Sustainable biomass and bioenergy in the Netherlands: Report 2012
Colophon

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Executive summary

Introduction

Background

Monitoring and mapping of biomass and bioenergy flows is important to build knowledge and gain insights into the relevant market mechanisms and trade flows. It is important to understand the market dynamics and their interrelation with sustainability considerations. The insights in the market can be achieved by assembling available information concerning biomass flows and share of sustainable certified biomass in these flows, as well as identification of the opportunities and barriers in connection with the bio-based economy. These insights will support the development of a sustainable bio-based economy.

Aims and scope

1. To provide a quantitative and qualitative overview of past and current solid and liquid biomass flows in the Netherlands (by constructing mass balances), and assess (as far as possible) to what extent these biomass were certified with sustainability schemes
2. To pinpoint major sustainability certification schemes for biomass
3. To propose a framework for monitoring (sustainable) biomass and bioenergy flows in the Netherlands

Monitoring framework for biomass and bioenergy

General approach

In view of the large diversity in biomass, the authors have chosen to categorize biomass according to three main categories: (i) woody biomass; (ii) oils and fats; and (iii) carbohydrates. Only biomass that falls under these three categories is investigated in this study. This selection is based on absolute size and their relevance to the bio-based economy:

a. they are relatively large streams with clear distinction;
b. their relevance to the bio-based economy – they are either long-chain polymers (starch & lignocellulose) or high-quality monomers (fatty acids & sugars);
c. they are closely related to bioenergy carriers – wood pellets, biodiesel and bioethanol (and also considering their large share in waste incineration).

Vegetables, fruits, fishes & meats, live stocks, plants & flowers, coffee & tea & spices and other biomass are not included in this study.

Methodology

Pre-phase: Identify sustainability certification schemes and monitoring bodies
Phase I: Creating inventory and collecting data
Phase II: Setting system boundaries and constructing the mass balances
Phase III: Harmonizing the data and assessing the developments

Data sources are illustrated in Figure ES-1.
Figure ES-1 Main sources of information according to biomass categories

Results

Woody biomass

Figure ES-2 illustrates the flows of woody biomass in the Netherlands in 2011. In 2010 and 2011, the Netherlands produced considerable amounts of round wood, but about half of that was exported. On the other hand, relatively large amount of sawn wood and wood panels was imported, mostly originated from adjacent countries. There was also significant import of paper and cardboard into the Dutch market. A large amount of wood pellets was consumed in the utilities. About 90% of the wood pellets were imported. Considerable amount of woody biomass and paper and cardboard were incinerated to generate electricity and heat.

Figure ES-3 shows the share of sustainable certified woody biomass in the Dutch market. "Use of waste and recycled streams" includes all waste wood, waste incinerations and recycled paper and cardboard. "Origins unclear" indicates round fuel wood used in household wood stoves. "Certified-" and "non-certified woody biomass entering the Dutch market" include all woody biomass excluding the aforementioned two categories. A significant change between 2010 and 2011 would be the increase of certified woody biomass for energy purpose. Probos
(2010) estimates that the market share of certified sawn timber and wood-based panels in 2011 will account for 43%. Most of the paper and cardboard is separated for recycling purposes. In 2010 and 2011, about 37% and 38% of paper and cardboard production came from recycled sources. The share of certified paper and paperboard in the Dutch market is expected to increase to 9% in 2011 according to the manufacturers and importers of paper and paperboard. The separated collected papers are recycled and not meant for fuel purpose. However, there are still large portions of woody biomass and paper and cardboard that could not be separated and end up in waste incineration.

Figure ES-2 Mass balance for woody biomass flows in the Netherlands in 2011

Figure ES-3 Use of certified, non-certified, recycled and waste woody biomass (MT) in the Netherlands

Figure ES-4 illustrates the amount of certified and non-certified pellets imported into the Netherlands from various countries. In 2011, most of the wood pellets are certified by sustainability schemes. However, still more than one third of wood pellets from Western Europe were not certified.
Oils and fats

Figure ES-5 shows the mass balance for oils and fats flows in the Netherlands in 2011. Soy bean is the largest flow of biomass entering the Netherlands in this group. Strictly speaking, soy is not primarily an oil crop but used mainly as a protein source. Therefore, a relatively small portion of oil was produced while most of the mass remained as meal after processing, mainly used as animal feeds. Palm oil is the largest oil source followed by rapeseed oil, soy oil and sunflower oil. Human consumption is the most important application of vegetable oils, recording about 67% in 2011, while about 17% is used for energy purpose, about 11% for animal consumption and the rest for technical purpose. Apart from palm and soy oil, rapeseed and sunflower are two large sources for oils. Rapeseed oil contributes the largest share in biodiesel production. From 2010 to 2011, no dramatic changes in the net flows of oil seeds and vegetable oils, but there are substantial increase in animal fats import. This is because the increased demand for biodiesel in 2011 absorbed more animal fats into the Netherlands. Production of biodiesel from these streams is favored due to the double counting mechanism.

Figure ES-6 shows the use of certified and non-certified vegetable oils, UCO and animal fats, and fatty acids in the Netherlands. To some extent the year 2011 can be regarded as the starting year for the significant use of sustainable certified vegetable oils in the Dutch market. In this year, the Dutch food and feeds industry imported the first batch of RTRS certified soy bean. Many Dutch food manufacturers also started to import RSPO certified palm oil with ambitious target in the next few years. It should be noted that this figure takes the assumption that all vegetable oils used for biodiesel production in the Netherlands are 100% sustainable certified (including RSPO certified palm oil which is not accepted by the EC yet but accepted in the Netherlands to demonstrate sustainability). With this assumption, about one third of palm oil and rapeseed oil is sustainable certified. Data for certified vegetable oils used for biodiesel production in 2010 is not available. Since there was no mandatory requirement, it is assumed all vegetable oils used for energy purpose in 2010 were not certified.
Figure ES-5 Mass balance for oils and fats flows in the Netherlands in 2011 (stock changes are not shown)

Figure ES-6 Use of certified and non-certified vegetable oils, UCO and animal fats, and fatty acids (MT) in the Netherlands

Carbohydrates

Figure ES-7 illustrates the quantified mass flows of carbohydrates in the Netherlands in 2011. All streams are drawn in the ratio to their actual amount. Basically the Netherlands is able to self-supply more than half of its total carbohydrates consumption. Other carbohydrates products and sugars (for e.g. white sugars) have very little flows. Maize (corn) turns out to be the largest Dutch carbohydrates source. Although the Netherlands produces relatively large amount of maize, considerable amount of maize are imported. Potatoes, sugar beets and barley are the other important sources of carbohydrates. Carbohydrates are widely used food staples, which can be directly used for food and animal feed, or processed to make food (bread, biscuits), beverages (beers) and feed, or industrial products such as ethanol. In addition to food and feeds, carbohydrates can also be feedstock for textiles, adhesives and energy. About 1.2 MT of maize
and wheat was processed in the Netherlands to produce bioethanol in 2011. The connection shown in Figure ES-7 is purely estimation because the exact feedstock and destination are unknown. Besides bioethanol, it can also be used as feedstock for biogas. About 0.36 MT of maize was fermented into biogas in 2010, but this figure drops to 0.18 MT in 2011.

Majority of carbohydrates consumed in the Netherlands originated from Europe. In recent years sustainability has been an important consideration in Dutch food industry, and included in procurement policies of many food companies. However, currently it is still unclear how sustainability certifications can be applied on grains in Europe. Companies generally purchase sustainable supplies through bilateral agreements by providing the suppliers a set of rules and criteria to follow. In addition, agriculture in Europe is largely monitored by environmental laws and regulations. Conventional certifications focus more on some other issues such as organic food.

![Figure ES-7](mass_balance_carbohydrates_in_netherlands_2011.png)

**Figure ES-7** Mass balance for carbohydrates flows in the Netherlands in 2011

**Discussions and conclusion**

**Monitoring framework: Opportunities and challenges**

For **woody biomass**, Probos has been analyzing data from CBS for years. This data is normally published at the end of the year. Probos also collects data for the market share of sustainable certified woody biomass and paper and cardboard in the Netherlands but only once in every three years. Annually updated data is not available yet. For the energy use of wood in power plants (particularly wood pellets), Utrecht University has been conducting surveys with the power plants for data collection in recent years. The information was obtained directly from the industry.

The data for **oils and fats** is by far the most systematic among the three groups. MVO has been monitoring the flows of oil seeds, oils and fats over the past few years. Currently palm oil and soy bean are the two major streams with sustainability certification; the shares of sustainable portion are reported by
Taskforce Duurzame Palmolie and IDH, respectively. This information can then be analyzed by comparing with data from CBS. It is difficult to distinguish the origins of sustainable certified biomass by country, but collectively it is possible to deduce that they come from specific regions.

Lastly, for carbohydrates, data for grains and crops is mostly available on CBS statistics. However, it is difficult to further analyze the streams after secondary processing, i.e. in food and feed sectors, because the chemical components are too complex. Therefore, only the flows of raw materials are included in the study. However, bioethanol (derived from carbohydrates) is also taken into account due to its significance to the bio-based economy. Most carbohydrates is either produced domestically or imported from the other European countries. No specific sustainability certification schemes are developed until 2011.

Development of sustainability certification

While woody biomass has been certified for a longer period already, it is worthwhile to point out that in 2011, the sustainability certification of solid biomass, liquid biofuels and vegetable oils for human consumption all have drastically increased. It could therefore be suitable to regard the year 2010 as a base-line year for monitoring the sustainability of biomass streams in all three categories.

At present, numerous sustainability certification schemes are being developed or implemented by a variety of private and public organisations with different interests, purposes and target groups:

• Woody biomass has already a long certification tradition, particularly sustainable forest management schemes. It is expected that the share of certified wood products will further grow steadily. Indeed, the hot topic in this category is the energy use of woody biomass by utilities, particularly wood pellets. In the past years the use sustainable certified wood pellets was dominated by the Green Gold Label system; the percentage of certified pellets in the market is very high, almost 90% in 2011.
• The situation is quite different for oils and fats. Significant certified palm oil and soy bean entered the Dutch market only since 2010/2011. However, the industrial players have set ambitious target to completely shift to certified palm oil and soy bean within a few years ahead. On the other hand, started from 2011, the Dutch government accepts only 100% sustainable certified biofuels. In other words, all oils and fats used for energy purpose must be either sustainable certified or originated from waste.
• For the last category, carbohydrates, there are no specific sustainable certifications over the years, although to some extent sustainability schemes are applied on bioethanol derived from carbohydrates. Most carbohydrates consumed in the Netherlands are originated from Europe and produced under proper environmental regulations, and therefore the demand for sustainability certification is not so strong (but focuses on the other concerns, such as organic food label). However, in 2012, there are efforts in putting sustainability certification on Dutch grains, namely VVAK and Stichting Veldleeuwerik. It is expected to see some sustainable certified grains in the Dutch market in the near future. For the energy use of carbohydrates, bioethanol derived from carbohydrates are mainly imported. Similar to biodiesel, started from 2011, only sustainable certified bioethanol will enter the Dutch market. Small scale biogas production from potatoes is also observed in the Netherlands under the Green Deal, but the involvement of certification schemes is not expected.

Table ES-1 shows the market share of sustainability certification schemes in the Netherlands. To some extent, this wide range of schemes, developed largely
without coordination among the organisations involved, may create incompatibility between different sectors, and turned out to be a trade barrier. For example, voluntary sustainability schemes for forestry might not be compatible with sustainability requirements of solid biofuels. Confusion may arise and questions on the level of sustainability requirement for different sectors may be raised. As an example: strict requirements have reduced the use of palm oil and increased that of rapeseed for biodiesel production. However, the amounts of overall consumption did not change – more palm oil is used in food sector replacing the gap left by rapeseed oil.

**Table ES-1** Market share of sustainability certification schemes in the Netherlands

<table>
<thead>
<tr>
<th>Type of biomass</th>
<th>Sustainability schemes</th>
<th>Market share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody biomass: Sawn</td>
<td>FSC</td>
<td>12% (2008)</td>
</tr>
<tr>
<td>timber and wood based</td>
<td>PEFC</td>
<td>22% (2008)</td>
</tr>
<tr>
<td>panels</td>
<td></td>
<td>Total share in 2011 is estimated to be 43%</td>
</tr>
<tr>
<td>Woody biomass: Paper</td>
<td>FSC</td>
<td>3% (2008)</td>
</tr>
<tr>
<td>and cardboard</td>
<td>PEFC</td>
<td>3% (2008)</td>
</tr>
<tr>
<td>Woody biomass: Wood</td>
<td>Green Gold Label</td>
<td>51.8% (2011)</td>
</tr>
<tr>
<td>pellets used by utilities</td>
<td>Laborelec Label</td>
<td>33.5% (2011)</td>
</tr>
<tr>
<td>Oils and fats: Total</td>
<td>RSPO (Palm oil)</td>
<td>6.7% (2011)</td>
</tr>
<tr>
<td>vegetable oils</td>
<td>RTRS (Soy bean)</td>
<td>0.3% (2011)</td>
</tr>
<tr>
<td>Carbohydrates: Grains</td>
<td>VVAK</td>
<td>Starts in 2012/13</td>
</tr>
<tr>
<td></td>
<td>Stichting Veldleeuwerik</td>
<td>Starts in 2012/13</td>
</tr>
<tr>
<td>Biodiesels</td>
<td>ISCC</td>
<td>48.4% (2011)</td>
</tr>
<tr>
<td></td>
<td>2BSvs</td>
<td>4.9% (2011)</td>
</tr>
<tr>
<td></td>
<td>RTRS</td>
<td>1.8% (2011)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>9.6% (2011)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The rest is double counting or unknown</td>
</tr>
<tr>
<td>Bioethanol</td>
<td>ISCC</td>
<td>84% (2011)</td>
</tr>
<tr>
<td></td>
<td>RBSA</td>
<td>4% (2011)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>12% (2011)</td>
</tr>
</tbody>
</table>

Recent data presented in Chapter 3 to 5 shows that sustainability certification mainly applied on biomass used for energy in 2010 and 2011. Woody biomass might be an exception in terms of absolute quantity, however in terms of percentage, near to 90% of wood pellets was certified but only about 50% of other woody biomass (for other use) was certified. For vegetable oils, about 16.3% was certified for biodiesel production and about 7% was certified for food and feed use. The situation is one-sided for the carbohydrates group, in which only biomass used for energy (bioethanol) was certified.

Indeed, there are many types of certifications for biomass, including the establishment of small labels that fill a niche and hardly grow beyond it. But bioenergy certification specializes in (mainly) environmental sustainability – a crucial aspect that may wind up transforming entire global industries. The EU has been carrying the environmental flag, intending to be distinct in that it utilizes the highest standards of environmental rules and regulations, especially on greenhouse gas emissions. In this regards, certification of bioenergy includes the strictest requirements compared to that of other biomass uses. It is not unusual to say that if bioenergy certification succeeds, they may stimulate the other biomass markets to follow the high standards.
1 Introduction

1.1 Previous projects

Between 2010 and 2011, Utrecht University has carried out work for Agentschap-NL with the following aims:

1. To provide a quantitative and qualitative overview of past and current solid and liquid biomass import flows, and assess (as far as possible) to what extent this biomass was produced sustainably; and
2. To identify trade and market barriers for sustainable biomass in the Netherlands, and identify possible solutions.

This work has resulted in a first report published in 2010 (Jonker and Junginger, 2010), and an updated report in 2011 (Jonker and Junginger, 2011). In these two reports, the first objective was achieved with the main focus on the energy use of biomass, particularly on the trade and consumption of wood pellets, biodiesel and bio-ethanol in and to the Netherlands. The studies also provide a concise overview of market development, current trade barriers and the status of sustainability certification, by conducting a number of interviews with the market actors.

In 2012, given the ambition of the Netherlands to develop the bio-based economy, monitoring of (sustainable) biomass flows for various end-uses is getting important to gain insight into the market mechanism and trade dynamics (see Section 1.2 below). This project builds on the previous two reports, but has a wider focus and uses an extended methodology, as further described in Section 1.3.

1.2 Background and rationale

Over the past years, the Dutch Government, Dutch academia and market parties have shown increasing interest and ambition to develop a bio-based economy in the Netherlands. The transition to a bio-based economy is considered to be essential to stimulate innovation and green economic growth. Sustainable biomass resources are the key element for the transition towards a low-carbon economy. The drive towards a bio-based economy will further increase demand for biomass resources. This is reflected in the increasing import of biomass for energy use over the last few years, as the Netherlands possess limited quantities of domestic biomass resources. Bio-ethanol, biodiesel and wood pellets (for co-firing) currently constitute the large majority of this import.

Biomass comes in many forms: (1) solid, e.g. woody biomass and agricultural products; (2) liquid, e.g. oils and fats; and (3) gas, e.g. biogas produced from fermentation. Shifting biomass to other purposes (for e.g. for energy use) from their original use may alter existing biomass flows, leading to increased utilization of other biomass to fill the demand gap created in the original sectors. As the bio-based economy is closely linked to many sectors, the flows of biomass across these sectors are therefore complex. Despite limited domestic biomass resources, the Netherlands is competitive in biomass trade with its leading ports, traders, logistics and market systems. Similar to other manufacturing industry, the Dutch biomass industry heavily relies on secondary processing and trade in both directions. For instance, oilseeds are crushed in the Netherlands and re-exported to the other European countries along the supply chain. However, both direction and quantity of many biomass flows in the Netherlands are not entirely clear, and knowledge on relevant cross-market mechanisms and trade flows is relatively limited. There are many discrete analyses and studies for specific biomass streams, but there is so far lack of cohesive and consistent monitoring.
In the face of a growing demand for biomass resources, ensuring sustainable sourcing of biomass has become increasingly important. The public has been expressing concern about sustainability of biomass production and use for energy. Biomass producers from private sector as well as governmental and non-governmental organisations have initiated various efforts to define 'sustainable' biomass and bioenergy. At present, numerous biomass and biofuel sustainability certification systems are being developed or implemented by a variety of private and public organisations. These systems have applicability to biomass raw materials production sectors (for e.g. forests, agricultural crops), different bioenergy products (for e.g. relatively unprocessed forest residues, ethanol, biodiesel, electricity), and whole or segmental supply chains (for e.g. production system, chain of custody from growers to energy consumers and etc.).

In the Netherlands, imported biomass accounts for a large share of total biomass consumption. However, no quantitative inventory of sustainable biomass flows in the Netherlands has been established. The biomass flows are complex and encompass diverse raw materials, intermediate- and end-products. A wide range of sustainability certifications and labels are unevenly applied across sectors. Despite the high variety, the certification systems have shown high degree of overlap and complementarities, especially when bioenergy plays a leading role in certifications, linking all the systems along the supply chain. Due to the complexity of existing biomass market, the potentials and risks of switching to a bio-based economy are still unclear. It is important to understand the market dynamics and their interrelation with sustainability considerations. Monitoring and mapping of biomass and bioenergy flows is important to build knowledge and gain insights into the relevant market mechanisms and trade flows. These could be achieved by assembling available information concerning biomass flows and share of sustainable certified biomass in these flows, as well as identification of the opportunities and barriers in connection with the bio-based economy.

1.3 Aims and scope

The main goal of this study is to propose a framework for monitoring and mapping of overall and sustainable biomass and bioenergy flows, and make a first quantitative assessment. The aims of this study are threefold:

1. To provide a quantitative and qualitative overview of past and current solid and liquid biomass flows in the Netherlands (by constructing mass balances), and assess (as far as possible) to what extent these biomass were certified with sustainability schemes

   In view of the large diversity in biomass streams traded within the Netherlands, 3 groups of biomass, i.e. (i) woody biomass (including paper and cardboard), (ii) oil and fats and (iii) carbohydrates are selected for further investigation based on absolute size and their relevance to the bio-based economy.

2. To pinpoint major sustainability certification schemes for biomass

   Analysis of proliferation and convergence of certification systems is not within the scope of this study, but an inventory of these systems is established.

3. To propose a framework for monitoring (sustainable) biomass and bioenergy flows in the Netherlands
Organizations that are involved in monitoring (sustainable) biomass flows will be identified and inventoried. An assessment is made in how far information on biomass trade flows can be delivered by these organizations annually. Assumptions, calculations and estimations made will be elaborated. All of these shall form a basis for continuous study in the subsequent years.
2 Monitoring framework for biomass and bioenergy

2.1 General approach

This proposed monitoring framework is part data assembly, part calculations and part analysis. In view of the large diversity in biomass, the authors propose to categorize biomass according to three main categories: (i) woody biomass; (ii) oils and fats; and (iii) carbohydrates. Only biomass that falls under these three categories is investigated. This selection is based on absolute size and their relevance to the bio-based economy:

a. they are relatively large streams with clear distinction;
b. their relevance to the bio-based economy – they are either long-chain polymers (starch & lignocellulose) or high-quality monomers (fatty acids & sugars);
c. they are closely related to bioenergy carriers – wood pellets, biodiesel and bio-ethanol (and also considering their large share in waste incineration).

Vegetables, fruits, fishes & meats, live stocks, plants & flowers, coffee & tea & spices and other biomass are not included in this study.

The mass balance of these biomass is presented in Chapter 3, 4 and 5 according to the three categories. In each chapter the energy use of these biomass is also specifically emphasized, particularly combustion of biomass (particularly wood pellets) for woody biomass, biodiesel for oils and fats, and bioethanol for carbohydrates.

2.2 Methodology

This section describes the general methodology used. Specific assumptions and calculations are indicated separately in Chapter 3, 4 and 5.

Pre-phase: Identify sustainability certification schemes and monitoring bodies

There are many discrete analysis and studies for specific biomass streams, and this work aims to build coherence between the information within the scope of biomass and bioenergy. While specific data sources are referenced elsewhere in the report, Figure 2-1 illustrates the general relationship between each source of information and biomass categories. Data was collected through various channels described below:

(I) Statistics portals: EU level – EUROSTAT; The Netherlands - Central Bureau of Statistics of the Netherlands (CBS)

(II) Production boards and monitoring agencies [and sources of information]

Woody biomass: Probos [Kerngegevens Bos en Hout in Nederland; other publications]

Oils and fats: Product board Margarine, Vetten, Olien (MVO) [Statistisch jaarboek]; Task force Duurzame Palm Olie [Jaarrapportage]; Initiatief Duurzame Handel (IDH) [Information on the website]

Biofuels: Dutch Emission Authority [Rapportage naleving jaarverplichting hernieuwbare energie vervoer en verplichting brandstoffen luchtverontreiniging]

Waste (waste wood trade and waste incineration): Afval database van Agentschap NL [Afvalverwerking in Nederland]; EVOA van AgentschapNL
(III) Trade, market, industrial and scientific publications: Various sources of information as listed in the Reference section, such as press releases by various industries, data from newsletters and newspapers, other relevant reports and scientific articles.

(IV) Direct information from market actors and experts: Surveys, interviews and dialogues with market actors.

**Figure 2-1** Main sources of information according to biomass categories

**Phase I: Creating inventory and collecting data**

Phase I involved creating an inventory of flows from and to nature for a product system. This inventory includes inputs of raw materials and releases to environment, end users or secondary users. First, flow models of different sections in the supply chain were constructed in separate flow charts based on systematic literature review. Second, relevant activities and supply chains were identified - only streams with significant volumes or very high relevance to the bio-based economy were inspected individually, while the rest were calculated collectively by grouping them into a few general product groups according to the product nature. For example, paper and cardboard were not separated into individual streams but
were considered as one general product group. Then, data was assembled from different sources in a puzzle-like approach. Streams or part of the chain that data was not available for were either merged or trimmed.

Data was typically collected through public available sources - see Section 2.3 for details.

**Phase II: Setting system boundaries and constructing the mass balances**

Different from general life cycle analysis, due to the relatively broad aims and scope (Section 1.3), the work did not start from pre-set boundaries. Instead of that, various possibilities were identified based on outcome from Phase I, and then the boundaries were drawn. This is not a cradle-to-grave study but rather a gate-to-gate study. However, current study is progressive and not definite as the authors look forward to have broader and deeper understanding with higher data availability in the future.

In the mass balance diagrams, the top and bottom axis indicate import and export, while the left and right axis indicate (domestic) input and output of the chain. System boundaries for three categories were set at different degrees, taking data availability as the major consideration. For woody biomass, due to rather simpler composition (no chemical reaction with other products), near to full life cycle of the biomass can be illustrated (from raw wood to combustion). For oils and fats, the mass balance diagrams include raw material processing (oil seeds) and secondary products flow focusing on energy use (from vegetable oils to biodiesel and other products). For carbohydrates, only primary material flows were drawn. The latter two categories are mainly used in food industries and processed with other materials. Therefore the chemical composition in the mass flows is highly complex, making quantifying difficult, and thus the boundaries shrunk.

All diagrams were constructed using Microsoft Excel. All streams were drawn in the ratio to their actual amount to provide useful visual representation of the data.

**Phase III: Harmonizing the data and assessing the developments**

Most of the data was collected from discrete and independent sources. Harmonization of data was performed to ensure a consistent set of metrics (e.g. mass units). This was carried out by making scientific assumptions, calculations and analysis. The specific technical units vary by biomass streams (for e.g., converting volume to mass, or translating energy units to mass), although all units were harmonized to a consistent one, i.e. million tonnes (MT). Certain assumptions can be made based on the fragmented information, if necessary. For example, the share of sustainable certified products in the Dutch market can be assumed equal to that of in the European market, as the country owns the largest trading hub in Europe, and the intra-Europe trade flows are too active and complex, making identifying the final destination of sustainable products impossible.

By reducing the variability, the resulting analysis show an overall harmonized estimation that can be used by certain analytical applications, policy, and investment decisions. This work tried to analyse and discuss the development of sustainable biomass and bioenergy chronologically, with this report serves as a starting point, based upon the various key elements that we have identified in the Dutch market in 2010 and 2011.
3 Woody biomass

3.1 Woody biomass trade and consumption in the Netherlands

This chapter covers all woody biomass flows in the Netherlands, including timber, processed woods, paper and cardboard, and energy use of woody biomass.

3.1.1 Mass balance

Figure 3-1 and 3-2 illustrate the flows of woody biomass in the Netherlands in 2010 and 2011. The top and bottom axis indicate import and export, while the left and right axis indicate (domestic) input and output of the chain. All streams are drawn in the ratio to their actual amount. In the middle of the diagram there is a box indicating "wood products", which represents storage of woody biomass in the form of buildings, furniture, and other types of wood products that are non-consumable or not short-lived.

In 2010 and 2011, the Netherlands produced considerable amounts of round wood, but about half of that was exported. On the other hand, relatively large amount of sawn wood and wood panels was imported, mostly originated from adjacent countries. There was also significant import of paper and cardboard into the Dutch market. Section 3.2 elaborates the development of sustainable woody biomass flows in the Netherlands. A large amount of wood pellets was consumed in the utilities. About 90% of the wood pellets were imported. This is further discussed in Section 3.3. Considerable amount of woody biomass and paper and cardboard were incinerated to generate electricity and heat.

Figure 3-3 shows the share of sustainable certified woody biomass in the Dutch market. "Use of waste and recycled streams" includes all waste wood, waste incinerations and recycled paper and cardboard. "Origins unclear" indicates round fuel wood used in household wood stoves. "Certified-" and "non-certified woody biomass entering the Dutch market" include all woody biomass excluding the aforementioned two categories. A significant change between 2010 and 2011 would be the increase of certified woody biomass for energy purpose.

To construct the complete mass flow diagrams (and also the other figures in this chapter), data from various sources was used and compared, limitations were identified, and various assumptions were made:

1. Data for "Consumed by the utilities (co-firing)" was collected from the utilities directly. As a comparison, data is also available on statistics using CN code CN 44013020. Furthermore, data for the share of certified woody biomass in this stream was also collected directly from the utilities, and was cross-checked with literature (Essent, 2012).

2. Data for "Combustion in BECs" was collected from CBS (2012b; 2012c). Biomass Energy Centres (BECs) are stand-alone biomass combustion plants.

3. Data for "Heat boilers for companies" was taken from CBS (2012b); assuming 60% of the biomass used by these heat boilers comes from fresh waste wood, as 60% of the boilers were used in wood processing companies. The rest largely comes from agriculture sector, and therefore is not shown here (CBS, 2012c).

4. Data for "Waste Incineration" was calculated based on direct information from Agentschap NL (2012) with a rough estimation of biogenic components in municipal and household waste streams made in 1995. However, the quantity of recycled paper and cardboard was also provided by Probos (2011; 2012), which was used to complete the recycling loop. Therefore, for paper and cardboard, the incinerated amount was calculated by calculating mass balance based on Probos figures.
5. Data for “Wood stoves for households” was taken from CBS (2012b), assuming 1/6 of wood used is “Waste wood”, and the rest are round fuel woods that might originated from forest residues, gardens residues, old fruit trees, public trees from parks and streets (CBS, 2012c).

6. The “Waste wood (A, B, C wood)” input stream from “Wood products” was derived through mass balance by assuming no export of waste wood. It does not include residues from forests, gardens and parks. Export of “Waste wood (A, B, C wood)” is not shown as data is not available. As a reference, waste wood export in 2007 is 1.16 MT (about 0.76 MT for energy purpose) (Goh et al., 2012).

7. Data for the other streams was taken from Probos (2011; 2012), assuming density of wood = 0.7 tonnes/m³. Data for the share of certified woody biomass for non-energy use was also taken from Probos (2010). Figures for 2010 were estimated using interpolation of data points. For certified sawn wood and panels, data for 2005 (13.3%) and 2008 (33.8%) and estimation for 2011 (43%) is available. The interpolation gives 40.9% for 2010. Similarly for paper and cardboard, the result for 2010 is 8% (6% in 2008, 9% in 2011).

8. Due to absence of data, both consumption and export streams of paper and cardboard were assumed to have a same percentage of recycled products.
Figure 3-1 Mass balance for woody biomass flows in the Netherlands in 2010
Figure 3-2 Mass balance for woody biomass flows in the Netherlands in 2011
Figure 3-3 Use of certified, non-certified, recycled and waste woody biomass (MT) in the Netherlands
3.1.2 Round wood, sawn wood and panels

The Netherlands is an important trader and consumer of wood. It consumed about 3.17 MT and 3.09 MT of sawn wood and panels in 2010 and 2011 of which more than 90% was imported (assuming density of wood = 0.7 tonnes/m³). The Netherlands is one of the largest consumers of tropical sawn wood in the EU (mainly used in construction), and also re-exports tropical timber mainly to the UK, Germany and Belgium. In 2011 it consumed approximately 0.31 MT of tropical wood, making it the second largest EU consumer. Consumption has been dropping since 2006 but slowly starting growing again in 2010. The majority of the tropical sawn wood timber imported originates from Malaysia, Brazil, Indonesia and Cameroon.

In 2010, imports of certified sawn hardwood (both tropical and non-tropical) have increased by 7%, leading to a market share of 31% in total (Probos, 2011; CBI, 2012). The market share of certified wood is expected to continue to increase. The market share of certified wood products increased from 13.3% to 33.8% from 2005 to 2008 (11.6% FSC certified and 22.1% PEFC certified). Probos (2010) estimates that the market share of certified sawn timber and wood based panels in 2011 will account for 43%. In 2008, sawn softwood had the highest certified percentage: 46% of the marketed volume, as most of this sawn softwood came from countries where 60 - 97% of the forest area is certified. On the other hand, due to the fact that only a small area of tropical forest is certified, a relatively small share of tropical timber is sustainable certified. However, the area of sustainable certified tropical forests is increasing, particularly FSC certified forest in Africa, as clearly reflected in the development of certified tropical sawn timber from 2005 to 2008. About 15.5% of tropical sawn wood is certified in 2008, almost double of the share in 2005. There are also a clear difference between PEFC and FSC market share. PEFC is leading in sawn timber and wood based panels, due to the fact that the PEFC certified forest area in the temperate (softwood) zone is much larger (Probos, 2010). About 74% of the total market volume of certified sawn timber and wood based panels was consumed by the construction sector and civil engineering.

The Dutch government is one of the largest drivers, as it is responsible for 40% of all timber buying contracts, mainly used in construction. The government has installed a Timber Procurement Assessment System (TPAS) in 2008 along with the procurement policy for sustainable timber. The Dutch Timber Trade Federation (VVNH) has also committed itself and its members to buying sustainable timber (tropical hardwood as well as softwood species). In addition, the Forest Law Enforcement, Governance and Trade (EU Regulation 995/2010, also known as FLEGT) developed by the EU to prevent illegal timber being sold on its market, possibly stimulates the demand for sustainable timber from 2013 onwards (CBI, 2012a). This is because there might be more harmonization of both legality and sustainability factors under the same schemes, as many have suggested the synergetic effects (Capiroso, 2011; Proforest, 2011). Many EU importers accept FSC or PEFC certification as proof of the legality and sustainability of the timber (CBI, 2012b).

Figure 3-4 shows the share of FSC and PEFC certified sawn timber and wood based panels in the Dutch market in 2008. The sharp rise in PEFC is mainly explained by the fact that in 2008 sawn softwood was purchased with a PEFC certificate by the members of the Royal Dutch Timber Trade Federation, while this was hardly the case in 2005 (Probos, 2010).
3.1.3 Paper and cardboard

In the Netherlands, most of the paper and cardboard is separated for recycling purposes. In 2010 and 2011, about 37% and 38% of paper and cardboard production came from recycled sources. Due to data limitations, these ratios were also applied on the consumption and export streams, assuming both streams have the same percentage of recycled products. Also in 2008, about 0.24 MT of certified paper and paperboard were available on Dutch market, accounting for 6% of total Dutch consumption. Figure 3-5 shows the share of PEFC and FSC certified paper and cardboard in the Dutch market in 2008. The share of certified paper and paperboard in the Dutch market is expected to increase to 9% in 2011 according to the manufacturers and importers of paper and paperboard (Probos, 2010). The separated collected papers are recycled and not meant for fuel purpose. However, there are still large portions of paper and cardboard that could not be separated and end up in waste incineration (See 3.1.6). Note that about 51% (both in 2010 and 2011) of paper and cardboard is imported products which may also be produced from recycled materials.

3.1.4 Waste wood

In three main Bioenergie Centrale (BEC) in Alkmaar, Twente and Rotterdam, the waste wood, mainly treated B-wood (painted, chipboard and etc.) and C-wood
(including sleepers) are consumed for energy generation, amounted to 0.46 MT in 2010 and 0.42 MT in 2011 (CBS, 2012c); about 10-15% are imported. Wood chips and other woody biomass are also combusted, amounted to 0.10 MT in 2010 and 0.13 MT in 2011 (CBS, 2012c). Most of this woody biomass is sourced domestically, avoiding extra cost and GHG emission in transportation.

In the period 2007-2009, about 11 PJ biogenic wastes were exported for energy purpose, according to the administration of the EU Waste Shipment Regulation (EVOA) of NL Agency. They mainly come from construction and demolition wood. There is also export of clean waste wood (A-wood) for energy which is not recorded by the EVOA (CBS, 2012b). In the absence of information, these streams could not be quantified. It is then assumed no stock-change of woody biomass in the Netherlands as shown in Figure 3-1. For comparison, waste wood export in 2007 is 1.16 MT (about 0.76 MT for energy purpose) (Goh et al., 2012).

3.1.5 Wood stoves for households and heat boilers for companies

During the last years, wood-burning stoves in private households are used more and more as a sustainable heat source. Expectations are that wood consumption in private wood-burning stoves will remain stable in the coming years. The main source is locally collected wood from tree felling. A second source of household wood is waste wood from forest maintenance (Goh et al., 2012).

3.1.6 Waste incinerations

In the Netherlands, relatively large amount of total woody biomass, paper and cardboard ended up in waste incineration, estimated at 2.27 MT and 2.48 MT in 2010 and 2011 respectively, calculated based on direct information from Agentschap NL (2012). Total waste incinerated is 6.59 MT and 7.21 MT respectively including non-biomass portion (CBS, 2012b). About half of the biomass (by mass basis) incinerated are non-woody organic compounds, followed by paper and cardboard, woody and other biomass. However, data presented is rough estimation and this biomass may still contain significant amount of non-biomass portion which is difficult to differentiate. Comparing with data from Probos, the recycled streams of paper and cardboard is much larger. In this case, to keep the recycling loop complete, the consumption, incineration and recycling streams of paper and cardboard were calculated based on Probos data using mass balance equation. This resulted in 1.42 MT (2010) and 0.98 MT (2011) incineration of paper and cardboard, and 2.21 MT (2010) and 2.16 MT (2011) in the recycling stream. New waste incineration plants were commissioned in Delfzijl in 2010 and in Harlingen in 2011, which are connected to industry use. Installations in Hengelo, Dordrecht and Roosendaal were also expanded in 2010 and 2011. At present, there is still unused incinerator capacity, which induced import of household waste from Germany, the United Kingdom and Italy (CBS, 2012b). In 2010, 0.06 MT was imported and in 2011 this has increased to 0.30 MT, mainly separated recycled waste materials.

3.2 Solid biofuels trade and consumption in the Netherlands

3.2.1 Trends analysis

Figure 3-6 shows the consumption of biomass by the utilities in the Netherlands in 2010 and 2011. Wood pellet is the largest group of solid biofuels consumed in the Netherlands. Canada and US are the two major suppliers. In 2011, Canadian import dropped to less than two third of the 2010 level, on the other hand, the import from US has increased and surpassed Canada. The import from Southern
Europe has doubled in 2011 compared to 2010. Consumption of domestic solid biomass for energy purpose has decreased, especially the consumption of wood chips has plummeted.

In the near future, the consumption of wood pellets by utilities is expected to increase, but this depends to a large extent on legislation (for e.g. possible introduction of a suppliers’ obligation) and market changes (for e.g. competition from wind and solar power for future investment). However, it is still unclear regarding the Green Deal for solid biomass. At the moment, the Government is planning to implement a coal tax. The situation might be clearer in 2013.

### 3.2.2 Application of sustainability certification

Figure 3-7 illustrates the amount of certified and non-certified pellets imported into the Netherlands from various countries. For certified wood pellets, direct data collected from the industry is available for 2011. For 2010, the share of certified biomass is calculated based on information from Essent (2011) only. The largest sustainability certification applied is Green Gold Label (GGL), mainly on wood pellets from North America, Baltic States and Southern Europe. In 2011, Essent has consumed 0.62 MT GGL certified wood pellets alone in the Amer power plant (Essent, 2012).

In 2011, most of the wood pellets are certified by sustainability schemes. However, still more than one third of wood pellets from Western Europe were not certified. Based on interviews with the market actors, it is expected that the utilities will be completely switching to sustainable certified wood fuels, particularly wood pellets. The Dutch government is currently in the process of drafting a reporting system for solid biomass jointly with the utilities. It is likely that the Dutch sustainability requirement for solid biomass (or regarded as “the Dutch assessment protocol for voluntary sustainability schemes for solid biomass”) will be comparable to the existing EU-RED criteria for biofuels and liquid biomass, with potential additional criteria on soil quality (derived from NTA8080), and a different minimum level of greenhouse gas emission reduction. Certain biomass flows might not be able to meet the requirements, and hence are prevented to enter the Netherlands. For instance, due to the consideration of GHG emission reduction, an energy company in the Netherlands has stopped to source wood pellets from a Russian producer, where natural gas was used for drying process.

Currently, there are a few industrial sustainability schemes available for solid biomass, particularly for wood pellets as listed in Appendix I. Some utilities claim that sustainably certified biomass availability is limited because (i) compatibility and competition between schemes has created barriers in supply: several voluntary schemes primarily serve for companies which developed them, such as Laborelec Label; (ii) new systems are not widely applied at this moment: it is very difficult to source biomass certified with NTA8080, as currently there are only 2 wood pellets manufacturers in the Netherlands using this system, and ISCC PLUS is still under development. Nevertheless, a huge volume of biomass resources are available. Currently, the industrial pellet buyers (mainly utilities) are working together to develop a harmonized sustainability system for wood pellets, namely IWPB. It is expected that the harmonized system will not only greatly facilitate trade process but also open up more trade channels.
Figure 3-6 Biomass co-fired by the Dutch utilities in 2010 and 2011 (kt tonnes) (Source: Surveys with the utilities; Essent, 2011)
Fig. 3-7 Wood pellet trade flows to the Netherlands in 2011 (consumed in the Netherlands) (Source: Surveys with utilities)
4 Oils and fats

4.1 Oils and fats trade and consumption in the Netherlands

This chapter covers oils and fats chains in the Netherlands. It covers vegetable oils from oil seeds, such as soybean, rapeseed, sunflower and tropical fruits like palm, coconut and others. Animal fats are also included, such as tallow, lard and others. Connection between oils and fats flows and biodiesel is emphasized, although in recent years in the Netherlands mainly used cooking oil (UCO) and animal fats are used for biodiesel production. Due to the fact that carbohydrates are mainly used in food industries and processed with other materials, causing the mass flows highly complex, the mass balance is limited to only primary material flows.

4.1.1 Mass balance

Figure 4-1 and Figure 4-2 show the mass balance for oils and fats flows in the Netherlands in 2010 and 2011. The top and bottom axis indicate (net) import and (net) export, while the left and right axis indicate domestic input and output of the chain. Each stream represents oil seeds, oils, fats, fatty acids, biodiesel, or mixture of them, in mass unit. All streams are drawn in the ratio to their actual amount. Figure 4-3 and 4-4 show gross trade balances of oil seeds, vegetable oils and animal fats in 2010 and 2011, respectively. More details about biodiesel consumed in the Netherlands are presented in Section 4.2. As shown in Figure 4-1, soy beans is the largest flow of biomass entering the Netherlands in this group. Strictly speaking, soy is not primarily an oil crop but used mainly as a protein source. Therefore, a relatively small portion of oil was produced while most of the mass remained as meal after processing, mainly used as animal feeds. Palm oil is the largest oil source followed by rapeseed oil, soy oil and sunflower oil. Human consumption is the most important application of vegetable oils, recording about 67% in 2011, while about 17% is used for energy purpose, about 11% for animal consumption and the rest for technical purpose. Both mass flows of soy and palm oil are further discussed in Section 4.1.2 and Section 4.1.3, respectively. Apart from palm and soy oil, rapeseed and sunflower are two large sources for oils. Rapeseed oil contributes the largest share in biodiesel production. From 2010 to 2011, no dramatic changes in the net flows of oil seeds and vegetable oils, but there are substantial increase in animal fats import. This is because the increased demand for biodiesel in 2011 absorbed more animal fats into the Netherlands. Production of biodiesel from these streams is favored due to the double counting mechanism, which is described in Section 4.2.

To construct the complete mass flow diagrams (and also the other figures in this chapter), data from various sources was used and compared, limitations were identified, and various assumptions were made:

1. Data for oils and fats mass flows was taken from MVO (2012).
2. Data for monoalkylesters, oil seeds, oils and fats trade flows by countries was taken from CBS (2012a) using CN code according to Appendix III. It was found that the MVO and CBS data for trade flows is close to each other. Monoalkylesters is assumed to be equivalent to biodiesel.
3. Data for production of biodiesels (oils and fats used for energy purpose) was taken from MVO (2012). MVO data was selected due to the level of details (types of feedstock). Instead of 0.29 MT (2010) and 0.55 MT (2011) reported by MVO (2012), CBS (2012a) reported 0.38 MT (2010) and 0.49 MT (2011).
4. Data for consumption of biodiesels was taken from NEa (2011; 2012a). There are discrepancies between CBS and NEa data for biodiesel: CBS reported physical consumption, whereas NEa published administrative data. Physical data is different from administrative data, because (!) companies are allowed...
to administratively carry over their physical efforts to later years; (ii) it is still unclear whether book and claim is used for the NEa reports after creating low blends - this implies that companies may create a low blend, administratively allocate this low blend to the Dutch market, whereas physically (part of) this low blend is exported. For comparison, CBS (2012a) reported biodiesel consumption of 0.11 MT and 0.20 MT (in 2010 and 2011 respectively), respectively, whereas NEa (2011; 2012a) reported 0.10 MT and 0.29 MT (in 2010 and 2011 respectively).

5. Data for glycerol was taken from CBS (2012a) using CN code according to Appendix III. Also assuming 1 kg of glycerol is produced as by-products of 10 kg of biodiesel production (own estimation).

6. Data for sustainable vegetable oils was taken from Taskforce Duurzame Palmolie (2012) for palm oil and RTRS (2012) for soy bean. An assumption was made that all vegetable oils used for biodiesel production in the Netherlands are 100% sustainable certified. Data for certified vegetable oils used for biodiesel production in 2010 is not available. Since there was no mandatory requirement, it is assumed all vegetable oils used for energy purpose was not certified in 2010.
Figure 4-1 Mass balance for oils and fats flows in the Netherlands in 2010
Figure 4-2 Mass balance for oils and fats flows in the Netherlands in 2011
Figure 4-3 Oil seeds trade balances 2010 and 2011 (stock changes are not shown)
Figure 4-4 Vegetable oils and animal fats trade balances 2010 and 2011 (stock changes are not shown)
Figure 4-5 Consumptions of oils and fats for different purposes (ktonnes) (Source: MVO, 2012) (Note: Animal fats include UCO)
Figure 4-5 illustrates the consumption trend of oils and fats for different purposes since 2008. The total consumption shows a steady increase. This increase is mainly contributed by the energy use of oils and fats, i.e. biodiesel production.

Figure 4-6 shows the share of certified vegetable oils in the Netherlands in 2011. Figure 4-7 shows the use of certified and non-certified vegetable oils, UCO and animal fats, and fatty acids in the Netherlands. To some extent the year 2011 can be regarded as the starting year for the significant use of sustainable certified vegetable oils in the Dutch market. In this year, the Dutch food and feeds industry imported the first batch of RTRS certified soy bean. Many Dutch food manufacturers also started to import RSPO certified palm oil with ambitious target in the next few years. It should be noted that this figure takes the assumption that all vegetable oils used for biodiesel production in the Netherlands are 100% sustainable certified (including RSPO certified palm oil which is not accepted by the EC yet but accepted in the Netherlands to demonstrate sustainability). With this assumption, about one third of palm oil and rapeseed oil is sustainable certified. See section 4.2.2 – 4.2.4 for details. Data for certified vegetable oils used for biodiesel production in 2010 is not available. Since there was no mandatory requirement, it is assumed all vegetable oils used for energy purpose in 2010 were not certified.

Figure 4-8 represents the trade flow of monoalkylesters, oil seeds and oils & fats by country or region. The import of monoalkylesters was halved since 2010, but the export has increased by about one half. The connection between monoalkylesters and biodiesels is not entirely clear; it is assumed they are equivalent. Net import of oil seeds reached the lowest in 2009 but slightly increased in 2010. On the other hand, trade volume of oils and fats has been decreasing since 2008. Over the years, Brazil and the US are the suppliers of soy bean, while Malaysia and Indonesia are the biggest suppliers of palm oil to the Netherlands.

Figure 4-6 Share of certified vegetable oils in the Netherlands in 2011 (Total consumption = 1.21 MT)
Figure 4-7 Use of certified and non-certified vegetable oils, UCO and animal fats, and fatty acids (MT) in the Netherlands
Figure 4-8 Monoalkylesters, oil seeds and oils & fats trade flows (net by regions) for the Netherlands from 2008 – 2011 (MT) (Source: CBS, 2012a)

a. Countries with small net trade volumes were omitted
b. CN 38249091: Monoalkylesters of fatty acids, with an ester content of 96.5% vol or more esters (FAME)<br>c. CN 12xxxxxx: Oil seeds and oleaginous fruits<br>d. CN 15xxxxxx: Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes
4.1.2 Sustainable palm oil

Palm oil is an important ingredient in food industry and a potential raw material for biodiesel. Food producers, processors and other market actors in the Netherlands aim to completely switch to Roundtable on Sustainable Palm Oil (RSPO) certified palm oil in 2015. The Dutch Task Force Sustainable Palm Oil is committed to promoting the cultivation and the use of sustainably produced palm oil. This task force consists of various market actors representing the Netherlands-based links in the palm oil chain, namely the palm oil refiners, processors, and retailers along the chain.

In 2011, RSPO certified portion represents some 11% of the 50.6 MT global production. At the end of 2011, nearly 5.6 and 1.3 MT of sustainable crude palm oil and palm kernel oil were produced from 1.1 million ha certified palm oil production area. Malaysia and Indonesia dominates the production, account for 47% and 41% respectively, while the rest was contributed by Papua New Guinea (8%), Brazil (3%), Solomon Islands and Colombia (both near to 1%). Total consumption of palm oil in the EU is about 6.8 MT, of which 55% is from Indonesia and 32% is from Malaysia.

The Dutch Task Force Sustainable Palm oil (2012) reported that 21% of total palm oil consumed for food purpose (about 81 kt out of 385 kt) in the Netherlands are sustainable certified. In 2011, 19 Dutch organizations have joined the RSPO, 10 companies have joined Palm Green Supply Chain and 15 companies are supply chain certified. The dairy industry and the margarine industry use sustainable palm oil by 39% and 35%, respectively, of their total volume of palm oil consumption. Friesland Campina and Unilever are among the forerunners in switching to sustainable certified palm oil. There is also progress in the bakery & confectionery industry and the snack industry, which have switched up to 17% and 13% of sustainable palm oil, respectively. Albert Heijn and Verkade have announced that they will only use sustainable palm oil in their products; and many other food companies have also committed themselves to start buying sustainable palm oil. It is expected that the demand for sustainable palm oil in the Dutch market will continue to increase steadily in 2012.

4.1.3 Sustainable soy

Soy is an ingredient for animal feed, a source of protein, vegetable oil and biofuel. The Netherlands is the world’s second largest importer of soy, mainly from Brazil, USA, Paraguay, Uruguay and Canada. The import is about 3.3 MT in 2010 and 3 MT in 2011. The net import amount is about 2.3 MT in both 2010 and 2011. Soybeans are crushed in the Netherlands and most of the soy oils are exported to the other European countries.

Sustainability standards for soy, Round Table on Responsible Soy (RTRS) were finalized in 2010, and have been implemented by soy producers in 2011. The Dutch food and feed industry has bought the first batch of soy produced according to the principles of the RTRS. This first ever market uptake of 85 ktonnes started in June 2011 (RTRS, 2011). Dutch market actors in the soy chain aim for switching to 100% responsible soy for the production of meat, dairy, eggs and other food in 2015. The Netherlands intends to become international leader in the use of responsibly grown soy. Targets are set: 25% in 2012, 50% in 2013 and 75% in 2014. The investment cost in sustainability chain is estimated at €7 million, shared by The Sustainable Trade Initiative (IDH) and the industry, mainly used to support soy growers in South America and also other market actors along the supply chain.
4.1.4 Sustainable rapeseed

There is currently no specific certification for rapeseed, but ISCC is normally used for the purpose of sustainable biodiesel production. Besides that, sustainable rapeseed is recognized when farmers signed self-declarations concerning the sustainability of their production and the government has submitted NUTS2 standard values for greenhouse gas emissions (i.e. standard values for GHG emission on a regional basis). Only sustainable rapeseed can be used for biodiesel production to obtain sustainability certification. However, some countries either have not yet submitted the standard values or are reluctant to sign the self-declarations. As a result, sustainable rapeseed from specific countries may be directed for biofuels production, while the other rapeseed may fill in the gap in food and feed sector. However, these changes are considered temporary seeing more and more rapeseed farmers will sign the self-declaration (GAIN, 2012b).

4.2 Biodiesel trade and consumption in the Netherlands

4.2.1 Trends analysis

Figure 4-9 shows the quantity of biodiesels consumed in the Netherlands in 2010 and 2011. The total volume amounted to 0.1 MT and 0.29 MT respectively in 2010 and 2011. Biofuels consumption in the Netherlands is monitored by NEa. Data for 2010 published by NEa is at highly-aggregated level due to confidentiality agreement with the industrial actors.

The nominal share of biodiesel in total Dutch diesel consumption is 4.62%, but note that this includes double counting of certain biodiesels. The Netherlands biodiesel market heavily focuses on double counting, as double-counted biofuels contribute 40% of the compliance with the annual requirement of 4.25% for renewable energy in transportation in 2011. The double counting mechanism is generally applied for biofuels produced from wastes, residues, non-food cellulosic material and lignocellulosic material. These biofuels are counted double for the annual obligation of renewable transport fuels. For this reason, the largest share of biodiesel consumption come from doubles counting, particularly domestic UCO and tallow from Germany. It is unclear whether the "Unknown" category includes UCO or not, but more than 80% of this category was counted double (see Figure 4-10).

The relatively large amount of double counting biodiesel not only in the Netherlands but also in the European market has caused some suspicion. Concerns have recently been raised that the market has been distorted by lack of verification on wastes (compared to crop feedstock) and over incentivisation causes unintended consequences. Indeed it is very difficult to trace the origins of the UCO (Tsay, 2012). This creates a loophole that may lead to the deliberate production of waste and the importing of poorly checked 'waste' from other countries. These flows of feedstock (which may include non-certified vegetable oils) are not traceable, as there are still no mechanisms to trace, verify or distinguish waste-derived biodiesel.

The annual production capacity in the Netherlands has increased from 0.52 MT in 2008, 1.32 MT in 2009, 1.31 MT in 2010 to 2.03 MT in 2011 (CBS, 2012a). The production of biodiesel is 0.39 MT in 2010 and 0.49 MT in 2011 (CBS, 2012a). It seems that the Netherlands has a huge unused production capacity for biodiesel, but the capacity is still increasing every year. Neste oil is the largest producer with its Rotterdam plant which has a capacity of 0.80 MT per year. The facility is capable of using a variety of vegetable oils, by-products of vegetable oil refining (e.g. stearin), as well as waste oils and fats (Neste Oil, 2011).
Figure 4-9 Biodiesel consumed in the Netherlands in 2010 and 2011 by feedstock (ktonnes) (Source: NEa, 2011; NEa, 2012a)

Note: Tiny streams are omitted
4.2.2 Application of sustainable certifications

Figure 4-10 shows the application of EC recognized sustainability schemes on biofuels consumed in the Netherlands. Apparently, ISCC is the most popular scheme with its dominance in most categories of biodiesel. Besides that, as mentioned before, a large portion of the biodiesels falls under double counting.

![Sustainable certified biodiesels consumed in the Netherlands in 2011 by schemes (ktonnes) (Source: NEa, 2012a)](chart.png)
5 Carbohydrates

5.1 Carbohydrates trade and consumption in the Netherlands

This chapter covers carbohydrate chains in the Netherlands. This includes grains and starch such as maize (maize), wheat barley, sugar beets, potatoes and etc. Due to the fact that carbohydrates are mainly used in food industries and processed with other materials, causing the mass flows highly complex, the mass balance is limited to only primary material flows.

5.1.1 Mass balance

Figure 5-1 and Figure 5-2 illustrate the quantified mass flows of carbohydrates in the Netherlands in 2010 and 2011. The top and bottom axis indicate import and export, while the left and right axis indicate domestic input and output of the chain. All streams are drawn in the ratio to their actual amount. Basically the Netherlands is able to self-supply more than half of its total carbohydrates consumption. Other carbohydrates products and sugars (for e.g. white sugars) have very little flows. Maize (corn) turns out to be the largest Dutch carbohydrates source. Although the Netherlands produces relatively large amount of maize, considerable amount of maize are imported. Potatoes, sugar beets and barley are the other important sources of carbohydrates. Carbohydrates are widely used food staples, which can be directly used for food and animal feed, or processed to make food (bread, biscuits), beverages (beers) and feed, or industrial products such as ethanol.

Majority of carbohydrates consumed in the Netherlands originated from Europe. In recent years sustainability has been an important consideration in Dutch food industry, and included in procurement policies of many food companies. However, currently it is still unclear how sustainability certifications can be applied on grains in Europe. Companies generally purchase sustainable supplies through bilateral agreements by providing the suppliers a set of rules and criteria to follow. In addition, agriculture in Europe is largely monitored by environmental laws and regulations. Conventional certifications focus more on some other issues such as organic food. In 2012, Productschap Akkerbouw has developed a sustainability module within the VVAK system for farmers to show compliance with the EU-RED. It covers cultivation, harvesting, processing, storage and transport of open field crops. The scheme has been approved and accepted by the Dutch government to be used for the production of sustainable biofuels (NEa, 2012b). In the same year, another Dutch sustainability initiative, namely Stichting Veldleeuwerik, representing a large number of Dutch farmers and processors, has signed the Green Deal with the government. Through this foundation, a new sustainability certification system on the Dutch agricultural products (more precisely on the farming practices) will be implemented in 2012.

In addition to food and feeds, carbohydrates can also be feedstock for textiles, adhesives and energy. About 1.2 MT of maize and wheat was processed in the Netherlands to produce bioethanol in 2011 (see Section 5.3.), however the connection shown in Figure 5-2 is purely estimation because the exact feedstock and destination are unknown. Besides bioethanol, it can also be used as feedstock for biogas. About 0.36 MT of maize was fermented into biogas in 2010, but this figure drops to 0.18 MT in 2011. AVEBE, a company that works on innovation use of potato starch has signed the Green Deal with Drenthe (province) that involves an investment for biogas production in "Potato Power", a large biogas project in Gasselternijveen using potato starch as feedstock. This project aims to produce 500 to 750 million m$^3$ of biogas by 2020 (Provincie Drenthe, 2012).
To construct the complete mass flow diagrams (and also the other figures in this chapter), data from various sources was used and compared, limitations were identified, and various assumptions were made:

1. Data for all streams other than bioethanol was taken from CBS (2012a), using CN code according to Appendix III.
2. Data for all crops produced domestically come with different moisture content (CBS, 2012a). Their moisture content is harmonized to 16%.
3. Data for consumption of bioethanol was taken from NEa (2012a).
4. Connection between bioethanol and grains is only a rough estimation. It is not publicly known that where the bioethanol production plant sources the raw materials from and exports the bioethanol and DGS to. NEa reported that 0.18 MT of bio-ethanol was consumed in 2011 and almost all of them was made from materials from foreign countries, but it is unclear where these bioethanol was produced.
5. Connection between secondary products (sugars, flour, glucose) and raw material is unable to establish due to data limitation.
Figure 5-1 Mass balance for carbohydrates flows in the Netherlands in 2010
Figure 5-2 Mass balance for carbohydrates flows in the Netherlands in 2011
Besides the direct use of carbohydrates, indirect flows of this biomass that end up in energy use are also interesting to look at, especially the flow of feeds via livestock. There are two major portions of energy to be tapped via livestock, i.e. co-digestion of manure and “milk heat”. Co-digestion of manure includes the production of biogas from the fermentation of manure, together with other plant materials. In 2011, more than 2 MT of wet biomass was fermented, and about half of them was manure. The total manure production in the Netherlands was 70 MT. The manure digesters yielded about 4% of the final consumption of Dutch renewable energy. On the other hand, “milk heat” is a special form of energy released during the cooling of milk in dairy farms. The heat comes mainly from the cows (CBS, 2012b).

Figure 5-3 depicts the Dutch grains and starchy crops production from 2008 to 2011. Potato has been the leading crop in domestic carbohydrates production, followed by sugar beets and green maize. There are no drastic changes over the years. The total carbohydrates production remains at a stable level of 17 – 19 MT. Figure 5-4 shows the trade flows of grains and starch for the Netherlands across the period 2008 to 2011. The Netherlands is an exporter of potatoes. On the other hand, the country imports large quantity of wheat, maize and barley. Most of the imports (near to 100%) come from Europe, except maize. For maize, South America is a significant source of supply. In 2008, the Netherlands imported 0.78 MT and 0.14 MT of maize from Brazil and Argentina, respectively. However, these imports drop dramatically in 2009 to less than 0.2 MT in total. In 2011, imports of maize from outside the EU took recovery and bounced back to about 1.1 MT, contributing to more than quarter of total maize import. Basically, the EU controls the entry of lower priced grains from third countries by means of a system of import duties and quotas.

![Figure 5-3 Grains and starchy crops production in the Netherlands from 2008 to 2011 (MT). (Source: CBS, 2012a)](image-url)
Figure 5-4 Trade flows (net by region / country) of grains and starch for the Netherlands from 2008 to 2011 (MT). (Source: CBS, 2012a)
5.2 Bioethanol trade and consumption in the Netherlands

5.2.1 Trends analysis

Figure 5-5 illustrates the Dutch bioethanol consumption in 2010 and 2011. Different from biodiesel, which has a diverse source of feedstock and origins, the majority of the bioethanol consumed in the Netherlands originated from US maize. Maize ethanol dominates with 40% and even 90% of market share in 2010 and 2011, respectively. This is followed by Brazilian sugarcane and French wheat, but in 2011 both streams plummeted drastically. This is mainly because the Brazilian domestic bioethanol market has absorbed most of the Brazilian sugar cane ethanol. Brazil has been increasing the consumption of biofuels domestically, and to date (2012) the Brazilian bioethanol production is still not large enough to meet domestic demand. It may take a long time for Brazil to once again export large amounts of biofuels towards the EU markets. There is small incentive for Brazilian producers to seek certification for entering the EU market because EU biofuels market (which requires sustainability certification) is currently regarded as the least profitable market for bioethanol (Pacini, 2012). Meanwhile the decrease of French wheat ethanol is probably caused by bad harvest in 2011 - feedstock price was high and production of bioethanol from cereal was less attractive (GAIN, 2012a; 2012c).

The Netherlands may continue to become a hub for biofuels blending and further distribution, as well as production since its large seaports provides easy access to feedstock. Abengoa Bioenergy’s bioethanol plant in Rotterdam that started in September 2010 is the largest single facility in the world. It can produce 480 million litres of bioethanol annually from 1.2 MT of maize or wheat cereal as feedstock. It also produces 0.36 MT of distilled grains and solubles (DGS) which can be used as an animal feed (Abengoa Bioenergy, 2012). In 2012, Cargill has also added 380 million litres of annual starch-based ethanol production capacity to its wheat wet-mill in Bergen op Zoom. The facility can process 0.6 MT of wheat annually. The ethanol is produced from a side stream containing starch as raw material instead of the whole wheat grain. It gained recognition by Dutch authorities, receiving double credit towards national renewable energy targets (Ethanol producer magazine, 2012). It is not publicly known that where they source the raw materials and where they export the bioethanol to.

Figure 5-6 depicts the trend of ethanol trade flows. The major import countries are US, Brazil and Guatemala. Net import from the EU is relatively very low. The import of ethanol under the groups CN 22071000 and CN 22072000 have plummeted since 2008. The main reason lies within the CN code swap of US ethanol. Since 2009, there was a steep increase of US ethanol entering the EU. These products were found to leave the US as denatured (CN 22072000) or undenatured ethanol (CN 22071000), but most of those exports enter the EU as chemical compound (CN 38249097) with lower tariff. At the EU side (most likely on shore) petrol is added to the ethanol (the percentage of petrol varies between 10 and 15). The problem with CN 38249097 is that it is a “other” & “other” category, so the CN code does not clearly state what good is being classified. This means that the good under consideration (a blend of ethanol and petrol) was being counted together with other goods. Hence it is difficult to trace back how much ethanol/petrol blends has really entered (Vierhout, 2012). These operations and imports have happened mainly in the UK, the Netherlands and Finland. The EU bioethanol industry has been facing problems of deteriorating margins and competitive imports. In 2012, these bioethanol blends is reclassified to the higher tariff rate, and trade of ethanol from US to Europe has slowed dramatically. However, it is not sure in the long term how will this impact imports from the US,
due to the fact that the EU domestic production is insufficient and Brazilian ethanol is too expensive for the EU market (Flach et al., 2012).

Figure 5-5 Bioethanol consumed in the Netherlands in 2010 and 2011 by feedstock (ktonnes) (Source: NEa, 2011; 2012a)
Figure 5-6 Ethanol trade balances (net) of the Netherlands for 2008 – 2011 (ktonnes). (Source: CBS (2012a) for the EU; Eurostat (2012) for the others)
a.CN 22071000: Undenatured ethyl alcohol of actual alcoholic strength of >= 80%
b.CN 22072000: Denatured ethyl alcohol and other spirits of any strength
c.CN 38249097: Fuel ethanol from US was found registered as 38249097 upon arriving in the EU.
5.2.2 Application of sustainability certification

Figure 5-7 shows the application of EC recognized sustainability schemes on biofuels consumed in the Netherlands. Apparently, maize is the dominant feedstock for bioethanol, and ISCC again is the most popular scheme with its dominance in maize ethanol certification.

![Figure 5-7 Sustainable certified bioethanol consumed in the Netherlands in 2011 by schemes (ktonnes) (Source: NEa, 2012a)](image-url)
6 Discussion and summary

6.1 Monitoring framework: Opportunities and challenges

As elaborated in Section 2.2, the system boundaries have to be set considering various limitations in data collection. However, this study is progressive and not definite – there are still rooms for further improvement and scope expansion. As depicted in Figure 2-1, information from numerous sources and different industry sectors is collected. It is not possible to gather complete information for each and every biomass stream. In spite of this limitation, a general picture of biomass flows and consumption of various end-uses can be drawn based on the available information. In the existing market analyses and studies, reporting priorities are normally given to biomass streams with high economic values or high volumes. These streams are naturally very relevant to the bio-based economy, and therefore the existing reporting systems fits nicely within this framework.

For woody biomass, Probos has been analysing data from CBS for years. This data is normally published at the end of the year. Probos also collects data for the market share of sustainable certified woody biomass and paper and cardboard in the Netherlands but only once in every three years. Annually updated data is not available yet. For the energy use of wood in power plants (particularly wood pellets), Utrecht University has been conducting surveys with the power plants for data collection in recent years. The information was obtained directly from the industry.

The data for oils and fats is by far the most systematic among the three groups. MVO has been monitoring the flows of oil seeds, oils and fats over the past few years. Currently palm oil and soy bean are the two major streams with sustainability certification, the shares of sustainable portion are reported by Taskforce Duurzame Palmolie and IDH, respectively. These information can then be analysed by comparing with data from CBS. It is difficult to distinguish the origins of sustainable certified biomass by country, but collectively it is possible to deduce that they come from specific regions.

Lastly, for carbohydrates, data for grains and crops is mostly available on CBS statistics. However, it is difficult to further analyse the streams after secondary processing, i.e. in food and feed sectors, because the chemical components are too complex. Therefore, only the flows of raw materials are included in the study. However, bioethanol (derived from carbohydrates) is also taken into account due to its significance to the bio-based economy. Most carbohydrates is either produced domestically or imported from the other European countries. No specific sustainability certification schemes are developed until 2011.

There are also diverse organizations reporting specific biomass flows which are referenced accordingly in Chapter 3 – 5.

The main technical challenge is the harmonization of data. Most of the data are collected from numerous sources in a variety of quantitative units. By using scientific assumptions, calculations and analysis, data are harmonized into a consistent set of metrics, i.e. mass basis, taking million tonnes (MT) as the base unit, although sometimes kilotons (kt) is also used to better address smaller streams. In this work, a few possibilities for utilizing fragmented data was figured out by making a number of assumptions, but eventually more precise information was obtained, and therefore some of them was not used. For example, at the beginning we considered to use the assumption that the share of sustainable vegetable oils in Dutch market may equal to that of in the European market, given the Netherlands is the most important trading hub in Europe and intra-Europe trade is very active. However, it could be interesting to compare the difference
between the Dutch market and the European market in future work that might serve as a basis for other analysis when making such an assumption.

6.2 Development of sustainability certification

Despite limited domestic biomass resources, the Netherlands has decided to move towards a bio-based economy. The concept of a bio-based economy has the objective of using biomass to its fullest values, that is to optimize the use of biomass through cascading to extract the added-values.

Chapter 3-5 have shown the volumes and applications of different major biomass streams, including the current status of implementation of sustainability certification in the Netherlands, and corresponding sustainability certification schemes. Biomass is widely used for different applications, such as food, feed, fuels, soap, furniture, building and etc.. Furthermore, biomass always flows across several-sectors, and thus can barely be regarded separately. In addition, the life cycle of different biomass may differ significantly; some are consumed on a very short time scale (for e.g. food and paper) while the others are part of the physical environment for decades (for e.g. building and furniture). All of these weave a complicated mass flow web of biomass.

Due to limited domestic biomass supply, most of the biomass is imported. Dutch policy makers also see the need for imports, but are also concerned regarding the sustainable production of bioenergy abroad. Since 2008, NL Agency executes the program: "Global Sustainable Biomass" (DBM) and in 2009 it became executive body of the program "Sustainable Biomass Import" (DBI), the latter being part of the program "Bio-based Economy" within the Innovation Agenda. The goal of DBM is to support developing countries to produce biomass for energy purposes more sustainably, considering the access to local and international energy market. The goal of the DBI program is to give an impulse to the development of sustainable international biomass supply chains for energy and chemical applications. In 2009 and 2010, approximately 20 million Euros of subsidy was allocated to 45 projects, in which market actors and research institutes aim to increase the sustainability of biomass production in developing countries and realize import of biomass to the Netherlands. Various other projects have also been initiated by the Initiatief Duurzame Handel (IDH).

As motivated by public opinions and policies, sustainability concern has become a trend or even a culture, especially in biomass-related industry (for e.g. agriculture and forestry). This culture, when combined with the legal requirement for bioenergy, spurs the development and application of numerous sustainability certification initiatives. To ensure that biomass are produced, processed and delivered sustainably, certification schemes are perceived as an effective tool to monitor and provide proof of sustainability.

While woody biomass has been certified for a longer period already, it is worthwhile to point out that in 2011, the sustainability certification of solid biomass, liquid biofuels and vegetable oils for human consumption has drastically increased. It could therefore be suitable to regard the year 2010 as a base-line year for monitoring the sustainability of biomass streams in all three categories.

At present, numerous sustainability certification schemes are being developed or implemented by a variety of private and public organisations with different interests, purposes and target groups:
- Woody biomass has already a long certification tradition, particularly sustainable forest management schemes. It is expected that the share of certified wood products will further grow steadily. Indeed, the hot topic in this category is the
energy use of woody biomass by utilities, particularly wood pellets. In the past years the percentage of certified pellets in the market is very high, almost 90% in 2011, and was dominated by the Green Gold Label (51.8%) and Laborelec Label (33.5%).

- The situation is quite different for oils and fats. Significant certified palm oil and soy bean entered the Dutch market only since 2010/2011. However, the industrial players have set ambitious target to completely shift to certified palm oil and soy bean within a few years ahead. On the other hand, started from 2011, the Dutch government accepts only 100% sustainable certified biofuels. In other words, all oils and fats used for energy purpose must be either sustainable certified or originated from waste.

- For the last category, carbohydrates, there are no specific sustainable certifications over the years, although sustainability schemes are applied on bioethanol derived from carbohydrates. Most carbohydrates consumed in the Netherlands are originated from Europe and produced under environmental regulations, and therefore the demand for sustainability certification is not so strong (but focuses on the other concerns, such as organic food label). However, in 2012, there are efforts in putting sustainability certification on Dutch grains (more precisely on farming practices), namely VVAK and Stichting Veldleeuwerik. It is expected to see some sustainable certified grains in the Dutch market in the near future. For the energy use of carbohydrates, bioethanol derived from carbohydrates are mainly imported. Similar to biodiesel, started from 2011, only sustainable certified bioethanol will enter the Dutch market. Small scale biogas production from potatoes is also observed in the Netherlands under the Green Deal, but the involvement of certification schemes is not expected.

Table 6-1 shows the market share of sustainability certification schemes in the Netherlands. To some extent, this wide range of schemes, developed largely without coordination among the organisations involved, may create incompatibility between different sectors, and turned out to be a trade barrier. For example, voluntary sustainability schemes for forestry might not be compatible with sustainability requirements of solid biofuels. Confusion may arise and questions on the level of sustainability requirement for different sectors may be raised. As an example: strict requirements have reduced the use of palm oil and increased that of rapeseed for biodiesel production. However, the amounts of overall consumption did not change – more palm oil is used in food sector replacing the gap left by rapeseed oil. Similar situation happened to rapeseed oil itself – sustainable certified rapeseed from certain countries was used to produce biodiesels, while the rest was used for food purpose.

Recent data presented in Chapter 3 to 5 show that sustainability certification mainly applied on biomass used for energy in 2010 and 2011. Woody biomass might be an exception in terms of absolute quantity, however in terms of percentage, near to 90% of wood pellets was certified but only about 50% of other woody biomass (for other use) was certified. For vegetable oils, about 16.3% was certified for biodiesel production and about 7% was certified for food and feed use. The situation is one-sided for carbohydrates, in which only biomass used for energy (bioethanol) was certified. Indeed, there are many types of certifications for biomass, including the establishment of small labels that fill a niche and hardly grow beyond it. But bioenergy certification specializes in (mainly) environmental sustainability – a crucial aspect that may wind up transforming entire global industries. The EU has been carrying the environmental flag, intends to be distinct in that it utilizes the highest standards of environmental rules and regulations, especially on greenhouse gas emissions. In this regards, certification of bioenergy includes the strictest requirements compared to that of other biomass uses. It is not unusual to say that if bioenergy certification succeeds, they may stimulate the other biomass markets to follow the high standards.
### Table 6-1  Market share of sustainability certification schemes

<table>
<thead>
<tr>
<th>Type of biomass</th>
<th>Sustainability schemes</th>
<th>Market share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woody biomass:</td>
<td>FSC</td>
<td>12% (2008)</td>
</tr>
<tr>
<td>Sawn timber and wood based panels</td>
<td>PEFC</td>
<td>22% (2008)</td>
</tr>
<tr>
<td>Woody biomass: Paper and cardboard</td>
<td>FSC</td>
<td>3% (2008)</td>
</tr>
<tr>
<td>Woody biomass: Wood pellets used by utilities</td>
<td>Green Gold Label</td>
<td>51.8% (2011)</td>
</tr>
<tr>
<td>Woody biomass: Wood pellets used by utilities</td>
<td>Laborelec Label</td>
<td>33.5% (2011)</td>
</tr>
<tr>
<td>Oils and fats: Total vegetable oils</td>
<td>RSPO (Palm oil)</td>
<td>6.7% (2011)</td>
</tr>
<tr>
<td>Oils and fats: Total vegetable oils</td>
<td>RTRS (Soy bean)</td>
<td>0.3% (2011)</td>
</tr>
<tr>
<td>Carbohydrates: Grains</td>
<td>VVAK</td>
<td>Starts in 2012/13</td>
</tr>
<tr>
<td>Carbohydrates: Grains</td>
<td>Stichting Veldleeuwerik</td>
<td>Starts in 2012/13</td>
</tr>
<tr>
<td>Biodiesels</td>
<td>ISCC</td>
<td>48.4% (2011)</td>
</tr>
<tr>
<td>Biodiesels</td>
<td>2BSvs</td>
<td>4.9% (2011)</td>
</tr>
<tr>
<td>Biodiesels</td>
<td>RTRS</td>
<td>1.8% (2011)</td>
</tr>
<tr>
<td>Biodiesels</td>
<td>Others</td>
<td>9.6% (2011)</td>
</tr>
<tr>
<td>Bioethanol</td>
<td>ISCC</td>
<td>84% (2011)</td>
</tr>
<tr>
<td>Bioethanol</td>
<td>RBSA</td>
<td>4% (2011)</td>
</tr>
<tr>
<td>Bioethanol</td>
<td>Others</td>
<td>12% (2011)</td>
</tr>
</tbody>
</table>

### 6.3 Conclusion and recommendation

To sum up, the authors see the opportunity of building a cohesive monitoring framework that contributes to the development of the bio-based economy. This work has identified key information and processed them with a consistent reporting framework. Appendix I and II listed the inventory (with short description and website address) of sustainability schemes and relevant Dutch organizations for different biomass categories. The biggest challenge ahead will be the difficulty in data collections, both in terms of availability and transparency, but the authors believe that will be getting more systematic and transparent in the near future. For the last point, a workshop was organised on October 25th to show the preliminary results to the experts for confirmation and comments.

This report is the first attempt to quantify sustainable biomass and bioenergy in the Netherlands and examine their trade flows. This study serves as a basis for further analysis such as energy balance, carbon emission balance, economic models or other similar analysis. The phase-by-phase method provides an approach for expanding, improving and upgrading the framework.
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Appendix I Overview of sustainability schemes

A. Woody biomass

Sustainable Forest Management (SFM)

The two largest forestry certification systems in Europe (and in the world) are the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification Schemes (PEFC). Both concentrate on sustainable forest management by using independent third party assessment of forestry practices against a set of forestry standards. The FSC Principles and Criteria (P&C) set out best practices for forest management. In many countries, FSC Regional or National Standards are developed by FSC working groups. Regional and national standards transfer the P&C to the specific conditions and context found in each country or region. PEFC is an umbrella standard that recognizes existing national forestry standards, such as SFI, CSA, ATFS and etc., when certain conditions are met (See Appendix III for all forest standards endorsed by PEFC). In some cases, such as the UK, the UKWAS scheme was endorsed by PEFC and approved by FSC for use in their UK certifications. These forestry standards have significant potential to be used to assess sustainable utilization of forestry biomass for energy production.

http://www.fsc.org/
http://www.pefc.org/

Industrial schemes for sustainable energy use of solid biomass

(I) GGL (Green Gold Label)

Green Gold Label was founded in 2002 by Essent (a power company from the Netherlands) and Skal International (now Control Union Certifications). The Green Gold Label programme is a certification system for sustainable biomass. It covers production, processing, transport and final energy transformation.

http://greengoldcertified.org/

(II) Laborelec Label

On behalf of GDF-SUEZ/Electrabel (a power company from Belgium), Laborelec and SGS have put in place a verification procedure applied to each biomass production unit.

http://www.laborelec.be/ENG/biomass-verification-procedure/

(III) IWPB (Initiative Wood pellet Buyers)

IWPB is a working panel grouping the major European utilities firing wood pellets in large power plants GDF SUEZ, RWE, E.On, Vattenfall, Drax Plc, and Dong, as well as certifying companies SGS, Inspectorate, and Control Union. Laborelec participates in this work panel as a technical expert. They propose to use the GGL
foundation as the new governance structure for the new sustainability standard based on the IWPB principles.


(IV) NTA 8080

Based on Dutch and European sustainability criteria, a certification system for biomass for energy purposes has been developed by a diverse group of stakeholders coordinated by NEN. The criteria have been turned into verifiable requirements. The certification system offers a way for suppliers and buyers of biomass to distinguish sustainable products.

http://www.sustainable-biomass.org/

(V) ISCC PLUS

A new certification system for food, feed, technical/chemical (e.g. bioplastics) and other bioenergy (e.g. solid biomass) applications developed as an extension of ISCC. An overview on the system was given at the Second ISCC Global Sustainability Conference and General Assembly in Brussels on February 8, 2012. The consultation period will end May 31st, 2012. ISCC PLUS offers an opportunity for already certified conversion units (ISCC DE or ISCC EU) to efficiently extend sustainability certification to food and feed products (e.g. oil seed meal, DDGS, oil for food and other uses).

B. Oils & fats and biodiesels

Schemes for vegetable oils

(I) Roundtable on Sustainable Palm Oil (RSPO) & Green Palm

In response to the urgent and pressing global call for sustainably produced palm oil, the Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 with the objective promoting the growth and use of sustainable oil palm products through credible global standards and engagement of stakeholders. GreenPalm is a certificate trading programme which is designed to tackle the environmental and social problems created by the production of palm oil. Market By selling certificates through the GreenPalm programme palm oil producers can earn more for their crop through sustainable farming. By buying a product which bears the GreenPalm logo, consumers can make a positive contribution to the production of certified sustainable palm oil (CSPO) and palm kernel oil (CSPKO). GreenPalm has been endorsed by the RSPO as the official broker for the trade in sustainable palm oil certificates.

The Netherlands: The Dutch Task Force Sustainable Palm Oil aims at making a significant contribution to the promoting of production and use of sustainable palm oil and is working towards the achieving of the following objective: ‘By the end of 2015 all palm oil destined for the Dutch market has to be sustainable.’ Participants: BNMF, CBL, FNLI, Nevedi, MVO, Vernof, VAVI, VBZ, Algemene Kokswaren- en Snackproducenten Vereniging.

http://www.rspo.org
http://www.taskforceduurzamepalmolie.nl/

(II) The Round Table on Responsible Soy Association (RTRS)

The Round Table on Responsible Soy Association (RTRS) is a multi-stakeholder initiative which aims to facilitate a global dialogue on soy production that is economically viable, socially equitable and environmentally sound. It provides stakeholders and interested parties – producers, social organizations and business and industry - with the opportunity to jointly develop global solutions leading to responsible soy production.

The Netherlands: Since 2005, soy producers, traders, processors and non-governmental organizations including the MVO, Nevedi, Unilever, Nutreco, Rabobank, Cargill, Solidaridad, WWF etc. have been setting a responsible soy producing standard in the RTRS. RTRS Standards were finalized in 2010, and have been implemented by soy producers in 2011.

http://www.responsiblesoy.org
http://www.taskforceduurzamesoja.nl

(III) The ProTerra Standard

The ProTerra Standard was developed by the Brazilian branch of Cert ID – a company providing third party certification services for organizations and people
involved in the production chain of agricultural goods. The ProTerra Standard was developed as an extension to the guidelines provided in The Basel Criteria for Responsible Soy. The ProTerra Standards build on the Basel Criteria by establishing basic sustainability guidelines and progress requirements that are not only applicable to soy, but to a variety of agricultural products.


(IV) Global Good Agricultural Practice (GAP)

GLOBAL GAP is a private sector body that sets voluntary standards for the certification of Good Agricultural Practice (GAP) around the globe. The GLOBAL GAP Standards are pre-farm gate or on farm standards designed to reassure consumers about how food is produced on the farm by minimizing detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare. These standards cover everything from crop-based food (fruit, vegetables, coffee, tea, flowers) to livestock (cattle, sheep, dairy, pigs, poultry, turkey) to aquaculture (salmonids, shrimp, tilapia, and so on). GLOBALGAP covers the whole agricultural production process and does not cover wild/catch, wild fish/catch or crops harvested in the wild. No processing, manufacturing or slaughtering is covered, except for the first level in Aquaculture. No labels appear on GLOBAL GAP certified products as it is a business-to-business (B2B) standard.

http://www.globalgap.org/cms/front_content.php?idcat=9

(V) Unilever Sustainable Agriculture Code & Scheme Rules

This scheme was developed by Unilever to be able to report on progress in Sustainable Sourcing. The supplier has to have acknowledged the Unilever Supplier Code and ensure their activities are conducted in accordance with it, in order for any volume that Unilever buys from this supplier, to qualify as ‘sustainably sourced’.


EC recognized schemes for biodiesel

(I) International Sustainability & Carbon Certification (ISCC)

ISCC promotes biomass, bio-energy and social sustainability among farmers and processors with the objective to respect climate and the environment. The International Sustainability & Carbon Certification – founded in 2010 - is a multi-stakeholder association registered in Germany and recognized by the European Commission for all Member countries. ISCC standards cover the entire biomass supply chain, from the farm and plantation towards warehouses or logistics points to conversion unions, and to final users, i.e. from the field to the final consumers. ISCC interacts with different categories of stakeholders: farmers, processors, trade, industry, NGOs, associations, research institutions and authorities.
http://www.iscc-system.org/

(II) RTRS EU RED

This is an add-on to the RTRS Standard. See Section 4.2.1 for RTRS.

(III) RSB EU RED (Roundtable of Sustainable Biofuels EU RED)

The Roundtable on Sustainable Biofuels (RSB) is an international initiative coordinated by the Energy Center at EPFL in Lausanne that brings together farmers, companies, non-governmental organizations, experts, governments, and inter-governmental agencies concerned with ensuring the sustainability of biofuels production and processing. Participation in the RSB is open to any organization working in a field relevant to biofuels sustainability.

http://rsb.epfl.ch/

(IV) 2BSvs (Biomass Biofuels voluntary scheme)

The 2BS consortium was founded in 2010 by the French biofuel, biodiesel and bioethanol production industries to create and manage the 2BSvs Biomass Biofuels Sustainability voluntary scheme, helping to comply to the European Union requirements in terms of biofuel sustainability.

http://en.2bsvs.org/

(V) RBSA (Abengoa RED Bioenergy Sustainability Assurance)

Abengoa, the international company that applies innovative technology solutions for sustainable development in the energy and environment sectors, is the first company to implement this system in Spain, which was presented by the European Commissioner for Energy, Günther Öttinger, yesterday together with a further six standards. Developed within the framework of the Renewable Energy Directive (RED), the RBSA Standard demonstrates the compliance of any raw material or production process with the requirements of the Directive, from agricultural production through to sales of biofuels, including the industrial transformation processes.

http://www.abengoabioenergy.com/
http://ec.europa.eu/energy/renewables/biofuels/doc/sustainability_schemes/06_rbsa.zip

(VI) Red Cert

REDcert was founded on 26 February 2010 by leading associations and organizations in the German agricultural and biofuel sector and approved as a certification system on 20 July 2010, by the Federal Agency for Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung – BLE) to fulfill the requirements of the German Biomass Sustainability Ordinances (BioSt-NachV and Biokraft-NachV). The certification system can be applied to all of the steps involved in the process starting with production and collection of input materials through to processing in oil mills and the production of biofuel and liquid biofuel.
At the beginning, the focus of REDcert’s activities with the new certification system will be in Germany and Europe.

http://www.redcert.org/

(VII) NTA 8080

See Section 3.2.2. NTA 8080 can be applied on all forms of biomass and biofuels. In July 2012, the EC has recognized NTA 8080 for demonstrating compliance with the sustainability criteria under Directives 98/70/EC and 2009/28/EC of the European Parliament and of the Council.
C. Carbohydrates

**Agricultural schemes and procurement policies**

(I) Milieukeur (Ecolabel)

Milieukeur is the Dutch environmental quality label for products and services. It is supported by the Dutch government. There are Milieukeur criteria for a wide variety of food and non-food products. The Milieukeur criteria relate to the entire life cycle of the product or service and represent an integrated approach to sustainability. The Milieukeur certification schemes cover a diverse range of sustainability issues, including raw materials, energy and water consumption, noxious substances, packaging and waste, plant protection, fertilizers, animal welfare, nature management, food safety and employee care. These criteria are reviewed every two to five years by the Stichting Milieukeur and adjusted if necessary.

http://www.smk.nl

(II) Sustainability Barometer (Barometer Duurzame)

It is a certification systems awarding certifications for companies at three levels for a sustainable operation and purchase of sustainable materials, such as grains and starch. There are several systems developed for different industries, such as bakery, supermarket and etc.. They were collaboratively developed by various organizations in the Netherlands.

http://www.smk.nl

(III) VVAK

The VVAK was created in early 2005 by merging the Food Safety Certificates (VVC) for potatoes, sugar beet, vegetables and industrial grains, seeds and legumes. In 2012, Productschap Akkerbouw has developed a module within the VVAK sustainability system for farmers to show compliance with the EU-RED. It covers cultivation, harvesting, processing, storage and transport of open field crops. In October 2012, NEa has reported that the requirements of the EU-RED criteria are sufficiently guaranteed by the VVAK module. The scheme is approved and accepted by the Dutch government to be used for the production of sustainable biofuels.

http://www.productschapakkerbouw.nl/teelt/vvak

(IV) Stichting Veldleeuwerik

Stichting Veldleeuwerik is a Dutch initiative for sustainable agricultural development. It aims to involve 500 farmers in 2013 and 1000 farmers in 2014. From 2012 onwards they will kick-off the Veldleeuwerik System certification.

http://www.veldleeuwerik.nl

(V) Global Good Agricultural Practice (GAP)
See Section 4.2.1.

(VI) **Red Tractor (Red Tractor Farm Assurance Combinable Crops & Sugar Beet Scheme)**

Red Tractor Farm Assurance Combinable Crops & Sugar Beet Scheme (formerly ACCS) The Red Tractor Farm Assurance Combinable Crops & Sugar Beet scheme sets out to maintain, develop and promote Assurance standards within the industry. The aim is to provide consumers and retailers with confidence about product quality attributes including food safety and environmental protection. Crops covered by the scheme include wheat, barley and rye, oilseeds such as linseed and rapeseed, pulses such as peas and beans and most recently, sugar beet. The phrase ‘Combinable Crops’ refers to the harvesting method by combine harvester, which picks the crop from the ground and separates edible parts of the plant, the seeds or beans, from the rest.

http://assurance.redtractor.org.uk/rtassurance/farm/crops/cr_about.eb

(VII) **SQC (Scottish Quality Farm Assured Combinable Crops (SQC) scheme)**

Scottish Quality Cereals (SQC) was formed in 1994 and was the first on-farm cereals assurance scheme to be accredited to ISO Guide 65 (EN 45011). In 2007, the company changed to Scottish Quality Crops to take into account that all combinable crops were now included within the scheme standards. The purpose of the scheme is to provide consumers and industry comprehensive assurance about good production standards, food safety and environmental care.

http://www.sfqc.co.uk/farm_schemes/scottish_quality_crops_sqc

**EU recognized schemes for bioethanol**

(I) **Bonsucro**

Bonsucro was born out of the Better Sugarcane Initiative, a global multi-stakeholder non-profit organisation dedicated to reducing the environmental and social impacts of sugar cane production which links its name to a product, process or service that has been certified by an independent certification body as being in compliance with the Bonsucro standard. It is the first global metric standard for sugar cane.

http://www.bonsucro.com

(II) **Greenergy Brazilian Bioethanol Verification Programme**

Greenergy has been sourcing ethanol from Brazil for more than five years and, with the creation of Greenergy Brazil in January 2010, has a permanent buying and sustainability team in Brazil. The team has long-term commercial relationships with Brazilian mills, all of which have demonstrated significant ongoing commitment to meeting Greenergy's gold standard criteria. Since 2010, 100% of the bioethanol supplied from Greenergy Brazil to Europe has complied with Greenergy's gold standard sustainability criteria.
http://greenergy.com

(III) **ENSUS voluntary scheme under RED for Ensus bioethanol production**

U.K. bioethanol producer Ensus has submitted a voluntary sustainability scheme to the European Commission, which issued a draft decision in January 2012. According to the Commission, the scheme covers bioethanol from EU feed wheat produced by the Ensus one plant in the U.K. For the part of the supply chain up to the first point of delivery of agricultural crops the Ensus scheme relies on other voluntary schemes recognised by the Commission.

http://www.ensusgroup.com/

(IV) **Red Tractor (Red Tractor Farm Assurance Combinable Crops & Sugar Beet Scheme)**

(V) **SQC (Scottish Quality Farm Assured Combinable Crops (SQC) scheme)**

(VI) **ISCC (International Sustainability and Carbon Certification)**

(VII) **RSB EU RED**

(VIII) **2BSvs**

(IX) **RBSA (Abengoa RED Bioenergy Sustainability Assurance)**

See B. for the description of schemes (VI to IX).
Appendix II Relevant Dutch organizations

A. Woody biomass

(I) Probos

Probos is an independent non-profit institute for forestry, forest products and services. Probos strives for a sound balance between the different forest services and values and a sustainable financial basis for forest management (see mission statement). Probos’ main fields of expertise are: sustainable forest management (SFM), afforestation, cultural heritage in forests, biomass production and procurement, timber market, certification of SFM and CoC, Green Public Procurement and specialised ICT services (forest data). Probos is the official Dutch National Correspondent for various international institutions and has therefore an extensive network of international contacts with amongst others UNECE, FAO, ITTO, timber traders, wood processing industry, timber trade associations, forest owner associations and (international) NGO’s.

http://www.probos.nl

(II) SMK

SMK develops, manages and assesses criteria for marks and certificates. This is more sustainably transparent, reliable and verifiable. Producer organizations, retail, government, scientists, environmentalists and advocacy organizations on behalf of consumers are involved in the content of the criteria. This ensures a broad social basis. Independent certification bodies ensure that products, processes or services to meet the criteria of CSA.

Timber Procurement Assessment Committee (TPAC): TPAC was formed within SMK to assess timber certification systems against the Dutch Procurement Criteria commissioned by the Ministry of Environment. This assessment was developed because the Dutch government has obliged itself from 2010 to only sustainable procurement. Besides Procurement Criteria, a set of meticulous procedures are developed to ensure that the assessment of certification schemes is transparent, reliable and verifiable.

http://www.smk.nl

(III) Europese Verordening Overbrenging Afvalstoffen (EVOA) van Agentschap NL

EVOA provides the procedures and rules for the international transport of waste, including waste woods.

http://www.agentschapnl.nl/programmas-regelingen/wet-en-regelgeving-evoa
B. Oils and fats

(I) The Product Board for Margarine, Fats and Oils (MVO)

MVO serves the common interests of all links in the production chain of oils and fats which carry out activities in the Netherlands. MVO operates as a centre of knowledge. It screens and analyses important developments in society, science and markets and transmits these two companies in the MVO production and distribution chain.

http://www.mvo.nl/

(II) Initiatief Duurzame Handel (IDH)

IDH accelerates and up-scales sustainable trade by building impact oriented coalitions of front running multinationals, civil society organizations, governments and other stakeholders. Through convening public and private interests, strengths and knowledge, IDH programs help create shared value for all partners. This will help make sustainability the new norm and will deliver impact on the Millennium Development goals.

Within IDH, the Dutch Taskforce for Sustainable Soy (representing Dutch production and trading companies) and Nevedi (representing the Dutch feed industry) aim at 100% responsible soy imports into the Netherlands within a few years. The goal of the IDH soy program is to transform the soy sector to an institutionalized responsible level. Compliance to RTRS criteria helps soy farmers in Brazil to become legal compliant and get access to financial services. Mainstreaming RTRS compliance supports governments in Latin America in their attempts to stop deforestation.

http://www.idhsustainabletrade.com/soy

(III) De Nederlandse Emissieautoriteit (NEa)

The NEa supports the implementation of emissions trading and the use of renewable energy (mostly biofuels) in the transportation. It acts as an independent supervisor assessing compliance with the rules in these areas.

https://www.emissieautoriteit.nl
C. Carbohydrates

(I) SMK (see A.)

(II) Productschap Akkerbouw

The Productschap Akkerbouw (PA) is set up on 1 Januari 2008. It combines the activities of the former activities of the formal Productschap Granen, Zaden en Peulvruchten and sectorial activities of the Hoofdproductschap Akkerbouw. PA is an organization of and for the arable sector, starting with the raw material sector to the retail (processed) agricultural products. In 2012 it developed the VVAK sustainability system which is accepted by the Dutch government for the production of sustainable biofuels.

http://www.productschapakkerbouw.nl/teelt/vvak

(III) Stichting Veldleeuwerik

Stichting Veldleeuwerik is a foundation for farmers and their customers to work together on sustainable food production, with active participation of a large number of leading buyers and processors. In 2012, Stichting Veldleeuwerik signed the Green Deal with the Central Government. See Section 5.2.1.

http://www.veldleeuwerik.nl/
### Appendix III CN code of biomass

<table>
<thead>
<tr>
<th>CN Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Woody biomass</strong></td>
<td></td>
</tr>
<tr>
<td>CN 44xxxxxx</td>
<td>Wood and articles of wood; wood charcoal</td>
</tr>
<tr>
<td>CN 45xxxxxx</td>
<td>Cork and articles of cork</td>
</tr>
<tr>
<td>CN 47xxxxxx</td>
<td>Pulp of wood or of other fibrous cellulosic material; recovered (Waste and scrap) paper and paperboard</td>
</tr>
<tr>
<td>CN 48xxxxxx</td>
<td>Paper and paperboard; articles of paper pulp, of paper or paperboard</td>
</tr>
<tr>
<td>CN 49xxxxxx</td>
<td>Printed books, newspapers, pictures and other products of the printing industry; manuscripts, type scripts and plans</td>
</tr>
<tr>
<td>CN 44013020</td>
<td>Sawdust and wood waste and scrap, agglomerated in pellets</td>
</tr>
<tr>
<td><strong>Oils and fats</strong></td>
<td></td>
</tr>
<tr>
<td>From CN 1201xxxx until CN 1209xxxx</td>
<td>Oil seeds and oleaginous fruits</td>
</tr>
<tr>
<td>CN 15xxxxxx</td>
<td>Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes</td>
</tr>
<tr>
<td>CN 15200000</td>
<td>Glycerol, crude; glycerol waters and glycerol lyes</td>
</tr>
<tr>
<td>CN 29054500</td>
<td>Glycerol</td>
</tr>
<tr>
<td>CN 382600xx</td>
<td>Biodiesel and mixtures thereof, not containing or containing less than 70% by weight of petroleum oils or oils obtained from bituminous minerals</td>
</tr>
<tr>
<td>CN 38249055</td>
<td>Mixtures of mono-, di- and tri-, fatty acid esters of glycerol (emulsifiers for fats)</td>
</tr>
<tr>
<td>CN 38249091</td>
<td>Monoalkyl esters of fatty acids, with an ester content of 96.5%vol or more esters (FAMAE)</td>
</tr>
<tr>
<td>(used by CBS)</td>
<td></td>
</tr>
<tr>
<td><strong>Carbohydrates</strong></td>
<td></td>
</tr>
<tr>
<td>CN 10xxxxxx</td>
<td>Cereals</td>
</tr>
<tr>
<td>CN 11xxxxxx</td>
<td>Products of the milling industry; malt; starches; inulin; wheat gluten</td>
</tr>
<tr>
<td>CN 121291xx</td>
<td>Sugar beets</td>
</tr>
<tr>
<td>CN 12129300</td>
<td>Sugar cane</td>
</tr>
<tr>
<td>CN 1213xxxx</td>
<td>Cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets</td>
</tr>
<tr>
<td>CN 17xxxxxx</td>
<td>Sugars and sugar confectionery</td>
</tr>
<tr>
<td>CN 19xxxxxx</td>
<td>Preparations of cereals, flour, starch or milk</td>
</tr>
<tr>
<td>CN 200410xx</td>
<td>Potatoes prepared or preserved otherwise than by vinegar or acetic acid, frozen, other than products of heading 2006:</td>
</tr>
<tr>
<td>CN 200520xx</td>
<td>Potatoes prepared or preserved otherwise than by vinegar or acetic acid, not frozen, other than products of heading 2006:</td>
</tr>
<tr>
<td>CN 22070100</td>
<td>Undenatured ethyl alcohol of an alcoholic strength by volume of 80%vol or higher</td>
</tr>
<tr>
<td>CN 22070200</td>
<td>Ethyl alcohol and other spirits, denatured, of any strength</td>
</tr>
<tr>
<td>CN 38249097</td>
<td>Other chemical compounds</td>
</tr>
</tbody>
</table>