The Swan Labelling of

Fuel

Proposal for version 1.0

Background document on the ecolabelling of fuel

Nordic Ecolabelling

1 Summary

The purpose of this document is to describe the background to the requirements proposed by Nordic Ecolabelling in the Consultation Document. This will enable applicants, consumers, public authorities and other interested parties to follow the arguments that lie behind the requirements and the way in which the requirements are imposed.

The document discusses Nordic Ecolabelling's motives in developing criteria for the ecolabelling of fuels. It also provides a general introduction into the market for fuel, the outlook for the biofuel sector and the challenges associated with the use and production of commercially available fuels and the fuel products of the future. The goal of the criteria is to stimulate the development of fuel products that are more climate adapted. Also included are requirements aimed at preventing Swan-labelled fuels from causing other environmental and health-related problems.

The requirements relating to emissions of greenhouse gases and energy consumption are imposed on the basis of a life cycle perspective. This means that all emissions and all energy consumed, from raw material production until the product is used, are included in the calculations. The data underpinning the requirements are based on what is referred to in the following as the JEC Report[1)]. This report is an annual collaboration between Concawe, EUCAR and the Joint Research Center.

2 Basic facts about the criteria

2.1 Products that are eligible for a Swan Label

For a fuel to qualify for a Swan Label, 50% or more of the raw materials used in production must be renewable. In this context, Nordic Ecolabelling defines renewable materials as biological materials that are reproduced in nature within a time frame of 100 years. The degradable fractions of products, waste and residue from agriculture and fisheries (both vegetable and animal products), sustainable forestry operations and similar industries and the biologically degradable fraction of industrial waste and municipal waste are also defined as renewable.

Animal oils from species on the IUCN's Red List of Threatened Species are not regarded as a renewable resource. In the case of animal waste fractions, only material classified in Category 2 and 3 of the Animal By-products Regulation (EC 1774/2002) may be used as materials in the production of a Swan-labelled fuel.

In practice, this means that in the case of fuel products comprising a blend of fossil fuel and biofuel, the applicant must be able to document that the portion of biofuel is 50% or more on an annual basis. Thus, a mixture of 51% natural gas and 49% biogas will not be eligible for a Swan Label.

In order to qualify to carry a Swan Label the product must fulfil all the requirements applicable to the ecolabelling of fuel. These include requirements relating to emissions of greenhouse gases, energy consumption, the traceability of raw materials, the use of certified raw materials, emissions of gases during the driving phase that are harmful to health and quality. When energy consumption and greenhouse gas emissions are calculated for products, a life cycle perspective must be adopted. This means that emissions and energy consumption throughout the entire product chain – from raw material production to use – must be included in the accounts. Values for greenhouse gas emissions and energy consumption must be related to distance driven.

The finished commercial product as well as the ingoing components in a fuel mix may be eligible for a Swan Label. In the first case, marketing will be directed at consumers and the Swan Label may be displayed on, for example, fuel pumps and in advertising campaigns. In the second instance, the manufacturer of the component may use the Swan Label as a sales argument when approaching producers of a fuel blend. However, in the case of a fuel blend containing a Swan-labelled component, the Swan Label cannot be used in marketing aimed at consumers unless the finished product also fulfils all the requirements applicable to a Swan-labelled fuel.

2.2 Motives for Swan-labelling

In its Fourth Assessment Report from 2007, the UN Panel on Climate Change (IPCC) concluded that it is very likely that human emissions of greenhouse gases are responsible for most of the observed increase in global temperature since the mid 1900s.

Indications of this include the fact that the average global temperature has increased by some 0.74°C over the last 100 years and that the frequency of heavy precipitation has increased over most areas of land. The concentration of carbon dioxide (CO_2) has risen by approximately 31 per cent since pre-industrial times (around 1750). This increase is attributed to man-made emissions and has resulted in a heightened greenhouse gas effect. The man-made emissions of CO_2 are ascribed primarily to the use of fossil fuels (coal, oil and gas) and to deforestation in tropical regions[2)].

The use of fossil fuels releases CO_2 from resources that have been stored for millions of years, and that do not form part of the cycle in which CO_2 is bound up today. Thus, the use of fossil fuels results in a net injection of CO_2 into the atmosphere.

Biofuels contain carbon which when combusted in engines creates CO_2 and CH4 which is then released into the atmosphere via exhaust gases. The CO_2 is absorbed by plants through photosynthesis. These plants form part of the same cycle as the cycle in which the fuel was originally produced. Thus, the use of biofuels results in no net increase in CO_2 in the atmosphere.

The transport sector is responsible for a considerable portion of emissions of greenhouse gases in the Nordic countries. In Norway, the transport sector accounted for 22% of total emissions of greenhouse gases in 2005[3)]. One way of halting and reversing this trend is to increase the use of biofuels.

The European Union's Biofuels Directive of 2003 recommends that by 2010, 5,75% of all fuel sold should be based on biological raw materials[4)]. International targets of this nature, combined with rising fossil raw materials prices, give impetus to the market for biofuels. In 2006, worldwide production of biofuels increased by 28%[5)] and over the coming years it is expected that a great number of operators will attempt to establish themselves within the production and distribution of biofuels. In this market, there will be a need for an independent party that can assess the products and offer consumers guidance on the question of how environmentally-friendly the products in fact are. Nordic Ecolabelling wishes to play the role of this independent third party.

Thus, in developing requirements for the ecolabelling of fuel, Nordic Ecolabelling wishes to play a part in the movement towards fuel alternatives that are more environmentally-friendly. Specific requirements apply to the levels of greenhouse gas emissions permitted for a fuel to be eligible for a Swan Label. In addition, requirements are imposed on energy efficiency.This too can be viewed as in indirect requirement applicable to emissions of greenhouse gases.

Other requirements applicable to Swan-labelled fuels are included to ensure that environmental benefits associated with these products are not gained at the expense of other environmental problems. For example, Swan Labels should not be awarded to products which offer environmental gains in terms of greenhouse gases, but which also contribute to environmental problems in the form of the felling of rain forest or extensive emissions of substances that are harmful to health during the driving phase.

It is also important to ensure that the quality of an ecolabelled fuel is such that it does not damage the engines in which it is used. The fulfilment of acknowledged fuel standards helps to ensure that this is the case.

2.3 Version and validity of the criteria

This is the first version of the criteria document for the Swan-labelling of fuel. The criteria will be valid for a period of XXX year (the period of validity will be determined later in the criteria development process).

2.4 About the criteria development process

The project for developing criteria for the ecolabelling of fuels commenced in January 2007. Prior to this, a preliminary study had been conducted to evaluate the scope for and consequences of developing criteria for this product group. Lena Rogemann headed the project until the middle of March 2007, at which point Marte K. Thommesen took over. Karin Bergbom from Finland has functioned as area coordinator throughout the process. Other project personnel: Svante Sterner from Sweden, Thomas Christensen from Denmark and Tormod Lien from Norway. Hannu Mattila was the Finnish representative up until May 2007.

The data underpinning the requirements applicable to emissions of greenhouse gases and to energy consumption were compiled by consultant Maria Grahn at Chalmers

University, Division of Physical Resource Theory. She based her report on the JEC Report [1)]. Her report, entitled ”Ecolabelling fuels for transport with the Swan Label”, is referred to this in this background document as the consultant’s report [6)].

During the consultation period, the requirements applicable to emissions of greenhouse gases and energy consumption will be tested in four pilot schemes. This includes a Norwegian producer of biodiesel based on rapeseed.

The project group was also contacted a number of interest organisations and the industry as a whole during the development of the criteria.:

- Ecofuel/Ecopar: At present produces synthetic diesel based on natural gas. However, will probably switch to bio-based raw materials in the future.
- Oslo City Council.
- BV Energy: Norwegian producer of RME.
- Zero: Norwegian environmental organisation with extensive expertise within biofuels.
- Nobio: Norwegian Bio-energy Association.
- Habiol: Has initiated a pilot scheme in cooperation with Borregaard to produce biodiesel based on forestry raw materials.
- Hynor: Hydrogen project under the auspices of Hydro and Zero.
- Bergfald: Norwegian consultancy firm within environmental advisory services.
- Statoil Norway
- Dong Energy: Danish producer of bioethanol based on wheat.
- Daka Energy: Danish producer of biodiesel based on slaughterhouse waste.
- Eco Center: Danish producer of bioethanol based on straw.
- Emmelev Mølle: Danish producer of biodiesel based on rapeseed.
- DanBio: Danish Bioenergy Association.
- The Danish Environmental Protection Agency.
- Neste Oil: Finnish producer of biodiesel based on, amongst other materials, palm oil.
- Bionova: Finnish consultants with a pilot scheme for biodiesel based on rapeseed.
- Preem: Sweden’s biggest chains of filling stations.
- Agroetanol: Swedish producer of bioethanol based on wheat.
- Gröna Bilister: Swedish interest grouping.
- The Swedish Road Administration.

3 The market for and investments in fuels based on renewable energy sources

3.1 International and national objectives

Most industrialised nations have laid plans for or are assessing the use of biofuels as a means of reducing national emissions of greenhouse gases. As has already been noted, the Biofuel Directive of 2003 indicates that by 2010, 5.75% of all fuels sold should be based on renewable raw materials [4)]. It has since been agreed that this percentage figure should be increased to 10% by 2020 [7)]. As an aid to the achievement of this goal, the European Union adopted Directive 2003/96/EC [8)] , which provides member states with scope for exempting biofuels from energy taxes. At the same time, other directives impose quantitative limitations on the amount of bioethanol and biodiesel that may be blended with petrol and diesel, respectively [6)]. Thus, one precondition for the achievement of the target of 10% biofuel by 2010 is that the limit for blending biofuels in fossil fuels must be increase in relation to current limits. Norway has concluded that the EU Directive on Biofuel is not relevant in relation to the EEA Treaty [9)].

In the United States, interest in biofuels can be traced back to the 1970s and was sparked by the oil crisis. There are major differences between states in the level of interest shown in biofuels. However, a federal target has been introduced that 4.5% of petrol requirements in 2012 should be met by ethanol. The United States produces ethanol based on maize, but also imports large quantities of ethanol from Brazil [7)].

Brazil is the world’s largest producer of ethanol. Although much of this output is exported, the country also uses a great deal of ethanol itself. Ethanol is blended into petrol to a level of up to 25%, and given the increasing sales in flexifuel vehicles in recent years, no reduction in the use of ethanol for fuel purposes is expected. [7)].

Other countries which have set national targets for biofuel use are China (10% by 2020), Canada (35% of petrol requirements by 2010) and Thailand (2% by 2010). [7)].

3.2 The Nordic market

There are major variations between the Nordic countries in terms of the scope of efforts directed at biofuels –both by public authorities and by the industry as a whole. There are also major differences between the products on which attention is focused.

3.2.1 Sweden

Sweden’s aim is to become completely independent of fossil energy sources and the State grants tax and duty exemptions on ethanol, biogas and RME. Tax and duty exemptions also apply to ”eco-cars” and in some areas parking is free for ”eco-cars”. The Swedish Riksdag has decided that all petrol stations with sales in excess of 3,000 m^3 of petrol and diesel must have a pump for delivering biofuel. The Swedish targets for biofuel sales were 3% in 2005 and 5.75% in 2010. Sweden takes a positive view of increasing the production and use of bioenergy as a possible part of a long-term, cost effective and sustainable energy policy [10)].
Sweden has several producers of biogas, bioethanol and biodiesel, amongst other fuels.

There are some 4,000 filling stations in Sweden [11)], of which 938 sell E85 [12)] (June 2006). Compared to the situation at the end of 2004, there has been an increase of some 650% in the number of filling stations at which E85 is available [13)]. The distribution network for biogas is also expanding and cars can now fill gas at

82 filling stations. Roughly half of the 26.8 million Nm^3 gas sold during the first half of 2007 was biogas [14)].
Pumps that deliver pure RME are available at only 18 filling stations [15)], which is a slight reduction on the 24 filling stations that offered RME two years ago.
In 2006, the Swedish government enacted a resolution under which the permitted quantity of bio substances in diesel was increased from 2% to 5%. This resulted in a significant upturn (approximately 600%) in the production of RME, the dominant Swedish biodiesel. However, this increase relates only to RME used as a low level blend in diesel and not to pure biodiesel.

According to Statistics Sweden, 33,137.000 litres of E85 and E-95 were sold in Sweden in 2005. [16)].
“Our forecast is that 70,000 m^3 of E85 will be sold in Sweden this year (2007). This is approximately twice as much as in the year before,” says Anders Fredriksson, Deputy Director of ethanol importers and producers Sekab in Örnsköldsvik. Sekab has been the leading force on the ethanol market in Sweden and is by far the dominant importer of ethanol produced from Brazilian sugar cane.
”There is no shortage of ethanol for use as fuel today, either as E85 or as the 5% additive blended into standard petrol in Sweden. On the contrary, prices have been falling over the course of the year as a result of a small surplus,” says Anders Fredriksson.
Nevertheless, he does not rule out the possibility that prices may fluctuate significantly in the future. Biofuel is a new market that is in rapid growth as a result of which there is not always a match between supply and demand.
”Nevertheless, we do not forecast any shortage of ethanol on the world market, at least before 2010, notwithstanding the fact that the number of eco-cars is increasing despite the European Union’s promotion of an increase in the level of ethanol blended in petrol,” says Anders Fredriksson [17)].

At present there are only two factories in Sweden producing ethanol. These are Agroetanol’s factory in Norrköping, which has a capacity of 57,000 m^3 /year and produces ethanol based on wheat, and Sekab’s factory in Örnsköldsvik, which has a capacity of 15,000 m^3 /year and produces ethanol based on black liquor.
In addition, 13 factories are at the planning stage, offering a total theoretical capacity of approximately 900,000 m^3/year [18)].

In the case of biodiesel and biogas, there are a handful of large and numerous small producers. At the time of writing, biogas is by far the cheapest fuel per unit of distance driven, costing approximately 8.2 SEK/petrol equivalent, compared with diesel at 10.50 SEK/petrol equivalent, petrol at 11.6 SEK/petrol equivalent and E85 at approximately 10.80 SEK/petrol equivalent [19)] [20)].

3.2.2 Finland

Table 1. Market shares in Finland at year-end 2006 [21), 22)]:

Company	Number of filling stations	Market share, Petrol	Market share, diesel
Neste	556	26.2 %	40.9 %
ABC	287	16.9 %	5.9 %
Teboil	302	15.4 %	26.5 %
Shell	236	14.0 %	12.0 %
Esso	182	10.%	7.9 %
Station 1 (St1)	251	9.1 %	4.2 %
JET	49	5.6 %	1.4 %
SEO	156	2.6 %	1.2 %
Total	**2013**	**2 482 762 m^3 = 1 862 072 tonnes**	**2 458 730 m^3 = 2 077 627 tonnes**

Since 2005, the number of petrol stations in Finland has increased by 12. There are just as many service stations as in 2005, but more are now automated. At the time of writing, the market for biofuel is marginal. Sales of petrol in 2007 were up by 0.7% on 2005, while sales of diesel were up by 3.2%.

E85 is not available in Finland. Nevertheless, some locally produced biogas is available, although sales are marginal compared with petrol and diesel [23)]. The only alternative fuel that might be introduced is (fossil) natural gas. Natural gas accounts for approximately 11% of total energy consumption in the country. Of this, approximately 0.1% is used as fuel [24)]. A few gas filling stations already offer methane gas from landfill sites for use in buses.

Sales of LPG (Liquefied Petroleum Gas) totalled 294,269 in 2006, but this figure includes LPG for all purposes. For tax-related reasons, the use of LPG as fuel is marginal. As in the case of natural gas, LPG is used only in buses and other heavy vehicles.

Economical and safe driving habits are being promoted in a range of projects. Apart from this, however, Finland does not appear to be aiming to reduce its CO_2 emissions through special measures within the traffic sector. Attention appears instead to be directed at voluntary industry-wide agreements for the automotive industry in the European Union, and it is thought that greater effects can be achieved by increasing the use of renewable fuels in power stations.

The penalty tax on biogas cars has been removed and the tax on sulphur-free fuels will be reduced. As a member of the European Union, Finland has implemented Directive 2003/30/EC which promotes the use of biofuels.

In September of 2007, St1 Biofuels, a subsidiary of St1 and VTT, opened its first ethanol plant. The ethanol is produced using waste from the area around the plant. Even on a small scale, the process is profitable. St1 Biofuels plan to increase their output and their aim is to produce 70 million litres of biofuel by the end of 2011. Plans have also been drawn up to establish production outside Finland – primarily in Sweden and Germany. St1 Biofuels markets its product as the world's most environmentally-friendly ethanol.

Neste Oil started sales of petrol with a low blend of ethanol in 2006 at all its stations in southern Finland. The ethanol is produced using surplus wine. NExBTL (Next Generation Biomass to Liquid) is a new product developed by Neste Oil. This is a high quality bio-based diesel product. According to Neste Oil, the new fuel generates significantly lower exhaust emissions. Virtually all known vegetable and animal fats can be used as raw materials in the production of NExBTL. The first production facility was located in the old Borgå refinery plant and production commenced in 2007. It is intended that the next plant should open towards the end of 2009. The capacity of both plants is 170,000 tonnes. Neste Oil plans to start sales of diesel with a 25% blend of biodiesel. 100% NExBTL will be tested on a number of buses in Helsinki during the spring of 2008.

Neste Oil also plans to buy ethanol for blending with petrol. The most likely sources are ethanol produced from Brazilian sugar cane, American maize, European surplus wine and European agricultural plants. Ethanol produced from Finnish agricultural products will probably not be as attractive, since the price of these raw materials is significantly higher. Notwithstanding the high price of Finnish agricultural products, two companies are planning ethanol production based on Finnish raw materials.

According to the Biodiesel Association of Finland [25], there are numerous small producers of biodiesel. Their production is generally based on rapeseed, field mustard and recycled oils. Output is less than a few hundred litres per day.

3.2.3 Denmark

The use of biomass in the production of fuel is a subject of considerable discussion in Denmark, since in 2004 the Danish Government notified the European Commission that Denmark had no plans to promote the use of biofuels in the transport sector in the short term. Accordingly, the Danish target was set at 0%, and this target was reiterated in 2005 when the European Commission sent a letter of formal notice to the Danish Government requesting that the Danish Government set targets in line with the Biofuel Directive [26, 27].

However, as part of the 2006 Danish Finance Act, the sum of 60 million Danish kroner was earmarked for conducting tests on the use of biodiesel. At the same time, the official target for biofuel use was raised from 0 to 0.1% in 2006.

Denmark's reasons for deviating from the targets set in the Biofuel Directive are:

- Denmark is already taking on considerable expense in exploiting the energy in biomass in the production of electricity and heating. In Denmark, bioenergy can be exploited most cost effectively by using the technologies in question in generating electricity and heating. In 2004, biomass covered some 11% of Danish energy requirements. The equivalent figure for the European Union was 4%. In the period 2000 to 2004, 0.75% of Denmark's fossil fuel consumption (approx 6 PJ) was replaced with bioenergy. Replacing 2% of the fossil fuel that was sold in 2006 with biofuel would have been equivalent to 3 – 4 PJ.

- Biofuel can best be promoted by giving priority to efforts to develop second generation fuel alternatives. This will prepare the ground for a broader use of biofuels in the future. The Danish Government has decided to increase the resources devoted to research and development into second generation technologies, and has earmarked 200 million Danish kroner for co-financing private sector research and development programmes.
- The Danish distribution network/car fleet for fuel has not been technologically adapted to biofuel. Accordingly, significant investments will be required, not to mention the time needed for converting to a system capable of handling different fuel alternatives [28)].

At present, Statoil offers its customers Bio95 and is the only supplier to do so. Bio95 is petrol with 5% Brazilian sugar cane ethanol blended in. Statoil has 306 service stations in Denmark and offers Bio95 at approximately 200 of these [29)].

At present, Emmelev A/S is the largest producer of biodiesel, with an output of 100 million litres in 2005. This fuel is produced from rapeseed. The entire output of the company is exported, primarily to Germany and Sweden [30)]. At the time of writing, Daka Biodiesel is in the process of erecting a new production facility for biodiesel based on animal fat. Initially, the output of the plant will be 50,000 tonnes per year, but capacity will probably be increased by 100%. Production is intended to start at the end of 2007 [31)].

An additional two project for the production of bioethanol based on biological waste products are expected to be completed in 2009. Dong Energy is behind one of these projects, which is designed to produce 4,5 million litres of ethanol based on straw per year. Biogasol is responsible for the other project, which will produce 10 million litres of ethanol as well as biogas, which will be used in generating electricity and heating [32)].

3.2.4 Norway

There is widespread interest in biofuels in Norway, in terms of both use and production. A range of companies are considering investing in production facilities or in other links in the value chain.

The production of first generation biofuels is being stepped up significantly in Norway. To date, most biodiesel has been produced using Norwegian raw materials in the form of fisheries waste.
However, the major expansion in capacity taking place at present is based largely on imported raw material, primarily rapeseed and soy. Estra in Trøndelag county has long been Norway's biggest producer of biodiesel. Previously, the company produced some 10 million litres of biodiesel a year based on fish oil. This production has now been terminated, in part because the value of processed fish oil has increased, and in

part because biodiesel based on fish oil does not fulfil the European biofuel standard, EN 14214, because it contains excessive quantities of iodine. Estra is instead importing rapeseed-based biodiesel from Denmark, which the company sells from its tank facilities in Trøndelag.

Several large production facilities for first generation biodiesel are now being established at various points around the Oslo fjord. BV Energy has already commenced production at Dynea's former glue factory at Sætre in Hurum. Production is based on imported rapeseed oil. The company is expecting to produce between 100 and 200 million litre in 2007 and 300 million litres when the plant has in full production, from 2008 onwards. In addition, Uniol in Fredrikstad is establishing a production plant for first generation biodiesel with an annual capacity of some 200 million litres. There is also some activity in the Bergen area, and both Biodrivstoff AS and Milvenn AS are planning to step up production. If the new plants are developed in full as planned, Norway will, during the course of some 12 months, have established a production capacity that represents almost 20% of current consumption of diesel. In view of the limitations that exist in the national car fleet, it is accordingly likely that for a period Norway will be a net exporter of biodiesel, although most of the raw materials will be imported.

At present, bioethanol for fuel purposes is at the test and development stage in Norway. Although Borregaard has produced some 20 million litres of ethanol as a by-product of food processing since before the Second World War, the absence of a market, infrastructure and customs protection has meant that this ethanol has been supplied for other purposes. Since December 2001, biomethane, i.e. biogas from which CO_2 and other unwanted components have been removed, has been produced by FREVAR in Fredrikstad. Production is based on sewage sludge and food waste and supplies six buses and some passenger cars from a special pump. The passenger cars are what are known as biofuel vehicles with tanks for both gas and petrol, and are accordingly able to switch between biomethane, natural gas (fossil methane) and petrol.

Large scale Norwegian production of biofuel based on Norwegian raw materials will probably be possible within 4 to 6 years. In 10 to 20 years, Norwegian-produced biofuel based on sustainable exploitation of Norwegian raw materials will be capable of meeting 20 to 30 per cent of the requirements of road traffic. An effort of this order will also create some 10,000 new jobs, primarily in outlying areas.

At the time of writing, there are some 15-20 sales outlets for pure or high-blend biofuels in Norway. E85, a mixture of 85 per cent bioethanol and 15 per cent petrol, is available at five Statoil filling stations in Norway. Biogas is sold by FREVAR in Fredrikstad. The rest of the outlets offers biodiesel. According to their website, Estra have four retail outlets. In addition, Hydro Texaco/YX Energy and some independent operators have pumps for pure biodiesel.
Hydro Texaco/YX Energy have practised 2-5 per cent blending of biodiesel in southern Norway since the end of the 1990s. Statoil commenced low blending of biodiesel in its ordinary diesel at a number of filling stations in eastern Norway at the end of 2006/beginning of 2007. A number of other oil companies are also starting to introduce low blending of biodiesel in ordinary diesel. The aim of the authorities and

the oil companies alike is that ethanol should be blended with ordinary petrol at a level of up to 5 per cent by volume.

Part of the reason for the limited availability is that very few cars are equipped from the factory to operate on pure or high-blend biofuel. As at March 2007, there were barely 500 factory-built bioethanol cars in Norway. These are cars where the fuel system is adjusted in such a way that the cars are to switch between both pure petrol and up to 85 per cent ethanol. In addition, it is estimated that some 20,000 diesel cars produced by VW, Audi and Skoda at the end of the 1990s and beginning of 2000s are equipped by the factory to operate on pure biodiesel. As at March 2000, no new diesel cars on the Norwegian market have factory approval of this nature. However, a wide range of trucks are now approved for biodiesel [33)].

3.3 Other ecolabelling schemes

The EU is in the process of drafting a certification system for biofuels that will secure sustainable production of biofuels on the European market. The consultation document "Biofuel issues in the new legislation on the promotion of renewable energy" which was presented by the European Commission in April 2007 outlines possible criteria for sustainable fuel production. These include reductions in emissions of greenhouse gases and the retention of biodiversity. Several years could pass before a system based on these criteria is in operation [34)].

The Global Bioenergy Partnership (GBEP), established in the wake of the G8 meeting in 2005, drafts principles for sustainability in the production of biofuels. These will include environmental, social and economic requirements applicable to the value chain as a whole. The plan is that the standard will be tested in a pilot project in January 2008 [35)].

The UK authorities have in recent years been working on the development of a certification scheme that will ensure that the official requirement that there be a certain proportion of renewable fuels on the market is implemented. In addition, a draft presented by the Department of Transport in June 2007 outlines requirements for GHG reporting and sustainable production. On the other hand, as far as Nordic Ecolabelling is able to tell, there are no requirements applicable to energy consumption [36)]. The Netherlands and Germany have also initiated similar projects.

4 Methodology

4.1 Life cycle analyses

A life cycle analysis is a tool which enables the environmental consequences associated with a product to be evaluated. Life cycle analyses are often conducted in order to allow two or more products to be compared. These are referred to as comparative analyses. Studies of this nature allow conclusions to be drawn as to which product is preferable from an environmental perspective. A life cycle analysis presents all the environmental impacts associated with the product in question, from the raw material production stage to the waste processing stage (cradle to grave).

A number of international standards have been compiled on the use of life cycle assessments [37)]:

- ISO 14040 “Environmental management – Life cycle assessment – principles and framework”
- ISO 14041 ”Environmental management – Life cycle assessment – Goal and scope definition and inventory analyses”
- ISO 14042 “Environmental management – Life cycle assessment – Life cycle impact assessment”
- ISO 14043 “Environmental management – Life cycle assessment – Life cycle interpretation”

As a background to the requirements imposed on emissions of greenhouse gases and energy consumption Nordic Ecolabelling has used data from the consultant’s report. This report in turn is based on figures taken from the JEC Report. Moreover, data from this study will also be used in the processing of applications. Accordingly, the methodology used in the calculations in application processing must match the methodology used in the consultant’s reports.

The consultant’s report refers to Börjesson who argues that the energy balance may vary by a factor of 5 from one study to another. This will depend on the methodology used and the data upon which the calculations are based. It may therefore be difficult to take data from different studies when comparing two products. For this reason the requirements for the ecolabelling of fuels contain rules regulating which data may be used for the purpose of calculating energy consumption and greenhouse gas emissions.

4.1.1 The functional unit

When the environmental impacts associated with a product are to be assessed, the point of departure must be the function of the product. The value of a functional unit is most apparent in comparative analyses where the products being compared meet the same need but do so in different ways. One example of this would be a comparison between the environmental impacts associated with the use of trains and and those associated with the use of cars. The primary function of both these alternatives is to carry people from A to B. Thus in the case of transport-related products the functional unit is generally the distance driven. In the consultant’s report the functional unit is set at 1 km for the purpose of calculating greenhouse gases, whereas for the purpose of calculating energy consumption the unit is 100 km.

An alternative functional unit in a study of fuel might be the environmental impact associated with 1 MJ of the product. However, a study of this nature would not include the latter stage of the life cycle of the fuel – the driving phase. For Nordic Ecolabelling it is important that this part of the life cycle should also be included since not doing so could have unfortunate consequences for fuels where the greatest environmental impacts are associated with the production phase. For example, the use of 1 MJ as a functional unit would give petrol a major advantage over hydrogen.

4.1.2 Systems and assumptions

This section discusses the assumptions underpinning the calculation of emissions of greenhouse gases and energy consumption.

The life cycle of a fuel is generally divided into two halves: From raw material production to finished product and distributed fuel (Well to Tank) and from filling station to filled functional unit (Tank to Wheel). An analysis that takes in both phases of the life cycle is usually referred to as a Well to Wheel Analysis (WtW). The JEC report and the consultant’s report are both examples of studies of this nature.

The data does not encompass energy consumption and emissions associated with the production of production equipment. Nor does a WtW analysis examine the social costs associated with the product in question. An example of a simplified flow chart is provided in figure 1 [6].

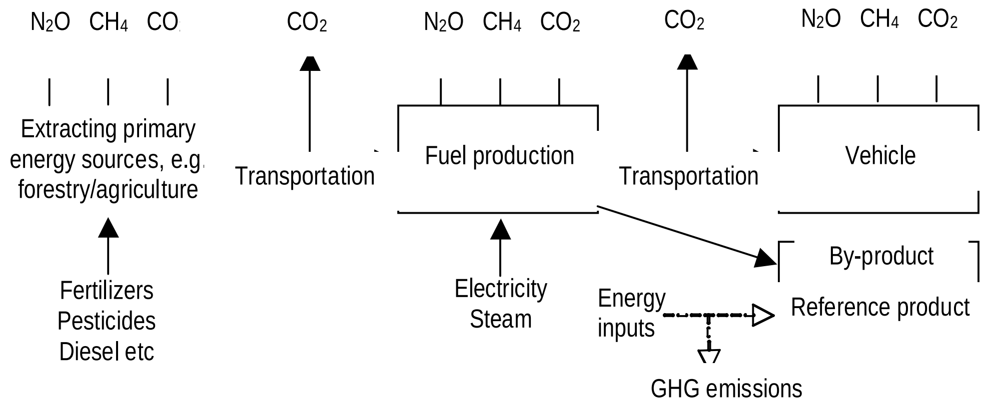

Figure 1: A simplified flow chart showing inputs, outputs and energy consumption in the production phase and the use phase of a fuel. The substitution method for allocating by-products is illustrated by giving credit for the energy and the emissions that can be attributed to the product that the by-product replaces on the market.

In order to calculate total emissions of greenhouse gases, the emissions must be weighted in proportion to the climate effect caused by individual gases. The IPPC factors are used for this purpose. These state that CH_4 is 23 times as effective a greenhouse gas as CO_2, whereas N_2O has 296 times greater effect than CO_2 [6]. The result of weighting the various gases is that emissions of greenhouse gases are expressed in terms of CO_2 equivalents.

The production of by-products can provide credits in relation to both energy consumption and emissions of greenhouse gases. See the section on allocation for the methodology behind this part of the calculations.

Data on the transportation and distribution of raw materials and finished products are included in the calculations in both the JEC report and the consultant’s report. The figures reveal how little significance transport has when viewed from a life cycle perspective. In the case of sugar cane ethanol from Brazil, transport and distribution account for 5.6% of the total energy consumption in a WtT perspective (the driving phase is not included). In the case of RME, energy consumption relating to transport and distribution accounts for less than 0.4% of the total. Generally speaking, the process of converting raw material to fuel has the greatest environmental impact in the WtT portion of the life cycle. The reason that transport is nevertheless included in the calculations is that transport is included in the figures for fossile fuel presented in the JEC report. The fuel for which a Swan Label is applied must be compared with these fuels and the comparisons should generally be on the same basis.

The figures for fuel consumption and emissions of greenhouse gases for an average European car with an average driving pattern are taken from ”NEDC 2002 internal combustion engine” [1)].

The fuel alternatives discussed in the consultant’s report are those that are considered likely to become commercially available within the next decade. However, the study has some faults: there are no data on the production of biodiesel from palm oil, jatropha or animal fat. Data on raw material production must therefore be sought from other/separate studies. In this context it is important that these studies should use the same methodology as the consultant’s report.

The data relating to second generation fuels are based on estimates. These will be updated when the technologies are introduced and accurate figures are available. Nordic Ecolabelling’s criteria documents remain in force for 3 – 5 years. Accordingly, when the criteria come to be revised there will probably be better and more accurate data available on the production of second generation biofuels.

Examples of data that must be included in the calculations:

1. Raw material production
    - Fertilizers: CaO, K_2O, P_2O_5, N
    - Pesticides
    - Seed materials
    - Diesel
    - Electricity
    - Emissions from cultivation areas
2. Transport of biomass
3. Fuel production
    - H_2SO_4
    - CaO
    - Cyclohexane
    - n-hexane
    - Other process chemicals
    - Methanol
    - Natural gas
    - Electricity
    - Diesel
    - Other energy sources
4. Credit for by-products
    - Glycerine

- Heat
- Electricity
- Rapeseed cake

5. Import/export transport
6. Distribution of the fuel
    - Tanker to storage facility
    - Blending of fossil fraction
    - Distribution
    - Fuelling station
7. Use of the fuel in car
    - NEDC 2002

4.1.3 Allocation

Nordic Ecolabelling permits the allocation of energy consumption and greenhouse gas emissions so that some of the environmental impact associated with a fuel can be deducted. Allocation involves distributing the environmental consequences between the main product and the by-product. This can be done in a variety of ways: On the basis of the weight ratio between the by-product and the main product, the relationship between energy content or the relationship between the economic potential of the various products. Allocation can also be based on what is termed the substitution method. There are problems and challenges associated with all of these methods.

The substitution method assesses which products the by-products will replace in the market. If, for example, a by-product of the production of biogas can be used as a fertilizer, one could say that the by-product replaces chemical fertilizer. The next stage involves mapping the environmental consequences associated with the production of chemical fertilizer. These are then credited to biogas since the production of biogas has "saved" the environment from x kg of chemical fertilizer production. This method is used in the consultant's report. See figure 1.

Although the substitution method will not provide us with the full and complete truth, this method will generally provide a more accurate picture of reality than do other allocation methods. Furthermore, the method follows the principles for allocation described in ISO14041.

In those cases in which data on by-products are not covered in the JEC study, allocation will be based on energy. This involves distributing greenhouse gas emissions and energy consumption in proportion to the relationship between the energy content of the main product and the by-product.

4.2 Reference values

When emissions of greenhouse gases and energy consumption are assessed from a life cycle perspective, there may be sub-processes in the life cycle on which the licence applicant does not have specific data. Examples might include emissions of greenhouse gases or energy consumption relating to the production of chemical fertilizer.

The licence applicant must as a minimum furnish specific data on the production of the fuel itself. Reference data may be used for other parts of the life cycle. Appendix 1 to the criteria document provides a list of the most relevant reference values for applicants for a Swan Label. This list is based on the JEC report [1)]. The background to the data and a complete list of reference values can be found at http://ies.jrc.cec.eu.int/wtw.html.

The data in Appendix 1 on both energy and greenhouse gases are stated according to the energy content of the output of the individual process (MJ), not as the energy content of the product chain as a whole. In other words, energy consumption relating to the production of wheat is stated per MJ of wheat and not per MJ of ethanol. All energy inputs refer to the quantity of primary energy (MJx). This entails that energy loss relating to the production of energy carriers is included in the calculations.

In combination, Appendix 1 and Appendix 2 of the JEC Well to Tank report provide a broad range of reference values for energy and greenhouse gas data for biomass production, production of fossile fuels, by-products, production of chemical fertilizers/pesticides and transport data for fuels. Data not found on the list or in Appendix 1 or Appendix 2 to the JEC report must be determined by the licence applicants themselves. LCA databases, studies or the applicant's own calculations may be used, although a fundamental principle is that as far as possible the methodology in the JEC study should be used. The rules governing the use of reference values are specified in Appendix 3.

The data on biomass production is provided in the form of average data for, for example, Europe (wheat, sugar cane and rapeseed). In other words, the production of, for example, rapeseed, does not take account of local soil or production conditions. Similarly, all data are related to the water-free lower heating value, LHV, of the individual biomass products. This is necessary in order to take account of the fact that wood raw materials dry out during storage and transportation.

Data on fossile fuels may be used in cases where an application is submitted for a Swan Label for a blended product such as E85.

An overview is provided at the beginning of Appendix 1 of the standard properties of traditional fuels and their raw materials as well as typical energy sources.

If applicants have data on greenhouse gas emissions and energy consumption from their own life cycle analyses, these may be used if a competent external third party certifies that the methodology upon which the calculations are based reflect the methodology described in the JEC report.

5 Fuel – raw materials and production

Fossil fuels are not discussed in this section, since knowledge of both the products and the production chains is assumed.

At present, biofuel production is based largely on agricultural products such as maize and rapeseed and the products are often referred to as first generation biofuels. Some of the criticism levelled at the increase in demand for biofuels is that this development could result in competition with production of food and animal feed. As a result, considerable research and investment is going into the development of technologies that draw on other raw materials that do not compete with food production in the same way – so-called second generation biofuels. Figure 2 provides an overview of the fuel types that can be produced on the basis of a range of raw materials [6)].

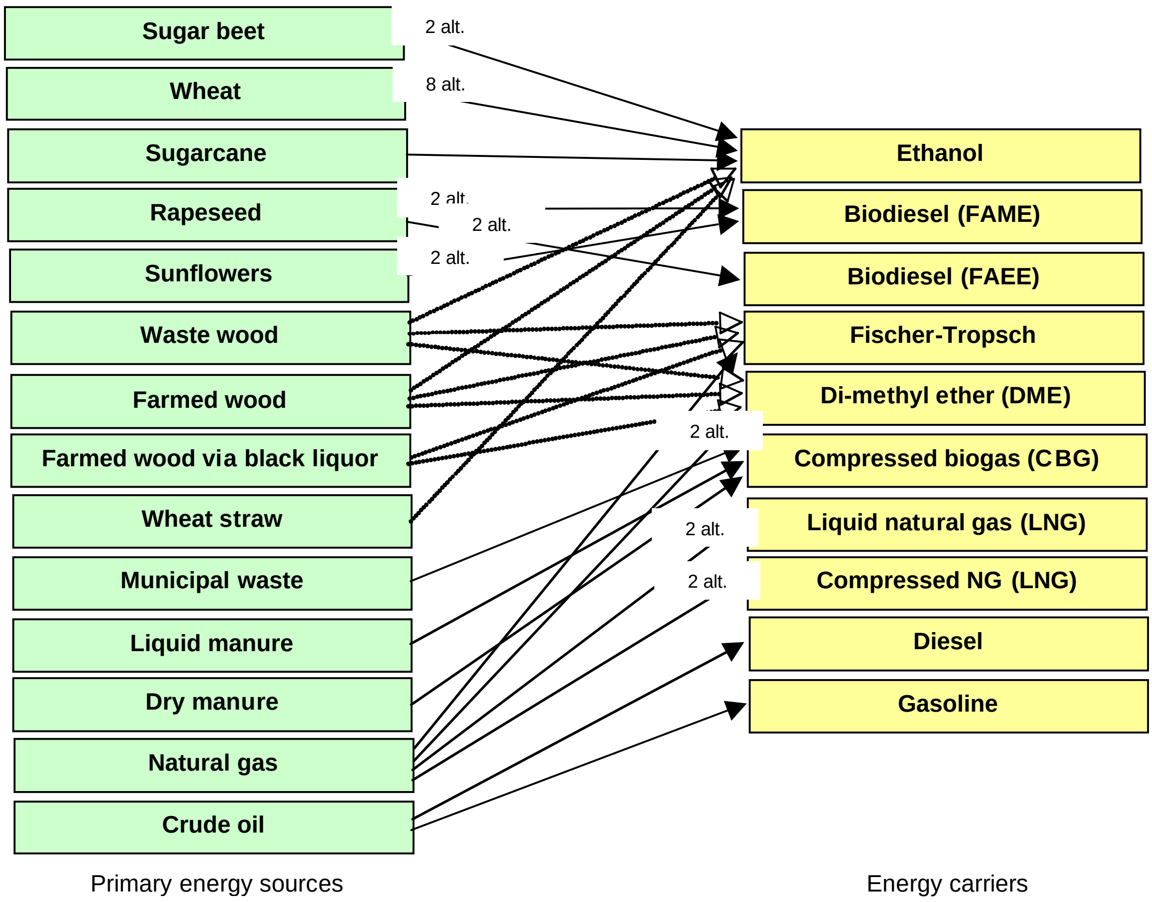

Figure 2: The figure shows the fuel products that can be produced using a range of raw materials.

In the future we will see an increasing tendency for conventional fossile fuels to be mixed with fuels produced on the basis of renewable raw materials. Examples of blends of this type include biogas blended with CNG (compressed natural gas) and petrol mixed with ethanol.

5.1 Commercially available technologies

5.1.1 Ethanol

Ethanol can be produced using a range of carbohydrate-rich plants. On a world wide basis sugar cane and maize are the plants that are most widely used in the production of bioethanol. Brazil is the biggest producer of sugar cane ethanol, while the United Stated is a major producer of ethanol based on maize. Whereas most of the maize ethanol produced in the United States is used domestically, Brazil exports a large proportion of its sugar cane ethanol output. This ethanol is also available on the Nordic market.

From a life cycle perspective sugar cane ethanol is relatively high in energy efficiency, while at the same time generating low emissions of greenhouse gases. This is because the energy requirements of the entire ethanol process can often be covered using the pulp that remains after the juice has been pressed out of the sugar cane (bagasse). The process may also provide a surplus of pulp which can be used to cover energy requirements elsewhere. Life cycle analyses reveal that the transport stages have little impact on the overall emissions from greenhouse gases or on the overall energy requirement, as a result of which the transport stages from Brazil to Europe make very little impression on the final data on sugar cane ethanol [7)]. On the other hand, there are a number of challenges associated with sustainable cultivation of sugar cane.

Southern Europe produces a significant proportion of the world’s sugar beet. Producing ethanol from sugar beet is a relatively simple and inexpensive process. On the other hand, there are challenges associated with soil erosion and a high consumption of pesticides. The pulp remaining after the juice has been pressed from the sugar beet can be used for both animal feed and in the production of electricity. The latter is the most profitable from a climate perspective.

Most of the bioethanol produced in the Nordic counties is based on wheat. Producing ethanol on the basis of wheat is somewhat more costly than when sugar cane or sugar beet are used as a raw material. The advantage of wheat ethanol is that the process is familiar and that farmers have been cultivating wheat for many years and accordingly have extensive experience and the required mechanical equipment. The by-product, known as DDGS, can be used as animal feed, in the production of biogas or for generating heat and electricity. Generally, DDGS is used for animal feed. However, the use of wheat as a raw material in the production of ethanol is one of the most energy-intensive processes discussed in the consultant’s report. Moreover, wheat-based ethanol is amongst the biofuel alternatives that provide the lowest reductions in greenhouse gas emissions.

Bioethanol is first and foremost a replacement product for petrol. Ethanol can be mixed in blends of up to 5% with ordinary fossil petrol without any need to modify conventional petrol engines.

5.1.2 Biodiesel

Biodiesel can be produced using a wide range of different plant oils, animal oils and waste fat. Generally speaking, the production of biodiesel is less energy-intensive than the production of ethanol, since the entire process consists of sub-processes at low temperatures and low pressure (sugar cane ethanol is lower than biodiesel since production of sugar cane is very energy-efficient). On the other hand, emissions of N_2O are greater in the biodiesel processes, as a result of which there are increased emissions of greenhouse gases.

Methyl esters are produced in the process. Biodiesel made from rapeseed is accordingly known as RME (Rapeseed Methyl Ester), while biodiesel based on sunflower seeds is called SME (Sunflower Methyl Ester). The by-product generated in the production of biodiesel is a protein-rich pulp, ideal for use as animal feed and for replacing other chemicals on the market.

As at the time of writing there is very little biodiesel based on palm oil or soybean oil on the European market. Production of biodiesel based on palm oil and soybean oil is, however, expected to increase significantly in the future. Palms and soybeans are generally cultivated in areas near tropical forests, as a result of which there has been a considerable focus of attention on sustainability in relation to the production of the raw materials.

The seeds of the jatropha plant can be used as a raw material in the production of biodiesel. Much attention has been focused on this plant in recent times since it is particularly hardy and able to withstand drought. The jatropha grows wild in India, but as a result of the increased interest in the plant oil many farmers intend to go in for jatropha cultivation. Large private companies have also invested in projects to extract plant oil from the jetropha plant [38)].

Biodiesel can also be produced from waste fractions from for example deep-fat frying oil, fish sludge and slaughterhouse waste. The use of animal fat in the production of biofuels is approved under Commission Regulation (EC) No. 92/2005 and 2067/2005. The European Union’s highest veterinary authority has assessed the health and safety aspects of this use of animal fat. The conclusion is that the production of biodiesel represents a very safe form of resource exploitation. The requirements relating to the use of by-products from production follow the rules governing animal by-products in general. This entails that Category 1 material (high risk) may be used only for combustion purposes. Categories 2 and 3, on the other hand, may be used in the production of biofuel [31)].

Biodiesel may be mixed in proportions of up to 5% in ordinary fossil diesel without the need to modify conventional diesel engines.

5.1.3 Biogas

When biological materials break down anaerobically, methane is formed. Using this gas in the production of biogas can save the environment from major emissions of greenhouse gases. This process is particularly attractive because it permits the use of something that has not traditionally been viewed as a resource. The consultant’s report assesses biogas based on household waste, dried animal manure and liquid animal manure. In the case of biogas produced on the basis of liquid and dried animal manure, the energy costs are lower than in the case of natural gas. (However, where biogas is produced using household waste, energy consumption is 13 MJ/100km more than in the case of natural gas.) In addition, the use of biogas offers by far the greatest reduction in emissions of greenhouse gases [6)]. One disadvantage of biogas is that the existing infrastructure for liquid fuel has to be modified to suit gas-based products. Vehicles capable of operating on both gas and liquid fuel (bi-fuel) are available on the market.

5.2 The technologies of the future

5.2.1 Synthetic diesel

Syngas is produced on the basis of a mixture carbon monoxide and hydrogen. Hydrogen can be produced using a variety of different sources, including cellulose, coal and natural gas. Synthetic fuels offer considerable potential, since the processes involved require little energy, emissions of greenhouse gases are low, the quality is high and the fuels are very flexible. No physical by-products are generated in the production of syngas. However, heat from the process can be used for district heating purposes. The various types of synthetic diesel available include Fischer-Tropsch diesel (FT diesel) and dimethylether (DME) [6)].

Black liquor is a by-product of the production of paper pulp and contains lignin. Syngas is created by means of gasification and the residual product is accordingly very well suited for the production of synthetic diesel. In addition, both energy consumption and greenhouse gas emissions are low compared with other sources used for the production of syngas. Although the theory behind the gasification of wood raw materials is well known, the process is not commercially available. There are problems associated with the mineral content of the raw material, as well as with what is known as slagging. Stora Enso and UPM are just two of the many operators that have embarked on projects to produce diesel from forestry waste. According to some sources the products are expected to be on the market as early as within a couple of years.

Synthetic biodiesel can be used directly in existing diesel vehicles without modifications to engine or fuel system [33)].

5.2.2 Ethanol from forestry raw materials

Cellulose can be used as a raw material in the production of ethanol, but this technology is still at the pilot stage. Norwegian consultants ECON have estimated that it will take between two and five years before the process is sufficiently optimised for full-scale plants to be established. When this does take place, there will be scope for using wood raw materials, straw and corn husks as raw materials in biofuel production. SEKAB has a pilot plant for cellulose ethanol in Örnsköldvik in Sweden [33)].

5.2.3 Algae diesel

Algae allow the extraction of up to 80 times more plant oil per unit of area than rapeseed. This oil can be used as a raw material in the production of biodiesel. In addition to the high oil yield, diesel produced from algae offers considerable potential in that the algae can be cultivated in areas that are unsuitable for the production of food and animal feed. In order to further extend yields experiments are being conducted in which algae are grown in both wastewater and exhaust gas from coal-fired power stations [33)].

Experiments have been conducted on the use of algae for energy production for many decades. Even so, commercialisation and large-scale production of biodiesel are still many years off.

5.2.4 Hydrogen

In practice, hydrogen is simply an energy carrier and can be formed by means of a range of different chemical processes using many different raw materials, including water, biomass, coal, natural gas and oil. Depending on the raw materials used hydrogen fuel can offer reduced emissions of greenhouse gases. An additional advantage of using hydrogen as a fuel is that any emissions of greenhouse gases will come during the production phase and can therefore be more readily captured for use or disposal [39)].

6 Justification for the requirements

6.1 Products that are eligible for a Swan Label

The aim of the product group definition is that the proportion of biofuel in a product should determine whether a manufacturer can apply for a Swan Label. The background to Nordic Ecolabelling's wish that blends with fossil fuels should be permitted is that there are very few pure biobased products available on the market at present. However, Nordic Ecolabelling does not wish to Swan-label low-blend products since it must be made clear to the consumer that the bulk of the raw material in a Swan-labelled fuel is renewable. As the market for biofuels expands it may be appropriate to tighten up the requirement applicable to the proportion of biofuel in blended products.

Moreover, Nordic Ecolabelling does not wish to permit the Swan-labelling of fuels that are based on oils from threatened species. The delimitation in relation to category 1 materials in the Animal By-products Regulation is due to the requirements imposed by the authorities on the processing of risk waste of this nature.

6.2 Description of life cycle (R1 – R5)

The purpose of these requirements is to ensure that a satisfactory picture is provided of the life cycle of the fuel: The raw materials used, the process chemicals and additives used, the distance over which the products are transported etc. This will be important information to the Nordic Ecolabelling personnel processing the applications when he/she is reviewing the requirements and will also make up the basis for the applicant's calculations of greenhouse gas emissions and energy consumption.

Nordic Ecolabelling wants information on all the chemicals added to the fuel for which a Swan Label is applied. These chemicals might be used for the purpose of improving the durability of the fuel, changing its freezing point/melting point etc. No requirements are imposed on these substances, but Nordic Ecolabelling needs this information in order to assess the scope for imposing requirements on chemical additives in revised versions of the criteria document. The contributions made by chemical additives are not to be included for the purpose of calculating greenhouse gas emissions and energy consumption. However, greenhouse gas emissions and energy consumption associated with process chemicals are to be included.

6.3 Climate-related requirements (R6 and R7)

6.3.1 Climate change

The greenhouse effect is a natural phenomenon that occurs when water vapour, CO_2, CH_4 and other so-called greenhouse gases in the atmosphere capture heat reflected from the earth. This helps to make the earth habitable for humans, animals and plants. However, increased man-made emissions of greenhouse gases disturb the natural balance between the amount of solar radiation that is allowed through the atmosphere and the amount that is reflected. Scientists now agree that this development will result in higher average temperatures on the earth in the future. This in turn may have widespread consequences for nature, vegetation and animal life. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change published in 2007 concluded as follows [39)]:

- 11 of the last 12 years have been amongst the 12 warmest years since 1850.
- The frequency of heavy precipitation has increased over most land areas. This frequency has increased in line with global warming and observed increases in water vapour in the atmosphere.
- Satellite data recorded since 1978 show that the sea ice in the Arctic has shrunk by 2.7% per decade. The reduction is greatest during the summer months, at a rate of 7.4% per decade.
- The average global sea level rose by an average rate of about 1.8 mm/year during the years 1961 to 2003. The rise was more rapid between 1993 and 2003: approximately 3.1 mm per year. It is not clear whether the increased rise between 1993 and 2003 reflects variation between decades or is an increase in a long-term trend. The total rise in sea level over the course of the 20th century is estimated to be 17 cm.

Worldwide, total emissions of greenhouse gases are increasing rapidly. One element in reversing this development will be to replace the use of fossil energy sources with renewable energy sources. The problem associated with fossil energy sources such as oil and gas is that the atmosphere takes up carbon that has been out of the carbon cycle for millions of years. Accordingly, the use of renewable energy sources is a means of countering man-made climate changes.

Simply requiring the use of renewable raw materials will not be enough to guarantee that a fuel will offer reductions in overall greenhouse gas emissions. Nordic Ecolabelling accordingly imposes requirements as to both emissions of greenhouse gases and energy consumption in a life cycle perspective.

6.3.2 Requirements applicable to emissions of greenhouse gases

In the consultation proposal the project group suggests a requirement level of 120 g CO_2-equivalents/km distance driven using values taken from the NEDC 2002 driving formula (NEDC is the standard European driving pattern). All emissions of CH_4, N_2O and CO_2 during the entire life cycle are to be included. Table 1 is taken from the consultant's report and shows levels of greenhouse gas emissions associated with various fuels.

It should be noted that the figures in Table 2 are based on reference data and are not necessarily true figures. Accordingly, the table should be used only for guidance on the types of fuel that will clear the requirement.

Table 2: The table shows greenhouse gas emissions associated with 38 different fuel alternatives. The figures are based on JEC Well to Wheel 2006.

No. in Fig. 4	**Primary energy to energy carrier**	**Tot WtW GHG** gCO_{2eq}/ km	**Comments**	No. in Fig. 4	**Primary energy to energy carrier**	**Tot WtW GHG** gCO_{2eq}/ km	**Comments**
1	Liquid manure Compr. Biogas	-167.9	Collected from farms. Local plant. Upgraded gas*	20	Rapeseed REE Biodiesel	73.5	By-product: animal feed, Bio-ethanol for esterification
2	Farmed wood via black liquor DME	7.2	Incl waste collection and chipping Black liquor repla-ced by waste wood in mills	21	Rapeseed RME Biodiesel	77.7	By-product: Glycerine as chemical, assuming NG-methanol for esterification
3	Dry manure Compr. Biogas	7.3	Collected from farms. Local plant. Upgraded gas*	22	Wheat Ethanol	86.6	By-product: co-fuel in a coal power plant. NG CCGT, surplus elec sold**
4	Farmed wood via black liquor FT-diesel	7.7	Incl. cultivation and chipping. Local transport. Black liquor replaced by waste wood in mills.	23	Rapeseed RME Biodiesel	87.1	By-product: animal feed, NG-methanol for esterification
5	Waste wood DME	11.7	Incl waste collection and chipping	24	Wheat Ethanol	106.0	By-product: Animal feed. NG CCGT, surplus elec sold**
6	Waste wood FT-diesel	12.1	Incl. waste collection and chipping.	25	Wheat Ethanol	114.5	By-product: co-fuel in a coal power plant, conv NG boiler, elec fr grid.
7	Farmed wood DME	16.3	Incl. cultivation and chipping. Local transport.	26	Sugar beet Ethanol	130.1	By-product: Animal feed.
8	Farmed wood FT-diesel	16.6	Incl. cultivation and chipping. Local transport.	27	Wheat Ethanol	134.0	By-product: Animal feed. Conv NG boiler, elec fr grid.
9	Wheat Straw Ethanol	21.7	Logen process, extra fertilizer comp for straw**.	28	Compressed NG	148.8	Current EU-mix, piped 1000km
10	Sugarcane Ethanol	25.1	Shipped to EU from Brazil, blended with gasoline	29	Diesel	163.9	
11	Sunflower SME Biodiesel	37.2	By-product: Glycerine as chemical, NG-methanol for esterification	30	NG DME	164.6	DME plant close to NG supply in EU. Dedicated DME network distribution
12	Wheat Ethanol	37.4	By-product: co-fuel in a coal power plant, Straw CHP surplus elec sold**, extra fertilizer comp for straw***.	31	Liquid NG	173.8	Imported shipped LNG, gaseous distribution from harbour into EU-gas grid
13	Municipal wasteCompr. Biogas	40.1	Municipal waste already collected. Upgraded gas*	32	Liquid NG	175.2	Imported shipped LNG, truck distribution from harbour to fuelling stations
14	Waste wood Ethanol	42.2	Shipped to EU from Brazil, blended with gasoline	33	Compressed NG	177.5	Imported NG, piped 7000km
15	Sunflower SME Biodiesel	46.2	By-product: animal feed, NG-methanol for esterification	34	NG FT-diesel	178.5	Plant installed near natural gas supply.

16	Farmed wood Ethanol	49.8	Incl. cultivation and chipping. Local transport.	35	Wheat Ethanol	192.3	By-product: co-fuel in a coal power plant. Coal CHP, surplus elec sold**
17	Wheat Ethanol	56.9	By-product: Animal feed. Straw CHP, surplus elec sold**, extra fertilizer comp for straw***.	36	Gasoline	195.9	
18	Rapeseed REE Biodiesel	64.5	By-product: Glycerine as chemical. Bio-ethanol instead of NG-methanol	37	NG DME	197.3	Imported NG, piped 7000km. DME plant close to NG supply in EU. Dedicated DME network distribution
19	Sugar beet Ethanol	68.2	By-product: Pulp for heat.	38	Wheat Ethanol	208.7	By-product: Animal feed. Coal CHP, surplus elec sold**

Most of the biofuels on the market today have lower emissions of greenhouse gases than the fossil fuel alternatives. The consultation document sets a limit of 120 g CO_2-equivalents per km – a requirement that most of the biofuel alternatives in the consultant's report will meet. Only ethanol produced on wheat and sugar beet, where the processes are not optimised in relation to the exploitation of by-products and energy supply, have emissions in excess of 120 g CO_2-equivalents per km driven. The table also shows the major environmental gains associated with increased use of biofuel. This gain comes from the fact that the biofuels can count on a credit for being based on renewable raw materials. This credit is based on the assumption that all emissions of CO_2 and CH_4 in car exhausts will return to the carbon cycle and will in turn be available for absorption in the photosynthesis of plants. When fossil fuels are combusted, however, large quantities of carbon that have been out of the natural cycle for millions of years are channelled into the carbon cycle. The fuel cannot be credited for emissions of N_2O.

A limit of 120 g CO_2-equivalents per km has been set with a view to balancing the aim of excluding the fuel alternatives that are worst from a climate perspective against the need to ensure that some products on the market should be capable of meeting the Swan Label requirements. It is likely that most of the products on the market in the period leading up to 2010 will be blended products (fossil and renewable). The emissions of greenhouse gases associated with these products will be higher than for the renewable fuels presented in the table above.

6.3.3 Energy use

Energy consumption is generally higher in the case of the production of biofuels than for the production of traditional fossil fuel alternatives. The reason that biofuels nevertheless come out on top in relation to emissions of greenhouse gases is that renewable raw materials are counted as CO_2 neutral. In addition, biomass is usually used to meet the energy requirement in the production of biofuels. If the energy requirement was covered by fossil fuels alone, the emissions of greenhouse gases would have increased. Nevertheless, it is essential to also impose requirements as to energy consumption on the basis of the principle that the renewable energy saved can be used to countbalance the use of non-renewable energy elsewhere.

In the case of biofuels the JEC report counts all "surplus energy" in raw materials as part of the overall amount of energy consumed. This means that if sugar cane equivalent to 2.7720 MJ is used to produce 1 MJ of ethanol, then 1.7720 MJ will be considered to have been used in the ethanol process. The proposed energy requirements in this consultation document is based on the consultant Maria Grahns report on the energy consumption related to the production and use of various fossil fuels and biofuels. According to her the method for calculating energy consumption for biofuels in the JEC report is unusual since these 1.7720 MJ cannot be transferred directly into pure energy consumption. Some goes to cover the energy requirements of the process whereas the rest “disappears” in the form of energy stored in process waste, heat loss etc.

With regard to fossil fuels, the JEC report does not calculate energy consumption in the same way. Here energy consumption is confined to the energy that can be linked directly to the energy requirements of the process. This makes it difficult to compare the data on biofuel and fossil fuel as presented in the JEC report.

The consultant has, for reasons mentioned above, chosen to subtract the difference between energy in the raw material and energy in the product from the total energy consumption. This implies that the energy requirement met by burning waste from the raw material is not calculated in the total energy consumption. The consultant argues that the part of the raw material that is used to cover the energy demand can be regarded as waste material to be used as “free energy”. This argument can also be illustrated as follows: In ethanol production based on sugar cane, the surplus from the sugar cane is used to meet the energy requirement. If this energy had been sold to other operators, the heat would have been a by-product of production and the system for sugar cane ethanol would have been credited for the energy that was sold. On the other hand, the process would have needed an injection of energy and it would have been necessary to purchase energy in a quantity equivalent to the energy requirement. Assuming that the process sold off just as must energy as needed to be injected, then the process would balance out.

In the consultant’s report, energy consumption – Table 3 – is specified with no difference in energy between raw material and product.

In the consultation process, the project group proposes two alternative energy requirements. The first alternative is a requirement where the production of biofuel or a blend of biofuel and a fossil fuel alternative does not exceed the energy consumption associated with the fossil alternative. Energy consumption for diesel, petrol and natural gas is 212 MJ/100 km, 255 MJ/100 km and 250 MJ/100 km, respectively, using values taken from NEDC 2002 driving formula (see table below).

Table 3: Table showing energy consumption associated with 38 different fuel alternatives. The figures are based on the JEC Well to Wheel 2006. Energy consumption does not include the difference in energy between raw material and product.

No. in Fig. 3	**Primary energy to energy carrier**	**Tot WtW energy** MJ/ 100km	**Comments**	No. in Fig. 3	**Primary energy to energy carrier**	**Tot WtW energy** MJ/ 100km	**Comments**
1	Farmed wood via black liquor DME	195.0	Incl waste collection and chipping Black liquor repla-ced by waste wood in mills	20	Liquid NG	280.7	Imported shipped LNG, truck distribution from harbour to fuelling stations
2	Farmed wood via black liquor FT-diesel	198.1	Incl. cultivation and chipping. Local transport. Black liquor replaced by waste wood in mills.	21	Rapeseed REE Biodiesel	288.8	By-product: Glycerine as chemical. Bio-ethanol instead of NG-methanol

3	Wheat Straw Ethanol	210.8	Logen process, extra fertilizer comp for straw**.	22	Compressed NG	289.6	Imported NG, piped 7000km
4	Diesel	212.4		23	Waste wood DME	290.2	Incl waste collection and chipping
5	Dry manure Compr. Biogas	225.8	Collected from farms. Local plant. Upgraded gas*	24	Farmed wood DME	290.2	Incl. cultivation and chipping. Local transport.
6	Sugarcane Ethanol	227.5	Shipped to EU from Brazil, blended with gasoline	25	Liquid NG	291.9	Imported shipped LNG, gaseous distribution from harbour into EU-gas grid
7	Waste wood Ethanol	228.6	Shipped to EU from Brazil, blended with gasoline	26	Rapeseed REE Biodiesel	296.1	By-product: animal feed, Bio-ethanol for esterification
8	Liquid manure Compr. Biogas	230.2	Collected from farms. Local plant. Upgraded gas*	27	Wheat Ethanol	303.0	By-product: co-fuel in a coal power plant, Straw CHP surplus elec sold**, extra fertilizer comp for straw***.
9	Farmed wood Ethanol	230.9	Incl. cultivation and chipping. Local transport.	28	Rapeseed RME Biodiesel	305.3	By-product: animal feed, NG-methanol for esterification
10	Waste wood FT-diesel	249.4	Incl. waste collection and chipping.	29	NG FT-diesel	307.6	Plant installed near natural gas supply.
11	Farmed wood FT-diesel	249.4	Incl. cultivation and chipping. Local transport.	30	Wheat Ethanol	314.2	By-product: co-fuel in a coal power plant. Coal CHP, surplus elec sold**
12	Compressed NG	249.5	Current EU-mix, piped 1000km	31	Sugar beet Ethanol	314.5	By-product: Pulp for heat.
13	Sunflower SME Biodiesel	254.5	By-product: Glycerine as chemical, NG-methanol for esterification	32	Wheat Ethanol	320.9	By-product: co-fuel in a coal power plant, conv NG boiler, elec fr grid.
14	Gasoline	254.8		33	NG DME	324.1	Imported NG, piped 7000km. DME plant close to NG supply in EU. Dedicated DME network distribution
15	Municipal waste Compr. Biogas	262.5	Municipal waste already collected. Upgraded gas*	34	Wheat Ethanol	372.3	By-product: Animal feed. NG CCGT, surplus elec sold**
16	Sunflower SME Biodiesel	265.5	By-product: animal feed, NG-methanol for esterification	35	Wheat Ethanol	408.0	By-product: Animal feed. Straw CHP, surplus elec sold**, extra fertilizer comp for straw***.
17	Wheat Ethanol	267.2	By-product: co-fuel in a coal power plant. NG CCGT, surplus elec sold**	36	Wheat Ethanol	419.2	By-product: Animal feed. Coal CHP, surplus elec sold**
18	Rapeseed RME Biodiesel	276.0	By-product: Glycerine as chemical, assuming NG-methanol for esterification	37	Wheat Ethanol	428.1	By-product: Animal feed. Conv NG boiler, elec fr grid.
19	NG DME	280.1	DME plant close to NG supply in EU. Dedicated DME network distribution	38	Sugar beet Ethanol	439.6	By-product: Animal feed.

The second alternative is a requirement where the limit with regard to energy consumption cannot be higher than the energy associated with the production and use of petrol – 255 MJ/100 km. Since the energy consumption associated with fossil diesel is lower than the energy consumption associated with petrol, the alternative under which all fuels are compared with petrol would make it somewhat easier for biodiesel to meet the requirement. The consultative bodies are requested to give their responses on which of the two alternative energy requirements they consider to be the best.

6.4 Raw material requirements (RK8 – R11)

Sustainable forestry requirements have long been in place in Nordic Ecolabelling criteria for products containing wood raw materials. More recently it has become appropriate to ensure that renewable raw materials for energy-related criteria are also sustainable. Biomass may be taken from forestry and plantation operations (palm oil, sugar cane, soybean) as well as ordinary agricultural products (rapeseed, corn and sugar beet). Our existing forestry requirements are not automatically applicable in the case of a number of these plants. A noteworthy absence is the inclusion of requirements as to the carbon dioxide balance.

Nordic Ecolabelling has chosen to apply the following three principles in order to ensure that sustainable raw materials are used in the production of Swan-labelled fuels:

1. Extend the capture requirement for renewable resources to take in all types of environment (instead of as in the past only forestry environment).
2. Introduce a new carbon dioxide balance requirement in the production of biomass.
3. Extend the existing guidelines on forestry certification to apply to the certification of biomass production.

6.4.1 Concerns about an increase in the use of biofuels

Although an increase in the use of biofuels offers obvious advantages in the form of reduced emissions of greenhouse gases, alarm bells have been sounded about a number of potential negative consequences. These relate first and foremost to plantation production in South America, Asia and Africa, even though the cultivation of rapeseed, wheat etc. also gives rise to environmental problems. Nevertheless, this chapter focuses on the challenges facing the developing world.

Loss of biodiversity:

Loss of biodiversity is associated in particular with the production of palm oil and sugar cane. Malaysia and Indonesia are the world's largest producers and exporters of palm oil, and most of the palm oil plantations have been established in what was formerly rain forest. The area of tropical forest in these countries that has been felled in order to establish palm oil plantations is uncertain. According to the Swedish Society for Nature Conservation's report entitled "Fuel for development" [38)] no less than 87% of all felling of rain forest in Malaysia between 1985 and 2000 can be attributed to palm oil plantations. In Indonesia, licences to establish palm oil plantations are used as a means of clearing areas that were originally rain forest. This is the result of the major values associated with rain forest timber. The question has therefore been asked whether the felling of rain forest would have taken place at the same rate even had no palm oil plantations been established.

At present, only one of Brazil's producers of sugar cane is located in the area around the Amazon. However, as a result of an increase in demand for sugar cane for use as a raw material, the possibility of extending the available production areas is being investigated. Accordingly, a loss of biodiversity may also become a problem associated with sugar cane ethanol in the future. Furthermore, the loss of biodiversity entails far more than simply the felling of rain forest. In Brazil, the area known as cerrado is under the greatest pressure from the sugar cane industry. This savannah, the home to over 90,000 species of insects, 550 species of birds and 150 mammals is also a favoured area for growing soybeans and coffee as well as sugar cane [38)].

The challenges related to the loss of biodiversity become extra complex if the secondary effects of plantation establishment are included in the equation. If large areas that were formerly used for, for example, rearing cattle or cultivating coffee are converted to sugar cane plantations, the outcome could be that cattle farmers and coffee growers switch their production activities to former rain forest areas or other areas worthy of protection for economic, ecological or social reasons.

Competition with other industries for available land:

With the increased focus on biofuels, the question has also arisen of how food production and the production of raw materials for biofuels should be prioritised. If demand for, for example, palm oil and sugar cane increases, the market price of these raw materials will also rise. This can result in areas that have traditionally been used for the production of food or animal feed being reassigned for the production of raw materials for biofuel production. As a consequence of this process the price of food could increase significantly. In Mexico, a price ceiling has been imposed on maize following an increase in price. In China, following a sharp increase in the price of maize and pork, no more ethanol plants may now be established [6)]. Whether or not the price rise can be attributed exclusively to increased demand from the ethanol industry is not known, however. Some portion of the blame could be attributable to failed harvests.

In addition to challenges associated with food safety, an increase in the demand for biofuels could fuel land rights disputes. The granting of land-use licences by the authorities to plantation owners, forestry operations and paper pulp mills, may conflict with the needs of the local community and the indigenous population. In Indonesia, no fewer than 40 million people are dependent on forestry areas in order to support themselves [37)]. If these areas are zoned as plantations or timber and paper pulp production areas many of these people will be in danger of losing the basis for their existence.

Nordic Ecolabelling’s aim is that the cultivation of raw materials used in the production of fuels should be as land-efficient as possible.

Local and regional environmental problems:

The cultivation of raw materials for biofuel production can lead to local and regional environmental damage. The widespread use of pesticides, fungicides and herbicides and high levels of water consumption are particular causes of environmental problems. Pesticides often contain toxic substances, which cause harm to both the environment and the health of plantation workers. In addition, the plantation operations often require large quantities of water. Irrigation of plantations is necessary in areas in which rainfall alone does not provide the plants with sufficient water. The effects of this include an increase in soil erosion. Production of ethanol and biodiesel generates organic materials that are frequently released directly into the natural ecosystem, effecting natural biochemical processes [38)].

Working conditions:

Working conditions on plantations are frequently very tough. In addition, many plantation owners prefer to employ people for short periods of time, without the option of unionisation. The performance requirements are stringent, housing conditions are often poor, school and health services are often limited and pay is low. Nor is it unusual for children to help their parents on the plantation in order to secure the day’s quota. Some years ago one of biggest producers of palm oil in Indonesia fired over 700 unionised workers who were demanding minimum wages and an end to discrimination of employees on longer contracts [38]. Monocultures, which generally occur in areas in which plantation operations take place, make local people very vulnerable to exploitation. The plantation will often be their only hope when it comes to feeding themselves and their families.

6.4.2 The traceability of vegetable and animal raw materials

The requirements applicable to raw materials are based on the full traceability of the individual raw material. This means that it must be possible to trace the raw material from the producer of the fuel back to the point at which it was produced. Applicants must accordingly disclose the origin of the raw material to Nordic Ecolabelling (country and region). Moreover, from the perspective of the requirement applicable to certified raw materials it is also essential for the producer to know the origin of the raw material. Nordic Ecolabelling reserves the right to withdraw a licence during the licence period if information comes to light indicating that the raw material derives from areas in which biodiversity or values in need for protection for social reasons are threatened.

In the case of animal raw materials, traceability is important in terms of ensuring that materials classified as Category 1 materials under the Animal By-product Regulation (EC 1774/2002) are not used. Full traceability is also important in order to ensure that the raw material does not contain organic materials from threatened animal species.

6.4.3 Carbon dioxide balance in the production of biomass

Worldwide, the market and demand for biofuels is expanding, which is leading to rising pressure on uncultivated agricultural land, forests and other vulnerable areas of the environment. Imposing the requirement that the production of biomass must not result in a negative carbon dioxide balance will ensure that new plantations for example are not established in areas of rainforest. Old tropical rain forest binds approximately 160 tons of carbon/hectare in biopulp above ground. By comparison, a field with high oil production binds approximately 4 tonnes of carbon/hectare/year [40]. The requirement that the carbon dioxide balance for plants/plantations established before November 2005 need not be calculated is justified on the grounds that the forthcoming proposal for the RSPO standard for palm oil and the UK certification scheme for biofuels use the same date. At the end of the 1990s/beginning of the 2000s large areas of rain forest/mangrove in Indonesia in particular were felled to enable oil plantations to be established. The RSPO has concluded that these areas can now be used for sustainable oil palm production since the damage has already been done.

In calculating the CO_2 balance, the methodology and data provided in ”Carbon and Sustainability Reporting Within the Renewable Transport Fuel Obligation – annex G” must be used [36]. This annex provides average values for the number of tonnes of CO_2 equivalents stored per hectare in various biomasses. The data has been compiled over a 25-year period and at the time of writing represents some of the most thoroughly documented material available in this field. It will also be beneficial for Nordic

Ecolabelling to harmonise its requirements with those of other labelling schemes that may play an important role in Europe in the coming years.

6.4.4 Certified raw materials

The increased focus on the use of biofuels has resulted in a need for sound certification schemes for both biomass and the finished biofuel products. Work is under way on this at both national and international level. Various NGOs and private operators are also compiling standardisation systems for biomass and/or biofuel. The biofuel schemes are discussed in Section 3.3. This section focuses on various certification schemes for biomass – i.e. the raw materials used in the production of biofuels.

As part of the process of developing criteria for the Swan-labelling of fuels it has been important for Nordic Ecolabelling to map the status of these certification schemes and to look at the possibility of imposing the requirement that certified raw materials be used. Nordic Ecolabelling is of the view that complex questions relating to sustainable production of raw materials, economic conditions and working conditions are best safeguarded through external systems with expertise within these areas.

Several of the certification schemes reviewed by Nordic Ecolabelling during the development of criteria for the ecolabelling of fuel, have formulated their principles, in other words agreement has been reached on what the certification scheme should encompass. However, many of these schemes have not as yet defined the requirements that will apply, nor have control and verification bodies been established. Building up a qualified standard is an extensive and complicated process. It has for example taken many years to develop the established standards for wood raw materials and organic production operated by FSC (Forst Stewardship Council) and IFOAM (International Federation of Organic Movements), respectively. Accordingly it is likely that most of the certification schemes assessed by Nordic Ecolabelling will not be operational for several years.

Six areas of focus stand out in the case of the certification schemes that have already formulated their principles [35)]:

- Emissions of greenhouse gases
- Conflicts with other industries in terms of land use
- Biodiversity
- The needs of the local and regional economy
- Social requirements relating to, inter alia, workers' rights
- Environmental criteria, including waste processing, the use of pesticides, emissions to water etc.

None of the certification schemes assessed by Nordic Ecolabelling embody all of the above principles. Normally there is a focus on between two and four of the principles. Nordic Ecolabelling monitored the work of the following certification schemes during the development of the criteria for the ecolabelling of fuels:

- RSPO (Roundtable of Sustainable Palm Oil): One of the certification schemes that has made most progress in the process of developing the standard. Eight principles and 48 criteria have been formulated. The principles relate to sustainable, social and economic criteria, which are now undergoing a two-year test phase. The scheme is voluntary and its members include operators from the entire palm oil production chain as well as a number of environmental organisations, including WWF, BP, Neste Oil and a number of palm oil producers [41)].

- RTRS (Roundtable on Sustainable Soy): The aim of the scheme is to develop and promote requirements relating to the production of soy based on sustainable, economic and social principles. The organisation has a great deal in common with RSPO in that it is based on voluntariness and its membership numbers a broad range of operators from the entire soy oil production chain. WWF, COOP and a number of soybean oil producers are amongst the contributors [42)].
- BSI (Better Sugarcane Initiative): Goals include defining the principles for a global standard for sustainable cultivation of sugar cane. Like RSPO and RTRS, BSI is a voluntary scheme. Its members include WWF and Coca Cola [43)].
- Green Gold Label: A Dutch initiative started by power producer Essent. The certification system is based on principles for the sustainable production of biomass and traceability systems for raw materials. GGL is based on other schemes such as FSC and IFOAM. In addition, GGL is a member of RSPO and will probably adopt this standard when it has been established. At present the scheme is considering whether to include social requirements in the standard [44)].
- FSC (Forest Stewardship Council): Operational since the end of the 1990s. The organisations accredits certification bodies for performing FSC certification of wood raw materials. Two types of certificates are available: FM (Forest Management) and Chain of Custody. At present the FSC is in the process of revising its plantation standard [35)].
- IFOAM (International Federation of Organic Agriculture Movements): An umbrella organisation for the world’s organic agriculture movements. IFOAM’s principles take in ecology, health and sustainability. The certification scheme is well established and has over 30 years experience [45)].

Nordic Ecolabelling has extensive experience in imposing forestry certification requirements in for example its criteria for paper products. Here the requirement is that the certified proportion must be 20%. At the time of writing no certification schemes exist for palm oil, soybean oil and sugar cane. RSPO is expecting to complete its criteria for palm oil in the autumn of 2008, whereas the equivalent schemes for soy and sugar cane are further off.

Nordic Ecolabelling has not developed its own requirements for sustainable production of biomass but has instead opted to impose the requirement that sustainable production of biomass must fulfil existing forestry and certification standards/schemes.

Nordic Ecolabelling imposes requirements applicable to the standards under which biopulp production is certified. The requirement is described below. Each individual national standard and certification system is reviewed by Nordic Ecolabelling to ensure that all requirements are fulfilled. The standards are reviewed again if they are revised.

Requirements applicable to standards

- The standard must balance economic, ecological and social interests and comply with the UN's Rio document: Agenda 21 and the Forestry Principles and respect international conventions and agreements.
- The standard must contain absolute requirements and promote and work towards sustainable production of biomass. The standard must ensure that production does not lead to a negative carbon balance.
- The standard must be generally available. The standard must be developed in an open process in which economic, ecological and social interests have been invited to participate.

The requirement as to standard ais formulated as a process requirement where the point of departure is that if economic, ecological and social interests in a process agree on a standard, then an acceptable level for the standard will be safeguarded.

The standard must contain absolute requirements that must be fulfilled before the forests/agricultural land is certified. This ensures that forestry and agriculture fulfils an acceptable level of environmental work. The requirement that the standard must promote and work towards sustainable production of biomass entails that the standard must be evaluated and revised regularly to ensure that the process is forward-looking and the environmental impacts are reduced successively.

The requirements applicable to certification and the certification bodies are described below:

Requirements applicable to certification systems

- The certification system must be open, enjoy broad national or international credibility and be capable of verifying that the requirements of the standard have been fulfilled.

Requirements applicable to certification bodies

- The certification body must be impartial, credible, able to verify that the requirements of the standard have been fulfilled, capable of communicating the results and secure the rapid and effective implementation of the standard.

The purpose of certification is to ensure by means of a quality assurance process that the requirements of the standard are met. Nordic Ecolabelling has neither the expertise nor the resources to assess forestry or agriculture management or to verify standards. Accordingly independent third party certification is required.

The certification system must be suitable for verifying that the requirements of the standard are fulfilled. The method used in certification must be repeatable. Similarly the method must be suitable for use within forestry and agriculture and certification must be in accordance with a specific forestry and agriculture standard. Verification of the standard must take place on the cultivated land in question before a certificate is issued.

There is no requirement that raw materials be certified in the case of other agricultural products such as wheat, rapeseed etc. In general terms, Nordic Ecolabelling is in favour of applying an existing certification system for such raw materials – this might for example take the form of imposing requirements as to the proportion of organic raw materials in accordance with IFOAM, EEC 2092/91 or equivalent systems. However, Nordic Ecolabelling is of the view that the organic production of raw materials of this nature is not large enough for certification to be required of other agricultural products in this version of the criteria document. Given the small proportion of agricultural products that are organically grown, Nordic Ecolabelling is of the view that this should be reserved for food production. Moreover, the requirements laid down by European authorities as regards cultivation of agricultural plants are considered to be sufficient. The European Union has a system that offers financial support to farmers that fulfil certain environmental requirements in their output. In Finland no fewer than 93% of all farmers receive support of this nature.

Nevertheless, Nordic Ecolabelling is of the view that it is important that requirements should also be imposed with respect to other agricultural crops and will in future versions consider the possibility of requiring the use of certified biomass in the case of wheat, rapeseed and other raw materials that can be used in the production of fuel. In this criteria document such raw materials must fulfil the requirements applicable to CO_2 balance and traceability.

6.5 Emissions of substances that are harmful to health (R12 and R13)

6.5.1 Emissions of carcinogenic substances

The risk of cancer must not be increased because the fuel in question is used in a vehicle as a replacement for a fossil fuel. A Swedish test of petrol engines and diesel engines operated on petrol, ethanol, diesel, RME, methane and methanol indicates that the cancer risk is reduced with the use of biofuels [46)]. If a competent, independent third party can document that fuel equivalent to the product for which a Swan Label is sought does not result in an increase in the cancer risk, then this will be accepted as documentation.

The requirement says nothing about test methods for determining the content of carcinogenic substances in exhaust fumes. The key point is that this must be determined using the same method for the fuel for which a Swan Label is sought and the fossil fuel alternative and that testing must be conducted on engines using the same combustion technology.

Nordic Ecolabelling is awaiting the results of a new study on emissions of carcinogenic substances from ethanol, biogas and petrol commissioned by the

Swedish Road Administration. The report is a cooperation between the University of Stockholm and consultants Ecotraffic and is due to be published in December of this year. The requirement may be amended as a consequence of the findings of the report.

6.5.2 Emissions of other substances harmful to health

Most recent reports on the subject conclude that with existing engine technology there is little difference in terms of local exhaust emissions between bioethanol and petrol. This is particularly true in the case of hydrocarbons, NOx and CO. As regards particle pollution a review of 20 different studies reveals that emissions can be reduced by blending ethanol into petrol and by using pure ethanol [47)].

A review of 20 different studies of local emissions from biodiesel and different blends of diesel and biodiesel reveals that emissions of particles, CO and HC are reduced, whereas emissions of NO_x increase somewhat [47)]. Increases can be of the order of 8-12% when using pure biodiesel [48)]. The problem of NO_x emissions from biodiesel is familiar and is caused by higher combustion temperatures. This can in many instances be avoided by installing an NO_x sensor which adjusts combustion depending on the composition of the fuel. Vehicles equipped with sensors of this nature will not release more NO_x than when normal auto diesel is used, and in some cases less [49)]. In addition, the fuel hoses and gaskets used must be capable of withstanding biodiesel (biodiesel functions as a solvent and dissolves rubber hoses).

Compared with fossil fuels, the use of biogas reduces local and regional pollution. The biggest benefit is recorded where biogas is used in place of older diesel engines. This has been documented in a number of Swedish towns where buses, refuse vehicles and taxis have switched to biogas [50)].

Car manufacturers are required to comply with the European Union's directives on exhaust gases from vehicles (CO, $NO_{x,}$ hydrocarbons and particles), what is termed the Euronorm. The Euronorm applies equally to cars/engines as to the fuel itself, and it will be technically and financially impossible for fuel producers to test a representative selection of cars in relation to the exhaust requirements in Euronorm.

Nordic Ecolabelling cannot impose requirements on car manufacturers, but we can impose requirements on fuel producers which will indirectly influence the fulfilment of the exhaust requirements. Nordic Ecolabelling therefore proposes the following requirement:

The licenceholder must ensure that the following notice is posted on the fuel pumps in question: "Check that your vehicle can be refuelled with XXX (insert "biodiesel", "bioethanol" or the equivalent).

6.6 Quality (R14)

The fuel standards [51)] are applied by the petroleum industry as industry standards and regulate the quality that fuels sold from public and generally available filling stations must meet.

The regular industry standards for petrol and diesel, EN 228 and EN 590, contain provisions to the effect that up to 5 per cent by volume of bioethanol and 5 per cent by volume of biodiesel (which meets the requirements of EN 14214) may be blended with petrol and diesel, respectively. The EU Commission is seeking to alter the standards so that 10% biofuel may be blended in. It is assumed that it will be easier to persuade a manufacturers to accept bioethanol than biodiesel. At present, only synthetic biodiesel fulfils the EN 590 standard, and this is not as yet commercially available [52)].

The European standard for biodiesel, EN 14214, has been formulated such that biofuel made from from rapeseed and waste oils from food preparation satisfy the requirements whereas other raw materials encounter problems with one or more parameters of the standard. In 2006, the European Commission presented a proposal for a strategic plan for increased use of biofuels for transport. The strategy states that the European Commission will investigate the possibilities of altering the standard so that additional types of raw materials can be used and increased blending will be possible in practice.

The European Union's Biofuel Directive (2003/30/EC) was adopted in May 2003. The directive contains what are termed ”indicative targets” for the use of biofuels. The directive opens the way for the use of 5% biofuels blended into petrol and diesel and higher percentage mixes and pure biofuel provided that they meet the quality standards. If pure biofuel or fuel containing a more than 5% blend of biofuel is used, the member states must monitor and verify that the exhaust requirements applicable to vehicles continue to be satisfied.

At present it is possible only to blend in 5% (by volume) of biodiesel in diesel and 5% (by volume) of ethanol combined with a small portion of ETBE in petrol, because of the existing standards for fuel in the European Union. The use of fuels with a higher bioproportion requires approval from the car manufacturers and technology adjustments.

The existing standards on petrol and diesel (EN 228 and EN 590) may be amended to permit increased blending, particularly of ethanol (up to 10%) and possibly of biodiesel, although it is not possible to say when.

In the case of ethanol, Sweden has developed a standard, SS 155480:2006 and the United States has developed the standard 2006 Edition of ASTM D 5798.

In the case of biodiesel the following standards have been developed: DIN 51 606, EN 14214 (based on DIN 51 606), in Sweden SS 155435 and in the United States, ASTM D975.

Since the use of biofuel is increasing rapidly, there will probably be additional quality standards in the future applicable to multiple fuel alternatives – both fossil and renewable.

6.7 Quality requirements and the requirements of the authorities (A1 – A9)

R1 Statutes and regulations
A minimum requirement for ecolabelled products is that the manufacturer/importer/ supplier must fulfil all the requirements laid down by the authorities in the country in which a licence is sought. The reason that Nordic Ecolabelling also includes the official requirements of the authorities in its criteria is to ensure that they are in fact observed. If it comes to light that applicable statutes and regulations are not observed, Nordic Ecolabelling may revoke the licence.

R2: Responsibility for the Swan Label
Nordic Ecolabelling must know at all times who at the licenceholder acts as a contact person with regard to the Swan Label. For this reason the applicant must nominate the person with responsibility for ensuring that the requirements applicable to the Swan-labelled product are met at all times. The contact person will also be responsible for all communication with Nordic Ecolabelling.

R3: Documentation
The licenceholder must retain copies of all documentation submitted to Nordic Ecolabelling in connection with the processing of the application. The background to this requirement is that it must be possible for the applicant's contact person to recover documentation as necessary and to communicate with Nordic Ecoabelling on the subject of the documentation.

R4: The quality of the fuel
It is a prerequisite for the awarding of a licence that the quality of the ecolabelled product should remain the same throughout the entire licence period. The requirement is therefore imposed that applicants must submit documentation on the efforts made to safeguard this. This might take the form of, for example, systems for storing batch samples and analysing the product based on parameters such as acid figures, the content of pollutants etc. It is also essentiel that the licenceholder has procedures in place for summarising and reporting complaints against the ecolabelled product.

R5: Planned changes
Changes to the ecolabelled product itself or to the production process may have consequences for the Swan licence. A written report on all changes that might be related to the requirements applicable to the ecolabelled product must accordingly be submitted to Nordic Ecolabelling. This will allow Nordic Ecolabelling to notify the licenceholder of what measures will be required in order for the change not to have consequences for the licence.

R6: Unforeseen deviations
Unforeseen deviations in the production of Swan-labelled products may have consequences for the Swan licence. A written report on unforeseen deviations that can be related to the requirements applicable to the ecolabelled product must therefore be submitted to Nordic Ecolabelling. This will enable Nordic Ecolabelling to assess the consequences of the unforeseen deviations and to offer advice on what measures the licenceholder should put in place.

R7: Traceability
The licenceholder must ensure the traceability of the Swan-labelled product in the production process. This is of particular importance where the producer also produces products that are not ecolabelled. If full traceability of the ecolabelled product is not safeguarded, the consequence may be that the requirements of the Swan Label are not complied with. Accordingly, a prerequisite for the granting of a licence is that the applicant submits a description of the system by which the traceability of the ecolabelled product is safeguarded.

R8: Marketing
The rules on the marketing of ecolabelled products can be confusing for those not familiar with the marketing rules applicable in the Nordic country in question. For this reason the marketing of Swan-labelled fuels must comply with the “Rules on Nordic Ecolabelling” of 12 December 2001 or subsequent versions regulating the way in which marketing must be conducted in relation to the national regulations in force in the various Nordic countries.

R9: Annual report
Each year the licenceholder must submit documentation to Nordic Ecolabelling showing that the requirements applicable to the ecolabelling of fuels continue to be followed.

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