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Consequences of new sources of supply on wood fuel prices

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Abstract

Consequences of new sources of supply on wood fuel prices

Anders Dahlberg

The use of wood fuels in Western Europe is growing rapidly each year. The co-firing of wood fuel in coal- fired power plants to reduce CO2 emissions makes the demand accelerate even more and a strained supply could be a reality in a near future. Regions as Canada and North-West Russia have large biomass potentials and small internal markets for wood fuels. In Canada the wood fuel industry is rather developed but in Russia the case is the contrary. However, Russia has the advantage of a much shorter distance to the large Western European market than Canada. Could a larger import of wood fuels from these countries prevent a possible supply strain in the European market in the future and is this scenario realistic?

The thesis have two purposes where the first, to make an overview of the available biomass resources in Canada and Russia, is a part of the EUBIONET III project. The second objective has been to examine the possibility of a larger import of wood fuels from Russia and Canada.

The results presented in the thesis are based on literature studies as well as a questionnaire survey conducted in both Sweden and Denmark. Interviews were also conducted with actors in Sweden regarding wood fuel trade.

The results are mainly that there are large resources available in both Canada and Russia but various barriers makes the wood fuel more or less accessible. In the case of Russia bad harbors and corruption seem to be the largest obstacles for European importers of wood fuel. The wood pellet industry is also immature compared to Canada. In the case of Canada the distance to Europe and the dependence of freight rates for economic successful import of wood fuel seem to be the largest barrier.

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Sammanfattning

Användandet av fasta biobränslen, både för värme och elproduktion, ökar snabbt i västra Europa. Sammeldning med fasta biobränslen i kolkraftverk för att reducera utsläpp av växthusgaser har gjort att efterfrågan har ökat ännu mer och brist på fasta biobränslen kan vara en realitet i framtiden.

Kanada och Nordvästra Ryssland har små lokala marknader för biobränslen och stora mängder biomassa. I Kanada så är industrin rörande fasta biobränslen väl utvecklad medan Rysslands industri fortfarande är relativt omogen. Ryssland har dock med sitt korta avstånd till den mogna europeiska marknaden alla möjligheter att utveckla sin industri. Skulle en ökad import av fasta biobränslen kunna förhindra en förväntad brist på den europeiska marknaden i framtiden och är detta scenario realistiskt?

Den huvudsakliga exporten av biobränslen från dessa två länder är i form av träpellets. Pellets är sammanpressad torkad biomassa som pressats ihop till cylindrar vilket ger ett homogent och energirikt bränsle som även lämpar sig för transporter. De vanligaste råmaterialen för pellets är idag biprodukter från sågverksindustrin som sågspån, kutterspån och torrflis. En stor sågverksindustri betyder alltså stor potential för att producera pellets.

Examensarbetet har två syften varav det första, att göra en översikt av tillgängliga biomassaresurser i Kanada och Nordvästra Ryssland, är en del av ett EU-projekt. Projektet *Eubionet III – Solutions for biomass fuel market barriers and raw material availability* har som syfte att finna hinder och lösningar för en ökad handel med biomassa inom EU-området. Det andra syftet har varit att undersöka möjligheten till mer import av fasta biobränslen från Kanada och Ryssland till EU-området samt barriärer som kan förhindra detta.

Förutom litteraturstudier så har två stycken enkätundersökningar utförts, en i Sverige och en i Danmark. De största upphandlarna och importörerna av biobränslen, både fasta och flytande, tillfrågades om import av fasta biobränslen från Ryssland och Kanada. För att följa upp resultaten från enkätundersökningarna så utfördes även ett flertal intervjuer med svenska aktörer.

Resultaten från studien visar huvudsakligen att det finns stor potential i båda länderna att både producera och exportera fasta biobränslen till EU-området med olika barriärer gör detta mer eller mindre rimligt. I Rysslands fall så gör eftersatta och omoderna hamnar i kombination med utspridd korruption de största hindren mot en ökad handel med fasta biobränslen. Industrin är även omogen, speciellt i jämförelse med Kanada, och många löften kan inte infrias. En svårpenetrerad byråkrati och dåliga logistik inom landet är även det faktorer som gör import relativt riskfullt.

I Kanadas fall så är avståndet till Europa och priset för frakt den största barriären. De höga priserna på transporter verkar ha gjort att svenska importörer sökt sig till andra marknader. En ökad import till Europa verkar dock ske i form av ökad införsel till kolkraftverk i Belgien, Nederländerna och Storbritannien där sammeldning med pellets ökar.

Preface

This work has been a part of the project EUBIONET III. The results were published as a part of the report “Price mechanisms for wood fuels Deliverable 3.2” in April 2010. The results were also presented on the International Biomass trade workshop in Verona, Italy at the 5th of February 2010

The thesis is a 30 credit master thesis as a part of the Masters Programme in Sociotechnical Systems Engineering at Uppsala University. The work has been taken place at the Department of Energy and Technology at the Swedish University of Agriculture Sciences in Uppsala. I would like to thank my supervisors, Olle Olsson and Johan Vinterbäck, for valuable help and support during the work.

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1 Introduction

The Western economies are today to a large extent based on fossil fuel resources which are not endless. In addition to this a majority of the resources are bought/traded from unstable regions of the world, which to some extent makes the energy system as unstable as the providers of the fossil fuels. This was especially noticeable during the oil crisis in the seventies which also made many countries interested in self-sufficiency concerning energy.

The awareness of the climate changes is growing on a global level and most scientists agree that green house gases indeed are causing the temperature to rise which may have catastrophically consequences not least in already warm parts of the world. Industrialized countries have historically been, and are still today, the biggest contributors to emissions of green house gases due to combustion of fossil fuels. One way to reduce the emissions of green house gases is to use bioenergy for both heating and electricity production. In many cases a larger use of biofuels leads to a lesser use of fossil fuels as oil and coal. Today biomass is the largest source of renewable energy but there are many barriers to an increased use of biomass in Europe. From most markets a shortage of raw materials is reported and in the long run it seems that import from countries outside the EU is essential for satisfying the growing demand for biofuels, both liquid and solid (Junginger 2009). The growing demand for biofuels in Europe has also led to a growing biomass trade, particularly inside Europe, but also from other continents in general. As the trade is increasing the knowledge of the same is, however, still deficient (Junginger 2009).

The use of wood fuels in Western Europe is growing rapidly each year. The co-firing of wood fuel in coal- fired power plants to reduce CO_2 emissions makes the demand accelerate even more and a strained supply could be a reality in a near future. Regions as Canada and North-West Russia have large biomass potentials and small internal markets for wood fuels. In Canada the wood fuel industry is rather developed but in Russia the case is the contrary. However, Russia has the advantage of a much shorter distance to the large Western European market than Canada. Could a larger import of wood fuels from these countries prevent a possible supply strain in the European market in the future and is this scenario realistic?

1.1 Project objectives

This project has two main objectives where one is a part of the project EUBIONET III.

- The purpose of EUBIONET III is to increase the knowledge of solid biomass fuel markets and facilitate the trade of solid biomass fuels. The primary objective of this project has been a part of EUBIONET III with the purpose to make an overview of available biomass resources in Canada and Russia
- The second objective has been to examine the possibility of a larger import of wood fuels from Russia and Canada to the European Union and the barriers that could prevent this. Also the effects on wood fuel prices and quality if additional sources of supply from Russia and Canada start penetrating the European market have been examined.

1.2 Disposition

Chapter 2 contains the methodology behind the thesis which mainly concerns how the empirical information was collected

Chapter 3 contains the theoretical approaches in the thesis. It begins with an introduction to bioenergy and wood fuels and continues with descriptions of wood fuel trade, pricing and markets.

Chapter 4 describes Russian wood fuel- potential, production and trade.

Chapter 5 contains the same as chapter 4 but regarding Canada.

Chapter 6 presents the results of the both interviews and the questionnaire surveys conducted in Sweden and Denmark.

Chapter7 contains analyses of the material gained in the literature survey. It also contains analyses of the information from the questionnaires and interviews.

1.3 Limitations

The most important methods for collection of empirical information have been interviews and questionnaires in Sweden and Denmark. The choice to conduct surveys on the Swedish and Danish district heating sectors and not the whole range of the wood fuel market in these countries was made for two reasons. Even though the forest related industries are the biggest consumers of wood fuels in Sweden, Denmark's forest industry is negligible in comparison, it is almost only using fuel generated internally which makes it uninteresting when studying import. The markets in both countries for heating of detached houses are rather large but a study including this market would concern many small consumers and small distributors which would make the scale of the investigation very large. The focus of the report is also to a large extent on wood pellets which has an explanation: The wood fuel export from Canada is due to different reasons almost only comprising wood pellets and also for Russia a very large part of the wood fuel export consists of wood pellets. In the case of Russia other forms of wood fuel import will be discussed but to a lesser extent than wood pellets. Various studies concerning biomass potential today and forecasts about the future is typically hard to compare due to variations in definitions on measurements and which forest products to include. Furthermore, the data used in the studies is not always the same which leads to different results.

2 Method

2.1 Background research and project planning

In the initial stage of the project, information was collected to get adequate information about the wood fuel industry and trade with wood fuel. On an early stage the collecting of information was mainly focused on the wood fuel industry in Canada and Russia and the export from these countries to Europe. Besides literature studies, planning of making surveys, both quantitative and qualitative, started in an early stage of the project.

2.2 Literature studies

During the whole project information both regarding wood fuel potential in Canada and Russia and for a theoretical framework for analyzing the empirical information gained in the studies were collected. Initially the websites eubionet.net[1], svebio.se[2], bioenergytrade.org[3] as well as the periodicals *Bioenergi*[4] and *Bioenergy International*[5] were helpful. Furthermore, articles from newspapers and energy publications from different countries were important sources. The Bioenergy Association of Canada and articles made by them have been of great use when studying Canadian wood fuel production and export. During the study statements about corruption when trading wood fuels made it relevant to find information that supports these statements and also explains the mechanisms behind corruption.

2.3 Objectives of the surveys

The data have been collected using two methods. A quantitative survey using questionnaires was conducted and a qualitative survey using personal interviews. The intention has been to give the survey both depth and width regarding information of trade with Canada and Russia. The purpose of the surveys has over all been to get an overview of the opinions of Swedish and Danish importers concerning wood fuel from Russia and Canada. The opinions regarding both today's trade concerning price, quality, logistics etc., and also the prospect of import in the future were of interest. Initially the purpose was to look on Scandinavia as a region but since Finland and Norway export much more wood fuel than they import today it was natural to only study Sweden and Denmark which both import large amounts of wood fuel. It may be mentioned that Finland some years have imported rather large amounts of wood chips from Russia, Latvia and Estonia but never wood pellets from any country. A survey of all the member states of the European Union would have been impossible for one person on the time disposed for this report. The opinions and amounts of import of Swedish and Danish importers may though give a picture regarding the potential and problems of import from Canada and Russia to the whole of the EU (Hiegl 2009; Bradley 2009a).

[1] Provides information about the EUBIONET project that among other is researching about woodfuel trade in the EU.
[2] Provides information about the Swedish bioenergy association and have an archive with biofuel related articles.
[3] Papers and reports from IEA Bioenergy task 40 is publicated here.
[4] Swedish periodical with information about bioenergy.
[5] International periodical regarding biofuel and everything associated with it.

2.4 Creating the questionnaire and attached letter

The questionnaire was sent out to the 50 largest users of wood fuel in Sweden as well as the 50 largest users in Denmark and the questionnaire focused on answering:

- Which types of wood fuel that are imported from Canada and Russia?
- How much of the importers total bought fuel that comes from Canada and Russia?
- Which factors that are positive or negative regarding the wood fuel and import-conditions from the different countries?
- Possibilities for increased or decreased import in the future?
- Barriers to import?

How much time and energy a respondent can be expected to have regarding answering a questionnaire is not an easy question. An extensive questionnaire makes the answer frequency lower and the answers can tend to be less serious the more extensive the questionnaire is (Holme & Solvang 2008). The questionnaire was created with the goal to make it as compact as possible which for example had the result that five questions concerning the price, quality etc. regarding wood pellets were reconstructed to one multiple choice question with a ranking system. This had the effect that 10 questions became two instead. The questions were constructed with the intention not to be directive more than absolutely necessary to understand the questions satisfactory. Some questions were made clearer after criticism concerning possible misunderstandings (Esaiasson et al. 2007).

2.5 Respondents for the questionnaire

The respondents were chosen with the aim to capture as much of the imported amount on the market as possible with a reasonable and manageable number of respondents. Small boilers in single family houses are common in both Sweden and Denmark but this market is much smaller than for the district heating plants and CHP-plants and the vast number of respondents makes it harder to conduct a survey on this market. In both countries large district heating plants consume lots of wood fuel. The companies owning the plants are the largest buyers and importers of biofuels in both countries and also the respondents in the surveys. In Sweden the questionnaire was sent out to 50 of the largest actors regarding the produced heat and electricity in district heating plants and combined heating and power plants (CHP). The assumption was made that the biggest actors on the market are probably the largest importers since they need bulky supplies of wood fuel and import from for example Canada in general demands very large amounts of wood to make it profitable. The same assumption was made regarding the Danish market.

In Sweden the members of the trade organization *Svensk Fjärrvärme* (Swedish District Heating Association) stands for 98 % of the national district heating deliveries. From the trade organization's statistics concerning the production of each plant in GWh, 50 companies where chosen (Svensk Fjärrvärme 2007). Some companies are owners of several plants that are among Sweden's largest. Each plant has in these cases not been handled as a separate actor and the main company's fuel supply manager have been the respondents. This means that a much higher number of plants have been covered than the amount of companies answering the questionnaire. All of the companies were contacted by telephone to get the name and email-address to the person responsible for buying wood fuel. The contact information to the companies was taken from the member database of SVEBIO, a Swedish organization aiming to increase the use of bio fuels (Svebio 2009). This step was taken with the assumption that a

direct contact with the right person would generate a higher answering frequency than emailing to the companies support-addresses etc. in hope that they send the letter to the right person. Because information concerning trade partners etc. may be sensitive for a company all the respondents in the survey are anonymous. One actor in the survey only trades bio fuel and is not a member of Svensk Fjärrvärme[6]. This actor has in the results not been presented different from the other respondents because an identification of the company would have been easily made and the promise of anonymity would have been betrayed. In the case of Denmark statistics from the trade organization *Dansk Fjernvarme* (Danish District Heating Association) were used to pick out the 50 largest actors on the Danish district heating market. Almost 100% of the Danish district heating market is covered by the members of Dansk Fjernvarme. The contact information to the companies was also taken from Dansk Fjernvarme's member database. (Dansk Fjernvarme 2009). The same procedure as in the Swedish survey were made which means that each plant has been handled as a separate actor and the main company's purchase-department have been the respondents. In contrary to the Swedish study the companies were not contacted by telephone regarding contact-information and the mail address in Dansk Fjernvarme's database were used in hope that the information in the attached letter would get the mail to the right person. The companies were not contacted by telephone mainly because Danish prefers to speak Danish to Swedes but my Danish skills are not good enough to understand them.

2.6 Response statistics and non-response analysis

A mail was sent out to the 50 actors in Sweden by the 27th of October 2009. One month later a reminder was sent out to all the respondents that didn't response. In the first letter, appendix A, there was information about EUBIONET III and the purpose of the survey as well as a promise of anonymity. A link to the questionnaire, appendix B, was also included in the mail. The second mail, the reminder, was identical to the first besides an appeal to answer the questionnaire in the beginning of the letter. 24 actors answered the questionnaire and 3 actors mailed back and informed that they didn't have anything to contribute in the questionnaire and would not answer it. The answer frequency of the survey thus reached 48 %. Because the main objectives were to get the opinions of the Swedish importers rather than be able to generalize and make conclusions regarding the whole market the non-response frequency is not unsatisfactory. A hypothesis is that companies that do not import bio fuel from Russia or Canada did not feel that their answers were important which is partly proven by the 3 actors that mailed back feeling they could not contribute to the survey. Personal contact with three of the respondents that did not answer revealed that one did not feel that he had time to answer questionnaires and two did not feel that they could contribute to the survey and therefore did not answer. Furthermore a majority of the participants in the study that answered did not import bio-fuels at all. The Danish survey was sent out by the 8th of December and a reminder was sent out one month later. The letter, the reminder as well as the questionnaire were translated to Danish. The answer frequency was much lower than for the Swedish study, only 18%, which may have its explanation. Several large companies answered that they never talked about trade and prices of wood fuel that are considered to be secret corporate information. One company active in both Sweden and Denmark answered the questionnaire in Sweden but not in Denmark with the sensitive information argument as explanation. It therefore seems that Danish companies are more reluctant to give away information than Swedish.

[6] Swedish District Energy

2.7 Qualitative interviews

To get a more deep understanding of the trade with Russia and Canada a number of personal interviews were conducted. Face to face meetings are considered to be the most appropriate form of interviewing because a closer contact occurs then when telephone interviews are conducted. The two main negative factors of conducting interviews by phone is the loss of indirect communication as body language is lost and it is hard to know which situation the respondent is in (Esaiasson et al. 2007). The first negative factor is hard to avoid but the second has been avoided as much as possible by paying attention to the situation the respondents have been in while contacting them. The first question has always been if the respondents have time for the interview or if it is possible to contact them in a more suitable time. In most cases another time has been agreed for the interview. It is preferable to tape an interview to not lose any of the information gained. To take notes in addition to remembering the interview is a method that most certainly will lead to some information being lost. The second approach has been chosen aware of the information loss because of the sensitive information mostly regarding Russian import which may have been more inconvenient and harder to speak about knowing the information were being taped. Directly after the interviews the notes were analyzed and written down immediately with the intention to forget as little of the interview as possible. The qualitative interviews were conducted with some principles in mind. It is of importance that the respondents are expressing their own opinion which in the interview situation means that the interviewer does not try to lead the respondent in the direction he/she wants. Of course it is impossible to not lead the respondent on the subject of interest but they should as much as possible decide the development of the interview. The factors that were considered to be suitable to discuss in the interviews were written down in a manual that differed a bit with different respondents. These manuals where rarely followed in order and rarely all the factors were discussed (Holme & Solvang 2008; Esaiasson et. al 2007).

2.8 Choosing respondents for the interviews

When choosing respondents for the qualitative interviews two factors were of importance.

- They come from companies that import bio fuels from either Russia or Canada or both.
- They have a good understanding of the trade from the above mentioned countries.

These two factors mainly make fuel managers and directors from the district heating market as suitable respondents. Interviews have also been conducted with companies outside the district heating market that import biofuel from Russia and Canada but do not use the fuel by themselves.

The respondents have been found using company web pages or just by contacting the companies' private branch exchange asking to get the number to someone in charge of buying biofuel. Because far from all the Swedish companies buying biofuel imports it from Russia or Canada a large number of companies have been contacted before finding appropriate respondents. The "snowball" method meaning asking the respondents where more information can be found have lead to new respondents. This makes the selection of respondents rather random.

Even though the respondents comes from different companies and sometimes different areas of the industry the answers and opinions are often the same which leads to a saturation and little new information is gained when more and more interviews are conducted. Even though new information is not always gained in an interview it is of interest to have several statements regarding the same phenomenon which makes it more probable that it is a common event. All of the respondents had or were conducting trade with either Russia or Canada.

3 Theoretical approaches

3.1 Bioenergy

Bioenergy is a term used to summarize all forms of energy that comes from biomass and is renewable. The word "Bio" comes from the Greek word "bi'os" that means life. Biomass then means "living mass". If biomass is used for energy purposes it becomes biofuel for example wood, straw, peat and bark (Nilsson 1999). Different kinds of energy carriers can be made from woody biomass:

- solid fuels: wood, wood chips, wood pellets, fuel powder and charcoal
- liquid fuels: methanol, ethanol and dimetyletes
- gas fuels: biogas and producer gas

When it comes to decreasing emissions of the most important greenhouse gas CO_2 biofuels are favourable because combustion of biofuels do not cause net CO_2 emissions. This is because the amount of the gas released while combusting is the same amount that the plant absorbed during its lifetime. The net release of CO_2 is therefore zero (Nilsson 1999).

Biomass and biofuel have many definitions specific to different countries, sectors, EU standards etc. Fuel wood, wood fuel, wood residues, forest energy, energy wood etc. are different terms often used when discussing bioenergy that comes from the forest and it is of interest to clarify the terms. Firstly, the scope of the study is solid biofuels, in particular wood fuels, and no focus will be on liquid biofuels as ethanol. What is meant by wood fuel in the survey is stated below (Nilsson 1999).

3.2 Wood fuel

Wood fuel is raw material from wood that has not gone through any chemical process i.e. solid biofuels that consists of woody biomass. The CEN[7] definition of wood fuels is "*all types of biofuels originating directly or indirectly from woody biomass*". Wood fuels can be processed to wood chips, wood briquettes, wood pellets and fuel powder (SIS 2003; Nilsson 1999).

3.2.1 Wood chips

Wood chips consist of both soft and hard wood that are roughly chipped to a typical length of 5 – 50mm and a low thickness compared to other dimensions. The CEN definition of wood chips is "*chipped woody biomass in the form of pieces with a defined particle size produced by mechanical treatment with sharp tools such as knives"*.(SIS 2004). Wood chips can be classified according to moisture content, bulk density, net calorific value, energy density and particle size. Most countries have treatment standards for wood chip import which usually includes fumigation and heating of the wood chips. Wood chips often have a high percentage of moisture which makes handling and storage harder. When harvested the defense system that protects a tree from microbes and fungi is made obsolete which can make the handling of wood chips to a health problem. When infested wood chips are handled and transported high air levels of fungal spores can be a result. From a human perspective this can lead to allergic reactions (SIS 2003; Bradley et. al 2009; Nilsson 1999).

[7] Comité Européen de Normalisation (European Committee for Standardization)

Figure 1: Wood chips

3.2.2 Wood pellets

Wood pellets are in general made from dry, untreated, industrial wood waste for example sawdust, shavings and wood chips. When manufactured the wood is dried to 10 % moisture content and under high pressure pressed through cylinders which determines the pellet size. The result becomes small rods with a diameter between 6 and 12 mm and a length of approx. 2 cm. After this the pellets are cooled allowing the natural bonding agents to set. Today there is no existing international pellet standard even though many countries, there among Sweden and Austria, have their own pellet standards where the quality and type of wood pellets are often decided by its size, both in diameter and length, and ash amount. The main advantage of wood pellets lies in an easy distribution and handling in either bulk or in smaller quantities by bags. Furthermore the storage becomes much more convenient compared to stacks of wood chips. Stored in dry conditions wood pellets do not degrade but tend to fall apart when exposed to water. If the strength of the pellets is poor dust can be a result which increases the risk of fire. Pellets can also give off rather large quantities of CO, CO_2 and methane especially during long transports. Beside the risk of fire, bacteria and fungi can cause microbial oxidation leading to high temperatures and explosions. Pellets are used in district heating, combined heat and power plants and in private small house heating. (Bradley et. al, 2009; Svebio *Fokus bioenergi* 2004, Nilsson 1999).

Figure 2: Wood Pellets

3.2.3 Wood Briquettes

Wood briquettes have the same advantage as pellets when it comes to transportation and storage. Wood briquettes are square or cylindrical pieces made under high pressure and pressed through cavities that decide the briquette size. Diameter or width are larger or equal to 2,5 cm and the moist level is normally below 15 %. Briquettes are made of sawdust, shavings or wood chips that need to be dry before the manufacturing process which in general means that the material must be dried before making the briquettes (Svebio *Fokus bioenergi* 2004; Nilsson 1999).

Figure 3: Wood Briquettes

3.2.4 Fuel powder

Fuel powder made of wood is minced/grinded stemwood that in general, in similarity with wood pellets and wood briquettes, is produced from wood chips, shavings or sawdust. The material is heavily dried and during the manufacture process the dust becomes even drier. The particles are smaller than 1mm and most of them are below 0.2 mm. Fuel powder is combusted in air suspension which makes is possible to control the combustion process very effectively and the result is a low level of emissions. It is common to mince pellets and briquettes to powder before combustion to make it more efficient (Svebio *Fokus bioenergi* 2004; Nilsson 1999).

3.3 Wood fuel trade - markets and pricing

3.3.1 Wood fuel markets

The research concerning bioenergy, wood fuel markets and price mechanisms regarding these is exactly as the market as a whole rather immature and the information is scarce in comparison with for example the oil market. Another factor is the lack of information concerning available resources, trade flows and prices on different kind of biofuels. This makes both the study of the market and the actual development of the market hard. (Olsson 2009) Much of the research has been conducted in Sweden for the simple reason that Sweden was early on building a large wood fuel market in comparison with other countries in Europe. Furthermore much of the research has been made before the large increase of the wood fuel market that can be seen today occurred.

3.3.2 Wood fuel prices

One of the aspects concerning wood fuel prices is the price competiveness and dependence towards fossil fuels. Studies from the 1990's came to the conclusion that the main factor behind the price of wood fuels is not the costs of material but the production costs. According to Schön (1992) the major reason why wood fuels became less important, in relation to other energy carriers, during the 20th century was periods of fast wage increases which made production and transportation expensive and wood fuels less competitive to fossil fuels. Another study by Hedman (1992) stated that the price of wood- pellets and briquettes was mainly decided by production costs. Furthermore the price on wood chips from residues were also mainly affected by production costs while production including sawmill residues were more dependent on what competitive users were able to pay for it. Regarding wood pellet production Obernberger & Thek (2004) came to the conclusion that raw material costs stood for approx. 35% of the production cost while personnel costs were 11%. A more recent study made in 2007 by VGB Powertech came to the conclusion that the raw material stood for 30-45 % of the total production cost while production and warehousing stood for 30-50%. The cost for wages was typically 1/6 of the end price (Langnickel 2007).

Hillring (1997, 1999a, 1999b) have stated in several papers that a larger demand for wood fuels does not affect the price which have been the case in Sweden during the 1990's. The increasing demand was balanced because of a good supply of wood residues from the forest industry. Hillring states that production costs dominate the price level because the physical access to wood fuels exceeds the demand. Radetzki (1997) is of another opinion and states that when more biomass is demanded higher marginal costs will make biomass uncompetitive

with fossil fuels. Even though Hillring (1997) states that there has not been any price affect because of a higher demand he do not say that this is impossible in the future. He makes three possible scenarios for the future:

- The price of biofuels will be connected with prices of other energy sources such as fossil fuels.
- Fossil fuels will be so expensive because of heavy taxation that competition only will be a fact between different biofuels.
- Biofuels will be more expensive when an increasing demand will lead to a utilization of more difficult resources which will lead to higher marginal costs. Difficult can in the case of refined wood fuels both mean long distance to the source or more expensive to transform to for example wood pellets.

A study made in 2009 states that there is no statistically significant relation between wood pellet prices and the oil prices. There seems to be some co-movement in the years 2006 and 2007 though (Hedenus et al., 2009). Even if there not seem to be any relation of oil prices and refined wood fuel prices there is another relation worth mentioning. Traditionally much of the wood fuel supply has consisted of different by-products from the forest industry as sawdust, bark, tops and branches. In Sweden and Finland the inexpensive raw material from the forest industry is one of the most important factors contributing to the success of wood energy (Björheden, 2006). During the economic downturn in 2008-2009 the sawmill industry suffered from a lesser demand of sawn timber and production was cut down. The reduction in sawmill by-products lead to an increase in wood fuel prices. In Nova Scotia in Canada a sawmill shutdown also led to the same for a wood pellet plant (Hartkamp et al. 2009; Bradley 2009).

In a study conducted by Heinimö et al. (2007) a number of critical factors were located regarding the future development of the biomass market:

- Price competitiveness of bioenergy
- Energy policy (taxation, subsidies, R&D)
- Imbalance between supply and demand of bioenergy (resources)
- International agreements
- Sustainability issues of the utilization of biomass
- Strong development of liquid biofuels in coming years

Boldt (2008) listed in a report to the Danish Energy Council different factors that could affect the wood pellet price in the future. The factors that could make the price go down were among others:

- Russian incentives to produce and export more wood pellets in combination with more professional Russian companies and better quality in 2008 compared with before.
- Large quantities of available biomass in North America. Large scale import to Europe though demands larger storage facilities in the harbors then today.

Factors that points on a higher price were:

- Higher prices on material.

    - Wood and furniture industries move to Asia leading to less material as sawdust for wood pellet production
    - Russia has started with customs on raw wood to support the national wood pellet industry
    - Accelerating electric production with biomass in Belgium, the Netherlands and the UK
- Insufficient production capacity. An increasing demand has though lead to an increase in wood pellet factory building.

Furthermore wood pellets from Canada are a little bit more expensive than the European alternatives but the possibility of increased import from Canada if the prices in Europe increases may be seen as roof for how high the prices can go (Boldt 2008).

According to Junginger et Al. (2009) a replacement of heating oil in Europe would demand 150 million tones of wood pellets and the number would be even greater if co-firing or replacement of coal in continental electricity plants would be changed to wood pellets. By extrapolating the current growth of wood pellet consumption the demand would reach 130-170 million tones per year round 2020. Theoretically there is support for a large growth of the wood pellet market in Europe but it is highly doubtful that the region will have sufficient feedstock for this demand. An increased international trade is with this in mind therefore very likely (Junginger et. al 2009).

3.3.2 Wood fuel trade

Large-scale as well as long-distance trade of solid biofuels has increased as a result of an increasing demand in Europe. The biomass production can in many regions not meet the demand and in contrary in many regions the case is the opposite. Hansson & Berndes (2006) estimates the global biofuels trade flow potential between different world regions to be between 80-150 EJ in the year 2050. This estimation may be considered to be a theoretical upper limit for international biofuel trade.

Hansen et al. (2006) and Smeets et al. (2007) points out Latin America, Oceania, Africa and former USSR to be potential large exporters of bioenergy in the future. The net-exporters of biofuels will according to Hansen et al.(2006) be North America, Western Europe and the Southern and South-Eastern sub regions of Asia. Biofuel trade is limited to non-grid transportation systems which make it similar to for example coal and oil. The market barriers are found in institutional and structural phenomena and not in physical connections (Olsson 2009). For long-distance transports of low value commodities as wood pellets feasibility will be reached if the transport costs are lower than the difference in price between the export and import country. Even when feasible the long-distance transports of wood fuel have been debated from an environmental view with the wood pellet export from North America to Europe in focus. Two different studies concerning this factor have come to various conclusions. Damen & Faaij (2003) came to the conclusion that energy requirements for wood pellets from Canada to the Netherlands were 10-11% of the energy content. Magelli et al. (2009) estimated the same figure to 39 % with the only difference that the importing country was Sweden.

Olsson, Hillring & Cardoso (2009) located several barriers for wood fuel imports to Sweden, there among constraints regarding transports. This is due to the fact that biofuels are transported in bulk which leads to high transport costs. That the sector is very young and risky

was also mentioned as a problem. This leads to rapid changes due to market unbalances. The supply and demand relation is unbalanced due to many new, and not always serious, actors on the market.

3.3.3 Wood Pellet production and trade

Wood pellet use is considered to be an important factor in contributing to new heat and electricity targets set by the European Union Renewable Energy Directive. (Eichhout et al. 2007) Sweden and Austria have strong established national pellet markets and additional markets are emerging in Europe. In Germany, Italy and Austria wood pellets are primarly used in heat production for the residential sector while industrial use for power generation is growing in the UK, the Netherlands and Belgium. In Sweden and Denmark both of these sectors are well established (Sikkema et al. 2009).

In 2008 more than 7.5 million tons of wood pellets were produced in Europe and more than 8.5 million tons were consumed (Douglas 2009) The demand for high quality pellets were in 2008 satisfied by production inside Europe while the demand for industrial pellets, that is inter alia used in the power production sector, was dependent on import from above all Russia and Canada. High quality pellets for the residential sector and medium scale heating production is considered to grow in the future. Industrial use of wood pellets is unsure(vad menas med detta?) mostly because CHP-plants where pellets used for co-heating easily can be replaced by other fuels. The pellet price and accessibility is therefore very important. The costs for biomass in relation to MWh produced are generally higher than for coal even when the price for emissions is included (Wild, 2009; Bauen et al. 2004; Junginger 2009).

Inside Europe refined wood fuels as wood pellets and briquettes were traded to an extent of 1.7 million tons. That means that about 35% of the wood pellets produced in Europe were traded across a border (Bauen et al. 2009).

In the recent years demand for pellets have grown much and market analysts expect the demand to grow fast between the years 2010-2020. The world market of pellets is expected to double in the coming four years. Europe is no exception and between 2005-2008 the production capacity nearly tripled. Today Europe is the largest pellet market but many analysts predict that Asia will grow to be a larger market in the coming years (Hartkamp et. al 2009).

From most of the European pellet markets a shortage of raw materials for pellet production is reported and a broadening of the feedstock base is becoming necessary. In addition to this an increased trade with countries outside the EU is becoming necessary to satisfy a growing demand in Europe (Sikkema et al. 2009).

A bigger long distance trade with high quality pellets from Canada and Russia might be necessary in the future if the demand exceeds the production capacities in Europe. Today the trade of this kind of pellets is mostly conducted between neighboring countries in Europe with a few exceptions. International long distance trade with industrial pellets has on the other hand reached impressive volumes. This is because countries such as Denmark, UK and the Netherlands do not have any large scale pellet production. At the same time, in many pellet producing countries the pellet production has emerged as a result of export opportunities and the domestic markets are immature. Canada, especially British Colombia, and North-West Russia are the two largest examples of this (Sikkema et. al 2009; Pelletatlas 2009).

The main routes of trade to Europe are from North America to the Netherlands and Belgium. This trade is mainly conducted from the West coast of Canada through the Panama channel conducted by so called Panamax ships with large loads, 20 000 to 30 000 tons per freight. Rather large amounts of trade are also conducted from the east coast of Canada and the US. The second largest trade route is between Russia and Scandinavia, especially Sweden, with average loads between 4000 to 6000 tons (Sikkema 2009; Bradley 2009; Rakitova 2009).

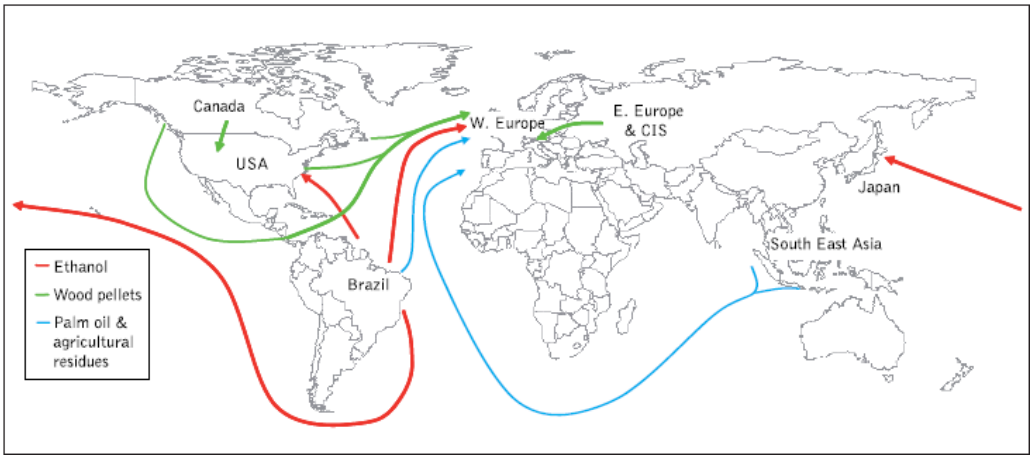

Figure 4: International trade routes of biofuels (Junginger et al. 2010)

3.3.4 Bioenergy trade in Sweden

In Sweden 19% of the energy produced comes from biofuels. Biofuels are mainly used in the forest-industry, in heat plants, for energy-production and for heating of housing. The Swedish industries were using approx. 55TWh of energy produced using bio-fuels. The housing- and service sector was using approx. 14 TWh. Approx. 37 TWh were used for district-heating where 21 TWh came from wood-fuel. About 12 TWh were used for electric-production. The total use of bio-fuels in 2007 was 120 TWh. The main part of the bio fuels that are used in Sweden is produced domestically but an extensive import of bio-fuels such as pellets and peat is also conducted. There is today no reliable statistics for Swedish import and export but studies estimate the bio fuel import to 5-9 TWh and the import of pellets to 358 000 tons in 2007 (Statistics Sweden 2010).

Typical Swedish import of wood fuel is conducted by utility plants located near suitable ports. Most Swedish CHP are located at sites suitable, from a logistic stand, for importing wood fuels. In 2006 Canada was the largest foreign supplier of wood pellets to Sweden followed by Latvia, Finland, Russia and Estonia. In 2008 the pattern had changed a little with Latvia as the main supplier followed by Russia, Finland, Estonia and Canada. In January 2009 official trade statistics for wood pellets were adopted in Sweden which has made it possible to follow trade flows of the product. Even if the statistics is preliminary and still unsure it still can give useful information. The statistics pointed out Russia as the largest exporter of wood pellets to Sweden followed by the Baltic States and Finland. Import from Norway, US and Germany was conducted to a lesser extent. Very small amounts of wood pellets were also exported to Sweden from France, Denmark and the Netherlands. The current trend is that the import from Canada is decreasing while the import from Russia is increasing (Statistics Sweden 2010).

Long term contracts are the most common form of trade but seasonal- as well as spot contracts are also common. Some of the trade is captive with Latvia as a good example where Swedish companies own both wood and pellet production facilities. Trade is also performed directly from producers in another country to end users in Sweden or several agents are involved in between. In Sweden there have been mainly three positive factors with wood fuel imports:

1. Competitive fuel costs
2. Risk distribution
3. Negotiation power

The third factor concerns the interest in keeping the prices of biomass as low as possible in Sweden (Hektor 2009).

There have been mainly three barriers to the Swedish import of biomass namely techincal barriers, transport barriers and quotas. The technical barriers have to this date been measuring the quality and energy content in a good way with no standard suitable for the different fuels yet applied. Shipping may be difficult with harbor facilities that not are equipped in a way that allows cost efficient handling and storage of the fuels imported. The quotas only concerns liquid biofuels and will not be discussed further here (Hektor 2009).

Earlier Sweden was rather alone regarding importing wood fuel but the case is much different today. With no competition the prices were good and the sources vast but with higher prices in the Baltic countries in combination with a demand for wood fuel on the European continent low costs is a smaller argument than before. In fact imported biomass often becomes more expensive than domestic (Hektor 2009).

4 Russia

4.1 Resources and potentials

Russia is a large country, the largest country in fact, with a high percentage of forest areas. The total area of Russia is 1 707 540 thousands hectares where 808 790 thousands hectares are considered to be forest areas. In Russia 23% of the total global growing stock of forests is located and 50% of the global coniferous forests. In 2007 Russia exported 49 million m^3 round wood and chips (FAO 2009).

With the second largest reserves in both coal and oil and the largest supply of natural gas these three energy sources stands for almost all of Russia's energy production. The use of renewable energy sources besides hydropower is negligible (International Energy Annual 2005).

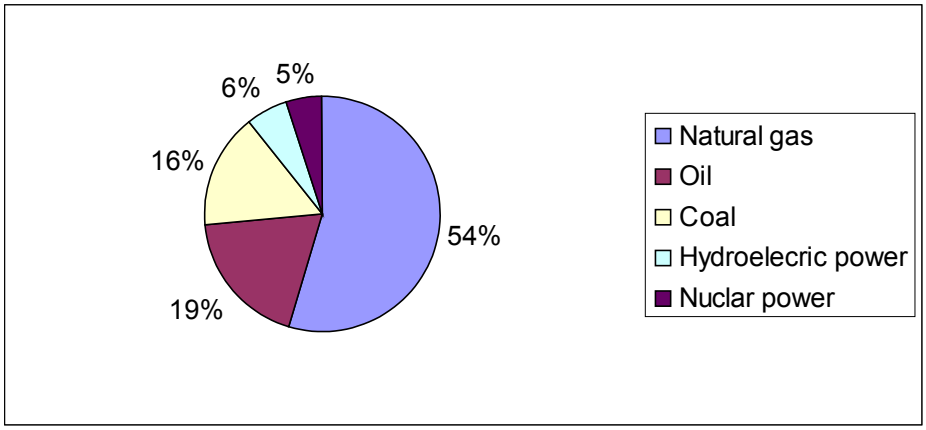

Figure 5: Total Energy Consumption in Russia (International Energy Annual 2005)

The interest in renewable energy sources in Russia is in contrast to the EU, the US and several other countries not mainly ecological but economical. By using renewable energy sources on a national level, more fossil fuels, which are more profitable, can be exported to other countries. Wood biomass is today the most important form of bioenergy in Russia and fuel wood, pellets etc. are increasingly used in heat production. More advanced technologies as combined heat and power plants are rarely used. With its rich wood resources and large wood industry Russia has a large wood fuel potential (Hartkamp et. al 2009).

4.1.2 Estimations on wood fuel potentials

In 2005 the allowed annual cut in Russia were 540 million m^3 and in North-Western Russia alone 91 million m^3. The total Russian forest harvests in 2005 were 131 million m^3 where 37 million m^3 were harvested in North-Western Russia. These numbers only include official fellings and not illegal logging which is a problem in Russia (Russian forests and forestry 2005; Brukhanov et al. 2003).

Estimations on Russia's fuel wood potentials in 2005 gives a lower estimation 76 TWh and an upper on 173 TWh. This estimate regards wood fuel used in large scale, see power plants etc.,

and does not account for wood used for cooking etc (Antilla et. al 2009). The proximity to Europe, large wood resources and the region's mature wood industry in combination with good logistic opportunities has made North-Western Russia more common to estimations regarding wood fuel potentials than the whole country. The region produces 60% of all paper produced in Russia and the forestry- pulp and paper industries are of great importance in the region (Forest Products Annual 2006).

Based on harvest statistics from 2006 the technical potential for wood possible for energy purposes was estimated to nearly 21.8 million m^3 in North-Western Russia. For the distribution of logging residues see table 4.1 (Gerasimov & Karjalainen 2009). In addition to this 9.1 million m^3 and more could have been available as by-products from the mechanical wood processing industry. This leads to an estimation of 30.9 million m^3 to energy from wood corresponding to 61.8 TWh. This is the actual cut but if the numbers for the allowed cut in combination with a more effective use of sawdust etc. the energy from wood could create 147 TWh. If all of the full technical potential was used this number could increase to 207.8 TWh (Gerasimov & Karjalainen 2009; Antilla et. al 2009).

Type of logging residue	Percentage
Non-industrial round wood	65%
Spruce stumps removed after clear felling	19%
Unused crown mass of branches and tops	8%
Defective wood from logging	8%

Figure 6: Distribution of logging residues in North-Western Russia

Another estimation of North-Western Russia's biomass resources states a potential of 1440 PJ per year which corresponds to 400 TWh. These estimations concern the biomass types shown in table 4.2 and do also include potential wood not used today. The actual yearly production of solid biofuels for energy purposes in North-Western Russia is 734.4 PJ where the fuels are firewood (53.5 %), forest industry residues (18 %) and straw/grain (28.5 %) (Hansen et. al 2006).

Type of biomass	Energy in PJ
Unused wood with potential	954
Already used wood	392
Agricultural residues	209
Surplus wood residues	133
Total	1688

Figure 7: Biomass types in North-Western Russia

4.1.3 Wood pellet estimations

Approximations claim that the production in 2007 was 550 000 tons and the amount for 2008 650 000 tons. In 2009 Russia is expected to produce 850 000 – 1 000 000 tons of pellets. Furthermore the capacity of the pellets plants was expected to increase from 1 3 million tons per year in 2008 to 1.7 -2.0 million tons in 2009. This can be compared with the production in 2003 that did not even reach 10 000 tons (Rakitova & Ovsyanko 2009; Rakitova 2008). estimates that with the annual allowable cut in North Western Russia, approx. 10 million tons of refined wood fuel could be produced.

4.2 Policies

4.2.1 Environmental Policies

The Prime minister of the Russian Federation, Vladimir Putin, signed the first document concerning Russian renewable energy in the beginning of January 2009. The new state policy is to increase energy effectiveness for electricity made of renewable sources. The goal is to reach a 4.5% energy production received out of renewable energy including bioenergy. (Rakitova 2009) Today less than 1% of Russia's energy is produced using renewable sources (Hartkamp et. al 2008).

4.2.2 Trade policies

Russia has decided to set high customs on exported raw wood which started with 20%, but not less than 10 Euro for 1 m^3 raw wood from the first of July in 2007 (Rakitova 2009). In April 2008 the customs were raised to 25% and in January 2009 the customs were supposed to reach 80%, but not less than 50 Euro for 1 $m^{3,}$ but this did not happen. Due to the financial crises this raise was postponed until the first of January 2011. However, the export customs for mechanical and chemical wood processing product are reduced but the production of these products is almost zero today. The heavy customs will probably mean that almost all raw wood will be used inside Russia and probably more wood fuel will be produced when the financial crisis is over (Rakitova 2009; Hartkamp et. al 2009). In Sweden the largest CHP is currently being built 30km south of Stockholm. It will need 5 000 m^3 of wood chips every day. Leif Bodinson, the CEO of Söderenergi that are building the plant, says that they first thought that imported chips arriving to a nearby port would be the main source but the raised customs in Russia made them look for Swedish alternatives instead (Söderenergi 2009).

4.3 Wood pellets production and internal market

The production of wood pellets in Russia is mainly conducted in the North-Western part but also in the central parts of the country. This is a result of the strong presence of wood-industries in the North-Western region and also the presence of harbors. Almost all wood pellet production is today dependent on sawdust from the wood industry. In the beginning of 2009 between 15 -30 % of the wood pellets were used inside Russia which shows that producers are very dependent on profitable export. The trend is though that more boilers are installed and more companies providing technology for boiling have shown their presence in Russia. The internal market has not until this date been of any interest to the government which has made the market develop without any plan and without support. It is the producers that have been driving and promoting the internal market mainly in 2007 and 2008 when profits on export fell compared to 2006. Export became more profitable in the end of 2008 and the beginning of 2009 and Russian pellet producers became more active regarding export of their pellets. In 2009 the costs for the producers are about the same as in 2008 but an increasing euro has made the profit in roubles larger than in both 2007 and 2008 (Rakitova & Ovsyanko 2009; Hartkamp et. al 2009).

When export prices fell in 2007 and 2008 investors started to doubt in projects related to the pellet-industry and for some producers their costs exceeded their revenues. In 2008 many pellet plants were sold and almost every plant with a production under 8000 tons a year was looking for investors (Rakitova 2009). Even for those producers that made profits these were poor. A cold winter in 2008-2009 made the pellet price go up and in combination with the weak ruble in relation to the euro the pellet export was twice as profitable as in 2007. Many

plants however had to decrease their production in 2009 due to crisis in woodworking and forestry industries leading to a lack of material (Rakitova & Ovsyanko 2009; Hartkamp et. al 2009). In 2008 the cost of production and delivery of wood pellets exceeded the sale price. Even though many producers get no profit or even losses, most feel that they have to continue to pay back the credits that were taken to buy equipment. The prices have gone up in 2009 and the situation for the industry is better (Rakitova 2008).

A large investment is currently being made by the Russian company Vyborgskaya Cellulos which are building what is planned to be the world's largest pellet factory with a production of 900 000 tons a year. The round wood needed, approx.3 000 000 m^3, will mainly come from the North-West of Russia but also Belarus. In comparison today's largest pellet plant in Russia produces approx. 60 000 tons of pellets. The wood will be transported to the factory by railway and the factory lies near the port of Viborg that will be used for export. The production is mainly supposed to go to European heat and power plants. The factory is supposed to be running during the third quarter of 2010 (Ostelius 2010; Hävner 2007; Hartkamp et. al 2009; Rakitova 2009).

There are also signs of foreign companies is investing money in Russian wood pellet production. The Finnish-Swedish forest-industry company *Stora Enso* has invested in two pellet-plants recently. The pellet plant situated in Impilahti - which lies in Karelia North-West of St. Petersburg - produces 25,000 tons of pellets annually. The other plant in Nebolchi east of St. Petersburg has the same capacity. Earlier the sawdust and other production residues have been sold to other particle board or pellet producers. The subsidiary to the Swedish furniture company IKEA, Swedwood, is another example of investment efforts made in the Russian wood pellet-industry. The company has sawmills in North-Western Russia and exactly as Stora Enso they want to produce pellets from the residues. The production will be approx. 72 000 tons/year.

4.4 Wood fuel export and logistics

Russia is exporting fuel wood, wood chips, peat, wood pellets and briquettes as well as round wood. Saw dust etc. gained from exported Russian timber is to a large extent used for energy purposes in countries as Sweden and can therefore be seen as indirect wood fuel trade (Olsson, Hillring & Cardoso 2009; Hektor 2009). In contrary to the high customs on timber which have caused a decrease in the trade of round wood there are so far no export duties on wood pellets (Rakitova 2009). Most Russian pellet plants have small monthly production which has made traders (intermediaries) the main force behind price building. Intermediary traders collect the wood pellets from many producers to make the trade profitable. Only a few pellet plants conduct direct trade with West European companies and even fewer plants are operating on the domestic market. In Russia most wood pellet producers manufacture approx 2000-2500 tons of wood pellets a month which not is enough for sea shipments to Western Europe.. Yuri Pasko[8]claims that this pattern will continue until production volumes exceed 3000 tons of pellets a month. The three main trading companies are the Norwegian S. Syr. Pedersen AS, Swedish Lantmännen Agroenergi and Russian Biofuel Association which all three sell their wood pellets to large pellet consumers. The Swedish and Norwegian traders buy their wood pellets from many producers and the price these traders pay serve as price guidance for the industry. The Swedish and Norwegian companies offer payment at the delivery to a seaport, warehousing at their own expense and stable prices which have shown to be attractive to Russian producers. Beside wood pellet sales conducted in the St. Petersburg

[8] Commercial director of ZAO RosPolitechLes

port the Baltic ports are an alternative where traders also buy wood pellets (Rakitova 2008).

At least 60 – 70 % of Russia's wood pellet-export goes through the harbour of St. Petersburg but about 15 % is exported through harbors in the Baltic countries. The rest goes by truck to the European continent. Approx. 50 % of Russia's wood pellet-export goes to Sweden and 33% to Belgium which are the two largest importers of Russian pellets (Neginskaya, 2009; Alexandrova 2008; Bradley 2009; Rakitova & Ovsyanko 2009).

In Russia typically "Big-bags" with a weight of 500-1500 kg are used when transporting pellets and transports from production is rarely conducted in bulk. In general the bags are torn in the port and then shipped in bulk because almost all of the European importers demand this. The bags are rather cheap but the costs become high when loading and unloading the wood pellets. The bad harbors in Russia make costs hard to maintain low which make long-distance trade more difficult. More investments regarding the Russian harbors could make them much more cost-efficient regarding handling and loading (Sikkema et. al 2009).

Inside Russia wood pellets are transported by truck or by railway to be shipped by bulk in seaports. According to Yuri Pasko the Russian producers experience that when loading the Big bags into the train wagons the bags can get torn. In addition most of the trains are old and need maintenance and repair. If a bag gets torn while loading in a port the producers have to pay for the maintenance costs (Rakitova 2008).

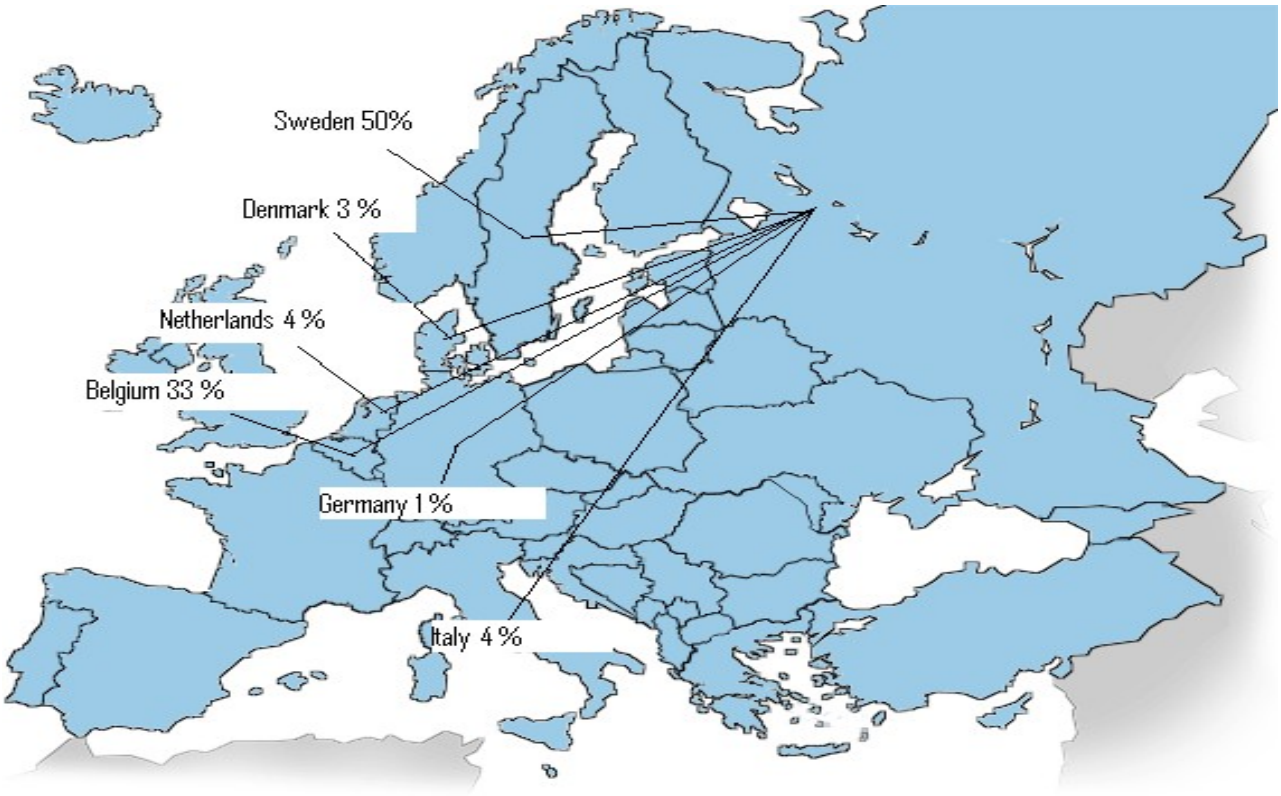

Figure 8: Percentage of Russian pellet export (Alexandrova, 2008)

Despite the fact that Russia has a great potential regarding wood pellet export the country has proved unreliable regarding different factors. Investments required to support efficient loading have not been made to the harbors, nor have Russian pellets-plants received the investments

necessary to be cost effective (Bradley et. al 2009, Hartkamp et. al 2009; Alexandrova 2008; Rakitova 2009).

Reliability concerning the supply of wood pellets and material for wood pellet-production is a problem that to this day has not been solved in Russia. The critical factors behind this are:

- A large and for foreigners hard to understand bureaucracy
- A stumbling business structure
- Lack of investments
- Problems with communication due to bad language skills
- Safety and comfort in business dealings
- 6 month winter
- Low trust and comfort regarding business dealings
- Transports in "Big-bags"
- Inefficient harbors
- Corruption

Before solving these problems Russia will have great difficulties in becoming a major actor regarding wood pellet-export, something that should be possible with the large supply of wood and forest-industry in North-Western Russia and its proximity to Europe (Neginskaya 2009; Bradley et. al 2009; Alexandrova 2009; Rakitova & Ovsyanko 2009).

4.5 Corruption and the Russian business climate

In the Oxford English Dictionary there are nine commonly accepted definitions of the word corruption but only one can be used in political and economical contexts, namely "Perversion or destruction of integrity in the discharge of public duties by bribery or favour; the use or existence of corrupt practices, especially in a state, public corporation, etc.". (OED 2009 Many social scientists follow this definition and mainly focus on duties of the public office. A smaller group of scientists have developed definitions that are more related to demand, supply and other concepts from economic theory. These definitions are considered to be market-centered. (Heidenheimer et al. 1999) Van Klaveren (1999) states that "*A corrupt civil servant regards his public office as a business, the income of which he will . . . seek to maximize. The office then becomes a "maximizing unit." The size of his income depends . . . upon the market situation and his talents for finding the point of maximal gain on the public's demand curve*."

A study made by the Swedish Trade Council on Swedish companies active in Russia stated among other results that:

- Information is very hard to obtain and authorities are most reticent sources of information
- Daily business runs into corruption and bribes to obtain proper certification is a common occurrence
- Bribes are very common and especially noticeable in contact with authorities
- Establishing a company can be a complicated task and the use of a sub-supplier facilitates
- The custom procedure is not satisfyingly, inferior and need improvement
- The certification process is rather complicated and described with demanding bureaucracy

- Governmental actions influence the operation and different opinions exist regarding how contracts are followed

Of the companies in the study 47 % claimed that they were highly affected by corruption and 37 % were affected to a lesser extent. Only 4 % claimed that they were not affected at all by corruption (Swedish Trade Council 2008).

Transparency International is an independent organization that works against corruption and on a yearly basis releases Corruption Perceptions Index. With 2.3 points where 0 is total corruption and 10 none Russia have the lowest ranking of the so called BRIC[9] countries and much worse than Western European countries. Sweden among with the other Scandinavian countries has the highest rank on the index (Transparency International 2009). The scale of the Russian corruption is estimated to 318 billion USD which is a third of the Russian GDP. (INDEM 2005) The Russian parliament member Gennadij Gudkov says that "*Corruption is a larger threat to Russia than NATO has ever been*"[10] (Blomgren 2010).

It is common to divide corruption in two dimensions, pervasiveness and arbitrariness. The dimension of pervasiveness describes how common corruption and bribes are on a market while arbitrariness describes if the corruption is predictable or unpredictable. A high frequency of corruption, large number of transactions to a high level of actors, leads to higher direct and indirect costs. This means high pervasiveness which may be rather easy to control if the corruption is predictable. High arbitrariness means that the corruption in the sense of which person to bribe and with how much money and maybe even more important if the services promised will be conducted is uncertain. Russia is considered to be a nation with high pervasiveness and high arbitrariness. This means that bribing is common but hard to budget for because it is unpredictable (Doh et al. 2003; Seung-Hyun 2007).

The Russian business culture is considered to be relation-based in contrary to the Scandinavian that is considered to be deal-based. This means that Russian companies tend to prefer doing business with persons they know from before and that doing business with foreigners is seen as inconvenient. A deal-based business culture is characterized by openness to strangers and a focus on making decisions fast. In a relation-focused business culture it is important to know the right people, especially in a country with difficult bureaucracy. As negotiators Russian companies are considered to be raw and insensitive in general. A common tactic is to use the impatience of the counterpart as an advantage which only can be handled with patience (Gesteland 2005).

In network theory the focus is on personal relations. In a relation-focused country it is of importance to have personal contacts with the appropriate persons because of the reluctance to do business with foreigners. Research has shown that Russians trust informal networks more than formal because of the earlier collapse of Russian institutions. One way to minimize risks is to conduct business with already known partners. For a foreign actor it is hard to gain a sufficient network but it can be crucial for successful businesses. If you are inside a network in a relation based economy the relations may make it possible to get things done without bribing. If a society is relation-based a large network is the most important factor when conducting business (Batjargal 2006; Gestaland 2005). To make business in Russia without bribing, great patience and financial strength is necessary. It is of great importance to have all permissions and licenses in order before starting business activities in the country. If extreme

[9] Brazil, Russia, India, China
[10] The authors own translation

urgency occurs it is likely that Russian authorities will use this advantage and demand bribes (Blomgren 2010).

5 Canada

5.1 Resources and potentials

Canada is the world's second largest country, after Russia, and has large forest areas. 402.1 million hectares of the land area is covered by forest. This is approximately 41% of Canada's land area and 10 % of the world's forest area. This makes Canada the country in the world with the third largest wood resources after Russia and Brazil. Not surprisingly Canada also has a large wood industry and 191 million m^3 of industrial round wood was harvested in 2005 of which 80 million m3 were harvested in the province of British Colombia. Due to falling demand, primary in the USA, this number decreased to approx. 180 million m^3 in 2008 which still makes Canada the world leader in exporting forest products (The state of Canadas forests 2009; Bradley 2009; FAO 2006).

5.1.1 Estimations of forest areas and wood fuel potentials

According to an approximation made by Gerasiomov and Karjalainen the modern wood fuel potentials in 2005 for Canada are lower 44 and upper 108 mill. m^3 which is about 316-774 PJ. (Antilla et al. 2009) Wood & Laysell (2003) estimates the total Canadian harvest of roundwood corresponds to 2.42 EJ/year. If the roundwood harvest used for forest products is not included the biomass left have an energy content of 0.72 – 1.44 EJ/year. The residues surplus not used today that is the result of processing the roundwood has an energy content of 0.1 EJ/year. Bradley (2006) estimates that Canadian pulp mills and sawmills produce 21 million BDt[11] yearly. The surplus is approx. 2.7 million BDt where 1.8 million can be found in the province of British Colombia. The surplus in British Colombia is expected to grow even more since the annual allowable cut have been increased though to infested Mountain Pine Beetle wood creating opportunities for production of wood pellets. The total unutilized biomass volumes in Canada are estimated to 123 million BDt

Unpreserved forests in Canada stands for 294.8 million hectare of the country's area and are in theory available for commercial harvesting but only about half of it is managed forest. Approximately 0.9 million hectare of this forest are harvested every year (Wiik et.al 2009).

In addition to both a large forestry industry and large supplies of biomass the infestation of forest-areas by the Mountain Pine Beetle, described below, in British Colombia has released even more amounts of wood for energy purposes. Many of the resources though lie in the hinterland of Canada, far from ports and often also logistic infrastructure. The two areas with the largest potential for exporting wood fuel to Europe are the West coast, in general British Colombia, and the St. Lawrence River on the Atlantic coast (Bradley 2009a).

In British Colombia the government has raised the annual allowable cut because of the opportunity to harvest the Mountain Pine Beetle[12] infested wood before the wood is destroyed. The province of British Colombia has 59 million hectare of forest and there are approx 9.3 million BDt harvest residues and 1.7 million BDt of standing Mountain Pine Beetle wood available every year. The level before the sub prime-crisis in the US the mill residues were 550 000 BDt and regarding to Douglas Bradley (2009a) it is reasonable that the same level

[11] Bone Dry ton

[12] The Mountain Pine Beetle is a bug that have infested and killed large forest areas. This is described more in chapter 5.3

will be reached when the house market recovers. Totally there is 11.5 million BDt available annually in British Colombia and estimation is that 5 million BDt is used for domestic heat and power and the rest for export. Estimations made by Douglas Bradley[13] claims that overseas export of pellets from British Colombia will grow from 770 000 tons in 2007 to 850 000 tons in 2009 (Bradley 2009a; Bradley 2009b).

The country also has large fossil fuel resources which also reflect the energy production where 33% comes from oil, 24% from natural gas and 10% from coal. Renewable energy sources, besides hydroelectric power, as wood energy is due to the large amount of fossil fuels not important sources for energy production. The Canadian energy production from solar, wind and geo-technology is negligible (Bradley 2009). Wood energy stands for approx 3.8% of the energy production and 48 million m^3 of wood is used and the wood energy is up to 94% produced of industrial residues that are combusted in heat- and power plants and in the industry (Wiik et.al 2009).

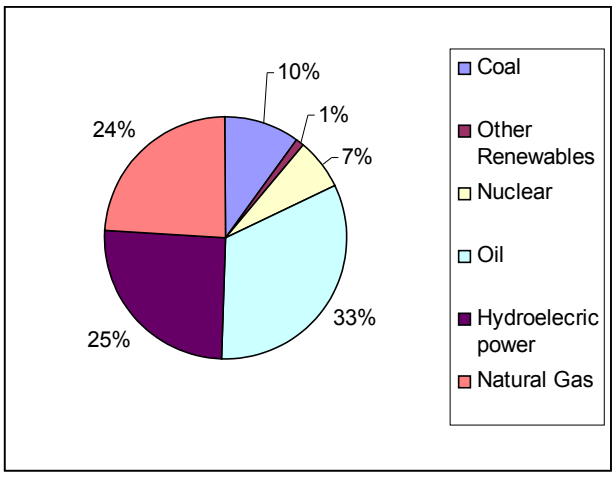

Figure 9: Canadian total energy consumption by type (EIA International Energy Annual 2006)

5.1.2 Wood pellet estimations

According to the Canadian wood pellet association the capacity for wood pellet production grew from 0.5 million tons to 2.0 million tons between 2002 and 2008. (Bradley 2009a) Other estimations claim that the west-coast of Canada has a pellet-production capacity on 1.77 million tons in 2009 (Spelter & Toth 2009).

The Canadian wood pellet association claims that the actual pellet production was about 1.3 million tons in 2008 but is expected to reach 1.4 million tons in 2009 which still is a lower production level than in 2007 (Spelter & Toth 2009; Bradley 2009a). Estimations regarding the highest possible sustainable pellet production in Canada are about 20 million tons a year (Swaan 2007). No new investments have occurred in 2009 so the production capacity is still the same as in 2008. This was the first time since large scale pellet production occurred in Canada that the production capacity did not increase (Bradley 2009a).

[13] President – Climate Change Solutions

5.2 Environmental policies

Canada ranked 57 of 58 industrialized and development nations judging climate change progress. Canada's population has been growing much faster than most industrialized countries and higher oil and gas extraction can mostly be explained by the US trying to improve their energy security. Even with this included the country has not shown much notice to renewable energy sources so far. GHG emissions in 2007 were 26% above 1990 levels and 33.8% above the Kyoto target. Instead a national Canada-plan has been designed that is supposed to achieve emission-reductions while ensuring economic growth. The goal is to reach a reduction of 150 million tons by 2020 compared with today's 747 tons and a greenhouse gas reporting system is supposed to be put in place for large industrial emitters (Environment Canada 2005). In May 2009 it was also declared that a system with carbon credits for reducing projects is going to be introduced. The government has stated an annual reduction of total GHG emissions by approx 4 million tons a year. Many provinces have taken their own actions that precede the federal goals. For example British Colombia has introduced the first full carbon tax on all fossil fuels in North-America and has set a target on a 33 % emission reduction until 2020 (Bradley 2009a, Hartkamp et. al 2008).

Policies and support for biomass heat and power have to this date been small and ineffective. The government policies have mostly focused on liquid bio fuels for transport. The Canadian policies mainly focus on power rather than heat which might explain the poor amount of wood fuel used in the country. The Canadian Bio Energy Association is working for a larger amount bio energy that gives both heat and power in contrary to wind power that the government has invested more money in. But there are some projects that support bioenergy. Canada's ecoEnergy for Renewable Power Program is working for an increase of electricity from renewable sources. One Canadian cent per kWh for up to ten years is provided to renewable energy projects. The sub prime crisis has made the pulp, paper and sawmills industries troubled and a number of mills have shut down. Provinces, in general British Colombia and Quebec, are beginning to see bioenergy as a good option to traditional forest products. It is mainly on provincial level most is done to develop the bioenergy industry (Bradley 2009a; Bradley 2009b).

5.3 Mountain Pine Beetle wood

A combination of dry summers and mild winters have made large areas of pine forests attacked by the Mountain Pine Beetle in the province of British Colombia. The beetle lays its eggs inside the tree leading to starvation and death. Approximately 13 million hectares has been infested of British Colombia's 130 million hectares of forest. The outburst is expected to kill 80 million m^3 in 2009 and thereafter subside until 2018. The peak was reached in 2005 when 435 million m^3 of trees were killed. Depending on temperature, humidity etcetera the trees can be used for 15 years or more as fuel. It has been calculated that approx. 1-3 million m^3 of timber could be harvested until 2025 including the 10 % that could be harvested without investments in infrastructure etc. (Kumar, 2008; Wiik et. al, 2009).

Due to the large areas infested with the beetle the annual allowable cut has been raised in the region but the allowable cut is expected to reach the same level as before the outbreak in 2015-2017 (Wiik et al., 2009, Stennes et al. 2006). An approximation of the mill residue surplus of today is 1 million tons that in combination with beetle-killed wood, 0.6-1.9 million tons, would give raw material for 10-20 pellet plants with a capacity of 100 000 tons a year each (Bradley, 2008; Wiik et al., 2009).

The existence of the Mountain Pine Beetle in Canada has forced the European Union to make directions for wood import from the country, and other countries with the same problem, so the beetle will not spread to the European states. The directives do not apply for pellets that are not considered to risk tree health in the European Union but other wood products must be treated and shiploads are controlled before entering a country. Other products must meet some requirements:

- Appropriate heat treatment to achieve a minimum core temperature of 56°C for at least 30 minutes, or
- Appropriate fumigation conducted in accordance with a specified procedure

An additional alternative for timber is treatment by chemical pressure impregnation before exporting to Europe (Directive 2000/29/EC, 2000; Wiik et al., 2009).
Heat treatment of wood chips does not seem implemental in practise and methyl bromide, used for fumigation, is not an approved treatment by the European commission which in effect makes import of wood chips impossible. Even if the heat treatment of shipments saves the wood from beetles it does not kill fungi which are a reason for sending back the shipment. Countries, there among Sweden, have applied for special permission to among other alternatives winter import wood from Canada because the directions is so hard to fulfil (Klefbom 2008; Nurmi 2008).

Besides the Mountain Pine Beetle the Pinewood Nematode, that is harmless in Canada, can do severe damage in other countries. The little nematode has reached Portugal and spread across the whole country damaging large amounts of pinewood. Today all wood exported from Portugal must be heat treated (Klefbom 2008).

5.4 Wood Pellet production

In 2007 Canada was the world's largest wood pellet producer but the sub prime crisis in USA led to a reduction new home building which in turn led to less sawmill production. A severe lack of mill residues caused a smaller wood pellet production in 2008 and Canada became the world's fourth largest producer of wood pellets. The lack of mill residues as sawdust has made it necessary for the manufactures to use harvest debris and non-commercial round wood when producing wood pellets. Supply chains from this increasing source of wood fibre in combination with higher raw material prices, 3-4 times higher then normally, have increased the price of export contracts with 30-40%. John Swaan, Executive Director of the Wood Pellet Association of Canada claims that: "*The raw materials that the industry has relied upon up to now has been mainly sawmill residues, and we've hit the ceiling*" (The Bioenergy International no 2 april 2009). As the forest industry for sawn goods sees less activity, smaller amounts of residues are available for the pelleting industry (Spelter & Toth 2009; Bradley 2009).

Low prices in Europe on wood pellets affect the margins of North American producers which keeps the growth of wood pellet production to a minimum according to John Swaan. Further he says that, "*Producing pellets from excess resources such as MPB*[14] *wood and forest debris - from around the globe - will not be feasible until the value of the wood pellet is improved. If producers will not pay an adequate price it will not allow the industry to use other materials*" (Kassabian 2008).

[14] Mountain Pine Beetle Wood

In British Colombia all wood pellet producers are using residues from Mountain Pine Beetle wood harvest in their wood pellets because the wood industry is at the moment harvesting that wood. Efforts are being made to collect all of the infested wood before it loses its merchant value. In Quebec on the eastern coast pellet plants could not obtain enough material to feed their plants because of major competition from other industries in 2008. The plants in Quebec have not been able to be cost effective with their operations after the pullback in sawmill industry (Clark 2008). The cheapest feedstock to use in British Colombia is by far sawmill residues, 17 USD/Odt, followed by roadside residues, 43.7 USD/BDt. Using trees killed by Mountain Pine Beetle is a much more expensive feedstock, 99.7 USD/Odt. Today only sawmill residues are being used but the competition for the materials is hard and the availability is limited. An increasing demand for high-value wood products may lead to a shift towards more available but more expensive feedstock in the near future. Expectations are that when the demand for feedstock grows investments on research and developments will reduce the costs of it. When it comes to wood pellets the current production could expand significantly. EU is assumed to demand 90PJ in 2012 of which British Colombia could in the highest case supply 60.9 PJ and in the lowest case 24.8 year. In the year 2020 British Colombia could supply the whole projected demand of the EU of 218 PJ but more moderate approximations show trade potentials of 50 PJ/year (Verkerk, 2008).

In Europe the average production capacity wood pellet plant is 7500 tons annually while the corresponding number for Canada is 50 000 – 60 000 (Wiik et al. 2009). The Canadian wood pellet plants are located near large sawmills which generates larger volumes of sawdust and shavings than European sawmills. A big difference between the Canadian wood pellet plants compared to European is that they have been designed with export in mind. 29 pellet plants are operating in Canada and most of them are sending their production to export (Wiik et al., 2009; Bradley 2009).

5.5 Wood pellet export

In 2008 approximately 83% of all wood pellets produced in Canada were exported and 58% of that export was conducted to Europe (Bradley, 2009). Other approximations state that 64% of Canada's export goes to the European Union (Swaan 2009). USA is the second largest importer of pellets with a 25% share in 2008. While Canada produces 60 % of the wood pellets in North America the US stands for 90% of the consumption. The export to the US is considered to decline in 2009 due to the sub prime crisis but the export to Europe is expected to increase. Asia imports about 5% of the pellets produced in Canada but is an emerging market. The largest importers of Canadian wood pellets in Europe are the Netherlands, Belgium, Sweden, Denmark, Italy, Ireland, UK and Germany. Of all the over-sea export of pellets in 2008 approx. 80% were shipped from the west coast of Canada (Bradley, 2009; Swaan, 2006; Swaan, 2009; Wiik, 2009; Alakangas 2007).

The Canadian wood pellet production is expected to reach 6 million tons in 2015 and the overseas export is considered to reach 1.5 million tons. This calculation regards an initiative[15] in Ontario which is considered to make the industry grow but without long sea transports it is much more profitable to sell wood pellets inside Canada. Experts also expect the trade to the US to grow when the growing government activities in GHG reductions are set into action. If this is not the case the overseas trade can reach 3.1 million tons in 2015. The total production of wood pellets is estimated to have a potential to grow tenfold to approx. 15 million tons/year (Swaan 2009b).

[15] The incentive is more described below.

The currently largest importers in Europe are, UK – 39%, Netherlands –37 %, Belgium –21 % and Sweden –3 %. The total amount of export to Europe was 770 000 tons in 2008 (Swaan, 2009a).

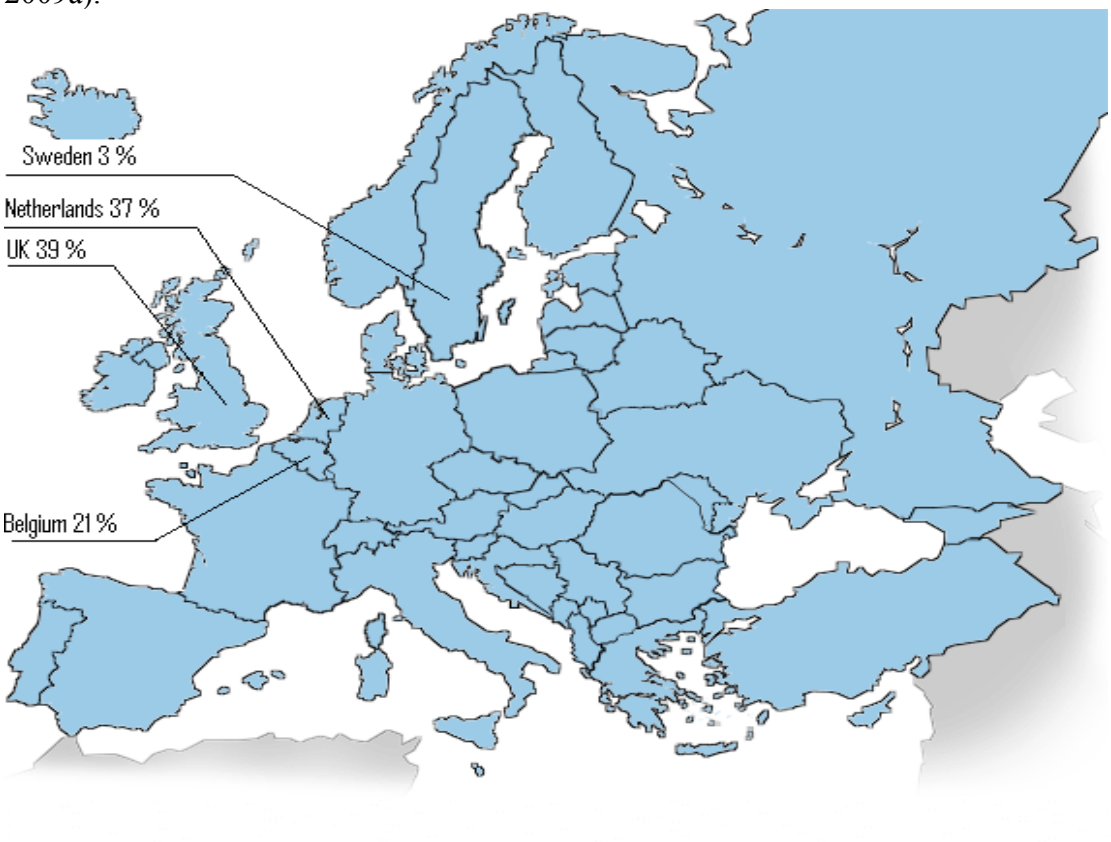

Figure 10: Percentage of Canadian pellet export to Europe (Swaan 2009b)

The high percentage of export to the UK, the Netherlands and Belgium can be explained by the co firing projects conducted in these countries. One example is the largest power plant in the UK with 4 000 MW installed capacity that can co fire 1 5 million tons of biomass where most will be imported wood pellets (Jackson 2009). The co firing is a result of both efforts to cut down the emissions of GHG but also a shortage of cheap national coal supplies. There are though no receiving facilities for Panamax size ships which may indicate that a growing wood pellet industry in the eastern coast of Canada which will use smaller vessels may be suitable for export to the UK (Ljungblom 2009; Bradley 2009a; Bradley 2009b).

As mentioned earlier there was in 2009 a severe shortage of mill residues which has forced the producers to use harvest residues and Mountain Pine Beatle wood which is a transition in progress. The availability of Mountain Pine Beetle wood is almost endless in comparison with sawdust but the process becomes much more expensive due to logistics and availibility. The higher cost of pellets has partly been invisible to European importers due to a collapse in ocean shipping rates since the middle of 2008. The pellet export potential is largest in British Colombia and it is also here that the pellet plants in contrary to the eastern coast not have seen material shortage due to vast amounts of harvest residues from Mountain Pine Beetle wood (Bradley 2009, Wiik 2009).

5.6 Logistics

Before the financial crisis in 2008 manufacturing grew fast in developing countries as China. This made prices on shipping grow rapidly when raw materials and manufactured goods were transported by sea to and from these countries.
For short-distance maritime shipping - as between St. Petersburg and Stockholm - high shipping costs may not be a major factor but for long-distance shipping from Vancouver to Stockholm it can be devastating. In these cases the cost of shipping is an important, possibly the largest, factor for the actual and final costs for importing pellets. In British Colombia in Canada many exporters of pellets would have had to stop exporting pellets to Europe if it was not for already arranged 3-5 year fixed shipping price contracts. After the crisis the prices dropped after an all time high in 2008 but it is not impossible that a large increase in shipping prices can cause a large source of biomass resource, as in British Colombia, to drop out of the market because of impossible profitability. Between 2004 and 2007 the shipping cost from Vancouver to Rotterdam grew from 35 USD/tonne to 100USD/tonne (Bradley et. al, 2009).

Figure 11: Freight prices on Panamax ships (Baltic Exchange Panamax Index, 2010)

It may be puzzling why the US in general and Canada especially stands for a much larger amount of wood pellet export to Europe having the large distance to Europe compared to Russia in mind. The first long distance transport of pellets was conducted between Canada and Sweden in 1998 and the logistic system in Canada is highly developed. Fifty thousand ton ships are loaded in Vancouver in approx. the same time it takes for a 3 thousand tonne ship to be loaded in St. Petersburg. In Canada the pellets are delivered to the ports in bulk and then pumped into the ships with hoses (Nezhinskaya 2009; Sikkema et. al 2009).

In 2007 all of the exported pellets from Canadian pellet exported to Europe was loaded in the port of Vancouver and went through the Panama channel on its way to Europe. The year before and the year after pellets were also exported to Europe from the port of Halifax on the east-coast but the 100,000 tonnes a year pellet plant in Nova Scotia that stood for the export was shut down due to the closure of a sawmill. The port of Vancouver is modern and has two

pellet-terminals. The newest of them has systems for removing pellet dust while loading etc. but there are still problems regarding efficient transports in British Colombia:

- The railway system is a monopoly and is often at its capacity. It may take days of waiting before pellets come into the loading terminal.
- The cars used to transport pellets in British Colombia are not optimized for pellets and a bad spread of the cargo often leads to 20% open space in a car.
- According to some sources, labour disputes in the port of Vancouver have presented an obstacle to the development of efficient loading operations.
- In Vancouver it rains 166 days per year and between November and March there can be 20 days with rain and you can not load pellets in rain.

Though it seems that the European climate policies will make export profitable, there still are some barriers where the two most crucial are described below.

- Ocean transport costs: As the distance to Europe is rather vast - especially from the west coast where transports must go through the Panama channel - freight rates are essential for making the trade profitable. The international recession in 2008 made the shipping demand collapse and the prices as well. Before this the prices were all time high. From British Colombia there is a 15,500 km transport distance to Stockholm through the Panama canal and freight costs are of course crucial for profitability. Many of the pellet producers had 3 year leaping contracts during the highest peak but if future prices are high, which is reasonable to believe regarding more transports from Asia and higher oil prices, the Canadian producers might find it hard to make profits on the European export.
- Transports inside the country: Much of Canada's biomass is in the interior of the country but even close to the coast the distances from forest to sawmill and pellet-plants and thereafter to shipping harbors are large and expensive especially with high petrol-prices.

From Quebec on the Canadian east coast there are 5000 km to Europe compared with 15 500 from British Colombia to Europe. A larger pellet-industry in Quebec and in Newfoundland Labrador could increase the export to Europe and the shorter distance could also make it more profitable compared to production on the west-coast especially if the shipping-rates increase. Ontario province on the west coast has capacity to produce 3 million tons of wood pellets annually on a long term and 80% of its land area is forested (Clark, 2008). In Ontario province investors are planning six new pellet-plants which are planned to be ready in 2011 that together will have a capacity of 1 million tons of pellets. This production is however? not likely to be exported because Ontario Power Generation has determined to stop using coal in their power plants by 2014. They will need 2 million tons of biomass to three power stations in the area. It is thus most likely that export of pellets to Europe from the east-coast will increase in the future. Today the costs of transporting pellets from the west-coast and the east-coast of Canada to Europe are about the same despite the different distances. The routes for biomass from the harbors of the east-coast are not as common and the ships are much smaller which makes transports expensive (Spelter & Toth 2009; Bradley et. al 2009).

An energy amount that corresponds to 40 % of the energy-content in the pellet fuel is required for the pellets produced in Canada and shipped to Europe from the west coast because of the long distance. This fact illustrates that it is crucial that both pellet production and pellet

logistics are efficient. To cut the transport costs by half and also decrease energy consumption an increase in ship-size from 40,000 DWt to 120,000 DWt is necessary (Magelli et al., 2009; Bradley et al., 2009).

6 Results

6.1 The Swedish Survey

In the survey 71% of the respondents did not import bio-fuels at all. Of the companies that did import bio-fuels a majority imported more than 30% of the bio-fuel used in the company from various countries both inside and outside the European Union.

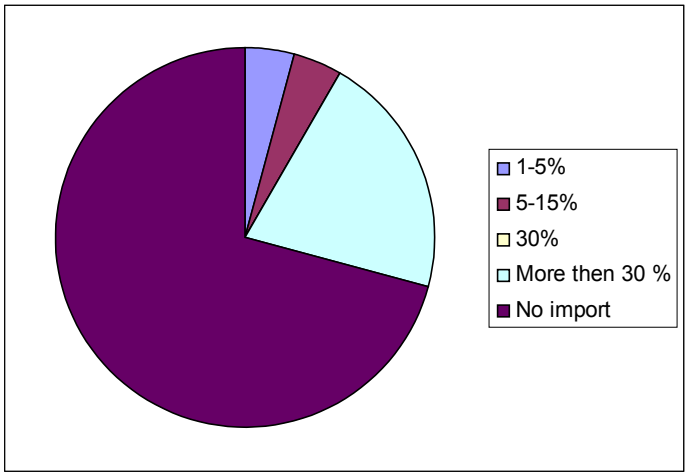

Figure 12: Share of imported bio-fuel

6.1.1 Russia

Almost 21% of the respondents that answered the questionnaire were importing bio-fuels from Russia. Among these companies 80% got between 0-10% of their bio-fuel from Russia and remaining 20% of the companies between 10-20%. The types of bio-fuel imported were divided as in Figure 13.

Type of fuel	Percentage
Pellets and briquettes	25%
Wood chips	25%
Peat	12.5%
Round wood	7.5%
Other	30%
Total:	**100%**

Figure 13: Types of biofuel imported

The respondents were asked to rank different factors concerning wood fuel trade with Russian companies on a scale between 1 and 5 where the highest number represented the highest grade regarding that factor. The averaging of the different factors became as in Figure 14.

Factor	Average

Availibility of supply	3.8
Quality	3.4
The price	2.8
Logistics	2.6
Reliability among suppliers	1.8

Figure 14: Wood fuel trade with Russia, average of different factors

This implies that quality and amount of biofuels in Russia is above average and the price is average. The biggest problem seems to be the reliability among suppliers and logistic problems. There were also a lot of comments on problems in Russia and Sweden regarding import of bio-fuels which are shown below.

- "Russian companies are reluctant to leave quotes and prefer bids from the buyers"
- "The delivery precision may be uncertain if another party pays more even though a deal has been made"
- "Deliveries are often delayed due to bad roads"
- "Their roads can not carry a heavy load which leads to small trucks and more costs"
- "Sometimes the suppliers after a while want to deliver products with a lower quality then agreed in the contract"
- "Great internal problems with bribed officials in the customs. It takes time and efforts to bribe as little as possible"
- "Entrepreneurs sometimes have unrealistic profit demands. In general they expect a 15% yield and some even expects to be millionaires immediately"
- "The harbors are hard to manage especially St. Petersburg that is notorious. The customs in all of the Russian harbors are unrealistically high"
- "Swedish harbors are dominated by municipal ownership and limited working-times which gives higher costs than private 24-7 harbors"

Regarding imports from Russia in the last five years four fifths of the respondents say that there has been an increase. The conditions are the opposite regarding the companies that are importing bio-fuels from Russia today. Only one fifth are sure that they will import more from Russia in the future and the rest are unsure.

The opinions regarding the raised customs in Russia on round-wood and the effect on the trade differ between the responding companies. Of the five companies that answered the question the distribution became as presented in Figure 15.

Effect on trade	Distribution
No opinion	1
Very much	1
Much	0
Not so much	1
Not at all	2

Figure 15: Effect on trade from raised customs in Russia

Companies that import much round-wood from Russia have probably been more affected than companies that import little or no amounts at all. Two companies commented this question. One company said, "That the respite of one year concerning the second step raises in customs is a relief". The other company claimed that, "The Russian export of timber is heavily

damaged by the customs. Wood stays in the forest and gets destroyed and the production decreases. If Russia was an investment-friendly country, Russian and foreign investors would solve this which will not happen with high customs".

Regarding the probability for the different companies that do not import wood fuels from Russia will do so in the future the opinions differs a lot.

Probability	Percentage
Do not know	22.7%
Very unlikely	22.7%
Unlikely	27.3%
Likely	22.7%
Very likely	4.6%
Total:	**100%**

Figure 16: Future imports of wood fuel from Russia, non-importing companies

Two companies made comments to this question regarding factors that decide future imports. One company stated that, "It depends on how the supply and demand situation on the Swedish market develops and which fuels we will be using in the future". The other company states that, "It depends on the future development of the customs system. It is hard to see that we will aim for larger flows because the source is so arbitrary. The uncertainty in political decisions makes it hard to bet on large-scale imports. Corruption is a lesser problem for us. It also depends on how the fuel price in Sweden changes in the future."

A large majority of the companies believed that more wood fuel will be imported from Russia in the future compared with today.

Probability	Percentage
Do not know	8.8%
Very unlikely	4.6%
Unlikely	3.4%
Likely	56.8%
Very likely	26.4%
Total:	**100%**

Figure 17: Future increase of wood fuel trade with Russia

One company commented that Russian authorities have to show more interest in the production and trade of bio-fuels or the export will not increase.

6.1.2 Canada

Only two companies in the survey were importing bio-fuels from Canada and both of them were only importing wood pellets. The import from Canada stood in both cases for between 0-10% of their total fuel consumption. The respondents were asked to rank different factors concerning bio-fuel trade with Canadian companies on a scale between 1 and 5 where the highest number represented the highest grade regarding that factor. The companies ranked the factors assets, quality, logistics and reliability among suppliers as 4 or 5 while price only got 2 from both respondents.

The companies had different opinions regarding more import from Canada in the future where one company was sure they would increase their import and the other unsure. One of the companies had increased their total import the last years while the other went in the opposite direction.

Regarding the probability for the different companies that do not import wood fuels from Canada today most companies seemed skeptical and unsure of import in the future.

Probability	Percentage
Do not know	18.2%
Very unlikely	27.3%
Unlikely	40.9%
Likely	13.6%
Very likely	0%
Total	**100%**

Figure 18: Future import of wood fuel from Canada

The companies that did not import wood fuels from Canada today neither believed they would do so in the future. A majority of the companies thought that it is likely or very likely that the total import to Sweden from Canada will grow in the future even though one company mentioned that high shipping rates strongly talks against this.

Probability	Percentage
Do not know	21.7%
Very unlikely	4.4%
Unlikely	17.4%
Likely	43.5%
Very likely	13.0%
Total:	**100%**

Figure 19: Future increase of wood fuel trade with Canada

6.2 Wood fuel trade in Denmark from Russia and Canada

The total production of pellets in Denmark 2008 is estimated to 50 000 tons which is far from the capacity of 500 000 tons. This has led to more import of pellets that in total most likely exceeded 1 million tons in 2008 (The Bioenergy International, no 6 dec 2008).

None of the Danish respondents were importing any kind of biofuel from Russia or Canada. The nine respondents were also unsure or negative towards importing from the two countries in the future. The only significant result that can be concluded from the answers is that it is more probable that future import of wood fuel to Denmark will come from Russia and not from Canada.

6.3 Interviews

6.3.1 Canada

The CEO of *EFO AB*[16]*,* Mr Johan Petrelius stated that they have had good experiences regarding importing pellets from Canada which they did for many years from the two largest pellet-producers in British Colombia. When the shipping-prices reached an all time high they had a long-term contract which saved them from most of the costs but extending the contracts was considered too risky and cheaper alternatives existed. Because the price of shipping the pellets is such a large part of the final price, the importer and the producer in general constructs a contract in which the producer will stand for a raise in shipping-prices until a certain level after which both parties share the exceeding cost. The raise that came with a couple of hundred percent made the final price higher than the other alternatives. Because the prices of shipping vary the risks became too high. Petrelius said that import from Canada today is "...hopeless to implement". He does not believe in a Canadian pellet export in the future although large scale export to coal power-plants with Panamax boats to other countries will probably grow. This is an opinion shared by Mr. Gunnar Petersson from energy utility *Göteborg Energi*, responsible for buying bio-fuel, who has the same experiences regarding importing pellets from Canada. Mr. Anders Sundelin from another company that earlier were importing pellets from Canada are states that they ended their contract three years ago because their distributors could not deliver due to high shipping costs. His opinion was that it is always a high risk involved with overseas trade but it is not impossible that they will start importing pellets from Canada again in the future.

According to Ms Agneta Filén from energy utility *Vattenfall AB* no import from Canada to Sweden is conducted today. A smaller amount of the import to Denmark is from Canada and in large ships. They are constantly in contact with Canadian producers and she belived that the import would continue. So far Vattenfall has been satisfied with the suppliers in Canada.

A company outside Sweden and Denmark that is planning to buy wood fuel from Canada is the Norwegian company *BioWood*. Mr. Torgheir Markhus is in charge of buying wood chips to *BioWood's* pellet factory in Averoy, Norway. The pellet factory in Averoy will have an annual production capacity of 450,000 tons which makes it one of the largest plants of its kind in Europe. They will in the initial stage import all wood chips and are discussing three main supply countries, one of which is Canada, in spite of the neccesity to heat treat the wood chips. Russia has not yet been discussed but Markhus do not believe it is impossible that Russia will be an alternative in a later stage. The plan is to only use Norwegian wood in the future.

6.3.2 Russia

Biofuel trader Leopold Malmkvist from *EFO AB* says that the Russian market doesn't look too good today. There are tremendous amounts of good wood and the potential is remarkable but fundamental problems in Russian society regarding politics, bureaucracy and logistics makes the trade difficult. His experience is that the Russian society is very top-bottom and in the lower layers of society few initiatives are taken. Besides this, the bureaucracy is difficult and the police and customs officials make the trade difficult. Approximately 0.5 million Swedish kronor (approx 47 000 EUR) is paid each month in bribes in the port of St: Petersburg to make the transports smooth. His experience is that Russia is a corrupt society but with tremendous resources. The political elite has made the custom on round wood high to get investors but "...if Russian investors are unwilling to invest, why should foreign investors

[16] EFO AB buys and distributes fuels for a number of Swedish CHP-plants

dare?" The main difficulties in trading with Russian companies are bribes to the customs officials, the badly maintained harbor of St. Petersburg and rogue trade partners. Most distributors are registered in tax havens and will not handle credits. Furthermore they tend to ask many companies and choose the one that pays best at the time. Malmkvist also feels that the distributors have unrealistic expectations on profits where the minimum earnings demand seems to be at least 15 % but often more. For the moment he is tired of the conditions in Russia and is unsure if the trade will continue. The trade with Russia is at this stage mostly strategically with the aim to have partners and supply networks if trade with Russia will be necessary in the future and he feels that other Swedish importers have the same opinion. Leopold doubts that large scale import from Russia will be a reality in the near future because the problems today are coming from above in the system. He takes IKEA as an example where a large multinational company did not succeed in overcoming the corruption and bureaucratic system in Russia and wonders if much smaller actors on the bio-fuel trade market has a chance if IKEA does not have one.

Another actor on the market that have more positive experiences of trading with Russia is the company *Fortum AB*. Mr. Jonas Torstensson is in charge of importing firewood and wood chips from Russia and the trade has this far been satisfactory. They have been working with the same intermediary in Russia since they started operating on the Russian market. The prices in Russia are comparable with other alternatives but the fluctuations of the currencies ruble, euro and the Swedish crown are a minor problem. *Fortum* is not using any of the Russian ports for the trade. Instead they are using the Russian river system to transport the wood from Russia to Swedish ports. This has so far been working satisfactory but sometimes 2-3 year old fire wood is in the shipments which seem a bit strange given the large amounts of fresh wood available in Russia. The amounts of old firewood are however small and have not been a problem. The largest problem is the customs controls of the wood in Sweden especially when more than one shipment arrives at the same time which makes the time delay longer. The controls take approx. 10 days for every shipment and they have about 50 shiploads annually from Russia. One disadvantage with using the river system is short delivery seasons because of the long Russian winter, which leads to many ships in line for controls in Sweden. To get the season longer they are considering using the port of St. Petersburg in wintertime, still using the same contacts in Russia they are using today.

Fortum AB is also importing wood pellets in rather large quantities from Russia. They are importing approx 100,000 tons annually from both North Western Russia and from other parts of Russia. They are using both Russian middle-hands but are also conducting direct trade with Russian pellet-plants. The main problem according to Mr. Kjell Nilsson at *Fortum AB* is the capacity and logistics in the Russian harbors. The company also feels an uncertainty regarding future export fees from Russia. The wood pellets are cheaper than buying from Sweden even with transport costs, and the company would increase their import if it was possible which it is not today.

Fortum AB, *Vattenfall AB* and *EON AB* are the largest energy-companies in Sweden and considered to be the "energy giants". *EON Sweden* is - according to Mr. Henrik Nilsson, process owner fuel - not importing any fuel from either Russia or Canada and does not have any intentions to do so in the near future. According to Filén *Vattenfall* is not at the moment importing bio-fuel from either Canada or Russia. This means that only one of the largest actors on the Swedish market currently is importing from Canada or Russia.

Mr. Lars Ahlblom from *Fortum AB* is also importing fire wood and wood chips from Russia.

He lived in Russia for many years before moving back to Sweden. *Fortum AB* is using intermediaries and does not have any direct contact with the producers. They have been experiencing different problems related to imports from Russia. The port of St. Petersburg has high loading charges as well as hidden charges. The logistics inside Russia are poor and the distributors have to pay for this. The price of fire wood and wood chips from Russia is the same as from other exporting countries but loading comes with a much higher cost. Different fees and certificates in combination with bribes to custom officials make import complicated. The resources in Russia are described as "fantastic" and the trade in a long term may go smoother than today. His experience is that there are few Swedish actors that are successful in trade with Russian actors more than one season. Trading with Russian partners is according to Ahlbom always a high risk project and often demands a lot of capital. One of the risks with Russian actors is that if they are not satisfied, they can change customer in the middle of a contract if something more lucrative appears. It is important to be a good and responsive customer when trading with Russian actors. Even though there are difficulties he knows about several actors on the Swedish market that are looking towards the Russian market. Ahlbom believes that imports from Russia will grow in the future because of the expansions in both Sweden and Denmark. In 2008 and 2009 cheap and large amounts of wood have been available because of storm fellings in France. Earlier the fellings from the storm Gudrun made large quantities of cheap wood available on the Swedish market. This may imply that Swedish actors soon must import more fuel wood from Russia especially when the tendencies from the Baltic States is that they cannot produce more wood fuel, according to Ahlbom.

According to Mr. Anders Sandelin from energy utility *Öresundskraft* they are importing approx. 20 000 – 25 000 tons of pellets from Russia annually. The price has been acceptable but they have had problems with bad business ethics and bad quality of the pellets. Despite these problems, however, they will continue the trade with Russia.

Sveaskog AB is a rather large importer of wood- fuel and chips from Russia through the port of St Petersburg. They are using a strategic Russian partner and do not have an organization in Russia, which they have in the Baltic States. The usual practise is to fill up ships with wood chips and load the deck with fire wood. Mr. Paavo Valhonen, former responsible for Russian activities on *Sveaskog AB,* finds the Russian bureaucracy hard to penetrate. However their largest problem is to find place in a Russian port and it is a must to have a long-term contract in a harbor. Before the financial crisis it was hard to get a place in the St Petersburg port for low value commodities as wood chips but for now the conditions are rather good. In general the Russian harbors are too few and expensive but there are also problems with getting the commodities to the ports because of poor logistics inside the country. Another problem is the hard controls of the wood in Swedish ports which causes a delay of 2-3 weeks. This makes large-scale imports hard and Valhonen thinks that the Swedish controls are a larger problem than the Russian ports. He takes Finland as a good example where samples of the wood are taken in the ports but it is possible to transport the wood for storage somewhere else than in the harbor.

The Swedish company *Ekman & Co* will be handling the logistics from what will be one of the largest wood pellet factories, situated in Viborg. Mr. Jonas Granath is in charge of the operation and believes that the factory will operate at 80% of its full capacity which will lead to the transportation of 720 000 tons of pellets annually. Besides logistics the company will be responsible for marketing and customer contacts. The harbor of Viborg is rather small and the shiploads will be around 5000 tons. The main track is to ship the wood pellets to the UK, the Netherlands and Belgium where a lot of wood pellets are consumed for co-firing in coal

plants. The Swedish district heating plants are also believed to be large customers.

6.4. Estimations of wood fuel potentials

6.4.1 Resources Canada

A presentation regarding different estimations found in literature is listed below:

Harvests	
182 million m^3 total harvested wood	Natural resources Canada 2007
207 million m^3 annual allowable cut	Natural resources Canada 2007
Biomass potential	
316-774 PJ/year (total biomass potential)	Gerasimov & Karjalainen 2009
0.72-1.44 EJ/year (total biomass potential)	Wood & Laysell 2003
123 million BDt/year (unutilized biomass)	Bradley 2006
Residues surplus	
0.1 EJ/year	Wood & Laysell 2003
2.7 million BDT/year (2005)	Bradley 2006
550,000 BDt/year	Bradley 2009
Wood Pellets	
2 million tons (capacity)	Bradley 2009
1.77 million tons (capacity)	Spelter & Toth 2009
1.4 million tons (actual production)	Bradley 2009
20 million tones/year (highest possible production)	Bradley 2009
15 million tones/year (highest possible production)	Swaan 2009
850,000 tones (overseas export 2009)	Bradley 2009
3.1 million tons/year (projected production Canada 2015)	Swaan 2009
24.8-60.9 PJ/year (projected production BC 2012)	Verkerk 2008
50-218 PJ/year (projected production BC 2020)	Verkerk 2008

Figure 20: Estimations of wood fuel potentials in Canada

Canada harvests a large part of the countries annual allowable cut as a result of a well developed forest industry. The production of wood pellets is lower than the actual production capacity and a large part of the produced wood pellets is shipped overseas. The highest possible production is estimated to somewhere between 15-20 million tones/year.

6.4.2 Resources Russia and North-Western Russia in specific

A presentation regarding different estimations found in litterature is listed below:

Harvests	
540 million m^3 (annual allowable cut in whole Russia)	Russian forests and forestry 2005
91 million m^3 (annual allowable cut NW-Russia)	Brukhanov 2003

131 million m^3 (actual harvest harvest Russia)	Russian forests and forestry 2005
37 million m^3 (actual harvest NW Russia)	Brukhanov 2003
Biomass potential	
223 PJ (NW Russia)	Gerasimov & Karjalainen 2009
274-554 PJ/year (NW Russia)	Antilla et. al 2009
1440 PJ/year (Whole Russia Russia)	Hansen et. al 2006
Wood Pellets	
2 million tons/year (capacity)	Rakitova & Ovsyanko 2009
650,000 tons/year (actual production)	Rakitova & Ovsyanko 2009
455,000-550,000 tons (export to Europe 2009)	Rakitova 2009
327,000 tons (exports to Europe 2009)	SCB 2009, Alexandrova 2009
10 million tones/year (possible production NW Russia)	Rakitova 2008
35 million tones/year (possible production Russia)	Rakitova 2008, Karjalainen 2009

Figure 21: Estimations of wood fuel potentials in Russia and North-Western Russia

Russia only harvest about a fifth of the countries annual allowable cut which makes the biomass potential in the future very large. The estimations of Russia's biomass potential is not surprisingly larger then for Canada because of the large forest areas in the world's largest country. The production of wood pellets is about half as much as in Canada. Most of the production is exported to Europe which is similar to the Canadian case. The highest possible production of wood pellets is estimated to 10 million tones/year in North Western Russia and 35 million tones/year for the whole country.

7 Conclusions and discussion

7.1 Canadian wood pellet exports

The import of pellets from Canada to Sweden in 2009 seemed to have stalled completely. From Swedish Statistics the information is clear; no amount of import of pellets from Canada took place at all during 2009. The largest import of wood pellets to Sweden was from Russia but the numbers shown in the statistics seemed to be lower then the reasonable actual import. The Statistics Sweden confirms that the import category ”wood pellets” is completely new and the quantities showed may be unsure because the importers still may place them in older categories of wood. The numbers should therefore be taken with caution but they still show qualitatively which countries Sweden import from and also which the biggest export countries to Sweden are. Russia is definitely one of them whereas Canada, which previously has been the largest exporter to Sweden, seems to have vanished. In the study only two Swedish companies claimed that they imported wood pellets from Canada and they had recently ended the cooperation with their Canadian partners because of high prices and high risks regarding fluctuating sea transport prices. The Swedish companies did not seem to believe in a larger import in the future. Only 14% of the companies believed it was likely that they would import wood pellets from Canada in the future.

The historically high shipping prices in 2007-2008 seem to have made the Swedish companies reluctant to continue the contracts with Canada. Swedish CHP utility *Öresundskraft*, which was one of the largest importers of Canadian wood pellets, claimed that it was possible that they would start importing again in the future if the right deals came up, which may imply more trade in the future. The large quantities of wood pellets that usually arrive in Panamax carriers demand a large and continuous consumption in the organization to avoid high warehousing costs. The high price of shipping and storing makes Canadian pellets more expensive than other alternatives for the Swedish companies. The existence of coal plants in the Netherlands, Belgium and the UK and the use of co-firing which demands large amounts of wood fuel is an emerging market. The large quantities of wood pellets transported with Panamax ships to these countries seem to be profitable enough for the buyers.

7.2 Barriers to Canadian export to Europe

Because the major part of the wood pellet production in Canada is in British Colombia the main barrier is the distance to the buyers. Even when trade is conducted from the East-coast of Canada this does not necessarily make the shipping costs lower. This is mainly because the ships used when transporting wood pellets are much smaller than on the West-coast. A larger rate of traffic could mean higher traffic and larger ships which would lead to lower shipping prices than in British Colombia. Today the trade from British Colombia to Europe is highly dependent on the freight rates on Panamax ships. The trade to Belgium, the UK and the Netherlands seems to be feasible today but the prices on wood pellets will probably go up when the world economy rises again. The high freight rates before the 2008 crisis have made Swedish companies reluctant to import wood fuels from Canada and the future will tell how high the rates can go again before the large energy companies that co-fire wood pellets find the costs too high in comparison with coal. The large size of the ships and the large storage facilities needed also makes a lot of harbors in Europe insufficient for handling Canadian West coast wood pellet import.

Today none of the barriers regarding the Canadian wood fuel trade reminds of the Russian problems. The harbors and logistic system are highly developed for wood pellet trade and the companies trading wood pellets are as trustworthy as any West European company both regarding business morale and way of making business. There are other factors besides the long distance transports may make the flow of wood pellets to Europe stay the same as today or even decrease even if the production increases. Firstly there are strong incentives to start using wood pellets for energy purposes in Ontario which both is the most populated area in Canada and the one most dependent on coal energy. While no incentives in Russia seems to be taken for domestic use of wood pellets the opposite seems to be a reality in Canada. Furthermore the US easily could take over the trade flows that now go to Europe if co-firing in coal power plants would be profitable because of political influence. Almost half of the energy production in the US consists of coal power today. The shorter distance especially to the west coast of the US from British Colombia would make this trade more feasible. Not in the spectrum of this report but worth mentioning is an evolving wood pellet industry in the US which is starting to show in rather large trade flows to Europe. On top of this many analysts see Asia as a larger wood fuel market than Europe in the medium or long term? future which certainly would increase the trade flows from Canada in another direction than Europe. It is therefore difficult to see Canadian wood pellet exports to Europe as a roof for how high the prices on wood pellets can go because it is very unsure if an increasing production in Canada is destined for European shores.

7.3 Russian wood fuel export

Firstly there is a big difference between the trade patterns regarding wood fuels from the different countries. From Russia both fuel wood, wood pellets; wood chips and peat are imported while the Swedish companies that until recently have been importing wood fuel from Canada only imported wood pellets. One reason is the costs of heat-treatening etc that is necessary to guarantee that the wood are not infested which is not necessary for wood pellets. Furthermore all wood has to be controlled by the Swedish Agricultural Authorities. Another reason is the lower energy density of other wood fuel than pellets. Wood products from Russia are also hardly controlled in the Swedish harbors but not as hard as the Canadian because of no proof of pests and fungus contaminating European forests so far. Swedish importers of wood chips and fuel wood estimate the time their shiploads is delayed in the harbor to be 10 days for smaller loads and 2-3 weeks for larger. One company mentioned that they are planning to use the port in St. Petersburg to make the transport season longer because they are currently using the flood system for transport. This is mainly because of the extra delays that appear when several boats arrive to Sweden on a short period.

Regarding the price of wood fuel from Russia the opinions go apart among the companies in the study. In general the prices seem to be average but some producers pay a higher price and some a lower than for comparable Swedish wood fuel if transports are included. This may depend on both the amounts imported but also hidden costs that may appear. The companies in the study seem satisfied with the availability of Russian wood fuel but less satisfied with the Russian logistic system and the reliability of their Russian partners. Problems with wood fuel delivered that have a worse quality than granted also seems to be a common problem.

Compared to Canada importing wood fuel from Russia seems to demand more effort from the importer. In the case of Canada the general procedure is to sign a long term contract with a company in Canada in charge of the whole logistic chain from the forest to the Swedish harbors. The Russian structure with a lot of small producers has made the use of

intermediaries natural. The common way of conducting trade often seems to be deliverance to the harbor of St Petersburg where the importer takes over the logistics.

7.4 Barriers to Russian export to Europe

The resources in North-Western Russia can only be considered to be resources if they are accessible. The Russian customs on round wood has heavily damaged the trade and today the Russian wood industry is not capable of consuming the allowed cut in the region. The wood pellet industry is today heavily dependent on saw dust which demands a large and working wood industry to gain growth. The pellet factory in Viborg will have the possibility to produce pellets from round wood which makes the problem smaller.

It is highly unlikely that Russia in a near future will use its own wood fuel and the industry is almost exclusively focused on export to Europe today and this most certainly will be the case also in the future. During 2009 foreign companies also invested in the wood pellet industry. The construction of the world's largest wood pellet factory in Viborg is also a large-scale investment that is made by a Russian company. This may also imply that the market can reach more maturity if not dominated by a lot of small producers and trade-organizations that works as middle hands. The use of a European logistic company for both transports and marketing may also be a way to make the business dealings more comfortable and secure. The use of the harbor in Viborg is also a way to avoid the large problems in the St Petersburg harbor. Besides this positive indicators Russia is facing large obstacles before becoming a large and secure wood fuel supplier to Europe.

The barriers to Russian wood fuel export can be divided into two groups, one concerns the logistics and the other is institutional. The institutional barriers are not restricted to the wood fuel exports but a problem that concerns all business activities in Russia.

The most common barrier that was mentioned in the survey was the harbor of St Petersburg that was considered to be the largest "bottle-neck" regarding wood fuel trade with Russia. The only factor that was ranked as more problematic in the questionnaire survey than logistics was the reliability of suppliers. In addition to the harbor the logistics inside Russia is old fashioned and some importers of Russian wood fuel have had problems getting the commodities to the harbor. Delays due to the bad roads in Russia were a problem mentioned by Swedish traders of wood fuel as well as the inability of many roads to carry heavy loads leading to smaller trucks and higher costs. The problems regarding the harbor is to a large extent a consequence of old-fashioned loading facilities but also low capacity in relation to the demand which makes the priority concerning low value commodities as wood pellets very low. During the economic recession Swedish importers have experienced it easier to get loading space in the harbor but it will probably change during an upturn in the economy. Another problem that is not harbor dependent is the use of big-bags for inland transports. Beside the cost of re-loading wood pellets to bulk they have a tendency to break both when loaded into train wagons and when handled in the harbor. Even if the bags do not break the handling and loading becomes more expensive. In comparison with Canadian harbors in British Colombia no investments have been made for a sufficient loading and storage of wood pellets. This makes the handling and loading more expensive. Even though the harbor is slow and old-fashioned the importers consider the harbor to be expensive. In addition to this, "hidden fees" are common to make the loading go smooth.

Other problems are related to the reliability of the suppliers which were considered to be the largest problem in the study regarding wood fuel trade with Russian actors. Russian

companies are often reluctant to leave quotes and prefer bids from buyers. If a contract is signed this do not guarantee delivery precision, if another actor pays more the contract may easily be broken. Another problem that was revealed in the study was the presence of lower quality wood fuel than promised, sometimes in the middle of a contract. The common view seems to be that actors in Russia lack business moral. Besides the structural problems regarding the harbor of St Petersburg corrupt custom officials seems to be a problem as bribing often is necessary to get the commodities from the harbor in a smooth way.

If a Swedish district heating plant that starts importing wood fuel from Russia they have probably never been in contact with corruption to the high extent which is the case in Russia. In a country where almost every company is affected by corruption to some extent and the hidden economy corresponds to a third of the country's GDP it is crucial to be aware of this. The high pervasiveness and arbitrariness in Russia makes it hard both to foresee the corruption and to avoid it when it occurs. Both in literature and in the survey the factors patience and financial strength are considered very important when doing business in Russia. The problems with bribing and corruption are something that European companies buying wood fuel from Russia have to struggle with for a long time as there are no signs of a decrease regarding this.

Companies importing wood fuel describe the situation in the Swedish harbors stressing because of the time consuming controls. It is of great importance that no new pests comes to Europe but possibilities to transport the commodities to another place than the harbors would make the controls cheaper for the importers.

7.5 Wood fuel prices and quality

There are no signs that an increased import from Canada and Russia should affect the general quality of wood pellets in Europe. Both countries are mainly trading industrial wood pellets where the quality is not as important as regarding high quality wood pellets. In the study no signs of Canadian wood pellets having a lower or higher quality than European have been seen. A lower quality than promised seemed to be a minor problem regarding trade with Russia but it can probably be explained by an immature market. The general opinion seems to be that Russian wood fuels have good quality.

If there is a lack of easy accessible raw material in the European countries the price of wood pellets will most likely be more expensive. Opinions regarding the importance of raw material differ between 30-45% and the price could easily go up if the demand for wood pellets continues in the same pace as today. In this situation it is possible that Canada and Russia might have an advantage towards European producers, at least initially, and might keep the prices down. The easy accessible raw materials in these countries are not endless and they would soon have to follow the European producers regarding more expensive raw material.

Hillring (1999b) came to the conclusion that the wood fuel prices in Sweden were not affected even though the demand became higher due to good wood supplies. This is of course the case if the demand not exceeds the supply. An increasing demand will lead to a utilization of more difficult resources and higher marginal costs. Difficult resources may both mean more expensive to transform to wood pellets and long distances. If the hypothetical speculations of a consumption of 130-170 million tons of wood pellets in 2020 (Antilla et. al, 2009) will come true the supplies in many countries will most certainly be severe in compare to the demand. Some experts see Russia and Canada as one of the main factors for a decrease in the

wood pellet price. Some even claim that the potential of increased trade with Canada can be seen as a roof for how high the wood pellet price in Europe can go.

It may be riskful to put to high confidence in Russia and Canada regarding an increase in import to keep the prices down. In the case of Canada higher transport costs may easily make it very costly for the buyers in Europe to import wood pellets, this was the case in Sweden in 2008. Furthermore other parts of the world as Asia and the US are likely to increase their wood pellet consumption which will increase the competition for Canadian wood pellets. Another scenario is that the previously mentioned incentive in Ontario will result in even more national consumption which also threatens the flows to Europe. It is highly doubtful that Russia will increase its own wood pellet consumption on a large scale and their wood pellet industry will likely be dependent on exports to Europe in the future. In the case of Russia the barriers to an extended trade is of another character than in the case of Canada as mentioned earlier. Looking at today's trade Russia has many problems before becoming a wood pellet exporter to count on.

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Appendix A – The letter

Enkätundersökning – Ryssland och Kanada som leverantörer av biobränsle

EU-länderna har kommit överens om att kraftigt minska användningen av fossila bränslen. Om detta ska ske krävs det bland annat att biobränsle kan importeras på ett bra sätt för att målen ska kunna uppfyllas. Under de senaste åren har ett flertal EU-länder börjat importera fasta biobränslen från framförallt Ryssland och Kanada, som har stora potentiella tillgångar på biomassa.

Då kunskaperna om denna handel är bristfällig så utförs nu denna enkätundersökning som en del i EUBIONET III, www.eubionet.net, som är ett EU-finansierat projekt som arbetar för att främja handel med biobränsle. Utan just er medverkan går det inte att undersöka hur handeln ser ut, hur stor den är samt vad som går att göra för att främja den. Undersökningen är helt anonym och meningen är inte att detaljstudera enskilda företag utan den svenska marknaden som helhet. Om ni vill ha tillgång till det färdiga arbetet innehållande undersökningen så bocka för detta i enkäten. Om det råder några oklarheter rörande enkäten så hör gärna av er, kontaktuppgifter står nedan.

Enkäten finnes:

http://enkater.slu.se/svara.cfm?sv=1250-Bioenergi (Klistra in länken i webläsaren om den inte fungerar)

Tack på förhand för er medverkan!

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Appendix B – The questionnaire

Import av Biobränsle - Ryssland och Kanada som leverantörer

Syfte

Detta är en del i EU-projektet EUBIONET3 som bland annat syftar till att underlätta internationell handel med biobränsle. Syftet med enkäten är att skapa kunskap om Ryssland och Kanada som exportörer av biobränsle till Europa.

Ansvarig utgivare

Anders Dahlberg, SLU

1 Allmänna uppgifter

1.1 Vilket företag arbetar ni på?

Denna fråga är endast till för att se vilka som besvarat enkäten. Alla enkätsvar kommer att behandlas anonymt.

1.2 Vill ni ta del av resultatet?

Skriv mailadress om så är fallet.

1.3 Hur stor är er bränsleomsättning per år?

- 0 - 50 milj. kronor
- 50 - 100 milj. kronor
- 100 - 300 milj. kronor
- Mer än 300 milj. kronor

Ev kommentar:

1.4 Hur stor del av er bränsleomsättning är importerad?

- ○ 1-5%
- ○ 5-15%
- ○ 15-30%
- ○ Mer än 30%
- ○ Vi importerar inte biobränsle (gå till fråga 4.1)

Ev kommentar:

1.5 Vilken typ av biobränsle importerar ni?

- ☐ Förädlat (pellets & briketter)
- ☐ Skogsflis
- ☐ Helved
- ☐ Returträ
- ☐ Torv
- ☐ Annat

Ev kommentar:

2 Biobränsle från Ryssland

2.1 Importerar ni biobränsle från Ryssland?

Om ni svarar nej, gå till fråga 3.1

- ○ Ja
- ○ Nej

Ev kommentar:

2.2 Vilken typ av biobränsle importeras från Ryssland?

- ☐ Förädlat (pellets & briketter)
- ☐ Skogsflis
- ☐ Helved
- ☐ Returträ
- ☐ Torv
- ☐ Annat

Ev kommentar:

2.3 Hur stor del av er bränsleomsättning kommer från Ryssland?

- ○ 0 - 10%
- ○ 10 - 20%
- ○ 20 - 30%
- ○ Mer än 30%

Ev kommentar:

2.4 Gradera följande faktorer rörande ryskt biobränsle och ryska leverantörer av detta.

	Min (dåligt)	1	2	3	4	5	*Max (bra)*
Pris på biobränsle		○	○	○	○	○	
Kvalité på biobränsle		○	○	○	○	○	
Tillgång på biobränsle		○	○	○	○	○	
Logistiska möjligheter från Ryssland		○	○	○	○	○	
Pålitliga leverantörer		○	○	○	○	○	

Ev kommentar:

2.5 Kommer ni att importera mer biobränsle från ryska leverantörer i framtiden?

- ○ Ja
- ○ Nej
- ○ Vet ej

Ev kommentar:

2.6 Har det skett en ökning rörande import från Ryssland de senaste 5 åren?

- ○ Ja
- ○ Nej
- ○ Vet ej

Ev kommentar:

2.7 Har de ökade exporskatterna/tullarna påverkat er import från Ryssland?

- I mycket hög grad
- I hög grad
- I mindre hög grad
- Inte alls
- Vet ej

Ev kommentar:

3 Biobränsle från Kanada

3.1 Importerar ni biobränsle från Kanada?

Om ni svarar nej, gå till fråga 4.1

- Ja
- Nej

3.2 Vilken typ av biobränsle importeras från Kanada?

- Förädlat (pellets & briketter)
- Skogsflis
- Helved
- Returträ

☐ Torv

☐ Annat

Ev kommentar:

3.3 Hur stor del av er bränsleomsättning kommer från Kanada?

○ 0 - 10%

○ 10 - 20%

○ 20 - 30%

○ Mer än 30%

Ev kommentar:

3.4 Gradera följande faktorer rörande kanadensiskt biobränsle och kanadensiska leverantörer av detta.

	Min (dåligt)	1	2	3	4	5	*Max (bra)*
Pris på biobränsle		○	○	○	○	○	
Kvalité på biobränsle		○	○	○	○	○	
Tillgång på biobränsle		○	○	○	○	○	
Logistiska möjligheter från Kanada		○	○	○	○	○	
Pålitliga leverantörer		○	○	○	○	○	

Ev kommentar:

3.5 Kommer ni att importera mer biobränsle från kanadensiska leverantörer i framtiden?

- Ja
- Nej
- Vet ej

Ev kommentar:

3.6 Har det skett en ökning rörande import från Kanada de senaste 5 åren?

- Ja
- Nej
- Vet ej

Ev kommentar:

4 Framtiden

4.1 Hur troligt är det att ditt företag kommer att importera bränsle från Ryssland i framtiden?

Besvaras endast av företag som ej importerar biobränsle från Ryssland idag

- Mycket osannolikt
- Osannolikt
- Troligt
- Mycket troligt
- Vet ej

Ev kommentar:

4.2 Hur troligt är det att ditt företag kommer att importera bränsle från Kanada i framtiden?

Besvaras endast av företag som ej importerar biobränsle från Kanada idag

- Mycket osannolikt
- Osannolikt
- Troligt
- Mycket troligt
- Vet ej

Ev kommentar:

4.3 Tror ni att mer fast biobränsle än idag kommer importeras från Ryssland till Sverige om 5 år?

- Mycket osannolikt
- Osannolikt
- Troligt
- Mycket troligt
- Vet ej

Ev kommentar:

4.4 Tror ni att mer fast biobränsle än idag kommer importeras från Kanada till Sverige om 5 år?

- Mycket osannolikt

- Osannolikt
- Troligt
- Mycket troligt
- Vet ej

Ev kommentar:

Tack för din medverkan!