show that these factors are seen as important for the legitimacy of the biofuel policy. Although, expertise is referred to, there is no extensive discussion of political uncertainties and scientific evidence. Instead, the proposed directive is configured as unproblematic. It is said that biofuels offer opportunities for job creation in the European Union and in developing countries. Also, it is said to boost innovation and improve trade relations so that Europe's competitive position in the new energy sector is maintained (EEA, 2008a). Those social economic benefits contribute to an image where not only science is regarded as a source of legitimacy for this biofuel policy. In the report several risks are mentioned but are not considered grave. In the impact assessment it is noted for example that:

> The rise in prices of agricultural products should benefit farmers and rural communities, notably in developing countries. It could be detrimental to poorer populations. However, it should be underlined that 70% of the world's poor are also rural, and hence can also be among the beneficiary group of rising agricultural prices.' (Commission 2008b p. 125)

So, Biofuels are seen as a potential solution to the poverty problem of third world countries rather than a risk. The potential problem that individual farmers would be vulnerable and may not benefit from the development is not mentioned. On the same page it is also noted that:

> If increased biofuel use leads to feedstock being grown on land that is inappropriate – such as natural forest and other habitats of high nature value – it will cause substantial environmental damage. There is no need to use this land to achieve a 14% biofuel share'. (Commission 2008bp.125).

4.4 Rising food prices and scientific criticism

In 2008, critical arguments regarding Biofuels arose in the public debate. In April that year, the topic on biofuels made headlines. The scientific committee of the EEA issued the public opinion criticizing the biofuel policy:

> The overambitious 10 % biofuel target is an experiment, whose unintended effects are difficult to predict and difficult to control. Therefore the Scientific Committee recommends suspending the 10 % goal; carrying out a new, comprehensive scientific study on the environmental risks and benefits of biofuels; and setting a new and more moderate longterm target, if sustainability cannot be guaranteed (EEA 2008b).'

This was very unusual since the EEA had never issued public statements or press releases. In the first half of 2008, biofuels were more and more questioned in the press as the rising of food prices became a dominant issue. Jean Ziegler, the Rapporteur for the 'the Right to food of the United Nations called the production of biofuels "*a crime against humanity*"(Hawley 2008). The rising of food prices also led to a governmental crisis in the Philipines and riots in Cameroon and Haiti. It also caused criticism throughout Europe. The Prime Minister of the United Kingdom, Gordon Brown organised a meeting to discuss the matter. He said "*If our UK review shows that we need to change our approach, we will also push for change in the EU biofuel targets*" (Number 10, 2008). However, the Commission argued that the increased food prices were caused by the risen demand for food, poor harvests, transport costs, increased energy, export restrictions and a depreciation of the US dollar (Europa 2008a). At this point, the external events and criticism forced the European Commission to defend the proposal. The criticism of scientists was actually reflected in the European Parliament. The draft report on the biofuel policy stated:

> The latest scientific and political evidence have shown that imposing a binding target on fuels for the transport sector coming from biomass of 10% cannot be achieved in a sustainable way. This target must therefore be dropped. Sustainable biomass will be more efficiently used for other energy purposes such as electricity combined with heat (or cool) production. (Turmes 2008a p. 7)

The report claims that evidence was growing and that the conditions set out by the European Council would not be fulfilled. Also, social criteria on sustainability were suggested in order to

protect small farmers in third world countries (Europa, 2008).

4.5 Discussions in the European Parliament

The opinions of the Committee in the European Parliament revealed a much more concerned view on biofuels. Only the Committee on European Regional Development was openly positive about the policy. They suggested that local and regional authorities should be an example for the Europeans by encouraging the use of biofuels (European Parliament, 2008). However, this opinion may not be surprising considering the traditional role of public transport in European regional development. The Committee on International Trade suggested to postpone the date of the 10% target and come up with a review clause so it would be possible to be revised, depending on the development progress of second generation biofuels (EEA, 2008a). The Committee on Agriculture and Rural development proposed that the 10% target should not be mandatory, out of concern for rising food prices (EEA, 2008a). The Committee on Economic and Monetary Affairs hardly even mentioned biofuels. The committees all claimed that the situation had changed since January 2007 regarding the estimations of the greenhouse gas balance of biofuels and food prices. The Committee on Tourism and Transport stated that the 10% target would only be achieved with a massive use of first generation biofuels. This would cause major social and environmental problems. They favoured a progressive flexible approach instead, so that the promotion of other energy sources is included (EEA, 2008a). The Committee on Environment, Food Safety and Public Health, which is more associated, provided the most extended opinion. Saying that a few years earlier, biofuels were seen as a solution for environmental and rural development issues (EEA, 2008a). Nowadays, they are criticized and questioned on the grounds of biodiversity, emission savings, destruction of rain forests and food security. MEP Wijkman refers to the scientific expert bodies of the European Union:

> biofuels are many. This is the background why both the EEA Scientific Committee as well as the JRC went as far as recommending a suspension of the 10% target. (Ibid, 2008 p. 172)

The uncertainties regarding the use of land and which technologies will be most effective to obtain biomass in the future are said to be the reason for a step-by-step approach. Therefore, the Committee proposed a lower target, like 8%. Finally, the final version of the report was adopted by the ITRE-Committee in September. The 10% biofuel target was accepted in this version although a 5% interim target by 2015 was proposed as well as the possibility of reviewing the 10% target by 2020 on the basis of a review, which will be completed by 2014. The report suggested an initial requirement of 45% greenhouse gas emission saving compared to conventional fuels, for biofuels to count towards the target. Also, indirect land use changes

would be part of the calculations. This requirement is to be increased to 60% by 2015. Furthermore, social sustainability criteria were inserted, including fair payments for all workers and respect for the land rights of local communities (European Parliament The Legislative Observatory 11/09/08, European Parliament 11/09/2008, Turmes 2008b p. 7, 10f, 13, 113, 124f). Even though the 10% biofuel target was kept, the amendments that were made were substantial. Due to these amendments there would be more focus on alternative transport technologies such as solar and wind energy. This would take the pressure of land as a principal resource. The fact that indirect land use is included in the greenhouse gas saving requirement gives most conventional fuels a negative greenhouse gas balance, which slows down the production (Europa, 2008). This is also showing that there was picked up on most scientific critique. Not all MEP's are as explicit as Wijkman about the role of scientific uncertainties in the opinions of the Committees. However, most of them are aware of the potential risks. Many individual MEP's had contact with the EEA in order to research preliminary findings and material. The proposed amendments to the policy and the 10% biofuel target contribute to the impression that the target was seen as hard and problematic to legitimize in the European Parliament (EEA, 2008a).

4.6 Discussions in the Member States

In the Council, the discussion was mostly about whether the binding nature of the target should actually be conditional. For example, Italy suggested a target of 4% by 2015 as an intermediate and making the 6% for 2020 subjected to second generation biofuels. Luxembourg did not reckon that Member States "*remain oblivious to recent discussions, even if it is hard to establish precisely how far biofuel production is responsible for the food supply crisis* (Ibid: 29)."

Denmark favoured a sustainability requirement that should be between 35% and 45%. Greece however favoured a lower requirement of 30%. The United Kingdom was more in favour of a savings requirement of 50%, claiming that "It is essential that we take into account the latest scientific evidence on biofuel sustainability, particularly about the indirect effects of biofuel production." (General Secretariat of the Council 2008a, p. 11) The United Kingdom was also referring to an upcoming review of Glalagher, which promised to share the results with all Member States (General Secretariat of the Council 2008a, p. 13). By the end of June, the report arrived and claimed that the 10% target was unlikely to be met in a sustainable way. The report recommended an eventual shift to targets in terms of greenhouse gas emission savings and a slowdown in biofuel production. It also stated that a target higher than 4% should be implemented after 2013 if indirect land use would be avoidable and biofuels demonstrated to be sustainable, with a target of between 5 and 8% by 2020. However, a target of 10% was not

excluded, depending on the development of second generation biofuels (General secretariat of the Council, 2008c). It seems that this had taken the edge of all scientific critique, since it was now possible to support the 10% target of the European Union and to agree with the results of the review of Gallagher. The discussions among the Member States indicate an awareness of the scientific concerns. Especially with the United Kingdom commissioning a review of scientific findings. However, the debate mostly concerned policy details in stead of its appropriateness. Therefore, it is likely that Member States had their national interests as a priority in the Council, rather than scientific uncertainties. The rise of oil prices over that summer has possibly contributed to the attractiveness of biofuels for some Member States.

4.7 Agreement on the EU's policy on biofuels

In the second half of 2008, the prices of food were decreasing again. This took the pressure of the biofuel debate. The concerns about the environment and climate change were more intact. In an EEA report of November 2008, it was stated that the expansion of the renewable energy production could cause adverse effects on the environment, which jeopardized the achievement of several other environmental goals. The report recommended domestic resources until global sustainability standards were there (EEA, 2008a). Different scenarios stated that 7% of the gasoline and diesel demand of the transport sector could be filled by biofuels by 2030 (EEA, 2008b). On the 11th of December an informal agreement was reached between the French Council Presidency and the MEPs, ahead of the Parliament's plenary vote. The draft text did not pick up the proposals of the ITRE Committee for a certain percentage of the target to be filled with alternative renewable technologies, nor for an interim target. In order to promote electric cars run on renewable energy and second generation biofuels. It was decided that an input like that would count double towards the target. A possible revision in future evaluations was mentioned. With regard to sustainability criteria, The proposed emission saving requirement will apply until 2017, then it will increase to 50 or 60% (European Parliament, 2008). The change of indirect land use is not included, but is to be addressed in a review report in 2010. Social criteria were not included either with reference to WTO rules. It was important for the Council to not increase the emission savings at first, as a 35% target would allow most contemporary biofuels to count towards the target (General secretariat of the Council, 2008c). There was a great pressure inside the European Parliament to reach agreement. This was indicated by the fact that a legislative resolution was adopted formally on the 17th of December 2008 by the European parliament with 25 against, 635 votes in favour and 25 abstentions (European Parliament, 2008).

5. Conclusion

The central question of this paper concerns what role scientific uncertainties played during the policy making process of biofuels and whether it affected the results or not. Following the policy making process it is obvious that the institutions of the European Union were not completely isolated from criticism that was raised against biofuels. Several science experts and research institutes transmitted their information and knowledge through the contribution of advices, public statements and reports. The European Parliament openly referred to several of these findings in their opinion, confirming that the given information would be taken into consideration. Some Member States mentioned the uncertainties and possible risks referring to expertise. The European Commission developed impact assessments for accompanying the legislative proposal. The political desire to refer to scientific knowledge for legitimacy purposes can therefore be confirmed. It is plausible that the interest of the European Commission in sustainability criteria was influenced by the concerns of scientists. The European Parliament suggested some changes of the policy in the end, referring to the objective and the means of the policy. This may suggest that the hypothesis would apply to one of the institutions, it seems that the influence of scientific uncertainties are only temporarily successful. The other European institutions were not willing the outcome of the policy making process to be affected. The changes in the final text were more adjustments. So, it seems that scientific criticism and uncertainties were not able to affect the proposal in a substantial way, which is confirming the second hypothesis. The possible risks to the environment were not substantial enough to question a policy proposal which also had merits in other areas. Also, the absence of scientific consensus made it easier to refer to scientific expertise that were in support of biofuels even if these sources had criticism on the high binding target of biofuels. Scientific uncertainty could in this case be down-played. Biofuels were framed as a solution with many advantages in the socio-economic and agricultural sector. Furthermore, it offered many alternative sources for the legitimacy of the policy proposal. There are several possible answers to why the scientific uncertainties did not affect the outcome of the biofuel policy. The financial crisis that hit Europe during the fall of 2008 made Member States not as keen to agree on an ambitious, but very expensive energy and climate package. To look back to some reasons for policy changes in section 4, further explanations may involve a lack of developed alternatives for biofuels, the lack of strategic leaderships among the experts and an absence of another crisis than the food price discussion, which was in the end proved to be mostly unconnected to biofuels. Also, the timing of scientific criticism may have made successful influence harder. If concerns would have been voiced in an earlier stage, influences would have been greater. This would also confirm that late

involvement of scientific information decreases the influence on international political discussions and negotiations.

It could be argued that the influence of the scientific criticism had something to do with the different reactions between the European institutions. For example, it would be possible that the Parliament is more sensitive to critique in the environmental sphere since it receives a part of its legitimacy from their green reputation. For the European Commission and the Member States, policy stakeholders, national industries and important economic actors may have been more substantial sources of legitimacy. This implies that the uncertainties concerning the environment were the reason for the different reactions. Subsequently, this may imply that uncertainties in the field of science could have had more influence on the result of the policy. However, it appeared that the biggest threat to the biofuel policy was the discussion on the rise of food prices, which implies that possible risks to welfare and people evokes much more reaction and attention than the risks to the environment and climate. Another idea may be that the view on science is different between the European institutions. So the European Parliament would have a more traditional scientific view than the other institutions. So science would be a more important ally for the parliament. The other institutions would see science as a source of legitimacy and knowledge. In this case, a stronger position of the European Parliament would lead to a stronger position for science in politics.

Finally, Science is used in politics as a source of legitimacy and knowledge in policy making processes. What mainly caused the debate is more the issue if science is actually listened to during the drafting of policy proposals. Within the European Union, it seems that the Parliament is more sensitive to the influence of scientific transmitted information on the environment than other institutions. The European Commission has to refer to impact assessments in their policy proposal, however, is also subjected to stakeholders opinions and lobbying. For the Commission, science is not the most important ally. For the European Council, it is a possibility that the interests of the Member States are given priority. Science could have influence, if it affects national public opinions or national interests, but could also be ignored if there is too little scientific consensus. The majority of the actors within the European Union refer to scientific knowledge, as it would serve the goals of legitimizing the positions of policies. Evidence that was presented to the public will partly be a political product more than scientific. So, the political scene does not question scientific authority. The role of scientific uncertainties was questioned in this paper because of the anxiety that new technologies could cause problems when applied on a large scale. To take an insight look on the biofuel case, it seems that increased scientific criticism and uncertainties are not sufficient criteria to cause substantial changes in a policy proposal. Scientific knowledge may be perceived in order to change views or to seek other political approaches, but it does not cause a certain reaction. It is likely that if science would have proved their findings with more certainty it would have had stronger effects. It is also possible that the

influence of science depends on in what stage the criticism is voiced. Furthermore, it may matter if policies intend to achieve more objectives, since critique in one area will not necessarily affect motives in other fields.

Bibliography

Ayala Sender, Ines, 2008. *"Opinion of the Committee on Transport and Tourism for the Committee on Industry, Research and Energy on the proposal for a directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources."* pp. 270 - 283

AEA Technology plc., 2008. "*Review of work on the environmental sustainability of international biofuels production and use.*" London: Department for Environment, Food and Rural Affairs, UK government.

Commission, 2006a. "*Communication from the Commission, An EU Strategy for Biofuels*." Retrieved on November 3 2009 from COM(2006)34, Brussels: http://ec.europa.eu/agriculture/biomass/biofuel/com2006_34_en.pdf

Commission, 2008a. "*Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources*." Retrieved on October 24 from COM(2008)19, Brussels: http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf

Corell, Elisabeth, 1999. "*The Negotiable Desert – Expert Knowledge in the Negotiation of the Convention to Combat Desertification.*" Cambridge, University of Cambridge

De Santi, Giovanni (Ed.), 2008. "*Biofuels in the European Context: Facts and Uncertainties."* Retrieved on November 12 2009, from: Petten: European Commission Joint Research Center: http://ec.europa.eu/dgs/jrc/downloads/jrc_biofuels_report.pdf

EEA, 2008a. "*Maximising the Environmental Benefits of Europe's Bioenergy Potential*". EEA Technical report, No 12/2007. Retrieved October 20 2009, from: http://reports.eea.europa.eu/technical_report_2008_10/en

EEA, 2006. "*How much bioenergy can Europe produce without harming the environment?*" EEA Report. Retrieved on October 30, 2009 from: http://reports.eea.europa.eu/eea_report_2006_7/en/eea_report_7_2006.pdf

Environmental Audit Committee, 2008a. "*Are biofuels sustainable?"* London: House of Common. Retrieved on November 3 2009, from: Http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvaud/76/76.pdf

Environmental Audit Committee, 2008b. "*Are biofuels sustainable? The Government response.*" London: House of Commons. Retrieved on November 14, 2009, from: http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvaud/528/528.pdf

Europa, 2008d. *Statement of Energy Commissioner Andris Piebalgs in response to the biofuels report of the House of Commons*. Retrieved on November 20 fromPress Releases Rapid: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/64&format=HTML&aged=0&language=EN&guiLanguage=en

European Parliament,. *European Parliament seals climate change package. 20% renewable energy in the EU's energy mix by 2020*. retrieved on October 30 from: http://www.europarl.europa.eu/news/expert/infopress_page/064-44858-350-12-51-911-20081216IPR44857-15-12-2008-2008-false/default_en.htm

European Parliament. "*MEPs and Council Presidency reach deal on final details of climate package.*" Retrieved on November 4 2009, from: http://www.europarl.europa.eu/news/expert/infopress_page/064-44461-343-12-50-911-20081213IPR44460-08-12-2008-2008-false/default_en.htm

George, Alexander L., Bennett, Andrew, 2005. *Case Studies and Theory Development in the Social Sciences*. Cambridge: the Belfer Centre for Science and International Affairs.

General Secretariat of the Council, 2008a. "*Addendum to Note from: General Secretariat to: Delegations. Document 1."* Retrieved on November 12, 2009 from: http://register.consilium.europa.eu/pdf/en/08/st10/st10236-ad01.en08.pdf

General Secretariat of the Council, 2008b. "*Addendum to Note from: General Secretariat to: Delegations.*" Retrieved on November 12 from: 2http://register.consilium.europa.eu/pdf/en/08/st10/st10236-ad02.en08.pdf

General secretariat of the Council, 2008c. "*Addendum to the Note from: General Secretariat to: Council Precidency questions for the policy debate, Written contributions from delegations.*" Retrieved on November 5, 2009 from: http://register.consilium.europa.eu/pdf/en/08/st07/st07025-ad02.en08.pdf

Jasanoff, Sheila S., 1987. "*Contested Boundaries in Policy-Relevant Science*". Social Studies of Science. 2, pp. 190-226.

Londo, H.M., Deurwaarder, E.P., van Thuijl, E., 2008. "*Review of EU Biofuels Directive Public consultation exercise, Summary of the responses".* Amsterdam. retrieved November 4 2009, from: Energy Research Centre of the Netherlands: http://www.biogasmax.eu/media/review_of_ue__099683300_1408_11062007.pdf

Korhola, Eija-Riitta 2007a. "*Written Question to the Commission.*" retrieved on November 2, 2009, from: http://www.europarl.europa.eu/sides/getDoc.do?type=WQ&reference=E-2007-6340&language=EN

Korhola, Eija-Riitta 2007b. *"Written Question to the Council."* Retrieved on November 2, 2009 from: http://www.europarl.europa.eu/sides/getDoc.do?type=WQ&reference=E-2007-6339&language=EN

Piebalgs, Andris, 2008. "*Parliamentary questions 27 February 2008 Answer given by Mr Piebalgs on behalf of the Commission.*" Retrieved on November 4 2009, from: http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2007-6340&language=EN

Thomsen, Britta, 2007. "*Report on the Roadmap for Renewable Energy in Europe. Committee on Industry, Research and Energy.*" Retrieved on November 4, 2009 from: http://www.europarl.europa.eu/sides/getDoc.do?pubRef=//EP//NONSGML+REPORT+A6-2007-0287+0+DOC+PDF+V0//EN

Turmes, Claude, 2008b. "*Report on the proposal for a directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources.*" Retrieved on November 10 2009, from: http://www.europarl.europa.eu/sides/getDoc.do?pubRef//EP//NONSGML+COMPARL+PE-405.949+01+DOC+PDF+V0//EN&language=EN

Wijkman, Anders, 2008. *Opinion of the Committee on the Environment, Public Health and Food Safety for the Committee on Industry, Research and Energy on the proposal for a directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources.* Retrieved on November 4 from:

http://www.europarl.europa.eu/meetdocs/2004_2009/documents/ad/730/730754/730754en.pdf

Yearley, Steven, 1996: *"Nature's Advocates: putting science to work in environemntal organisations",* pp 184-198 Cambridge: Cambridge University Press.