About Nordic Swan Ecolabelled

Liquid and gaseous fuels



Version 3.0

Background to ecolabelling
07/02/2017
Consultation proposal

Nordic Ecolabelling

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099 Liquid and gaseous fuels, version 3.0, 07/02/2017

Note: The original document, of which this is a translation, was written in a combination of several Scandinavian languages. The reason for this is that the Nordic countries work in close collaboration to develop the Nordic Swan Ecolabelling criteria. Nordic Ecolabelling is of the opinion that this variation in the original document (provided there is coherence) can be seen as confirmation of this strong Nordic partnership, which enables and drives the development of the Nordic Swan Ecolabel's criteria.

Addresses

In 1989, the Nordic Council of Ministers decided to introduce a voluntary official ecolabel, the Nordic Swan Ecolabel. These organisations/companies are responsible for the official Nordic Swan Ecolabel on behalf of their own country's government.For more information, see the websites:

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1 Summary

The overall aim of this revision is to ensure that the Nordic Swan Ecolabel's criteria continue to secure a positive environmental benefit via ecolabelling and also that the criteria are viable and clear for the industry. The revision has considered the areas that were apparent on the evaluation of the criteria. It has also focused on expanding the product group to make it possible for liquid and gaseous fuels for air and marine transport, and for heating and industrial use, to be Nordic Swan Ecolabelled.

Product group message

Nordic Swan Ecolabelled liquid and gaseous fuels for transport (road, sea and air) contain at least 60% renewable resources derived from sustainably produced and controlled sources. Up to 10% of the total fuel mix may be so-called first generation biofuels. Biogas and liquid fuels for heating and industrial use are required to contain 100% renewable resources to be Nordic Swan Ecolabelled. In the case of liquid fuels, the fuel is required to physically comply with the share of renewable resources all the way to the filling station (the pump). The use of mass balance is permitted for biogas that is distributed through the existing gas grid. The use of problematic feedstocks, such as palm oil, soy oil and sugarcane and unconventional fossil fuel sources, such as crude oil from tar sands, is not permitted in Nordic Swan Ecolabelled fuels. From a life cycle perspective, a Nordic Swan Ecolabelled fuel has low greenhouse gas emission levels that are stricter than the limits stipulated by EU regulations. Nordic Ecolabelled liquid and gaseous fuels live up to recognised fuel standards in order to guarantee good combustion characteristics.

MECO and RPS analyses

To obtain an overview of the key environmental impacts in the products' life cycles, an environmental assessment of the product group was performed as a qualitative MECO analysis for each of the four product areas. MECO stands for the assessment of Materials, Energy, Chemicals and Other characteristics and describes the principal environmental impacts during the product group's life cycle phases. This was followed by an overall RPS analysis for the product group as a whole. RPS stands for Relevance, Potential and Steerability and the analysis identifies the most relevant environmental impacts that the Nordic Swan Ecolabel has the greatest possibility of steering towards a lower environmental impact. RPS was found for the following:

- Feedstocks used in liquid and gaseous fuels
- Energy consumption and impact on the climate
- The quality of the liquid and gaseous fuels

Market description

A brief description of the Nordic market shows that liquid and gaseous fuels are mainly used in the road transport sector but there is a growing interest in their use in the aviation and maritime transport sectors. Biogas is used as transportation fuel and for heating and industrial purposes. The market description shows there are large differences in consumption (amounts) of biofuels in the Nordic countries.

This is also reflected in the availability of so-called lower-level and higher-level blends in the respective markets.

Changes in the revised version

Based on the assessment, the MECO and RPS analyses and the market description, the main changes in the revision focus on:

- Expanding the criteria to include liquid and gaseous fuels for air and sea transport and for heating and industrial purposes.
- Strengthening the requirements for what percentage of first generation and advanced biofuels should be included in the Nordic Swan Ecolabelled fuels
- Harmonising requirements for greenhouse gas emissions calculation methods with the EU's Renewable Energy Directive (RED) (2009/28/EC)
- Strenghtening the level of requirements for greenhouse gas emissions, so that they are more stringent than the EU's Renewable Energy Directive (RED) (2009/28/EC)
- Removing the requirement for energy use

All changes and amendments to the requirements are listed in Chapter 8. Further details about the changes to requirements and new requirements can be found in Chapter 7.

2 Basic facts about the criteria

2.1 Products that may be ecolabelled

The product group comprises liquid and gaseous fuels for transport (road, sea and air), heating and industrial purposes. The material in the fuels consists of renewable energy or blends of renewable energy sources and fossil fuels.

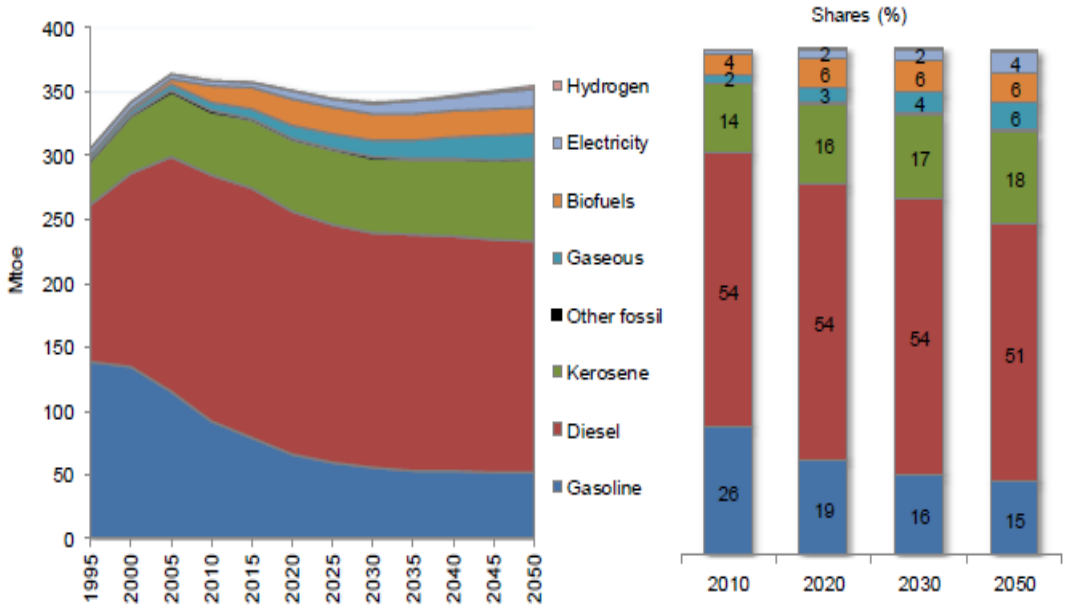
Solid fuels cannot be Nordic Swan Ecolabelled according to these criteria, but can be Nordic Swan Ecolabelled according to criteria for solid fuels. Nor does the product group include electriciry, hydrogen, lubricating oils or firelighting products.

2.2 Reason for Nordic Swan Ecolabelling

Following the Paris Agreement on climate change, the EU target is a 40% reduction in greenhouse gas emissions by 2030 from 1990 levels[1], and a significant part of the effort must be within non-ETS sectors, such as transport, agriculture and buildings. The transport sector in the EU currently accounts for about one third of total energy consumption in Europe[2], and the majority of fuels used for transport in the EU and the world are based on fossil sources of energy, primarily crude oil[3].

[1] http://ec.europa.eu/clima/policies/strategies/2030/index_en.htm, accessed 4 November 2016
[2] EU Reference Scenario 2016 – Energy, transport and GHG emissions - Trends to 2050 publication report, Figure 10
[3] http://ec.europa.eu/transport/themes/urban/cpt_en, accessed 4 November 2016

EU's expectations are that fossil-derived oil products in the transport sector will account for approximately 90% in 2030 and approximately 86% in 2050 (cf. the figure below).



Figur 1: Expected energy demand in transport in the EU by fuel type up to 2050. Kerosene is primarily used as fuel for aircraft (jet fuel). Source: EU Reference Scenario 2016 – Energy, transport and GHG emissions - Trends to 2050 publication report, Figure 15.

As a means of meeting the targets of the climate agreement, the EU has adopted the Renewable Energy Directive (RED, 2009/28/EC)[4], which sets a binding target of 20% final energy consumption from renewable sources for all EU Member States, and at least a 10% target for renewables in transport energy consumption in 2020. The Renewable Energy Directive (RED) is supported by the European Commission's Strategy[5] for Low Emission Mobility, which identifies three priority areas for action across the transport areas:

- Increase energy efficiency in the transport sector - increased use of digital technologies and intelligent transport systems
- Increase the development of alternative energies/fuels with low emissions for transport - such as advanced biofuels (2nd and 3rd generation biofuels), electricity, hydrogen and renewable synthetic fuels
- Increase the development of low and zero emission means of transport - need for further improvement of the internal combustion engine and to accelerate the transition to low and zero emission vehicles.

[4] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009L0028, accessed 10 October 2016
[5] http://ec.europa.eu/transport/themes/strategies/news/2016-07-20-decarbonisation_en, accessed 4 November 2016

The aim of the EU's 2020 Aviation Strategy[6] is to reduce fuel consumption and hence CO_2 emissions by 50% per passenger kilometre, to reduce NOx emissions by 80% (in landing and take-off according to ICAO standards[7]) and to reduce unburnt hydrocarbons and CO emissions by 50%.

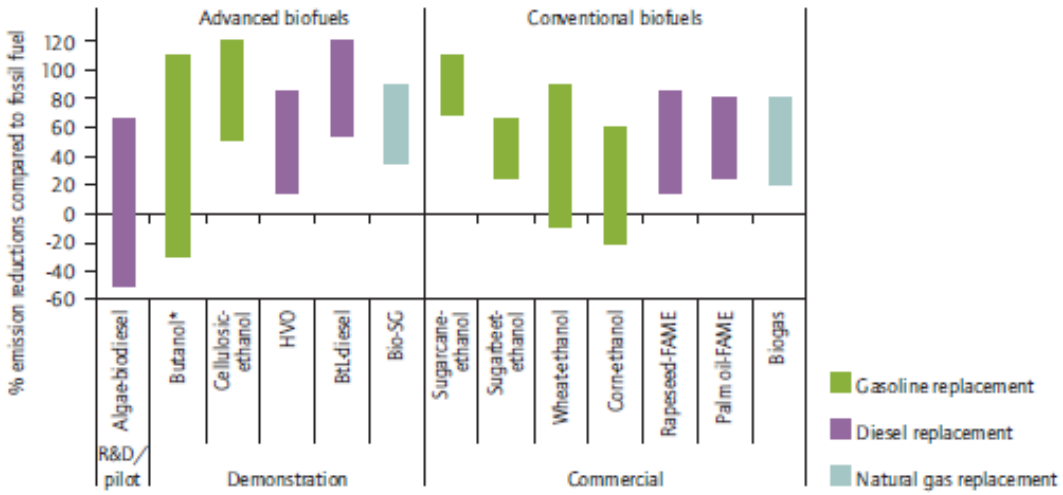
International shipping is not yet covered by the EU's current greenhouse gas savings requirements[8]. However, the EU has adopted a regulation[9] for the monitoring, reporting and verification of greenhouse gas emissions from maritime transport based on the ships' fuel consumption. The European Union's Sulphur Directive[10] regulates sulphur emissions from combustion of certain types of fossil-based liquid fuels.

Nordic Ecolabelling supports the European Commission's Strategy by identifying the best environmental alternative energies/fuels with low emissions for transport, heating and industrial purposes (the Strategy's second area of action). The focus is therefore on ensuring the sustainable and efficient use of renewable resources. Biomass is a limited resource that cannot meet all our energy requirements. Conversion of biomass into fuel is not necessarily the best way to use the available biomass (greatest possible CO_2 emissions savings), as the use of biomass for power and heat production can, technologically and theoretically, be a better solution[11]. Despite this, the use of biomass for the production of solid fuels and liquid and gaseous fuels is expected to increase over the coming years due to political decisions on targets.

Transport fuel used to be relatively similar products (petrochemical-based petrol and diesel), whereas nowadays the range of fuels is tending to become more and more differentiated. With a greater diversity of products in the market, there is a greater diversity of life-cycle environmental impacts between different fuels. This means there is now greater need than ever before for Nordic Ecolabelling to identify the fuels that are the most environmentally-friendly in the market from amongst those with poor environmental profiles. In particular in the case of biomass-based fuels, there can be significant differences in environmental impacts depending on the type of biomass, origin and conversion process.

The potential for GHG savings for a number of conventional biofuels (first generation) and more advanced biofuels is compared in Figure 2 below. The figure is based on a number of Well-to-Wheels (WtW) life-cycle analyses (LCA) that compare GHG savings with fossil alternatives[12]. The figure shows that there are significant differences between potential greenhouse gas savings and the individual fuel types/technologies.

[6] http://ec.europa.eu/transport/modes/air/environment_en, accessed 10 October 2016
[7] ICAO= International Civil Aviation Organization
[8] http://ec.europa.eu/transport/modes/maritime/safety/actions_en, accessed 3 November 2016
[9] Directive 2009/16/EC
[10] Directive 1999/32/EC
[11] http://www.dr.dk/NR/rdonlyres/10AFAF7D-197B-4D7B-B011-37C65A15B39F/442233/Ritzausomtale.doc. Accessed 10 October 2016
[12] 120 IEA Technology Roadmap (2011) Biofuels for Transport

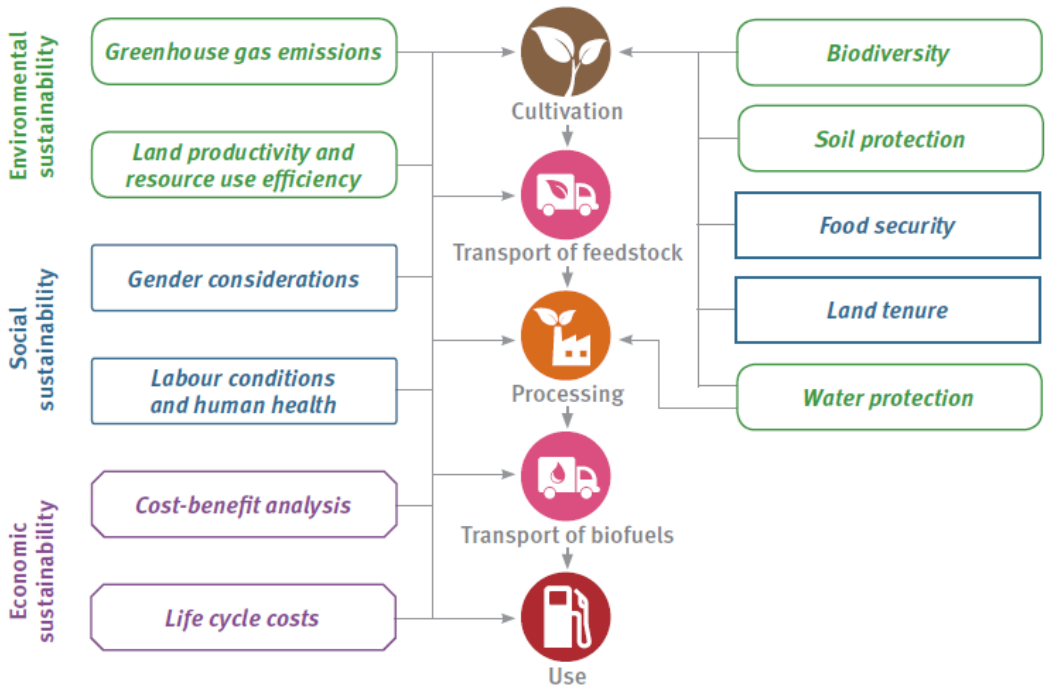


Figur 2: Life-cycle greenhouse gas savings for different biofuels (first generation and advanced biofuels). Note: The assessments have not included emissions from indirect land-use changes (ILUC). Emission savings of more than 100% are possible through use of by-products. Bio-SG = bio-synthetic gas; BtL = biomass-to-liquids; FAME = fatty acid methyl esters; HVO = hydrotreated vegetable oil. IEA analysis is based on data from more than 60 LCA studies.

However, it is important to emphasise that the use of by-products and of other process energies has a major effect on the total life-cycle GHG emission savings. For example, producing ethanol from sugar cane shows significant potential for GHG savings, if no indirect land-use change occurs (ILUC). A recent report by the European Commission[13] on biofuels and inclusion of ILUC concludes that the results for GHG savings can look completely different (further information is given under Requirement O2). Advanced fuels, such as ethanol from straw, likewise potentially provide high GHG savings, particularly by making use of by-products. Indirect land-use change impacts can, however, have great significance for total greenhouse gas savings of the fuel. Biogas produced from waste products (manure), for example, provides considerable greenhouse gas savings. However, if the gas is produced from maize (involving a change in land use), there may be additional emission impacts. The uncertainties associated with the modelling of indirect land-use change are still too great for ILUC factors to be introduced into the EU's sustainability criteria (Directive 2009/28/EC). The intention is that eventually the indirect consequences of cultivation in the form of emissions from secondary changes in land use elsewhere will also be included.

In addition to greenhouse gas emissions, there is a long list of environmental, social and economic parameters that impact the sustainability of a fuel (Figure 3 below). Eutrophication, acidification, ozone impacts, ecotoxicity, water consumption, direct and indirect land use changes are some of the relevant environmental impacts.

[13] Valin et al. 2015. The land use change impact of biofuels consumed in the EU Quantification of area and greenhouse gas impacts. Ecofys, IIASA, E4tech. European Commission Ref. Ares (2015)4173087.



Figur 3: Summary of the production flow and parameters that have an impact on the overall sustainability assessment of a fuel. Source: Global Assessments and Guidelines for Sustainable Liquid Biofuel Production in Developing Countries. IFEU – Institute for Energy and Environmental Research Heidelberg GmbH, 2013.

By setting criteria for the Nordic Swan Ecolabelling of liquid and gaseous fuels for transport, heating and industrial purposes, Nordic Ecolabelling wishes to play a role in the development of more climate-friendly fuels. The requirements are stricter than the EU legislation for greenhouse gas emission savings from the renewable share of the fuel blend. There are also requirements for what share of renewable energy Nordic Swan Ecolabelled fuels must contain. The specifications of the requirements are also focused on using a high percentage of advanced biofuels.

Product group message

Nordic Swan Ecolabelled liquid and gaseous fuels for transport (road, sea and air) contain at least 60% renewable resources derived from sustainably produced and controlled sources. Up to 10% of the total fuel mix may be so-called first generation biofuels. Biogas and liquid fuels for heating and industrial use are required to contain 100% renewable resources to be Nordic Swan Ecolabelled. In the case of liquid fuels, the fuel is required to physically comply with the share of renewable resources all the way to the filling station (the pump). The use of mass balance is permitted for biogas that is distributed through the existing gas grid. The use of problematic feedstocks, such as palm oil, soy oil and sugarcane and unconventional fossil fuel sources, such as crude oil from tar sands, is not permitted in Nordic Swan Ecolabelled fuels. From a life cycle perspective, a Nordic Swan Ecolabelled fuel has low greenhouse gas emission levels that are stricter than the limits stipulated by EU regulations. Nordic Swan Ecolabelled liquid and gaseous fuels live up to recognised fuel standards in order to guarantee good combustion characteristics.

Nordic Swan Ecolabelled liquid and gaseous fuels:

- Contain a high share of renewable energy - e.g. forest and agricultural crops or residues and waste products, such as straw, manure and household waste
- Contain sustainably produced feedstocks - to conserve the earth's resources and biodiversity
- From a life cycle perspective, have low greenhouse gas emissions - to reduce the impacts of climate change
- Comply with recognised fuel standards - ensuring they have good combustion characteristics

2.3 The version and validity of the criteria

Nordic Ecolabelling adopted Version 1 of the criteria for the Nordic Swan Ecolabelling of fuels for transport on 25 June 2008. The validity of the criteria was extended on 8 June 2007 to 31 December 2011.

Version 2 was adopted by the Nordic Ecolabelling Board on 11 October 2011. Version 2 of the criteria is valid until 30 June 2016.

On 10 December 2014, the Nordic Criteria Group (NCG) decided to adjust and clarify requirements for calculating energy consumption and definitions of waste and residual products. At a meeting of the Association's committee on 17 November 2014, it was decided to remove the requirement O23 “Marketing” from the criteria. The new version of the criteria is 2.1, which is valid until 30 June 2016.

It was decided on 17 March 2015 by the Nordic Criteria Group (NCG) to adjust the reference value for fossil diesel from 87.6g CO_2 eq/MJ to 83.8g CO_2 eq/MJ. The reference value also applies to petrol. The new version of the criteria is 2.2, which is valid until 30 June 2016.

It was decided on 16 June 2015 by the Nordic Criteria Group (NCG) to extend the criteria by 18 months until 31 December 2017. The new version of the criteria is 2.3.

On 9 September 2015, the Nordic Ecolabelling Board adopted the decision to expand the product group to include biogas for heating and industrial purposes. The new version of the criteria is 2.4.

At the Nordic Criteria Team meeting of 11 October 2016, it was decided to extend the validity of the criteria until 31 October 2018. The new version is called 2.5.

Nordic Swan Ecolabel licences

Tabel 1: Overview of licences in the Nordic market.

Licensees	Country	Type of fuels
FordonsGas Sverige AB	Sweden	Gas for transport
Preem AB	Sweden	Diesel for transport
Gassum Oy	Finland	Gas for transport and heating
NGF Nature Energy A/S	Denmark	Gas for transport and heating
Sorpa bs.	Iceland	Gas for transport and heating

3 The Nordic market

This chapter briefly describes the Nordic market for liquid and gaseous fuels, and outlines the liquid and gaseous fuels industry in each of the Nordic countries (data from 2013-2015).

3.1 The Nordic market for liquid and gaseous fuels

Consumption of different types of liquid and gaseous biofuels in the Nordic countries (2014) is summarised in the table below. It includes both lower-level and higher-level blends and shows that there are large national differences. Of the Nordic countries, Sweden has the most proactive strategy for biofuel use. This has resulted in a much higher percentage of biofuels than the other Nordic countries. According to statistics, the biodiesel types HVO (Hydrotreated Vegetable Oil) and FAME (Fatty Acid Methyl Ester) are the dominant fuel types in the Nordic countries. Ethanol is particularly common in Sweden and Finland, and biogas in both gaseous and liquid form is common in Sweden.

Tabel 2: Use of different types of liquid and gaseous biofuels in the Nordic countries (not Iceland)

	Denmark[14]	**Finland[15]**	**Norway[16]**	**Sweden[17]**
Year	**2014**	**2014**	**2014**	**2014**
Unit	**GWh**	**GWh**	**GWh**	**GWh**
HVO (Hydrotreated Vegetable Oil).	846	1546	280	4,607
FAME (Fatty Acid Methyl Ester)	799	320	1122	4,156
Ethanol	232	813	116	1,902
Biogas in gaseous form	64	17	20	972
Biogas in liquid form				39
ETBE (Ethyl tertiary butyl ether), octane enhancing additive in petrol)				3
DME (Dimethyl ether)				2
Total	1941	2696	1538	11,681

[14] Energy Statistics 2014, the Danish Energy Agency.
[15] http://www.eurobserv-er.org/biofuels-barometer-2015/
[16] Transport and the environment 2015. Statistics and indicators for the transport sector. Statistics Norway. 2015:34. Converted from litres and that 80% of biodiesel has been calculated to be FAME and the rest HVO according to data in the report.
[17] Swedish Petroleum & Biofuel Institute (SPBI). 2015. SPBI Facts 2015.

Table 3 shows that road transport accounted for the largest energy consumption in domestic transport in the Nordic countries in 2014. Of the total energy consumption of road transport, renewable biofuels accounted for between 3.5% in Norway and 12% in Sweden. In all the countries, the trend is towards a higher consumption of diesel than petrol. This is also reflected in the types and quantities of biofuels that are used in the markets that are suitable for use in diesel engines (HVO, DME and FAME). The Swedish road transport market differs from the other Nordic countries with a well-developed gas market, which was 9% biogas in 2014.

Materials for biofuels[18];[19],[20] are dominated by "first generation biofuels", i.e. produced from agricultural products as feedstocks. Rapeseed, grains, potatoes and sugar beet from EU countries and sugar cane from South America are typical crops from which RME, FAME and ethanol are produced. Hydrotreated vegetable oils (HVO) and biogas are primarily produced from residual products and waste (waste oils, slaughterhouse waste, animal fats, crude tall oil, straw, animal manure) and palm oil.

Tabel 3: Energy use in domestic transport in the Nordic countries in 2014 and fuel types in road transport.

	Denmark[21]	**Finland[22],[23]**	**Norway[24]**	**Sweden[25],[26]**
Unit	**%**	**%**	**%**	**%**
Road	76	78	62	94
Rail	2	1	1	3
Air	19	17	14	2
Sea	3	4	23	1
Renewable % in road transport	6	6	3.5	12
Fuel types in road transport				
Diesel	63	62	72	60
Petrol	36	37	25	38
Gas	1	1	2	2
Types of biofuels in road transport				
HVO	36	57.4	15.5	40
RME	20		15.5	
FAME	13	11.8	61.1	32
Ethanol	30	30.2	6.6	19
Biogas	1	0.6	1.1	9

[18] http://www.eof.dk/Viden/Statistik/Forbrug%20i%20Danmark/biobraendstoffer (8 December 2015)
[19] http://www.eurobserv-er.org/biofuels-barometer-2015/
[20] Swedish Energy Agency. 2015. Sustainable biofuels and liquid biofuels in 2014, ET2015:12.
[21] Energy Statistics 2014, the Danish Energy Agency
[22] Statistics Finland. Although it is not stated for which type of transport the electricity is used, it is reasonable to assume it is rail transport.
http://pxweb2.stat.fi/sahkoiset_julkaisut/energia2014/html/engl0004.htm
[23] Statistics Finland. http://pxweb2.stat.fi/sahkoiset_julkaisut/energia2014/html/engl0004.htm
[24] Transport and the environment 2015. Statistics and indicators for the transport sector. Statistics Norway. 2015:34. (Converted from PJ to TWh)
[25] Swedish Energy Agency. 2015. Energy use in the transport sector 2014. ES 2015:01.
[26] Swedish Petroleum & Biofuel Institute (SPBI). 2015. SPBI Facts 2015.

Bio-oil and biogas outside the transport sector are primarily used in industry for heat and power production, in boilers in private households and machinery (boat engines, garden and park equipment, etc.). Table 4 below shows that the majority of all biogas produced goes to this area, primarily for injection into existing natural gas pipelines. Bio-oil also covers fuel types such as ethanol, methanol and FAME. Bio-oil is produced from rapeseed and other oil plants, from forestry by-products (crude tall oil and crude methanol) and from the agro-industry and food industry. It has not been possible to find data for production/consumption of bio-oil in Finland or Norway, but it is assumed to be on a similar level to Sweden, due mainly to the extensive forest industry.

Tabel 4: Production and consumption of biogas and bio-oil that are not used in the transport sector (2014)

	Denmark	Finland	Norway	Sweden
Production of biogas	1.3[27] TWh	0.4[28] TWh	0.3[29] TWh	1.8[30] TWh
Biogas produced	95%	99%	94%	43%
Bio-oil consumption	0.28[31] TWh	-	-	4.2[32] TWh

3.2 Developments in the market

The municipal public transport system plays a key role in the transition to renewables in the transport sector. Market data from Norway, Denmark, Finland and Sweden show that public transport systems are working strategically with environmentally-friendly initiatives and activities to promote greener transport. This presents an opportunity for the Nordic Swan Ecolabel in this sector.

A summary of the most significant products currently in the market is given below. There are differences in the renewable fuels industry across the Nordic countries. What they have in common is that petrol volumes are decreasing and diesel volumes are increasing. One consequence of this is that the volumes of low-ethanol blends in petrol are decreasing while the volumes of low-biodiesel blends in the form of FAME and HVO are increasing, mainly because diesel volumes are on the rise.

One reason that the diesel volumes are increasing is that the number of newly-registered diesel-engine passenger cars has increased, while the number of petrol-engine cars has been declining annually since 2005. Consumers have preferred diesel cars because they consume less fuel per mile, their performance is better and lower taxes on diesel makes it cheaper than petrol.

[27] http://www.ens.dk/forventet-biogasproduktion-frem-2020, accessed 10 November 2015
[28] http://www.eurobserv-er.org/biofuels-barometer-2015/
[29] Transport and the environment 2015. Statistics and indicators for the transport sector. Statistics Norway. 2015:34. (Converted from PJ to TWh)
[30] http://www.biogasportalen.se/BiogasISverigeOchVarlden/BiogasISiffror (4 December 2015)
[31] Energy Statistics 2014, the Danish Energy Agency
[32] Swedish Energy Agency. 2015. Sustainable biofuels and liquid biofuels in 2014, ET2015:12 and Statistics Sweden's (SCB) statistics for fuel consumption for the production of steam, hot water and electricity: www.scb.se.

Another reason, which comes from Sweden, is the high level of economic activity in society, with approximately 70% of the volume attributable to heavy traffic.

Ethanol

The market space for renewable ethanol is steadily diminishing. This is due to a fall in petrol sales, where ethanol is blended with petrol at a low level of 5%, and to steadily declining sales of E85. Ethanol buses have been in operation in Sweden for about 20 years. There were 650 ethanol buses in Stockholm in 2012, but the number has decreased, probably due to an increase in gas engines.[33] ED95 is used to power some buses in Oslo, but there are only about 20 public filling stations for E85 in Norway and about 100 flex-fuel cars in Norway[34]. E85 is available in Finland but is not sold in great quantities today. In 2015, 69.9 kilotonnes of oil equivalent (ktoe) were consumed. Most of this was used for 5% and 10% low-level blends (bio-component) in E5 and E10 petrol. In Denmark, bioethanol is used for 5% low-level blends in petrol.

Synthetic diesel (HVO)

Development of diesel products with HVO is currently under way in the Swedish, Danish and Finnish markets. HVO is blended to a greater extent in Sweden in particular and also in Finland than in other countries. In Sweden, this has been due to tax incentives for high percentage biofuels. The average blend of HVO in fossil diesel in 2014 in Sweden in total was about 9%. Diesel products with 50% renewables are now available in the Swedish market.[35]

It is interesting to note that modern lorries and buses can use several different types of fuels. For example, the same engine can often run on conventional diesel, FAME/RME and HVO. This makes it possible for procurement managers at, for example, bus companies to choose the fuel product that is cheapest at the time. However, the products cannot be blended in any way that the user wants. The Swedish Fuel Quality Act stipulates that diesel in environmental classes 1 and 2 must have a maximum FAME content of 7%. Furthermore, the density of diesel must be between 800-830 kg/m3, which sets the framework for how much FAME and HVO can be blended into the fuel.

FAME (Fatty Acid Methyl Ester)

FAME can be used as a drop-in fuel up to 7% or pure as B100. Practically all FAME in the Nordic countries is produced from rapeseed oil, but other vegetable oils and used cooking oils are also alternatives for FAME production. One of the reasons for using rapeseed is that it produces a FAME that is better suited to the cold Nordic climate[36].

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33 http://www.trafikverket.se/contentassets/dfa3c781092b4b1c834a8e76320ba039/12_branslen_for_tunga_fordon.pdf

34 Terje Hyldmo, Manager for Business Development, Biokraft. Presentation Zero Conference https://zerokonferansen2015.files.wordpress.com/2015/11/biokraft-spydspiss.pdf

35 Swedish Energy Agency. 2015. Markets for biofuels in 2015. ER 2015:31, page 32.

36 Swedish Energy Agency. 2016. Fuel and biofuels 2015 Quantities, components and origins reported in compliance with the Swedish Fuel Quality Act and the Renewables Act. ER 2016:12.

Swedish biodiesel producers have also initiated large-scale testing to blend in various types of alcohols from Swedish forest raw materials to further improve the fuel's performance in cold climates[37].

Biogas

Biogas can be upgraded to methane gas, similar to natural gas, and used as a vehicle fuel. The most common method of producing biogas is anaerobic digestion of organic materials. It can also be produced by the thermal gasification of biomass.

Sweden is currently the country that uses biogas as a vehicle fuel the most in the world[38]. Since 2009, the average national blend for vehicle gas has been approximately 70% biogas and 30% natural gas[39]. There are now just over 52,000 vehicles running on gas in Sweden. Gas-powered vehicles are mainly smaller vehicles like passenger cars and light commercial vehicles today. What is particularly interesting at the moment is that the market for gas buses and heavy goods vehicles is growing and several new models of gas cars have recently been launched by Volvo and other car makers.[40]

The Swedish industry considers that a national target of 15 TWh biogas by 2030 is realistic. An estimated 12 TWh of this will be needed in the transport sector, equating to the figure arrived at in the government enquiry Fossilfrihet på väg (Fossil Free on the Road). It is estimated that in the light of increased demand for high-value green fuel, biogas use in industry will reach 3 TWh by 2030.[41]

Biogas production in Denmark is expected to increase from 1.3 TWh (4.64 PJ) in 2013 to 3.9 TWh (14 PJ) by 2020[42]. Denmark has a well-developed natural gas grid which offers great potential for using both natural gas and biogas as transport fuels. Biogas can be upgraded and distributed via the natural gas pipelines to filling stations. Denmark currently has 11 gas filling stations that offer various fractions of biogas and natural gas blends (0, 25, 50 and 100%).

There are currently no general government statistics nor overview of the use of biogas in Norway. The estimated theoretical potential for biogas production is approximately 6 TWh and the realistic potential in the short term (2020) is approximately 2.3 TWh.

[37] https://www.perstorp.com/sv-se/news_and_events/pressreleases/2016/20160427_biodiesel_med_oktanol_fran_svensk_skog_testkors_i_full_skala/ (27 April 2016)
[38] Swedish Energy Agency. 2015. The market for biofuels 2014, ER2015:27.
[39] Swedish Energy Agency. 2016. Fuels and biofuels 2015. Quantities, components and origins reported in compliance with the Swedish Fuel Quality Act and the Renewables Act. ER 2016:12.
[40] www.gasbilen.se/Att-tanka-pa-miljon/Fordonsgas-i-siffror/ForsaljningPerManad (13 October 2015)
[41] http://www.mynewsdesk.com/se/energigas-sverige-service-ab/pressreleases/nationell-biogasstrategi-lanseras-1264536?utm_source=rss&utm_medium=rss&utm_campaign=Subscription&utm_content=pressrelease (2 December 2015)
[42] http://www.ens.dk/forventet-biogasproduktion-frem-2020, accessed 10 November 2015

Only a small proportion of that has been met and preliminary data from Statistics Norway (SSB) show that production is approximately 0.3 TWh for 2014.[43]

In 2015, the Norwegian government granted 10 million Norwegian kronor for biogas pilot plants and research. The objective of the pilot plant is to test technologies for biogas based on feedstocks other than waste (e.g. manure) and thereby contribute to future cost savings in climate measures and achieve greater emission savings. The Norwegian government is investing in biogas as a climate measure to meet the ambitious targets for Norway's emissions mitigation by 2020 and the transition to a low-carbon society by 2050.[44] At present, the Norwegian market has few private vehicles adapted to run on gas.

In Finland, biogas production is expected to increase considerably by 2020. The use of biogas as a fuel for vehicles increased in 2014 by 57% from 2013. There are currently 24 gas filling stations and another 16 are due to open in 2016.

Hydrogen

There are currently only a few hydrogen stations in the Nordic countries. Swedish, Norwegian and Danish operators in the Scandinavian Hydrogen Highway Partnership (SHHP) are working together to make Scandinavia one of the first regions in Europe where hydrogen is available as transport fuel[45]. There are currently 10 hydrogen stations in Denmark, 5 in Norway and 2 in Sweden.

Liquid and gaseous biofuels

The use of liquid natural gas in industry in the Nordic countries has increased over the last few years. As gas is used more widely in industry, it may become more readily available to private users when it is distributed to the different industries across the country.[46]

In the Nordic region, the bio-oil industry has seen an increase in demand for its products in recent years. These liquid biofuels are waste and by-products from other industrial processes, such as tall oil pitch, crude tall oil, MFA (Mixed Fatty Acids), ethanol from black liquor, FAME from rapeseed and other feedstocks, and methanol from crude methanol. All liquid biofuels must demonstrate compliance with the Renewable Energy Directive today.

Manufacturers are increasingly replacing fuel oils with biofuels. It is not unusual for companies to use this conversion from fossil energy to renewable energy as part of the marketing strategy to enhance their environmental image. This presents an opening for criteria that include liquid biofuels.

[43] Transport and the environment 2015. Statistics and indicators for the transport sector. Statistics Norway. 2015:34.
[44] http://www.tekniskenyheter.no/index.php/13-aktuelle-smasaker/bioenergi/440-10-millioner-til-pilotprosjekt-for-biogass (27 April 2015)
[45] http://www.vatgas.se/fakta/vaetgas-som-fordonsbraensle (18 March 2016)
[46] Swedish Energy Agency. 2015. Markets for biofuels in 2014. ER 2015:27, page 40.

Aviation fuel

Biofuels for the aviation industry must meet stringent requirements for performance, quality and safety. They must also be 100% compatible with current standards for fossil fuels. Today, there are three manufacturing processes for the development of biofuels that are approved for use as aviation fuel by the American Society for Testing And Materials (ASTM). Hydrogenated Esters and Fatty Acids (HEFA), Fischer-Tropsch (FT) based on biomass (BtL - biomass to liquid) and Renewable Synthesized Iso-Paraffinic (SIP) fuel (renewable farnesane hydrocarbon)[47].

HEFA is a type of HVO fuel that has been further processed and is today the most widely used technology for the production of aviation biofuels. HEFA/HVO is typically produced from oilseed crops, such as soybeans, palm, rapeseed, algae, tall oil from the forest industry, and waste animal fats. The production process is thus identical to the processes used for the production of road transport fuels[48].

The use of biofuels in the aviation industry is still very limited, but is expected to increase dramatically in the near future[49]. A series of initiatives have been launched at EU level for the production and use of biofuels in the aviation sector: "White Paper - Roadmap to a Single European Transport Area (COM (2011) 144)" sets the goal of reaching 40% use of biofuels in aviation by 2050.

Marine fuels

As in the aviation industry, the use of biofuels in the shipping sector is still in the development stage. The production process is thus identical to the processes used for the production of road transport fuels. International shipping is the only form of transport not yet covered by the EU's current greenhouse gas emission savings requirements. However, the EU has adopted a regulation[50] for the monitoring, reporting and verification of greenhouse gas emissions from maritime transport based on the ships' fuel consumption. The European Union's Sulphur Directive[51] regulates sulphur emissions from combustion of certain types of fossil-based liquid fuels. The requirement for marine fuels has been revised in two stages to make it more stringent, most recently in 2012 with effect from 1 January 2015. This revision includes a reduction of limits on sulphur emissions from 1.0 to 0.1% by weight in designated Sulphur Emissions Control Areas[52] (SECA). These much stricter requirements for sulphur emissions now make biofuels very interesting for the shipping industry[53]. The UN's International Marine Organisation (IMO) has recently decided to establish an international data reporting system, which requires all vessels to report their fuel consumption and greenhouse gas emissions[54].

[47] http://biofuelstp.eu/aviation-biofuels.html#randd (accessed 14 March 2016)
[48] The Swedish Energy Agency, The Markets for Biofuels 2015, ER2015:31
[49] http://biofuelstp.eu/aviation-biofuels.html (accessed 14 March 2016)
[50] Directive 2009/16/EC
[51] Directive 1999/32/EC
[52] Sulphur Emission Control Area (the Baltic Sea area; the North Sea area; the North American area (covering designated coastal areas off the United States and Canada); and the United States Caribbean Sea area (around Puerto Rico and the United States Virgin Islands).
[53] Ecofys 2012: Potential of biofuels for shipping
[54] http://www.regeringen.se/pressmeddelanden/2016/11/fns-sjofartsorganisation-imo-tar-ett-viktigt-steg-i-klimatfragan-for-sjofart/, accessed 11 November 2016

One of the new fuel types (alternative fuel to traditional heavy diesel) is liquefied natural gas (LNG) which is used to power ships. The ferries serving Gotland and Åland are fuelled by LNG today. One of Stena Line's ferries runs on methanol. A company in Denmark is establishing a bio-refinery in Frederikshavn[55] for the production of biodiesel from biomass (wood biomass in the first phase) for ships.

4 Regulatory requirements, other labelling schemes and controls

This chapter summarises the main regulatory requirements, controls and labelling schemes for liquid and gaseous fuels. Liquid and gaseous fuels for transportation and heating are largely governed by EU directives and regulations and the most important of these are briefly described below. Appendix 1 provides a summary of national targets and controls, including implementation of the EU directives, in the Nordic countries (the text is in swedish, has not been translated in to english). A summary of relevant standards can be found in Appendix 3.

4.1 Directives and Regulations

In 2009, the EU introduced a comprehensive and binding sustainability directive. Under the Renewable Energy Directive (RED 2009/28/EC)[56], which promotes the use of energy from renewable energy sources, and the Fuel Quality Directive (FQD, 2009/30/EC),[57] companies that provide biofuels for transport usage must be able to demonstrate that their products meet the criteria for sustainability stipulated by the directives in order to receive support for the products from national governments and be counted towards the fulfilment of the renewable energy targets and obligations[58]. The criteria apply to both biofuels and liquid fuels produced in the EU and those that are imported into the EU from third countries.

4.1.1 Renewable Energy Directive (RED, 2009/28/EC)

The Renewable Energy Directive sets a 20% binding EU-wide renewable energy target and at least 10% renewable energy use in the transportation sector by 2020. The 10% renewable energy can be in the form of liquid or gaseous fuels, but it can also, for example, be wind electricity used to power trains and cars.

The Directive contains sustainability criteria that should prevent negative environmental impacts associated with scaling up the use of biofuels. The sustainability criteria include requirements for displacement of greenhouse gases by the biofuels and traceability through the whole supply chain. Displacement of greenhouse gases by the biofuel refers to the greenhouse gas emission savings achieved by using a particular biofuel rather than an equivalent fossil fuel[59].

[55] http://steeperenergy.com/ (accessed 16 March 2016)
[56] http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32009L0028, accessed 10 October 2016
[57] http://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32009L0030, accessed 10 October 2016
[58] The criteria also apply to liquid biofuels used for heating and power supply.
[59] Calculation of greenhouse gas displacement under the Renewable Energy Directive (2009/28/EC (Appendix V, Section 4) the greenhouse gas emission saving from the use of biofuel and bio-liquids

The sustainability criteria also include provisions stating that the feedstock for the biofuels must not be grown in areas with high carbon stocks or high biodiversity values.

The calculation of the greenhouse gas displacement takes into consideration the biofuel's emissions over the entire life cycle, i.e. from cultivation, processing and distribution to combustion of the final biofuel in the car engine. The greenhouse gas emissions from the combustion process are assumed to be zero, based on the reasoning that only the CO_2 that the crop absorbed from the atmosphere through photosynthesis during growth is released during combustion.

At present, the requirement is that biofuels must achieve at least a 35% greenhouse gas emission saving over the fossil fuels that they replace. This requirement rises to 50% from 2017. From 2018, the requirement rises to 60% for biofuels from plants that come into operation from 2017 onwards.

With regard to feedstock cultivation, displacement of greenhouse gases by the biofuel are calculated solely based on the emissions at the point where the feedstock for the specific biofuel was grown. However, the intention is that eventually the indirect consequences of the cultivation in the form of emissions from secondary changes in land use elsewhere (Indirect Land Use Change or ILUC) will also be included.

Greenhouse gas emissions can be determined by using actual values, default values, or a combination of actual values and disaggregated default values. The default values have been calculated by the EU Commission for the most widely used production chains and include emissions from the previously mentioned phases in the life cycle. The Renewable Energy Directive (RED) contains default values and disaggregated default values. The calculation methodology for actual values contained in RED must be used.

Several Nordic countries have developed national guidelines[60],[61],[62] explaining the rules that apply for documentation of compliance with legislative acts for sustainable biofuels and for greenhouse gas emission savings.

The sustainability criteria of the RED contain no requirements related to economic or social sustainability. Several of the approved voluntary certification schemes contain social requirements. Approved voluntary certification schemes are listed in Appendix 2.

shall be calculated as: SAVING = (total emissions from the fossil fuel comparator – total emissions from the biofuel or bio-liquid)/ total emissions from the fossil fuel comparator)

[60] ER2016:2012 https://energimyndigheten.aw2m.se/FolderContents.mvc/Download?ResourceId=5586

[61] https://ens.dk/sites/ens.dk/files/Transport/haandbog_version_1_2.pdf, accessed 10 October 2016

[62] Norwegian Environment Agency 2016. Reporting on sustainability criteria for biofuels and liquid biofuels. Product regulation guide, Chapter 3, Version 4, January 2016. Norway.

4.1.2 Fuel Quality Directive (FQD, 2009/30/EC) - amendment of (FQD 98/70/EU[63])

EU Member States are mandated to ensure that suppliers of biofuels for transport reduce the greenhouse gas emissions per unit of energy from fuel supplied by at least 6% by the end of 2020, compared to the baseline, which represents the average emissions from fossil fuels in 2010. The European Commission has not yet established a baseline or a detailed methodology for calculating greenhouse gas emissions. So far, the authorities in the Nordic countries have decided to use a baseline of 83.8 g CO_2 eq/MJ for petrol and diesel under the Renewable Energy Sources (RES) Directive (2009/28/EC), Annex V.

4.1.3 ILUC Directive (EU) 2015/1513 (amendment of the RED and FQD Directives)

The ILUC Directive (EU) 2015/1513[64] adopted in 2015 sets a cap for first generation biofuels of no more than 7% of the statutory 10% energy from renewables in transport by 2020. The Directive also requires so-called advanced biofuels to account for at least 0.5% of all fuels used in the transport sector. Advanced biofuels are fuels that can be manufactured from certain types of waste and by-products and new feedstocks, such as algae[65].

A new European Commission proposal amending the RED, published on 1 December 2016,[66] suggested changing the maximum share of first generation biofuels from 7% in 2020 to 3.8% in 2030.

The impacts of a biofuel on greenhouse gas emissions are measured today by considering only emissions from direct land use change - emissions released where the feedstock for the biofuel is grown. A proposal to include Indirect Land Use Changes (ILUC) in the calculation was also put forward at the Directive's preparation stage. This was not included in the Directive, however. Instead, fuel suppliers must report to the EU countries and the European Commission how much additional emissions can be expected as a result of converting from the production of food crops to energy crops.

4.1.4 Infrastructure Directive (2014/94/EU)

A directive on the establishment of an alternative fuel infrastructure (2014/94/EU)[67] came into force on 28 October 2014. The Directive requires the Member States to establish national policy frameworks for the development of the market as regards alternative fuels and their infrastructure.

[63] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0030&from=en, accessed 10 October 2016
[64] http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1453992836873&uri=CELEX:32015L1513, accessed 10 October 2016
[65] http://www.europarl.europa.eu/news/en/news-room/20150424IPR45730/Parliament-supports-shift-towards-advanced-biofuels, accessed 10 October 2016
[66] https://ec.europa.eu/energy/sites/ener/files/documents/technical_memo_renewables.pdf, accessed 7 December 2016
[67] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0094&from=EN, accessed 10 October 2016

The Directive sets out minimum requirements for the building-up of alternative fuels infrastructure, including recharging points for electric vehicles and refuelling points for natural gas (LNG: Liquefied Natural Gas, CNG: Compressed natural gas and LPG: Liquefied petroleum gas) and hydrogen. It also sets out requirements for common technical specifications for such recharging and refuelling points.

The Member States have two years in which to submit their national policy frameworks. The Commission will then assess and report on these national policy frameworks and their coherence at European Union level.

4.2 Other labelling schemes and controls

This section summarises the main labelling schemes for liquid and gaseous fuels.

Bra Miljöval

The “Bra Miljöval" (Good Environmental Choice) is like the Nordic Ecolabelling label, a Type 1 ecolabel, ie that Bra Miljövalg meet the requirements of the international standard for type-1 ecolabels (ISO 14024), which included is a demand for transparent and open processes. Bra Miljöval provides a set of criteria for biofuels (2013:2[68]) which include many types of renewable solid, liquid and gaseous fuels. There are currently five licences: one for biogas, one for barbecue charcoal/briquettes, one for pellets and two for firelighting products.

The criteria stipulate that non-renewable energy which is part of the product's life cycle must account for a maximum of 10% of the product's energy content. Moreover, there are requirements for sustainable renewable energy sources and chemical products and constituent substances classified as CMR.

EKOenergy

EKOenergy is a European network and a trade mark of non-governmental organizations (27 European environmental organizations). The secretariat is in Helsinki and managed by the Finnish Association for Nature Conservation[69]. EKOenergy is currently developing criteria for biogas[70] and it is expected that they will be adopted on 1 January 2017. The proposed criteria want to ecolabel 100% biogas, that can be labelled as 100% biogas or as a blending component in natural gas.

Raw materials labelling and traceability systems

Sustainability labels for wood are very relevant within the liquid and gaseous fuels product group. FSC[71] and PEFC[72] are the two most dominant sustainability certifications for wood and wood-based products. Although there are some differences between the schemes, Nordic Ecolabelling considers them both to be at the leading edge of the legislation, and thus driving change towards more sustainable forestry.

[68] http://www.naturskyddsforeningen.se/bra-miljoval/biobransle, accessed 21 April 2015
[69] Ekoenergi. (2014). Om oss. Hentet 4. januar 2014 fra http://www.ekoenergy.org/sv/about-us/
[70] http://www.ekoenergy.org/?s=Biogas accessed 2 December 2016
[71] https://ic.fsc.org/en, accessed 1 November 2016
[72] http://pefc.org/, accessed 1 November 2016

The European Commission recognises a number of voluntary certification schemes for the verification of compliance with the sustainability criteria in the RED (see Appendix 2). All schemes cover the whole or parts of the biofuel supply chain. Parts of the supply chain can be feedstock standards for soybeans, sugar cane, palm oil or grain.

Industry labels

In Denmark, there is a certification scheme managed by Energinet[73] that can be used to certify upgraded biogas that is injected into the natural gas grid. It is stated on the bio-natural gas certificates that biogas has replaced a similar volume of natural gas. The purchaser of certificates can thus prove that they have bought bio-natural gas corresponding to the quantity of purchased certificates. Energinet.dk's certificates do not specify which feedstocks were used to produce the bio-natural gas and there are no specific sustainability requirements.

5 About the criteria development/revision process

Evaluation of the current version 2 of the criteria for the Nordic Swan Ecolabelling of fuels and biogas for heating and industrial purposes (2016) resulted in a proposal to revise the criteria, primarily by raising the requirement level for the share of first and second generation biofuels, the requirement level for greenhouse gas emissions, updating the requirements for feedstocks and quality, and expanding the product group to include liquid and gaseous fuels for heating, industrial use (boilers/machinery) and aviation and maritime transport.

Based on the recommendations in the evaluation report, the objectives of the revision have been to:

- Establish the product group definition to cover liquid and gaseous fuels for heating, industrial use (boilers/machinery) and aviation and maritime transport.
- Raise requirement levels on what percentage of first and second generation biofuels must/should be included in a Nordic Swan Ecolabelled fuel.
- The level of requirements for greenhouse gas emissions must be raised, so that they are more stringent than the Renewable Energy Directive (RED) (2009/28/EU). Examine alternatives for harmonising the calculation method with the RED (2009/28/EU) by focusing on the renewable share and establish a definition of the EU electricity mix in order to simplify criteria (for applicants, licensing and marketing).
- Revision of the energy consumption requirement regarding the use of reference value/default values.

[73] http://www.energinet.dk/DA/GAS/biogas/Gascertifikater/Sider/default.aspx, accessed 2 November 2016

- Update of requirements for wood raw materials in line with the Nordic Swan Ecolabel's new forest requirements including requirements for certified traceability. Requirements for the definition of waste and by-products are explained in more detail in relation to the RED (2009/28/EU).
- The level of requirements for controversial feedstocks, such as palm oil and soybeans, must be raised to clearly show that these (both virgin and by-products/waste) must not be present in Nordic Swan Ecolabelled fuels.
- Requirements for working conditions must be updated in line with the UN's Global Compact and adjusted with any requirements for codes of conduct.
- Requirements for the quality of the fuels must be extended to include quality standards that are relevant to the new product types in the product group.
- Requirements for traceability of the Nordic Swan Ecolabelled fuel must be updated to clearly show that the Nordic Swan Ecolabel permits the use of mass balancing under the RED (2009/28/EU). The Nordic Swan Ecolabel's requirement for mass balancing for the Nordic Swan Ecolabelled fuel must also be clarified.
- Generally update current requirements to ensure they are clear and relevant.
- Update background documents in line with the revision of requirements and conclusions from MECO and RPS made in this evaluation.

About this revision of criteria

The revision was conducted by Product Group Manager Thomas Christensen (DK) as the project manager, and Eva-Lotta Lindholm (S) as the project adviser. Stinus Kappel Andersen (DK), Kristian Kruse (N), Eva-Lotta Lindholm (S) and Harri Hotulainen (Fin) are the national product specialist (PS).

The revision was conducted as an internal Nordic Ecolabelling project with an ongoing dialogue with international and national stakeholders.

6 Environmental impact of "the product group"

The product group liquid and gaseous fuels comprises liquid and gaseous fuels for transport (road, air and sea) and heating and industrial purposes, with very different materials and types of production, but with a uniform function: namely to produce energy through combustion in engines or boilers.

A so-called MECO analysis was performed in conjunction with Nordic Ecolabelling's evaluation of the criteria in 2015/2016[74]. MECO stands for the assessment of Materials, Energy, Chemicals and Other characteristics and describes the principal environmental impacts during the products' life cycle phases. The MECO analyses are based on LCA studies, datasets from generic databases and scientific reports.

[74] The separate MECO analysis for liquid and gaseous fuels is written in Danish and is available upon request from Nordic Ecolabelling: tc@ecolabel.dk

Based on the MECO analysis, an RPS analysis was conducted which identifies the relevance, steerability and potential of the various environmental aspects of liquid and gaseous fuels.

Nordic Ecolabelling uses the RPS analysis to pinpoint the environmental issues that are most relevant (R) in the life cycle of the products and assess what potential (P) exists for reducing adverse effects on the environment in these areas. At the same time, it is important to examine how the manufacturers in particular can make changes to the products (steerability = S) that will trigger the potential for environmental improvements. This section describes the key findings of the RPS analysis. The complete analysis is presented in Appendix 4 (the text is only en danish).

The RPS analysis for liquid and gaseous fuels shows that RPS has been found in a life cycle for the following areas:

- Feedstocks used in liquid and gaseous fuels
- Energy consumption and impact on the climate
- The quality of the liquid and gaseous fuels

Feedstocks used in liquid and gaseous fuels

Liquid and gaseous biofuels are predominantly derived from agricultural and forest materials (virgin or by-products/waste) and therefore renewable resources, as well as waste and by-products from agriculture, households, retail chains, food industries, etc. They are usually divided into so-called first generation biofuels which are produced from high-value parts of plants such as sugar, maize, grains and grass, and advanced biofuels based on the by-products from a primary production process such as straw, bagasse, other fibrous materials or livestock waste. Advanced biofuels are defined in the ILUC Directive (EU) 2015/1513 (see glossary). Requirements concerning sustainable production of renewable feedstocks are therefore highly relevant (R) and can be ensured by setting requirements for the use of sustainability standards (P). Requirements for the use of certified feedstocks and traceability standards/schemes will also strengthen the traceability (S) of renewable feedstocks that are used in the Nordic Swan Ecolabelled liquid and gaseous fuels.

Requirements to exclude unconventional feedstocks, such as tar sand, extra heavy oil and crude oil or pyrolysis from oil shale are relevant (R) and can be ensured by not including them in the Nordic Swan Ecolabelled liquid and gaseous fuels (P). The traceability (S) is assessed to be limited, but the requirement sends a strong signal and obliges applicants to focus on the fossil component's origin.

Energy consumption and impact on the climate

There is both a high relevance (R) and potential (P) for limiting the energy consumption for production of renewable liquid and gaseous fuels. The steerability (S) is assessed to be limited, however, as energy consumption is not part of the European Union's Renewable Energy Directive. The EU's RED permits the use of voluntary certification schemes that use national electricity factors, see O9.

Since the electricity factors vary greatly from one country to the next, there is relatively low relevance (R), as eletricitet is only beeing used to a limited extent in the production of liquid and gaseous fuels (5 to 10%). The benefits of RED Directive is estimated to be higher than in the Nordic Ecolabelling maintains the requirements for energy consumption. The requirement to energy use has therefor been deleted in this criteria generation.

The requirement concerning the use of fossil fuels in the production of liquid and gaseous fuels is of utmost relevance (R) from a climate and life cycle perspective, as they emit high levels of greenhouse gases during combustion. Both renewable resources and fossil fuels release CO_2 during combustion and thus contribute to the greenhouse effect. The benefit of burning renewables is that they do not contribute additional CO_2 to the atmosphere, as is the case with fossil fuels. CO_2 in new biomass is absorbed much more quickly than fossil sources. Biomass therefore has a relatively short impact on the climate compared with fossil CO_2, where the effect lasts for thousands of years[75]. However, this is provided that the biomass comes from sustainable sources.

There is great potential (P) in following the guidelines of the European Union's Renewable Energy Directive and selecting renewable biofuels with high greenhouse gas emission savings for Nordic Swan Ecolabelled liquid and gaseous fuels. Requirements for the use of certification schemes for the verification of compliance with the Renewable Energy Directive also strengthen the traceability (S).

The quality of the liquid and gaseous fuels

Material composition and production methods vary greatly for the individual product types of liquid and gaseous fuels. This has a major impact on the quality of the products. It is therefore highly relevant (R) to ensure that the quality of the fuels is good. This can be ensured through requirements for relevant quality standards (P). Steerability (S) of the liquid and gaseous fuels' quality is increased by requiring relevant quality standards to be tested for compliance by independent third parties.

7 Reasons for requirements

7.1 Product group definition

The product group comprises liquid and gaseous fuels for transport (road, sea and air), heating and industrial purposes. The material in the fuels consists of renewable energy or blends of renewable energy sources and fossil fuels.

[75] Cheeubini F. et al: "CO2 emissions from biomass combustion for bioenergy: atmospheric decay and contribution to global warming," March 2011

Solid fuels cannot be Nordic Swan Ecolabelled according to these criteria, but can be Nordic Swan Ecolabelled according to criteria for solid fuels. Nor does the product group include electriciry, hydrogen, lubricating oils orfirelighting products.

Background to the product group definition

The product group includes, as in the criteria generation 2, liquid and gaseous fuels for road transportation and biogas for heating and industrial use, which are included by EU RED (2009/28 / EC). In this criteria generation, the product group has been expanded with liquid and gaseous fuels for air- and sea transport and also liquid fuels for heating/industrial use. Production of liquid fuel (bio-oils) for heating, industrial use or machines are exactly the same as for fuels for transportation. This means that product life cycles are the same as for the fuels included in todays criteria; production of raw material, production of fuels and transport of the finished fuel. The difference in the types of products lays in the degree of refining or requirements for purity/quality of the bio-oil/ -fuel relative to use, e.g boiler or engine type. The same applies to the biofuel types used for aircraft and ships.

Biofuels have great potential to reduce emissions of greenhouse gases and at the same time reducing the use of fossil oil and gas. Nordic ecolabelling still allows to mix in a fossil fraction in the ecolabelled fuel due to the limited few pure biobased products on the market today. Nordic Ecolabelling does not wish to Ecolabel low biofuels blends fuels.

Biogas, with a quality equivalent natural gas, can be ecolabelled for use in transport and eg. heating (district heating, heat for industrial use, private residences), in kitchens (private residences, commercial kitchens, restaurants) and industrial processes (eg. production of steam for laundries).

In order to have a clear product definition the product group includes only liquid and gaseous fuels for transport, heating and industrial production in the product definition. Solid fuels cannot be Nordic Swan Ecolabelled according to these criteria, but can be Nordic Swan Ecolabelled according to criteria for solid fuels. Electricity is, as in the previous criteria generation, not included in this product group. Electricity is not a physical salesproduct in the same way as other fuels, and the Nordic Ecolabel do not want to be a certification body for electricity.

Hydrogen is, unlike criteria generation 2, not included in this criteria version. This is partly because the criteria now has been harmonized with RED (2009/28/EC) regarding requirements and calculation of emissions of greenhouse gases. The requirements for energy use has also been removed. Energy consumption for the production of hydrogen is generally high, particularly via electrolysis, but also via thermal processes[76]. As RED (2009/28/EC) now allows the use of the national electricity mix factors, the controllability (S) is low in order to label the least energy-consuming hydrogen products. It is important to point out that Nordic ecolabel is possitive to the use of hydrogen for transport.

[76] European Commission-Joint Research Centre (JRC). 2014. Well-to-Wheels analysis of future automotive fuels and powertrains in the European context. WELL-TO-TANK (WTT) Report. Appendix 4 - Version 4a. Hydrogene (electrolysis) ,(thermal). April 2014.

The technology is considered to be immature at the moment, with very limited distributionsites in the Nordic countries. Nordic Ecolabelling will continue to explore the possibility of involving hydrogen in the product group and closely follow the developments in the ongoing review of RED Directive in relation to hydrogen production.

Lubricating oils are not included in the product group since their function is not to provide energy by burning. Liquid firelighting products and lamp oils are also not covered by the product group, as these are covered by other quality and safety standards that lie outside this product group.

Finished commercial Ecolabelled products can be labeled with the Swanlabel if all the requirements are met. Normally marketing is directed at consumers, and the Swanlabel could be used eg. at fuel pumps/supply point and in advertising campaigns. In other cases, producers of Swanlabelled fuels could marked its product at other fuel producers. A fuel mixture, which included a Swan labeled component, will not be able to use the Swanlabel direct at consumers, onless the final product also meets all the requirements for a Swan label liquid or gaseous fuel.

7.2 Production and product description

O1 Description of the product(s)

The applicant must submit the following information about the product(s):

- Brand/trading name(s).
- Description of product(s) included in the application, and what kind of transport/heating purposes the fuel is intended for. It must also be described whether the finished fuel is only sold on the market in its pure form or whether it also may be included as a component in a composite product.
- A description of the technology and the manufacturing process for the production of the renewable fuels (the description must include the entire production chain, from renewable feedstocks to the end product). Subcontractors must be described with company name, production location, contact person and the production processes used.
- A description of the supplier chain for both the renewable fuels and fossil fuels all the way to the filling station. Any joint depot usage or collaboration with regard to deliveries of fuels to filling stations must also be described.
- If an applicant is a reseller of Nordic Swan Ecolabelled liquid fuels for transport, all filling stations and resellers that sell the Nordic Swan Ecolabelled products must be stated.

✉ Description of the points above. A flow chart is recommended to explain the production process.

Background to requirement O1

The requirement has been amended slightly, compared with version 2 of the criteria. The purpose of the requirement is to provide a satisfactory picture of the life cycle of the fuel: what feedstocks and technology/production processes are used, a description of the supplier chain, what kind of transport/heating purposes the fuel is intended for, and so on.

Liquid and gaseous fuels can be produced at multiple sites, e.g. refineries and other similar production facilities, and fossil and renewable components can be blended at many depots in the business. To provide traceability for the Nordic Swan Ecolabelled fuel, these collaborative activities must be described. The requirement must thus provide an insight into which product(s) the application is submitted for, in order to ensure correct processing. The requirement for disclosure of all filling stations/resellers that sell the Nordic Swan Ecolabelled liquid fuels for transport makes it possible to follow up requirement O2 concerning reclassication of fuels. The requirement also makes it possible to test (post-testing) compliance with renewable fuel volume requirements.

7.3 Resources

O2 Material composition

Fuels for transport (road, air and sea)

Fuels for transport (road, air and sea) must be based on at least 60% biofuels from renewable raw materials . Up to 10% of the total fuel mix may be so-called first generation biofuels.

Exception:

- Ethanol is exempted from the requirement to reduce the proportion of renewable raw materials from first generation technology.

Biogas and liquid fuels that are used for heating and industrial purposes

Biogas and liquid fuels that are used for heating and industrial purposes must be made from 100% renewable feedstocks. Up to 10% of the renewable raw materials may be so-called first generation biofuels. Any additives and gases that are added to the total amount up to 10% by volume to increase the calorific value of the biogas must not be included.

In the case of liquid fuels, the fuel is required to physically comply with the share of renewable raw materials all the way to the filling station (the pump).

Certified traceability is required for gaseous fuels distributed through existing gas grids. A documented traceability scheme reviewed by an external auditor is alternatively acceptable. It must be documented that the quantity of gas injected into the gas grid is equal to the quantity of gas extracted from the grid on an annual basis. An external audit must also be conducted annually to verify that the total purchased quantity of biogas is equal to the quantity of biogas in the Nordic Swan Ecolabelled gas that is sold.

The volume of renewable raw materials in the Nordic Swan Ecolabelled fuel must be documented annually using a mass balance system as required by the Renewable Energy Directive (2009/28/EC) and the guidelines set out in Appendix 1.

The applicant must declare all relevant feedstocks that are used to produce the fuel.

The definition of first generation and advanced biofuels can be found under "Terms and definitions".

For a liquid fuel, a 2% reclassification is accepted in total for all filling stations under one licence a year.

✉ Calculation and documentation showing compliance with material composition and traceability requirements.

☒ The applicant must declare all relevant feedstocks that are used to produce the Nordic Swan Ecolabelled liquid or gaseous fuels.

☒ Biogas in existing gas grids: A copy of a certificate or statement from an external auditor showing compliance with traceability requirements.

Background to requirement O2

The requirement has been amended and strengthened with respect to the percentage of renewable biofuels that Nordic Swan Ecolabelled liquid and gaseous fuels for transport must contain[77]. The Nordic Swan Ecolabel now requires the Nordic Swan Ecolabelled fuel to be based on at least 60% biofuels from renewable feedstocks. Up to 10% of the total fuel mis may be so-called first generation biofuels.The requirement limit that a maximum of 10% of the total fuel mis may be so-called first generation biofuels has been set in dialog with licenseholders and producers of biofuels. In the production of biodiesel or biogas, it is often necessary to use small amounts of first generation biofuels in order to ensure continuous production throughout the year. A limit at max. 10% first generation of the total fuel mix is a considerable strengthening of the requirement compared to the criteria generation 2, where the requirement says that the Swanlabeled fuel must contain at least 50% of first-generation biofuels. A limitation on the use of first generation biofuels is in line with the requirements of the ILUC Directive (EU 2015/1513). The ILUC Directive specifies a 7% cap contribution of first generation biofuels to the mandatory 10% target for renewable energy sources by 2020. A new European Commission proposal amending the RED, published on 1 December 2016,[78] suggested changing the maximum contribution of first generation biofuels from 7% in 2020 to 3.8% in 2030. A limit of 3.8% means that first generation biofuels must account for 22.8% of the Nordic Swan Ecolabel's requirement for at least 60% renewable raw materials. A requirementlimit at a maximum of 10% first generation biofuels entails Nordic Ecaolebelling to be at the forefront when it comes to expected future legislation.

Nordic Ecolabelling suggest, however, that first-generation bioethanol (ethanol) is exempted from the limit of max. 10%. This is because of todays marked situation in a number of Nordic countries where there is a marded for fuels with a high proportion of ethanol interference (ED 85 or ED 95). Nordic Ecolabel tough requirements to reduce emissions of greenhouse gases from first generation biofuels (75%, see requirements O9) ensures that only ethanol production with a high reduction of greenhouse gases, meet the requirement. Requirements O6 (renewable raw materials not permitted to be used in the Swanlabeled fuel) as well as requirements O7 (GMO), also limits the type of renewable raw materials that can be used for production of Swan labeled ethanol. Sugar cane can for example not be used, while corn can have problems in relation to GMO. Ethanol from sugar beet or grain seems to meet the requirements. Annex 6 gives an overall picture of emissions from first generation biofuels, which both taken into account direct and indirect effects on land use.

[77] The requirement for the fuel mix in version 2 of the criteria is that at least 30% of the second generation biofuel feedstocks are renewable or 50% of the first generation biofuel feedstocks are renewable.
[78] https://ec.europa.eu/energy/sites/ener/files/documents/technical_memo_renewables.pdf, accessed 7 December 2016

A high proportion of renewables in current liquid and gaseous fuels is important from both a resource and climate perspective. The proposed requirement aims to promote advanced biofuels that do not compete with food production. Advanced biofuels are defined according to the ILUC Directive, i.e. fuels from agricultural by-products, biomass fractions of waste and residues from forestry and forestry-based industries, industrial waste from the agricultural food industry, fishing and aquaculture industries, animal fats, used cooking oil (UCO), organic waste (household, food, sludge from sewage treatment) and manure.

With regard to liquid and gaseous fuels, Nordic Ecolabelling is of the opinion that a moderate amount of renewable fuel in a blend is more beneficial to the environment than insisting on pure biofuels (100% renewable). This is because the market for fuels with a higher renewable content is still relatively limited for private car use. Fuel sold as pure biofuels and higher-level blends (80-100% renewable) accounted for 0.2% of total liquid fuel sales in Sweden in 2015[79]. Pure biofuels are not sold in Denmark except for biogas which is sold as 100% renewable vehicle gas but on a mass balance level since the Danish gas grid is used for storing and distributing the gas. In lower-level blends, petrol contains 5% ethanol and diesel contains 7.5% biodiesel. E85 is sold in Finland but in small quantities and most of the 813 GWh of ethanol is sold in lower-level blends of 5-10% in petrol. In general, pure or high-level blend fuels are used mainly for public transport to a greater extent. According to the Swedish Bus and Coach Federation (Sveriges Bussföretag), more than 75% of bus and coach services that are publicly procured in Sweden should be run on renewable fuels[80].

Preem, the largest fuel company in Sweden, estimates that up to 70 volume percent of HVO could be blended into fossil diesel without affecting the classification of the diesel fuel[81]. Neste, the world's leading supplier of renewable diesel, considers that unlike FAME/RME there is no technical limit when it comes to blending HVO in fossil diesel, and that the product is fully compatible with all modern diesel engines in cars, buses, coaches, lorries and off-road machines[82]. Neste's renewable diesel, NEXBTL, meets the European diesel fuel standard in all respects except density, which is below the lower limit[83].

The requirement for a liquid Nordic Swan Ecolabelled fuel is that it must contain the volume of renewable fuel at the filling station (pump) required by the standard. This is because Nordic Ecolabelling believes there is a risk that the consumer would feel cheated if the product does not contain the promised volume of renewable fuel.

[79] Swedish Energy Agency. 2016. Fuels and biofuels 2015. Quantities, components and origins reported in compliance with the Swedish Fuel Quality Act and the Renewables Act. ER 2016:12.
[80] Grönlund. 2016. The government must provide information on future terms and conditions for renewable fuels. Aktuell Hållbarhet. (17 November 2016)
[81] The Ministry of Enterprise and Innovation (Näringsdepartementet). 2013. Kvotplikt för biodrivmedel N2013/934/RS.
[82] https://www.neste.com/sites/default/files/nexbtl_-_bransle_for_framtidens_fordonsflotta.pdf (21 November 2016)
[83] https://www.neste.com/sites/default/files/attachments/neste_renewable_diesel_handbook.pdf (28 November 2016)

However, mass balancing for renewable components is accepted under the RED (2009/28/EC) and the subsequent communications from the European Commission[84]. For HVO and FAME, the mass balance approach is not permitted for palm oil, soy and PFAD (palm oil fatty acid distillate), which are prohibited under the following requirement (see O6)[85]. The mass balancing must be audited and verified on an annual basis by professionally competent, independent auditors in accordance with requirement O19 and the rules specified in Appendix 1. The application of the mass balancing methodology for liquid biofuels means that it is not permitted to use a book-and-claim system (the sale and purchase of certificates). In this system, disclosures about sustainability attributes do not stay linked to the physical mixes. If a certification system is used in combination with mass balancing, Nordic Ecolabelling will assess these in relation to traceability, biological diversity and guidelines for certification as specified in Appendix 7 of the criteria.

Nordic Ecolabelling requires 100% renewables for biogas and the liquid fuels that are not used as fuels in transport. This is justified by the fact that these products are sold today as pure (100% renewable) biofuels. Nordic Ecolabelling accepts mass balancing in the gas grid for the distribution and storage of biogas.

Upgraded biogas can be mixed with vehicle gas in an unlimited quantity and can also be sold in pure form. The Swedish vehicle gas fuel industry has jointly undertaken to ensure that at least 50 volume percent of the gas sold at public filling stations is produced from renewable feedstocks[86].

The requirement is therefore intended to reward so-called drop-in fuels, i.e. biofuels that have similar performance characteristics to current petroleum-based fuels and can therefore use existing infrastructures (distribution and refining, fuel specifications, etc.) and vehicles. This is because most of today's light and heavy vehicles in all the Nordic countries have petrol and diesel engines. Not imposing a requirement for higher-level blends or pure biofuels will make the Nordic Swan Ecolabelled fuel available for more vehicles. Sweden is practically the only Nordic country with pure liquid biofuels, yet relatively few cars, about 5% of all vehicles, are adapted for these fuels.

7.3.1 Requirements concerning vegetable and animal feedstocks

O3 Traceability and control of vegetable and animal feedstocks

The licensee must:

- ensure that vegetable feedstocks are traceable

[84] European Commission. 2010. Communication from the Commission on voluntary schemes and default values in the European Union's sustainability scheme for biofuels and liquid biofuels (2010/C 160/01). The official newspaper of the European Union.
[85] Traces of these feedstocks may be accepted, since waste and by-products from secondary industries are accepted, and food waste may contain these feedstocks. Traces of soy and palm oil may also be present because of residues from previous cargoes in transport tanks.
[86] Swedish Energy Agency. 2016. Fuels and biofuels 2015. Quantities, components and origins reported in compliance with the Swedish Fuel Quality Act and the Renewables Act. ER 2016:12.

- ensure that the feedstock does not originate in areas with high bio-diversity value (as defined in detail in Article 17, paragraph 3 of the Renewable Energy Directive (2009/28/EC))
- ensure that the feedstock does not originate in areas with a high carbon stock (as defined in Article 17, paragraphs 4 and 5 of the Renewable Energy Directive (2009/28/EC))

If imported renewable feedstocks are used, they must be certified by one of the European Commission's approved voluntary certification schemes[87] for documentation of the EU's sustainability criteria under the Renewable Energy Directive (2009/28/EC). If nationally produced renewable feedstocks are used, they must comply with the official regulations of each Nordic country for documentation of the EU's sustainability criteria under the Renewable Energy Directive (2009/28/EC).

The requirement does not cover by-products or waste defined in the ILUC Directive (EU) 2015/1513.

✉ Copies of relevant certificates or other documentation showing compliance with the requirements. Documentation/declaration from the body that has inspected and approved compliance with the Renewable Energy Directive (2009/28/EC).

Nordic Ecolabelling reserves the right to require the submission of further documentation in the event of uncertainty about whether the raw material originated in areas with a high biodiversity value or areas with a high carbon stock.

Background to requirement O3

The requirement has been amended slightly to ensure compliance with the requirement that if imported renewable feedstocks are used, they must be certified by one of the European Commission's approved certification schemes for documentation of the EU's sustainability criteria under the Renewable Energy Directive (2009/28/EC). The European Commission recognises a number of voluntary certification schemes for the verification of compliance with the sustainability criteria in the Renewable Energy Directive (see Appendix 2). All schemes cover the whole or parts of the biofuel supply chain. Parts of the supply chain can be feedstock standards for soybeans, sugar cane, palm oil or grain. By setting the requirement that imported feedstocks must be certified by one of the European Commission's approved certification schemes for documentation of the EU's sustainability criteria, Nordic Ecolabelling ensures that the applicant's production process is independently audited. Nationally produced renewable feedstocks must meet national legislation, i.e. national implementation of the Renewable Energy Directive.

The requirement regarding traceability and control of vegetable feedstocks is important to the credibility of the Nordic Swan Ecolabel. A chain of custody from the feedstock producer to the fuel supplier must be established for sustainability disclosures through the supply chain.

[87] https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes, accessed 18 November 2016

The chain of custody shall ensure that there is a link between information disclosed about the sustainability aspects of the feedstocks at the start of the supply chain (e.g. land criteria) and the claims that are made about the sustainability of the fuel at the end of the supply chain.

Wood raw materials, palm oil, soybean oil and sugar cane must still comply with requirements O4 to O6 regarding certified feedstocks and feedstocks that may not be used in Nordic Swan Ecolabelled liquid and gaseous fuels.

7.3.2 Wood

O4 Tree species that may not be used in Nordic Swan Ecolabelled liquid and gaseous fuels

Species of trees on the Nordic Swan Ecolabel list of protected tree species* may not be used in Nordic Swan Ecolabelled liquid and gaseous fuels. The requirement only applies to virgin forest species and not species defined as recycled material, see requirements O5.

*The complete list of protected tree species is available for viewing at: www.nordic-ecolabel.org/wood/

✉ Declaration from applicant/manufacturer of compliance with the requirement for tree species that may not be used in Nordic Swan Ecolabelled liquid and gaseous fuels. Appendix 2 may be used.

Background to requirement 04

Nordic Ecolabelling requires that a number of tree species are not permitted for use in Nordic Swan Ecolabelled liquid and gaseous fuels. The requirement only applies to virgin forest tree species and not tree species defined as recycled materials (for the definition of recycled materials, see glossary/requirements for wood raw materials below).

The list of protected species is based on tree species that are relevant to the Nordic Swan Ecolabel's criteria, i.e. tree species that have the potential to be included in Nordic Swan Ecolabelled products. The scientific name and the most common trade names are given for the listed tree species. The list of scientific and trade names is not always adequate, as there may be more than one scientific name or trade name for the listed tree species than the list indicates. The list includes closely-related or similar tree species as a precautionary measure.

Criteria for species on the list are wood originating from:

- IUCN Red List, categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and relevant species as Near Threatened (NT)
- Tree species listed by CITES, Appendices I, II and III.
- Unsustainable forestry practices, such as felling of trees in HCVF, IFL areas in countries/regions with high levels of corruption.

The IUCN Red List[88] of threatened species is the world's most comprehensive inventory of the global conservation status of biological species, including trees.

[88] http://www.iucnredlist.org/

The IUCN Red List provides consistent criteria to assess the risk of extinction for thousands of species and subspecies. These criteria cover all countries and all species in the world. Nordic Ecolabelling wishes to prohibit the use of tree species listed as endangered (categories CR, EN and VU) and individual tree species with the status NT, in cases where the IUCN Red List specifies the scientific family name and "spp", which indicates that there are several tree species.

A large number of the tree species (apart from 6 tree species) listed on the IUCN Red List, categorised as CR, EN and VU, are also listed by CITES[89]. CITES is an international convention that regulates international trade in wild fauna and flora. CITES includes around 5,600 animal species and around 28,000 plant species, some of which are relevant timber tree species (mainly tropical species). Depending on how endangered they are, the species are included in Appendix I, II or III. Species listed in Appendix I are highly endangered and trade in these species is totally banned. Special import and export permits are required for the other tree species (Appendices II and III). CITES is regulated by EU legislation (Council Regulation (EC) No 338/97) and trees with valid CITES permits are considered to be legally harvested under EUTR. Nordic Ecolabelling's ban on the use of tree species listed by CITES (Appendix I, II or III) thus goes beyond the EU legislation.

There may be other tree species that are not currently listed on the IUCN national Red Lists or by CITES. Nevertheless, Nordic Ecolabelling believes it may be relevant to prohibit the use of such species in Nordic Swan Ecolabelled products, due to the risk of unsustainable forest management even though they have been certified. This is the case, for example, with the Siberian Larch, which is a popular tree species because it provides high-quality timber for building purposes. This species is widespread in the boreal zone. In Russia, there are vast tracts of forest that are largely untouched by human activity, known as Intact Forest Landscapes (IFL)[90]. These pristine forest areas are threatened by clearing, logging, infrastructure development, etc.[91] Corruption is also a serious problem in Russia. This is evidenced by Transparency International's Corruption Perceptions Index (CPI)[92]. Siberian Larch, and in particular the species Larix sibirica, Larix gmelinii, Larix cajanderi and Larix sukaczewii, is widespread in these so-called IFL areas in Russia.

There has been a growing focus in recent years on the legality and sustainability of European imports of wood, especially from tropical countries and countries where corruption is rife. Environmental organisations have thrown the spotlight onto problems related to the trade and use of endangered wood types and timber from sensitive forest ecosystems. Organisations and consumers have been concerned that their use of wood products is contributing to the extinction of wood types or the destruction of forests and other unique forest environments. According to the findings of a recent survey[93], illegal logging accounts for 50-90% of all felling activities in key tropical producer countries and 15-30% globally.

[89] https://www.cites.org/sites/default/files/eng/com/pc/19/e19-11-05.pdf, accessed 20 October 2015
[90] Aksenov et al. 2002. Atlas of Russia's Intact Forest Landscapes. Global Forest Watch Russia.
[91] http://www.worldwildlife.org/ecoregions/pa0601> (accessed 14 September 2015)
[92] http://www.transparency.org/cpi2014 (accessed 14 September 2015)
[93] Nellemann, C., INTERPOL Environmental Crime Programme (eds). 2012. Green Carbon, Black Trade: Illegal Logging, Tax Fraud and Laundering in the World's Tropical Forests. A Rapid Response Assessment. United Nations Environment Programme

As a consequence of this survey and other findings, the European Union adopted the Timber Regulation EU 995/2010[94], which prohibits the marketing and sale of illegally harvested timber in the European Union market. The Regulation covers imported wood and timber harvested in the EU. The EU Timber Regulation (EUTR) came into force on 3 March 2013. It contains obligations for all players operating in the European market for timber or timber products. The objective of the regulation is to tackle the problem of illegal harvesting of timber and prevent the trade of illegally felled wood. Illegal logging contributes in several places in the world to unsustainable forestry practices e.g. deforestation, forest degradation and major secondary effects such as loss of biodiversity.

Nordic Ecolabelling is positive towards EUTR's focus on combating illegal logging, but is also aware of the challenges involved in protecting endangered tree species and wood from sensitive forest areas, so-called High Conservation Value Forestry (HCVF) such as hotspots of high biodiversity (e.g. rainforests) or Intact Forest Landscapes (IFL). Preservation of rainforests is also a central theme in the UN climate negotiations when it comes to regulating the earth's climate. Several reports show, for example, that the Amazon plays a key role in precipitation patterns and temperatures elsewhere in the world[95],[96],[97]. Deforestation in the Amazon can for example lead to drought in the United States and floods in Norway.

The list of protected tree species is available for viewing at www.nordic-ecolabel.org/wood/ . The applicant shall provide a declaration of compliance with the requirement that protected tree species are not used in Nordic Swan Ecolabelled products. Appendix 2 may be used. Nordic Ecolabelling may demand more documentation for a specific tree species.

O5 Wood raw material

The applicant must state the name (species name) of the wood raw material used in the Nordic Swan Ecolabelled liquid and gaseous fuels.

Chain of Custody certification

Suppliers of wood raw materials must have Chain of Custody certification under the FSC/PEFC schemes.

Suppliers who only supply recycled materials for the Nordic Swan Ecolabelled liquid and gaseous fuels are exempted from the requirement concerning Chain of Custody certification. The definition of recycled material, see glossary/below∗.

Certified wood raw material

A minimum of 70% of wood raw materials used in the Nordic Swan Ecolabelled liquid or gaseous fuels (virgin and/or recycled material) must be certified as sustainably forested under the FSC or PEFC schemes or be recycled material∗.

The remaining percentage of wood raw materials must be covered by the FSC/PEFC compliance schemes or be recycled material.

The requirement must be documented as annual purchases of wood.

[94] http://ec.europa.eu/environment/forests/timber_regulation.htm
[95] Nobre AD, 2014, The Future Climate of Amazonia, Scientific Assessment Report. Sponsored by CCST-INPE, INPA and ARA. São José dosCampos, Brazil, 42p.
[96] http://news.mongabay.com/2014/12/tropical-deforestation-could-disrupt-rainfall-globally/
[97] Medvigy. et al, 2013, Simulated Changes in Northwest U.S. Climate in Response to Amazon Deforestation, J. Climate, 26, 9115–9136.

∗ Recycled material defined according to ISO 14021 in the following two categories:

"Pre-consumer" is defined as material that is reclaimed from the waste stream during a manufacturing process. Re-use of materials, that are processed or crushed, or waste, that has been produced in a process and can be reclaimed in the same manufacturing process that generated it, is not considered to be pre-consumer reclaimed material.

"Post-consumer" is defined as material generated by households or commercial, industrial or institutional facilities in their role as end-users of a product that can no longer be used for its intended purpose. This includes materials from the distribution chain.

Nordic Ecolabelling includes by-products from primary wood processing industries (sawdust, wood chips, shavings, bark, etc.) or residues from forestry operations (branches, roots, etc.) in its definition of recycled material.

✉ Name (species name in latin, nordic or english) of the wood raw materials that are used in Nordic Swan Ecolabelled liquid or gaseous fuels.

✉ A valid FSC/PEFC Chain of Custody certificate from all suppliers that covers all wood raw materials used in the Nordic Swan Ecolabelled liquid and gaseous fuels. (Suppliers who only supply recycled materials are exempted from this requirement).

✉ Declaration of compliance with the requirement for the percentage of certified material or recycled material.

Background to requirement O5, Wood raw materials

Name of the wood raw material. Nordic Ecolabelling requires information to be provided about which tree species are used in Nordic Swan Ecolabelled products. The requirement makes it possible to check the Chain of Custody certificates in the supply chain (whether the stated tree species is covered by the Chain of Custody certificates in question) and provide information for future forestry-related requirements. If recycled material is used in the Nordic Swan Ecolabelled liquid or gaseous fuels, particularly fibrous materials, it is not always possible to specify the species name of all wood raw materials used. In this case, the requirement for documentation of recycled material must be complied with.

FSC, PEFC and EUTR. The Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification schemes (PEFC) together cover 98% of the world's certified sustainably-managed forest areas[98], and together are predominant in the global market for certified sustainable wood. Both these schemes cover Forest Management certification of forests and subsequent Chain of Custody (CoC) certification, which documents the traceability of timber and timber products from certified forests. The schemes are generally regarded by forest owners, forest industries, manufacturers and distributors of wood products, and public authorities as reliable systems for sustainable forestry practices.

[98] UN: Forest Products – Annual market review 2011-2012, ch. 10

FSC's updated traceability standard from 2015[99] and PEFC's traceability standard from 2013[100] comply in all respects with the requirements of the EU Timber Regulation (995/2010/EC)[101] which prohibits marketing and sale of illegally harvested timber in the EU. The Regulation covers imported wood and timber harvested in the EU. Nordic Ecolabelling recognises both FSC and PEFC as schemes that provide sufficient guarantees for legal and sustainable forestry practices.

Traceability certification. Nordic Ecolabelling requires that suppliers have Chain of Custody certification under the FSC/PEFC schemes. The requirement for Chain of Custody certification contributes to traceability in the supply chain under FSC's and PEFC's guidelines and regulatory frameworks for traceability. The company's Chain of Custody certification proves how certified wood is kept separate from other wood during production, administration and warehousing and is inspected annually by independent certification bodies. Chain of Custody certification can vary according to the minimum content of certified wood and the way in which this is calculated. Both schemes allow, under specific circumstances and rules, wood from certified forests to be mixed with recycled material or legal wood from non-certified forests. There is thus no guarantee that a batch of FSC or PEFC certified wood necessarily comes from a certified forest. In all cases, the remaining percentage of the wood shall comply with a number of minimum requirements for it to be considered “legal timber”. Several traceability verification methods are allowed by the FSC and PEFC schemes. They are the physical separation method, percentage-based method and volume-credit method. Nordic Ecolabelling accepts all of FSC's and PEFC's methods for traceability verification and the percentage of certified and controlled wood raw materials. The applicant’s suppliers must submit a valid FSC/PEFC Chain of Custody certificate that covers all wood raw materials used in the Nordic Swan Ecolabelled liquid or gaseous fuels as documentation.

Nordic Ecolabelling equates recycled material with virgin material procured from sustainable forests. Recycled material that is not covered by FSC’s or PEFC’s Chain of Custody certification may also be used in Nordic Swan Ecolabelled products. Suppliers of recycled materials would then be exempted from the requirement for Chain of Custody certification under the FSC/PEFC schemes.

Reclaimed material. Pre-consumer and post-consumer reclaimed materials are defined by the ISO 14021 standard.

“Pre-consumer" is defined as material that is reclaimed from the waste stream during a manufacturing process. Re-use of materials, that are processed or crushed, or waste, that has been produced in a process and can be reclaimed in the same manufacturing process that generated it, is not considered to be pre-consumer reclaimed material.

[99] https://ic.fsc.org/en/our-impact/timber-legality/ensuring-compliance, accessed 21 December 2015
[100] http://www.pefc.org/certification-services/eu-timber-regulation, accessed 21 December 2015
[101] http://ec.europa.eu/environment/forests/timber_regulation.htm

“Post-consumer" is defined as material generated by households or commercial, industrial or institutional facilities in their role as end-users of a product that can no longer be used for its intended purpose. This includes materials from the distribution chain.

Nordic Ecolabelling includes by-products from primary wood processing industries (sawdust, wood chips, shavings, bark etc.) or residues from forestry operations (bark, branches, roots, etc.) in its definition of recycled material. Virgin material purchased by industries primarily to make wood chips, for example, is not counted as recycled material. Industries that process raw wood are counted as primary wood-using industries.

It should be noted that the EU Timber Regulation, unlike Nordic Ecolabelling, does not define by-products from primary wood-using industries as residual products. Sawdust, wood chips, shavings, bark, etc. or residues from forestry operations, such as bark, branches, roots, etc. are covered by the EU Timber Regulation, i.e. legal and traceability requirements.

A record must be kept to show that the wood in question has the status of recycled material according to the definitions above.

Certified wood raw materials. Applicants must have documentation to show that a minimum of 70% of wood raw materials (virgin and/or recycled) used in the Nordic Swan Ecolabelled product or product line, is certified as sustainably forested under FSC/PEFC or is recycled material. The remaining percentage of wood raw materials must be FSC Controlled Wood, wood from PEFC Controlled Sources or recycled material. The requirement must be documented as annual purchases of wood. The requirement limit that a minimum of 70% of wood raw materials (virgin and/or recycled) must be certified as sustainably forested under the FSC or PEFC schemes, corresponds to FSC's and PEFC's requirement limits for the use of the respective logos on products, for example, “FSC mix” and “PEFC certified”. Together, FSC and PEFC have five official logos. Further details about the use of logos can be found on the FSC[102] and PEFC[103] websites. The requirement can make it easier for manufacturers of Nordic Swan Ecolabelled products to document the requirement, as they can demand labelled FSC/PEFC products.

Recycled material is explicitly emphasised in the requirement, as both FSC's and PEFC's schemes include certified recycled material. Nordic Ecolabelling equates recycled material with virgin material procured from sustainable forests. Recycled material that is not covered by FSC’s or PEFC’s Chain of Custody certification may also be used in Nordic Swan Ecolabelled products. The recycled materials that are not included in FSC/PEFC’s Chain of Custody certification must satisfy the requirement for the percentage of wood raw materials with FSC or PEFC sustainably forested certification.

A record must be kept to prove compliance with the requirement for a percentage of certified timber or recycled material.

[102] http://welcome.fsc.org/understanding-the-fsc-labels.27.htm
[103] http://www.pefc.co.uk/chain-of-custody-logo-use/pefc-label

The percentage of certified material must be documented on an invoice or delivery note (paper or e-invoice) with certification codes for the certified company/companies from which the wood raw material was purchased. It must be clearly stated on the invoice or delivery note which parts of the delivery are certified (there must be a claim/material category, e.g. FSC MIX 70% and FSC 100% relating to the product in question on the invoice or delivery note, when it comes to FSC certified goods). A valid label with the relevant scheme's logo on the actual product or on an unbroken package, in which the wood product (or a batch of wood products) are sold, may also be used to demonstrate compliance with the requirement. On this may be listed a certification number or licence code, that provides information about the authorised trader who sold the product in question as being certified. The certification schemes have different rules regarding labelling and logo use. Should there be any doubt, it is advisable to consult the websites of the schemes for detailed information on the rules.

Certification and accreditation. The certification (check and approve compliance with the standard, and that the Chain of Custody and any use of label are in order) must be conducted by an independent, competent and accredited third party and must follow relevant international guidelines for certification: ISO/IEC 17065:2012: Conformity assessment - Requirements for bodies certifying products, processes and services, EN ISO/IEC 17021:2011 Conformity assessment - Requirements for bodies providing audit and certification of management systems).

The accreditation (check and approve that the certification firm is working correctly) must be performed by a national or international body, whose systems and procedures are consistent with the relevant international guidelines for accreditation bodies (“EN ISO/IEC 17011:2004 Conformity assessment - General requirements for accreditation bodies accrediting conformity assessment bodies” or equivalent).

O6 Renewable raw materials not alloved to use in Swan labelled liquid and gaseous fuels

Renewable raw materials from palmoil, soybean oils and sucar cane must not be used in Nordic Swan labelled liquid and gaseous fuels. The requirement also includes by-products, residues and waste fractions from palm and soybean oil industries (e.g. Palm Fatty Acid Distillate: PFAD and soybean meal).

The requirement does not cover residues and waste products generated by households or commercial, industrial or institutional facilities in their role as end-users of a product that can no longer be used for its intended purpose.

✉ The applicant shall provide a declaration of compliance with the requirement concerning renewable feedstocks from palm oil, soybean oil and sugar cane. Appendix 3 may be used. Nordic Ecolabelling reserves the right to require further documentation in the event of uncertainty about fulfilment of the requirement.

Background to requirement 06

In this version 3 of the criteria, the requirement has been amended to clearly show that the use of feedstocks from palm oil, soybean oil and sugar cane is not permitted. Palm oil and soybean oil are vegetable feedstocks that are used in the production of biodiesel. In 2014, palm oil and soybean oil were the third and fourth, respectively, most used feedstocks in the production of biodiesel in Europe[104] (rapeseed and Used Cooking Oil (UCO) being the top two biodiesel feedstocks). One of the reasons for this is an increased demand for renewable Hydrated Vegetable Oil (HVO) diesel, which is blended into fossil diesel products (drop-in fuels). By-products from the production of palm oil (e.g. Palm Fatty Acid Distillate: PFAD) are increasingly being used for the production of HVO, since PFAD is considered to be a by-product in many of the European countries' national legislation[105] in line with the implementation of the Renewable Energy Sources (RES) Directive. Several environmental organisations are highly sceptical that PFAD is defined as a by-product[106]. They are concerned that this will lead to a greater demand for PFAD, as a result of the EU strategy and legislation to promote second generation biofuels. Nordic Ecolabelling shares this concern and the requirement therefore also includes by-products, residues and waste fractions from the actual palm oil and soybean oil industries. Imports of sugar cane ethanol to the EU from South-, Central America and the United States peaked in 2014, but has since fallen sharply, because of prohibitive import duties from the EU[107]. The requirement does not include residues and waste from sugar cane production defined under the RED (2009/28/EC).

The requirement does not cover feedstocks from palm oil, soybean oil and sugar cane that are contained in residues and waste products generated by households or commercial, industrial or institutional facilities in their role as end-users of a product that can no longer be used for its intended purpose.

[104] EU Biofuels Annual 2016_EU28-6-29-2016
[105] Norway and Finland define PFAD as a by-product.
[106] ZERO and Rainforest Foundation Norway, paper: Palm Fatty Acid Distillate (PFAD) in biofuels, dated 16 February 2016
[107] EU Biofules-Annual 2016_EU28-6-29-2016

This is because the traceability of the constituent substances of these waste products is very low. A large proportion of the feedstocks used in biogas production are, for example, food waste from households/restaurants/food industries. The Nordic Swan Ecolabel wishes to promote reuse of this waste fraction.

Alle 3 feedsticjs are associated with serious environmental and social problems during cultivation and production.

Issues surrounding the production of palm oil:

As the consumption of vegetable oils has increased over the last 30 years, the cultivation of vegetable oil crops has increased faster than any other industrial crop during the last forty years[108]. The total area of oil palm plantations has increased by almost 10 million hectares since 1990, with the largest increases occurring in Malaysia and Indonesia. Palm oil can be separated into a number of different oils with different characteristics. It is used in cooking oils, margarine, liquid detergents, soaps, cosmetics, waxes, polishes, livestock feed and other products. The early 1970s saw a drastic expansion of palm oil plantations in Malaysia and Indonesia. In 2000, the two countries accounted for just over half of the world's palm oil plantations, while Nigeria accounted for 30% of global palm oil production.

The greatest environmental problem linked to palm oil production is the conversion of natural areas into palm oil plantations. The erosion of natural habitats poses a critical threat to many endangered species. In addition, there may be environmental problems associated with the use of toxins in production, air pollution from burning forests, soil erosion and heavy sedimentation to rivers and streams, as well as discharge of waste water from palm oil mills. As well as natural and environmental problems, large-scale palm oil production is creating social problems in South-east Asia. This includes the violation of labour rights, where the use of chemical and pesticide constitutes a risk to the health of the plantation workers[109]. High unemployment in Indonesia and illegal work in Malaysia increase the risks of workers being paid below the minimum wage, poor response to requests to engage in trade unions and unsafe working conditions. The expansion of palm oil plantations is also associated with the displacement of local communities. As a result of many disagreements about ownership of the land, the plantation business is the most conflict-prone land-based sector in Indonesia and Malaysia today.

Issues surrounding the production of soybean oil:

The intensive production of soy in countries like Argentina and Brazil has various environmental and natural consequences. Agricultural production of soy and exports from Argentina and Brazil affect the environment on local and global levels.

[108] RSPO 2012. Promoting The Growth And Use Of Sustainable Palm Oil - Fact sheet.
[109] OLSEN LJ, FENGER NA & GRAVERSEN J 2011a. Palm oil - Denmark's role in the global production of palm oil. WWF World Wide Fund for Nature, Denmark.

There is an increasing risk of loss of biodiversity and habitat fragmentation due to deforestation, draining of wetlands and establishment of monocultures, such as soy bean fields. Over the last three decades, about 13 million hectares of the world's forests have been cleared on average each year. The loss of migratory routes between natural habitats reduces the genetic health of the population and increases the risk of species and their food supplies dying out. The environmental and natural consequences are in particular associated with natural or semi-natural areas being converted into areas of cultivation and specialisation of cultivation methods and the use of pesticides.

The widespread use of pesticides in Argentina and other countries means that many workers come into daily contact with toxins[110]. The farmers and farm workers who handle the pesticides, and those who live close to the fields where soy beans are grown, are affected.

Issues surrounding the production of sugar cane:

Sugar cane is not currently associated as strongly with the problems of rainforest destruction mentioned above as palm oil and soy oil are, but there can also be challenges linked to its production. Over the period 1960–2008, the land used for sugar cane cultivation rose from 1.4 to 9 Mha. Around 65% of newly planted sugar cane is grown on plains (grasslands and savannahs) and the remainder comprises areas previously used for other types of farming. However, as demand for sugar cane as a raw material rises, opportunities to expand the production areas are being explored. A loss of biodiversity in the rainforest may therefore become a problem associated with sugar cane in the future. At this point in time, the Cerrado is under the greatest pressure from the sugar cane industry. The Cerrado is a tropical savannah in Brazil that has unique biodiversity and specific ecosystems that are under threat.[111]

Nordic Ecolabelling's team of feedstock experts has reviewed the standards for palm oil (RSPO[112]), soy (RTRS[113]) and sugar cane (Bonsucro[114]). It has concluded that neither of the standards currently meet Nordic Ecolabelling's labelling scheme requirements. This is mainly due to a lack of absolute requirements for the protection of key biological areas, and also a lack of requirements for compliance with the basic international conventions. This means that Nordic Ecolabelling prohibits the use of these feedstocks in Nordic Swan Ecolabelled liquid and gaseous fuels.

O7 Genetically modified plants

Raw materials from pesticide-tolerant and insect-resistant genetically modified plants are not permitted to use in a Nordic Ecolabelled fuel.

[110] DANWATCH 2011. Soy production in Argentina - Agriculture's unknown toxin scandal. DanWatch 1-15
[111] http://www.wwf.dk/wwfs_arbejde/skov/soja/skovomrader/cerrado/ (accessed 14.07.2016)
[112] http://www.rspo.org/
[113] http://www.responsiblesoy.org/en/
[114] http://bonsucro.com/

This requirement does not include residuals or waste defined according to the RES(2009/28/EC), however not by-products, residues and waste fractions from palm and soybean oil industries (e.g. Palm Fatty Acid Distillate: PFAD and soybean meal).

✉ Declaration from the raw material supplier of compliance with the requirement. Appendix 4 may be used

Background to requirement O7

The requirement has been amended slightly, compared with version 2 of the criteria, with respect to clarify that residues and wastes defined under the RED Directive (2009/28 /EC) is not covered by the requirement. This does however not include by-products, residues and waste fractions from palm and soybean oil industries (e.g. Palm Fatty Acid Distillate: PFAD and soybean meal), which is prohibits the use, see O6.

The evaluation of the requirement in the criteria generation 2 showed, that it is unclear what is meant by raw material suppliers. Also there is a low traceability in case of productiontypes with many raw material suppliers. There are practical difficulties of getting statements from all farmers (raw material supplier), as the market for biofuels has become global like trading with crops. There are often many links[115] between the licensee and the individual farmer. Nordic Ecolabelling considers that a raw material supplier is not necessarily the individual farmer. This could also be the supplier of rapeseed oil (the one that has crushes oil out of rape).

The most common genetically modified plants (GM) suitable for biofuel production are soy, corn and rapeseed. In 2012[116] the use of GM soy amounted 81% of the worlds total soybean area, for maizethe figure was 35%, and for rapeseed 30%. Soybean is cultivated mainly in South America and the United States while GM corn and -rapeseed also is grown in Europe.

GMO (genetically modified organisms) are a much debated topic and many countries have banned the cultivation of GM crops. The themes of the debate include food safety, land use, lack of scientific knowledge about the effects of GM crops under local agricultural/forestry conditions and the risk of negative impacts on health and the environment. The argument often put forward by advocates of genetic modification is that it will reduce the use of herbicides. Recent studies have, however, raised questions about this.[117] The report from Genøk: “Genetically Modified Organisms – A Summary of Potential Adverse Effects Relevant to Sustainable Development” [118], commissioned by Nordic Ecolabelling in 2011, states that GMO has possible negative effects along the whole value chain from plant research and development, via growing, to storage, use and waste handling.

[115] or en biodiesel som RME anslå leverandørkæden at dække; landmand, råvarehandler (kan være flere led), olieleverandør (presser olie), RME producent og brændstofproducenten (licenshaver).
[116] Gösta Kjellsson et al: Økologisk risikovurdering af genmodificerede planter i 2012, Videnskabelig rapport fra DCE, nr. 100, 2014
[117] http://www.bioteknologiradet.no/2012/06/gmo-kan-gi-mindre-sproytemidler/ (accessed 08.10.2016)
[118] Georgina Catacora-Vargas, 2011, Genetically Modified Organisms – A Summary of Potential Adverse Effects Relevant to Sustainable Development, Biosafety Report 2011/02, GenØk – Centre for Biosafety

The report also describes a lack of scientific research in several of these phases and a lack of assessment of the overall picture. The report particularly highlights the lack of research results on the long-term effects of GM plants. It is important to make clear that Nordic Ecolabelling is not an opponent of the technology in itself, but is concerned about the consequences when genetically modified plants spread into nature.

7.3.3 Requirement concerning fossil fuels

O8 Unconventional fossil fuels

Fossil components in the Nordic Swan Ecolabelled liquid or gaseous fuel must not be based on tar sand, shale oil, shale gas or coal.

The requirement does not cover gas that is distributed in existing gas grids.

See Terms and definitions for a definition of unconventional fossil fuel sources.

☒ Both the applicant and supplier of fossil fuels shall provide declarations of compliance with the requirement concerning unconventional fossil fuels. Appendix 5 may be used.

Background to requirement 08

The requirement has been amended slightly, compared with version 2 of the criteria, to clarify that gas which is distributed in gas grids is exempted from the requirement. The evaluation of version 2 of the criteria shows that there is both high relevance (R) and potential (P) to keep the requirement, while the steerability (S) is assessed to be relatively low. There are several reasons for this:

- The European Union's Alternative Fuels Infrastructure Directive 2014/94/EC requires the Member States to build an infrastructure for alternative fuels (particularly LNG: Liquefied Natural Gas, CNG: Compressed natural gas and LPG: Liquefied Petroleum Gas).
- The European Commission appears positive towards the exploitation of shale gas and has defined common guidelines to ensure that exploitation takes place in an environmentally responsible manner[119].
- Two thirds (71 of 95) of Europe's oil refineries are equipped to handle tar sands oil[120].

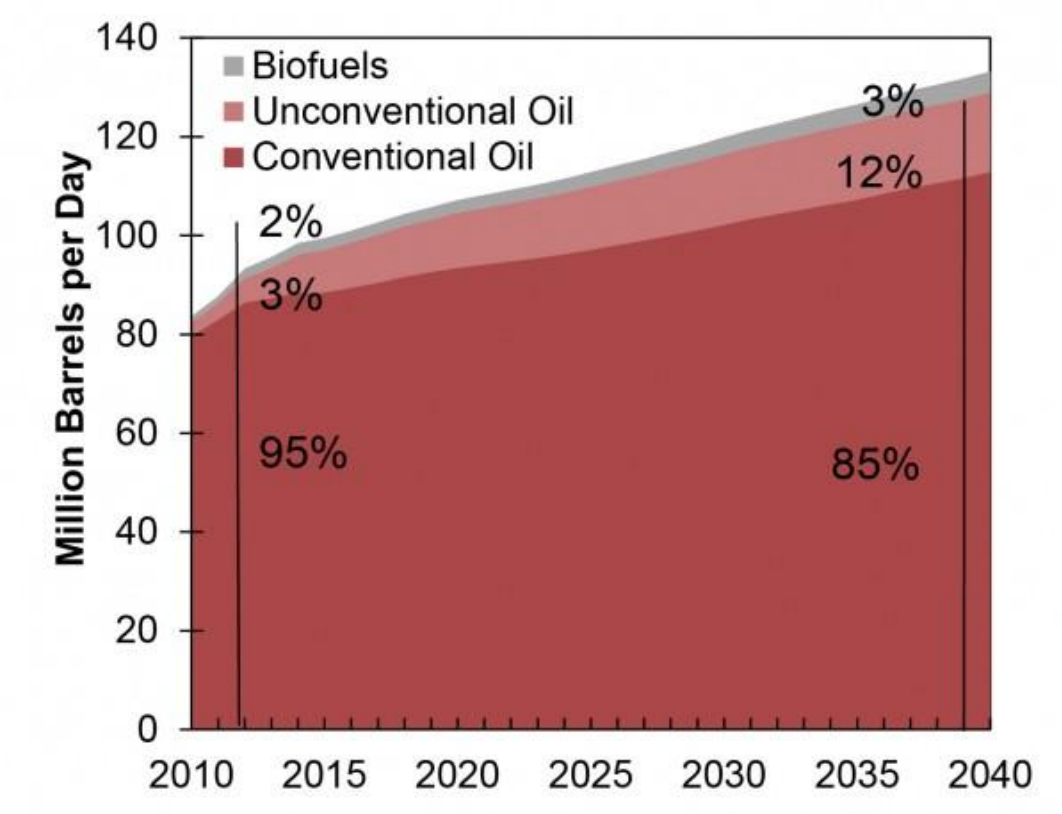
On the other hand, the assessment of the current criteria also shows that Nordic Swan Ecolabel's licensees also want the requirement to be maintained, even though it is difficult to get the information and keep unconventional fossil fuels separate from Nordic Swan Ecolabelled fuels. This is to ensure that liquid and gaseous fuel producers also have a focus on the fossil sources. Nordic Ecolabelling is unanimous in this view and the requirement has therefore not been changed in this version of the criteria.

[119] http://ec.europa.eu/environment/integration/energy/hc_bref_en.htm
[120]http://www.transportenvironment.org/sites/te/files/FoEE_TE_03_Final_Project_Report_091015.pdf

However, it has been made clear that the requirement does not cover gas that is distributed via the European gas grid. Licensees have no steerability with regard to the gas in the gas grid.

Fossil fuels accounted for 81% of the world's primary energy consumption in 2015[121]. Unconventional fossil fuels are defined as fuels that are expensive to produce because of the difficult processes necessary to extract them from their geological settings. Bitumen or crude oil from tar sand, extra heavy oil and crude oil or pyrolysis from shale oil are included in this definition. Energy Research Architecture (ERA) also defines liquid fuels produced from coal (Coal to Liquid, CTL) and natural gas (Gas to Liquid, GTL) as unconventional fuels[122].

The global crude oil price trend has a major impact on when it becomes worthwhile to extract the unconventional fossil fuels. The price of crude oil rose on average by 207% from 2000 to 2014, which allowed for the more economically viable production of the unconventional fossil fuels[123]. The price of crude oil has dropped sharply again since 2015. The production of unconventional fossil fuels is expected to increase to 12% in 2040 from approximately 3% in 2012 (see figure below).



Figur 4: Global projected liquid fuel production[124]

[121] International Energy Agency (IEA) (2015) 2015 Key World Energy Statistics
[122] ERA (Energy Research Architecture): The impact of fossil fuels, greenhouse gas emissions, environmental consequences and socio-economic effects, 2009
[123] http://www.eof.dk/Priser-og-Forbrug/Raaolie, accessed 17 November 2016
[124] EIA (2015) Annual Energy Outlook 2015.

A number of negative environmental consequences have been identified in association with extraction of unconventional fossil fuels. These include:

- Intense intervention into landscapes (surface extraction – tar sand and shale oil).
- Clearance of vast areas of boreal forests and removal of huge volumes of soil. Release of large quantities of carbon in conjunction with tar sand extraction[125].
- Tar sand processing uses large volumes of water and results in huge quantities of toxic sludge, which is deposited over large areas. Tar sand tailing ponds pose a big threat of contaminating groundwater reserves, lakes, rivers and wetlands.
- Contamination of groundwater reserves and other aquatic environments in conjunction with the extraction of shale oil and gas.
- The production of unconventional fossil fuels also generally entails increased emissions of various ecotoxins to the ground, water and air. Numerous regions have already been contaminated by this type of operation and they pose a serious threat to the health of the inhabitants, the wildlife and natural environments in these areas.

In its report, "The Impact of Fossil Fuels", ERA[126] describes the environmental and socio-economic effects of the production of both conventional and unconventional fossil fuels.

7.4 Requirements for greenhouse gas emission savings

O9 Reduction of greenhouse gases

The renewable amount of the Nordic Swan Ecolabelled fuel must reduce greenhouse gas emissions in the entire production chain, from the production of feedstocks to the filling station, by 70% for advanced biofuels and 75% for first generation biofuels compared with the corresponding fossil fuels.

Calculations of greenhouse gas emission savings must comply with Articles 17-19 of the Renewable Energy Directive and its Appendix V.

The calculations must be performed by a competent and independent third party or by the applicant. Calculations performed by the applicant must be verified and approved by a competent and independent third party.

If the Nordic Swan Ecolabelled fuel is a blend of several components or components from different suppliers, the greenhouse gas emissions must be a weighted average of the constituent renewable components.

[125] http://www.greenpeace.org/canada/en/campaigns/Energy/tarsands/ accessed 17 November 2016
[126] ERA (Energy Research Architecture): The impact of fossil fuels, greenhouse gas emissions, environmental consequences and socio-economic effects, 2009

Rules and default values for calculating the reduction of greenhouse gas emissions must comply with the official regulations of each Nordic country or, if a biofuel component is certified according to one of the European Commission's voluntary certification schemes, compliance is required with these rules and default values∗.

∗*Default value (conversion factors): data that is required to convert the input values (stated in kg, kWh, etc.) into greenhouse gas emissions.*

☒ Present data for greenhouse gas emission savings for the Nordic Swan Ecolabelled mix of renewable fuel components, including the GHG performance of the components in the last six-month period at the time of application. The data must be reviewed and approved by an independent third party.

Background to requirement O9

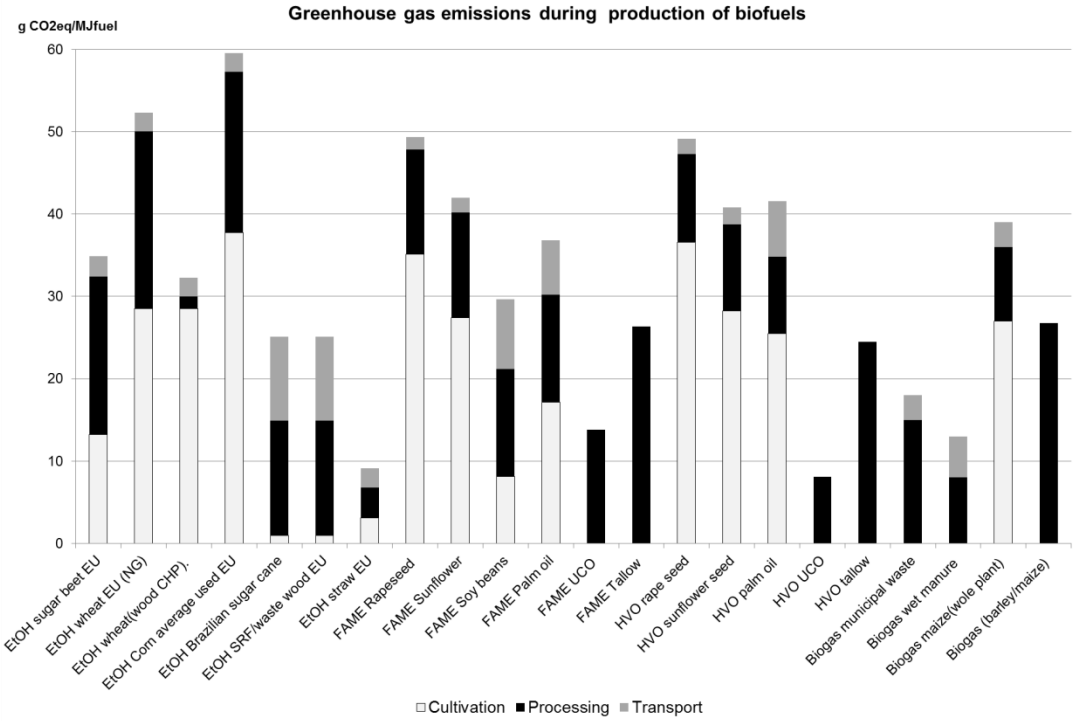
The requirement concerning calculation of greenhouse gas emissions has been amended, compared with version 2 of the criteria. The specifications of the requirement are now in compliance with the Renewable Energy Directive (2009/28/EC), which means that the GHG savings requirement only applies to the renewable share of the fuel. The stringency of the GHG savings requirement has also been revised from 40% to 70% for advanced biofuels and to 75% for first generation fuels.

The requirement in the previous version set a cap of 50g CO_2eq/MJ of fuel on GHG emissions, which also included renewable and fossil content in the fuel. Since a reference value for GHG emissions was stated for the fossil components, it was considered better for communication purposes to formulate the requirement in the same way as the Renewable Energy Directive. The cap of 50g CO_2eq/MJ of fuel in the previous version is equivalent to a 40% reduction of GHG emissions, compared with a fossil alternative. The requirement thresholds of 70% and 75% respectively are based in part on the decision to make the Nordic Swan Ecolabel's requirement thresholds more stringent than the legislation (European Union's Renewable Energy Directive). From 2018, GHG emission savings from biofuels must be at least 60% compared with fossil fuels. The differentiated requirement threshold of 70% for advanced biofuels and 75% for first generation biofuels also supports the use of advanced biofuels. Most types of supply chains for advanced biofuels have low GHG emissions (max 25g CO_2eq/MJ of fuel) which results in high GHG savings (more than 70%)[127]. See Figures 5 and 6. The 75% threshold for first generation biofuels ensures that only the supply chains with high GHG savings meet the requirement.

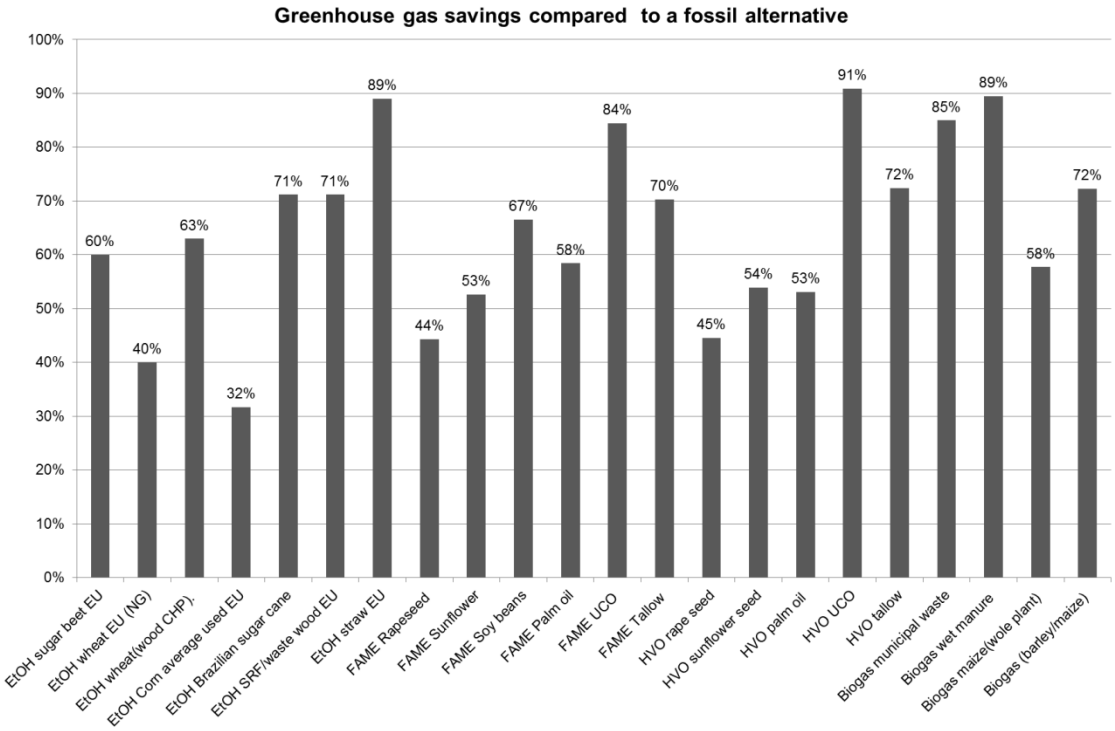
Statistics from the Swedish Energy Agency show that the average reduction of greenhouse gases under the RED for biofuels in the Swedish market in 2014 was 57% for ethanol, 46% for RME, 81% for HVO and 72% for biogas[128]. Requirement O2 (Materials composition) shows that some first generation biofuels have high levels of indirect and direct greenhouse gas emissions compared with the greenhouse gas emissions related to biofuel production processes.

[127] European Commission Joint Research Centre. 2014. Well-to-Wheels analysis of future automotive fuels and powertrains in the European context. WELL-TO-TANK (WTT) Report. Version 4a, January 2014.
[128] Swedish Energy Agency. 2015. Sustainable biofuels and liquid biofuels 2014 ET2015:12.

Various analyses show that first generation fuels often have higher emissions related to biofuel production than advanced biofuels (Figure 6). This is mainly because an input of energy is required to grow the feedstock.



Figur 5: Emission of greenhouse gases in the biofuel production chain, according to analyses conducted by the European Commission's Joint Research Centre (JRC).



Figur 6: Greenhouse gas savings from the use of biofuels compared with a fossil alternative based on analyses conducted by the European Commission's Joint Research Centre (JRC).

In this generation, Nordic Ecolabelling has decided that the applicable rules and default values for the calculation will be the same as for each Nordic country's implementation of the RED. This means that if a biofuel component is certified according to one of the EU Commission's voluntary certification schemes, its rules and default values must be complied with.

The calculation methodology in the previous criteria generation was also according to RED, but the requirement also specified rules and reference values in appendices in the criteria that were different to RED. One difference was that the criteria of the Nordic Swan Ecolabel required GHG emissions for electricity that was used to be a European electricity mix. This meant that the Nordic Swan Ecolabel did not approve the official reporting of sustainability data made under the Renewable Energy Directive, where sustainability data (GHG values, traceability (country of origin) and feedstock) are reported at each stage of the fuel supply chain for each batch of renewable fuel sold to the next operator in the chain.

By using the same rules for calculations, in accordance with the RED, there is no specific GHG value for electricity[129].

[129] In 2010, the Commission published practical guidelines and calculation rules for the RED with the following regulations for electricity: "The Directive requires the use of the average emission intensity for a 'defined region'. In the case of the EU the most logical choice is the whole EU. In the case of third countries, where grids are often less linked-up across borders, the national average could be the appropriate choice."

The BioGrace project, which also has a calculation tool and default values for many different processes, such as electricity, is recognised by a lot of the European Union's voluntary schemes. Only an EU electricity mix used to be allowed in the BioGrace tool. However, since April 2015, national electricity mix values are permitted, according to Table 5. The Table shows that the GHG value for electricity varies considerably from one country to another. According to both the Swedish and Finnish implementation of the RED, the factor for the electricity should be equal to the average emission for producing and distributing electricity in the region where the process takes place[130]. For Sweden, this region shall be the Nordic region or the European Union[131]. For Finland, a mean value for electricity provided by Statistics Finland shall be used. However, if a renewable component in a fuel is certified under a certification scheme approved by the Commission, the rules of that scheme shall apply. It is still unclear how this is regulated by other Nordic countries. However, if a fuel is certified under one of the European Union's voluntary schemes, then the rules of that scheme apply.

Tabel 5: BioGrace GHG emissions for electricity.

Europe (EU - 28)	gCO2eq/MJ
Austria	52.1
Belgium	59.4
Bulgaria	191.5
Croatia	112.2
Cyprus	263.2
Czech Republic	197
Denmark	115.7
Estonia	321.1
Finland	63.5
France	22.7
Germany	169.9
Greece	243
Hungary	120
Ireland	164.2
Italy	137.8
Latvia	60.9
Lithuania	127.1
Luxembourg	82.4
Malta	356.2
the Netherlands	146.4
Poland	285.9
Portugal	137.1
Romania	176.4
Slovakia	69.4
Slovenia	122.1
Spain	106.8

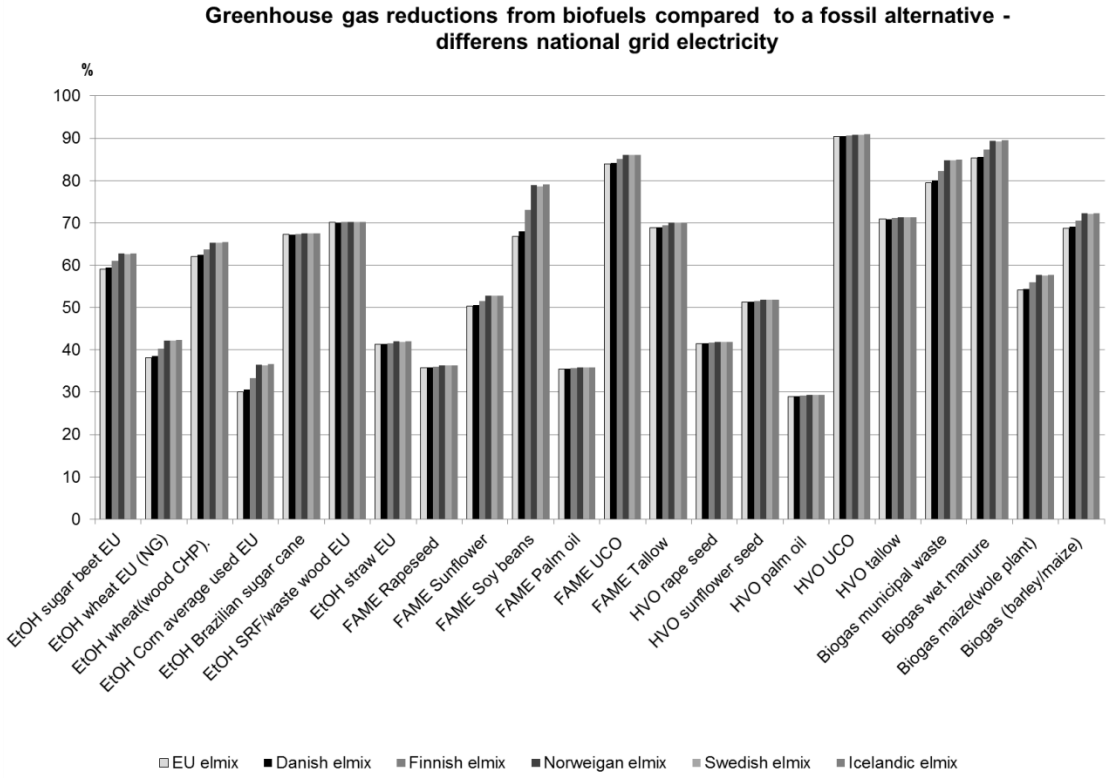
[130] Swedish Energy Agency. 2012. Guidelines to the requirements for sustainability criteria for biofuels and liquid biofuels Version 3.0. ER2012:27.
[131] The Swedish Energy Agency also provides a mean value for Nordic electricity mixes for 2005 to 2009 125.5 g CO2e/kWh or 34.9 gCO2eq/MJ.

Sweden	6.1
United Kingdom	164.8
Europe (Non-EU)	
Norway	3
Iceland	0.4

The consequence of electricity being able to have a value as low as 0.4-6.1 g CO_2eq/MJ is that any inefficient use of electricity is not captured by this requirement. Nordic Ecolabelling has therefore made an estimate of what significance the national electricity mix values have in different production chains, based on data from JRC (Figure 7)[132]. According to the Figure, electricity does not play such a significant role in most of the production chains. Electricity has some significance for first generation ethanol produced from sugar beet, maize and wheat, FAME produced from soybeans, and biogas produced from organic waste, manure and maize.

It should also be noted that in reality there is considerable variation in greenhouse gas emissions from all of these biofuel chains that are presented in Figure 8, but unfortunately there are no data for the variation. This means that there may be biofuel production chains that have much worse and much better values than those reported by JRC. One example is Agroetanol, Sweden's largest producer of grain-based fuel ethanol, whose facilities mainly use process stream from a nearby heat and power plant which utilises waste and biofuels. Agroetanol also separates carbon dioxide from the process and the company can credit the reduction to its emissions account. Agroetanol reports that its product, Agro Cleanpower 95 with 95% bioethanol, reduces GHG emissions by 90%[133].

[132] JRC does not report the electricity's percentage of total greenhouse gas emissions for each production chain. An estimate has therefore been made based on the total primary energy consumption and amount of primary energy in electricity generation.
[133] http://www.agroetanol.se/Agro_cleanpower_95/ (24 November 2016)



Figur 7: Estimated greenhouse gas emission savings from various fuel production chains based on the analyses of the EU Commission's Joint Research Centre (JRC) but with national emission values for electricity according to the BioGrace GHG calculation rules.

7.5 Requirements for working conditions

O10 Working conditions

The licensee must have a written Code of Conduct that explains how the licensee ensures compliance with the following UN conventions and the UN Global Compact at feedstock- and fuel suppliers. This requirement applies to both renewable and fossil components in the Nordic Swan Ecolabelled fuel:

- The UN Convention on the Rights of the Child, Article 32
- The UN Declaration (61/295) on the Rights of Indigenous Peoples

UN's: Global Compact[134], which comprises the following ten principles:

- Principle 1: Businesses should support and respect the protection of internationally proclaimed human rights
- Principle 2: make sure that they are not complicit in human rights abuses Principle 3: Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining (ILO Convention 87 and 98)
- Principle 4: the elimination of all forms of forced and compulsory labour; (ILO Convention 29 and 105)
- Principle 5: the effective abolition of child labour (ILO Convention 138 and 182)

[134] http://www.unglobalcompact.org

- Principle 6: the elimination of discrimination in respect of employment and occupation (ILO Convention 100 and 111).
  Principle 7: Businesses should support a precautionary approach to environmental challenges
- Principle 8: undertake initiatives to promote greater environmental responsibility
- Principle 9: encourage the development and diffusion of environmentally friendly technologies
- Principle 10: Businesses should work against corruption in all its forms, including extortion and bribery.

The licensee must ensure that all feedstock- and fuel suppliers are familiar with and comply with the Code of Conduct.

✉ Licensees must submit a written Code of Conduct that explains how the licensee ensures that its feedstock- and fuel suppliers comply with the requirements of the UN conventions and the UN Global Compact.

✉ A description of how the licensee's Code of Conduct is communicated to all of its feedstock- and fuel suppliers.

Background to requirement 010

The requirement concerning working conditions has been amended slightly, compared with version 2. Version 2 of the criteria required licensees to have a plan in place for compliance with a number of UN and ILO conventions at all feedstock and fuel producers for both renewable and fossil fuel components. An evaluation of the criteria shows that the requirement is very demanding in terms of administration and that it is difficult to get all feedstock and fuel producers to make these plans, particularly in production processes that involve multiple subcontractors. The evaluation also revealed that many countries have ratified ILO's 8 Core Conventions, while very few countries have ratified the other 3 ILO conventions (ILO 148, 155 and 170)[135] contained in the requirement.

Nordic Ecolabelling has therefore decided to amend the requirement in this criteria version. A licensee must now have a written Code of Conduct explaining how the licensee ensures that its feedstock producers/supplier and fuel producers comply with UN and ILO Conventions. This Code of Conduct must be communicated to all feedstock- and fuel suppliers. The requirement has also been amended to comply with the UN Global Compact[136], whose aim is to create international principles on human rights, labour, environment and anti-corruption.

[135] The International Labour Organisation (ILO) Conventions: ILO 148 Working Environment (Air Pollution, Noise and Vibration), ILO 155 Occupational Safety and Health and the Working Environment and ILO 170 Safety in the Use of Chemicals at Work
[136] http://www.unglobalcompact.org

This means that the three aforementioned ILO conventions (148, 155 and 170), which are not part of the ILO Core Conventions, have been replaced with the UN Convention on Human Rights[137], the UN Convention against Corruption[138] and the RIO Declaration on Environment and Development[139]. The requirement for compliance with the UN Convention on the Rights of the Child (Article 32) and the UN Declaration (61/295) on the Rights of Indigenous Peoples also remains unaffected.

Nordic Ecolabelling is aware that it may be difficult to ensure that the working environment of all feedstock producers in the Nordic Swan Ecolabelled fuel's production chain is satisfactory. Nevertheless, Nordic Ecolabelling is convinced that the more producers/suppliers of feedstocks and fuel producers that are confronted with a requirement/signal from their customers that compliance with a Code of Conduct is required, the greater the possibility of its achievement. Licensees must inform their suppliers about their Code of Conduct. However, the licensee must not guarantee that it will be complied with by its suppliers.

The requirement concerning working conditions continues to apply to both renewable and fossil components in the Nordic Swan Ecolabelled fuel. The evaluation shows that the steerability for fossil fuels is generally poor, but also that the licensees have conveyed that it is also important to have a focus on fossil components. This is in great contrast with the renewable feedstocks where the EU has managed, in a short time, to establish a system for meeting the sustainability criteria in the Renewable Energy Directive. The Swedish Association of Green Motorists (Gröna Bilister) has recently conducted a survey of sustainable fuels in the Swedish market[140]. One of its conclusions is the importance of continuing to focus on fossil fuels to ensure that their traceability improves.

7.6 Quality requirements for liquid and gaseous fuels

This chapter covers the quality requirements for liquid and gaseous fuels for transport (road, sea and air), heating and industrial purposes.

O11 Quality specifications for liquid and gaseous fuels

The requirement applies to the end product.

Liquid fuels for road transport* must meet the relevant fuel standards and fuel quality standard (2009/30/EC) established by the EU.

**The fuel quality standard (2009/30/EC) also covers off-road machinery, such as forestry and agricultural machinery.*

Fuels for shipping must meet the requirements of the ISO 8217:2012 standard and the European Union's Sulphur Directive (2012/33/EC).

Fuels for air transport must meet the requirements of the ASTM D7566 standard.

[137] http://www.ohchr.org/EN/UDHR/pages/WorldRecord.aspx (24 October 2016)
[138] the United Nations Convention against Corruption, http://www.unodc.org/unodc/en/treaties/CAC/index.html (24 October 2016)
[139] the Rio Declaration on Environment and Development https://sustainabledevelopment.un.org/rio20/futurewewant (24 October 2016)
[140] Östborn, Lagercrantz and Goldmann. 2013. Sustainable fuels in Sweden Status report and review of fuel companies. Swedish Association of Green Motorists (Gröna Bilister).

Liquid fuels for heating and industrial purposes must meet the requirements of the EN 14214 (biodiesel) or the EN15376 (ethanol) standards.

If a licensee can demonstrate that the end user of the fuel (e.g. bus company, shipping company, airline, car pool, etc. with their own pumps) accepts this, the licensee may, following approval by Nordic Ecolabelling, be allowed to use the Nordic Swan Ecolabel without meeting specified fuel standards.

Biogas for transport/heating/industrial use must be upgraded and meet the quality requirements of the national inspection authority for biogas in the natural gas grid, or equivalent quality requirements from the body responsible for operating the natural gas grid system.

The requirements concerning test laboratories and test instructions are stated in Appendix 6.

Liquid fuels:

☒ The applicant must indicate which standard the liquid fuel is compliant with.

☒ An analysis report and an attestation statement from a test laboratory verifying compliance with the fuel standard.

☒ Alternatively, a written statement from the end user of the fuel in which it is clearly stated that the end user accepts that the fuel does not need to comply with the above standards.

Biogas for transport/heating/industrial purposes:

☒ Biogas for transport/heating/industrial purposes: A declaration from the national regulatory authority stating that the gas is compliant with the gas quality requirements of the regulatory authority or the system operators.

Background to requirement O11

The requirement has been amended slightly, compared with version 2 of the criteria, to now include quality criteria for sea and air transport as well as liquid fuels for heating.

Liquid fuels for road transport as well as off-road machinery, such as forest and agricultural machinery, must meet the fuel quality standard (2009/30/EC) established by the EU. Petrol and diesel are produced from crude oil through the process of refining. The composition of petrol and diesel is controlled by a number of general parameters laid down in the European Union's Fuel Quality Directive and international/national fuel regulations. The Fuel Quality Directive sets limits on the presence of sulphur, benzene, aromatics and other substances in the petrol. The presence of these substances is capped to reduce emissions from motor vehicles. The automotive industry, oil companies and the European Commission have jointly established a number of additional requirements for petrol, namely the CEN standards EN228 and EN15736 (bio-ethanol) and for diesel with the EN590 (biodiesel) and EN14214 (biodiesel, FAME) standards. If these are complied with, motorists can be sure that their car engine will not be damaged by running on the fuel, no matter where they are in Europe. There are also a number of national standards, such as SS 155437:2015, that include ethanol (ED95) in Sweden. Nordic Ecollabelling requires the Nordic Swan Ecolabelled liquid fuels to meet recognised fuel standards to guarantee the quality. However, the Nordic Swan Ecolabelled liquid fuel must also comply with the Fuel Quality Directive (2009/30/EC).

Biofuels for the aviation industry must meet stringent requirements for performance, quality and safety. They must also be 100% compatible with current standards for fossil fuels. Today, commercial aviation fuels are required to comply with the ASTM D155 standard (Jet A or Jet-a)[141]. ASTM is the leading standards development organisation for certification of renewable fuels and has developed the ASTM D7566 standard, which is a specification for aviation fuels containing blends of synthetic and conventional components[142]. Hence a blend meeting the ASTM D7566 standard is an ASTM D1655 jet fuel.

Today, there are three manufacturing processes for the development of biofuels that are approved for use as aviation fuel by the American Society for Testing And Materials (ASTM): Hydrogenated Esters and Fatty Acids (HEFA), Fischer-Tropsch (FT) based on biomass (BtL - biomass to liquid) and Renewable Synthesized Iso-Paraffinic (SIP) fuel (renewable farnesane hydrocarbon)[143].

As in the aviation industry, the use of biofuels in the shipping sector is still in the development stage. The production process is thus identical to the processes used for the production of road transport fuels. Fuels for the shipping industry must meet the ISO 8217: 2012 standard, which regulates traditional fossil fuels and also blends of biofuels. The European Union's Sulphur Directive[144] regulates sulphur emissions from combustion of certain types of fossil-based liquid fuels. The requirement for marine fuels has been revised in two stages to make it more stringent, most recently in 2012 with effect from 1 January 2015. This revision includes a reduction of limits on sulphur emissions from 1.0 to 0.1% by weight in designated Sulphur Emissions Control Areas[145] (SECA). These much stricter requirements for sulphur emissions now make biofuels very interesting for the shipping industry[146].

Liquid fuels for heating and industrial purposes must meet the requirements of the EN 14214 (biodiesel) or the EN15376 (ethanol) standards, i.e. the same standards that regulate fuels for transport.

When biomass passes through a biogas plant, it is typically 60% methane and 40% CO_2. CO_2 has no calorific value and must therefore be removed from the raw biogas, along with moisture and sulphur, before it can be injected into the natural gas grid. This takes place in an upgrading plant. After the upgrading process, the CO_2-neutral biogas, like natural gas, comprises almost pure methane.

At present, there are no standards than can be used to specify the quality of the gas.

[141] https://ec.europa.eu/energy/sites/ener/files/20130911_a_performing_biofuels_supply_chain.pdf.
[142] http://www.astm.org/Standards/D7566.htm.
[143] http://biofuelstp.eu/aviation-biofuels.html#randd (accessed 14 March 2016)
[144] Directive 1999/32/EC
[145] Sulphur Emission Control Area (the Baltic Sea area; the North Sea area; the North American area (covering designated coastal areas off the United States and Canada); and the United States Caribbean Sea area (around Puerto Rico and the United States Virgin Islands).
[146] Ecofys 2012: Potential of biofuels for shipping

Nordic Ecollabelling therefore requires the biogas to be upgraded to a quality that is equivalent to natural gas and to meet the quality criteria of the national inspection authority for the gas grid, or the equivalent quality requirements from the body responsible for operating the natural gas grid system.

7.7 Quality and official requirements

To ensure that the Nordic Swan Ecolabel requirements are met, the following procedures must be implemented.

If the manufacturer/licensee has a certified environmental management system in accordance with ISO 14 001 or EMAS in which the following procedures are implemented, it is sufficient for the accredited auditor to confirm that the requirements are being implemented. This does not apply, however, to requirement O19.

O12 Person responsible for the Nordic Swan Ecolabel

The company shall appoint individuals who are responsible for ensuring compliance with the requirements of the Nordic Swan Ecolabel, for marketing and for finance, and a contact person for communications with Nordic Ecolabelling.

✉ Organisational chart showing who is responsible for the above.

O13 Documentation

The licensee must archive the documentation that is sent in with the application or, in a similar way, store the information in the Nordic Swan Ecolabelling data systems.

🔑 This is checked on site as necessary.

O14 Product quality

The licensee must guarantee that the quality of the Nordic Swan Ecolabelled liquid or gaseous fuel is maintained throughout the validity period of the licence.

🔑 Claims archive. On-site inspection.

O15 Planned changes

Written notice of planned product and marketing changes that affect the Nordic Swan Ecolabelling requirements must be given to Nordic Ecolabelling.

✉ Procedures detailing how planned product and marketing changes are dealt with.

O16 Unforeseen non-conformities

Unforeseen non-conformities that affect the Nordic Swan Ecolabel requirements must be reported in writing to Nordic Ecolabelling and logged.

✉ Procedures showing how unforeseen non-conformities are handled.

O17 Traceability

The licensee must have a traceability system for the production of the Nordic Swan Ecolabelled liquid and gaseous fuels.

✉ Procedures explaining how the requirement is met.

O18 Laws and regulations

The licence holder must guarantee adherence to relevant laws and regulations at all production sites for the Nordic Swan Ecolabelled products. For example, concerning safety, working environment, environmental legislation and plant-specific conditions and concessions.

✉ Duly signed application form.

O19 Annual report on material composition, mass balancing and greenhouse gas emission savings

Compliance of the Nordic Swan Ecolabelled products with the material composition ans mass balancing (requirement O2) and greenhouse gas savings (requirement O9) must be reported annually. The reports must be audited and approved by independent third parties.

✉ Annually report material composition andmass balance data and greenhouse gas savings data for the Nordic Swan Ecolabelled fuels, including the GHG performance of the constituent components over the past year. The data must be audited and approved by an independent third party.

Background to requirement

Requirements O12 to O19 are general quality assurance requirements for ensuring that the Nordic Swan Ecolabelled products fulfil the requirements and comply with legislation and regulations such that the products maintain the environmental quality which is the purpose of the requirements. Most of these requirements are general and apply to all production of ecolabelled products. Individual requirements are not justified in greater detail here.

Requirement O19 for annual reporting was included in the previous version of the criteria. It has been amended, however, to specify exactly what information must be reported each year. An additional new requirement is that mass balancing and greenhouse gas savings must have been audited and approved by an independent third party.

7.8 Areas without requirements

The following proposal for requirements has been discussed and analysed during the review process. However, for the reasons explained below, Nordic Ecolabelling has decided that it will not be included in the consultation draft.

GMO

Harmful substances in emissions/fumes

Version 2 of the criteria includes the requirement to test for harmful substances in the emissions from the Nordic Swan Ecolabelled fuel. The requirement states that the risk of cancer must not increase when a Nordic Swan Ecolabelled fuel is used instead of a fossil fuel. The requirement has not been updated since the first version of the criteria and the risk factors etc. are based on old data (from 1994). It is suggested that the requirement should be deleted in version 3.

A Swedish study[147] conducted in 2012 analysed harmful emissions from cars with catalytic converters in order to investigate the use of diesel classified as environmental class 1 or 3 respectively. The study concluded that it was not possible to detect any significant differences in emissions in the use of class 1 and class 3 diesel. In other words, it is the engine and the use of particulate filters rather than the fuel itself that have a greater effect on harmful emissions.

One of the tools to reduce pollution from cars, buses and other vehicles are the common European requirements, the so-called euro-norms. The euro-norms sets limits on how much new car can pollute. The euro-norms also sets a maximum limit for a number of substances releases from exhaust gases. All new cars sold in the EU may therefore not pollute more than permitted. The euro-norms sets limits on how many substances a vehicle can emit, but does not require to use afspecific equipment as a catalyst or the like. For the most part it will be necessary to have a catalyst to meet the limit value for new vehicles.

The introduction of the euro-norms in the EU have been very effective. Although traffic has increased, the pollution with particulate matter, lead and sulfur has decreased. Since the introduction of euro-norm 5 (effective from 2011) emissions of PM and NOx from each vehicle has been reduced to less than 95% of the level from before the euro-standards were introduced in 1992[148].

8 Changes compared to previous versions

The following are the key amendments compared with the previous version 2.

Tabel 6: Overview of amendments to requirements following the version 2 to version 3 revision.

Requirements draft version 3	Requirements version 2	Same req.	Amendment	New requirement	Comment
Products that may be Nordic Swan Ecolabelled	Products that may be Nordic Swan Ecolabelled		*		The product definition has been expanded to include liquid and gaseous fuels for air and marine transport and liquid fuels for heating and industrial purposes.
O1	K2	*			Description of the product(s)
O2	K3 and K17		*		The requrement to material composition now also includes requirements for traceability

[147] The Swedish Transport Administration. 2012. Assignment from the Swedish government to highlight the differences in environmental impact and health effects of the use of environmental class 1 and environmental class 3 diesel. Publication number: 2012:178.
[148] http://mst.dk/borger/luftforurening/biler-busser-og-andre-koeretoejer/euro-normer-for-bedre-miljoe/ (besøgt 2016-12-12)

03	K10		*		Imported renewable raw materials must be certified by one of the European Commission's approved voluntary certification schemes
04				*	New requirement: Species of trees on the Nordic Swan Ecolabel list of protected tree species may not be used in Nordic Swan Ecolabelled liquid and gaseous fuels
05	K11		*		The requirement has been changed so suppliers of wood raw material must be CoC certified according to FSC or PEFC.
06				*	New requirement: Palm oil, soybean oil and sugar cane must not be used in Swan labeled liquid and gaseous fuels.
07	K12	*			Raw materials from pesticide-tolerant and insect-resistant genetically modified plants are not permitted to use in a Nordic Ecolabelled fuel.
08	K9	*			Fossil components in the Nordic Swan Ecolabelled liquid or gaseous fuel must not be based on tar sand, shale oil, shale gas or coal.
09	K7		*		Hamonicering of requirements and calculation method for the reduction of greenhouse gases with RED (2009/28/EC). The requirement applies only to the renewable share.
O10	K13		*		Requirement to a code of conduct which shows how the manufacturer is working to comply with a number of UN and ILO conventions

O11	K14		*		The requirement now includes quality specifications for the new product areas in the criteria.
O12-O18	K16-K21	*			Quality and official requirements
O19	K22		*		It has been amended, to specify exactly what information must be reported each year New requirement for verification and approval by independent third parties.
Removed requirements					
	K1				Laws and regulations
	K4-K6				Production and by-products, energy consumption in production and transport of raw materials
	K8				Use of energy
	K15				Harmful substances in exhaust gases

9 New criteria

As part of any future evaluation of the criteria, it will be relevant to consider the following:

- Requirements concerning renewable energy sources
- Requirements concerning greenhouse gas emissions
- Requirements for energy consumption in the production of solid fuels
- Requirements for quality aspects

10 Document version history

Nordic Ecolabelling adopted generation 3.0 of the criteria for liquid and gaseous fuels on DAY MONTH YEAR and they are valid until DAY MONTH YEAR.

11 Terms and definitions

Term	Explanation or definition
1. generation biofuels	Commercially produced with conventional technology. Basic Commodities are seed, grain or whole plants such as maize, sugar cane, oilseed rape, wheat, sunflower or palm oil. These plants were originally selected as human and animal feeds. The most common first generation biofuels are bioethanol, biodielsel, vegetable oils and biogas. Definitions follows ILUC Directive (EU) 2015/1513.
Advanced biofuels	Defined in the ILUC Directive (EU) 2015/1513.
Residues and waste fractions	All material and all objects that fall within the definition under the RED (2009/28 / EC) and ILUC Directive (EU) 2015/1513. Nordic Miljmærkning do not allow the use of residues and waste fractions from the palm and soy oil industry (for example, Palm Fatty Acid DESTILLAT: PFAD and soybean meal), see requirements O6.
Biodiesel	Biodiesel is a fatty acid methyl ester (FAME). It is produced from a reaction between an alcohol and vegetable or animal fats and oils. Methanol (wood alcohol) is the most frequently used alcohol although ethanol can also be used. A by-product of biodiesel production is glycerine.
Biogas	Biogas is composed of about 2/3 methane (CH_4), 1/3 carbon dioxide (CO_2), and hydrogen sulphide (H_2S) and a tiny amount of hydrogen (H_2) and is formed by the decomposition of animal manure and other organic industrial or household waste in anaerobic (i.e. oxygen-free) tanks, where it is heated. Biogas can be used for the production of heat and electricity.
Biomass	The analysis applies a broad definition; all forms of biomass, including vegetable biomass (e.g. straw, wood, algae), animal biomass (e.g. livestock manure), waste water, sewage sludge and other biodegradable waste.
CO_2-eq	Carbon dioxide equivalent or CO_2 equivalent are conversion factors for comparison of the impact of different greenhouse gases on the greenhouse gas effect. It is a calculation to find how many tonnes of CO_2 are needed to have the same effect as a tonne of another gas over a given time frame (see GWP below). That figure is the CO_2 equivalent of the gas.
Fossil fuels	Fuels produced from fossil raw materials such as oil, natural gas and coal.
Fuel component	E85 is an example of a product which consists of two fuel components - a fossil component of 15% and deb bio-based component of 85%.
LNG	Liquefied Natural Gas.
CNG	Compressed Natural Gas.

LPG	Liquefied Petroleum Gas.
Greenhouse gases	Atmospheric gases that allow sunlight to pass through the atmosphere, but captures the Earth's heat radiation and returns a part of it. Greenhouse gases in the atmosphere is so crucial to the average temperature. There are a number of gases that contribute to this heating, including CO2, CH4 and N2O.
GWP	Global Warming Potential: GWP is an index that attempts to quantify the relative impacts of different greenhouse gases on global warming. GWP is measured over a specific period of time, generally 20, 100 or 500 years. GWP is expressed as a factor of carbon dioxide (whose GWP is standardised to 1). For example, methane has a GWP of 86 over 20 years, which means that if the same mass of methane and carbon dioxide was added to the atmosphere, methane would trap 86 times more heat than carbon dioxide in the next 20 years.
ILUC	Indirect Land Use Change is about the indirect consequences of using biomass to produce energy. Indirect effects are triggered, for example, if the amount of timber from the area is reduced and another location (possibly in another country) in the supply chain has to be used to maintain the supply of timber.
Reclassification	Reclassification is when the wrong product is delivered to a filling station.
RED	Renewable Energy Directive (RED) (2009/28/EU).
LUC	Land Use Change is about the direct consequences of extracting biomass from a specific area to produce energy. Direct effects are, for example, a reduction in the carbon stock in the area.
RME	Rapeseed Methyl Ester.
Unconventional fossil raw materials	Unconventional fossil raw materials are defined as raw materials are expensive to produce, since these geological interest are difficult to access. Under this definition, this includes bitumen or crude oil from tar sands, extra heavy oil and crude oil or pyrolysis oil from shale. Energy Research Architecture (ERA) define also liquid fuels produced from coal (Coal two Liquied, CTL) and natural gas (Gas to Liquied, GTL) as unconventional ingredients[149].
WtW	Well-to-Wheel is a specific life-cycle analysis that assesses the path of a fuel from its production (Well) through to its combustion or deployment (Wheel). The focus is on the flow of the energy through the system. WtW basically assesses the energy consumption but also analyses the resulting emissions as well as the costs and benefits from welfare and economic points of view.

[149] ERA (Energy Research Architecture): The impact of fossil fuels, greenhouse gas emissions, environmental consequences and socio-economic effects, 2009

HVO	Hydrotreated vegetable oil is a synthetic diesel that can be produced from vegetable oils, such as rapeseed, forest processing by-products, and animal waste products.
FQD	Fuel Quality Directive (FQD) 98/70 EC).
Drop-in fuel	A biofuel product that can be directly blended with conventional fuels (diesel and gasoline) in any ratio.
FAME	Fatty Acid Methyl Ether – a biodiesel product that can be blended with diesel. FAME does not have the same chemical properties as diesel, which places restrictions on the amount that different diesel engines can tolerate.
Renewable raw materials	Renewable raw materials are biological materials that are reproduced continuously in nature. It includes the biodegradable fraction of products, vegetable waste and residues from agriculture, sustainable forestry and similar industries, as well as animal waste and the biodegradable fraction of industrial and municipal waste.
Fischer-Tropsch	A catalytic process that converts syngas into diesel oil.

Appendix 1 National targets and controls in the Nordic countries

The text is only in swedish, has not been translated in to english.

Appendix 2 List of approved voluntary schemes

Tabel 7: Overview of voluntary certification schemes[150] as approved by the EU for verification of compliance with sustainability criteria Renewable Energy Directive (2009/28/EU)

Certification schemes	Feedstock	Extent of supply chain covered
International Sustainability and Carbon Certification (ISCC)	Wide range of feedstocks	Full supply chain
Bonsucro EU	Sugar cane	Full supply chain
Round Table on Responsible Soy EU RED (RTRS EU RED)	Soy	Full supply chain
Roundtable on Sustainable Biofuels EU RED (RSB EU RED)	Wide range of feedstocks	Full supply chain
Biomass Biofuels voluntary scheme (2BSvs)	Wide range of feedstocks	Full supply chain
Abengoa RED Bioenergy Sustainability Assurance (RBSA)	Wide range of feedstocks	Full supply chain
Greenergy Brazilian Bioethanol verification programme (Greenergy)	Sugar cane	Full supply chain
Ensus Voluntary Scheme under RED for Ensus Bioethanol Production (Ensus)	Feed wheat	From the first feedstock delivery point to the Ensus One bioethanol storage
Red Tractor Farm Assurance Combinable Crops & Sugar Beet (Red Tractor)	Cereals, oilseeds, sugar beet	Until the first feedstock delivery point
Scottish Quality Farm Assured Combinable Crops Limited (SQC)	All cereals and oilseeds	Until the first feedstock delivery point
Roundtable on Sustainable Palm Oil RED	Palm oil	Full supply chain
REDcert	Wide range of feedstocks	Full supply chain
NTA 8080	Wide range of feedstocks	Full supply chain
Biograce GHG calculation tool	Wide range of feedstocks	Supply chain not covered
HVO Renewable Diesel Scheme for Verification of Compliance with the RED sustainability criteria for biofuels	All feedstocks suitable for HVO-type biodiesel	From the producer of HVOtype renewable diesel
Gafta Trade Assurance Scheme	Wide range of feedstocks	Covers chain of custody from farm gate to first processor
KZR INiG System	Wide range of feedstocks	Full supply chain
Trade Assurance Scheme for Combinable Crops	Combinable crops, such as cereals, oilseeds and sugar beet	Covers chain of custody from farm gate to first processor
Universal Feed Assurance Scheme	Feed ingredients and compound feeds as well as combinable crops	Covers chain of custody from farm gate to first processor

[150] https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/voluntary-schemes, besøgt 10. oktober 2016

Appendix 3 Standards

ISO 13065:2015 Sustainability criteria for bioenergy

This international standard aims to facilitate the sustainable production, use and trade of bioenergy and will enable users to identify areas for continual improvement in the sustainability of bioenergy. It can be used in several ways. It can facilitate business-to-business communications by providing a standard framework that allows businesses to “speak the same language” when describing aspects of sustainability. Purchasers can use this International Standard to compare sustainability information from suppliers to help identify bioenergy processes and products that meet their requirements. Other standards, certification initiatives and government agencies can use this International Standard as a reference for how to provide information regarding sustainability.

The standard does not provide threshold values. Threshold values can be defined by economic operators in the supply chain and/or other organizations (e.g. government). Sustainability information provided through the use of this International Standard can then be compared with defined threshold values.

ISO 13065:2015

- specifies principles, criteria and indicators for the bioenergy supply chain to facilitate assessment of environmental, social and economic aspects of sustainability.
- is applicable to the whole supply chain, parts of a supply chain or a single process in the supply chain. This International Standard applies to all forms of bioenergy, irrespective of raw material, geographical location, technology or end use.
- does not establish thresholds or limits and does not describe specific bioenergy processes and production methods. Compliance with this International Standard does not determine the sustainability of processes or products.
- is intended to facilitate comparability of various bioenergy processes or products. It can also be used to facilitate comparability of bioenergy and other energy options.

EN 16214: Sustainability criteria for the production of biofuels and bioliquids for energy applications

This European Standard comprises the following parts:

- EN 16214-1, Sustainability criteria for the production of biofuels and bioliquids for energy applications — Principles, criteria, indicators and verifiers — Part 1: Terminology;
- prEN 16214-2, Sustainability criteria for the production of biofuels and bioliquids for energy applications — Part 2: Conformity assessment including chain of custody and mass balance;

- EN 16214-3, Sustainability criteria for the production of biofuels and bioliquids for energy applications — Principles, criteria, indicators and verifiers — Part 3: Biodiversity and environmental aspects related to nature protection purposes;
- prEN 16214-4, Sustainability criteria for the production of biofuels and bioliquids for energy applications — Part 4: Calculation methods of the greenhouse gas emission balance using a life cycle analysis.

Work is under way within the European group, CEN /TC 383 to update the the part-standard handling environmental issues, EN 16214-3: 2012, so that this also includes the new regulation regarding high Biodivercity grasslands. There is also underway evaluating the desirability started standardization work related to indirect effects, partly because of the new ILUC directive and partly due to some stakeholders in the European group would like to take a broader approach to these questions when the ISO 13065: 2015 do not include them.

Appendix 4 Relevans, potential and steerability (RPS- analysis)

The text is only in danish and has not been translated in to english.

Appendix 5 Guidelines for using mass balance

Documentation for the share of renewable raw materials in the Swan-labeled fuel must be done on an annual basis using the mass balance under the RED (2009/28/EC). Nordic Ecolabelling does not allow:

- use of trade licenses, sk. "Book and claim"
- Allocation between renewable and fossil

Apart from that there is:

- prohibiting the use of a variety of tree species specified in requirement O4.
- ban on the use of renewable raw materials from palm oil, soybean oil and sugar cane. The requirement also includes by-products, residues and waste fractions from the palm and soy oil industry (for example, Palm Fatty Acid DESTILLAT: PFAD and soybean meal), requirements O6.

If certificates (voluntary certification schemes) is used in combination with mass balance accounting, Nordic Ecolabel reserves the right to assess these certificates in relation to traceability, biodiversity and guidelines for certification given in Annex 7 of the criteria.

Rules for use of the mass balance under the RED (2009/28/EC):

According to the mass balance method of verifying compliance, there is a physical link between the production of biofuels and bioliquids meeting the sustainability criteria and the consumption of biofuels and bioliquids in the Community, providing an appropriate balance between supply and demand and ensuring a price premium that is greater than in systems where there is no such link. Economic operators shall show that the sustainability criteria set out in Article 17(2) to (5) have been fulfilled. For that purpose they shall require economic operators to use a mass balance system which:

(a) allows consignments of raw material or biofuel with differing sustainability characteristics to be mixed;

(b)requires information about the sustainability characteristics and sizes of the consignments referred to in point (a) to remain assigned to the mixture; and

(c)provides for the sum of all consignments withdrawn from the mixture to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture.[151]

European Commission has in a commuication informed about rules for mass balance which are[152]:

[151] Renewable Energy Directive (RED, 2009/28/EC)
[152] European Commission. 2010. Communication from the Commission on voluntary schemes and default values in the EU biofuels and bioliquids sustainability scheme (2010/C 160/01)

It is in relation to the final product that compliance with the requirements of the Directive need to be shown. To show this, claims will need to be made about the raw material and/or intermediate products used. The method by which a connection is made between information or claims concerning raw materials or intermediate products and claims concerning final products is known as the chain of custody. The chain of custody would normally include all the stages from the feedstock production up until the release of the fuels for consumption. The method laid down in the Directive for the chain of custody is the mass balance method[153].

The voluntary scheme should require verification of the mass balance system to be performed simultaneously with verification of correctness in respecting the scheme's criteria. This should include the verification of any evidence or systems used for the purpose of complying with the requirements of the mass balance system.

The mass balance system means[154] a system in which 'sustainability characteristics' remain assigned to 'consignments'. Sustainability characteristics could include for example:

- evidence showing compliance with the Directive's sustainability criteria, and/or
- a statement that the raw materials used were obtained in a way that complies with the Directive's land related sustainability criteria, and/or
- a greenhouse gas emission figure, and/or
- a description of the raw material used[155], and/or
- the statement 'production has been awarded a certificate of type X from recognised voluntary scheme Y', etc.

When consignments with different (or no) sustainability characteristics are mixed[156], the separate sizes[157] and sustainability characteristics of each consignment remain assigned to the mixture[158]. If a mixture is split up, any consignment taken out of it can be assigned any of the sets of sustainability characteristics[159] (accompanied with sizes) as long as the combination of all consignments taken out of the mixture has the same sizes for each of the sets of sustainability characteristics that were in the mixture.

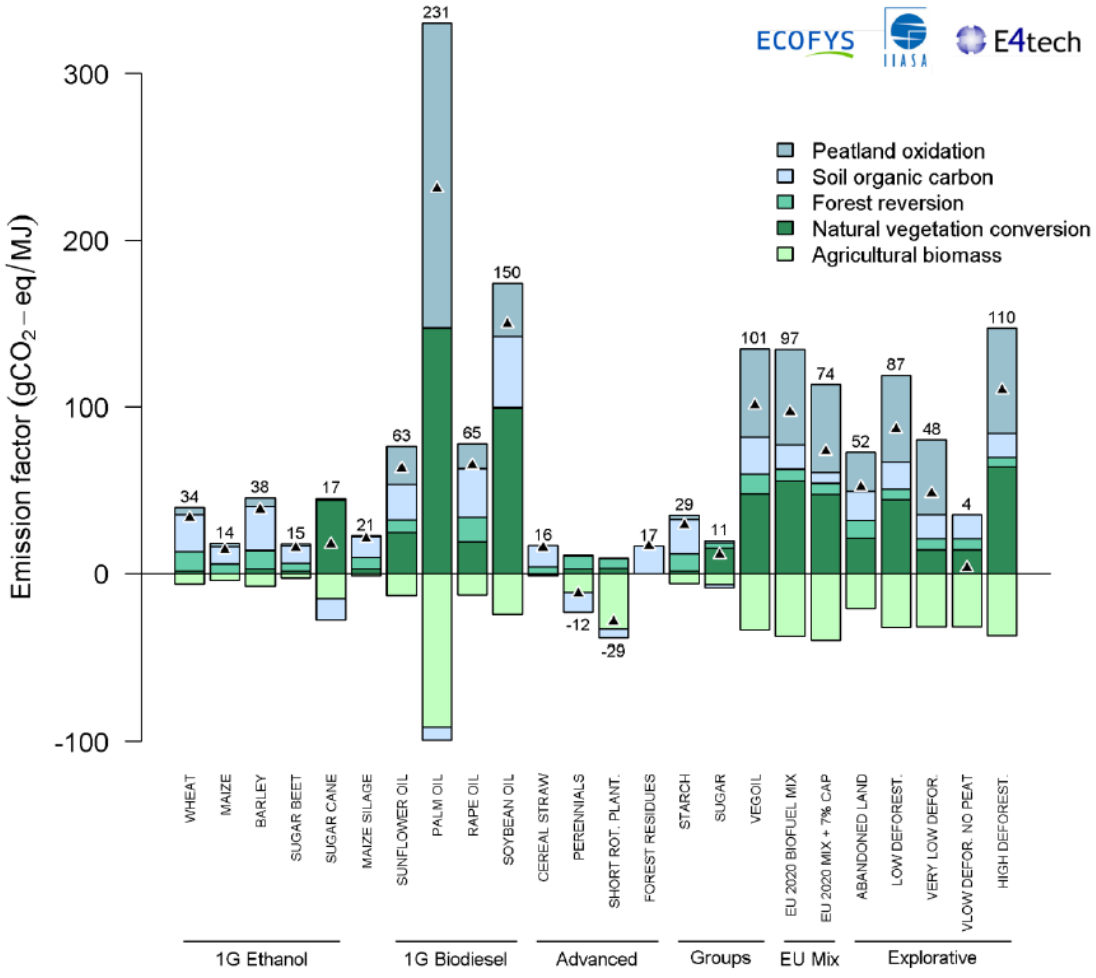
[153] Article 18(1).
[154] According to Article 18(1).
[155] e.g. to claim a default value
[156] When consignments with the same sustainability characteristics are mixed only the size of the consignment is adjusted accordingly. Sustainability characteristics are likely to be the same where the same feedstocks are used and use is made of 'default values' or 'regional actual values'.
[157] Where a processing step or losses are involved, appropriate conversion factors should be used to adjust the size of a consignment accordingly
[158] Thus, if the characteristics include different figures on greenhouse gas emissions they remain separate; these figures cannot be averaged for the purpose of showing compliance with the sustainability requirements.
[159] This means that when a 'sustainability characteristic' would be the description of the feedstock, e.g. 'rapeseed', this characteristic can be different from what the consignment physically contains, e.g. a mix of rapeseed and sunflower oil.

A ‘mixture’ can have any form where consignments would normally be in contact, such as in a container, processing or logistical facility or site (defined as a geographical location with precise boundaries within which products can be mixed).

The balance in the system can be continuous in time, in which case a ‘deficit’, i.e. that at any point in time more sustainable material has been withdrawn than has been added, is required not to occur. Alternatively the balance could be achieved over an appropriate period of time and regularly verified. In both cases it is necessary for appropriate arrangements to be in place to ensure that the balance is respected

Appendix 6 Indirect and direct greenhouse gas emissions

The Globiom study, which was funded by the European Commission, analysed the direct and indirect impacts from biofuels consumed in Europe on carbon stocks and land[160]. The scenarios that are modelled are political scenarios based on the European Union's Renewable Energy Directive (RED). Since earlier studies have shown that the land use impacts differ per crop and supply chain, the Globiom study has analysed 14 crop-specific scenarios for the main conventional (first generation) and advanced biofuels. The study reports two types of outcomes: land use change caused by increased demand for biofuels and, based on this land change, related greenhouse gas emissions (LUC = both direct and indirect impacts on carbon stocks and land) for each of the 14 modelled scenarios. See Figure 9 below.



[160] Valin et al. 2015. The land use change impact of biofuels consumed in the EU Quantification of area and greenhouse gas impacts. Ecofys, IIASA, E4tech. European Commission Ref. Ares (2015)4173087.

Figure 8: Indirect and direct emissions (LUC) for scenarios of different biofuel feedstocks and the EU's 2020 scenarios. The part of each bar above zero on the y-axis represents positive emissions, while the part of the bar below zero represents negative

emissions that are being deducted from the positive emissions. The resulting net LUC emission value (direct and indirect) is represented by the small triangle in each bar and by the number on top of each bar.

The study shows that conventional biodiesel feedstocks have high LUC effects compared to the GHG emissions that are related to the biofuel production process. The highest LUC emissions are for palm oil and soybean oil. Sunflower and rapeseed have high emissions too. Compared with the biodiesel feedstocks, the conventional ethanol feedstocks – sugar and starch from maize, wheat, sugar cane and sugar beet – have much lower LUC emission impacts. This is mainly because these feedstocks lead to much less oxidation of organic matter in peat and deforestation compared with vegetable oil feedstocks. The results also show that, in general, crops with higher energy yields per hectare have lower indirect impacts on land use change and greenhouse gas emissions. A notable exception is palm oil, one of the highest yielding crops, whose performance is strongly impacted by emissions from deforestation and peatland conversion.

Advanced biofuels have negative LUC emissions if produced from short rotation crops or perennials, mainly because of the increase in the carbon stock on the land that is converted to produce these higher carbon stock crops. Advanced biodiesel (Fischer-Tropsch) from forestry residues leads to a significant LUC emission value, despite the fact that no land use change takes place. The emissions result instead from a lower build-up of soil organic carbon (SOC). The GLOBOM study uses a twenty-year perspective, which is the period used in the Renewable Energy Directive (RED) for the allocation of direct land use change emissions and which is a short time perspective for feedstock from forests with significantly longer life-cycles than 20 years. If a longer allocation period were chosen, for example 30 or 50 years, LUC emission values would be lower for some sources, since the total land use change emissions associated with a certain quantity of biofuels would be divided over a greater number of years. The natural decomposition of organic carbon in readily biodegradable residues would also lead to a reduction of soil organic carbon (SOC) (returned to the air as CO_2) from forestry activities[161] [162].

In the study, various scenarios were also tested for biofuels in the transport sector, where the EU 2020 biofuel mix is based on the National Renewable Energy Action Plans (NREAPs) of the Member States, and the total amount of fuel consists of 8.6% conventional biofuel (first generation) and 0.8% advanced biofuels. The scenario gives a high LUC impact (97g CO_2eq/MJ of biofuel) which is largely due to the fact that palm oil constitutes 16% of the feedstock. A scenario in which more abandoned land in the EU is used for biofuel production reduces total LUC emissions from 97g CO2eq/MJ of biofuel to 52g CO2eq/MJ of fuel. Part of this reduction results directly from using abandoned agricultural land where cultivation can lead to storage of carbon, and the other part is the result of a reduced share of palm oil in the total feedstock mix.

[161] Schlamadinger, B. & Marland, G. (1996). The role of forest and bioenergy strategies in the global carbon cycle. Biomass and Bioenergy, 10(5-6), 275300.
[162] Lindholm et al. 2011. Greenhouse gas balance of harvesting stumps and logging residues for energy in Sweden. Scandinavian Journal of Forest Research. 26(6):586-594.