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Social Acceptance of Bioenergy in Europe

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Abstract

It is widely acknowledged that the diffusion of bioenergy technologies does not depend on technological advances and favorable economic conditions alone. A good understanding and a strong backing of bioenergy by the general public is also essential. Thus, a better understanding of public perceptions and acceptance of bioenergy is a crucial factor to improve conditions for bioenergy policies and markets in European countries. This study focuses on identifying key factors that influence the social acceptance of bioenergy in Europe, an example of a region with a strong commitment to the development of renewable energy resources. The purpose of the thesis is to gain insights regarding the key factors that influence public acceptance of bioenergy so as to provide suggestions that can be useful to make a shift towards greater use of bioenergy in Europe.

Keywords: Social acceptance, Bioenergy, Renewable energy, Europe

Executive summary

In surveys of citizens in Europe, the results often show strong support for the dissemination and implementation of renewable energy technologies. However, when bioenergy projects or technologies are proposed, there are often uncertainties and concerns that can hinder the progress of bioenergy development. Bioenergy is also often ranked much lower than other renewable energy sources by the general public in surveys.

Public acceptance is identified as a key factor influencing the broad implementation of renewable energy technologies and the accomplishment of energy policy objectives. Significantly expanding bioenergy will not be feasible without social acceptance, which is primarily established through public trust and support, and this requires a policy framework for efficient and interactive communication between stakeholders.

The purpose of this thesis is to identify the key factors influencing social acceptance of bioenergy in European countries. It is clear that a good understanding of these influencing factors is essential for setting policies supporting the introduction and a wider use of bioenergy for the development of bioenergy markets.

This thesis involves a literature review, interviews with bioenergy experts, and an analysis of Eurobarometer surveys to identify and evaluate the key factors influencing social acceptance of bioenergy in Europe. Social acceptance as it relates to renewable energy is explored in this thesis through an analytical framework, which defines three dimensions of social acceptance: socio-political acceptance, community acceptance, and market acceptance.

Several factors influencing social acceptance of bioenergy in European countries are identified in this research. In this thesis, five of the most important factors are discussed. These factors are:

- Lack of information
- Political uncertainties
- Sustainability of bioenergy
- Diversity in the supply chain
- Competition for new industries

This thesis highlights some possible ways to improve the social acceptance of bioenergy. The study also shows that the level of social acceptance of bioenergy is not high in many European countries and more effort and investigation are needed to improve the social acceptance of bioenergy to develop bioenergy markets.

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1. Introduction

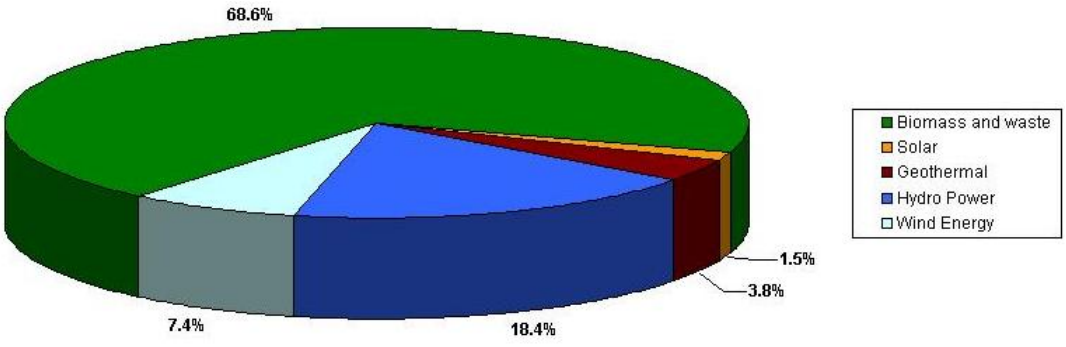
This research focuses on the social acceptance of bioenergy in European countries. While some surveys show a high level of public awareness and acceptance among European people (e.g. a survey by Magar, et.al. in 2010 of 92 bioenergy experts from eight member states within the European Union concludes that bioenergy use is widely accepted), public resistance and opposition to some bioenergy projects can lead to cancellation of those projects. So, it is important to recognize the main factors influencing social acceptance of bioenergy projects in order to better implement and develop bioenergy systems.

1.1 Background

Nearly 8% of total energy consumption in the EU comes from renewable energy and around 70% of this renewable energy stems from biomass (EU commission, 2010). It is likely that biomass will be a crucial feedstock for different energy conversion systems, i.e., electricity, biofuels, and heat in the future. (Prieler et al., 2010)

Bioenergy includes all types of energy derived from biological sources that are utilized in energy production (Domac et al., 2005). A variety of possible energy carriers are included in bioenergy, for instance energy crops (palm-oil and maize), biogenic residues (straw and forestry wood) or waste products (slurry, sewage sludge) (Jenssen, 2010). Bioenergy also includes different groups of technologies such as direct biomass use in industrial and residential sectors, biomass-based plants to produce heat and electricity and biofuels for transportation. Some types of bioenergy technologies are relatively new in European countries, for example biomass-based district heating, combined heat, electricity production, and some types of biofuels and co-digestion of organic wastes to produce biogas (ECN, 2008). During the recent decades, the modern usage of bioenergy has increased quickly. The EU climate policies and the increase of the oil price were two main reasons for that issue. So, bioenergy is a very interesting substitute for fossil-based fuels (Faaij & Domac, 2006).

Figure 1: Renewable energy consumption in Europe. 2009



Source: AEBIOM, 2011

Considering the graph, bioenergy is the most used renewable energy in Europe in the year 2009. Hydro power and wind energy are the second and third most used renewable energy resources after biomass.

Table 1, The share of biomass in the final energy consumption in EU countries in 2009

	Final Energy Consumption Total Mtoe	Final Energy Consumption Biomass Mtoe	Share of Biomass
EU-27	1113.6	83.68	7.51%
Austria	26.2	4.15	15.84%
Belgium	34.5	1.23	3.57%
Bulgaria	8.6	0.69	8.02%
Cyprus	1.9	0.03	1.58%
Czech Republic	24.3	1.84	7.57%
Denmark	14.7	2.43	16.53%
Estonia	2.7	0.61	22.59%
Finland	24.0	6.95	28.96%
France	155.5	12.43	7.99%
Germany	213.2	15.73	7.38%
Greece	20.5	0.96	4.68%
Hungary	16.4	1.03	6.28%
Ireland	11.8	0.24	2.03%
Italy	120.9	3.45	2.85%
Latvia	3.9	1.05	26.92%
Lithuania	4.4	0.76	17.27%
Luxembourg	4.0	0.07	1.75%
Malta	0.4	0.00	0%
Netherlands	50.4	1.47	2.92%
Poland	60.9	4.80	7.88%
Portugal	18.2	2.87	15.77%
Romania	22.1	3.91	17.69%
Slovak Republic	10.6	0.58	5.47%
Slovenia	4.6	0.46	10.00%
Spain	88.9	4.63	5.21%
Sweden	31.6	8.92	28.23%
United Kingdom	137.5	2.38	1.73%

Source: AEBIOM, 2011

According to Table 1, the total share of biomass in the final energy consumption at EU level is only 7.51%. Sweden (28.23%) and Finland (28.90%) have the biggest share of biomass in their final energy consumption.

Besides being renewable, bioenergy has many environmental benefits. It is useful for recovering degraded lands, decreasing soil erosion and protecting watersheds if its production and harvest are implemented in a sustainable way (Silveira, 2005). Moreover, it is one suitable option to decrease fossil fuels dependency, and it has the potential to provide some advantages like job creation (the level of job creation in a bio-based power plant is four times higher than the fossil fuel power plant (Domac et.al., 2005)) and economic development especially in rural areas; in other words, bioenergy is more beneficial for regional and local economies in comparison with fossil fuels, which is very capital intensive. From a macroeconomic point of view, one can say that bioenergy can encour-

age all major elements of country development including economic growth, energy efficiency improvements, security of energy supplies, etc. (Domac et al., 2005). Thus, in addition to several positive environmental impacts, bioenergy can also provide some socio-economic benefits for both developed and developing countries (Berndes et al., 2007). Another benefit (that is debated) is that it is CO2 neutral, which is helpful for climate change mitigation. In this regard, CO2 neutral means that the amount of CO2 emission during the combustion phase is equal to the level of absorption of CO2 during plant-growth. However, when life-cycle assessment is considered, this balance can change but in comparison to fossil-based sources of energy, there are many fewer GHG emissions from bioenergy based sources (Jenssen, 2010).

In addition to all of these well known advantages, there are two types of problems and barriers that can disrupt or slow down the development of bioenergy technologies. On the one hand, there are some broad problems like emitting determinable amounts of different pollutants to air, land, and water. Also, in the case of agricultural wastes, energy crops, and forest residues, it can remove nutrients and minerals needed for local ecosystems if harvested incorrectly. In addition, extensive use of these crops can lead to deforestation (Sovacool, 2009). Bioenergy can also contribute to competition for land and water and conflict with food production (Silveira, 2005). On the other hand, there are some problems that are usually experienced at the local level, such as complaints about smell, traffic particulates, noise, and at the same time complaints about the lack of equity in distribution of environmental benefits and costs. So, based on these negative points, there is a very hot debate on the bioenergy issue. Some actors such as energy experts, local people, and NGOs try to challenge the sustainability of biofuels (Raven et al., 2010), so all of these disadvantages can lead to failure of development of bioenergy technologies (Jenssen, 2010).

1.1.1 European policy

The European Union (EU) is promoting the use of bioenergy to reduce greenhouse gas (GHG) emissions, to diversify fuel supply sources, to develop long-term replacements for fossil fuels, and to offer new opportunities for rural income. Today, around 54% of the total consumed energy by the European countries is imported (Magar et al., 2010), and energy imports are expected to grow significantly.

According to the directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable resources, a target of 20% share of renewable energy and a biofuel usage target of 10% in transport sector by 2020 have been established. In order to achieve the directive's targets and the development of different renewable energy technologies, all member states should establish obligatory national targets that are aligned with targets of the directive. So, the target of 20% share of renewable energy should be translated into separate targets for each member state based on a fair and sufficient criterion, but in order to ensure consistency in transport fuel availability, the target of 10% share of biofuel is the same for all member states. In the case of bioenergy, the emphasis of the directive is on production of bioenergy in a sustainable manner, ensuring an efficient energy market, security of supply, better mobilization of forestry systems, greater development of second-generation of biofuel (that is produced from non-edible crops), efforts to enhance the public support, and setting international or national standards for production of sustainable biofuels (EU Commission, 2009). Moreover, there are other policy measures relevant to bioenergy in EU level such as:

- Green Paper on Energy Security: To increase supply security and reduce energy imports and change in consumer behavior (EU Commission, 2001a).
- Common Agricultural Policy (CAP): To define mechanisms to regulate agriculture in the EU with emphasis on rural development, environmental protection, sustainability promotion (EU Commission, 2001b).
- Directive on establishing a scheme for greenhouse gas emission allowance trading: To encourage reductions of greenhouse gas emissions in an efficient way in order to meet the targets in the Kyoto Protocol (EU Commission, 2004).

1.1.2 Social acceptance

The public needs and thoughts are key factors in the decision making process in democratic societies. Ignoring these factors can lead to a major lag between the time of the discussions about a project and the time of implementation of that project (Assefa et al., 2007). Public acceptance is a main issue that helps the development of renewable energy systems and fulfillment of energy policy objectives. Furthermore, in order to make more fundamental scenarios about the exploitation of renewable energy technologies, public support is needed (Devine- Wright, 2007). In the case of bioenergy systems also, social acceptance would help to achieve a better condition for growth of its market share (Magar et al., 2010). The characteristics of social acceptance of a new technology are as follows:

- Existing support for a new technology among policy makers and experts
- Public availability of information and a positive view about a new technology in society
- Willingness to adopt the application of new technology by the general public
- No serious obstacles from NGOs, local policy makers, and other representatives of public interests (ECN, 2008).

The following three indicators play an important role in shaping social acceptance, namely, knowledge, fear, and perception:

- Knowledge: refers to the public's knowledge about different aspects of a new technology;
- Fear: refers to the unpleasant sensation of perceived risks related to a new system;
- Perception: refers to what people think about and how they interpret the physical and psycho-sociological health of various aspects of a new technology (Assefa et al., 2007).

There are many social acceptance studies that show high levels of public acceptance for issues like climate change policies or green energy technologies, e.g. the Eurobarometer that shows around 60% of European people are optimistic about bioenergy technologies (EU Commission, 2010a), but they usually fail to show the real picture of the projects that suffer and face severe rejections by society. Opposition to renewable energy projects is usually organized by small groups, which have considerable influence on the media, and this kind of opposition couldn't be reflected in social perception studies alone (Devine-Wright, 2005). Public resistance can have different forms such as demonstration, lobbying for maintaining the current situation, and debates in the media which is a very common form of resistance to bioenergy (Raven et al., 2010).

The interaction between a new technology and different contextual factors such as social, historical, economic, geographical, and cultural factors can lead to different levels of societal acceptance of the new technology. Different renewable technologies have various conditions regarding social acceptance. Some are completely new and unknown, and some are well-known to the society. For example public acceptance of bioenergy systems is much lower than some other types of renewable energies like wind or solar energy. Acceptance of bioenergy technology in countries with high levels of biomass use, like Sweden and Austria, is higher than some other countries like Ireland or The Netherlands, where there is a lower level of awareness about bioenergy (Rohracher, 2010).

Overall, it should be mentioned that public resistance to bioenergy technologies should be removed, and it shouldn't be considered as an insurmountable obstacle for a prosperous implementation of this technology (Jenssen, 2010). Unfortunately, academic literature on social acceptance of bioenergy is not too much, and there is a need for more research to understand public attitudes, stakeholder's opinions, and media debates about this technology (Raven et al., 2010).

1.2 Research objective and question

The aim of this research is to identify key factors influencing the social acceptance of bioenergy in European countries based on three different dimensions of social acceptance – socio-political, community, and market acceptance. The focus of this research is to recognize the current situation of social acceptance in the EU and to identify the main factors shaping and affecting public support of bioenergy technologies. In order to reach the stated aim, the main research question for this study is: What are the key factors influencing the social acceptance of bioenergy in the EU?

1.3 Scope and limitations

The scope of this paper is limited to different bioenergy technologies including bioenergy for electricity, heat, and biofuels, and also all types of energy carriers including energy crops, biogenic residues and waste. In other words, bioenergy is considered as a general issue.

The geographic boundary for this research includes EU countries. Some findings of the study may be applicable to other regions, but since the EU has a specific situation especially in regards to regulation and policy setting, this region has been chosen as the study scope.

Social acceptance is a complex issue and context specific. It means that individual and community attitudes, decision-making processes, and the project approval process are greatly influenced by the culture and context. So it is obvious that social acceptance of bioenergy in different European countries can have different situations. But the aim of this research is to recognize the common factors shaping social acceptance in these countries.

1.4 Methodology

To answer the research questions and the objective of this thesis, three approaches are applied – literature review, statistical analysis, and stakeholder interviews. Firstly, a literature review was conducted. The literature followed a compilation and examination of official documents, academic literature, and online information regarding bioenergy. The literature helped to identify the main challenges and barriers related to social acceptance

of bioenergy, as well as the significant actors who influence this issue. Secondly, a separate section related to the current situation of social acceptance of bioenergy in the EU is presented which is based on the Eurobarometer surveys and bioenergy expert opinions.

Thirdly, as the purpose of this research is to identify the key factors influencing social acceptance in EU level, contact with main actors in the field was performed to understand the factors behind the current situation of public support of bioenergy technologies and recognizing main factors shaping it. Interviewees are mainly experts in different international and national bioenergy associations such as EuropaBio, AEBIOM, Bioenergy NoE, IEA bioenergy and … Also in order to recognize the role of NGOs and environmental organizations and their perceptions and activities toward bioenergy, some interviews with bioenergy experts in most famous NGOs and environmental organizations such as Green peace and UNEP were performed.

2. Analytical framework

Social acceptance is identified as a very important constraining factor in achieving the target of increasing the share of renewable energy in many countries. It is not realistic to consider one general public and its realization as a relevant factor for the success of the various bioenergy technologies. There are different relevant publics from local to international around this issue (Rohracher, 2010). Wüstenhagen et.al (2007) has introduced three dimensions of social acceptance that are crucial for understanding the current conflicts between general public acceptance for renewable energy technologies and the difficulties that some specific projects are facing. These dimensions are socio-political acceptance, community acceptance, and market acceptance. These three dimensions are visualized in a triangle as shown in figure 2.

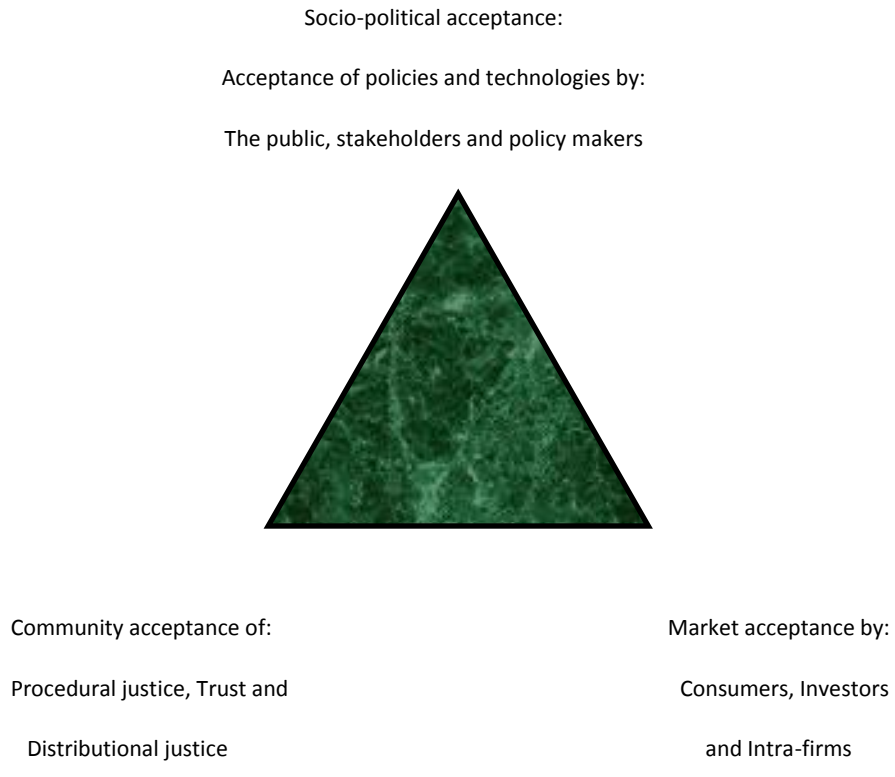


Figure 2, The triangle of social acceptance of renewable energy innovation. (Wüstenhagen et.al, 2007)

2.1 Socio-political acceptance

Socio-political issues include "the process of how actors (individuals and organizations) make decisions, resolve conflicts, form partnerships, respond to government policies and engage with public issues" (McCormick, 2007). This dimension refers to the social acceptance on the wide and general level of policies and technologies related to a new energy system. Stakeholders and policy makers involved in discussing "renewable policies" become crucial when addressing planning issues or promoting local involvement initiatives. Thus, the assessment of their levels of acceptance is an area of increasing interest

for social researchers. Some surveys like Eurobarometer show an almost high level of public acceptance for renewable energy and technologies, and that makes a good picture of renewable energy among policy and decision makers. But it is not a common situation in all European countries and in some local levels. Socio-political acceptance also concerns the acceptance by policy makers and stakeholders of relevant policies such as those policies related to creation of efficient financial systems in order to attract more investors in this sector (Wüstenhagen et.al, 2007).

2.2 Community acceptance

This dimension refers to the acceptance of local residents or stakeholders regards to sitting decisions. While several opinion surveys show a high level of public support for renewable energy systems, the actual development of many of these projects faces serious local opposition which has been defined as NIMBYism (Not In My Back Yard) (Devine-Wright, 2009). Proximity to a project like bioenergy projects has very strong influence on public attitudes to the project. But the level of this influence depends on the local context (Horst, 2007). It is demonstrated that time is also an influencing factor on local acceptance. Wolsink (2007) shows that local acceptance of a renewable project before, during, and after the implementation of a project has a typical pattern, and it is like a U-curve. It means that there is a high level of acceptance before and after implementation and a low acceptance during the implementation phase (Wolsink, 2007, sited in Wüstenhagen et.al, 2007). Wüstenhagen et.al (2007) identifies three important factors influencing community acceptance of renewable energy projects. The first one is related to distributional justice or the way that cost and benefits of a project are shared. The second dimension refers to the fairness of the decision making process. It means all relevant stakeholders have an opportunity to participate in decision making process, which is named procedural justice. And the third dimension refers to the level of community trust in the outside investors and the information about the projects.

2.3 Market acceptance

The final aspect of social acceptance is the market acceptance that refers to the adoption of a new technology in a market or the process by which market parties adopt and support (or otherwise) the energy innovation. (Wüstenhagen et.al, 2007). The emergence of the ability of scientists and innovators to introduce new energy technologies to the market is always faster than the public understanding (ICAF, 2009). So, recognizing the level of customer awareness and their adoption process is a key factor for developing innovative products in a market (Tapanien, 2008). In the market acceptance, besides consumers, the focus is also on investors and intra-firms' acceptance of new energy technologies. It could be seen as a link with socio-political acceptance because most of these investors or companies can play a very important role as stakeholders, and some of them are very influential in the process of policy making or financial systems related to energy systems (Wüstenhagen et.al, 2007).

2.4 Legitimacy

It is important to mention that there is another concept that is interlinked with social acceptance called legitimacy that has two dimensions: cognitive and socio-political. The concept of legitimacy is interwoven throughout the analysis in this thesis.

- Cognitive legitimacy refers to the spread of knowledge about a new technology. So, by examining the level of public knowledge about the bioenergy technology, one can assess cognitive legitimacy of this technology.

- Socio-political legitimacy refers to "the process by which key stakeholders, the general public, key opinion leaders, or government officials accept a venture as appropriate and right, given existing norms and laws. One can measure sociopolitical legitimation by assessing public acceptance of an industry, government subsidies to the industry, or the public prestige of its leaders". (Aldrich and Fiol, 1994)

Aldrich and Fiol (1994) argue that the cognitive legitimacy is a prerequisite for the socio-political legitimacy because without the widespread knowledge of a new system, the acceptance of a new system by stakeholders, people, and policy makers is not possible (Aldrich and Fiol, 1994).

3. Analysis of factors for social acceptance

This chapter identifies the main factors influencing the social acceptance of bioenergy in different dimensions based on the framework that was presented. It provides information that will help to answer the research question. In the next sections the main factors shaping cognitive and socio-political legitimacy are discussed besides other factors.

3.1 Socio-Political acceptance

As stated earlier, this dimension refers to the acceptance of bioenergy technologies and policies by the public, stakeholders, and policy makers (Wüstenhagen et.al, 2007) that are presented in following sections.

3.1.1 General Public

While some authors claim that there is a widespread support for using bioenergy in EU countries, in many cases, new bioenergy technologies face severe social controversies. It means that non-technical factors can play a very important role in the development of bioenergy systems (ECN, 2008). Although there is agreement on the importance of social acceptance of bioenergy among related organizations and actors, there are still many uncertainties about the suitable strategies to increase public acceptance. Thus, it is logical to investigate the public perception of bioenergy and identify the factors that shape and influence it. Improving the social acceptance of bioenergy could be seen as a cross-sectoral issue. It means that national and regional contexts have strong influence on it (Rohracher et.al, 2005)

Perception of bioenergy differs from country to country. In some countries, biomass technology is seen as a modern source of energy, while in some other countries it is a dirty and traditional way to produce energy. There are also different reactions towards different types of bioenergy technologies (Noel Gavigan, Interview). The reason is the diverse national structures and traditions (Thornley and Prins, 2008). For instance, in Denmark bioenergy in the form of wood fired furnaces is well accepted whereas the establishment of biogas plants often faces opposition from local communities despite the fact that today you can make a biogas plant which is almost odorless (Anne-Luise Skov, Interview). Also, a similar situation exists in Ireland (Noel Gavigan, Interview). In Germany and the UK, there is more resistance to the use of biofuels due to the reports on growing crops for biofuels in developing countries that raise negative issues and the food versus fuel debate along with land grabbing. In Sweden bioenergy is more acceptable and they have been using it for a long time. In all countries, more informed people and special groups (e.g. green groups) are more interested in renewable energy in general and not necessarily a bioenergy solution. (Rocio Chavez, Interview)

Surveys in different European countries show that the terms bioenergy or biomass are not used in everyday language. Usually people just talk about some special types of bioenergy technologies such as wood stoves or biogas plants, but it is rare to use the term of bioenergy. For instance, in Finland many people do not understand that bioenergy is renewable energy (Eija Alakangas, Interview). The reason for this issue is the fact that the heterogeneity of bioenergy and the diverse images and technologies that are attached to this concept are the main obstacles to communicate this term efficiently. In other words, the term bioenergy is not related to specific images of consumers and is not a concrete term (Rohracher et.al, 2005). So, it is assumed that there is not a very clear idea about

different kinds of renewable energy among people in EU countries. Evidence indicates that some specific types of renewable energies such as wind, solar energy, and hydro power are more recognized, while there is a low level of awareness about different bioenergy resources (Devine-Wright, 2007).

People's perceptions of a new technology have roots in social and cultural norms, and usually are not in line with expert opinions about advantages and disadvantages of a certain technology (Gold, 2010).The interaction between new technologies and local, historical, cultural, institutional, social, geographical, and economic contexts is one important component of social acceptance. Social acceptance is not just an issue of accepting or rejecting a new technology, but it is related to the way that this new technology is introduced in a specific context (ECN, 2008).The EU has a variety of geographic conditions and natural endowments of energy, and while their energy systems are interlinked, they have roots in diverse historical and cultural patterns. Each member state has specific policies, natural resources, and market conditions that can affect public perceptions towards bioenergy technologies. So, in all EU countries, both general public and policy makers have their specific perspectives on energy (ECN, 2008). But in general, there are some common concerns related to bioenergy among people that make it more difficult to accept. The first one is the competition for agricultural land between food production and energy crops. Further subsidies for energy production also make it harder and have led to a rise in food prices during the recent years. This issue in addition to the growing population and increasing demand for food has caused much opposition by people and NGOs in different countries (Zah & Ruddy, 2009). Another negative image of bioenergy among people has its root in their attitudes toward bioenergy as an unsustainable source of energy. Most of bioenergy opponents argue that an increased biomass use and its supporting regulations will harm biodiversity, streams and rivers in many areas. So, related national and EU level organizations feel a need to improve sustainability of different bioenergy systems as a solution for this problem (Rohracher et.al, 2005).

The public perception is a determinant factor on their acceptance or resistance toward bioenergy technologies. So, it is normally assumed that people's perceptions and attitudes toward energy technologies need to change in order to better implement renewable energy technologies especially bioenergy, and it is important to know what the main factors shaping their perceptions and attitudes are (Devine-Wright, 2007). It is important to know that the perception of bioenergy by the public can also influence the legal and political systems in a society by elections or support for specific NGOs. Thus citizens have enough power to put forth their claims against bioenergy systems (Gold, 2010).

According to McGowan and Sauter (2005) there are three categories of factors influencing and shaping people's perceptions and attitudes. Those are: personal, psychological, and contextual factors that are explained below:

1- Personal factors include several socio-demographic factors such as age, gender, level of education, income level, and social class. Some regional studies have been done in different EU countries to illustrate the role of these factors in acceptance of renewable or bioenergy. For example, a case study in Greece shows that older people are more favorable on renewable energy than younger people, and they worry more about energy dependency problems especially at the national level. This study also shows that people with a low level of education who usually belong to low social class groups are less probable to worry about energy dependency and international problems. Low educated people are less willing to pay for bioenergy compared with those of higher education (Zervas

et.al, 2010). Gender is also a factor that has an influence on people's perception toward bioenergy technology. A study about young students in Finnish schools shows that while girls are more concerned about environmental issues, boys are more positive than girls toward bioenergy (Halder et.al, 2011).

2- Psychological factors include:

- The level of knowledge and awareness about the new technology (while it is assumed that people with higher level of knowledge about bioenergy technology are more supportive, some studies show that there is not such a clear relation!) (Devine-Wright, 2007). For instance a case study in Greece shows that people with a high level of awareness about environmental issues are favorable on renewable energies, but also they have more critiques related to the sustainability of bioenergy (Zervas et.al, 2010).
- Political beliefs have an influence on social acceptance of renewable energy technologies. For example, Populus (2005) indicates that members of the conservative party in the UK were more favorable of new nuclear power plants while Labour supporters were more supportive of other renewable energy technologies.
- Environmental beliefs and concerns are also effective. Some studies show a relatively high level of support for renewable energy technologies by people who have more concerns about environmental issues like climate change, but sometimes these environmental concerns can lead to conflicts between people who are concerned about climate change and are supportive of renewable technologies and people who are concerned about negative environmental impacts of some renewable technologies, in other words a conflict characterized as 'green' on 'green' (Warren et.al, 2005).

- Place attachment: it means "positive emotional bonds between people and valued environments" (Devine-Wright, 2007). It is a factor that can motivate social support or resistance to new technologies. For example In a study in a rural community in Norway, the local attitudes toward a proposal of a major hydropower development, which will cause major environmental impacts, were examined in relation to socio-demographic variables and place attachment. The results from a postal survey show that place attachment explains more of the variances in attitudes than the socio-demographic variables all together (Devine-Wright, 2007) and (Vorkinn & Riese, 2001).

3- Contextual factors include:

- Technological factors that refer to the scale and type of new technology. Renewable technologies are diverse, including small to large scales. Birger Kerckow (interview) believes that "Often social acceptance is better for small scale systems than for large scale applications, irrespective of emissions or compliance with sustainability criteria". He also claims that the scale of deployment is an influential factor. For example if the share of biogas plants in the total energy system in a country is big, people can find more positive perception towards this technology (Birger Kerckow, Interview) For large scale projects, the level of resistance is usually higher because of their extensive impacts (ECN, 2008). Different energy carriers and each type have different environmental, economic, and social impacts, so public perceptions towards each type of these technologies are different.

For instance, public attitude toward a biogas plant mainly is related to the amount of emissions or the level of traffic that it can produce, while people's attitude toward wind turbines is more related to their visual aspects and noise. (Warren et.al, 2005).

- Institutional factors that refer to some factors like ownership patterns and the distribution of costs and benefits and the use of people engagement approach in developing a new technology. Public attitudes toward the ownership by private sectors are different from ownership by public institutions or local authorities. Also their attitudes toward the distribution of benefits among private individuals or a community of interest are different. Another factor that has influence on public attitudes toward a new technology is the level of public engagement. Some studies in different countries indicate that it is a very determinant factor in people's perception about the proposed technology. For instance in Denmark, people who were shareholders in a turbine meaningfully had more positive attitude toward wind energy than people who didn't have any economic interest (Krohn & Damborg, 1999). According to some evidence, people seek to have a higher degree of engagement in developing a new technology. For example, the level of people's support will be very high if the project is conducted by local people for local use and profit sharing with local people. But it is necessary to state that trust is a key factor in such cases. The lack of trust even if the project proposes considerable benefits for public can lead to resistance to new technology (Devine-Wright, 2007).

Based on a social, psychological approach introduced by Wegener and Kelly, attitudes that are established on direct experience with the attitude object are more helpful to predict real behaviors. For example, a positive attitude toward using biofuel is more likely to lead to buying biofuel if the person has actual experience of driving a car using biofuel. Also, attitudes that are more accessible and come to mind faster can predict behavior better. Wegener and Kelly believe that the concept of bioenergy is not accessible in public minds. One way to make attitudes more accessible is to remind people of the attitudes in many times. It can be done in different ways such as advertising. Moreover, strong attitudes that last for a long time can guide behavior more than other attitudes. Attitudes also guide behavior better when the person has a lot of knowledge rather than little knowledge related to the attitude. It is also assumed that strengthening positive attitudes is easier than changing negative attitudes to become more positive (Wegener & Kelly, 2008)

Based on this social psychological approach, social norms are a main factor influencing people's attitudes. Usually people try to change their attitudes and behaviors in order to match with the social norms of the groups to which they belong. When it comes to specific behaviors like buying biofuel or other types of bioenergy technologies, people mostly look at their reference groups and try to learn from them because they like to be accepted by the group and want to satisfy the groups' expectations. So identifying these reference groups and trying to influence their attitudes and norms can lead to a change in people's behavior (Wegener & Kelly, 2008). These reference groups could be some governmental or non-governmental organizations, scientific organizations, regional and national media, industry associations, and even family and friends (Birger Kerckow & Erno Duda, Interview)

Overall, changing a person's attitudes provides a way to influence the person's behaviors across different settings and time (Wegener & Kelly, 2008). But it should be kept in mind that a positive attitude towards bioenergy does not necessarily lead to behavioral change toward it. "Attitudes indicate intentions to behave in a certain way, but are not behavior as such, as one cannot directly observe them" (Herald et.al, 2011).

Another factor influencing people's behavior is ambivalence toward a specific issue. It can occur especially about issues that have both positive and negative aspects. For instance, in the case of bioenergy, many people know that it can provide many environmental, social and economic advantages for a society but on the other hand they may be aware of the negative aspects of unsustainable cultivation of energy crops. A research by Maio and Olson (2001) indicates that in such a situation, people try to think carefully about their information, and it can make them ambivalent, and they will pay more attention to disagreeable messages rather than positive and agreeable ones. A way to overcome this obstacle is to use efficient communication processes (Wegener & Kelly, 2008). Research organizations, universities and the media have a crucial role to establish an efficient communication process in order to widen public awareness of bioenergy technologies. Media can both reinforce existing attitudes and also create new opinions towards environmental issues. Fan (1998) claims that "the media not only is successful in giving people topics to think about, but also in telling people what to think" (Fan, 1998, cited in Halder et.al, 2011). It is also useful to make the public see the advantage of using bioenergy. It could be done by showing experience of early users and good examples in the media (Erno Duda, Interview). Evidence shows that TV is the main source of information among the public, and in rural areas local newspapers play a very significant role in dissemination of energy information (Devine-Wright, 2007).

3.1.2 Key Stakeholders

Freeman and Reed (1983) define stakeholders as "any identifiable group or individual who can affect the achievement of an organization's objectives or who are affected by the achievement of an organization's objectives". It is an acceptable definition of stakeholders because it has a wider view about them than some traditional and narrow views that see stakeholders as a group which an organization has to be dependent on in order to survive (Gold, 2010).

In this research, a distinction between different groups of stakeholders is used. Based on this classification, stakeholders are divided to two main categories:

1- Internal stakeholders, such as the members of a bioenergy supply chain or farmers and

2- External stakeholders including A) Governmental organizations B) NGOs C) Residents and citizens (Gold, 2010; Peck et.al, 2009). The third category of stakeholders, who are residents, will be discussed in community acceptance section.

Internal Stakeholders

In many EU countries, farmers do not have enough experience with growing, processing, storing, and transporting energy crops, and this is a reason for the discouragement of farmers (Bioenergy NoE, 2005). The main concern for farmers is the economic viability of bioenergy. The acceptable situation for farmers is a real developed market for bioenergy feedstock and fair prices for energy crops which is higher than their costs. Usually some specific environmental issues like concerns about sustainability and productivity of

soil are also very important influential factors on farmer's attitudes toward biomass. Farmers who produce organic products are more worried about environmental issues related to bioenergy. In general farmers' interest toward bioenergy is under the influence of some factors like the size of land, land productivity, owner/ contractor status, and economic options in agricultural environment which is managed by agribusiness. For instance, farmers who have small or fallow lands have a more positive attitude to bioenergy crops since it can help them to extend their land ownership (Peelle, 2002).

A case study in Enköping, Sweden, identifies several factors influencing farmer's acceptance of bioenergy crops. These include:

- Showing short-term economic benefits and long-term commitment for the purchase of their energy crops are needed to encourage them to cultivate bioenergy crops.
- The lack of information about cultivation of bioenergy crops and the bioenergy market among farmers lead to unwillingness to produce energy crops.
- Distributing and reducing risk is a crucial factor to encourage farmers to produce energy crops. Energy companies and bioenergy planners are responsible to create confidence and trust among farmers (Bioenergy NoE, 2005).

An interesting example of encouraging farmers to produce bioenergy crops is biomass heating entrepreneurship in Finland, where local biomass producers like farmers take care of heating of usually public buildings and they are paid according to the produced heat. This started in the Western part of Finland in early 1990's, and now they have about 500 of this kind of plants in Finland. Many visits to these plants were organized, and the model was spread to the Eastern part of Finland too (Eija Alakangas, Interview).

External stakeholders

NGOs and governmental organizations have a very strong influence on political and legal conditions surrounding bioenergy technology (Gold, 2010). Obviously, policy makers who are informed about different bioenergy resources and conversion technologies can play an efficient role in the decision making process (Bioenergy NoE, 2005). A high degree of political support is needed to develop bioenergy systems. In the case of capital intensive technologies, governments can invest in such technologies before the industry to make more confidence for investors. So, political legitimacy is very important because a lack of political legitimacy will lead to a lack of access to capital, and it can hinder the progress of the new system (Bioenergy NoE, 2008).

Government representatives are one of the major stakeholders that design and shape the legal framework of bioenergy, and they are the first targets for lobbying activities related to bioenergy (Gold, 2010). In most cases, individual policy makers at local level have a great influence on other stakeholders. For example, positive attitude of the mayor toward bioenergy can influence some other regional stakeholders and consequently influence the project (ECN, 2008).Governmental organizations that are the most important decision-makers can take different positions on bioenergy. They usually have some questions and uncertainties about bioenergy such as:

- Its environmental impacts related to their use as a fuel or its sustainability in the case of using residues and agricultural crops for energy proposes
- Competitiveness of biomass in the market compared to other energy resources

- Distributional justice and emphasis on both local and national benefits

These are main questions and uncertainties that should be answered to improve acceptance level among policy makers (Panoutsou, 2008).

On the other hand, NGOs as one of the external stakeholders also have different positions on bioenergy. Some are supporting bioenergy and some are apposed to it. The reasons for this diversity in their responses are:

- The heterogeneity in nature and complexity of bioenergy;
- Some of bioenergy systems are too young and are being designed or under construction and this may cause information gap (e.g. 2nd generation of biofuels) (Peelle, 2002).

For many environmental groups and NGOs there are several positive drivers. The first and the most important driver is the climate change. Developing bioenergy resources and renewable energies is a good way to reduce the negative impacts of the climate change according to these environmental groups. Another driver is the role of bioenergy in decreasing the dependency on fossil fuels. But besides its positive drivers, there are some negative drivers that make many uncertainties for NGOs or environmental organizations. The first one is sustainability of bioenergy production especially regarding advanced or industrialized agriculture practices.

- What is the advanced biofuel?

"Advanced biofuels are those biofuels that have the potential to be produced in significant quantities and deliver a significant lifecycle GHG emission saving while minimizing competition for agricultural land. They also have the potential to be economically competitive in terms of cost with conventional fossil fuels – just as ethanol from sugar cane in Brazil is today. Advanced biofuels may be produced for instance from waste, agricultural (food crops) residues, nonfood (ligno) cellulosic biomass, crops grown on marginal land and algae".

Source: Europa Bio, 2009

Larry Gell from IAED (International Agency for Economic Development) claims that they are supportive of every energy resource which a country can use to make them independent of oil (Larry Gell, Interview). Another environmental organization is UNEP (United Nations Environment Programme), which is supportive of bioenergy technologies as long as they are sustainable. Martina Otto, the Head of the Energy and Transport Policy Unit of UNEP, claims that bioenergy is neither good nor bad per se. Whether risks or benefits materialize depends on how and where it is produced. The assessment necessarily is location specific and has to take into account the different policy objectives; what can be good in one case can't be detrimental in another. She mentions that they work closely with governments (for example through the Global Bioenergy Partnership, and through relevant Multilateral Environmental Conventions) and with industry (for example through different Roundtables) and the results of these discussions have been translated, amongst others, in sustainability standards. They have also published a number of articles and press releases, and organized/attended events related to bioenergy to

get their message across. For example, the Bioenergy Decision Support Tool is one of their publications that has provided detailed guidance on both the policy and project level as to the considerations and process (Martina Otto, Interview). Sven Teske from Greenpeace who believes that their NGO has a very large influence on public perception of bioenergy, argues that "we do support sustainable bioenergy use. The fuel needs to meet strict criteria. In general terms we prefer stationary use - such as co-generation plant - over mobile applications (such as bio fuels for cars) due to the technical higher efficiency". He continued that Greenpeace has published a detailed research about the sustainable technical potential for biomass (Sven Teske, Interview).

Evidence shows that NGOs opposition towards bioenergy is selective and conditional. In other words, they look at these technologies through their own lenses. Some of NGOs are opposed to some specific feedstock such as forest residues or animal waste, and some are opposed to producing energy from edible crops. So it leads to a pattern of partial support of bioenergy by environmental organizations or NGOs (Peelle, 2002).

Besides relatively positive attitudes, today we can find many reports and surveys by environmental organizations and NGOs about growing doubt regarding sustainability of bioenergy systems. In such an atmosphere, it seems that stakeholders don't have the capacity to judge the reliability of claims regarding the sustainability of bioenergy especially more advanced bioenergy systems. The complexity of advanced bioenergy systems can make more confusion among stakeholders and can ultimately lead to more uncertainties among public. (Peck, Berndes, Hektor, to be published). The key issues for stakeholders related to bioenergy are summarized in table 2.

Table 2, Key bioenergy issues for stakeholders

Sustainable agriculture and forestry	• soil quality • water quality • air quality • national forest logging, use and protection • chemical inputs • residue use & removal - forests - agriculture
Sustainable energy systems	• global warming/carbon sequestration • renewable vs. fossil energy • ethanol and alternative fuels • conservation of energy • energy efficiency
Biodiversity	• monoculture • genetically modified organisms (GMOs) • suitability for wildlife habitat • exotic and invasive species
Conversion technologies	• combustion and cofiring • combustion as incineration • gasification

Land use	• use of marginal, ecologically sensitive or unique lands - draining wetlands • land use competition • landscape effects • food vs. energy
Economic viability	• cost • subsidies of fossil fuels, biomass • competition with fossil fuels, other renewables • developing markets, market opportunities

Source: Peelle, 2000

Since most public information on bioenergy has a focus on general aspects not on detailed facts and data, most of the stakeholders are requesting for more information to reduce uncertainties around bioenergy technologies, their exact environmental impacts and sustainability and their net benefits. They need more evidence in order to develop their position about bioenergy. If stakeholders cannot find accurate answers for their questions and concerns, they will lose interest. So, availability of reliable data on different types of bioenergy technologies is a very important factor to increase stakeholders' support and reduce their uncertainties on this issue (Peelle, 2002).

All stakeholders don't have the same level of power and influence. Those who are controlling fiscal resources, rule making, or both can play a major role in the development of bioenergy industry if they accept and place value on technological innovations. However, it should be mentioned that such stakeholders can play their role better in a mature and self-determinant market which is able to influence its external environment.

Diversity in supply chain is another factor that can hinder the acceptance of bioenergy products. Bioenergy supply chain is too complex and includes different sub-systems and a large number of possible combinations of sources and conversion processes and technologies and delivered services (Elghali et.al, 2007). So, the communication process along the supply chain is more difficult compared with other renewable energies. Coordination in the supply chain is a key factor for future market development. In order to prevent more confusion and uncertainty among stakeholders and people, the bioenergy industry has to put more emphasis on communication and diffusion of information (Aldrich and Fiol, 1994)

Another important factor influencing the acceptance of bioenergy is involving all related stakeholders in the development and evaluation of bioenergy projects. This involvement gives a good opportunity for more discussions between stakeholders and planners and is a useful way to transfer information on bioenergy projects to stakeholders and to remove their uncertainties and get information about the local context. Also it can help planners to be aware of different groups of stakeholder's expectations. It is better to start this engagement from the early stages of the project because it can clear up misconceptions from the beginning. On the level of policy making, also, stakeholders' participation in decision making and monitoring processes is a very effective way to improve their perceptions and to increase positive impacts of policies. It could be also a way to educate stakeholders about practical restrictions and opportunities (UNEP, 2005).

3.2 Community acceptance

Many of the new energy technologies have roots in local contexts. Local context is likely to differ for each project because each context has specific characteristics and dynamics. In other words, projects and their context are essentially interlinked. Therefore, some questions like how the project fits or doesn't fit the context should be addressed before the implementation of a bioenergy project (ECN, 2008). Residents and local people are often more concerned about local issues than on national or international issues. However, some concerns like the climate change are very widespread in all levels and are an important issue even for people who can't understand them completely. Many people know that one way to reduce negative impacts of climate change is energy conservation and shifting to renewable energy resources. So, in general, people are relatively favorable of bioenergy, but still they have some uncertainties about its environmental impacts (Panoutsou, 2008).

Bioenergy projects have both positive and negative impacts on local communities. The most considerable benefits associated with local bioenergy projects are summarized in table 3.

Table 3, Benefits of local bioenergy projects

Dimension	Benefits
Social aspects	_ Increased standard of living. o Environment. o Health. o Education. _ Social adherence and constancy. o Migration effects (decreasing rural depopulation). o Regional development. o Rural diversification
Macro level	_ Security of supply/risk diversification. _ Regional growth. _ Reduced regional trade balance. _ Export potential.
Supply side	_ Increased productivity. _ Enhanced competitiveness. _ Labor and population mobility _ Improved infrastructure
Demand side	_ Employment. _ Income and wealth creation. _ Induced investment. _ Support of related industries.

Source: Domac et.al, 2005

Local residents are the first groups that are affected by bioenergy projects, so they are at the heart of challenges and negative aspects of bioenergy. Some drawbacks like traffic congestion, smell, noise, emissions, fears about damage to bio- diversity, economic con-

cerns such as negative effects on property prices and negative impacts on the appearance of landscape can lead to different types of opposition or resistance towards bioenergy projects. However, these drawbacks may be balanced by advantageous and positive impacts of bioenergy production (Gold, 2010). Local opposition is "a form of place-protective action, which arises when new developments disrupt pre-existing emotional attachments and threaten place related identity processes" (ECN, 2008). Usually ad hoc interest groups are those who manage local resistance to bioenergy projects. These groups include people who feel their local area is at risk (Rohracher et.al, 2005). Local opposition has several forms. The group of opponents can voice their concerns by some specific activities like signing petitions, public meetings, protest marches or voting for local councilors who have promised to contest the bioenergy project (Van der Horst, 2007).

In the renewable energy literature, there is a concept that refers to some of the protesters named NIMBY (Not In My Backyard). This attitude indicates the supportive attitude of local residents toward "green" energy technology, but as long as it is not in their neighborhood (Zervas et.al, 2010). In formal words, NIMBY refers to "protectionist attitudes of and oppositional tactics adopted by community groups facing an unwelcome development in their neighborhood" (Devine-Wright, 2009). Most people think that it is not acceptable to express opposite opinions toward green technologies because it would show that they do not care about environmental issues and future generations. So, most of them try to express a pro-green opinion, but it doesn't mean that they will act like a green citizen. The best way to show opposition but prevent being seen as NIMBY, is to stress other people and make a more legitimate opposition forum (Van der Horst, 2007).

There are several driving forces for the acceptability of a bioenergy project at a local level that are summarized in Table 4.

Table 4, Local factors influencing acceptance of new energy projects

Factors related to local context		example
Political factors	Power of local government	Influence of decisions of local government on the project.
	Policies for urban planning and financial involvement in new energy	Influence of local policies concerning urban planning and financial involvement in new energy on the project.
	Impacts on the local environment	Impact of the project on local environment influencing the societal acceptance.
	Influence of individual local public figures	Personal influence of public figures on the (acceptance) of the project.
	Availability and perception of natural resources	Stakeholder confidence in feasibility of project due to (perception of) availability of sufficient resources on the location.

Socio- economic factors	Attitude to 'foreign' (non-local) investors	Stakeholder confidence in external (non-local) project partners influences their acceptance of the whole project.
	Importance of local energy independence	Usefulness of arguments supporting project visions based on willingness to become locally energy independent and to insure local security of supply.
	Interest in employment opportunities and presence of local economic development policies and programs	Social and economic support available for projects from stakeholders that support development of employability locally.
	Availability of local competence and infrastructures	Existence of local competence and infrastructures influences the support of stakeholders for the project.
Cultural factors	Trust in local institutions	Stakeholders' trust in local project partners and institutions.
	Tradition of top-down vs. bottom-up movements	Project partners' ability to mobilize resources locally from the top down or from the bottom up.
	Historical experiences	Local experiences with the location/technology/initiator or other aspects of the project.
Geographic factors	Climate	Natural endowments and demands for energy due to temperature, wind, etc.
	Availability of suitable locations	Possibilities and problems encountered in the location of the project.

Resource: (ECN, 2008)

Sometimes the opposition to bioenergy technologies is supported by some environmental organizations and NGOs and makes it stronger. But there are some ways to decrease the resistance level. For instance, in the case of energy from waste, it is better to choose an industrial area or the site of a previous similar facility because there is less opposition in these areas (Rohracher et.al, 2005). In general, resistance in industrial areas is less than other places, and people in these places are more positive toward new and especially green facilities (Van der Horst, 2007).

There are several case studies that examine the local opposition towards bioenergy technologies, and they could suggest several useful solutions in order to increase the acceptance of new technology among local residents (e.g. Khan (2004), Uperti (2004) and Rohracher et.al (2005)). For instance, in the cases that the new project is unfamiliar to local people, a learning process goes on during the planning phase for protest groups and their leader would be very effective. Many other features of successful projects are identified by some authors that are summarized below:

According to Khan (2004), Upreti (2004) and Rohracher et.al (2005), these factors contribute to success of bioenergy projects at the local level:

Local embeddedness includes:

- Obtaining support from key local representatives;
- Embeddedness in the local economy;
- Flexibility in planning process and readiness to change the plan according to local context.

Local benefits include:

- Using local contractors and facilities and distributing the benefits of projects among local stakeholders;
- Participating in satisfying local energy needs;
- Community ownership and local investment;
- Improving environmental conditions in the local area.

Continuity with local structures such as physical and social structures by:

- Using existing infrastructures such as industrial sites;
- Familiarity with the level of awareness among people and their positive experiences about bioenergy projects;
- Links to regional economic development or other ongoing change processes.

Effective communication and participation include:

- Understanding different attitudes and perceptions among local people;
- Recognition of local people's vision for their community;
- Identifying target groups , using suitable language, and channeling information to target groups;
- Continuous dialog with people especially ones in opposition (ECN, 2008).

On the other hand, the main factors contributing to failure of bioenergy projects at the local level are:

- Unwillingness among inhabitants toward changing their energy gaining mode, regardless of advantages and disadvantages of new technologies;
- People are not interested in participating in learning process;
- Conflicts among local people;
- Negative attitudes towards some specific types of renewable energy among local people. For example in some regions, burning wood seems like an unecological process. Or in other area, burning waste doesn't seem an environmentally friendly mode;
- Doubts regarding economic results of the project and distribution of benefits and environmental impacts (Schmuck, 2007).

It is necessary to keep in mind that local acceptance is not a solution for all conflicts. Several projects have failed with an acceptable level of public support just because there was not an efficient communication process to solve probable conflicts among protesting and supporting people (Rohracher et.al, 2005).

Wüstenhagen et.al (2007) identifies three important factors influencing community acceptance of renewable energy projects including trust, distributional justice, and procedural justice that are explained in next sections.

3.2.1 Trust

It is commonly assumed that trust will lead to a greater rate of acceptance. Dasquota believes that (1988) "trust is the "lubricant" that smoothes the way throughout the legitimacy-building process" (Dasquota, 1988, cited in Aldrich &Fiol, 1994). Many studies claim that in many cases opposition to bioenergy projects arises as a result of the lack of trust among local people and investors from outside. Without an efficient communication process and involving the local people in the planning process, it is impossible to gain trust of local inhabitants, and in such situations, people may feel alienated from decision makers and believe that their interests and benefits are not considered. A higher level of trust can increase the chance of acceptance by local people (Aitken, 2010).

There are some cases in which politicians tried to limit residents' influence and speed planning procedures despite local resistance. But such strategies could lead to a decrease in the level of the public trust (Jensson, 2010). Some interviews with developers indicate that they believe that there is a common sense among local people that acceptance of a specific energy facility might lead to its use for other targets. Lack of trust may ultimately result in a negative image of bioenergy technology that is not similar to the reality (Rohracher et.al, 2005).

According to Upreti (2004), distrust is one of the main obstacles to the development of bioenergy projects in Europe. He claims that in many cases if people have access to other sources of energy and at the same time do not have any trust in bioenergy developers or don't have a proper understanding of the bioenergy project, they will not accept to have that project in their region. He mentions that local people use objective criteria to evaluate the results of a bioenergy project, and they will protest if they feel that the project is involuntarily imposed on them, and they don't have any decision making power, and there is not any benefit for local inhabitants (Thornley and Prins, 2008).

A research shows that there is a higher level of trust among local people and local municipalities rather than private companies from outside (Thornley and Prins, 2008). It has been claimed that trust is both a crucial part and a potential result of cooperative behaviors. It can build mutual regard and respect and encourages cooperation and ultimately builds social capital and leads to benefits in local and other levels (Walker et.al, 2010).Trusting relations with local people enable collaboration and commitment such that energy projects can be established in a way which is beneficial for local residents and more appropriate to local conditions. It is assumed that greater social trust in the case of bioenergy projects can be obtained by using a bottom-up approach. By trusting interpersonal relations, people will feel more positive about the local projects and feel they are able to involve in influence the outcomes (Walker et.al, 2010). The main method for achieving collaboration, trust, and reliability is increasing knowledge and information. People can trust a project when enough information and evidence are gathered. Gartner and Low (1990) believe that "the social process of gaining legitimacy is shaped by the interpersonal processes of achieving trust in the organizing process" (Gartner & Low, 1990, cited in Aldrich &Fiol, 1994).

3.2.2 Distributional justice

It is common sense among local people that these are outside investors who come and establish a project only for high profits. In other words, people view bioenergy projects as a way for investors to make money (Walter & Gutscher, 2010). So, equity in distribution of benefits and also negative impacts are additional important dimensions of community acceptance. Obviously, in all bioenergy projects, there are many environmental benefits for the local and global levels and people in local areas expect to have an equal share in these benefits. Ignoring this issue by planners and developers can increase the level of conflict and opposition toward bioenergy projects (ECN, 2008). These concerns can be resolved by redistributing some of interests among local inhabitants (Thornley and Prins, 2008). In other words, distributional justice can help mitigate some of the other negative outcomes of bioenergy projects (IEA Wind Task 28).

During the operation phase of a bioenergy project, the major part of positive outcomes can be distributed. These positive outcomes are:

- Commissioning local people or companies to protect facilities;
- Implementing profit participation model (mostly in the form of communal investments);
- Providing fuel supply locally;
- Delivering heat to local consumers to give all stakeholders, inhabitants and local companies the chance of connecting directly with the project (Walter & Gutscher, 2010).

As stated in section 3.2, the main negative impacts of bioenergy projects are: smell, noise, traffic, emissions, and landscape impact. Based on an interview which was done in three countries (Germany, Switzerland and Austria), traffic is seen as the main problem for most local residents. People are too sensitive about the distribution of these negative impacts, and planners should try to find acceptable solutions for such problems. There are some factors influencing people's perception of negative outcomes of bioenergy projects. These are:

- Project size: Usually, big projects are more probable to fail. Based on interviews conducted by Walter and Gutscher, from The Advisory House, with developers of bioenergy projects in Germany and Switzerland, people have a more positive perception toward small heat plants, and they believe that small is beautiful. But in the case of big bioenergy projects, such as electricity generation, some problems and opposition will occur;
- An elaborate master plan: an accurate master plan can decrease the negative outcomes of bioenergy projects if emphasis is put on establishing the project in an area where raw materials are available and clients are close to the plant and other considerations. If these factors are met, the project has more chance to be accepted;
- Measures to minimize landscape impact: some especial measures have to be taken in order to decrease the landscape impacts, but such measures should be required and supported by law;
- Foundation of renewable energy projects in overall energy policies: it is believed that a clear national energy policy that is promoting renewable energy and is supported by people and politicians at all levels can lead to lower valence of negative impacts (Walter & Gutscher, 2010).

3.2.3 Procedural justice

As mentioned earlier, Procedural justice refers to the fairness of decision making processes in a way that all relevant stakeholders can find opportunity to participate (Wüstenhagen et.al, 2007). Interaction with the local residents is a key factor during the operation process, and it should be a long and stable relationship to promote procedural justice. It is assumed that involving people actively is a key factor. Most of local oppositions occur when people feel they are not asked and actively engaged in the process. However, there are different opinions about when to engage people. Some developers claim that the public should be involved very early, even before the regulatory authorities, while some others believe that too early an engagement can lead to some unnecessary discussions (Walter & Gutscher, 2010).

There are two groups of theories related to procedural justice:

- Structural model – "focuses on how structural procedure characteristics can influence perceived justice";
- Interactional model - "focuses on interactional aspects of procedures which are seen as being relevant for stable long-term relationships with authorities".

Leventhal (1980) and Tyler and Lind (1992, cited in Walter & Gutscher, 2010), developed some principles for these two models that are summarized in table 5.

Table 5, Procedural justice principles

Structural justice principles	Consistency	Allocation procedures among people in local community should be applied consistently and over time.
	Bias suppression	Personal selfishness and blind devotion to bias preconceptions should be impeded.
	Accuracy	Good and reliable information should be the base for decision making.
	Correctability	Modifying decisions should be possible
	Ethicality	The allocation process must be based on moral and ethical standards.
	Representativeness	The concerns of all important people and stakeholders should be represented in the allocation process.
Interactional justice principles	Standing	Standing leads people to judge their encounters with authorities for evidence that they are being treated with courtesy and respect and that their person and their rights are being respected
	Neutrality	Evidence of bias or discrimination can form a strong threat to one's self-image. Evidence of fundamental dishonesty or inadequacy can threaten the fundamental assumptions of the authority social system, denying the assumption that those in power will behave in a rational and certain fashion.
	Trust	Concern about authorities' goals leads people to

		examine their encounters with authorities for evidence of trustworthiness, i.e., to seek for signs of moral behavior, and intention to act fairly, and beneficence.

Resource: (Walter & Gutscher, 2010)

The role of leaders at the local level is also vital in the success of bioenergy projects. These leaders could be the mayor or other local politicians (Walter & Gutscher, 2010). The public usually respect the standing point of their leaders in the local level as well as the national level. It is especially true when it is about a topic they are not totally aware of (Erno Duda, Interview). The interactional justice principle "neutrality" is determinant here. Since project developers are not neutral about the project and are seeking their specific goals, a neutral leader has a key position to decrease the conflicts between the local residents and the developers. It is sometimes even more effective than when the leader is supportive of the project.

Overall, since developers are not neutral, they have to put emphasis on other principles of procedural justice in order to increase their legitimacy and local acceptance. Decision makers need to ensure that requirements of procedural justice are adhered to, i.e. that relevant stakeholders are included in the decision-making process and that decisions are made in a transparent and accountable fashion and are based on reasons which are deemed to be rational and acceptable by all parties involved. They should make trust within the community and try to improve the resident's attitudes. Walter and Gutscher in their survey on some bioenergy projects in Austria, Switzerland, and Germany conclude that these five measures are needed to promote procedural justice:

- Providing simple and understandable information for local community;
- Assuring high level of accuracy and transparency;
- Taking citizen's fears seriously;
- Changing project parameters based on resident's needs and wants;
- Establishing long-term relationships with local communities (Walter & Gutscher, 2010).

3.3 Market acceptance

As mentioned in the second chapter, market acceptance refers to the process of market adoption of a new technology by consumers and also by other important actors in market such as investors and intra-firms.

3.3.1 Consumers

Although the demand for green energy resources has increased in many countries and people know more about them especially about wind and solar energy, bioenergy still receives inattention by consumers, and there are some misconceptions toward bioenergy among people. The main reason for that is the fact that bioenergy needs a combustion process in order to produce energy while other types of renewable energy, like wind and solar energy, don't need such a process. Another reason is the lack of information about carbon cycle among consumers (IEA, task 30).

In order to understand the way people adopt to a new energy technology, it is important to know the key factors influencing their purchase behaviors. Gathered information indi-

cates that the norms of reference groups, including friends and neighbors in a society, play a key role in shaping people's behavior when it comes to adoption of new technologies such as bioenergy. In other words, people look to their reference group as a reliable source of information. Usually people view similar others as a more influential reference group and their behavior is more affected by these similar people than dissimilar groups in regard to issues like age, location, education and … (Wegener & Kelly, 2008).

In many countries, energy managers for companies or housing developments usually seek the cheapest and simplest options for heat or power systems. For some of them, using energy efficient light bulbs is enough to be green (IEA, task 30). On the other hand, sometimes the price of different energy resources is a base for consumers to evaluate different options, and it is clear that most of the time the price of conventional energy resources such as fossil fuels is lower than renewable resources. This kind of evaluation has a key limitation that is ignoring the external costs of these resources of energy such as potential health costs due to pollution associated with fossil fuels and their environmental impacts. Thus, the higher price can be seen as a barrier to adoption (Harmon & Cowan, 2009).

The main concerns of end users of bioenergy technology are supply security, availability of efficient and updated technology, current price of feedstock and planned increases, governmental support such as subsidies for this type of technology (Panoutsou, 2008), and secured feedstock supply (Birger Kerckow, Interview). Two good examples of uncertainty about technological performance are the situation of E10 (a mixture of 10% ethanol and 90% gasoline) in Germany (Birger Kerckow, Interview) and the same situation in Finland (Eija Alakangas, Interview). Germans refuse to buy and use E10 just because car owners are uninformed and scared. They think E10 will damage their car or will invalidate their warranties. Germans are too sensitive to anything that might blotch their car history. While experts estimate that less than 3% of the cars could be damaged by E10 but 100% of car owners remain insecure. In Finland, on the other hand, consumers have a lot of questions about E10, e.g. if it is good for old cars or not. (Eija Alakangas, Interview)

When consumers can choose among different alternatives, they desire to purchase a specific product of whose benefits they are convinced. They have very a strong influence on production and supply processes. Several pieces of evidence show that the innovative products which couldn't match with consumer's concerns, lifestyle, and attitudes couldn't succeed in the market (Van de Velde et.al, 2011). Establishing a competitive bioenergy market is one of the EU goals. Competitive market is a market where numerous producers offer homogeneous products. In a competitive market, end users have many options with similar prices and all producers are trying to produce their goods based on consumers' priorities and consequently they encourage a sustainable bioenergy trade (Magar et.al, 2010).

The consumer adoption can take place in five steps:

- Awareness: in this step consumers are aware of a new product, but they don't have enough information about it;
- Interest: in this step consumers search for more information about a new product;
- Evaluation: in this step consumers consider whether to try;
- Trial: they test the product in a small scale;

- Adoption: consumers decide to use the new product (Anderson & Vincze, 2000).

Adoption step for most of the innovative products takes several years. The characteristics of the new technology can influence this adoption process. For example, small scale technologies (e.g. technologies at household level) that involve small negative impacts are easier to adopt, and the slow up scaling can give more time and opportunities to people to learn more about the new technology and observe the impacts without bearing a big risk or harm (ECN, 2008). In the case of small scale technologies, the level of awareness and information among end users, their understanding of the new technology, comfort, and investment costs are determinant factors in the adoption process and need especial marketing strategies for more development (Rohracher et.al, 2005). So, an efficient communication process is needed to improve their awareness and knowledge, and it is better to start with focus on tangible technologies such as wood stoves, pellet boilers, and biodiesel (Thornley and Prins, 2008). Besides the new technology, its relevant services and features also have effect on the adoption process (Tapaninen & Seppänen, 2008). On the other hand, large scale projects to produce energy are highly dependent on local conditions and the level of acceptance among local people (Rohracher et.al, 2005).

A well established small scale segment is very important for more improvements in large and medium scales, and it is claimed that small scale projects have more potential for the increase of bioenergy use and will have more positive impacts on the structure of the industry such as creating qualified jobs. A good example in this case is the wood chips and pellet boilers in Sweden that are very popular among people and could lead to an increase in the number of bioenergy related companies and consequently establish an effective lobbying and marketing power to improve the market (Rohracher et.al, 2005).

In order to increase the end users' awareness and understanding of a new bioenergy technology, targeting customers is very effective. If the end users can be convinced that the new technology can meet their specific concerns and needs, they can accept it more easily. In one study, three different segments of consumers for biofuel industry are identified:

- The first segment includes the performance oriented consumers who put emphasis on the quality and performance of the product. They usually do not believe that using biofuel can enhance the performance of their car, and they do not believe that their behavior can have some impacts on the environment. For such customers, information on the importance of individual behavior and also information on the quality standards for biofuels is needed.
- The second segment includes the society oriented consumers who are more concerned about environmental issues and do believe that their individual behavior can make differences to the environment. For this group, the amount of emissions is an important factor when they have to buy a car or fuel. So, emphasis on the environmental positive impacts of biofuel and quality assurance is needed.
- The final segment includes the convenience oriented consumers who pay more attention to issues related to convenience such as availability of fuel stations. For them, the performance and costs are in the second degree of importance. Convincing this segment is not very easy since they are more concerned about their comfort and do not believe that their behavior is influential on environmental issues although this study shows that green products are important for this people (Van de Velde, 2009).

3.3.2 Investors

Investors are other key actors in bioenergy markets. Their willingness to invest in this market can lead to the development of this technology. This willingness is highly dependent on their perception and assessment of the predictable benefits and risks. The complexity of bioenergy technologies which are developed in different scales and involve diverse consumer segments, supply chains, and actors make it difficult to assess the market (Elghali et.al, 2007). Firm related motives for adoption of bioenergy technology are cost reduction, competitive actions, and a marketable green image. Also driving forces at the consumer level are one of the major factors in triggering suppliers' investments in green technologies since only the products that are accepted by the public can penetrate the market (Van de Velde, 2009).

The main difficulties connected to investment in bioenergy market are related to some uncertainties about the following issues:

- Risks and uncertainties related to new technologies that are not yet verified in commercial markets
- Uncertainties related to political issues which have a strong influence on the market, especially the competitiveness of bioenergy market
- Risk of market power held by established industries (Peck, Berndes and Hektor, to be published).

The low level of the investors' confidence is reported as a barrier to the market development. Because of some negative experiences and project failures in the past, there is a low level of confidence among investors and there are some uncertainties about the future market situation and government support in the long run (IEA, task 30); there are also uncertainties around the prices of raw materials and capital costs. Energy companies need a stable supply of biomass to make investment in this market (Bioenergy NoE, 2005).

In some countries investors perceive the national policies related to bioenergy as uncertain and unstable, and they experience a negative feedback mechanism in the market. The reason is that in many cases some industry or finance sector actors invested unwisely in the market without considering the economic and policy support regimes, so these investments failed and led to a damaged bioenergy industry and bad reputation. Uncertainty can also increase when a government makes changes in its legislation or even discusses some changes. Such dynamic policy conditions would be a source of problems and uncertainties for the investors (Bioenergy NoE, 2008). A basic principle of risk allocation is that "risk should be allocated to those partiers that are best able to deal with the risk, through their ability to assess the risk, reduce it, or mix it with other risks". It is true in the case of policy risks in the bioenergy market. It means that policy actors should guarantee their decisions, and they should not allow any doubts for the investors because such doubts will increase the risk premium required by investors, and ultimately the new technology will be costly for the society. The best way to decrease such doubts is establishing a regime that doesn't allow policy makers to change their decisions easily. There are some sufficient instruments for this, such as easy access to the state budget, upfront payments, or binding commitments made in international treaties. A solid parliamentary and public opinion majority behind policy aims can help to reassure investors. (Helby et.al, 2004).

When bioenergy market is established on existing market, they normally confront competition from established industries that have already earned their market share. So the new technology should take the place of existing technologies to reduce this competition (Tapaninen & Seppänen, 2008). Competition for biomass feedstock has also influence on investors. For example, in some cases there is a high competition for raw materials between wood pellet industry and pulp and paper industry that can lead to some conflicts and oppositions and sometimes the established industry has more power and can hinder the introduction of a new technology (Bioenergy NoE, 2005). Aldrich and Fiol (1994) claim, "once an industry's activities are well understood, government regulatory agencies have shown considerable resistance to new industries whose activities challenge an older industry but which use unfamiliar or novel technologies". In contrast, there are also some cases that show synergies instead of competition. It means that bioenergy production usually entails some by-products or co-products that can be used as raw material for other industries. For instance, rapeseed, that is used to produce biodiesel, has rapeseed cake as a byproduct that can be served as a protein feed for livestock. The high value by-products also can encourage investors to work on specific types of products. So the existence of a developed market for byproducts can increase the investors' willingness to enter into the bioenergy market (Meeusen & van Tongeren, 2005). Obviously in these different conditions, investors have different perceptions and attitudes toward investing in bioenergy market (Bioenergy NoE, 2005).

The high initial cost for some bioenergy systems is another challenge for investors. Nowadays biomass heating systems tend to have higher initial costs than conventional fossil fuel burning systems. Moreover, more physical space is needed for storage, delivery and handling of biomass. Bioenergy production should be acceptable financially. It means that in a long term all investments done to it should be paid back, and also investors should gain profits of their investments. So the high initial cost of investment in bioenergy production is a key challenge for investors (Ojala, 2011).

As mentioned earlier, the concerns about the environmental issues like climate change would be a key driver for policy makers to support bioenergy technologies. Investors and business people might have such concerns, but still they do not perceive it as a real economic challenge to their business activities. Thus, they prefer not to involve in some new technologies like bioenergy too early. They usually believe that acting on political signals would be risky, and it is more logical to wait for a reliable policy framework which is followed by permanent incentives (Helby et.al, 2004).

Another important factor related to the bioenergy market is establishing the appropriate conditions where bioenergy is competitive with fossil fuels and other renewable energies. Some economic strategies such as taxes on fossil fuels or subsidies for bioenergy or green certificates are needed to serve this purpose. In addition, external costs of energy production related to all of these different energy resources should be communicated in order to increase consumer's understanding of real costs of energy production. Obviously fossil fuels and nuclear power have more external costs in comparison with bioenergy (Bioenergy NoE, 2005).

3.3.3 Intra-firms

A new technology in the first phase of its life, i.e. the formative phase, encounters some uncertainties (Jacobsson & Bergek, 2004) and often the lack of legitimacy (Aldrich & Fiol, 1994). One can say that bioenergy technology, especially technological systems related to advanced bioenergy, are at the formative phase, and some of them, like the se-

cond generation of biofuels, are even at the early stages of the formative phase because this technology has not yet been introduced as a commercial product. Only some specific types of bioenergy like wood fuels from established forestry industries could be recognized as a mature industry. During the formative phase, the new technology has to try hard to gain legitimacy in order to survive (Jacobsson & Bergek, 2004). As the new industry grows, increasing numbers of organizations may question its legitimacy along two dimensions: cognitive dimension that refers to the knowledge about the new technology and what is needed to succeed in an industry, and socio-political dimension that refers to the acceptance of the new technology by the public, key stakeholders, and policy makers (Aldrich &Fiol, 1994).

Aldrich and Fiol (1994) introduce some ways to increase the cognitive and socio-political legitimacy for a new technology. In the case of cognitive legitimacy, they believe that founders of a new industry should find suitable strategies to interact with other organizations and convince them about their industry's remaining power. One major problem is the competition on the design and standard of products and services within the industry during the formative phase, which can lead to some confusion in the eyes of the public and other industries because they can't find a unique definition for this new technology. To overcome such a problem, the new industry has to develop a basis for trust within its organization and then converge around dominant designs and standards to increase its cognitive legitimacy within the society and to decrease the uncertainties and confusions in the eyes of other industries.

In the case of socio-political legitimacy, collective actions are needed to gain such legitimacy. Establishing collective actions would be as a way to share risks, information, and knowledge and to develop shared norms and language that ease legitimacy, transfer goods, services and social processes, and go through a mutual modification process of structures and administration (Knight, 2002). Moreover, such bodies such as associations can be very active in the political sphere to lobby with key policy makers and stakeholders and represent the interests of the bioenergy industry to government agencies (Peck, Berndes, and Hector, to be published). Sweden is a pioneer in forming such associations. There are several associations related to different types of bioenergy such as Pelletsindustrins Riksförbund (PIR) [National pellet industry federation], Svenska Torvproducentföreningen (STPF) [Swedish peat producers' association] and Svenska Trädbränsleföreningen [Swedish wood fuels association] that are related to solid biofuels and also two other associations related to liquid and gaseous fuels that are Bio Alcohol Fuel Foundation (BAFF) and Svenska Biogasföreningen (SBGF) [Swedish biogas association].Besides these associations also there are some Umbrella organizations such as SVEBIO [Swedish Bioenergy Association], Lantmännen [Farmers association]; Renhållningsverksföreningen (RVF) [Association of waste management facilities], Gröna Bilister [Green Motorists], Lantbrukarnas Riksförbund (LRF) [National farmers association], Miljöfordon i Sverige [Environmental vehicles in Sweden] and Svensk Fjärrvärme [Swedish district heat].

There are also several bioenergy associations in other European countries. The existence of these associations and organizations shows that the collective action in bioenergy industry is emerging, but it doesn't mean that all of them are collaborating and sending the same signals to the public sector or their stakeholders and policy makers. In order to gain more power for successful lobbying and effective information dissemination, these associations should increase their cooperation level and present a common view at the EU level (Peck, Berndes, and Hektor, to be published).

4. Assessment of the levels of social acceptance of bioenergy in the EU

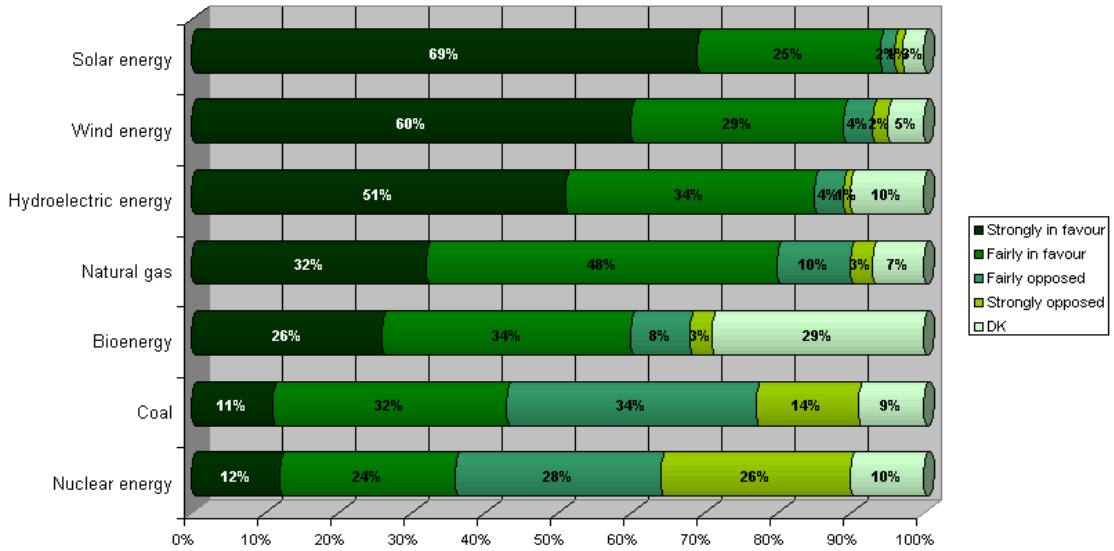
This section looks at what Eurobarometer (EB) surveys and bioenergy experts tell us about the social acceptance of bioenergy in the EU. The first section is an assessment of the results of different EB surveys, and after that there is a section including bioenergy experts' opinions about this issue.

4.1 Eurobarometer surveys

Among opinion polls, one of the most reliable indicators allowing comparisons of the level of support in different countries is the Eurobarometer Standard Survey (EB), carried out twice yearly and covering the population of the EU aged 15 and over. Throughout the 30 years that these surveys have been conducted, they have proved to be a helpful source of information for EU policy-makers on a broad range of economic, social, environmental, and other issues of importance to EU citizens. The following sections attempt to highlight the major findings of EB concerning bioenergy.

According to the Eurobarometer survey, "Public Awareness and Acceptance of CO2 capture and storage" (2011), on average 60% of EU citizens are in favor of the use of bioenergy in their countries (26% strongly in favor and 34% fairly in favor). The table also illustrates that the support of bioenergy is lower than other types of renewable energy (EB, 2011).

Figure 3: To what extent are in favor or opposed to the use of the following sources of energy in (OUR COUNTRY)?

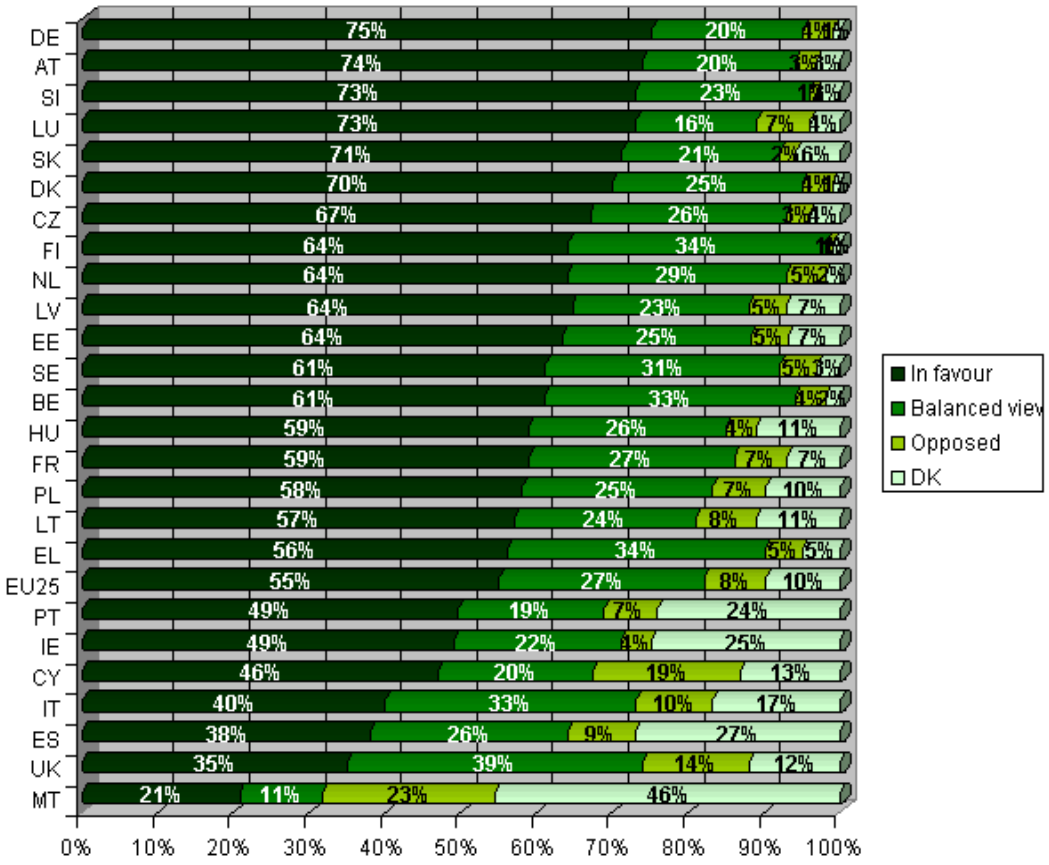


Source: EB, 2011

The country by country survey shows that citizens in Germany, Austria and Denmark are most in favor of the use of bioenergy. The reason for this relatively good support would be the supportive regulations in Germany and some improving activities by FNR (agency for renewable resources) such as the establishment of a certification system – International Sustainable Carbon Certification (ISCC) - for bioenergy which is now in use for biofuels for transport. The certification guarantees the sustainability of biofuels according

to the Directive 2009/28/EC on the promotion of the use of energy from renewable sources. In addition, there are other factors like supporting research and development in the area of renewable resources, informing the public about the current research results, giving advice on a range of applications of renewable resources, and organizing and taking part in scientific events (Birger Kerckow, Interview). BIOHEAT is a consultant company that is developing the use of modern automatic wood boilers in 14 European countries such as Austria, Germany and Denmark. This company makes significant efforts for providing information about wood fuels to relevant target groups such as municipalities, housing associations, etc. Some successful marketing strategies in Germany and Austria have played a significant role in the development of bioenergy. For example, there have been some campaigns for wood pellet heating with the focus on issues and solutions not on products and using the positive implication of pellet (comfort and cleanness). Important factors influencing the support of bioenergy, especially in Austria and Denmark, are well-established fuel supply systems, availability of update technology, the existence of a sufficient quality assurance system for the whole chain of products and services, and also skilled professionals. In Denmark, the existence of a well-educated population who is aware of energy issues is a key factor for the acceptance of bioenergy. In addition, several bioenergy agencies and associations in Denmark play a key role in improving the public support of bioenergy (Rohracher et.al. (2010). Respondents from Malta, the UK and Spain express lower willingness to use bioenergy.

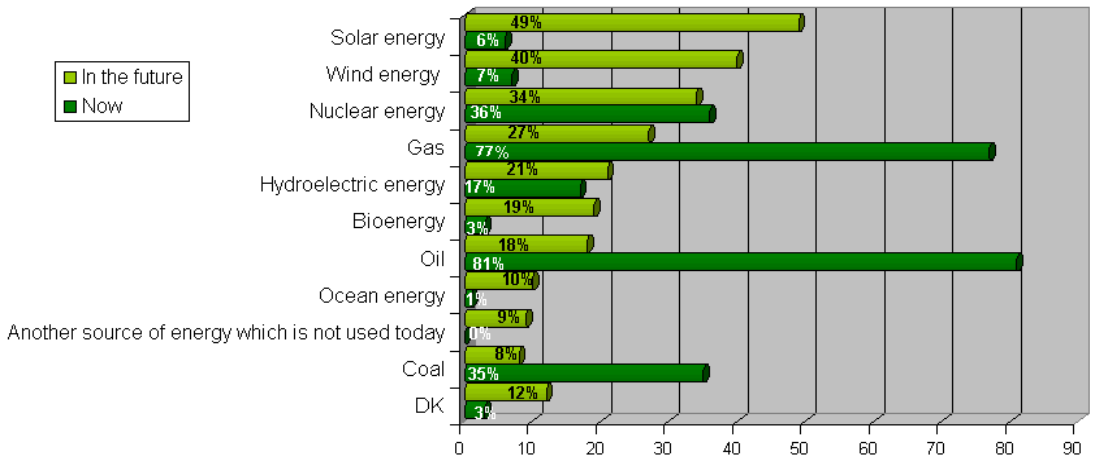
Figure 4: Favorability of bioenergy in European countries (country by country)



Source: EB, 2007

EU citizens have also demonstrated a very positive view on the use of renewable energy in the future, but wind and solar power are expected to be the key energy sources. The expected increase in the use of bioenergy from 2007 to 2037 is not so important. It seems that current concerns related to bioenergy have influence on the public support for the bioenergy use in the future. Concerns like sustainability of bioenergy, unstable policies, food versus fuel debates, and people's perception of the competitiveness of this industry versus other energy industries (IEEP, 2011).

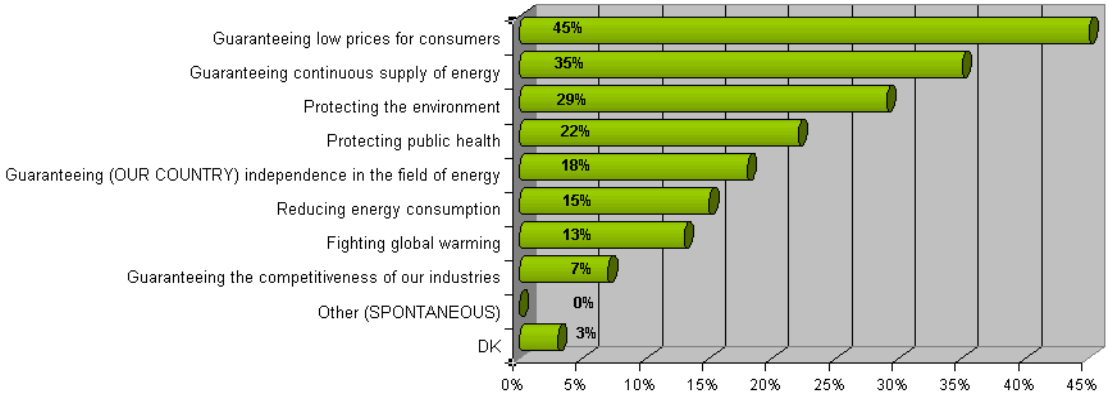
Figure 5: And thinking about energy in 30 years, which do you think will be the three most used energy sources in (OUR COUNTRY)? (MAX. 3 ANSWERS) - % EU25



Source: EB, 2007

When respondents were asked about the top priorities in the government's energy policy, 18% ranked independence in the field of energy and 29% ranked protecting the environment as very important. While 45% were concerned about energy prices. It shows that concerns about energy prices are more important among European people, and the security of supply is the second important priority for them. So, bioenergy industry would be successful and competitive with other energy industries if it can guarantee the lower prices and continuous supply of bioenergy to the market.

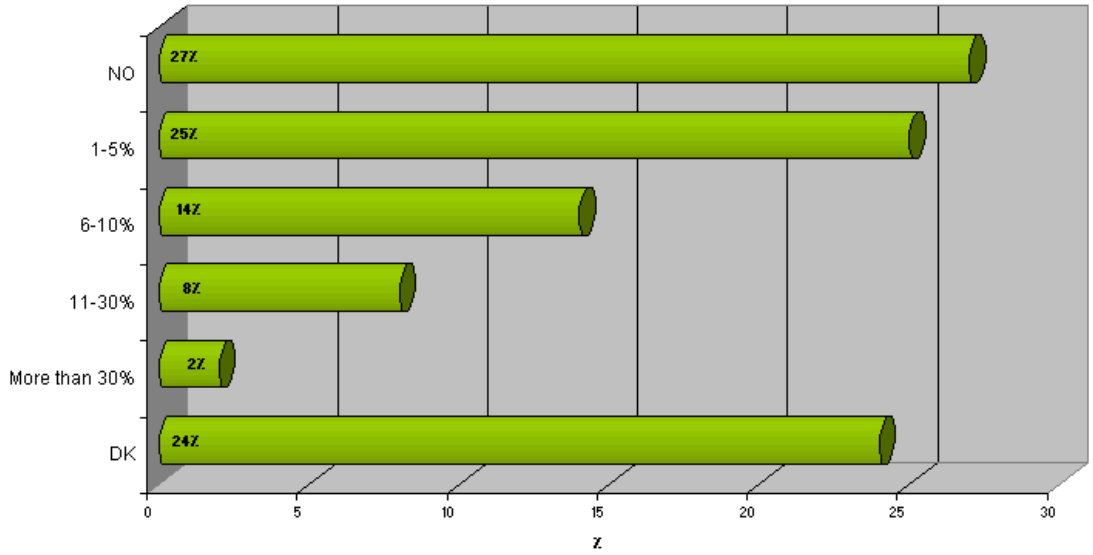
Figure 6: In your opinion, which two of the following should be given top priority in the (NATIONALITY) Government's energy policy? (MAX. 2 ANSWERS) - % EU25



Source: EB, 2007

In 2009, 50% of European people believed that the climate change is the biggest problem currently facing the world. And 75% believed that alternative fuels like biofuel are useful to mitigate the climate change problems. (EB, 2009a) When the citizens were asked about their willingness to pay more for green energy to fight the climate change, the majority were not willing to pay more. Respondents from Sweden, Denmark, Finland and Luxembourg were the most willing to pay more for green energy, whilst respondents from Latvia, Czech Republic, Estonia, and Germany were the least willing to pay more. So as stated before, price is an important priority for consumers to decide about the acceptance and use of a specific energy source.

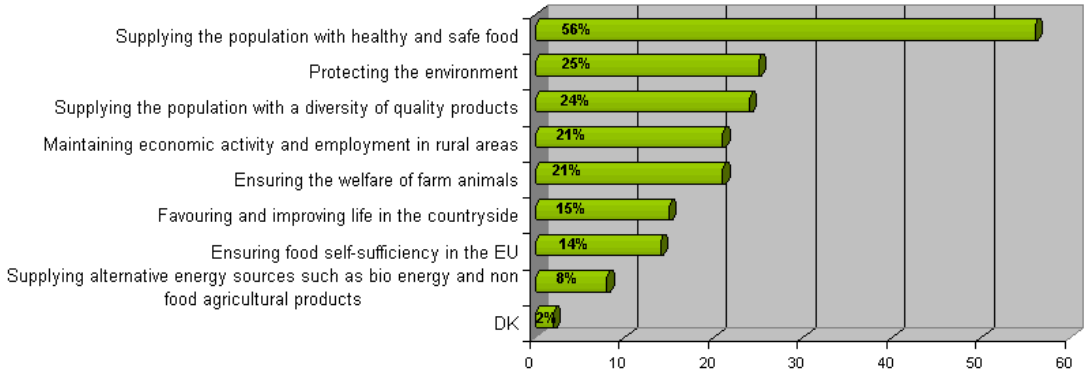
Figure 7: Personally, how much would you be prepared to pay more for energy produced from sources that emit less greenhouse gases in order to fight the climate change? In average, how much, in percent, would you be ready to pay more? - % EU



Source: EB, 2009b

In the survey of Europeans, Agriculture and the Common Agricultural Policy in 2010, respondents were asked about two main responsibilities of farmers; the majority of respondents ranked supplying the population with healthy and safe food and protecting the environment as the two main responsibilities for farmers. Only 8% of the citizens rank the supplying of alternative energy sources as the main responsibility of farmers. Respondents from Denmark (15%), Finland (13%) and the Netherlands (14%) ranked this responsibility as the most important. Respondents in Romania (2%) and Spain (3%) were very unlikely to quote this aspect as the most important. This survey shows that at that time, the majority of European people still hadn't accepted the producing energy crops as a need for their society, while issues related to food and economic welfare are their main needs and priorities.

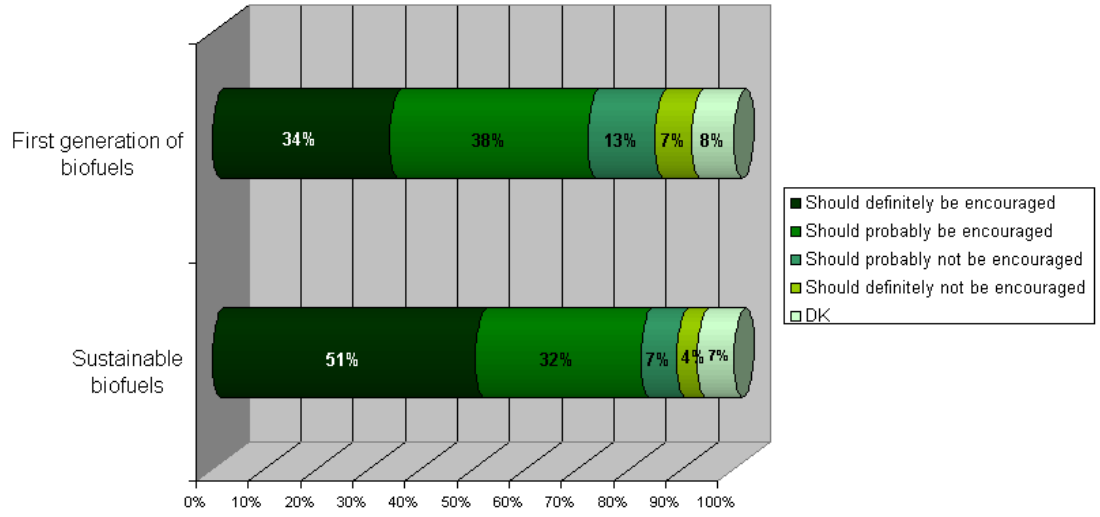
Figure 8: In your opinion, which should be the two main responsibilities of farmers in our society. (ROTATE – MAX. 2 ANSWERS) - % EU



Source: EB, 2010a

As stated in the section 3.1.1, the sustainability of bioenergy is one of the most important factors influencing the acceptance of bioenergy by the public and stakeholders. In one survey, respondents were asked about two generations of biofuels. Overall, there is a positive attitude toward biofuel in the EU. Around 72% of European citizens were in favor of crop based biofuels, and they are optimistic about the 2nd generation of biofuels. Approximately, 83% were supportive of biofuels from non-edible and more sustainable crops. So the level of acceptance of more sustainable bioenergy resources would be higher than other types and technologies.

Figure 9: Opinions regarding first generation and second generation of biofuels, EU27

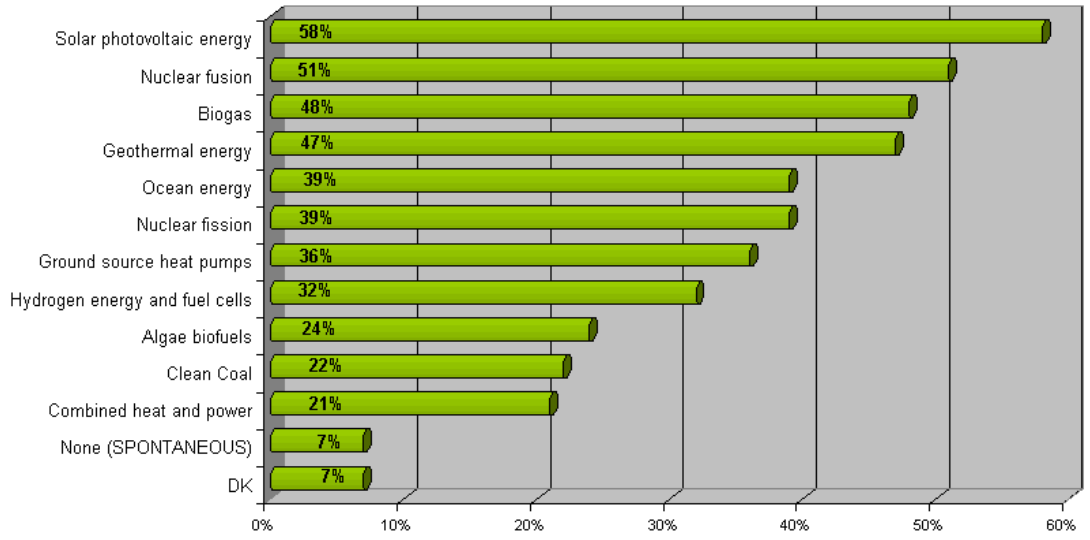


Source: EB, 2010b

As stated in section 3.1.1, in most of the European countries, people don't have a clear definition of bioenergy as a whole. They mostly know about some specific bioenergy technologies. One factor stated earlier as an influencing factor on the social acceptance of bioenergy was the lack of information among the public, policy makers, and other stakeholders. There are some surveys on the way people get information about different

energy resources and their familiarity with different energy resources. Biogas was the most well-known bioenergy technology among European people.

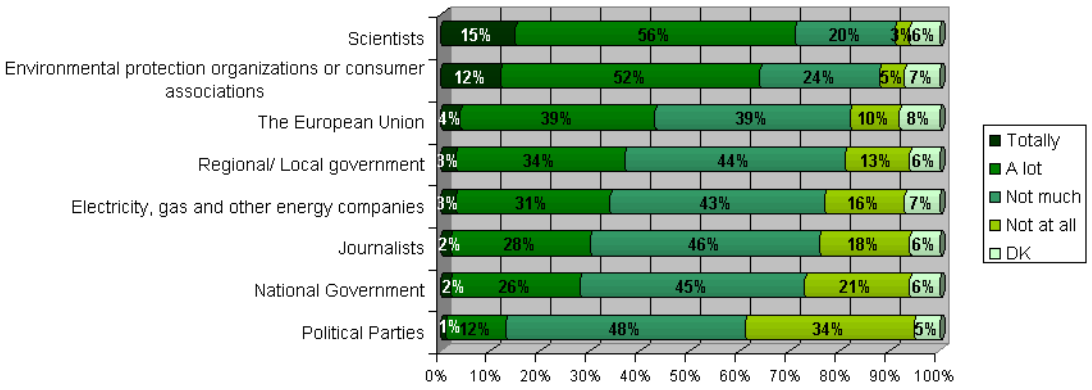
Figure 10: In the context of energy production, which, if any of the following have you heard of



Source: EB, 2011

When asked about the most reliable information sources, the respondents mentioned scientists (71%) and environmental organizations (64%). National governments (28 %) and political parties (13%) were the least reliable sources. Thus, scientific organizations and environmental associations or NGOs have a key role in disseminating bioenergy information among the public and, therefore, to help to increase the acceptability of bioenergy technologies.

Figure 11: To what extent would you trust information about energy related issues from each of the following sources? - % EU25



Source: EB, 2007

4.2 Expert opinions

Almost all of the interviewed experts claim that the level of social acceptance of different energy resources differs from country to country. Rocio Chavez (interview, July 20, 2011) from Imperial College London believes that there is not a wide understanding of the general public on the use of biomass in the EU, but the acceptance of bioenergy differs from country to country. Rocio Chavez continues that bioenergy is highly acceptable in Sweden, but this is not a common situation in all European countries. In the UK, there is a high level of resistance to bioenergy, and people are more favorable to wind power. In some countries, like Spain and Portugal, people prefer to use solar energy instead of bioenergy.

Even inside a country, the acceptance of different bioenergy technologies is not the same. Noel Gavigan (interview, July 11, 2011) from the Irish Bioenergy Association claims that there is a mixed level of acceptance to different bioenergy technologies in Ireland. Some have been openly accepted, while some others have met severe objections. This is also true about other energy resources; for instance, in Ireland there was considerable objection towards the largest coal powered station, while the gas plant did not receive much objection.

Anne-Luise Skov (Interview, July 8, 2011) from agro-business park- Denmark believes that "in general there is a lack of knowledge in the broad public about bioenergy, since wind power has always been a strong factor in Denmark". She argued that bioenergy in the form of wood fired furnaces is well accepted in Denmark, but there is a high level of opposition toward biogas plants, especially from local people. While experts assure that we can make an almost odorless biogas plant, still people don't have positive attitudes toward this bioenergy technology.

Eija Alakangas from EUBIONET 3- Finland (Interview, August 8, 2011), claims that in Finland many people do not know that bioenergy is a renewable energy. General acceptance for bioenergy is good, but some specific types of bioenergy are well-known and more popular; for instance, many people in Finland use firewood in their own stoves and fireplaces, in all 6 million solid cubic meters.

Erno Duda from Europa Bio (Interview, July 20, 2011) believes that in general, people are in favor of bioenergy because they know that this type of energy is more environmental-friendly, but since the price of bioenergy resources is usually higher than other energy resources, people cannot afford using bioenergy resources. He also emphasizes that the acceptance of different types of bioenergy technologies is not the same, and some types of bioenergy systems are more acceptable than others.

Based on a study which conducted by Støer and Yang (2003) in the UK, it is proved that the support for wind power (72%) and solar energy (74.7 %) was much higher than for bioenergy (16%). In this survey, the majority of respondents (79%) as a reply to the question "Do you support bioenergy?" answered by "don't know", which could be a result of misunderstanding of what bioenergy meant (Rohracher et.al, 2010).

Another study on the "implementation barriers of energy from biomass" by researchers in Technische Universiteit Eindhoven in the Netherlands (2003), illustrates that the level of acceptance of different bioenergy technologies in the Netherlands is not the same. Some specific types of bioenergy like bioenergy from waste are highly accepted, while

there is a strong opposition towards bioenergy from farmed wood or crops (Rohracher et.al, 2010).

Philip Peck (interview, July 18, 2011) from Lund University believes that the social acceptance of the fossil fuels is better than renewable energy. And among the fossil fuels, the acceptance of the natural gas is better than oil, which in turn is better than coal. According to Philip Peck, the acceptance of nuclear energy in some European countries is higher than bioenergy, while in some other countries it is lower (especially after the recent event in Japan, the acceptance of nuclear energy has been dramatically reduced in countries like Germany). Moreover, he categorizes the social acceptance of different bioenergy technologies as shown in Table 6.

Table 6, Comparison of acceptance of different bioenergy technologies

Social acceptance of different bioenergy technologies	poor acceptance	moderate to poor acceptance	moderate acceptance	moderate to good acceptance	good acceptance
Biogas from waste					*
Biogas from cropping systems and waste				*	
First generation liquid biofuels for transport		*			
Second generation transport biofuels			*		
Biomass fired Power, CHP and heat from forestry waste					*
Biomass fired Power, CHP and heat from agricultural waste			*		
Biomass fired Power, CHP and heat from agricultural cropping systems			*		

Based on the information in Table 5, the acceptance of biogas from waste is high, and the European people have a positive attitude toward this technology, but as mentioned earlier, the establishment of a new biogas plants in different regions often meets strong opposition by local people and environmental groups which need to be more informed through sufficient communications as discussed in the discussion chapter. Bioenergy from agricultural residues is usually less acceptable because of the concerns related to the sustainability of energy production and some negative impacts on land productivity and so on. The level of acceptance of energy from forestry waste is also at a good level; the reason could be the existence of a sustainability certification system that is applicable in several European countries and also standard for wood pellets proposed by EU which can be seen as an effective tool to improve the social acceptance of this type of bioenergy. In the case of biofuels, it is assumed that the dissemination of biofuel use in European countries is a result of regulatory changes or tax incentives rather than public awareness and acceptance of biofuel (Rohracher et.al, 2010). But the second generation of biofuels is more acceptable because it seems to be more sustainable.

According to these surveys and opinions, the level of public awareness of bioenergy technologies is often low and some types of bioenergy technologies are not well-known and acceptable by the public and stakeholders. Since bioenergy has a heterogeneous na-

ture, the potentials and advantages of each application need to be communicated separately. In general, one can say that a high level of acceptance of bioenergy in a specific country or region doesn't mean that all types of bioenergy are well-known and applicable in that country. So there is always room to increase the social acceptance of different bioenergy systems in all member states.

5. Discussion

In the first part of this chapter, the thesis author discusses the important factors influencing the social acceptance of bioenergy in Europe, and in the second part gives some recommendations to improve the social acceptance of bioenergy in European countries.

5.1 Key factors for social acceptance

Several factors influencing social acceptance of bioenergy in European countries have been identified in this research. Findings from interviews indicated that some important factors like availability of information and sufficient communication process with public, stakeholders and within the supply chain, secured sustainability, competitiveness of the bioenergy industry in the energy market and reliable political framework conditions are the main influential factors in almost all European countries. In the first section of the discussion, these factors are discussed:

- Lack of information;
- Political uncertainties;
- Sustainability of bioenergy;
- Diversity in the supply chain;
- Competition for new industries.

5.1.1 Lack of information

Lack of information on bioenergy technologies is a common situation among the public, stakeholders, and policy makers. Since they don't have enough information about the positive and negative impacts of these technologies, they have a high level of uncertainty and are not able to find a positive attitude towards bioenergy technologies.

According to Aldrich and Fiol (1994), cognitive legitimacy is related to knowledge as a prerequisite for the acceptance of a new technology. As stated in section 2.4, one can assess the level of cognitive legitimacy of the bioenergy technology by examining the level of public knowledge about this technology. Considering the current information gap which is present in many countries in relation with many bioenergy projects, this thesis author assumes that more efforts are needed to improve the cognitive legitimacy of the bioenergy industry in European countries. Without widespread knowledge on bioenergy, this industry may face difficulties to obtain the support of people, policy makers, stakeholders and financial organizations. This is especially the case when the new technology is novel and unfamiliar to the people. In other words, important stakeholders are more likely to support issues that they perceive as understandable and feasible and for which they can promptly access reliable information (Peck, Berndes, and Hector, to be published).

The flow of information to the society about bioenergy is not adequate to create reliable understanding and to decrease the uncertainties around bioenergy. Peck, Berndes, and Hector (to be published) believe that the dissemination of information on benefits of bioenergy technologies, especially advanced bioenergy technologies, is not well-managed by the bioenergy industry, and there are no clear strategies for the presentation of such information in forms suitable for a range of social stakeholders. Also, "the bioenergy sector does not yet have consistent strategies for dealing with critique of the bioenergy industry". Today, the legitimacy of bioenergy is undermined by inaccurate and incorrect information (Peck, Berndes, and Hector, to be published).

Today, people have information about general concepts related to bioenergy and not about facts and data. Many of stakeholders who are deciding about specific bioenergy technologies ask for more information and data on environmental impacts, sustainability, and net benefits. Environmental organizations and NGOs also request information and evidence on feedstock and conversion process impacts. In many cases detailed information about different feedstock and conversion processes is not available, and such requests are often not answered at all. In such conditions, stakeholders may lose their interest in more cooperation. So, providing an in-depth description and analyses of the different feedstock and conversion systems with approximate sustainability rankings is necessary to improve acceptance of bioenergy (Peelle, 2002).

Information campaigns are one of the solutions to increase people's knowledge about bioenergy technologies, but it should be mentioned that such campaigns should be followed by suitable marketing strategies. Also, these information campaigns should be based on a complete understanding of the factors important for people's perception and attitudes of the specific technology (Rohracher et.al, 2005).

The need for more information is more evident for local projects. Since local residents and stakeholders are more sensitive about local issues than national and international issues, they need accurate information in order to decide on the implementation of bioenergy projects (Panoutsou, 2008). In the case of new or unfamiliar projects, people are worried about having to serve as a "test-bed" or "laboratory for an unproven technology"; thus, people need to be informed about all outcomes of a specific bioenergy project at the early stage of the project implementation. Late information provision can result in more uncertainties and ultimately more opposition and resistance from local stakeholders and inhabitants (ECN, 2008).

5.1.2 Political uncertainties

In order to provide the possibility to compete with traditional energy resources, governments have to intervene in the renewable energy market. By making a stable regulatory framework, policy can play a key role in increasing the investor's confidence and decreasing uncertainties and confusions especially in the case of young and new industries like bioenergy (Menichetti, Doctoral dissertation, 2010). It is indicated that the policy sphere surrounding bioenergy is uncertain, and policy actors don't adequately understand this industry. These conditions lead to less positive attitudes among investors for more investigation in bioenergy markets. In other words, "the current interactions between industry and policy makers are not positive and the main reason is a poor mutual understanding between industrial actors and political actors" (Bioenergy NoE, 2008); thus, providing enough and reliable information and more communication with policy makers are essential to promote this mutual understanding.

As stated in section 3.3.2, dynamic policy conditions can result in more uncertainties. When governments make changes in regulations or discuss such changes, it can lead to more uncertainties about stability of the regulations. Although there are always some levels of risk for investors in the bioenergy industry, uncertain policy conditions can add more to the levels of risk especially when they are seeking finances for their projects (Bioenergy NoE, 2008). When investors don't have enough familiarity with new technologies, they may overestimate the risks and overlook promising business opportunities. In such a situation, policies can help to correct market failures and help the investors get a more balanced perspective. In order to do such corrective actions, policies should have some characteristics such as commitment, stability, reliability and predictability (Peck,

Berndes, and Hektor, to be published). Risk reduction is a key influential factor on the investor's behavior because reducing risk can decrease the cost of capital and will make bioenergy projects more attractive for investors and finally can help to develop the bioenergy market. Therefore, policy makers can send positive signals to the market actors if they set a predictable and stable policy framework. Some policy schemes like feed-in tariffs are an example of support schemes that can have a positive role in leading to an increase of the renewable energy share by lowering the risk associated with the investment decision. A properly designed feed-in tariff scheme can encourages the financial participation of smaller and more risk averse investors by creating lower-risk investment conditions (Langniss, 1999 cited in Menichetti, Doctoral dissertation, 2010).

Removing non-economic barriers and establishing predictable and a transparent support framework are two highest priorities for effective policies identified by IEA that can improve functioning and attract investments (Tanaka, 2008 cited in Menichetti, Doctoral dissertation, 2010). Another finding of the IEA study is that specific support measures should be developed in order to target renewable energy technologies with different degrees of maturity (Christiansen, 2001) in other words, there is not a best support policy for all bioenergy technologies. A mix of policy instruments is needed to support specific bioenergy system. This policy mix should be evolved with the technology (Haas et.al, 2004). Also, in order to increase the impact of future energy policies, policy makers should try to get a better understanding of investor's behavior and the way that they make their decisions. Other factors such as the degree of bioenergy technology maturity, country-specific conditions and needs, and concerns expressed by different market actors should be considered by policy makers (Menichetti, Doctoral dissertation, 2010).

5.1.3 Sustainability of bioenergy

There are different sustainability concerns about different bioenergy technologies. In the case of agricultural crops, some environmental organizations, soil scientist, and organic farmers are concerned that some intensive agricultural methods lead to "mining the soil" even if farmers use different agricultural chemicals such as fertilizers or pesticides. Another concern is related to the removal of agricultural residues such as corn stalks that can lead to the loss of humus and increase soil erosion (Peelle, 2002). Although these concerns could be logical about some specific types of bioenergy technologies, these few technologies have come to represent the whole bioenergy for many environmental stakeholders and made some uncertainties among these stakeholders, and these uncertainties can decrease stakeholders' interest and support (Peelle, 2002)

One can observe growing uncertainty especially regarding the sustainability of modern agricultural practices. Biofuel has a very high profile in this debate (Peck, Berndes, and Hector, to be published), and now we can see widespread criticisms that range from supposed restricted potential for real reduction in greenhouse gas emissions to describing bioenergy crop cultivation as the root-cause for deforestation, harm to biodiversity, and social malfunctions and hunger in developing countries (Raven et.al, 2010)

In order to decrease sustainability uncertainties, some countries are initiating national sustainability standards for some types of bioenergy technologies and feedstock (UNEP, 2005), and it appears to be an important work at the national and European level to make strategies and regulations to enhance the sustainability of different bioenergy technologies as an instrument to make a better image of this source of energy (Rohracher et.al, 2005). For this purpose, it is useful to get in contact with environmental organizations, opposition groups, and scientific organizations to achieve an agreement over the

sustainability of bioenergy (Rohracher et.al, 2005). Some environmental organizations and NGOs like UNEP and Greenpeace are doing very useful works on sustainability issues, and their publications are available for bioenergy developers. (Martina Otto and Sven Teske, Interview)

5.1.4 Diversity in the supply chain

As stated in section 1.1, bioenergy has many forms and levels of complexity and can be produced from waste and by-product streams (e.g. agriculture, forestry, municipal waste, industrial waste) or can be produced as a separate product from agricultural or forestry systems. Some areas of bioenergy are well developed, while many others are very young. For some types of bioenergy technologies, there is a well developed standard while others are only emerging. There is even diversity in the scale of bioenergy application; it could be a large, medium, or small scale. For some types of bioenergy technologies, there is a high competition for raw materials or land, while for others there is no competition, and finally there are very severe concerns about the environmental impacts of some forms of biomass, while other forms are free of controversy. This diversity and complexity can introduce considerable confusion in the eyes, minds, and debates of the society. It is even more confusing when evidence of good functions within one type of bioenergy technologies does not automatically serve as evidence of trustworthiness within other contexts (Peck, Berndes, and Hektor, to be published). Moreover, the diversity in the supply chain can be seen as a barrier to create alliances among supply chain members in order to increase the power of the bioenergy industry in lobbying and obtaining legitimacy and acceptance, especially by policy makers. In order to decrease such problems and confusion, there are some partial resolutions such as establishing common standards and collective actions in the form of industry councils, cooperative alliances, and trade associations (Peck, Berndes, and Hektor, to be published) that are discussed in section 5.2.

5.1.5 Competition for new industries

As stated in sections 3.3.2 and 3.3.3, the bioenergy industry interacts with some other industries and has some synergies or conflicts with those industries. In some cases, there is a direct competition for raw materials (e.g. over wood with pulp and paper industry) or for market share with other energy industries. In these conditions, usually, the established industry which feels threatened by a new industry has the potential to question the value of the new industry, its efficacy, or its level of conformance to the existing norms and rules. Thus, an established industry can hinder the progress of legitimacy or the acceptance of the new industry by rumors or information suppression. The established industries seek to find a way to maintain their control on the market and resources and can make different barriers for a new industry like bioenergy. So the growth of the new industry is highly dependent on the level of severity of attacks from the established industry (Peck, Berndes, and Hektor, to be published). A good example in this case is a study presented by the Confederation of European Paper Industries that claims that "it is four times more economically viable to use wood as a paper resource first, than to use it for energy" (Peck, Berndes, and Hector, to be published). It clearly shows a carefully constructed example of a competing industry attempting to block the legitimacy of the bioenergy sector. Aldrich and Fiol (1994) suggest that new industries should create reliable relationships with established industries in order to overcome such barriers and problems. Collective action can also increase the power of the new industry for lobbying and improving the acceptance and legitimacy of the industry.

5.2 Possible ways to improve social acceptance

Clearly, one of the most important ways to improve understanding and acceptance of a new technology is providing adequate information and establishing a transparent communication with all people and stakeholders who are involved in, or affected by, bioenergy projects. As stated in section 3.1.1, the heterogeneity of bioenergy is an obstacle to the public understanding and acceptance and makes it more difficult to communicate messages on these technologies and their advantages. So designing an appropriate communication strategy is crucial in order to improve the social acceptance of bioenergy. A successful communication process should not target bioenergy as a general technology. It is highly recommended to start with introducing tangible subjects and topics which are closer to the experiences and imaginations of end-users in each specific context rather than presenting general topics like bioenergy or biomass. Another element that should be considered in communication strategies is that such strategies should be based on a detailed market research and understanding of attitudes, perceptions, and incentives in different target groups, and the focus should be on successful solutions and services not on abstract technologies (Rohracher et.al., 2005). All positive aspects of the technology, like design or cost-effectiveness, should be emphasized. It also would be helpful to use credible testimonials from people who have shifted from "traditional wood fuel" to innovative and modern pellet technology (Rohracher et.al, 2005). Barker and Riddington (2003) believe that the public's main concerns and needs should be considered in a sufficient communication process (e.g. the cost of bioenergy technology or provided incentives like subsidies) (cited in Thornley & Prins, 2008).

Establishing an effective communication process can decrease the resistance to bioenergy projects. It is crucial to respect and acknowledge all people and their views. Developers should listen to people and local stakeholders such as NGOs, and then acknowledge and explain the options (Thornley & Prins, 2008) in these communication processes; project developers should provide enough information for local stakeholders and try to gain information about the local context and stakeholders' concerns (ECN, 2008). Some authors (Devine-Wright (2004), Uperti (2004), Khan (2004) and Roracher et.al (2005)) have made the following recommendations related to communication:

- Clarify the purpose of the project;
- Identify the different concerns and attitudes within the local community;
- Realize the local people's perception towards their community;
- Identify specific groups pivotal to acceptance and use an understandable language to communicate;
- Maintain communication with local people, especially those in opposition;
- Develop horizontal communication within the community (ECN, 2008).

Another way to obtain legitimacy is organizing collective actions in the bioenergy industry. Collective actions in the form of industry councils, cooperative alliances, and trade associations can help to build trust and reliability within the emerging industry, to communicate with the public trust (by information dissemination), and to build or maintain a good reputation for the industry in the eyes of other industries (Aldrich &Fiol, 1994). Moreover, unavoidable intra-industry competitions over products and service designs and standards can make more confusion and uncertainty among external stakeholders; thus, there is a key role for collective actions in reducing such confusions by encouraging convergence around a dominant product or a service design or a standard. Being active in political spheres is another assumed role for collective actions. They can represent the

interests of the new industry to government bodies. In order to reach these goals, collective actions should create new labels, values, and beliefs by linking the underlying beliefs and values of the industry or its culture with the behaviors of its members and what stakeholders may perceive as their identities (Peck, Berndes, and Hector, to be published).

A successful example of collective actions is the Swedish Bioenergy Association (Svebio) which is highly organized and structured. Svebio has established a meeting platform and is an overarching political lobby organization and provides possibilities to connect all actors within the bioenergy sector and also with research and development bases and academics. For example, "until the 1980s, a network of suppliers and technology producers had not worked since the only way (for the technology developers) to survive was to get grants and provide local support. There had been competition for the funds and the market fragmented among the big companies versus the small ones were split off from these big companies. When they saw that Svebio was getting organized and they were supporting the technology developers too, they started to join Svebio as well". Thus, Svebio has been noticeable as a successful association to connect all actors together successfully since the 1980s and has helped to market formation during the formative phase of bioenergy industry in Sweden (Erik, Master dissertation, 2006).

As stated in section 3.1, concerns about sustainability of bioenergy products are a main obstacle to develop acceptability of bioenergy systems, and it is almost a common concern among people, environmental organizations, and policy makers. An emerging issue in the bioenergy market is the certification of bioenergy in order to promote its sustainability. The application of biomass certification scheme is a relatively new issue, and there is limited experience on how some criteria can be specific, monitored, and enforced (Peck, Berndes, and Hector, to be published). Magar et.al (2010) believes that "the basic concepts of certification are to verify sustainable production through a third party audit of systems, ensuring that operations seek to minimize negative environmental, social and economic impacts that may be associated with biomass production and trade". The certification scheme that certifies some parts of the bioenergy supply chain or the whole supply chain can promote the sustainability of bioenergy and reduce related concerns (Magar et.al, 2010). Sustainability certification for biofuels would be more complex than wood or agricultural commodities because both agricultural and industrial processes are relevant.

Currently, several certification schemes are under development, for instance the UK Renewable Transportation Fuel Obligation (RTFO), the Swiss mineral oil tax redemption for sustainable biofuels, the EU directive for renewable energy, or the voluntary criteria of the Roundtable for Sustainable Biofuels. This plethora of certification schemes makes a vague situation for producers, and decreases the public acceptance of sustainability measures. Thus, developing widely accepted criteria that are based on reliable scientific knowledge and which follow the definition of sustainability are highly crucial and needed. (Zah et.al, 2009). Successful certification schemes will need to match the specific necessities of a region, take into account land use dynamics, and adapt to rapidly growing markets. They also should be in place soon enough to help secure the sustainability of biomass within a short term. A real certification scheme needs a high level of coordination within the bioenergy industry at international level, and for this purpose harmonized standards are needed (Peck, Berndes, and Hektor, to be published).

6. Conclusion

This research was designed to identify the key factors influencing social acceptance of bioenergy in European countries. It was found that context has a very important role in the acceptance of bioenergy, and some contextual elements like cultural, social, historical and, political situations of each context should be considered in order to better understand the social acceptance of bioenergy systems, but this thesis author aims to identify common factors across European countries. Since, there is not only one general public and its perception that is relevant for the success of different bioenergy projects and there are various relevant publics- from local level like neighbors to national and international levels like citizens, investors and policy makers- so, this research framework included three different dimensions of social acceptance and attempted to analyze different interest groups involved in the bioenergy planning and implementation and ultimately contributed to a collection of the various aspects and factors involved in social acceptance of bioenergy technologies. Findings are categorized based on the three dimensions of social acceptance of the renewable energy framework proposed by Wüstenhagen et al. (2007): socio-political acceptance, community acceptance, and market acceptance. Several influential factors were identified for each dimension that can affect the level of acceptance of bioenergy. The identified key factors influencing social acceptance of bioenergy in three different dimensions of social acceptance of renewable energy (i.e. socio-political, community and market acceptance) are highlighted in the following paragraphs.

1- Socio-political acceptance

Socio-political acceptance is defined as the acceptance of bioenergy on the broadest and most general level. In other words, it refers to the acceptance of bioenergy policies and technologies by the public, stakeholders, and policy makers.

- **Public acceptance**: this research concludes that most of people in European countries do not have enough information about different types of bioenergy technologies and their positive and negative impacts and that the heterogeneity of this industry can increase confusions about bioenergy. People have some concerns about sustainability of bioenergy products and services and the impact of biomass production on food production. Perceptions and attitudes have very strong effects on the behavior of people; especially strong and long lasting attitudes are more likely to create specific behaviors. Direct experience towards bioenergy products or services and also social norms and reference groups are other factors influencing the acceptance of bioenergy among the public. In addition to these factors, some personal (e.g. age, gender, education), psychological (e.g. political and environmental beliefs), and contextual factors (institutional and technological factors) are identified that can play a role in the acceptance of bioenergy by people.
- **Stakeholders' acceptance**: the research identifies two separate categories of stakeholders: internal and external stakeholders. In the internal category, farmers are the main stakeholders and are highly concerned about the economic benefits of biomass production especially in the short term. The lack of information and experience about cultivation, storage, and transporting biomass feedstock are significant factors in decreasing their willingness to cultivate energy crops. Farmers, especially those producing organic products, are also worried about sustainability issues and negative environmental impacts of bioenergy. Some factors like the long-term commitment for the purchase of their energy crops and also the sup-

port from industry in the case of probable risks are significant and influential on farmers' acceptance. On the other hand, policy makers as one of the key external stakeholders also do not have enough information about the different bioenergy systems. This information gap leads to concerns about net benefits of bioenergy at the national and local levels. They need to be sure about the sustainability of bioenergy products/services; the competitiveness of bioenergy industry compared to other industries is a determinant factor in their decision making process. Other key external stakeholders are NGOs and environmental organizations whose main concern about bioenergy is the sustainability of it. Overall, they have a positive attitude towards bioenergy, but they just support those technologies that are sustainable and have the least negative impacts.

2- Community acceptance

Local people are often more concerned about local issues rather than national or international problems. When a bioenergy project is proposed to a local community they are highly concerned about its negative and positive impacts and justice in distributing these positive and negative outcomes. According to Wüstenhagen et al. (2007) trust, procedural justice, and distributional justice are significant factors influencing community acceptance.

- **Trust**: the study concludes that a high level of trust among local residents and project developers will lead to better acceptance of projects. Providing enough and reliable information about a project and its impacts is the first step to make trusting relationships. It would also be helpful if developers try to make a bottom-up approach in their planning and decision making processes. Evidence shows that there is a higher level of trust among local residents and local organizations such as municipalities rather than in private companies from outside their community.
- **Procedural justice**: in order to provide opportunities for stakeholders to participate in the decision making process, interaction with local people and stakeholders during operation process is crucial. Leaders of opposite groups should be engaged in all stages of the project. Developers should make sure that the interests and well being of all affected people have been taken into account. Some effective ways to improve procedural justice are: A) providing simple and understandable information for local people B) establishing transparent and accurate communications C) taking residents' concerns seriously D) having flexibility in the planning process in order to develop the project according to residents' wishes and E) maintaining long-term relationships with communities.
- **Distributional justice**: equity in distribution of benefits and negative impacts of a bioenergy project is another influencing factor. Large scale projects usually encounter more concerns about their negative impacts such as emissions, traffic, landscape impacts, odor, and noise. Redistributing positive impacts such as satisfying local energy needs or creating job opportunities for local people and establishing a profit participation model can be helpful approaches to increase distributional justice in local communities. Moreover, clear national policies that are promoting bioenergy and considering measures to minimize landscape impacts can influence people's perceptions of distributional justice.

3- Market acceptance

Market acceptance refers to the process of market adoption of bioenergy technologies by consumers and also the acceptance of these technologies by investors and intra-firms as the key actors in the market. As stated in section 2.3, there is a link between this dimension and the socio-political dimension because sometimes investors or outside organizations are influential stakeholders in the development of energy policies and financial decisions.

- **Customers**: customers' acceptance of bioenergy technologies is affected by a lack of information and some uncertainties about different types of technologies and feedstock. The main factors influencing customers' acceptance are the prices of products and services, subsidies and other relevant policies that support these technologies or the taxation on other sources of energy, the availability of updated technology and a secure supply of feedstock. Reference groups and social norms have an influence on their behavior on purchasing specific energy technology. The size of products is also a determinant factor. Small scale technologies (e.g. at household level) that involve smaller negative impacts are easier to adapt. Establishing a competitive market for bioenergy can provide better opportunities for customers to find goods based on their priorities and can encourage the industry actors to develop a sustainable bioenergy trade.
- **Investors**: as one of the key actors in the bioenergy market, investors are willing to investigate in this market if they have a positive perception of predictable risks and benefits. However, the complexity and diversity of bioenergy technologies can make some difficulties to predict the future. Their decision towards investments in the bioenergy market is highly affected by investment costs, consumer acceptance of new technology, and supporting policies. As stated in section 3.3.2, today in most European countries there are several uncertainties about the energy policies and the new technologies that are not yet verified in commercial markets. Some investors are not willing to enter into this market because of their negative experiences in the past. Prices of raw materials and availability of feedstock and the competition among different industries for raw materials are other factors influencing the investors' acceptance of bioenergy.
- **Intra firms**: new industries at the formative phase need to gain cognitive and socio-political legitimacy to have a chance of survival in a market with powerful and established industries. Since the bioenergy industry has a diverse supply chain, it can have difficulties in communication. So in the formative phase, founders should try to converge around dominant designs and standards to increase their cognitive legitimacy in the eyes of other industries and improve the image of bioenergy. In the case of socio-political legitimacy, collective actions in the industry can help to increase legitimacy. By making alliances in the form of trade associations or cooperative alliances, the bioenergy industry can find power to increase lobbying in the policy sphere.

All of the above-mentioned factors are important to know if we want to make a change in people's behavior and improve the social acceptance of bioenergy. Findings from literature and interviews indicate that the acceptance of bioenergy in different European countries have different conditions. In order to develop the bioenergy market at EU level, it is necessary to set supportive policies and use suitable measures that have been chosen based on the specific context of each country. When surveys like Eurobarometer indicate that the acceptance of bioenergy at EU region is around 60%, it is a big mistake if we think that it is a common situation in all European countries or that is true about all types of bioenergy technologies. Almost all of interviewees claim that the acceptance of

bioenergy in different European countries is not the same, and even in countries like Scandinavian countries with relatively higher level of acceptance, the acceptance of some types of bioenergy systems is not really high. So the author of this thesis concludes that the identified factors in this research are more basic factors that should be considered in all contexts, but in order to make more improvement in the social acceptance of bioenergy projects, detailed context specific studies are needed to distinguish the main challenges and obstacles of the acceptance of bioenergy and decide which types of bioenergy technology need to be investigated more than others.

Finally, this research concludes that there is room to improve the social acceptance of bioenergy in Europe, and more researches and investigations are needed to develop a better understanding of factors influencing the social acceptance of bioenergy not only in Europe but also in other regions in order to develop a worldwide bioenergy market in the future. Further research could investigate the following topics:

- How to advance the practical ways to communicate about all different types of bioenergy technologies, resources, and systems?
- How to develop and implement policies and strategies to improve the social acceptance of bioenergy?
- How to extrapolate the lessons about the social acceptance of bioenergy in Europe to different regions and contexts?

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Appendix 1: List of interviewees

1- Erno Duda	Europa Bio, President and CEO representing : Hungarian Biotechnology
2- Cristina Calderon	AEBIOM, BIOENERGY EXPERT
3- Philip Peck	BIOENERGY NoE, Environment and Socio-economics
4- Birger Kerckow	IEA bioenergy, ExCo Chairman
5- Dr. Rocio Diaz-Chavez	Imperial College London, Research Fellow
6- Dr. Larry T. Gell	IAED, Director-General
7- Joanna Dupont	EuropaBio, Director, Industrial Biotechnology
8- Martina Otto	UNEP, Head, Policy Unit - Energy Branch Coordinator Bioenergy
9- Noel Gavigan	Irish BioEnergy Association
10- Eija Alakangas	EUBIONET 3, Coordination & Biomass and forest industry
11- Anne - Luise Skov Jensen	Agro Business Park. Denmark. International Project Consultant Enterprise Europe Network
12- Dominic Jackson	Land-based Renewables, Office for Renewable Energy Deployment, Department of Energy and Climate Change. London
13- Sven Teske	Greenpeace, Bioenergy expert

Appendix 2: Contribution of renewable energy technologies to final energy consumption in EU

	2005	2010	2015	2020		2025		2030	
				Baseline	Advanced	Baseline	Advanced	Baseline	Advanced
Wind	6	14,7	25,8	42,5	55,1	64,2	75	86	95
Hydro *	29	29,8	30,6	31,8	34	32,5	33,9	33	34,2
PV	0,2	1,7	4,5	7,2	11,5	21,9	27,5	36,6	44
Bioenergy	60	82,2	103,8	134,5	145	184,5	200,5	236	255
Geothermal	1,1	2,4	4,1	7,5	17,5	17,6	30,1	28,4	42
Solar Thermal	0,7	1,4	3	6,3	10,5	37	46	68	81
CSP	0	0,09	0,8	1,7	2,2	5	8,5	8,4	15
Ocean	0,09	0,09	0,8	0,5	0,7	1,3	3,4	2	6
Total RES	96	132,3	173,4	232	276,3	364	424,9	498,4	572,2
Total share of RES (%)	8,5%	11,3%	14,3%	19-20%	23-24%	30%	35%	41-42%	47-48%

Source: AEBIOM, 2011

Appendix 3: Summary of biomass/bioenergy targets (Mtoe)

	2007	2020	2030	2050
Primary biomass	93,2	200	270	330
Imports	4,2	20	30	40
Exports	1,9	-	-	-
Gross inland consumption	98,4	220	300	370
Input to Electricity and CHP	33,3	65	80	95
Input to DHC	3,3	10	20	15
Input to Biofuels 2G/Biorefineries	0	5	10	30
Biomass use by households and services	35,0	80	115	130
Biomass use by industries	18,6	30	35	45
Total electricity (TWh)	8,8 (102)	20 (227)	35 (404)	56 (645)
Total biomass for heat	53,6	110	150	175
Total bioheat (or derived heat)	7,7	14	32	56
Total biofuels	7,9	32	45	70
Total final energy consumption from biomass	78,0	175	261	357

Source: AEBIOM, 2011

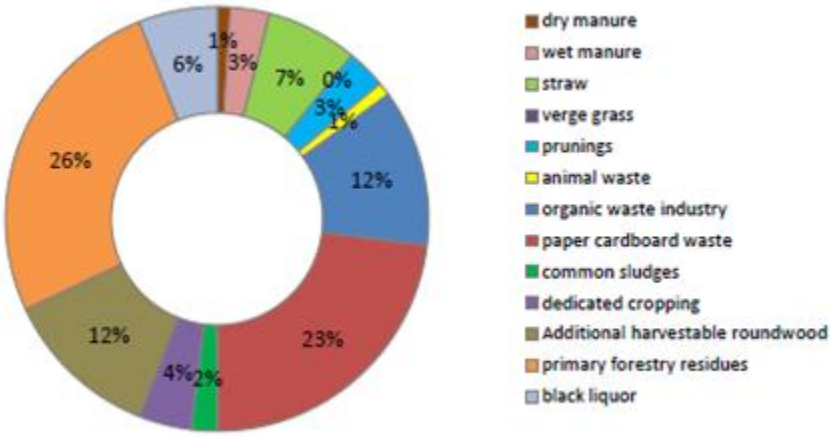
Appendix 4: Expectation of biomass supply in 2020-2030-2050

		2007		2020		2030		2050	
		Surface (Mha)	Biomass (Mtoe)	Surface (Mha)	Biomass (Mtoe)	Surface (Mha)	Biomass (Mtoe)	Surface (Mha)	Biomass (Mtoe)
Agriculture	Energy crops	5,2	10	20	43	25	75	30	129
	By-products		4		20		30		30
	Other						5		15
Forestry	Residues		18		40		55		55
	Industry by-products		54		65		65		66
Waste			10		32		40		35
Imports			2		20		30		40
Total		5,2	98	20	220	25	300	30	370

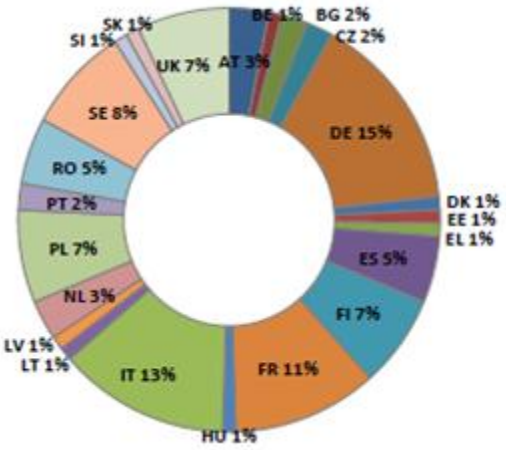
Source: AEBIOM, 2011

Appendix 5: EU biomass potential

1- Summary of present EU biomass potential (Ktoe) over categories



2- Overview of total EU potential per country



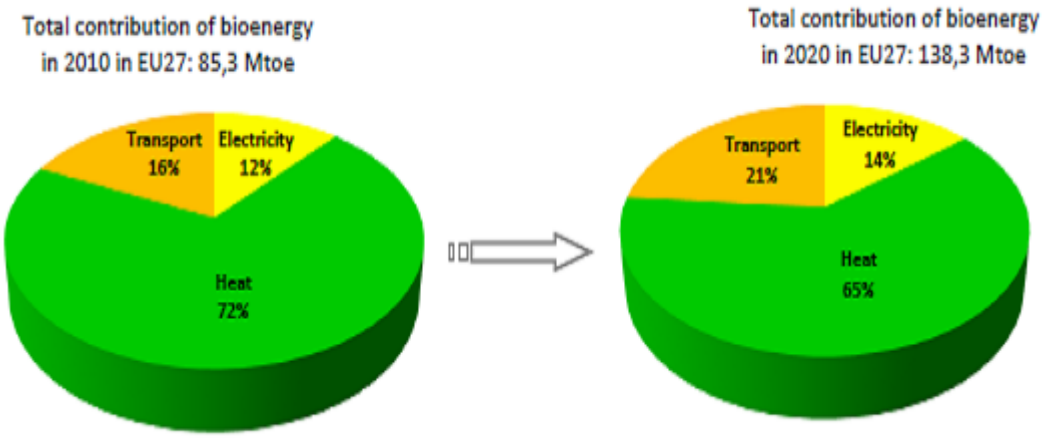
Sourse: AEBIOM, 2011

Appendix 6: Environmentally compatible bioenergy potential (Mtoe) in EU25

	2003	2010	2020	2030
Total	**69**	**187**	**228**	**284**
Wood direct from forest	-	43	43	55
Wastes and residues	67	100	100	102
Energy crops from agriculture	2	44	85	122

Source: AEBIOM, 2011

Appendix 7: Estimation of total contribution expected from bioenergy in EU27



Source: AEBIOM, 2011

Appendix 8: Estimation of total contribution expected from bioenergy (Ktoe) per country

	Bioelectricity				Biomass for heat and bioheat *				Biofuels			
	2005	2010	2015	2020	2005	2010	2015	2020	2005	2010	2015	2020
EU27	5.936	9.737	14.344	19.697	52.522	61.782	72.882	89.756	2.821	13.819	19.460	28.859
Austria	243	406	415	443	3033	3415	3463	3607	35	330	370	490
Belgium	154	259	512	949	477	682	1178	2034	0	329	497	789
Bulgaria	0	0	56	75	724	734	929	1073	0	30	115	196
Cyprus	0	3	7	12	4	18	24	30	0	16	22	38
Czech Republic	62	166	414	531	1374	1759	2248	2517	3	243	438	623
Denmark	279	324	519	761	1759	2245	2526	2643	0	31	247	261
Estonia	3	21	30	30	505	612	626	607	0	1	35	89
Finland	831	696	850	1110	5490	4990	5810	6610	0	220	420	560
France	328	378	902	1476	9153	9953	12760	16455	403	2715	2925	3500
Germany	1206	2818	3619	4253	7260	9092	10388	11355	1742	3429	3070	5300
Greece	8	22	43	108	951	1012	1128	1222	1	107	386	617
Hungary	0	168	193	286	0	812	829	1277	5	144	250	506
Ireland	10	30	76	87	183	198	388	486	1	134	299	481
Italy	402	743	1179	1615	1655	2239	3521	5670	179	1016	1748	2480
Latvia	4	6	57	105	1114	1020	1147	1392	3	39	39	46
Lithuania	1	13	65	105	686	663	879	1023	4	55	109	167
Luxembourg	4	6	17	29	19	23	50	83	1	42	81	216
Malta	0	1	12	12	0	1	2	2	0	0	0	0
Netherlands	433	514	1148	1431	609	684	778	878	0	307	567	834
Poland	125	518	851	1223	0	3911	4227	5089	43	966	1327	1902
Portugal	170	206	289	302	2507	2179	2339	2322	0	281	429	477
Romania	0	0	0	0	3166	2794	2931	3876	0	224	363	489
Slovakia	3	52	116	147	358	447	576	690	0	82	137	185
Slovenia	10	26	54	58	445	415	495	526	0	41	79	192
Spain	228	388	513	861	3477	3583	4060	4950	258	1703	2470	3500
Sweden	651	914	1177	1441	7013	7978	8622	9426	144	340	528	716
UK	783	1060	1229	2249	560	323	958	3914	nm	996	2510	4205

Source: AEBIOM, 2011