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Strategic Intertask Study (Task 40/43/38):
Monitoring Sustainabiility Certification of Bioenergy

Impacts of sustainability certification on bioenergy markets and trade

IEA Bioenergy

Strategic Inter-Task Study:
Monitoring Sustainability Certification of Bioenergy

A cooperation between IEA Bioenergy Task 40, Task 43 and Task 38

Task 3: Impacts of sustainability certification on bioenergy markets and trade

A study commissioned by IEA Bioenergy

February, 2013

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Strategic Inter-Task Study:
Monitoring Sustainability Certification of Bioenergy

At present numerous biomass and biofuel sustainability certification schemes are being developed or implemented by a variety of private and public organisations. Schemes are applicable to different feedstock production sectors (forests, agricultural crops), different bioenergy products (wood chips, pellets, ethanol, biodiesel, electricity), and whole or segments of supply chains. There are multiple challenges associated with the current status of sustainability certification, i.e. the proliferation of schemes has lead to – to name a few – confusion among actors involved, market distortion and trade barriers, an increase of commodity costs, questions on the adequacy of systems in place and how to develop systems that are effective and cost-efficient.

Within IEA Bioenergy a strategic study was initiated among Tasks 40, 43 and 38 to monitor the actual implementation process of sustainability certification of bioenergy. The study was executed between January 2012 and Feb 2013. Its main goals were to evaluate how stakeholders are affected by certification initiatives, quantify the anticipated impact on worldwide bioenergy trade, assess the level of coordination among schemes, and make recommendations to remove barriers which may depress markets and reduce sustainable trade. A worldwide survey was launched to investigate the operational experiences of people actively involved with any aspects of bioenergy production systems, including those engaged in biomass feedstock production, conversion into primary and secondary biofuel and bioenergy products, markets and trade. The survey placed a particular focus on the input of stakeholders on how systems can be improved to be more effective. Many people have responded - we have received over 200 survey responses, from all over the world.

The study has produced four reports, which are available on-line on the IEA Bioenergy website and the sites of the participating tasks*:

- Task 1: Examining sustainability certification of bioenergy
- Task 2: Survey on governance and certification of sustainable biomass and bioenergy
- Task 3: Impacts of sustainability certification on bioenergy markets
- Task 4: Recommendations for improvement of sustainability certified markets

On Tuesday 12 March 2013 the main outcomes of the study were presented in a workshop, in connection to the World Biofuels Markets in Rotterdam.

* *www.ieabioenergy.com*
www.bioenergytrade.org *(Task 40, Sustainable Bioenergy Trade)*
www.ieabioenergytask43.org *(Task 43, Biomass Feedstocks for Energy Markets)*
http://www.ieabioenergy-task38.org *(Task 38, Climate Change Impacts)*

The authors would like to gratefully acknowledge the IEA Bioenergy Executive Committee for providing funding to make the project possible. We would especially like to thank the interviewees and the respondents of the survey, for providing thoughtful and engaging answers, and helping to move the discussion beyond the identification of problems, toward solutions.

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1. Introduction

1.1 General introduction

The increased utilization of bioenergy has led to increasing trade. Rising concerns regarding the sustainable production and use of biomass for energy has led to development and implementation of sustainability certification schemes for both liquid biofuels and solid biomass. For liquid biofuels to receive governmental support or count towards mandatory national renewable energy targets within the EU, biofuels used (whether locally produced or imported) have to comply with sustainability criteria. A number of schemes are primarily designed or have been modified to comply with bioenergy regulatory frameworks, basically following the RED sustainability criteria. The EC has fully or partly recognized 12 schemes as being acceptable to demonstrate compliance with RED criteria as of September 2012. The United States is one of the largest markets for liquid biofuels and has established the Renewable Fuel Standard (RFS2) in 2007 implemented by the Environmental Protection Agency (EPA) (EISA 2007). However, due to limitations in data availability and resources, we focus mainly on the EU market within this report (particularly the two case studies described in Section 1.2). The EU is the biggest market for solid biofuels but there is still no EU-wide regulatory framework. As of 2012, only the UK and Belgium have implemented national regulations for sustainability requirements of solid biofuels. Nevertheless, a few voluntary schemes have been developed for industrial wood pellets, mainly initiated by large industrial buyers. A collaborative effort of the largest utility companies within Europe, known as Initiative Wood Pellets Buyers (IWPB) is currently working towards the harmonization of the existing schemes.

The existing bioenergy trade is largely influenced by market characteristics and public policies. The market is shaped by a diverse group of factors such as resources availability, feedstock prices and other economic factors. These market elements are intertwined with intervention of a variety of national and regional policies, weaving a complex trading web. The implementation of sustainability certifications might have significant impact on the existing trade dynamics. These market factors impact bioenergy trade and market to different degrees. This considerable complexity suggests a need to gain more insight into the interrelation between this wide range of factors and trading patterns to investigate the impact of sustainability certification.

Within IEA Bioenergy a strategic study was initiated among Tasks 40, 43 and 38 to monitor the actual implementation process of sustainability certification of bioenergy. The study is divided into four tasks, focuses on the implementing process (Task 1), operational experience and stakeholders views (Task 2), anticipated impact on bioenergy trade (Task 3) and recommendations for improvement (Task 4). This report is the outcome of Task 3. The central question this task investigates is: to what extent has the requirement (or the voluntary commitment) to meet sustainability criteria (proven by the use of certification schemes) been changing bioenergy markets and trade flows? This task focuses on the systems selected in Task 1. It is also linked to the information collected from stakeholders in various markets in Task 2, particularly the information from the trade and market section in the questionnaire.

In principle, there can be multiple effects of certification on biomass production, availability and supply and trade, including: (i) certain producing areas or resources can become excluded from specific markets (which can in turn enhance opportunities and market access of other potential suppliers), (ii) costs of production and feedstock supplies may increase, and (iii) certification can act to increase coherence along the supply chain and facilitate the realization of benefits (both ecological and socio-economic) associated with increased market access. Such mechanisms have been described for a few regions and resources (Smeets and Faaij, 2010). Changes in trade flows are of particular interest when it comes to international (and intercontinental) bioenergy trade.

1.2 Background: Drivers for sustainability certification of bioenergy

In recent decades, the EU has been attempting to position itself as a leader in combating climate change. Bioenergy has been regarded as one of the more effective tools in reducing greenhouse gases. However, the expansion of bioenergy has given rise to serious concerns on the sustainability aspect, especially the environmental impact from bioenergy. As a response, the EU has introduced the RED sustainability criteria to ensure sustainability of biofuels. The Renewable Energy Directive (RED) requires member states to generate 20% of energy from renewable sources by 2020, and for 10% of transport fuels to be made from renewable resources. The Directive includes sustainability criteria that liquid biofuels must comply with in order to count toward the targets. Since 19 July 2011, the EC has recognized a number of voluntary schemes that applies directly to biofuels used or produced in EU-27 to demonstrate compliance, in order to receive government support or count towards mandatory national renewable energy targets. The United Kingdom and the Netherlands are among the forerunners in the implementation of sustainability certification requirement.

To ensure sustainability of solid biomass used or produced within the EU, the EC has recommended the use of the same sustainability criteria as liquid biofuels. In the current absence of mandatory EU-wide sustainability criteria for solid biomass (a decision is still being awaited), it is quite likely that a number of individual member states unilaterally will develop (further) sustainability criteria, while others maintain the status quo. A few individual Member Countries have defined their own sustainability obligations, e.g. the UK (ROCs) and Belgium (Green Certificates). The Netherlands has also been considering the implementation of a reporting system for sustainable certified solid biomass, and therefore developed the Dutch Biomass Protocol. Furthermore, as part of their long-term development strategies, some industrial users have decided to invest in sustainability systems too. Numerous voluntary certification schemes have been developed (such as industrial pellet schemes) or adapted (such as forest management schemes) to promote good practices throughout the supply chain. Adapting and developing sustainable bioenergy has become a strategy in many utilities to maintain profitability and enhance long term value. Certification is a way to prove the sustainability of biomass energy that helps to promote social acceptance of biomass energy.

The aforementioned policies and legislations can be regarded among the strictest worldwide of their kind. For liquid biofuels, this has triggered intense debate whether the EU's actions intended to protect its heavily subsidized native biofuels industry, which is sometimes described by other producing countries as inefficient and uneconomical (Afionis, 2012). The main arguments lie within the definition of land types and the issues regarding (indirect) land use changes. Furthermore, the imposition of tariffs and the institution of subsidies have led to more questions on the EU's commitment to sustainability goals. This is understandable if the original intentions of biofuels development is re-examined – in addition to mitigating climate change, domestic economic development is also one of the primary objectives. Inevitably, the governments take into account the interests of local industries, looking for a more balanced approach between environmental, social and economic goals. This has led to the paradox that Europe has become the world's leading producer of biodiesel despite the fact that they are less productive compared to their counterparts in tropical countries.

In the so-called 'iLUC proposal' of the EC, published in October 2012, the EC proposes to impose a 5% cap on the amount of crop-based biofuels used in transport fuel, and on the longer term indirect land use change (iLUC) factors may be used to calculate overall GHG balances of biofuels. The EC also intends to encourage the production of second generation biofuels. The iLUC proposal may have a huge effect on biofuel imports to Europe. However, as the underlying work for this report was carried our between March and September 2012, these developments have not been included in the

analysis, i.e. the stakeholders views presented in the report do not reflect these recent policy developments.

1.3 Objectives

In this study, an analysis of global bioenergy trade flows was undertaken. Two categories of modern bioenergy were investigated: liquid biofuels for transportation, and solid biomass used for heating and power generation. The latter group focused on wood pellets due to the relatively large scale of international wood pellet trade. This investigation was fraught with difficulty, largely due to strict confidentiality preserved by the private stakeholders. The proliferation of sustainability schemes complicates the analysis further. Due to these limitations, the Netherlands and the United Kingdom were selected for in-depth case studies rather than compiling data on entire global trade flows. These two countries are the forerunners in the development and implementation of sustainability certification, and have quite detailed statistics on amounts and origins of imported biomass and biofuels. As both countries have been importing substantial amounts of solid biomass and liquid biofuels over the past decade with increasing sustainability requirements, these certified bioenergy trade flows can be used to analyze the potential impact of certification to bioenergy trade flows.

This report is organized into the following sections: In Section 2, the methodology underlying this study was explained. Sections 3 and 4 present the trade flows of sustainable liquid and solid biofuels, respectively, each section with two case studies on the Netherlands and the United Kingdom. Section 5 discusses and concludes the impact of sustainability certifications on bioenergy trade and market.

2. Methodology and data collection

This task is explorative and aims to provide an overview of the relationship of sustainability certification with bioenergy trade dynamics. The main objective is to understand to what extent the requirement (or the voluntary commitment) to meet sustainability criteria have been affecting bioenergy markets and trade flows. As part of the Intertask strategic project, this task focuses on the systems selected in Task 1 (Examining Sustainability Certification of Bioenergy). The information about trade and market collected from stakeholders in various markets in Task 2 is also integrated into this study. It is important to understand the limitations of this study:

1) Data availability: To the authors' knowledge, only two countries have public annual reporting systems for sustainable certified biofuels that indicate amount and origins. The UK uses a transparent reporting system by the Office of the Gas and Electricity Markets (Ofgem) for both liquid and solid biofuels. For the Netherlands, the use of liquid biofuels is monitored by the Dutch Emission Authority (NEa), and the use of solid biofuels is monitored by University Utrecht.
2) Confidentiality: Many companies (especially liquid biofuels market actors) withhold trade information as commercial confidentiality to protect their business interest.
3) Mandatory reporting of liquid biofuel certification has only been introduced in the UK in 2008 and in NL in 2011, and exclusion of biofuels which do not meet the criteria/are not certified has effectively only been enforced since 2012 in both countries. Thus, it is possible that trade patterns for liquid biofuels are only now starting to change. For solid biomass, only Belgium and the UK have introduced binding criteria. Note that for the UK the system will come into force in April 2013 (mandatory reporting is already ongoing). However, in the UK and the Netherlands, utilities have started to voluntarily certify their biomass (RWE

Essent / RWE npower, Drax, Electrabel), some of them up to a very large percentage of their total biomass consumption.

4) Trade patterns are also influenced by other drivers than sustainability certification, especially (i) economic factors such as prices of commodities/crops, changing shipping costs, varying exchange rates, and (ii) policy measures such as export subsidies, anti-dumping countervailing measures by the EU, etc.

For these reasons, it is impossible to accurately quantify how (much) trade patterns changed solely in relation to sustainability certification. However, charting current certified and uncertified trade flows can serve as a benchmark. From the results of the questionnaire, we can derive how market actors and other experts expect trade patterns to change in the future.

This study largely depends on publicly available information. It draws on data collected in several ways:

1) Data was obtained from national/international statistics and reports from authorities, such as the Dutch Emission Authorities (NEa) and the Office of the Gas and Electricity Markets (Ofgem). These sources yield data for liquid biofuels on consumption volumes, origins, feedstock and share of sustainable certified biofuels. Ofgem also reports data for solid biofuels consumed in the UK in details as for liquid biofuels.
2) For solid biofuels consumed in the Netherlands, data were collected from questionnaire surveys and interviews with market actors. **Table 1** presents the list of interviewees and other direct sources of information. We conducted intensive individual interviews with a small number of respondents to explore their perspectives on the impact of sustainability certification on bioenergy trade.
3) The data collection was complemented by a thorough contextual literature search whenever required. Some discrepancies were observed between EUROSTAT trade data and the data provided by country specific sources (associations, national experts, Task 40 members etc.). Therefore the data presented in this report should be regarded only as indications of actual trade flows.

Table 1. Direct sources of information

Interviewee lists	**Interview transcript**
Allan Rankine, BP UK	Appendix I
N.N., Biofuel manager, Shell	Confidential
Onofre Andrade, Argos North Sea, the Netherlands	Appendix II
Sustainability manager at a large international biofuels company	Confidential
Peter-Paul Schouwenberg, RWE Essent, the Netherlands	Appendix III
Duncan Robinson, RWE npower, UK	Appendix IV
Mairi Black, Drax Power, UK	Appendix V
Other direct sources of information: Survey with utilities in the Netherlands; dialogues with liquid biofuels traders, producers, certification experts and policies experts	Confidential
Online survey conducted in Task 2	Refer to Task 2

Note: All the above information was collected in the period of May - August 2012.

3. Overview of liquid biofuels trade flows

3.1 Global liquid biofuels trade flows

Biodiesel and bio-ethanol are the main biofuels used in the EU, accounting for about 70% and 28% of total biofuels consumption on volume basis in 2011 (GAIN, 2012a). World biofuel trade has grown exponentially, with the EU continuing to dominate world biodiesel production, whereas the US and Brazil remain leaders in bio-ethanol production. **Figure 1** and **Figure 2** show the trade flows of biodiesel and bio-ethanol in 2011, respectively.

Imports of *biodiesel* into the EU rose to 96 PJ (2.6 MT) in 2011, compared to 68 PJ in 2009 (Lamers et al., 2010). US imports have plummeted because of record production of biodiesel with valuable RINs (Renewable Identification Number[1]), and the gap is replaced by Indonesian biodiesel. Argentinean biodiesel remains the biggest supplier to the EU, with 52 PJ (1.4 MT) in 2011 compared to 32 PJ in 2009.

For *bio-ethanol*, the US has become the primary destination for competitively priced exports, importing about 982 million litres of bio-ethanol in 2011, driven by higher value RINs of Brazilian ethanol, of which the vast majority originated from Brazil directly, and through Trinidad and Tobago, Jamaica and El Salvador. Note that there are significant differences in Brazilian ethanol trade flows between CAMEX and USDA data (Lamers, 2012). This study uses Lamers (2012) for most global ethanol trade flows and adapts the CAMEX data provided by the Brazil Ministry of Mining & Energy for Brazilian ethanol flows (CAMEX, 2013).

3.2 Case study 1: The Netherlands

3.2.1 Sustainability requirements

In the Netherlands, the use of liquid biofuel is regulated by Dutch Biofuel Policy. Fuel suppliers are obliged to blend transport fuels with a minimum percentage of biofuels. The sustainability of biofuels is assured according to sustainability schemes (usually a certification system) recognized by the European Commission or accepted by the Dutch government, such as RTRS, ISCC, NTA 8080/8081, BioGrace Version 4 Public, Double counting protocol, REDcert, RED Compliance Inspection Protocol (RCIP), RSPO.

However, a sustainable system that is not recognized by and has not been submitted for approval to the European Commission may be accepted for up to 5 years by undertaking a complete review on the basis of the Dutch Testing Protocol for sustainability systems for biofuels.

Table 2. Annual supply target of liquid biofuels for the Netherlands

Annual supplier target	2009		2010		2011		2012
	Target	Achieved	Target	Achieved	Target	Achieved	Target
Percentage in total road transport fuel (Mandatory blending)	3,75%	3,42%	4,00%	2,09%*	4,25%	N/A	5,25%

* The physical supply is considerably lower than the requirement but it does not mean that the suppliers do not meet their obligation. First, significant portion of biodiesel was derived from waste or by-products, which can be counted double for the annual obligation of renewable transport fuels. Second, suppliers can also use additional supplies from previous years to fulfil the requirement.

[1] A serial number assigned to a batch of biofuel for the purpose of tracking its production, use, and trading as required by the United States Environmental Protection Agency's Renewable Fuel.

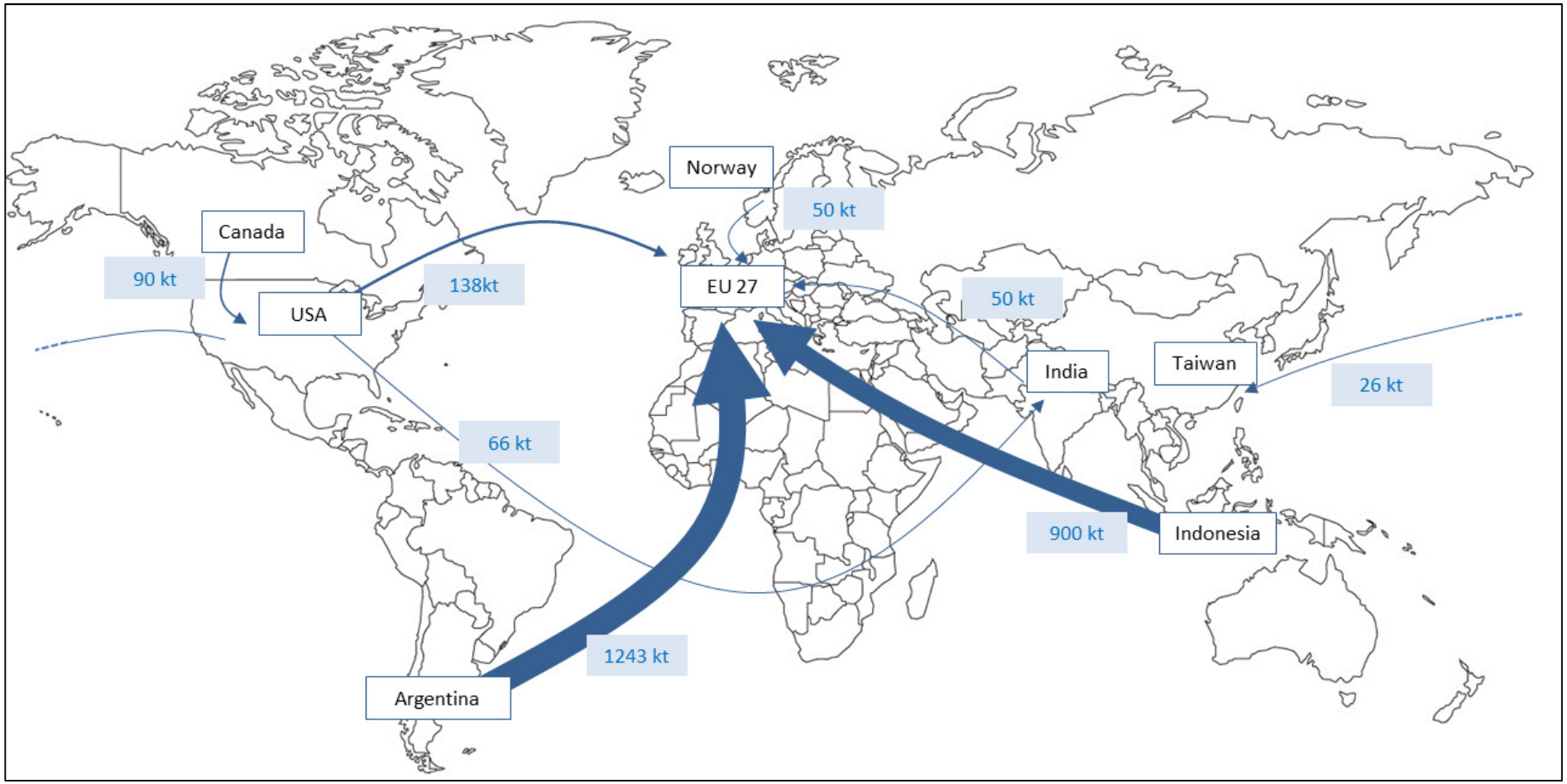

Figure 1. Global biodiesel trade in 2011 (net flow in ktonnes) (assuming energy content = 37.8 GJ/tonnes) (Source: Lamers, 2012)

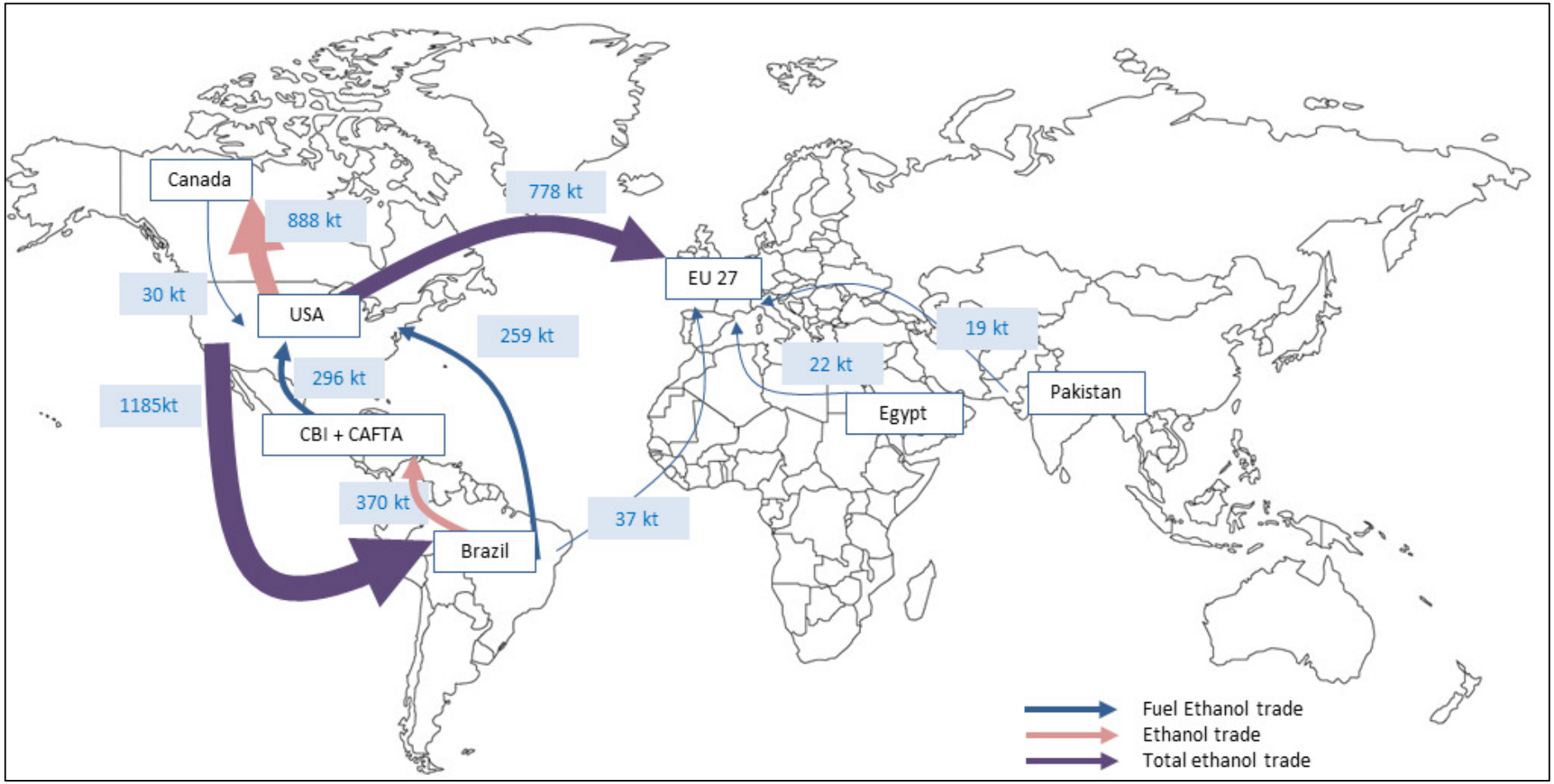

Figure 2. Global fuel ethanol trade in 2011 (net flow in ktonnes) (Assuming energy content = 27 GJ/tonnes) (For Brazilian ethanol trade flows: Source: USDA, 2012; SECEX, 2012; CAMEX, 2013; for the other trade flows: Source: Lamers, 2012)

3.2.2 Overview of liquid biofuels trade flows

Figure 3 and **Figure 4** show the quantities of biodiesel consumed in the Netherlands in 2010 and 2011. Biofuel consumption in the Netherlands is monitored by NEa. Data for 2010 published by NEa are highly-aggregated due to confidentiality agreements with the industry actors. The share of biodiesel in total Dutch diesel consumption is 4.62%, but note that this included double counting of certain biodiesel types. The Dutch biodiesel market heavily focuses on double counting - 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 on 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 comes from used cooking oil (UCO) and tallow, particularly domestic UCO and tallow from Germany. As shown in **Figure 4**, ISCC is the most widely used scheme with its dominance in most categories of biodiesel.

Figure 5 illustrates the Dutch bio-ethanol consumption in 2010 and 2011. Bio-ethanol differs from biodiesel with a diverse source of feedstock and origins, in that the majority of the bio-ethanol originates from US corn. Corn 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 of those streams plummeted drastically in the Netherlands. This is mainly because the US and Brazilian domestic bio-ethanol market has absorbed most of the Brazilian sugarcane ethanol. Between 2010 and 2011 ethanol production from sugarcane in Brazil dropped 11% to levels of 2007-2008 (GAIN, 2011). A combination of Brazilian sugarcane production shortages (weather and management related issues), low stocks of sugar worldwide, increased global demand, poor investments in Brazil to add ethanol production capacity, and policy issues in Brazil contributed to the production of the most expensive ethanol during 2011, while sugar supply to international markets provided very high profits (GAIN, 2012e; F.O.Licht's 2012). Meanwhile the decrease of French wheat ethanol is likely due to bad harvest in 2011 - feedstock price was high and production of bio-ethanol from cereal was less attractive (GAIN, 2012a; 2012c). As shown in **Figure 6** ISCC again is the most popular scheme with its dominance in corn ethanol. 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 (GAIN, 2012a).

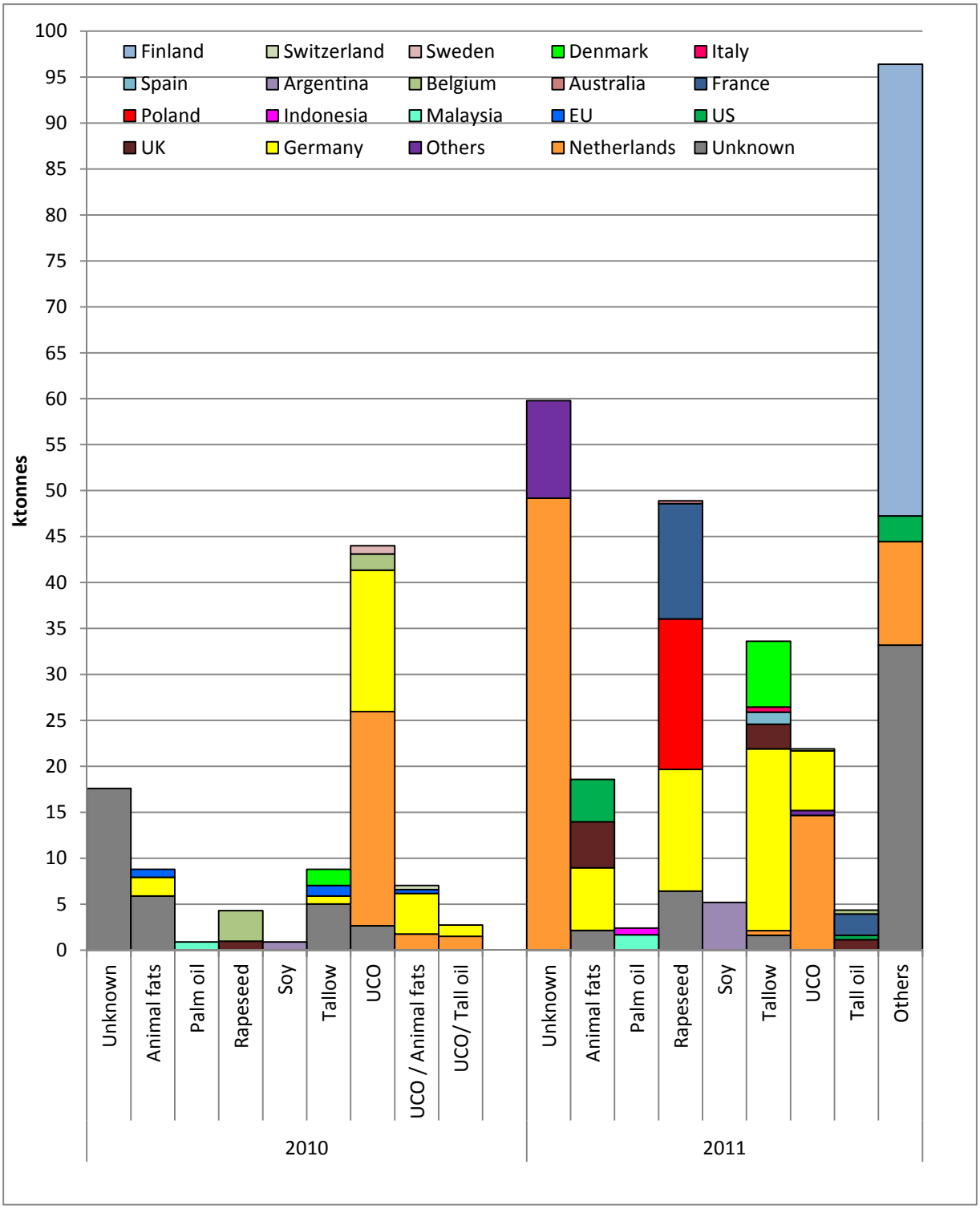

Figure 3. Total biodiesel consumed in the Netherlands in 2010 and 2011 by feedstock (ktonnes) by feedstock and country of origin (Source: NEa 2011, NEa 2012)
Note: Small trade flow streams are omitted

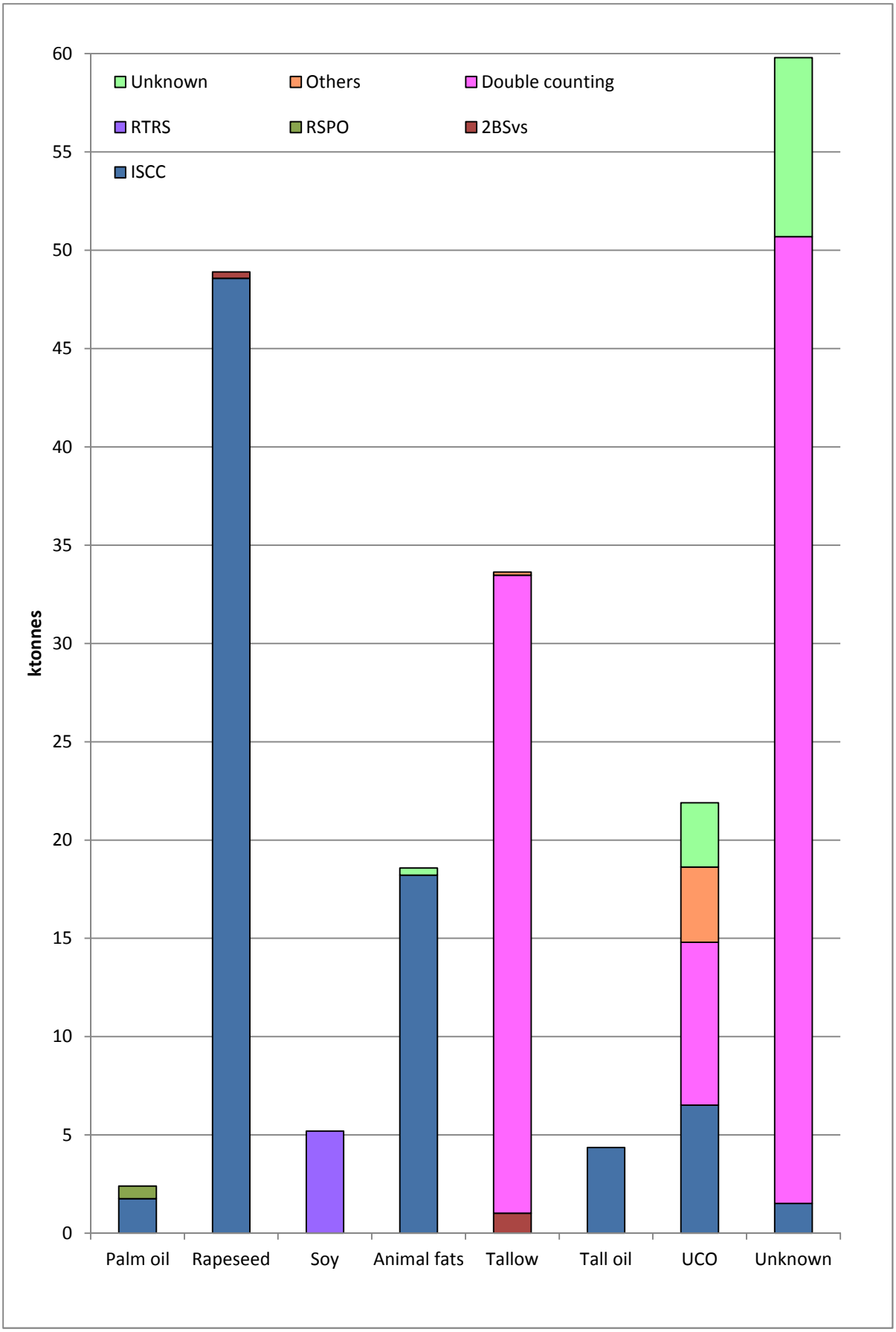

Figure 4. Sustainable certified biodiesel consumed in the Netherlands by schemes in 2011 (ktonnes) (Source: NEa, 2011; NEa, 2012)

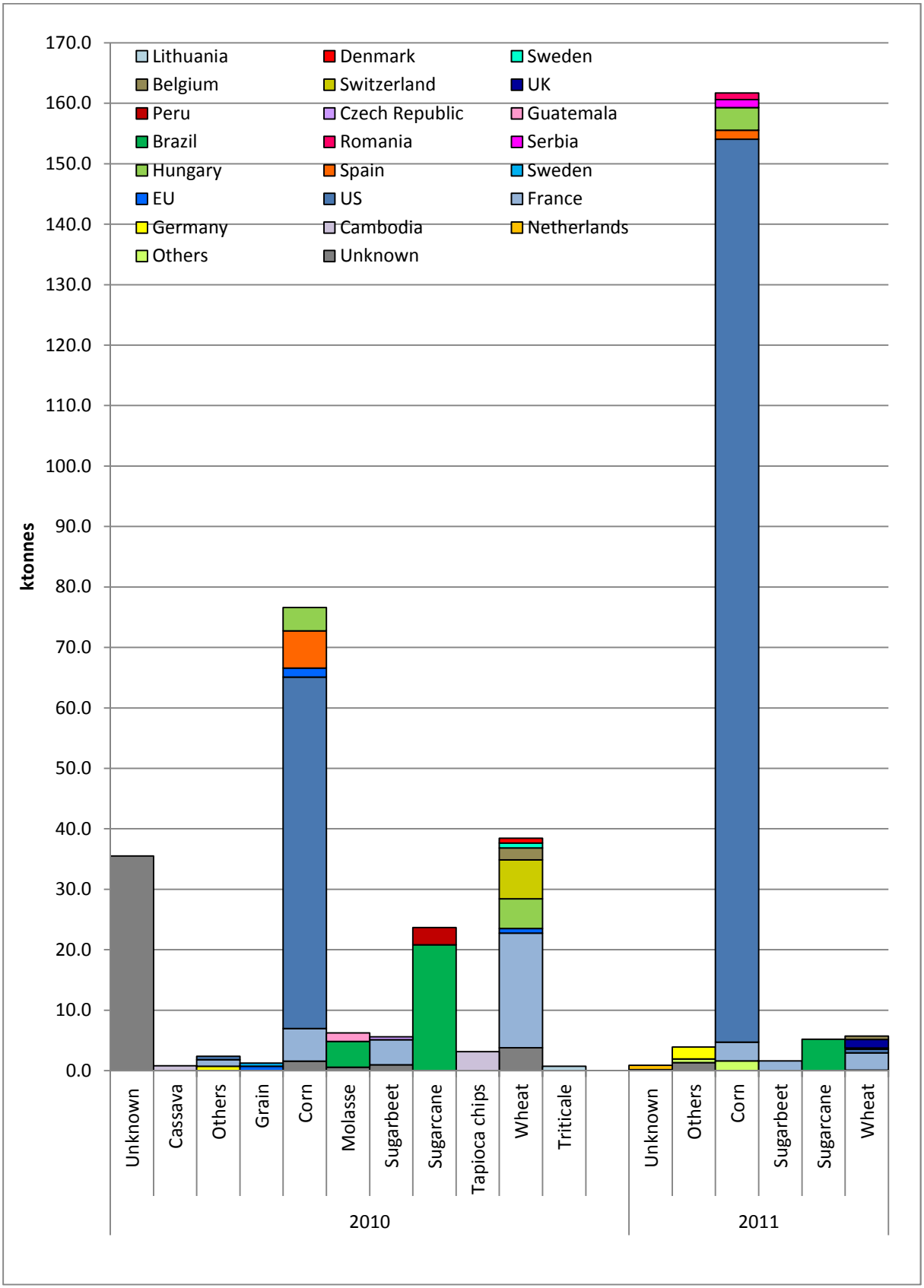

Figure 5. Bio-ethanol consumed in the Netherlands in 2010 and 2011 by feedstock (ktonnes) (Source: NEa 2011, NEa 2012)

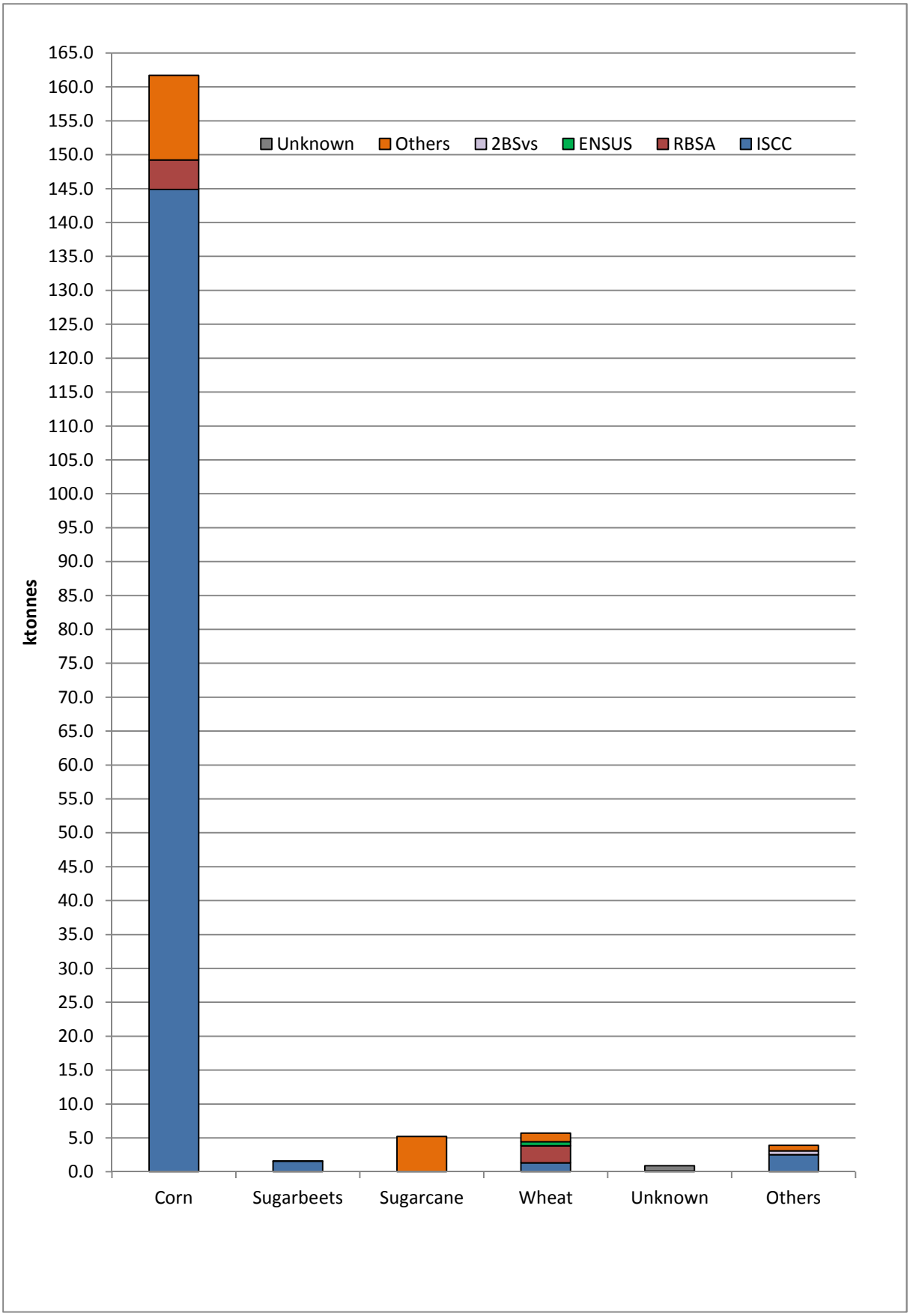

Figure 6. Sustainable certified bio-ethanol consumed in the Netherlands by schemes in 2011 (ktonnes) (Source: NEa 2011, NEa 2012)

3.3 Case study 2: The United Kingdom

3.3.1 Sustainability requirements

In the UK, the RTFO is applied to road transport across the whole country. Refiners, importers and others who supply more than 450,000 litres of relevant hydrocarbon oil for road transport annually to the UK market are obligated to follow it. Before 2012, sustainability assurance schemes were divided into Environmental and Social Standards and those can be split into three categories:

1. RTFO sustainable biofuel meta-standard (RTFO) - this is a higher standard than most existing sustainability standards and covers seven key environmental and social principles.
2. Qualifying Standards (QS) - those that meet the majority of the environmental and/or social criteria defined under the RTFO meta-standard. Fuels from wastes (e.g. used cooking oil and tallow) are automatically considered to meet the qualifying level.
3. Other Standards - these have either not yet been benchmarked, or have been benchmarked against the RTFO meta-standard, but do not meet sufficient criteria to be awarded QS status.

In December 2011, the RTFO Order was amended to implement the sustainability criteria of the RED. This introduced mandatory sustainability criteria which biofuels must meet to be eligible for Renewable Transport Fuel Certificates (RTFCs). Biofuels that do not meet these criteria are considered fossil fuels for the purposes of the Order and accrue an obligation to supply sustainable biofuels in the same manner.

3.3.2 Overview of liquid biofuels trade flows

Table 3 shows the annual supply target and achievement for the UK since 2008. At the end of the year, suppliers of fossil road transport fuel must demonstrate compliance with the RTFO by redeeming the appropriate number of RTFCs to demonstrate the required volume of biofuel was supplied. Alternatively, obligated fossil fuel suppliers can pay a buy-out price per litre of obligation as set in the RTFO Order.

Table 3. Annual supply target and achievement for the UK

Annual supplier target	2008-09		2009-10		2010-11	
	Target	Achieved	Target	Achieved	Target	Achieved
Percentage of feedstock meeting a Qualifying Environmental Standard	30%	20%	50%	31%	80%	55%
Annual GHG saving of fuel supplied	40%	46%	45%	51%	50%	58%
Percentage in total road transport fuel	-	2.7%	3.25%	3.33%	3.5%	3.1%

Figure 7 and **Figure 8** illustrate the origins of liquid biofuels used for energy in the UK in the recent reporting years. Due to the counter splash-and-dash effect[2], the most widely reported source of biodiesel being imported into the UK has been shifted from US soy (24% of biodiesel supplied in 2008/09) to Argentinean soy (29% in 2009/10 and 21% in 2010/11). Argentina is the largest biodiesel supplier in 2010, recorded 326 million litres, but the amount was halved in 2011. Argentinean biodiesel was not certified in 2010, and has shown a small increase in certification in 2011. The US is the second largest supplier. Similar to Argentina, the US supply in 2011 dropped to 89 million litres. Two-thirds of American biodiesel was certified. Biodiesel from Western Europe almost doubled in 2011 to 328 million litres. About 80% of these biodiesels are certified. However, there are large amount of biodiesels reported by Department for Transport (DfT) with unknown origins in 2010. On the other hand, imports of palm oil based biodiesel from Malaysia and Indonesia have plummeted in 2011.

[2] This happened when American producers import pure biodiesel made somewhere else, blend with 1% of petro-diesel to the fuel, collect the tax credit ($1 per gallon) and then ship and sell the biodiesel to Europe in lower price.

In **Figure 9** and **Figure 10**, the different bio-ethanol streams into the UK are illustrated. The most widely reported source of bio-ethanol in 2010 was Brazilian sugarcane; however it drops drastically in 2011 to 124 million litres. Between April 2010 and April 2011, about 131 million litres of corn ethanol was imported from the US, however, this volume was not certified. From 2008 - 2011, the percentage of biofuels that met an environmental standard was always lower than the target, but the annual GHG savings of fuel supplied were able to meet and exceed the target every year (see **Table 3**).

3.3 Recent development of liquid biofuels in the U.S.

Due to resource constraint, the United States was not included in case studies, but a short summary of recent development is provided. The US is the worlds' largest liquid biofuel market (mainly bio-ethanol) and has established the RFS2 in 2007 implemented by the EPA. EPA's proposed approach for monitoring sustainability is in the public comments phase prior to ruling of a quality assurance program to demonstrate compliance of the regulated parties that obtain Renewable Identification Numbers (RIN) for volumes of fuels needed to reach the renewable volume obligation of the year, as determined by EPA. A RIN is a 38 digit number that physically labels a specific batch (volume) of renewable fuel produced (or imported) in a certain year, generated by a specific company's facility, for a certain category of renewable fuel characterized by, among other things, the reduction of GHG emissions relative to the gasoline of the year 2005 petroleum baseline. Upon blending with gasoline, the RIN is detached from producer and used by the blender as proof of traded renewable fuel or sold to another obligated party unable to meet the obligation (EPA 2012). The quality assurance plan proposed parties is composed of four components (1) feedstocks meet the definition of "renewable biomass" of EISA with criteria for land that can be used for production of biofuel, e.g., agricultural land has to be either actively managed or fallow, and non-forested in 2007; (2) the specific fuel production pathway at the facility and specific process validation; (3) renewable fuel component category of standards (e.g., cellulosic biofuels, advanced biofuels and biomass-based diesel, reducing GHG lifecycle emissions from the baseline respectively 60, 50, and 50% or conventional renewable fuel at 20%) for road transport application or to be used as jet fuel or as heating oil substitute; and (4) RIN generation and separation. Progress in land monitoring for previous use and tools for calculating the life cycle assessment GHG emissions are becoming available (Mueller and Copenhaver 2012).

The context of Brazilian and U.S. ethanol production in 2011 introduces factors that should be kept in mind when interpreting impacts of sustainability standards. Between 2010 and 2011 ethanol production from sugarcane in Brazil dropped 11% to levels of 2007-2008 (GAIN 2011). Brazilian sugarcane production shortages (weather and management related issues), low stocks of sugar worldwide, increased global demand, poor investments in Brazil to add ethanol production capacity, and policy issues in Brazil contributed to the production of the most expensive ethanol during 2011, while sugar supply to international markets provided very high profits (GAIN 2012 Brazil Sugar; F.O.Licht's 2012). The U.S., on the other hand, had a record ethanol production, nearly reaching the RSF 2007 legislated volumes of obligated production but that were reaching the 10% volume basis (a blend wall unless 15% is implemented), making U.S. corn ethanol cheaper on average than the cost of ethanol from sugarcane during 2011. This fact was exemplified in the IPCC SRREN modelled example of levelized costs of ethanol production as a function of feedstock cost and sugar market price – corn and sugarcane lines of levelized biofuel production cost versus feedstock cost intercept (Chum et al. 2011). The outcome was that in 2011 the U.S. became the major ethanol exporter to Brazil, EU (some meeting EU RED standards), Canada and many other countries covering the shortage from sugarcane ethanol from Brazil (REN21, 2012; F.O.Licht's 2012).

The 2011 America's situation illustrates the interlinked nature of global weather impacts on global commodity patterns that can decrease biofuel production in one country, which were overcome by oversupply in another country. The year 2011 possibly illustrates the beginning of ***biofuels commoditization*** at a significant level and the resilience afforded by having multiple countries and multiple crops able to supply biofuels. This global commoditization of biofuels was one of the objectives of the governments of Brazil and the United States at the start of the ongoing implementation of the Memorandum of Understanding to Advance Collaboration on Biofuels (MOU 2007). An effort to expand production to third countries with potential for sugarcane development such as in the Caribbean, other Latin American, and African countries is another ongoing activity, with multilateral partnerships (e.g., IDB) and also participation of GBEP in capacity building in these countries. A review of the jointly sponsored activities can be found in the presentations of the GBEP Seminar side meeting "Sustainable Bioenergy: Providing Energy Access for Sustainable Development" to UN+20 in Rio de Janeiro, Brazil (GBEP 2012). Advanced biofuels R&D is another objective led by the U.S. Department of Energy (Chum 2012).

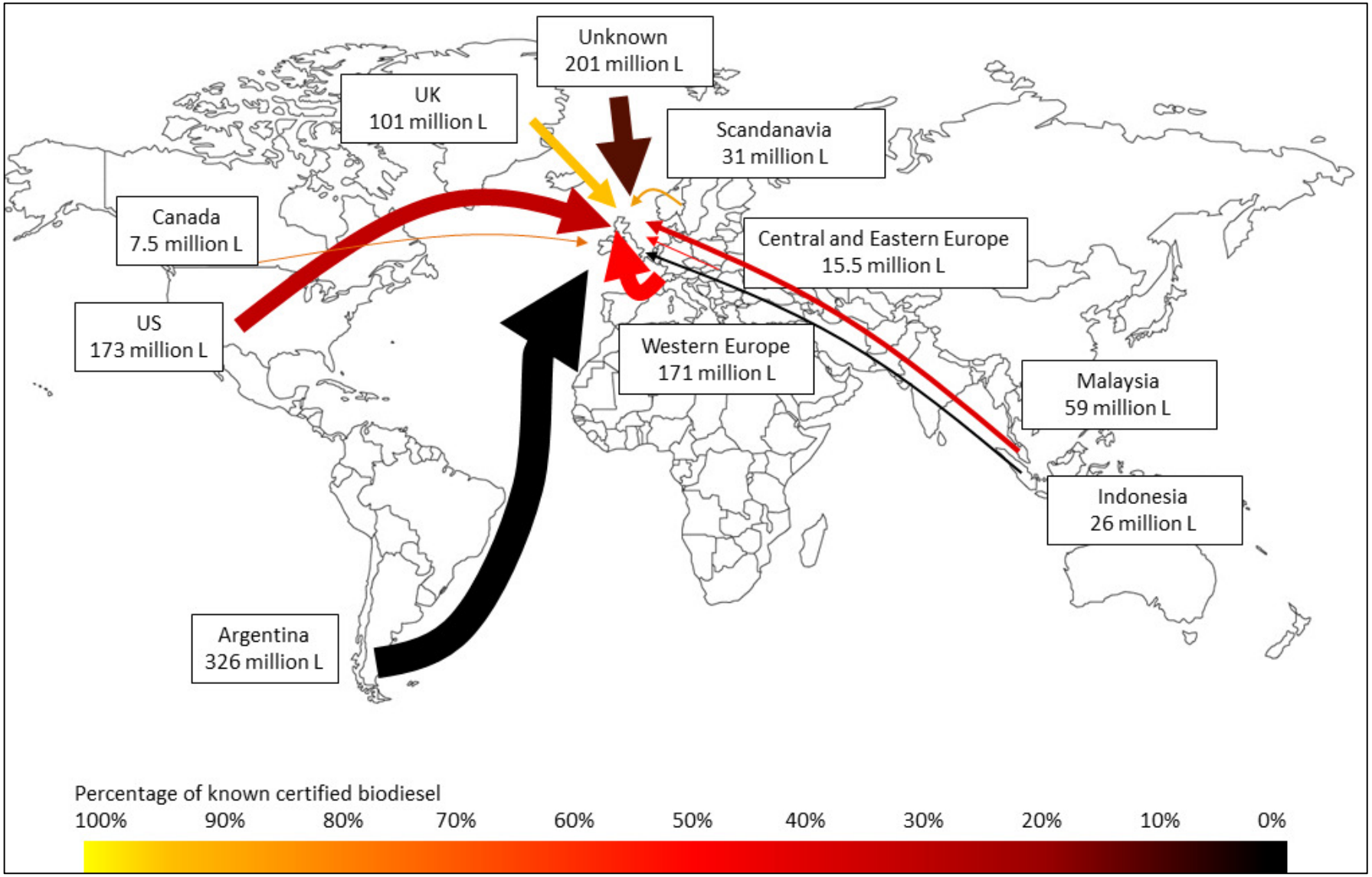

Figure 7. Biodiesel consumed in the UK between April 2009 to April 2010 (Source: DfT, 2012a; 2012b) (These diagrams are only indicative, for exact figures please refer to the source)

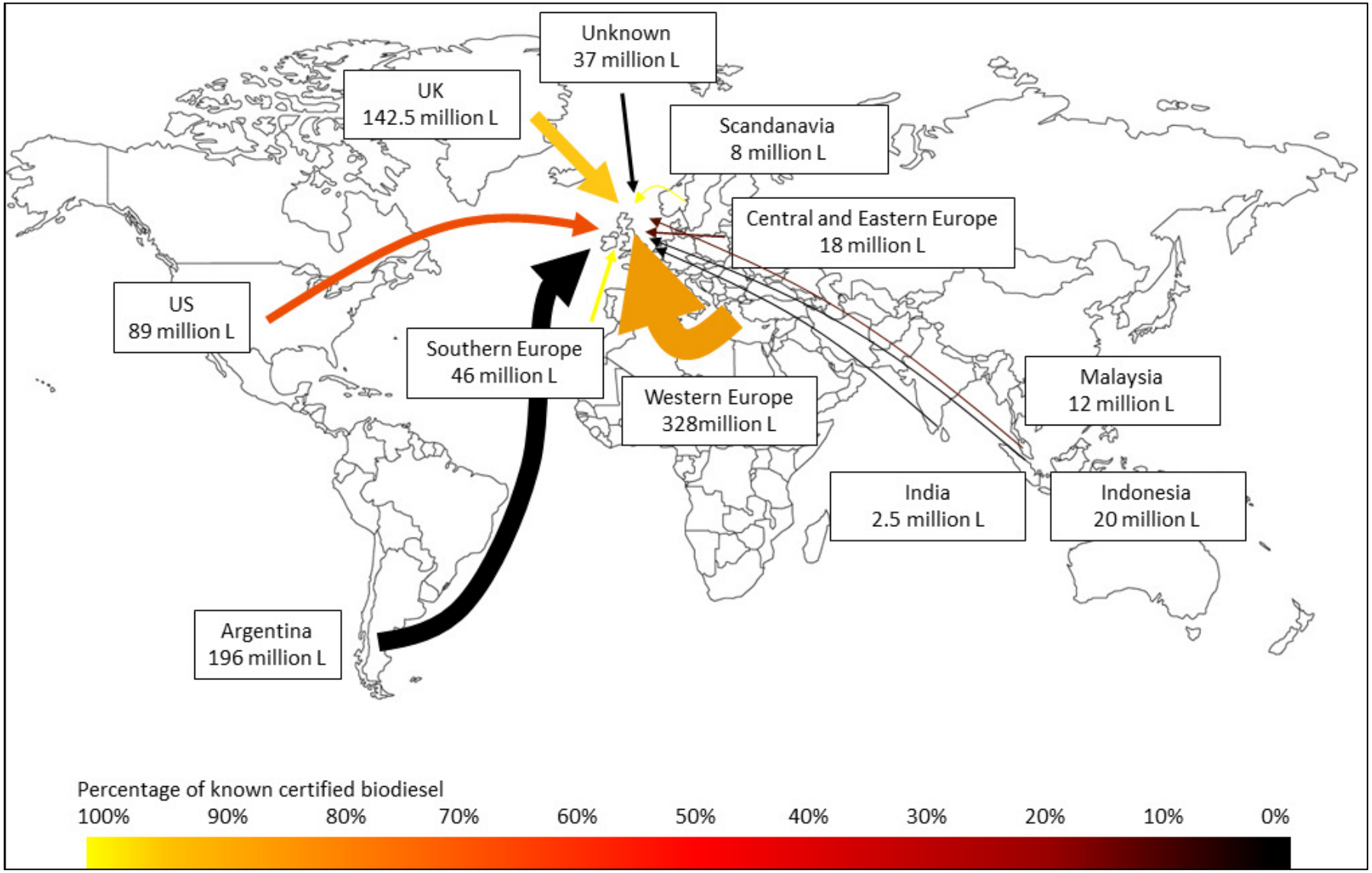

Figure 8. Biodiesel consumed in the UK between April 2010 and April 2011 (Source: DfT, 2012a; 2012b) (These diagrams are only indicative, for exact figures please refer to the source)

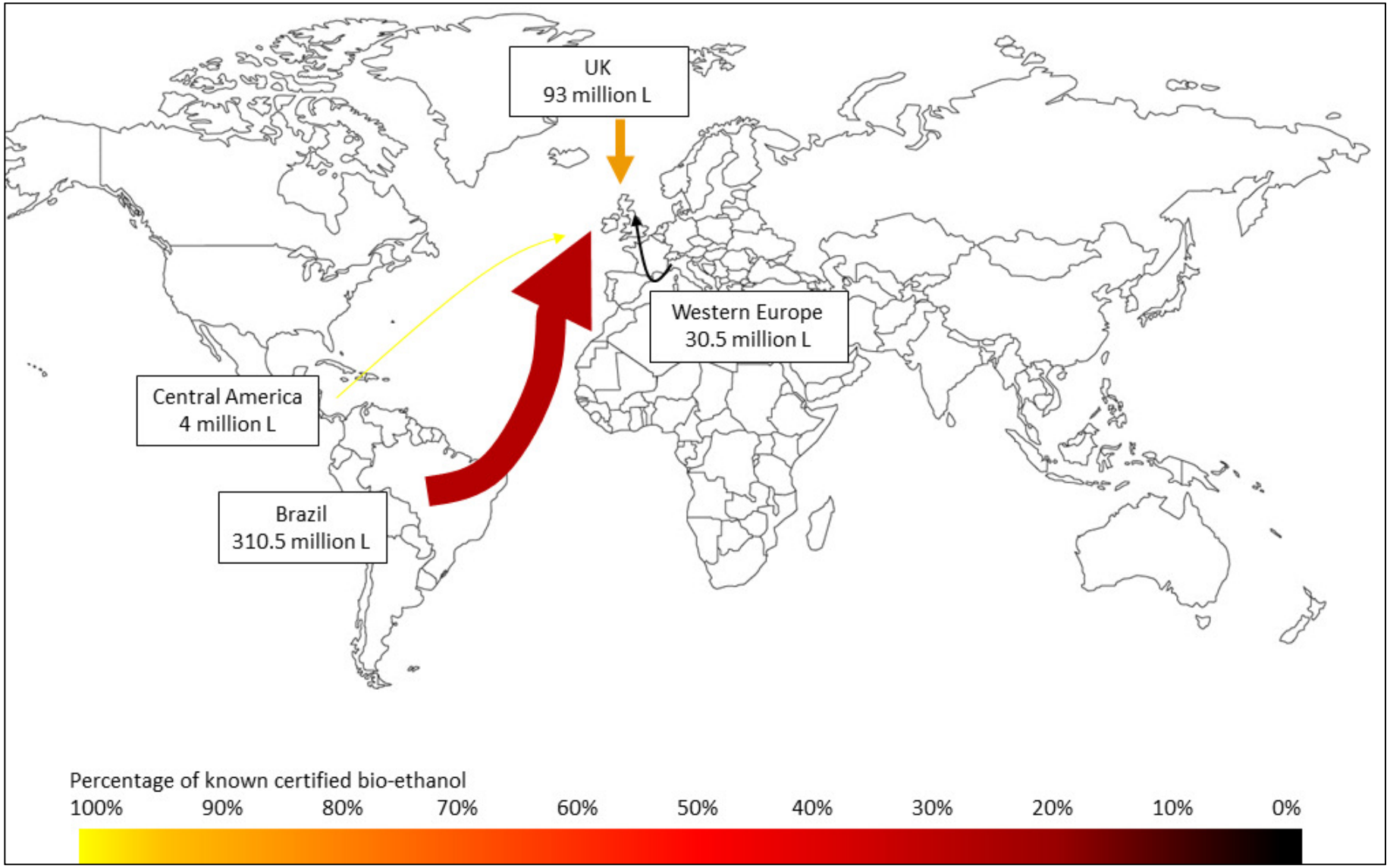

Figure 9. Bio-ethanol consumed in the UK between April 2009 and April 2010 (Source: DfT, 2012a; 2012b) Note that according to the Brazilian statistics of the chamber of commerce, Brazil exported 189.5 million litres of fuel ethanol exports to the UK (Dornelles, 2013).

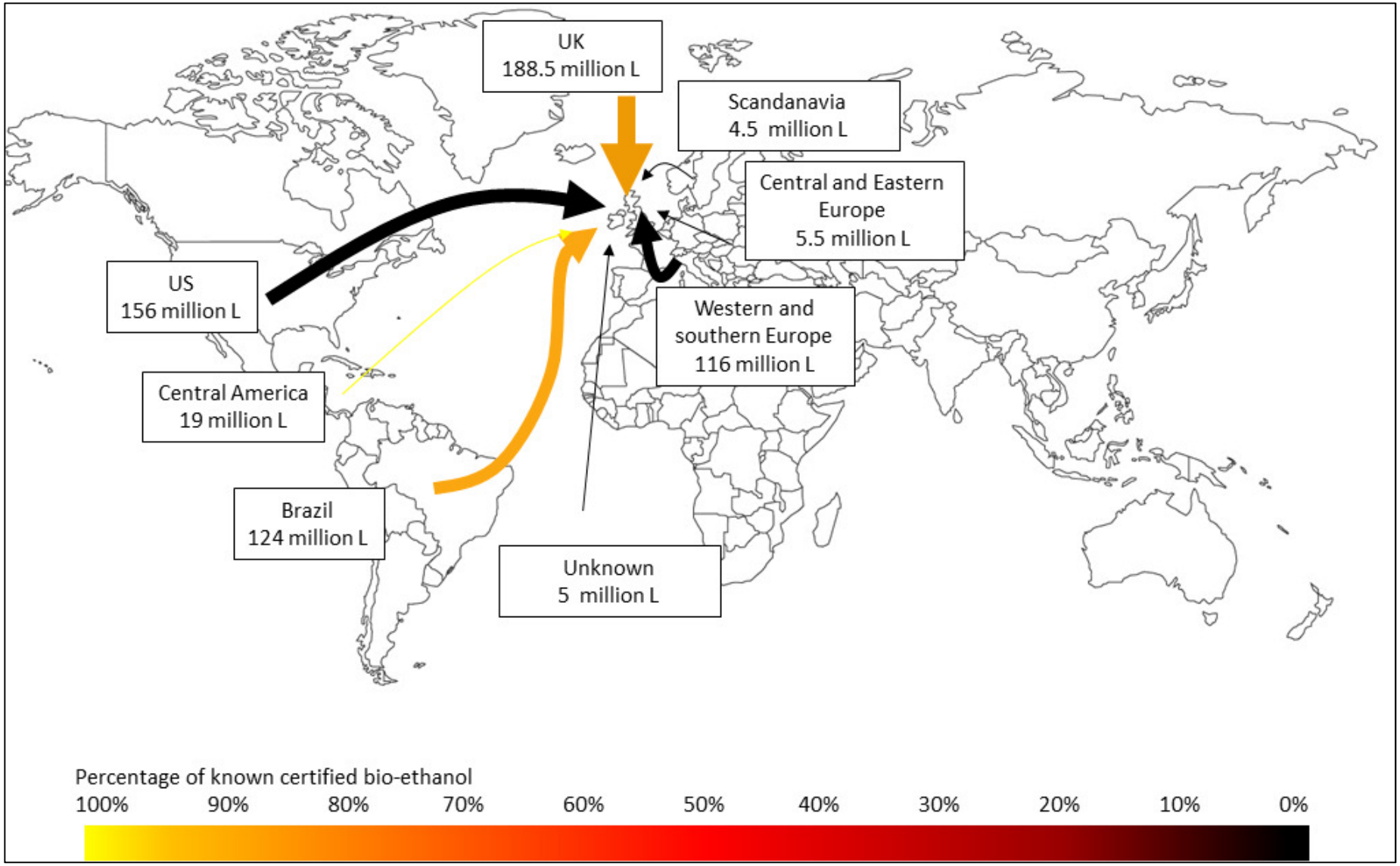

Figure 10. Bio-ethanol consumed in the UK between April 2010 to April 2011 (Source: DfT, 2012a; 2012b) (These diagrams are only indicative, for exact figures please refer to the source)

4. Overview of solid biofuels trade flows

4.1 Global solid biofuels trade flows

The trade volumes of wood pellets between EU and non-EU countries in 2010 is about 45 PJ and has increased to about 57 PJ in 2011. **Figure 11** shows the global trade flows of wood pellets. Two types of pellets are mainly traded - high quality pellets (white pellets) which are supplied in bulk or bagged to the residential heating market; and industrial quality pellets (brown pellets) derived from low(er) value feedstock which are used by large-scale district heating and co-firing installations. The worldwide production capacity and average size of pellet plants also shows an increasing trend, recorded an impressive 22% increase from 2009 to 2010. The European Union is still the primary market for wood pellets and should remain as such for the next several years. Canada and the United States remain as the largest exporter of industrial pellets, followed by Russia and Baltic States. Demand of industrial pellets for co-firing in Japan and South Korea are also growing. Japan and S. Korea are currently sourcing primarily from Canada, but are starting to initiate trade relationships with countries in Southeast Asia and Oceania.

4.2 Case study: The Netherlands

4.2.1 Sustainability requirements

The Netherlands is in the process of developing sustainability criteria for solid biomass, and have therefore developed the "Dutch assessment protocol for voluntary sustainability schemes for solid biomass", also referred to as Biomass Protocol (BP). The BP is closely related to the criteria that the EC has recommended for solid biomass and the criteria of the EU RED for biofuels and bioliquids, with an additional criterion addressing soil quality derived from NTA 8080. However, the Green Deal policy for solid biofuels is still unclear. The sustainability certification (most commonly) applied for industrial wood pellets are Green Gold Label, Laborelec Label and Drax Power Sustainability Principles.

4.2.2 Overview of solid biofuels trade flows

Figure 12 and **Figure 13** show the consumption of solid biofuels in the Netherlands in 2010 and 2011. Wood pellets are the largest type of solid biofuels consumed in the Netherlands. Canada and the US are the two biggest suppliers. In 2011, Canadian imports dropped to less than two third of 2010, and imports from the US increased and surpassed Canada. It should be noted that imports from Southern Europe have doubled in 2011. Consumption of domestic solid biomass for energy purposes has decreased, especially the consumption of wood chips. Most of the wood pellets are certified by sustainability schemes; however more than one third of wood pellets from Western Europe are not certified.

Communication with market actors suggests that the utilities will be switching to sustainable certified wood fuels, particularly wood pellets. The Dutch government is currently in the process of drafting national sustainability criteria for solid biomass, taking account of the European Commission's recommendations, the advices by the Corbey Commission, and other stakeholders' views. It is likely that the Dutch sustainability criteria for solid biomass (or regarded as "the Dutch assessment protocol for voluntary sustainability schemes for solid biomass") will be comparable to existing EU-RED criteria for biofuels and liquid biomass, with potential additional criteria on soil quality (derived from the NTA8080), and a different minimum level of greenhouse gas emission reduction. Currently there are a few industrial schemes available for solid biomass, particular for wood pellets. The most commonly applied sustainability certification is Green Gold Label, mainly from North America, Baltic States and Southern Europe.

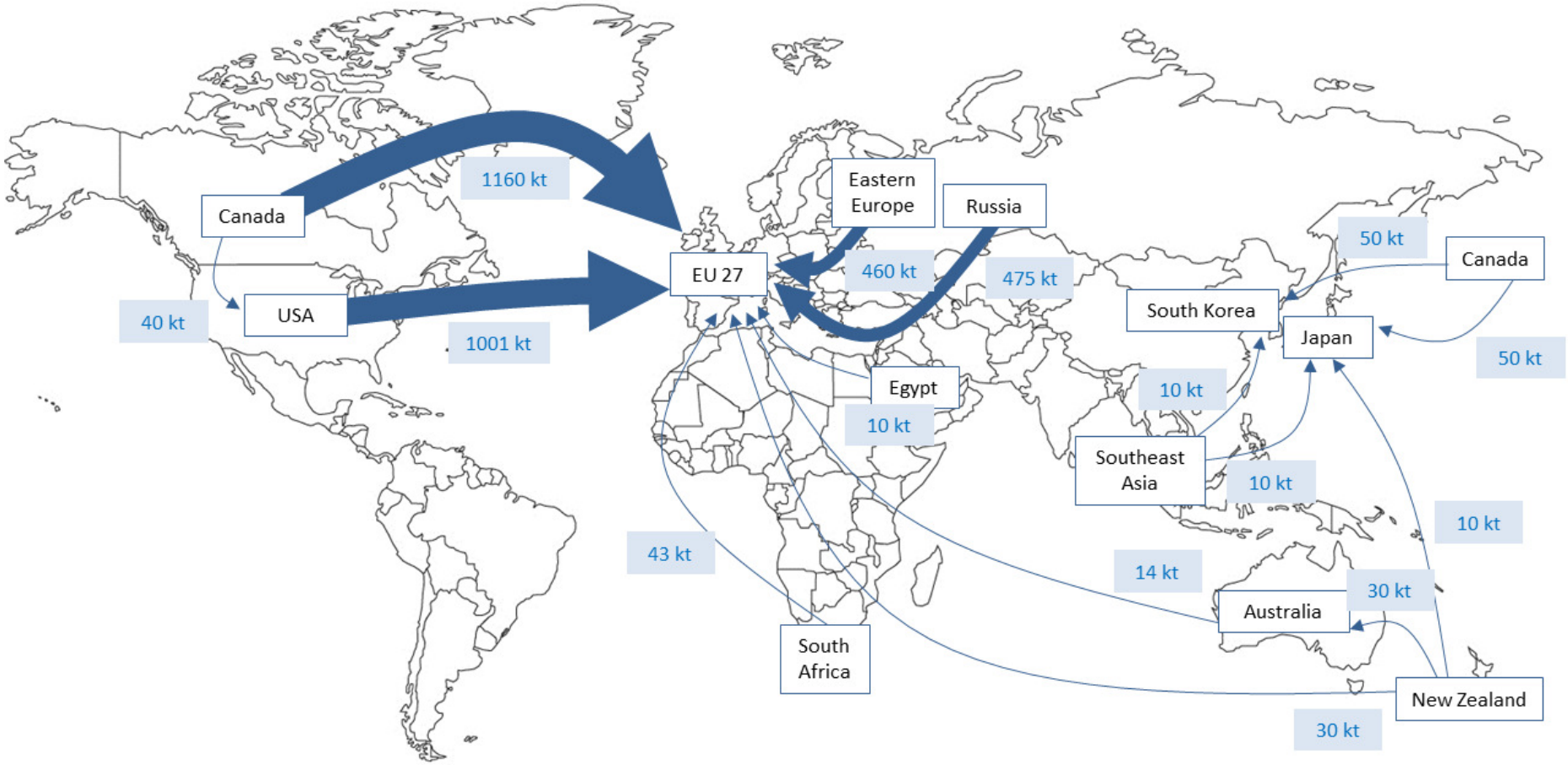

Figure 11. Global wood pellets trade flows in 2011 (ktonnes) (Source: EUROSTAT, COMTRADE, Lamers 2012)

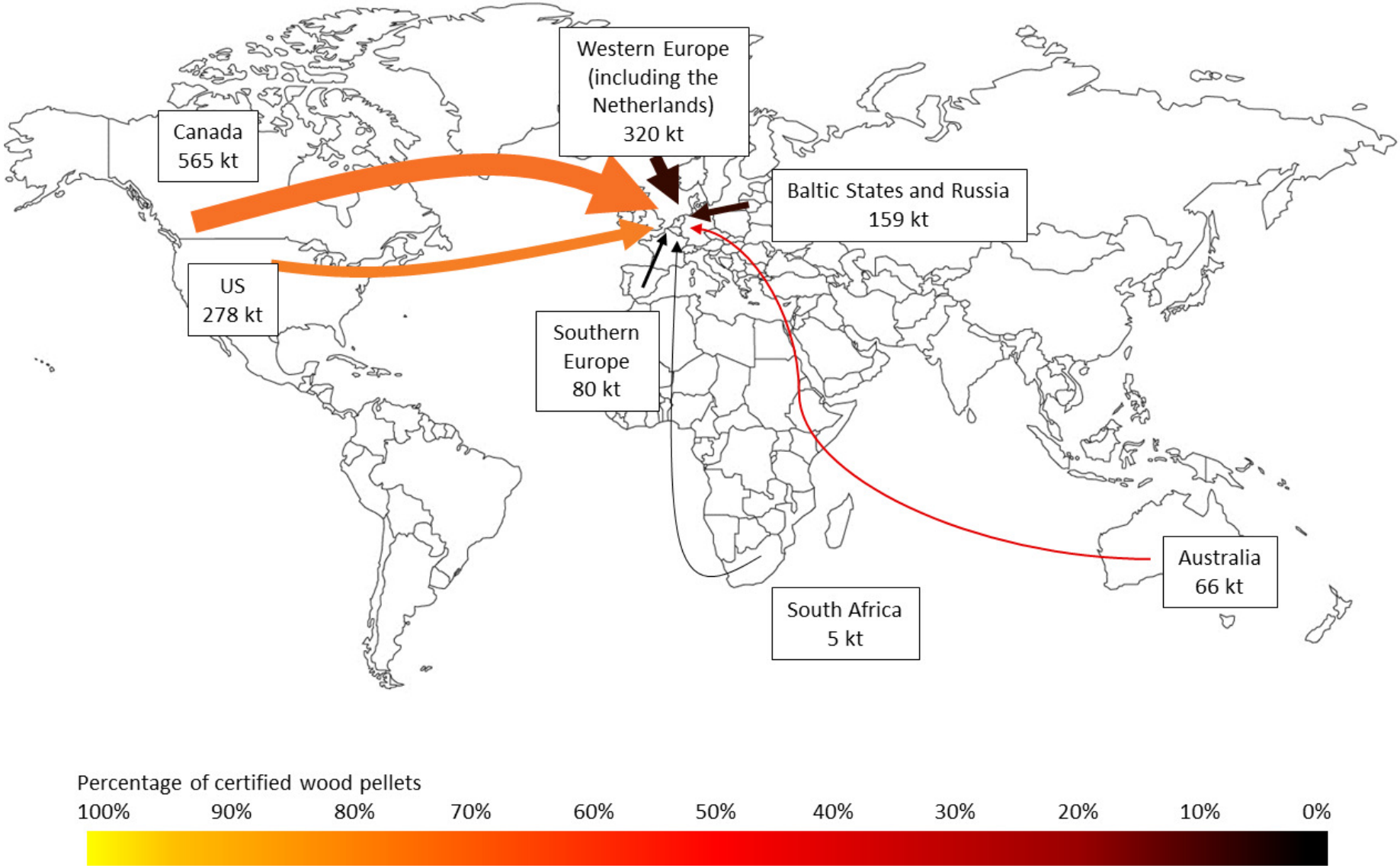

Figure 12. Wood pellet trade flows to the Netherlands (consumed in the Netherlands) in 2010 (Source: Interviews)

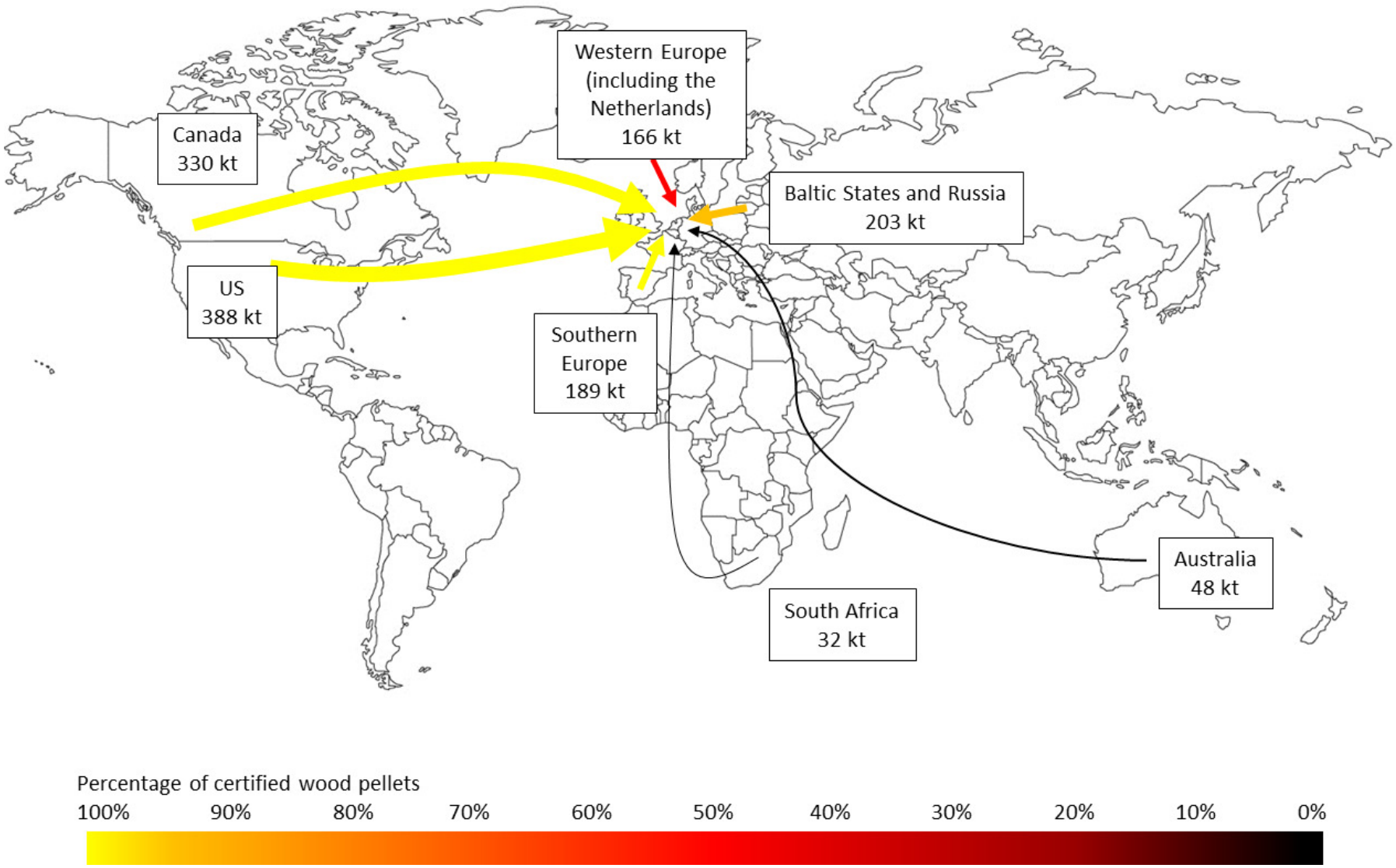

Figure 13. Wood pellet trade flows to the Netherlands (consumed in the Netherlands) in 2011 (Source: Interviews)

4.3 Case study: The United Kingdom

4.3.1 Sustainability requirements

The UK government promulgated the Renewables Obligation: Sustainability Criteria for Solid and Gaseous Biomass for Generators (greater than 50 kilowatts) in December 2011 (ROO) as previously discussed. This document outlines the new requirement to provide information to Ofgem on sustainability criteria with regard to greenhouse gas reductions and prior land use for the biomass used. This requirement was introduced in the 2011 amendments to these Orders. The sustainability criteria for solid and gaseous biomass refer to:

1. land criteria: relate to the type of land on which the biomass was produced (during or after January 2008); and
2. GHG emissions criteria: relate to the GHG emissions from the use of the biomass to generate one MJ of electricity.

The land criteria requirements are directly translated from the EU RED; specifically Articles on the protection of biodiversity (17.3), land with high carbon stocks (17.4) and peatland (17.5). Biomass electricity generators in the UK have to report compliance with the ROO land criteria.

Since April 2011, the Ofgem sustainability requirement obliged the UK energy generators to report against sustainability criteria for solid biomass under the Renewables Obligation. Energy generators were given two years of transition period. This was originally expected to be in place for April 2013 but is now proposed for October 2013 (DECC, 2012c). From October 2013 onwards, solid biomass will need to meet the sustainability criteria to be eligible to receive ROCs. DECC (2012c) reported the proposed content for RO sustainability reports covering the use of solid biomass & biogas feedstock. Currently, the GGL - RED standard is the only voluntary system that has been approved by Ofgem. However, they also accept the use of other voluntary schemes but additional information may need to be provided to demonstrate compliance. A short guidance note was published by Ofgem (2012b).

4.3.2 Overview of solid biofuels trade flows

Figure 14, **Figure 15**, **Figure 16** and **Figure 17** show the consumption of solid biomass in the UK for energy purpose by origins, in two consecutively reporting years – April 2010 to April 2011 and April 2011 to April 2012. Domestic biomass is the largest source of solid biofuels within the UK. Canada is the largest importer of wood pellets, recording about 0.4 MT in April 2010 - April 2011, and double that in the next reporting year. The increase mainly comes from the consumption in the Tilbury biomass power plant. A similar trend can be seen for the US, which also contributes significant amount of wood pellets: 0.2 MT (80% certified) in 2010 and 0.4 MT (100% certified) in 2011. Utilization of domestic non-woody biomass decreased drastically in the ongoing 2012 reporting year (April 2011 to April 2012), but there are small import streams of olive residues from North Africa and palm kernels from Malaysia which are likely used because they are waste or by-products from the agriculture industry.

* Note that the information was published as it was provided by the generators and was not verified by Ofgem. As of April 2011 onwards where the material was considered by the operator as 'waste' or 'wholly derived from waste' it was exempt from reporting. For example, in the 2010/11 period generators using a material such as waste wood would have been required to report, in the 2011/12 period they would not have.

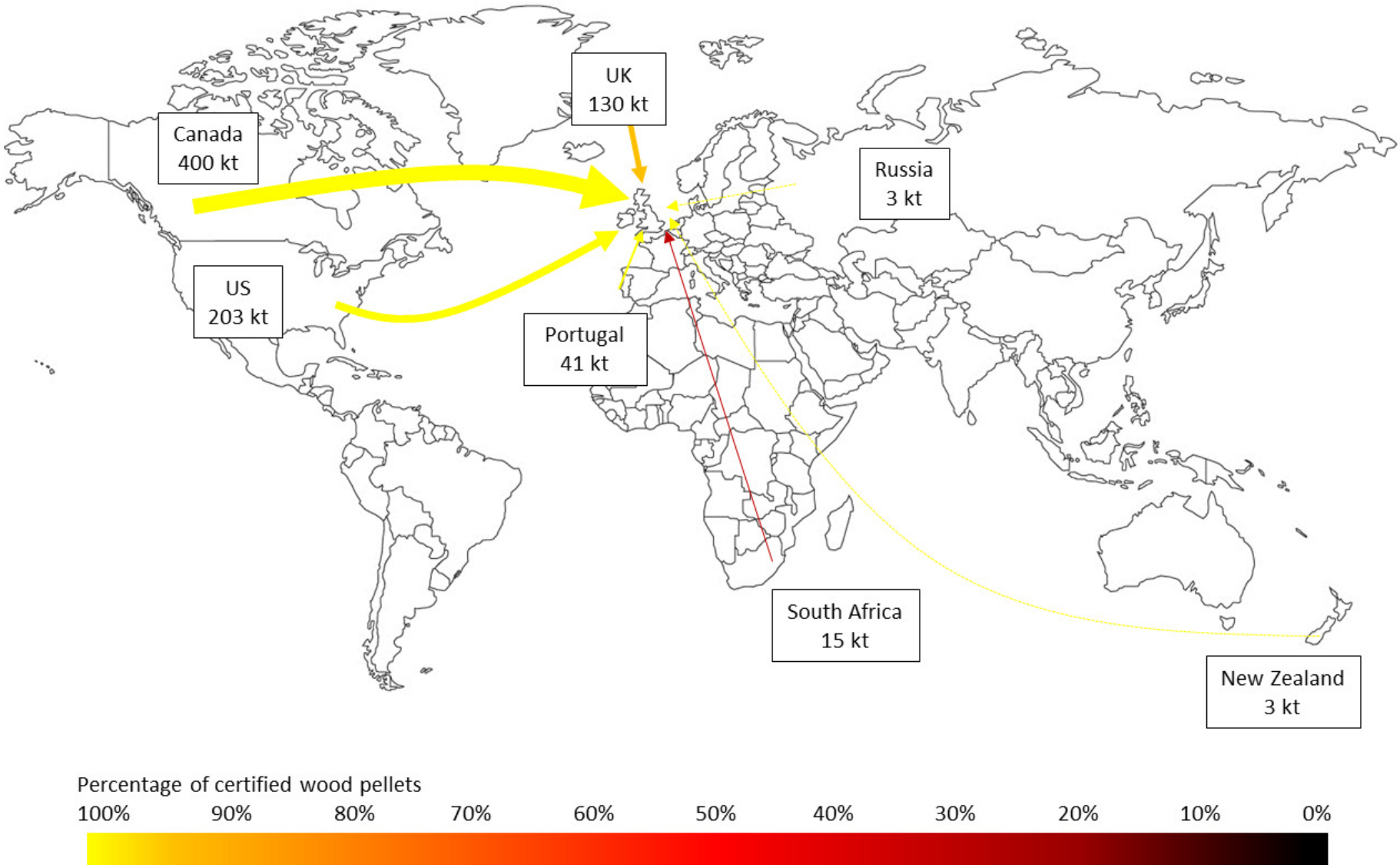

Figure 14. Wood pellets consumed by the utilities in the UK between April 2010 and April 2011

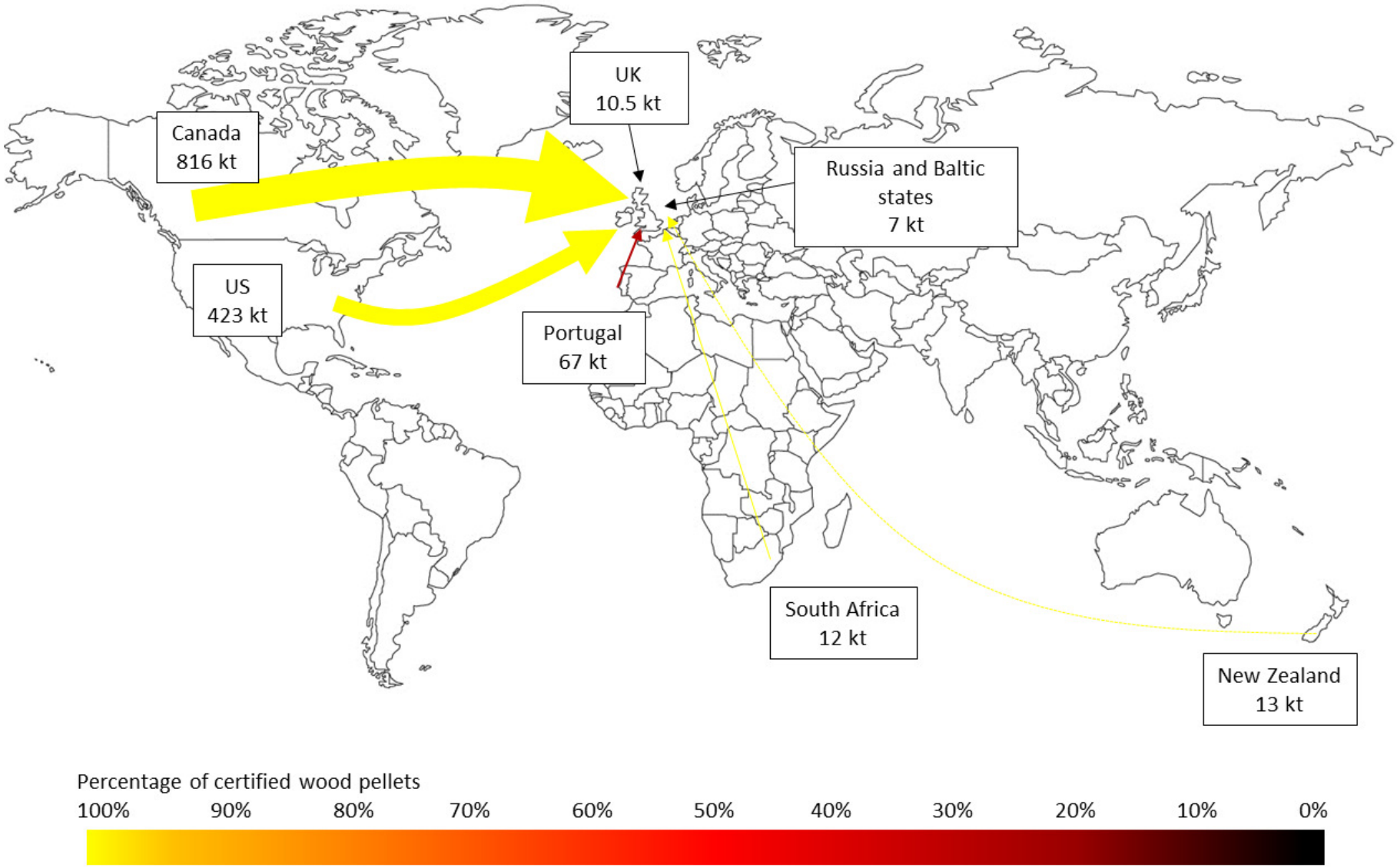

Figure 15. Wood pellets consumed by the utilities in the UK between April 2011 and April 2012 (Source: Ofgem, 2012) (These diagrams are only indicative, for exact figures please refer to the source)

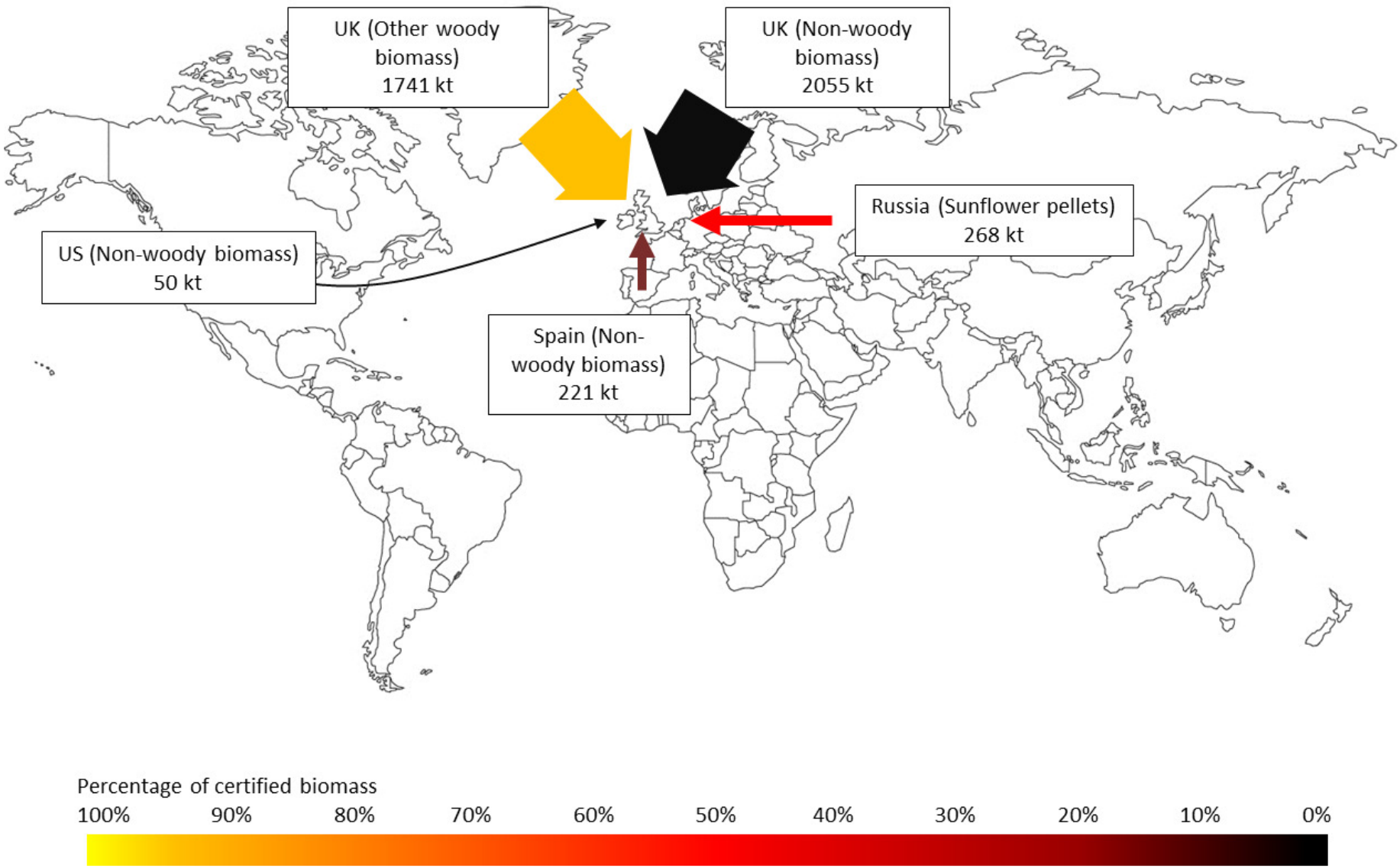

Figure 16. Other solid biomass consumed by the utilities in the UK between April 2010 and April 2011 (Source: Ofgem, 2012) (These diagrams are only indicative, for exact figures please refer to the source)

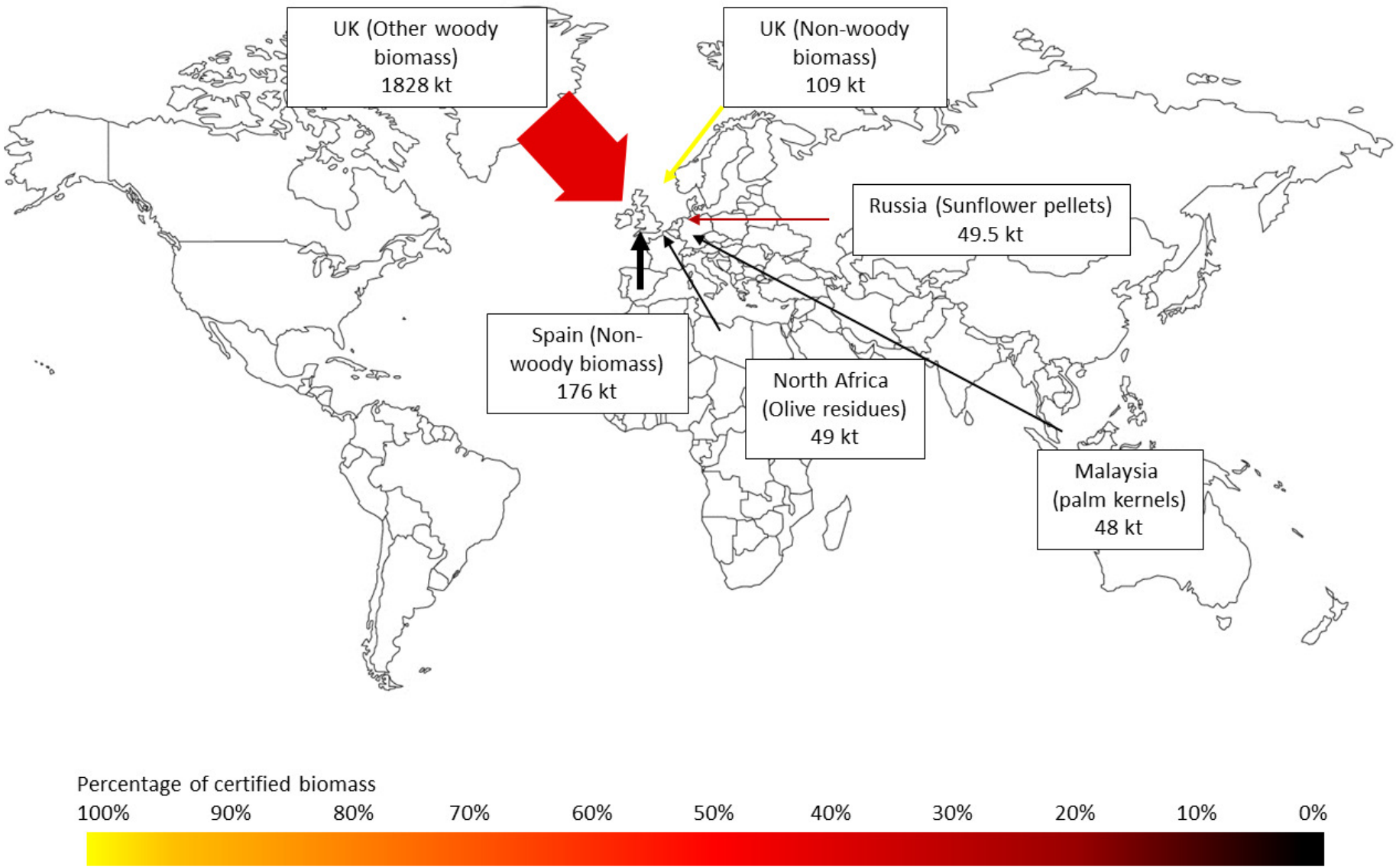

Figure 17. Other solid biomass consumed by the utilities in the UK between April 2011 and April 2012 (Source: Ofgem, 2012) (These diagrams are only indicative, for exact figures please refer to the source)

5. Impacts on trade and market

Sustainability certification may be an important factor shaping bioenergy trade flows, but there are many other factors to consider. Markets are also shaped by economic factors, cross-country variation in policy development and counter responses from market actors along the supply chain. This section describes the selected case studies if and how sustainability concerns have so far impacted bioenergy trade and discusses possible developments in the near future, taking the EU as the core focus area. A number of market actors were interviewed and their experiences with sustainability certification and other forms of governance were studied. Part of the interview transcripts are enclosed in the appendices (some have requested to keep the interviews confidential). Two main categories of biofuels were investigated: liquid biofuels and solid biofuels. These two markets have been found to have very different characteristics, mainly due to the nature of the feedstocks. Section 5.1 shows the result from the trade section in the questionnaire of Task 2. Discussion on liquid biofuels and solid biofuels are presented in Section 5.2 and 5.3 respectively.

5.1 Results from the questionnaire

The trade and market section in the survey questionnaire of Task 2 received 70 responses from biomass and biofuels producers, traders and other relevant market actors. **Figure 18** shows the distribution of respondents in different categories. "Others" refer to producers and traders of other commodities related to biofuel production, such as enzymes. "Observers" includes other market actors that do not belong to the designated categories. The largest category of respondents is producers and traders of solid biomass, followed by those of liquid biofuels (and raw materials for liquid biofuels) and observers.

Figure 19 shows the results for the connecting questions: *"Have you observed in the period of 2008-2012 any major changes for your business (or the ones you audit) in production or trade flows as a result of the introduction of new sustainability governance for bioenergy production or trade? If you made changes in your business as a result of the challenges and opportunities associated with any new governance, was the outcome positive or negative? Please clarify."* About 40% of the respondents have experienced changes in their production and trade flows. These are mainly due to two reasons: (i) the demand for certified biofuels by the customers; and (ii) the demand created by policies such as the RFS2 in the US and the RED in Europe. However, not all changes received positive outcome. 17% of the respondents indicate that new sustainability governance for bioenergy has brought positive outcome. Generally they believe that sustainability governance helps to improve their business in terms of long term values, bringing in specific market access. A representative of one of the NGOs, the Swedish Green motorists said that *"worst emitters among biofuels (has been) eliminated."* 13% of the respondents did not ascribe either a positive or negative impact to the implementation of sustainability governance. Some think that it is still either too early to see the impact, or the business is too small to receive significant impact. Some have expressed their concerns of additional cost, but have indicated that they receive better communications and market access in return, and therefore see sustainability certification as a marketing tool. Approximately 4% of the respondents expressed their concerns over the negative outcomes from the sustainability governance. They argued that they have difficulties in adapting the new governance, and hence are losing the market. The other 6% of the respondents did not answer the second question. The representative of the Australian Forest Products Association has indicated that *"putting restrictions on the sustainable use of native forest residues is an illogical and unnecessary measure that is affecting the commercial viability of the Australian SFM industry."*

16% of the respondents answered "No changes" to the production or trade of bioenergy as a result of sustainability certification. Some indicates that their production system has been already following sustainable practices and therefore experienced no impact on production and trade flows, but an

additional cost was added in the process of obtaining certification. For example, a representative of the US National Biodiesel Board said that "Sustainability measures are only a hurdle to my members. Their practices already comply with sustainability principles." Nevertheless, a respondent from Rutgers EcoComplex has expressed his worries about the uncertainty from the iLUC issue that may limit investments.

The results show that although the impact on trade so far has not been significant, sustainability certification has the potential to significantly impact on bioenergy trade and markets, particularly impacting biomass supply. This corresponds to the results obtained from the interviews and literature review, as discussed in Section 5.3.

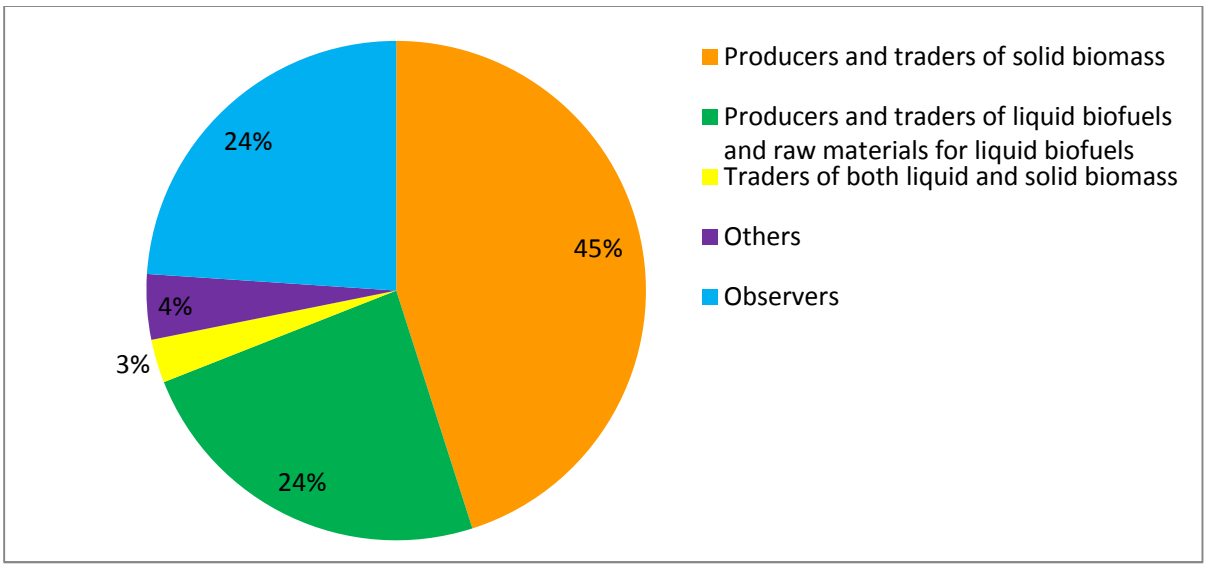

Figure 18. Distribution of respondents in different categories [Sample size: 70]

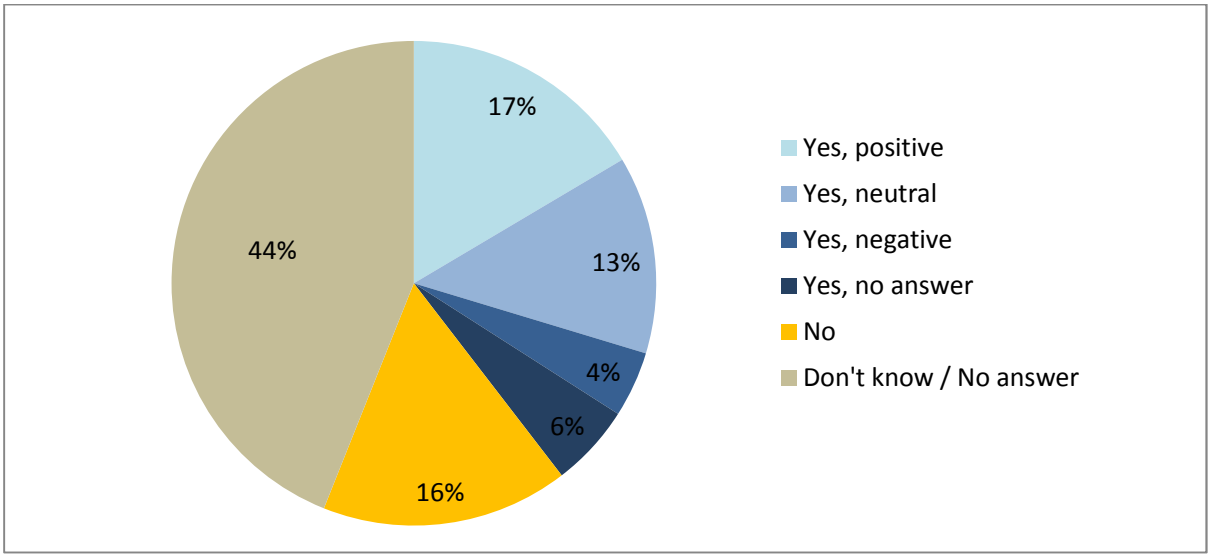

Figure 19. Results for the question: "Have you observed in the period of 2008-2012 any major changes for your business (or the ones you audit) in production or trade flows as a result of the introduction of new sustainability governance for bioenergy production or trade? If you made changes in your business as a result of the challenges and opportunities associated with any new governance, was the outcome positive or negative? Please clarify." [Sample size: 70]

5.2 Trade dynamics of sustainable certified liquid biofuels

Demand for sustainable certified biofuels: Legislation factor

First of all, a difference must be made between sustainability certification for liquid biofuels and certification for other commodities, such as food and wood. While the main purpose of voluntary certification schemes for food or wood is to achieve market differentiation, the main purpose of sustainability schemes servicing the fuel market in Europe is to assist fuel companies to meet their legal compliance obligations. In reality, the vast majority of consumers are not making choices on the relative merits of the biofuels contained within the fuel mix. Demands are created by mandate and incentive. It is essential to understand that fuel companies are driven by legislation to blend biofuels. Therefore, biofuels reported will be mostly the compliant biofuels which are cost effective and available in the traded market at any point in time. This means that the demand for sustainable certified biofuels will be determined by mandate and unlikely to exceed the mandate level (Rankine, 2012).

Available supply of sustainable certified biofuels

Biodiesel

Another big concern about sustainability certifications is whether or not the quantity of certified biofuels will be drastically limited due to the strict RED requirements which have effectively only been enforced since the beginning of 2012. According to market responses, at the current consumption (mandate) level, the market still provides sufficient fluidity in sustainable biofuels supply (Andrade, 2012). According to a large producer, biofuels trade and market has become complicated due to the implementation of sustainability requirements. Although there is still fluidity, the limited choice of sustainable certified raw materials (and biofuels) exacerbates the difficulty of procurement caused by the fluctuating prices of raw materials (and biofuels). This is likely partially due to insufficient coverage of feedstocks and incompatibility of certification schemes. The trade network is often changing depending on prevailing circumstances, i.e. prices and availability of sustainable supply. Exploration and diversification of supply regions (and suppliers) has become a common strategy used to control financial risk.

Since the biofuels market is dynamic, involving international and inter-sectoral trade, there is always competition between biofuels made from different feedstock. In fact, some feedstock has been made more competitive in terms of "sustainability" by the GHG default values set in the EC-RED. Recently, soy methyl esters (SME) has struggled to reach the EU market as the EC set the greenhouse gas savings default value for SME at 31%, short of the 35% reduction required (35% emissions saving versus the fossil fuel baseline) (EC, 2009; Rankine, 2012). Importers of soy now have to create a chain of custody that tracks actual emissions from farm to fuel for every consignment. The soy industry claims that the commission default value is unrepresentative of actual emissions (they propose a 52% emissions saving) because most soy is grown on untilled land (ASA, 2011; Rankine, 2012). For palm oil biodiesel, the EU has estimated an emission saving level of only 19% compared to fossil diesel, based on land use change assumptions. This makes palm oil methyl esters (PME) relatively undesirable in the EU market. However, the oil palm industry argues that emissions associated to palm oil production have been offset by the sequestration capacity of the oil palm plantations, proposing that oil palms are trees and not only oil seeds crops (Basiron, 2012).

While the existing sustainability criteria limit the use of certain types of biofuels, biofuels that are considered to have better emission saving will be further approved or even qualify for additional incentives. For example, rapeseed is granted relatively higher GHG savings but many scientists have

been questioning this (Pehnelt and Vietze, 2012). The process for updating default values by the Commission is still ongoing. The process for creating and updating default emission values is therefore a potential temporary barrier to the import of some types of biofuels. As a matter of fact, in the past two years the import of palm oil has been low in the UK and the Netherlands. The import of soy bean has also started to decline in the UK (in the Netherlands the consumption of SME has always been small).

Bio-ethanol

The impact of sustainability requirements on bio-ethanol is less significant, as the current level of consumption in Europe is relatively low compared to biodiesel. But in the future, trade could be hampered by stricter requirements or inconsistent execution by the Member States (GAIN, 2012a). This impact could be exacerbated if demand increases.

It is also very important to point out that US is also a large market for liquid bio-ethanol (see also section 3.3). In the US, Renewable Fuel Standard (RFS2) has made biofuels into a few categories with different incentives. Only biofuels derived from feedstock that meet the definition of renewable biomass qualify under the RFS2 program. This has created demand for specific types of biofuels in the US such as sugarcane bio-ethanol (Pacini et al., 2012). The existence of the other main liquid biofuel market with specific sustainability demands (the EU market) and the remaining world market not requiring certification may affect the availability of supply, especially the export of Brazilian ethanol. This will be further discussed later under "*Local economic realities and policies*".

Feedstock prices

The downstream marketers unanimously indicated that the biggest factor that affects the trade flows are feedstock prices (direct information from anonymous sources). In 2011, when some EU markets still accepted non-certified biofuels, the price difference between certified and non-certified biofuels was about $25 - $50 per tonne, as can be found in quotations by the likes of Platts and Argus. This premium is relatively less significant compared to pricing pressures from feedstock. For example palm oil and rapeseed oil prices have fluctuated in the range of $700-800 per tonne in 2009-2012, or $200-300 per tonne in 2011-2012. Soy price has doubled in 2012 compared to 2011, from $300 to $600 per tonne (Index Mundi, 2012). High cost schemes which over-achieve (i.e. include more criteria than is necessary within the RED requirements) are unlikely to be taken up. The RSB might be regarded as one example of scheme that is struggling to find a market (direct information from anonymous source). However, it is expected that the economic impact of certification will increase proportionally to the mandate level, and will impact all players along the supply chain in some way.

Feedstock prices are closely related to annual harvest volumes. Most of the feedstocks commonly used for biofuels are commodities, and the prices fluctuate daily based on global supply and demand. During a bad harvest, production may drop and feedstock prices may rise. This is particularly true for corn, wheat, sugarcane, soy and rapeseed, i.e. the annual crops. Feedstock supplies are anticipated to remain tight in Europe in 2012 and 2013 (GAIN, 2012a). To avoid or minimize such risk, the UK compliance market allows those producers short of products to buy compliance tickets from those that having surplus. Moreover, obligated fossil fuel suppliers can pay a buy-out price that set in the RTFO Order in times of severe disruption (DECC, 2012a). This could be effective in smoothing out any short term supply disruptions. There are indications that the market for certificate trading (compliance tickets) has begun to mature (Rankine, 2012).

Vertical integration

As feedstock prices are the most significant component affecting biomass trade and production, the value-creation in biofuels has generally focused on upstream activities. Control of the feedstock costs seems to be an essential strategy for downstream players. Some oil companies, such as BP can have completed vertical integration with R&D, biofuel production and downstream fuels. In contrast to solid biofuels (see Section 5.3), the incentive is small for the liquid fuel companies to control the whole supply chain for improving sustainability reporting (Rankine, 2012). Additionally, uncertainties in generic iLUC factors or other additional sustainability criteria that may be implemented in the future could in principle further limit the access of specific biofuels to the EU or US markets may thus increase investment risk and prevent the interest in vertical integration.

Local economic realities and policies

Aside from feedstock prices, local economic realities and policies have also been greatly affecting the trade flows. Brazil and the US are two large markets for biofuels. Sugar cane (SC) ethanol and SME were big contributors to the biofuel mix in the UK, during the first year of the RTFO (See Section 3). Shortly after, the US RFS2 began importing SC into the USA as it qualified under the 'advanced category'. The EU also introduced anti-dumping measures on US SME. Eventually, the import of SME from the US halted. The dynamics of the internal market in Brazil are also influencing the international trade. Brazil has been increasing its consumption of biofuels domestically, and to date (2012) the Brazilian bio-ethanol production is currently not enough to meet domestic demand. It may take a long time for Brazil to once again export large amounts of biofuels towards US and EU markets. Therefore, trade of SC ethanol between Brazil and UK has virtually dried up (Pacini et al., 2012). On the other hand, the US bio-ethanol market was in 2012 more attractive (see also section 3.3). The US has two main certification systems - a scheme by the Environmental Protection Agency (EPA) and a scheme by the California Air Resources Board (CARB). Those two certifications are important for producers, as they deliver a premium of about 10% compared to the Brazilian market (where no type of certification is required) (Pacini et al., 2012). It is therefore worthwhile for Brazilian ethanol producers at this moment to obtain certification for the US market. Nevertheless, on the longer term, also export of certified ethanol to the EU may become significant.

EU trade policies

Since 2009, there has been a steep increase of US ethanol being imported into the EU. These products were found to leave the USA as denatured (CN 2207 20 00) or undenatured ethanol (CN 2207 10 00), but most entered the EU as a chemical compound (CN 3824 90 97) with a lower import tariff. On the EU side (most likely onshore) petrol is added to the ethanol (the percentage of petrol varies between 10 and 15%). This has been happened mainly in the UK, the Netherlands and Finland. The EU bio-ethanol industry as a result has been facing problems of deteriorating margins and competitive imports (Vierhout, 2012). In 2012, these bio-ethanol blends were reclassified under the higher tariff rate, thus slowing trade of ethanol from USA to Europe dramatically. However, it is not certain over the long term how this will impact imports from the US, due to the fact that EU domestic production is insufficient and Brazilian ethanol is too expensive for the EU market (as it is also subject to import duties) (GAIN, 2012a).

Double counting

In 2011, the double counting mechanism introduced for Used Cooking Oil (UCO) has substantially impacted the market, especially in the UK and the Netherlands. 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. In the UK, duty subsidies were removed from all reported biofuels except UCO. This triggered a dramatic increase in the use of UCO, and the price of UCO went from having almost no value to a price that sometimes exceeded the value of virgin oil. Similarly, the biodiesel market in the Netherlands focuses on double counting, and 40% of the compliance with the target for renewable energy in transport in 2011 was achieved with double-counted biofuels (NEa, 2012). UCO (which was thought to be a niche biofuel) became the largest reported biofuel in the UK and the Netherlands. Concerns have recently been raised that the market has been distorted by lack of verification measures for wastes (compared to crop feedstock) and that this incentive has caused unintended consequences. Indeed, it is very difficult to trace the origins of the UCO. This creates a loophole that may lead to the deliberate production of waste and the importing of poorly checked 'waste' from other countries. This flow of feedstock (which likely include fresh non-certified vegetable oils) is generally not traceable, as there are still no mechanisms to do so currently (Rankine, 2012; Tsay, 2012).

Compatibility of sustainability certification schemes

A number of certification schemes are recognized by the EC. Although proliferation of sustainability certification schemes may greatly increase the complexity of liquid biofuels trade, many of the existing schemes are already well-established and have been working in a stable way, indicating that accepting more schemes may open up more trade channels. Most schemes, however, lack harmonization and mutual acceptance. Some schemes recognize themselves as brands in a competitive market. They are unwilling to link up with other schemes to avoid brand dilution. Furthermore, some schemes are completely designed for the operations of a particular company only. Certain schemes are more widely used due to their compatibility with other schemes. For example, ISCC's Chain of Custody can be combined with 'good farming' schemes such as RedTractor. However, there are also cases where different schemes are used and accepted in the same supply chain, and they do not necessary recognize each other. For example, ISCC accepts volumes of biofuels from the other EC recognized schemes, but not the other way round (Andrade, 2012). This seems to create a trade barrier especially when scheme coverage is regional, thus restricting trade between regions with different dominant schemes.

Administrative barriers

The administrative burdens that stem from sustainability certification are significant. These have created barriers in biofuels trade. For example, in Germany, it takes about half to a year to incorporate approved EU certification schemes into the Nabisy[3] database. Resource constraints in the European Commission can also cause serious delays for approving schemes and approving improvements to schemes (personal communication from anonymous source).

Future trends

Uncertainties in the iLUC issue: The EC may impose a 5% cap on the amount of crop-based biofuels used in fuel, and it remains to be seen whether the new standards will address the indirect land use change (iLUC) issues associated with bioenergy production. In any case, the trade of crop-based

[3] The proof of sustainability and of keeping a mass balance system for biofuels, biogas or bioliquids for electricity production according to the EU Directive 2009/28/EC is provided via Nabisy. Economic operators who place biofuels / biogas on the market in Germany may have their biofuels / biogas counted towards their quota obligation or may obtain tax relief only if they can prove that the biofuels meet the sustainability criteria laid down in EU Directive 2009/28/EC. The same applies to bioliquids for energy/ electricity production if operators apply for funding according to the Renewable Energies Act (EEG). See also: https://nabisy.ble.de/app/locale?set=en

biofuels might be severely affected with the introduction of these new requirements. This proposal has not yet been finalized at the time of writing (November 2012).

Advanced biofuels / Second generation biofuels: Advanced or second generation biofuels have attracted the attention of the market, mainly due to their potential for double counting. The United States has a program to incentivize the production of lignocellulosic (LC) ethanol (Rankine, 2012). The recent proposal from the EC to put a 5% cap on crop-based biofuels is reportedly intended to encourage the use of advanced biofuels.

New markets: Sustainability requirements might open new markets for biofuels. One example is the aviation bio-jet kerosene, which is not yet mandatory in the EU (Andrade, 2012). Commercial aviation is predicted to grow at a 5% rate annually until 2030, exceeding expected fuel efficiency improvements of approximately 3%; this implies that fuel consumption and emissions will continue to rise. The use of biofuels in commercial aviation has received considerable attention in recent years, as it is currently one of the best short to medium term alternatives (Rosillo-Calle et al., 2012).

Waste/UCO biofuels: Due to the recent double counting controversy; there may be stricter verification of waste introduced to ensure that waste is not being produced specifically to capture incentives. However, similar to the case of advanced biofuels, a 5% cap on crop-based biofuels, if introduced, might act to increase the share of waste-based biofuels to fill in the gap.

Biofuels consumptions: Some biofuels are already competitive with crude oil without subsidies. For instance, many consumers in Brazil have flexible vehicles which can switch from 100% gasoline to 100% ethanol. Brazilian consumers are making decisions at the filling station primarily based on price. In the USA, the basic cost of ethanol is often competitive or lower than gasoline. There is a possibility that soon subsidies will no longer be required for some conventional ethanol types and that these biofuels will become just another fuel blend stock like any other (Rankine, 2012).

Impact on trade flows in other sectors

Companies across different sectors are also getting together to embrace improvements together. Schemes such as Bonsucro which cover sugar and ethanol are supported by industries from both the food and biofuels sector. Sugarcane producers are most likely attracted to certification mostly because of an increasing interest in certified sugar (with Bonsucro as a dual-purpose scheme) (Rankine, 2012). There are similar trends developing for palm oil (RSPO), soy bean (RTRS) and other agricultural goods.

Sustainability requirements have also had considerable impact on rapeseed trade flows, particularly intra-EU trades. Sustainable rapeseed production is recognized when farmers sign 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). Reportedly, some French farmers were reluctant to sign the required self-declaration in the first half of market year 2010/11, and the Polish Government has not yet submitted the NUTS2 standard values. As a result, sustainable rapeseed from the other countries such as the Czech Republic and Hungary may replace French and Polish rapeseed for biofuels production, while French and Polish rapeseed may fill in the gap in food and feed sector. However, these changes are likely temporary as more and more rapeseed farmers are expected to sign the self-declaration (GAIN, 2012b).

5.3 Trade dynamics of sustainable solid biofuels

Demand for sustainable certified biofuels: Policies and legislation factor

Currently, wood pellets are far more expensive than coal and utilities need government support to develop biomass energy (Robinson, 2012). As with liquid biofuels, the ultimate purpose of sustainability schemes developed for wood pellets are to assist the utilities to meet their (expected) legal compliance obligations, particularly in Belgium, the UK and possibly in the Netherlands in the near future. Different member states in Europe have significant variations in policies and regulations for bioenergy from solid biomass. For example, the UK has very stringent sustainability requirements compared to the other member countries. Currently the Green Gold Label is the only voluntary scheme approved by Ofgem for the UK market. The Netherlands is also considering implementing a reporting system based on the Biomass Protocol that is closely related to the EC recommended sustainability criteria. In other words, the decision of governments on scheme acceptance will determine the trade flows: the volume of sustainable certified biomass will increase steadily corresponding to the policies; and it is likely that only biomass certified by the approved schemes will be imported to that particular market.

In the Netherlands, the impacts for solid biomass under the new Dutch government (installed in November 2012) are still unclear. Legislation may be the driving force pushing utilities to use biomass in power plants (Schouwenberg, 2012). While there are still uncertainties in the Netherlands, the UK has announced the new Renewables Obligation subsidy levels in July 2012 (DECC, 2012b). A smaller subsidy for biomass co-firing may affect the demand for solid biofuels in the near future. Several utilities have re-examine plans for using biomass. Under the new subsidy levels, the government will incentivize full conversion of individual generating units to biomass, and offer lower rewards for only partial conversion (co-firing with fossil fuels). It is still uncertain how the utilities will react to these changes, since a unit cannot be converted back once it is fully converted to 100% biomass.

An all-decisive factor will be whether the European Commission will introduce mandatory sustainability criteria for solid biomass, and if so, what these criteria will include. A decision is expected at the earliest in January 2013. If EU-wide criteria are introduced, they will supersede all regulations on national level.

Available supply of sustainable certified biofuels

Currently there are a few industrial schemes available for solid biomass, particular for wood pellets as listed in the previous section. However, most of these schemes are designed primarily for their own companies, such as Laborelec Label and Green Gold Label. Furthermore, the use of NTA 8080 for wood pellets is still limited, and ISCC PLUS is still under development. As indicated by an energy company in the Netherlands, there have been some difficulties experienced in sourcing sustainable certified wood pellets (direct information from anonymous source). Nevertheless, huge volumes of biomass resources are available. It is expected that a harmonized system, which is being developed under IWPB, may greatly facilitate the trade process.

Sustainability requirements

Due to differences in sustainability requirements, certain producing areas or resources might be excluded from supplying specific markets. As mentioned earlier, UK, and Belgium may have the most stringent sustainability requirements among the Member States. Biomass produced in certain areas may not meet the requirements in these countries, and hence are prevented from entering these markets. For instance, an energy company in the Netherlands (Essent) has stopped sourcing wood

pellets from a Russia supplier due to the GHG emission reduction requirements, which their pellets do not meet (Schouwenberg, 2012). Another example is the recent discussion over the definition of "primary forest" within the RED requirements as it applies to Canada. Applying a generic definition of "primary forest" on Canadian forests may create barriers to the export of sustainable biomass produced in Canada (Goh et al., 2012).

Compatibility of sustainability certification schemes

Many different sustainability systems exist along the supply chain, covering different parts of the supply chain, feedstocks and geographic areas. At the first sight, this may create a potential trade barrier. As certification is a highly administrative process, accommodating different systems in the same supply chain could be time consuming and costly. However, mutual acceptance of principles and criteria of existing schemes (which may already be well-established and cover particular aspects of the supply chain) can turn out to be an opportunity to reduce administrative requirements. In the future, benchmarking and acceptance of schemes under policy requirements for renewable energy may further alter the trade flows to shift to sustainable biomass supply sources.

On the other hand, incompatibility between schemes designed at the same level in a supply chain may reduce flexibility in logistics. Due to technical and cost considerations, horizontal trading between large biomass power plants has become essential; however incompatibilities between different sustainability certifications designed for energy use of wood pellets has become one factor that restricts the trading of wood pellets between power plants. Harmonization of schemes seems to be an effective solution, but presents a serious challenge. The challenges to bring each scheme into conformity mainly comes from the disparity in sustainability requirements among the Member States.

Vertical integration

Some power companies have decided to invest in vertical integration. Many energy companies consider that adapting and developing bioenergy is a strategy to enhance the long term value of the company. Investing in vertical integration provides not only security of supply but also increases traceability of supply chain. An example of vertical expansion would be the establishment of the world's largest wood pellet factory in Georgia (USA) by RWE Innogy. These wood pellets are shipped to the Netherlands, and are co-fired in the Amer power station (Georgia Biomass, 2012).

Future trend

We expect the market will be further expanded, especially in East Asia, although the EU will still remain the main wood pellets market. The EU is leading the development and harmonization of sustainability certification schemes for wood pellets, which has become the one of the major factors in shaping global trade and market. More sustainable certified wood pellets are expected to be imported from North America to Europe in the next few years. Besides wood pellets, the utilities also started to explore opportunities in using waste products, lower grade fuels or biomass (Schouwenberg, 2012). In the Netherlands, the new coal tax (removal of the tax exemption currently received by coal-fired plants) will come into force on 1 January 2013. Although the intention is to encourage the use of cleaner resources such as biomass, the utilities argue that this may result in lower electricity production from coal, and consequently a decrease in biomass co-firing (Argus, 2012).

Note: All the information in Chapter 5 was derived from a number of sources, using reports, interviews and dialogues conducted with various market actors.

6. Summary and conclusion

Currently, bioenergy markets are largely influenced by national policies. Apart from the impacts of energy policy and existing import duties and taxes, the trade dynamics for the bioenergy industry are influenced by three general factors: feedstock prices, sustainability governance (and legislation), and local economic reality. These issues are intertwined with each other and hence it is important to look into each aspect not only separately, but also collectively to see the opportunities and challenges that may determine the trade dynamics.

The trade dynamics of liquid and solid biofuels are significantly different. The liquid biofuels markets are reasonably developed markets and are closely related to agriculture commodities; therefore the markets are highly complex. Indeed, the impact of sustainability governance is not obvious at this moment. The liquid biofuels market is largely influenced by feedstock prices, which are closely related to food and feed commodities market. At the time of writing, liquid biofuel trade to the EU is still mainly influenced by feedstock prices. For most of the crops, weather has been the determining factor for the supply, and hence the feedstock prices. However, sustainability governance has had a negative impact on certain supply chains, such as Argentinean SME and Southeast Asian PME, especially since 2011 as only sustainable certified biofuels are now accepted in the UK and the Netherlands. This is mainly caused by the default GHG saving values set by the EC. So the impact of sustainability governance on these specific biofuels has been significant. However, it has so far not affected overall supply of sustainable biofuels, as fuels which fall under the double counting mechanism (such as waste-based biofuels) have increasingly dominated the market. Additionally, the US has also developed a parallel market that effectively captures the Brazilian ethanol with a price premium (although Brazil's sugar-based ethanol production is currently more costly than US corn-based domestic supply). Brazil itself is currently facing a shortage of ethanol due to drought and poor investment in its cane belt (Reuters, 2012). However, the ethanol trade between Brazil and the EU might recover in the near future, and the Brazilian Government, together with the private sector is fully engaged on the discussions for ethanol certification for European market (Dornelles, 2013). We conclude that overall, for liquid biofuels, at the current mandate level, other factors have outweighed the sustainability governance to determine the trade dynamics, namely feedstock prices and local economic realities in individual markets. However, the impact from sustainability governance most likely will grow with the mandate level in the near future. The recent proposal from the EC to put a 5% limit on food based biofuels (in an effort to address iLUC considerations) may depress the food crop-based biofuel trade and have a major impact on trade flows.

The market is less complex and trade dynamics are more straightforward for solid biofuels. The main market is the EU, and the primary driver of development are national support policies mainly for the promotion of renewable electricity production. Wood pellets are more expensive than coal, and this is not likely to change in the short term. Government subsidies determine the demand for solid biofuels, and subsidies typically come with sustainability requirements. It is still too early to discuss the impacts of new sustainability requirements within, for example, the UK and Netherlands, as utilities are still reacting to the policies. It is also important to consider that most wood pellets procurement strategies involve long term contracts. Therefore, trade flows are unlikely to change on short notice. There is also a tendency for utilities to carry out vertical integration for solid biomass operations. Due to the nature of the market, solid biofuels consumers, in particular wood pellets buyers have been working on harmonizing the existing certification schemes and systems. Beyond sustainability considerations, harmonization of technical aspects and quality specifications is also one important consideration which requires coordination and harmonization. By putting effort in integrating diverse existing systems and regulations requirements, the industry players aim to create a commodity market for solid biofuels. Due to the vertical integration and harmonization effort, sustainability certification is less likely to become a trade barrier in the future. Some areas might be

excluded due to sustainability considerations in the processing section of supply chain rather than the harvesting. For example, pellets from a Russian producer were not accepted by the Dutch and Belgian utilities due to the use of natural gas for drying, which lowered the overall GHG savings. The other important consideration would be the logistics issue (considering the emissions created through the transportation of solid biomass both by truck and long-distance shipping). However, there are no trade conflicts with solid biomass as with liquid biofuels (such as the import of ethanol under different CN codes to get lower tariff, as explained in Section 5.2). Finally, the possible introduction of sustainability criteria on an EU level may be a major factor influencing solid biomass trade flows. Especially if strict thresholds for GHG emission reductions are introduced, or strict definitions of primary forests are introduced, a number of currently exporting regions such as Canada and Russia could be affected. We conclude that the sustainable solid biofuels market will continue to grow without dramatic changes in trade flows based on current development, but that demand highly relies on government policies.

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Appendix I

Interviewee: Allan Rankine
Interviewer: Chun Sheng Goh, Copernicus Instituut, Universiteit Utrecht
Date: 31/7/2012, 15:00 hour CET
Venue: E-mail + Telephone

Description:

Position:	Regulatory Affairs, BP Biofuels
Responsibility:	Responsible for managing BP Biofuels European regulatory affairs including issues relating to sustainability, legislative support frameworks for biofuels and advising on the penetration of different biofuels into the fuel market.
Experience:	4 years with current position; before this worked in BP Trading London division
Company profile:	BP is one of the world's leading international oil and gas companies, providing its customers with fuel for transportation, energy for heat and light, retail services and petrochemicals products for everyday items. BP Alternative Energy continues to invest in a sustainable and secure energy future – producing low-carbon fuels and power, while developing sustainable energy technologies. (Source: BP website)

What have you observed for the consumption of sustainability certified liquid biofuels over the years? What is your expectation in the near future?

2007 – no useful biofuels sustainability schemes in operation (to end user/biofuels trader)
2012 – now around 10 EU schemes approved and c. 40 in the pipeline.

Slow start was due to voluntary reporting.

Mandated sustainability criteria are essential to survival of sustainability schemes. In the fuel market, consumers are not making choices on the relative merits of the biofuels contained within the fuel that they buy (most fuel customers are not aware that they are buying biofuel). The main purpose of sustainability schemes servicing the fuel market is therefore to assist fuel companies to meet their legal compliance obligations and are not to achieve market differentiation in the forecourt. This means that there is no big demand for sustainability schemes which exceeds the basic requirements.

We have seen a rapid change in Europe. From voluntary reporting of some sustainability of biofuels in some member states to all biofuels being reported in all member states having to meet the toughest environmental conditions put on any product anywhere in the world. (Guther Oettinger, EU commissioner for Energy http://ec.europa.eu/commission_2010-2014/oettinger/headlines/news/2011/07/20110719_en.htm). Given the fluidity of the fuel market, the requirement for independent third party checks tracing biofuels from field to fuel is truly an achievement in such a short space of time.

Expectation:

The share of certified biofuels In Europe must be close to 100% because the cost of compliance foregoing an approved scheme is high, many member states have no compliance mechanisms that allow biofuels to be approved without schemes and there is little value upside from "doing your own thing".

The initial growth in variety of sustainability schemes will be followed by consolidation, driven by requirement for efficient trading in fungible fuel markets, lowest cost operations and compliance requirements.

Surviving schemes will be:

1. Compliance approved by the relevant authorities (reputable)
2. Have the least risk of non-compliance – better tracking tools and robust guarantees at time of transaction.
3. Cost competitive
4. Cover multiple biofuels types
5. Operate globally
6. Ability to be tailored or enhanced to individual company specifications and claims to allow product differentiation.

What are the challenges and opportunities arose from sustainability schemes?

Difficulties: Too much attention paid to the front end compared to the back end. There is no point in producing very sustainable biofuels if you do not have the mechanisms to prove that the biofuel is sustainable by the time it gets to the fuel blender. We are now getting over this.

Opportunities foreseen: Gaining confidence in biofuel sustainability allows more practical and confident approaches to be taken. Simpler low cost, harmonised approaches will aid the flow of sustainable biofuels into the system.

Sustainability schemes are critical to the biofuels industry. The RED will fail without good, practical schemes. Schemes will improve until eventually sustainability is treated as part of the normal quality control procedures and paper work that transfers on every transaction. The bureaucracy of compliance will come down as the relative risks of different types of biofuels are better understood. Some biofuels may expect more scrutiny in the future than others based on learnings being gathered now. This will allow the low risk biofuels to be handled with less fuss and cost.

How does sustainable certification requirement affect trade and market?

I. <u>Availability of sustainable biomass supply</u>

- Markets are dynamic – between countries and other sectors. There is competition for sustainable supplies. Some feedstocks are more challenging when it comes to certification.

Additional comment:

Sustainability schemes created for biofuels have shown a light on the agricultural practices that existed before biofuels and which largely fell 'below the public radar'. Biofuels sustainability mandates have forced some improvements to be made in the agriculture sector generally. Biofuels has been a catalyst for good in agriculture and some other markets have been forced to spend

money to adopt better environmental and social practices which they might have otherwise not have done. This extra scrutiny and cost may be one reason why some food and industrial companies complain so bitterly about biofuels. However, companies across different sectors are also getting together to embrace improvements together. Schemes such as Bonsucro which cover sugar and ethanol are supported by industries from both the food and biofuels sector.

Large multinational companies that are investing biofuels in developing companies have to operate within their own codes of conduct which are subject to shareholder scrutiny and sometimes much higher than local standards. It is clear that in many cases these companies are improving worker's rights, equality, safety, environmental conditions, education and training and enhancing the local communities that they operate in.

II. Compatibility between sustainability certification schemes

- Some schemes are compatible with other schemes e.g. ISCC which strength comes from its reliable Chain of Custody has also benefitted producers because it can be combined with good farming schemes such as RedTractor.
- Some schemes recognize they are a brand in a competitive market and do not want to link up with other schemes as it has a brand dilution effect.
- Company schemes are designer schemes completely tailored to the unique operations of a particular company. There is no real upside for collaboration with other schemes.

III. Biomass prices

- The fuel market accepts that there is a cost associated with sustainability. The main driver in the fuel market is cost. High cost schemes which over deliver are unlikely to be taken up. RSB might be regarded as an example of an elaborate scheme that is struggling to find a market.
- We have to remember that even the most basic RED compliance scheme is delivering 3rd party verified criteria way beyond that demanded of any other product. It is unrealistic for the biofuels industry to accept sustainability costs not borne by other publically supported industries e.g. the sustainability of biomass to power, the sustainability and emissions of electric battery manufacture, the direct lifecycle and indirect emissions impacts of electric vehicles, the indirect emissions of solar panels placed on farm land etc.

IV. Technical reasons

- There are resource constraints in the commission for a) approving schemes and b) approving improvements to schemes. This has caused serious delays to scheme approval and will cause further delays to improve approved schemes.
- GHG default values do not cover all feed pathways. This is a hindrance. The commission do not allow member states to apply the commissions GHG default methodology to pathways approved by member states. The process for updating default values by the commission is far too slow.
- Some feedstocks rely on aggregators who collect from thousands of farms. In this circumstance it is almost impossible to collect reliable data and potentially sustainable feedstocks and biofuels production are being ruled out by bureaucracy.

V. Supply security

- Biofuels producers that are producing biofuels have to make a margin. If there is a bad harvest then feedstock prices might rise and production may drop to compensate.
- Compliance markets where buy-outs are offered e.g. UK RTFO allow those producers producing a surplus of product to sell compliance tickets to those that are short. Or operators may be able to "buy-out" directly from the compliance authority at a high price in times of severe disruption. This is effective in smoothing out any short term supply disruptions.

- The market is able to deliver sustainable production. Compliance authorities should provide buy-out mechanisms to allow for short term disruptions. To ensure that investments in the biofuels industry are protected, the cost of buy-outs has to be set carefully so that they are only used in extreme conditions.

Have you experienced shifting of supply region / suppliers / commodities from one to another? What is your expectation in the near future? Does sustainability certification requirement rule out certain regions (or feedstocks) from exporting their biofuels into the Europe?

It is useful to look at the UK RTFO which tracks different biofuels feedstock types being reported since 2008 (although not a complete picture because this was initially voluntary reporting).

EU reported biofuels are market, mandate, incentive and tariff driven. It is essential to understand that compliance drives companies and therefore biofuels reported will be mostly the compliant biofuels which are the most cost effective and available in the traded market at any point in time.

In the first year of the RTFO sugar cane (SC) ethanol and soy biodiesel (SME) were big contributors. The US RFS2 started sucking SC into the USA 'advanced category' and Brazil also became short of biofuels so trade of SC between Brazil and UK virtually dried up. There was an EU anti-dumping enquiry (US blending credits) into SME from US and the EU introduced anti-dumping measures. The trade in US SME dried up. Recently SME has struggled to come into Europe because the EU commissions Soy carbon intensity default value does not clear the renewable energy directive emission saving hurdle (35% emissions saving versus the fossil fuel baseline). This means that importers of Soy have to create a chain of custody that tracks actual emissions from farm to fuel for every consignment. Soy tends to grown on small family farms and collected by many aggregators before being sent to a processing plant. This makes tracking actual emission values almost impossible to do cost effectively. The commission default value is also thought to be unrepresentative of actual emissions by the Soy industry because most Soy is grown on untilled land. The commission process for creating and updating default emission values is therefore a potential temporary barrier to the import of some types of biofuels.

In the UK, duty subsidies were removed from all reported biofuels except Used Cooking Oil (UCO). This saw the value of UCO increase dramatically versus alternative biofuels and UCO went from having almost no value to having a value that sometimes exceed the value of virgin oil. The reporting of UCO which was thought to be a niche biofuel became the largest reported biofuel in the UK RTFO. Concerns have recently been raised that the market has been distorted by lack of verification on wastes (compared to crop feedstocks) and overincentivation causes unintended consequences e.g. can lead to the deliberate production of waste and the importing of poorly checked 'waste' from other countries. This has been compounded by the award of double counting certificates for waste derived biofuels under the RED version of the RTFO. The UK has had to take action, removing the duty incentive and requiring much tougher verification for waste pathways.

When Brazilian SC volumes started drying up, it was quickly replaced by corn ethanol volumes coming from the USA. Traders were legally exploiting a loophole in the tariff classifications which meant US Corn ethanol could undercut domestic EU production if the imported denatured ethanol was declared as a chemical (which has a lower tariff rate). That loophole has been closed and trade of ethanol from USA to Europe has slowed dramatically.

So all of this demonstrates that the changes in trade and different types of biofuels have had little to do with the sustainability credentials but were more driven by other factors (except the case of SME which its GHG default does not meet the sustainability minimum threshold).

Actually, in some cases, certification has helped biofuels made from certain feedstocks (which have been controversial for sustainability) such as palm oil from Malaysia and Indonesia in terms of providing independent verification mechanisms to prove sustainability.

What is your expectation of future trend of biofuel trade?

In the future I think we will see stricter verification of waste to ensure that waste is not being produced specifically to capture incentives. This means that waste biofuels will recede slightly in the immediate future to reflect the fact that genuine waste production is not a material supply source for an alternative fuel (biofuels). Waste may increase in share again post 2020 if the economics of turning agricultural waste into biofuels has advanced significantly from where we are today.

To 2020 and probably beyond we will see a great reliance on domestically produced biodiesel (rapeseed) and ethanol (grain and beet). Sustainable imports will probably be advantageous if they are used to produce biofuel molecules e.g. biobutanol and HVO. These molecules allow greater penetration because they have few vehicle and infrastructure compatibility issues.

The US has a significant program to incentivize the production of lignocellulosic ethanol. LC ethanol from energy cane and grasses has significant scope for commercialization at scale. The success of this program is likely to see LC ethanol attracted to Europe because of double counting of this type of biofuel in the RED.

What is the dominant scheme currently?

The dominant European scheme currently is ISCC. Operators like this scheme because:

1. It is EU approved
2. It gives guarantees of sustainability at the time of transaction with no comeback. Reduces financial exposure to non-compliance. (biofuels being rejected and acquiring fossil fuel price)
3. It has simple registration processes and tools.
4. It is cost competitive versus other schemes.
5. It can operate globally across multiple feedstocks.
6. It gets the balance right between pragmatic operation and robust verification.
7. It can be used in combination with other schemes e.g. some operators will use UK RedTractor EU approved scheme for the upstream farming verification and ISCC for the biofuels process and fuel supply chain. Combines excellent sustainability with excellent chain of custody guarantees.

Does BP consider vertical integration to upstream?

Some Oil companies, such as BP can have completed vertical integration with R&D, biofuel production and downstream fuels but this is not the same as “self-supply”.

A comparison can be made between biofuels production and upstream crude oil production. The crude oil production can be either kept in-house and processed through the companies own refinery and turned into fuel that is then sold in an own branded forecourt or more likely, the crude oil is sold directly into the crude market for the highest price. The companies downstream oil refinery is therefore free to purchase crude oil from the market and sell refined oil back into the market. The

company's fuel retail operation is free to buy refined fuel from the market. An oil company therefore has the choice to choose self-supply, part self-supply or full market interaction along the whole of the supply chain.

The same market dynamics are applicable to biofuels. An oil company can have an upstream biofuels production business (R&D, farming, land leasing, waste collection and biofuels production) similar to upstream crude oil production. The oil company produces biofuels that are sold into the market at the highest price – this is biofuels as a commercial enterprise. The oil companies other businesses (downstream fuels market – biofuels as a compliance activity) buy the lowest cost compliant biofuels from the market. As with crude oil purchase it is not necessary for the downstream oil business to purchase biofuels from own production. Market efficiencies such as this tend to keep prices at the pump down for the consumer.

There is also little incentive for fuel companies to control the whole supply chain (either physically or through legal contracts) specifically to improve reporting sustainability because:

- There is no value incentive at the pump for biofuels which exceed minimum criteria
- It is massively expensive, except when it can be done locally with a short supply chain. For e.g. biofuel producer, with an approved company scheme and a tight commercial relationship with a few massive farm.
- Oil companies trading in the market to keep prices down for the consumer need mass market sustainability schemes.
- Growing crops is not a core activity for many fuel suppliers and the extended fuel supply chain often involve tens of transactions – the financial risk of failure can be massive.
- For biofuels to become a real alternative fuel, without subsidy it has to be traded in the same way as fuel is traded. One company controlling the whole of the supply chain is restrictive and if all biofuels were handled this way it would compel biofuels to being a niche fuel.

Is horizontal trading an important component in biofuel trade? Is compatibility between schemes an issue?

This is essential for Biofuels to survive as a low carbon alternative to fossil fuel.

Initially, in early compliance schemes such as the voluntary UK RTFO self-supply was required because the UK RTFO was not big enough to encourage sustainability schemes to become international and provide secure chain of custody.

The EU RED has changed the game with its global reach and mandates on sustainability. Traders must have schemes to trade and so schemes have had to be fast tracked to deliver compliance.

Now EU has approved several schemes, so horizontal trading can happen without compliance risk. There is no reason why biofuels cannot be traded like any other fuel. The cost of biofuels will drop because of this.

Some biofuels are already competitive with crude oil without subsidy. For instance consumers at a pump in Brazil have flexi-vehicles which can switch from 100% gasoline to 100% ethanol – Brazilian consumers are making decisions at the filling station based on price only. In the USA the basic cost of ethanol is often competitive or lower than gasoline. There is a possibility that soon subsidies will no

longer be required for some conventional ethanol types and that these biofuels will become just another fuel blendstock like any other fuel blend stock.

Appendix II

Interviewee: Onofre Andrade
Interviewer: Chun Sheng Goh, Copernicus Instituut, Universiteit Utrecht
Date: 6/7/2012, 14:30 hour CET
Venue: Phone

Description:

Position:	Sustainability manager
Responsibility:	To ensure the biofuels streams are sustainable and certified
Experience:	About 2.5 years
Company profile:	Argos North Sea Group was created in 2011 as the result of a merger between Argos Oil and North Sea Group. It is the largest independent player (not listed on the stock exchange or state affiliated) in the Western European downstream oil market, combining storage and distribution with the international trade in and sale of mineral oils and biofuels.

What are the major impacts on trade that you have experienced due to the introduction of sustainable certification schemes?

The major impact would be on the administration, i.e. setting up internal procedures for sourcing sustainable biomass, and to keep track of documents for sustainability proof.

Initially, it was very unclear how the certification schemes were to be used, and it was very difficult to educate internally how trading and operation should do with it. However, now it is getting clearer.

Impact of certification on trade flows is not significant. There is no drastic change in trade volumes. In terms of supply, there is still liquidity in the market.

There are changes in suppliers compared to traditional trade flows, but these are not necessary due to sustainability certification. The changes mainly caused by local economic realities. For e.g. Brazil has increased their consumption of biofuel domestically, causing Brazilian ethanol to become more expensive to Europe, and thus limiting export.

Do your company intend to expand to upstream?

It's open but not our goal and priority at this moment.

Have you experienced difficulties in compatibility between certification schemes?

Competition between certification is welcomed. But, the schemes are lacking of harmonization and mutual acceptance. As our focus is only supplying to Europe, it is pretty straight forward that we need to supply sustainable certified biofuels that is complied with one of the eight RED schemes. However, there are cases where different schemes were being used and accepted in the same chain, and they do not necessary recognize each other. For instance, ISCC accepts volumes of biofuels from the other seven schemes, but not the other way round.

What are the opportunities from certification schemes?

Sustainability certification is a license to operate, as we have to comply with the law. Besides that, in view of increasing awareness of sustainability at global scale, certainly biofuels will play a more and more important role. We will keep improving our approach for sustainability and looking for best-in-class biofuels. We would focus on sustainability credentials, not only on one certification and not only bound to minimum criteria. We aim to open new market by presenting sustainability credentials, which also include voluntary schemes. There are good reasons to invest in sustainability certification, not only because to meet the requirement of legislation, but going further and making a difference certainly lead to more opportunities. For example, we are working on the aviation bio-jet kerosene, which is not yet mandatory. We have a partnership with KLM for supplying bio-jet kerosene.

Appendix III

Interviewee: Peter-Paul Schouwenberg
Interviewer: Chun Sheng Goh, Copernicus Instituut, Universiteit Utrecht
Date: 12 - 16/7/2012
Venue: E-mail

Description:

Position:	Senior Officer Regulatory Affairs and Project Manager Biobased Economy
Responsibility:	More than 10 years responsible for the sourcing, trading and development of biomass (solids and liquids) on a global scale
Experience:	See above
Company profile:	Essent is the largest energy company in the Netherlands (Belgium as second home market). Essent provides private and business customers with gas, electricity, heat and energy services. Essent is the leading producer of sustainable energy in the Netherlands. Essent is now part of the RWE Group.

In regards with the implementation of sustainability schemes, what are the changes you experienced over the past few years? And what is your expectation for the coming years? What are the factors for these changes / expectations? Please add remarks wherever you wish to.

(a) Total consumption of (solid) biofuels

Changes over the years (2007 – now): Large increase
Expectation in the coming years: Large increase

Factors	Remark
Economic factor: Biomass prices	Are consumers willing to pay for the extra costs? The market model will also change due to the increase of solar and wind energy and nobody wants to pay for base load as reserve when no wind and solar is available. The coal fired plants are mainly THE units who co-fire biomass. If they aren't in operations, the biomass co-firing will decrease.
Technical factors: Logistics issues or other technical issues	Without new investments it is impossible to increase the volume. The market has to pay for it, otherwise it will not happen.
Market factor: Supply security / competition with other sectors (e.g. food, wood)	Depending on the price of the biomass the market volume will increase. At the moment the outlook is that the prices should decrease and that the volume will not increase. Utilities looking more and more at waste products/lower grade fuels/biomass
Other factors	Legislation is the pushing force for using biomass

(b) Share of sustainable certified biofuels in total consumption

Changes over the years (2007 – now): Large increase
Expectation in the coming years: Large increase

Sustainable certified biomass contributes to how many % of your total biomass consumption?
98 % of total portfolio

(c) Shifting of (raw materials) supply region / suppliers / commodities from one to another

Changes over the years (2007 – now): No changes.
Expectation in the coming years: Shifting in supply region and suppliers. Also shifting of commodities to agri-residues and waste

Factors	**Remark**
Economic factor: Biomass prices	Yes. Multi fuel strategy
Technical factors: Logistics issues or other technical issues	Yes. Multi fuel strategy
Market factor: Supply security / competition with other sectors (e.g. food, wood)	Yes. Multi fuel strategy
Other factors	Yes. Multi fuel strategy

To my knowledge, Essent will stop sourcing pellets from Russia. Why? Are there any other supply chains that will be stopped too?
Yes, due to sustainability issues. By the way current supply chains will not end; utilities will implement a multi fuel strategy: wood pellets, clean biomass, agri-residues, waste residues. As said supply chains will only stop due to sustainability issues.

From where this supply gap will be filled? How about utilization of other raw materials – such as agro residues and waste – in the form of agropellets?
This is confidential, because this is a new strategy

(d) Diversion in (raw materials) sourcing region

Changes over the years (2007 – now): No diversion
Expectation in the coming years: Yes

Factors	**Remark**
Availability of sustainable biomass supply	Yes. Huge volumes are available
Compatibility between proliferated sustainability certification schemes	Yes. It's a must
Economic factor: Biomass prices	Yes. As cheap as possible.
Technical factors: Logistics issues or other	Yes. Trials will proof which investments are necessary

technical issues	
Other factors	Legislation factor: Permits has to be changed

(e) Vertical expansion to upstream (self-supply)

Changes over the years (2007 – now): Yes we expand to upstream
Expectation in the coming years: No

Factors	Remark
Market factor: Supply security / competition with other sectors (e.g. food, wood)	Yes.
Economic factor	No vertical integration in the near future - no money available.

(f) Horizontal trading (trade between traders / between buyers)

Changes over the years (2007 – now): Yes we did.
Expectation in the coming years: Yes we will.

(g) Other changes (Please specify)

This will be depending of legislation changes and market changes (for example influence of wind and solar).

When do you expect IWPB will be implemented?

1-1-2013

How is the development of Green Deal for co-firing of biomass in the Netherlands?

Nothing is clear regarding the GD. At the moment we know only that the Government will implement a coal tax. After the elections on September 12 maybe we will know more. I don't expect anything

Appendix IV

Interviewee: Duncan Robinson
Interviewer: Chun Sheng Goh, Copernicus Instituut, Universiteit Utrecht
Date: 20/7/2012, 17:00 hour CET
Venue: Telephone

Description:

Position:	Corporate Responsibility Manager at RWE npower
Responsibility:	Provision of strategic advice to RWE npower senior management on sustainability issues and their commercial implications; Responsible for sustainability performance management at Tilbury power station (conversion project)
Experience:	Over 20 years
Company profile:	RWE npower is a leading integrated UK energy company. We supply gas, electricity and related services to residential and business customers and operate and manage a flexible portfolio of coal, gas and oil-fired power stations. We also manage a portfolio of cogeneration plant. (Source: RWE npower website)

When did you start to use biomass for power generation?

Npower started co-firing a range of biomass such as olive residues and shea meal, since 10 years ago but only at very low level. At the end of 2010, we decided to convert a power station (Tilbury B power station) from coal to 100% dedicated biomass. The conversion took about a year. In the 4th quarter of 2011, we have completed the conversion and created a 750 MW of power station powered by wood pellets and limited amounts of supporting liquid biofuels.

How much wood pellets do you use?

It depends on market conditions and operation. We roughly take 1 - 1.5 mio metric tonnes a year in this phase of operation (2011).

Will the use of wood pellets increase?

Tilbury power station is 'opted out' of the EU Large Combustion Plant Directive. This means that it will close before 2015 (mid – end 2013 likely). We intend to run at close to maximum capacity (1.5 mio metric tonnes per year) until plant closure. We are currently considering plans to extend the life of the power station (to the mid 2020s). If we so do, future capacity will be between 1.5 – 2.0 mio metric tonnes per year.

How much of these wood pellets are certified?

The sourcing and supply of wood pellets are managed by RWE trading in Geneva. Basically we use 100% of wood pellets that come from Green Gold Label certified suppliers with information and additional data to demonstrate that these wood pellets are sustainable.

On occasion, we use biomass come from GGL equivalent sources (e.g. SGS verified materials) to fill the supply gap due to logistical consideration. We do not store wood pellets in Tilbury. Wood pellets are either directly shipped to Tilbury from producers, e.g. from North America; or we use small coastal freighters to take materials backward and forward from RWEST's storage, in Amsterdam, Rotterdam and Antwerp.

What are the drivers for your company to use certified biomass?

RWE npower is a private company. Our primary goal is to make profits. To tackle climate change issue, low carbon economy is growing globally and in the UK. Adapting and developing low carbon business is a strategy to maintain the profitability and enhance the long term value of the company. We believe that biomass has significant potential as a low carbon source of energy.

Currently wood pellets are more expensive than coal. We need government support to develop biomass energy. The government requires energy generators to report against sustainability criteria under the Renewables Obligation. Furthermore, biomass energy has to be acceptable by the society. Certification is a way to proof the sustainability of biomass energy. We want to guarantee that our sustainability management is of the highest standard.

Currently Green Gold Label is the only scheme approved by Ofgem. What does this imply?

As from April 2011, the Ofgem sustainability requirement obliged the UK energy generators to report against sustainability criteria for solid biomass under the Renewables Obligation. Energy generators were given two years of transition period. From April 2013 onwards, solid biomass will need to meet the sustainability criteria to be eligible to receive ROCs. There are significant benefits to operators in using Ofgem approved sustainability schemes for any wood pellets that will be burned from April 2013.

A harmonized scheme for wood pellets, i.e. IWPB, probably will be implemented in January 2013. What are the barriers in developing a harmonized scheme?

Indeed a harmonized scheme like IWPB brings real value. However, it is also very challenging to make a harmonized scheme. Different member states in Europe have different conditions. There are significant variations in policies and regulations. I would say that timing is very important. Currently the UK has very stringent sustainability requirements compared to the other member countries. If we would want to have a harmonized scheme now, we would like to make it at the highest standard. The challenges to bring each schemes and systems into conformity mainly come from the disparity in sustainability requirement between the member states.

Does the Tilbury fire incident give any impact on npower's plan in using wood pellets?

No. It does not give any impact on our plan. The fire resulted from a combination of various minor factors. The inquiry into the fire recommended a number of modifications, which have since been implemented. Therefore it should not be a reason for stop using wood pellets.

Appendix V

Interviewee: Mairi Black (Ph.D.)
Interviewer: Chun Sheng Goh, Copernicus Instituut, Universiteit Utrecht
Date: 2/8/2012, 15:00 CET
Venue: E-mail + Telephone

Description:

Position:	Biomass Sustainability Development Manager
Responsibility:	Involved in the practical implementation of sustainability principles in biomass supply chains.
Experience:	20 years of commercial and academic experience in the pharmaceutical and biotechnology industries. Joined Drax Power Ltd in April 2011 as Biomass Sustainability Development Manager
Company profile:	Drax Power Ltd

Q1. In regards with the implementation of sustainability schemes, what are the changes you experienced over the past few years? And what is your expectation for the coming years? Please add remarks wherever you wish to.		
	Changes over the years (2007 – now)	Expectation in the coming years
Shifting of (raw materials) supply region / suppliers / commodities from one to another	-	Expect to see some shift in supply areas but highly dependent on the ability of supply regions and suppliers to demonstrate and fulfil sustainability requirements for UK RO policy
Diversion in (raw materials) sourcing region	-	As above
Vertical expansion to upstream (self-supply)	-	-
Horizontal trading (trade between traders / between buyers)	-	Expect to see commoditization of biomass for bioenergy (refer to http://www.laborelec.be/ENG/initiative-wood-pellet-buyers-iwpb/)
Other changes (Please specify here _____)	Policy changes including more rigorous sustainability requirements	-

Q2. What are the reasons for these changes / expectations? Key: Yes, and remarks / otherwise leave it blank					
Reasons → (This column is same as the one in Q1)	Availability of sustainable biomass supply	Compatibility between proliferated sustainability certification	Economic reason: Biomass prices	Technical reasons: Logistics issues or other technical issues	Market factor: Supply security / competition with other sectors (e.g. food, wood)

		schemes			
Shifting of (raw materials) supply region / suppliers / commodities from one to another	Yes as new supply chains develop around new pelleting facilities		Yes – cost is always a considerati on		
Diversion in (raw materials) sourcing region					
Vertical expansion to upstream (self-supply)	Yes – security of supply and traceability of supply chain		Yes – cost is always a considerati on		Supply security
Horizontal trading (trade between traders / between buyers)	Yes – the requirement / demand for pellets at a given time and problems with long term storage will make this highly likely		Yes – cost is always a considerati on		
Other changes (Please specify here _____)					

Q3. Do you see sustainability certification schemes as a barrier or an opportunity?
Difficulties encountered: Certification is a highly administrative process which is time consuming and costs money. Many schemes exist – some cover some areas of policy requirements, others cover other areas….suppliers and users need to have thorough understanding of many schemes used in different geographic areas and for different feedstock and be able to apply these to policy requirements. There is a need for thorough benchmarking and acceptance of schemes under policy requirements for renewable energy
Opportunities foreseen: There is a need for thorough benchmarking and acceptance of schemes under policy requirements for renewable energy. Interaction and acceptance of principles and criteria of different schemes, which cover particular aspects of the supply chain is an opportunity to reduce administrative requirements
Other comments: Certification does provide levels of confidence in developing supply chains which is essential as the biomass- bioenergy industry develops

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