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European Power from U.S. Forests

How Evolving EU Policy Is Shaping the Transatlantic Trade in Wood Biomass

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Executive summary

The European Union (EU) is currently the largest market for wood pellets (i.e., solid wood biomass compressed into a pellet form) in the world. Wood pellet demand has been driven primarily by the 2009 Renewable Energy Directive (RED), a requirement that EU member countries reduce greenhouse gas (GHG) emissions by 20%, produce 20% of total energy consumption from renewable resources and decrease total energy consumption by 20% by 2020 (known as the 20/20/20 targets). The European Commission (EC) has set mandatory targets for all Member States, and wood pellets and solid biomass has emerged as an important component of the plan to meet these targets.

The United States, in particular the southeastern states, have responded to this demand by increasing production of pellets for export to Europe. Significant investments have been made in large-scale pellet plants throughout the Southeast, often using chipped trees and other harvested forest material.

Debate in the U.S. and the EU over sustainability of biomass production and its carbon-reduction benefits has been intensifying as demand increases. New regulations on solid biomass, expected in late 2012, may set standards on solid biomass sustainability and carbon reduction requirements.

With the release of the 2009 RED, the EC provided binding minimum sustainability requirements for biofuels and bioliquids, but not solid biomass. In 2010, the Commission

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Wood pellets, derived from wood chips or roundwood, are easily exportable. European policies including the EU Renewable Energy Directive are driving production and export of wood pellets from the Southeast U.S.

released a follow-up report (Report COM (2010)11, which outlined recommended sustainability criteria for solid biomass production and use (European Commission 2010(b)). The criteria were essentially identical to that of the RED requirements for biofuels and bioliquids, with some additional stipulations for agricultural feedstocks, and modifications to the carbon accounting.

The COM (2010) report states that the Commission will release an additional report, expected in late 2012, to clarify crucial uncertainties in the EU pellet market, such as (1) identifying which sustainability programs meet EU approval, (2) ruling whether certification or other sustainability schemes constitute a barrier to trade and (3) whether EU-wide binding sustainability criteria are necessary for solid biomass (versus allowing each Member State to set sustainability criteria).

Many experts predict that the sustainability requirements outlined in the RED and COM (2010) will remain as baseline criteria for the new standards for solid biomass. Beyond the sustainability standards, the report may outline which certification systems pellet manufacturers can use, the steps toward harmonization or standardization among certification systems, and the rules governing biogenic carbon accounting and accounting for indirect effects of biomass production.

For the U.S. export market to benefit from the large potential capacity for pellet production, producers in the U.S. will need to meet or exceed EU sustainability requirements.

The EU pellet market currently is marked by a welter of sustainability standards that have been developed or are being developed by EU Member States, utilities using biomass and independent standard-setting agencies. Most EU countries importing or exporting pellets have their own incentives and policies to encourage sustainable production and use, and there is little coordination between them. Some of those national regulations have developed into independent third-party certification schemes, such as the NTA 8080/8081 scheme in the Netherlands.

In addition, industry-led certification programs to ensure sustainability and meet EU recommended criteria have proliferated, often by multinational energy companies such as RWE-Essent (e.g., Green Gold Label) and Electrabel (e.g., the Laborelec Certification System). Most industry-led schemes have attempted to ensure compatibility with the EU recommended criteria as much as possible. Recently, the seven largest energy companies have started an initiative known as the Initiative Wood Pellet Buyers (IWPB) to create a set of harmonized sustainability criteria. A long-term goal of this initiative is to gain EU approval or acceptance as an official EU standard.

The European Committee of Standardization and the International Standardization Organization are also developing sustainability standards that are meant to create uniform or consistent sustainability and quality standards for solid biomass, and to provide guidance on terminology, verification and auditing, indirect effects, GHG accounting, and other such issues.

For the U.S. export market to benefit from the large potential capacity for pellet production (estimated at 6 million tonnes), producers in the U.S. will need to meet or exceed the sustainability requirements that the EU finally does set. It is possible that some type of forest management or pellet supply chain certification will become required by the EC, and U.S. pellet producers are now considering how they might meet the new requirements.

CHAPTER 1

Introduction

The global wood pellet market has expanded and matured over the past five years. Wood pellets can be used in a broad array of applications including residential pellet stoves, district heating systems, combined heat and power plants (CHP) which produce both useable heat and power, and co-firing with coal in industrial power plants (Cocchi & Marchal 2011). The recent development in the pellet market has been driven by public and corporate policies designed to (1) decrease the use of traditional fossil fuels, (2) address concern over the effects of climate change and (3) improve energy security and independence.

Global consumption of pellets was estimated at 12 million tonnes in 2009 (IEA Bioenergy Task 40 2011). Globally, the European Union is the biggest market for wood pellets, consuming 10.4 million tonnes in 2009 (Cocchi & Marchal 2011). Traditionally made from wood processing residues (such as sawmill dust, bark and pulp and paper residues), pellet feedstocks have expanded to include logging residues, recycled wood waste, and increasingly chipped roundwood (i.e., whole trees) (Cocchi & Marchal 2011). Globally, the biggest producers of pellets are the United States, Canada, Germany, Sweden, Russia and Austria (IEA Bioenergy Task 40 2011).

Global consumption of pellets was estimated at 12 million tonnes in 2009. The European Union is the biggest market for wood pellets, consuming 10.4 million tonnes in 2009.

United States

The domestic market for pellets, primarily for home heating in the Northeast, is quite well developed in the United States and the export market is relatively new (Sikkema et al. 2011). In 2008, pellet production was 1.8 million tonnes (66% of capacity), and over 80% of that was used domestically for residential heating (Sikkema et al. 2011). The U.S. has a number of policies that encourage domestic demand of solid biomass. Renewable Portfolio Standards have been written for 29 states that require a certain percentage of power to come from renewable sources. However, these policies have created very little demand for wood pellets.

Development of large-scale pellet plants throughout the U.S. is ongoing, and the recovery of the logging industry may create as much as 5.5 million tonnes of new residues for pellets in 2012 (Cocchi & Marchal 2011). In addition, many new pellet mills are now being built to use chipped roundwood (whole trees) as a feedstock, decreasing reliance on the traditional forest industry for feedstock supply but raising new sustainability concerns (Cocchi & Marchal 2011). This has allowed the size and capacity of plants to increase substantially. These newer, larger pellet plants have attracted substantial investment from European utilities, which has helped to develop the U.S. export market (IEA Bioenergy Task 40 2011). In 2010, approximately 750,000 tonnes of pellets were exported to Europe, mostly to northern countries for industrial co-firing, but also to Italy for residential heating (IEA Bioenergy Task 40 2011). As evident in Figure 1, the U.S. produced approximately 2 million tonnes of pellets in 2010. Most recent estimates of total production capacity are 6 million tonnes (Cocchi & Marchal 2011). This suggests a large opportunity for increased production.

Canada

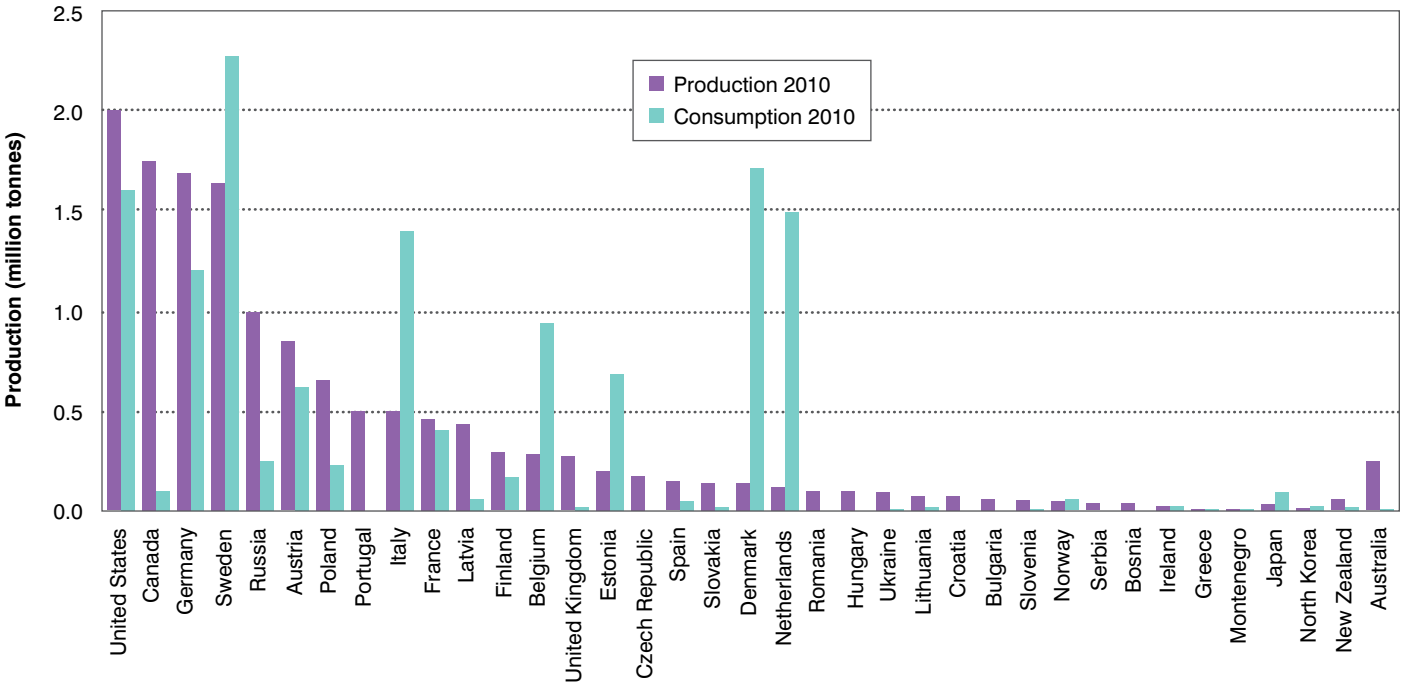
Canada is a net exporter of wood pellets, producing 1.7 million tonnes in 2010 and shipping over 90% of that to Europe via the main international pellet trading ports of Amsterdam, Rotterdam and Antwerp (IEA Bioenergy Task 40 2011, Sikkema et al. 2011). Japan also recently began its first industrial co-firing project using Canadian-sourced pellets in 2008 (Sikkema et al. 2011). At present, there is little domestic demand within Canada, though developments in Ontario to eliminate coal use in power generation stations by 2014 may stimulate an increase in domestic demand (Ontario Ministry of the Environment 2011). An additional 15 new pellet plants have been proposed throughout Canada and may increase production capacity from 3 million tonnes (in 2009) to 4.4 million tonnes in the near future (Cocchi & Marchal 2011).

Overview of report

The primary goal of this report is to identify and understand the relevant policy drivers in the EU, which may drive pellet production in the U.S., with particular emphasis on existing and emerging sustainability requirements. To this end, Chapters 2 and 3 provide an overview of the relevant EU legislation, sustainability requirements and demand projections based on those policies. Chapter 4 evaluates the major exporting and importing countries to identify important policy drivers at the national level. Chapter 5 examines how industry is responding to those policy drivers, through the creation of industry-led sustainability schemes or other methods. Finally, Chapter 6 identifies key themes or cross-cutting issues influencing the pellet market within the EU, and how those issues may affect U.S. production.

FIGURE 1

Production and consumption of wood pellets in 2010



Soure: IEA Bioenergy Task 40 "Global Wood Pellet Industry Market Study, 2011"

CHAPTER 2

Relevant EU legislation

There are several pieces of EU legislation which influence the use of biomass within the European Union. Appendix 1 provides a tabular summary of relevant EU legislation. The two primary policy drivers for wood pellet consumption are described below followed by several additional related policies.

Renewable energy directive

Perhaps the most significant piece of EU legislation pertaining to the use of biomass for energy is the Renewable Energy Directive (RED) of 2009. This Directive outlines a strategy for the EU to reach several targets: 20% total energy consumption from renewable energy (RE) sources, 20% reduction in energy consumption and 20% reduction in GHG emissions by 2020 (also known as the 20/20/20 targets). The Directive also calls for 10% RE in transport by 2020 (European Commission 2009). These targets are mandatory for all Member States, and as part of this Directive, Member States must write National Renewable Energy Action Plans (NREAPs) to outline the strategy toward meeting the goals. Required in the NREAPs are estimates and projections of total biomass needed, total domestic production and estimated amount of

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EU energy policy, especially the Renewable Energy Directive (RED) and Report COM (2010) 11, are driving wood pellet production in the United States.

imports for 2020 (European Commission 2009). The Member States must also prepare progress reports every two years until 2020. Member Countries are allowed to transfer excess RE or initiate joint projects to achieve national targets (European Commission 2009). It should be noted that the 20% energy from RE sources is an overall combined target for the entire EU, and individual Member targets are different. They are calculated as an "equal increase in each Member States share, weighted by their GDP, modulated to reflect their starting points" and these targets are provided in the Directive (European Commission 2009). There is quite a substantial range in the assigned targets (for example, Malta has a target of 10% while Sweden has a target of 49%) (European Commission 2009).

TABLE 1

Sustainability requirements of the EC-RED and Report COM (2010)11

	Sustainability requirements	Reference/additional information
Directive 2009/28/EC (also known as EC-RED)	1. GHG emission saving shall be at least 35% until Jan 2017, when it must be 50%, and then 60% after Jan 2018 2. Biomass shall not be produced from land with high biodiversity value: • primary forest or wooded land, with native species and no visible indication of human activity, with functioning ecological processes • designated protection areas, reserves or rare or endangered species habitats as designated by IUCN, unless there is proof that production does not interfere with those protection purposes • highly biodiverse grassland that is natural or non-natural but species-rich unless harvest can be shown to preserve its grassland status 3. Biomass shall not be produced from the conversion of lands with high carbon stock, namely land that was one of the following in 2008: • wetlands • continuously forested areas (> one ha) with a canopy cover of more than 30% and trees higher than five meters • land spanning more than one ha with trees over five meters and a canopy cover between 10–30% unless the biofuels can be produced in such a way as to still offer 35% GHG reduction benefits 4. Biomass shall not be made from land that was peatland in 2008 unless it can be proven that harvesting did not involve drainage of previously undrained soils	• Binding criteria for biofuels and bioliquids (not solid biomass) • Must demonstrate compliance with these requirements to be able to count toward RE targets and apply for support schemes For more information: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32009L0028:EN:NOT
Report COM (2010)11	1. Minimum GHG savings of 35%, rising to 50% in 2017 and 60% in 2018. NOTE: Waste and residue based feedstocks do not need to comply with this criterion 2. Raw material must not come from high biodiversity areas, conversion of high-carbon stock areas, or undrained peatlands as outlined in RED requirements above 3. Agricultural raw materials produced within the EU must follow agricultural regulations of the EU 4. Economic operators must show compliance with these criteria using the "mass balance" method for the chain of custody 5. LCA methodology must be extended to include the final conversion efficiency of biomass to electricity or heating and cooling	• Recommended sustainability requirements be developed for solid and gaseous biomass (expected in 2012) • Compliance can be proven three ways: by EU level recognition of voluntary schemes which address the sustainability criteria, through bilateral or multilateral agreements with third countries, and by Member States national verification methods • Criteria apply only to energy producers of 1 MW or more For more information: http://ec.europa.eu/energy/renewables/bioenergy/sustainability_criteria_en.htm

The Directive provides binding sustainability requirements for transportation biofuels and bioliquids, but not for solid biomass. The Commission does not elaborate on why they choose to focus sustainability efforts on biofuels and bioliquids other than "a concern that the production of biofuels and bioliquids may not respect minimum environmental and social requirements" (European Commission 2009). All biofuels and bioliquids produced or consumed in the EU must meet these requirements in order to count toward RED targets or be applicable for any support schemes (European Commission 2009). Requirements for biofuels and bioliquids address mandatory GHG emission reductions and limit production in sensitive areas (such as highly biodiverse areas or areas of high carbon stock). The Directive also indicates that the mass-balance method is the one that must be used for verifying compliance and that the energy allocation method is most appropriate for GHG emission calculations (European Commission 2009). For a detailed description of the sustainability requirements in the Directive, see Table 1. The Directive states that it will re-examine whether sustainability requirements for solid biomass are necessary at a later date (European Commission 2009). This has since been done, and the results are outlined in the Report COM (2010)11, discussed below. A clarifying report is expected later in 2012.

Report COM (2010)11

The Report COM (2010)11 was released in 2010 by the European Commission addressing the need for further sustainability requirements for solid and gaseous biomass for use in electricity, heating and cooling. The Commission considered three factors when looking at EU-wide sustainability criteria: (1) the effectiveness of dealing with sustainability issues associated with biomass use, (2) cost-efficiency in meeting the EU objectives, and (3) consistency with existing policies (European Commission 2010b). Appendix 5 provides a summary of the impact analysis undertaken by the EC to help determine the need for binding sustainability requirements. The EC concluded that biomass produced within the EU is generally sustainable because of the current forestry and agricultural best practices in place, and does not need additional sustainability requirements for energy purposes (European Commission 2010b). They concluded that binding criteria wasn't necessary at the time of the report for several reasons: because it may present different cost implications on different Member States; because of the complexity of feedstocks (with regards to sustainable production, greenhouse gas performance, efficient energy conversion) making uniform regulation difficult to enforce; and because of the limited amount of imports coming into the EU (European Commission 2010a, European Commission 2010b). However, the Commission did outline a set of recommended criteria, and suggested that Member States develop their own national sustainability schemes (European Commission 2010b). The criteria they recommended were essentially identical to those for biofuels and bioliquids as outlined in the RED, with the exception of slight modifications of GHG methodologies to include conversion efficiencies of end product, and an exemption for wastes from the GHG minimum requirements (European Commission 2010b). Please see Table 1 for more information.

The results of a public consultation in early 2011 indicated broad support for minimum EU-wide binding sustainability criteria

The EC indicate in the Report COM (2010)11 that there may be several ways to demonstrate compliance with sustainability criteria: (1) EU-approved voluntary schemes, (2) bilateral or multilateral agreements with third parties and (3) national verification methods (European Commission 2010b). The EC will identify which Member Countries' national sustainability schemes meet EU approval, will determine whether national schemes constitute a barrier to international trade, and revisit binding EU-wide criteria in a future report (European Commission 2010b). This report was meant to be released by the end of 2011, but has since been put on hold until 2012 (V. Dossche, FERN, pers. comm. 01-24-2012, Junginger et al. 2010). The results of a public consultation in early 2011 indicated broad support for minimum EU-wide binding sustainability criteria (Directorate-General for Energy 2011).

Additional EU policies affecting biomass demand

The Emissions Trading System (ETS) was introduced in 2005 to develop a carbon cap-and-trade system for EU Member Countries and participating third countries (Iceland, Liechtenstein, and Norway). The EU ETS caps carbon dioxide emissions from some 12,000 installations across various sectors of the European economy. The ETS is a crucial element of the EU's overall goal of limiting EU-wide greenhouse gas emissions to 8% below 1990 levels for the years 2008 through 2012, and driving EU-wide overall emissions down 20% below 1990 levels by 2020. Industries included in the ETS include power stations and other facilities that may use solid biomass as a greenhouse gas mitigation strategy.

Another, more recent piece of legislation that may affect biomass consumption in the EU is the Energy Efficiency Directive of 2011 (also known as COM (2011) 370). The aim of this Directive is to ensure that the EU meets a target of 20% reduction in energy consumption by 2020 (European Commission 2011). This Directive has many initiatives, but in particular it strives to encourage the use and expansion of CHP plants and district heating and cooling in each Member Country (European Commission 2011). It requires Member States to develop national heating and cooling plans, and set non-binding energy efficiency targets by 2014. If the Commission believes the EU is not making sufficient strides toward energy efficiency by 2014, it will set out binding efficiency targets for all Member States (European Commission 2011). This may stimulate an additional demand for pellets for CHP or district heating throughout the EU.

Recently, the EC has introduced an (Illegal) Timber Regulation (Regulation (EU) No. 995/2010) which will enter into effect in 2013 (Bennet & Ares 2011). This prohibits illegally logged timber from entering the EU markets. This regulation is mandatory for all Member Countries, and it requires EU traders (importers or buyers) to exercise due diligence and perform risk assessments to monitor for legal compliance of sourced wood and wood products (European Commission 2012c). This regulation may have consequences for illegally sourced pellets from areas such as Russia or South America, and may influence where pellets are imported from beginning in 2013.

CHAPTER 3

Current and projected demand in the EU

Total EU consumption in 2009 was estimated at 10.4 million tonnes of solid biomass (IEA Bioenergy Task 40 2011, Sikkema et al. 2011), and imports from non-Member Countries were approximately 2.6 million in 2010 (IEA Bioenergy Task 40 2011). Inconsistencies in the reporting and accounting of biomass, differences in market regulations and variability in feedstocks make it difficult to determine with absolute certainty actual production, consumption and import levels (Beurskens et al. 2011, Hewitt 2011, Atanasiu 2010). Several attempts have been made to estimate total EU demand for 2020, and demand projections for the EU vary widely (see Table 2 for various estimates). Projected total demand for 2020 varies widely from 35 million tonnes to 315 million tonnes, and projected imports range from 16 million to 60 million tonnes (Beurskens et al. 2011, Cocchi & Marchal 2011, Sikkema et al. 2011, Atanasiu 2010, European Commission 2010b).

There are three distinct end-use markets for wood pellets within Europe: (1) industrial co-firing in power plants, (2) smaller-scale district heating or CHP plants and (3) residential heating (using higher quality bagged or bulk pellets) (Sikkema et al. 2011). Trade and production of pellets varies by market segment. Most high quality pellets for residential heating are produced

TABLE 2

EU demand projections for solid biomass by 2020 (by source)

	Current total EU demand	Projected total EU demand	Projected demand (imports)	Notes
Sikkema et al. 2011	9.8 million tonnes (2009)	114. 8 million tonnes	60 million tonnes	Reference scenario: Growth projections based on current growth rates, competition with forestry sector
Sikkema et al. 2011	9.8 million tonnes (2009)	314.8 million tonnes	Demand met entirely by domestic supply	Rapid growth scenario: Maximum production within the EU from forestry, increased recovery of waste, energy plantations, etc.
IEA Bioenergy Task 40 2011	10.4 million tonnes (2009)	~ 35 million tonnes	16 million tonnes	BAU scenario: based on past and current trends, industry expectations, press releases, existing studies, etc.
IEA Bioenergy Task 40 2011	10.4 million tonnes (2009)	~ 35 million tonnes	33 million tonnes	High-import scenario: rapid growth in demand stimulates increased plantations, pellet production in new areas.
Report COM (2010)11	n/a	80 million tonnes	n/a	
Atanasiu 2010	n/a	193 million tonnes	n/a	
Beurskens et al. 2011	149 million tonnes (2010)	219 million tonnes	n/a	From NREAPs: Solid biomass for electricity and heating

within Europe, while many industrial bulk pellets for co-firing or CHP are imported from North America (IEA Bioenergy Task 40 2011). Several reports and presentations released in the past few years have provided information on the demand and supply, production and consumption of pellets within the EU, and have also provided assessments of import and export levels (e.g., Cocchi & Marchal 2011, Hennig 2011, Sikkema et al. 2011, Junginger et al. 2010, Peksa-Blanchard et al. 2007). For the purposes of this paper, we have used the aggregate results of those studies to focus our efforts for the in-depth country profiles that follow in Chapter 4. The following tables provide a summary of the different assessments of net importing and net exporting countries.

The main exporting countries in the EU include Germany, Austria, Baltic States (Latvia, Lithuania and Estonia are considered together), Finland, Portugal, Spain, Poland and France (see Table 3) and the main importing countries include Denmark, the Netherlands, Sweden, Italy, Belgium, and the UK (see Table 4). The following section will focus on the major importing countries listed above, and several major exporters (namely Germany and Austria). The exporting countries are included to provide a more complete understanding of the pellet market in Europe, and to better understand how production and consumption levels might change by 2020.

TABLE 3

Net exporting countries (by source)

	Canada	Russia	Germany	Baltic States*	Finland	Portugal	Spain	Austria	USA	Poland	France
Hennig 2011	●	●	●	●							
Sikkema et al. 2011		●		●	●	●	●				
Peksa-Blanchard et al. 2007	●	●		●	●					●	
Egger 2010	●	●	●					●	●		●
Junginger et al. 2010	●	●		●	●				●		
Cocchi & Marchal 2011			●	●	●	●	●	●			

*Latvia, Lithuania, Estonia

TABLE 4

Net importing countries (by source)

	Denmark	Netherlands	Sweden	Italy	Belgium	UK
Hennig 2011	●	●			●	
Sikkema et al. 2011	●	●		●	●	
Peksa-Blanchard et al. 2007	●			●		
Egger 2010	●	●	●	●		
Junginger et al. 2010		●	●	●	●	
Cocchi & Marchal 2011	●	●		●	●	●
Report COM (2010)11		●			●	●

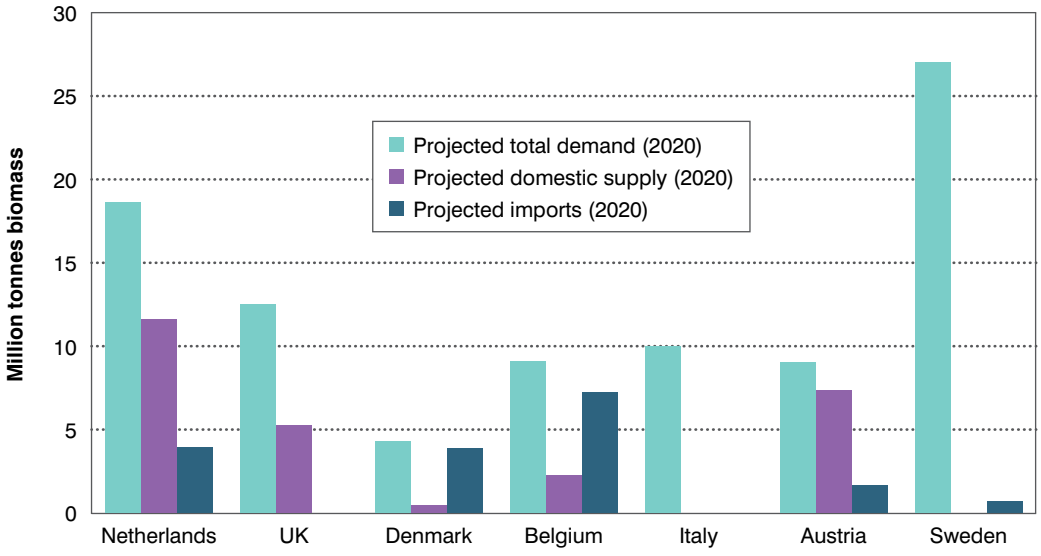
CHAPTER 4

Individual country demand and policy drivers

All 27 Member Countries supplied National Renewable Energy Action Plans (NREAPs) according to the timeline put forth by the European Commission. Although all Member Countries were asked to explicitly outline a number of things, including anticipated total solid biomass demand, anticipated domestic production capacity and anticipated amount of imports, the NREAPs are generally unclear when it comes to solid biomass, especially with regards to imports (Hewett 2011, Atanasiu 2010). Furthermore, different units of measurement, different biomass fractions (e.g., estimates for total solid biomass, but not biomass from forestry) and different conversion units make it difficult to analyze demand projections (Atanasiu 2010). A summary report by Beurskens et al. from the Energy Research Center of the Netherlands was published in November 2011, providing an overview and synthesis of the figures and projections in the NREAPs. The demand projections for individual countries come from this synthesis paper and the original NREAP documents themselves. All national support schemes and relevant legislation are provided in Appendix 2. For a visual representation of demand projections, see Figure 2. Detailed demand and supply projections by Member Country are provided in Appendix 4.

FIGURE 2

Supply and demand projections for 2020



Numbers taken from individual country NREAPs. Missing bars are due to lack of information for that parameter (i.e., domestic supply plus imports may not equal total demand). Note that Germany has been excluded because its NREAP projections are for total biomass, not woody biomass.

Germany

Production and consumption

Germany is currently the largest pellet producer in Europe, and has been a net exporter since 2006 to neighboring countries such as Austria, Denmark, Italy, Sweden and France (Cocchi & Marchal 2011). Pellet production was 1.7 million tonnes in 2010 (Cocchi & Marchal 2011). Domestic consumption of pellets occurs mainly to support the residential and small-scale industrial heating sectors, and is fueled by the high costs of coal and oil (IEA Bioenergy Task 40 2011, Peksa-Blanchard et al. 2007).

Projections for 2020

Although Germany is currently a net exporting country, the country's projection for 2020 states that 22.1 million tonnes of total biomass may be imported by 2020, while the country's domestic supply of total biomass may be as much as 55.6 million tonnes (Beurskens et al. 2011, Germany's NREAP 2010). Unfortunately, the NREAP does not separate projections for woody biomass from total biomass and does not state where imports might orginate (Germany's NREAP 2010).

Domestic incentives and policies

Germany has several national initiatives to encourage the use of biomass. The Market Incentive Program is scheduled to end in 2012, but provided subsidies for pellet boiler purchase and installation for residential heating since 1999 (IEA Bioenergy Task 40 2011, Peksa-Blanchard et al. 2007). A newer regulation, called the Biomass Power Sustainability Ordinance provides feed-in tariffs for electricity produced from sustainable bioliquids, using compliance with the EC-RED requirements as proof of sustainability. A similar regulation called the Biomass Sustainability Ordinance for Biofuels also exists (van Dam et al. 2010).

Austria

Production and consumption

Austria is also a net exporter of pellets, mostly to neighboring countries like Italy (Cocchi & Marchal 2011). The Austrian pellet market has grown rapidly, having doubled from 2006 to 2010. Domestic consumption of pellets is also primarily used for residential heating and small-scale industrial heating (Sikkema et al. 2011). Demand in 2010 was estimated at 630,000 tonnes, while total production was 850,000 tonnes (Cocchi & Marchal 2011).

Projections to 2020

Projections from the country NREAP indicate that Austria may require as much as 9 million tonnes of woody biomass in total, producing over 7 million tonnes domestically and requiring an additional import of 1.63 million tonnes (Beurskens et al. 2011, Austrian NREAP 2010). Austria imports mostly woody residues, such as pulp and paper by-products and sawmill residues from neighbouring countries and no substantial amount of pellets (Austrian NREAP 2010).

Domestic incentives and policies

Austria has a number of initiatives to encourage the use of biomass, including the Green Electricity Act, and the Energy Action Plan of Upper Austria (Austrian NREAP 2010, Egger 2010). An important program that ran from 2005 until 2009 was the "Holzwärme" which gave incentives for installation of home pellet heating systems (IEA Bioenergy Task 40 2011).

Sweden

Production and consumption

Sweden is currently the largest consumer of pellets in Europe (2.28 million tonnes in 2010), which it uses for district heating, CHP, and some residential heating (Sikkema et al. 2011). Sweden has

recently become a net importer of pellets (importing approximately 695,000 tonnes in 2010) even though production levels remain high, at 1.65 million tonnes annually (IEA Bioenergy Task 40 2011). Sweden has imported pellets from Canada and Poland in the past, but recently has begun importing more from Russia, Finland and the Baltic States (IEA Bioenergy Task 40 2011).

Projections for 2020

According to the Swedish NREAP projected total demand of solid biomass may reach 27 million tonnes by 2020, but projections for imports remain a modest 660,584 tonnes (Beurskens et al. 2011, Swedish NREAP 2010).

Domestic incentives and policies

Since 1991, Sweden has imposed a fossil fuel tax on thermal energy and some electricity applications, and provides exemptions for energy from "carbon neutral" fuels such as biomass or biogas (Sikkema et al. 2011, Swedish NREAP 2010). There is also an electricity certificate scheme which mandates a certain minimum percentage of electricity generation from renewable sources. This was initiated in 2003, and minimum requirements are set to increase steeply until 2035 (Swedish NREAP 2010).

Italy

Production and consumption

Italy is a net importing country with total demand of 1.4 million tonnes in 2010 (Cocchi & Marchal 2011). The pellet market in Italy is overwhelmingly made up by demand for residential heating markets. Reliance on imports is growing, with Italy increasingly importing from the United States. Imports for 2010 were approximately 1.05 million tonnes (Cocchi & Marchal 2011).

Projections for 2020

Although the Italian NREAP does not include projections for imports in 2020, it estimates a total demand of 10.2 million tonnes (Beurskens et al. 2011).

Domestic incentives and policies

Support measures for biomass heating in Italy include energy efficiency certificates to promote energy-saving projects across sectors, tax relief for energy efficiency home improvements, such as boiler installations, and mandatory quota of energy consumption in new buildings of 50% from renewable sources (IEA Bioenergy Task 40 2011). New laws introduced in 2011 to further promote biomass in district heating and cooling may create increased demand (IEA Bioenergy Task 40 2011).

Belgium

Production and consumption

In Belgium, pellets are mainly used for co-firing in industrial power plants, but also for residential heating (Belgium NREAP 2010). Demand in 2010 was estimated at 940,000 tonnes, and domestic production varies dramatically by region and is estimated at 300,000 tonnes for 2011 (IEA Bioenergy Task 40 2011). Belgium is one of the top importing countries in Europe and imports a significant fraction of its biomass from Canada, U.S. and Germany (IEA Bioenergy Task 40 2011).

Projections for 2020

Projections from the NREAP indicate a total demand of 9.11 million tonnes by 2020, and a domestic supply of 2.23 million tonnes (Beurskens et al. 2011, Belgium NREAP 2010). This suggests that 7.21 million tonnes of imports may be required by 2020, indicating that imports will likely remain very important for Belgium through 2020.

Domestic incentives and policies

Belgium's Green Certificate Scheme (GEC)is a well-developed system for stimulating demand for biomass at electric power plants. The GEC provides a guaranteed value for electricity generated from biomass, based on the percentage of green electricity provided, and by meeting minimum efficiency measures (van Dam et al. 2010). In 2010, changes in the scheme dictated that co-firing stations would receive 50% of the original GEC, while dedicated biomass stations still receive 100% (IEA Bioenergy Task 40 2011, van Dam et al. 2010). Residential heating is also supported through fiscal incentives to install pellet boilers and stoves (IEA Bioenergy Task 40 2011).

Denmark

Production and consumption

Denmark is another major importing country, importing approximately 1.58 million tonnes in 2010, while domestic production was only 137,000 tonnes (IEA Bioenergy Task 40 2011). Imports come from the Balkan States, Poland, Sweden, Finland and Canada and are mostly used for district heating, CHP and industrial co-firing (IEA Bioenergy Task 40 2011, Peksa-Blanchard et al. 2007).

Projections for 2020

Demand projections for 2020 from the Danish NREAP show a growth in total demand to 4.28 million tonnes, with 3.85 million tonnes coming from imports (Danish Energy Agency 2011). The Danish NREAP projects that domestic supply will continue to be limited at 428,000 tonnes in 2020, indicating that imports will remain an important part of Danish biomass supply into the foreseeable future.

Domestic incentives and policies

The Danish government initiated the Biomass Agreement in 1993, which mandated that large utilities co-fire a minimum percentage of biomass per year (IEA Bioenergy Task 40 2011, Danish NREAP 2010). A newer initiative is the Green Growth 2.0 program, which seeks to promote biomass use in smaller CHP plants, and stimulate domestic biomass production (Danish NREAP 2010). There are also certain tax exemptions to promote pellets as well (IEA Bioenergy Task 40 2011, Danish NREAP 2010).

Netherlands

Production and consumption

The Netherlands is another major importing country, using pellets almost entirely for industrial co-firing in large power plants (IEA Bioenergy Task 40 2011, Sikkema et al. 2011). Current demand is estimated at 1.5 million tonnes in 2011, while imports were 1.4 million tonnes in 2010 (Cocchi & Marchal 2011). Most of the imports are coming from Canada and the United States.

Projections for 2020

Demand projections for 2020 show a total biomass demand of 18.6 million tonnes, while imported pellets for co-firing are estimated at 3.95 million tonnes (Beurskens et al. 2011, Netherlands NREAP 2010). This indicates that imports in the Netherlands will likely increase in the near future.

Domestic incentives and policies

There are a number of incentives that have encouraged biomass consumption in the Netherlands. The existing MEP subsidies are scheduled to end in 2012–2014 and have provided feed-in tariffs for large industrial power plants. These subsidies require sustainability certification by NTA

8080/8081 standards, a sustainability scheme developed by the government, to receive the premiums (IEA Bioenergy Task 40 2011). The MEP subsidies will soon be replaced by the newly proposed SDE and SDE+ schemes, which focus more on small-scale electricity production. The government also announced recently that it plans to set a mandatory minimum limit for biomass co-firing in all power plants by 2022 (IEA Bioenergy Task 40 2011).

United Kingdom

Production and consumption

The United Kingdom has only recently become a major importer, and as a result there is a lot of uncertainty with respect to demand and import figures. Nevertheless, current demand was listed as 683,000 tonnes in 2010 by the IEA Bioenergy Task 40 (2011). Imports have been estimated at 550,000 tonnes to 884,000 tonnes in 2010 suggesting a significant reliance on imports within the UK (IEA Bioenergy Task 40 2011). [Note: The upper range of reported imports exceeds the reported current demand. It is clear these two different sources do not fully align.]

Projections for 2020

Demand projections from the UK NREAP are vague, and biomass from the forestry sector isn't separated from total solid biomass (UK NREAP 2010). However, 12.5 million tonnes of solid biomass is projected for 2020 for electricity, heating & cooling demands, with an estimated 5.2 million tonnes as a projected supply, suggesting that imports will play a large role in meeting the UK's RED targets (Beurskens et al. 2011, UK NREAP 2010).

Domestic incentives and policies

The United Kingdom's Renewable Obligations (ROs) are regulatory measures to increase RE in energy generation, and in particular support large CHP and electricity producers. These measures were initiated in 2002 and are in effect until 2037 (IEA Bioenergy Task 40 2011, UK NREAP 2010). The government has recently proposed feed-in tariffs to go alongside the ROs. Feed-in tariffs are also available for small-scale technologies, such as small scale industrial, residential heating or CHP up to 5 MW (IEA Bioenergy Task 40 2011, UK NREAP 2010). These were introduced in 2010 and will close to new entrants in 2021 (UK NREAP 2010). Renewable Heat Incentives were introduced in 2011 to a wide range of heating projects with the goal of increasing heating from RE to 12% (IEA Bioenergy Task 40 2011, UK NREAP 2010).

CHAPTER 5

Industry-led sustainability initiatives

With the increasing development of the global pellet market and the ongoing discussions related to sustainability requirements, the wood pellet industry has responded with several initiatives to ensure sustainability. At the suggestion of the EU, sustainability requirements are increasingly being written to comply with those outlined in the EC-RED and Report COM (2010)11. Different certification schemes have been initiated in different regions, with varying levels of rigour. We will consider those that are most current and relevant to the focus areas discussed above. Please see Appendix 3 for a summary of relevant industry-led sustainability schemes and initiatives.

Nordic Ecolabel

The Nordic Ecolabel (also known as the SWAN Ecolabel) is one of the older schemes still currently in use. Initiated in 1989 by the Nordic Council of Ministers, this certifies a broad array of product groups, including solid biomass and biofuels sold in Nordic countries (van Dam et al. 2010). The criteria are updated every 3–5 years, and include requirements on type of material, origin, and energy consumption during manufacturing (Nordic Ecolabel 2007). Upcoming changes might include lowering of allowable energy consumption, changes to quality specifications for different feedstock types, and changes to control of emissions from stored pellets (van Dam et al. 2010). This scheme also stipulates that if virgin wood raw material is used for pellets, at least 70% per annum of raw material must come from certified forests (Nordic Ecolabel 2007).

Green Gold Label

The Green Gold Label (GGL) was originally initiated by Essent, a large energy company based in the Netherlands, in 2002 for biomass supplied to Essent (van Dam et al. 2010). This was in response to government concerns over sustainability of imported biomass (van Dam et al. 2010). The certification system has grown to include eight separate standards and is currently being used in at least nine countries by 25 different suppliers (Green Gold 2012). The aim of this certification system is to ensure sustainability from feedstock to source (Green Gold 2012). It has been formally recognized by the EU, the Netherlands and the UK as a valid certification scheme, and currently the EU and GGL are working toward a coordinated GGL-RED standard, which ensures consistency with RED requirements (Green Gold 2012). Planned activities include incorporating the NTA8080/8081 requirements into GGL standards, and opening the GGL system to other energy companies (van Dam et al. 2010).

Laborelec Certification System

An initiative similar to the Green Gold Label was designed by Laborelec and SGS in 2005 for Electrabel (a Belgium energy company) and is called the Laborelec Certification System (LBE) (van Dam et al. 2010). Laborelec is a technical competency and innovation center for electricity

and energy production, and SGS is the certification body in Belgium (van Dam et al. 2010). This certification system is meant to correspond with the Green Certificate Scheme in Belgium, and it involves a detailed analysis of full supply chain of biomass (Ryckmans & Andre 2005). The emphasis of the certification is on traceability of the resources, to ensure sustainability along the entire supply chain, and on energy and carbon balances of biomass production (van Dam et al. 2010, Ryckmans & Andre 2005). LBE does not have its own standards, but uses the standards of others (i.e., FSC, RSPO) to demonstrate sustainability. This certification system mostly applies to woody residues, but also some agricultural residues as well (van Dam et al. 2010).

Drax Sustainability Policy

The most recent utility company to define sustainability principles is Drax Power Limited, with the release of the Drax Sustainability Policy in 2011 (Drax Power 2011). This outlines several principles for responsible procurement of biomass, and mandates that all suppliers adhere to the principles. Although currently just principles, Drax has committed to ongoing improvement of principles and plans to include third-party auditors in the future (Drax Power 2011, van Dam et al. 2010). Those principles address GHG emissions, carbon stock, biodiversity, competition with local food and water, local prosperity and social well-being (Drax Power 2011, van Dam et al. 2010). Currently, they require minimum compliance with UK sustainability requirements.

Initiative wood pellet buyers

Recently, there has been a shift toward a harmonized set of industrial sustainability standards with the Initiative Wood Pellet Buyers (IWPB) group (IEA Bioenergy Task 40 2011, IWPB 2011). This project is led by Laborelec, with the aim of developing common quality specifications and sustainability principles to better facilitate trade of wood pellets (IWPB 2011). This initiative involves seven major European utilities companies: Vattenfal, DONG Energy, E.ON, Drax Power, Delta, RWE-Essent, and GDF-SUEZ. The initiative draws on the certification schemes that have

Will McDow

Southern pine forests, especially those along the Atlantic and Gulf coastal states, are highly desirable for wood pellet production. Emerging EU sustainability requirements will influence the future management of these forests.

come before it, such as GGL and LBE (IWPB 2011). It is not yet clear whether the IWPB principles would replace the existing utilities standards or would serve as a meta-standard, using those schemes to demonstrate compliance (IWPB 2011). The process is ongoing, and there are currently eight principles that have been developed. The first three (GHG balance, carbon stock, and biodiversity) are considered mandatory and must be adhered to, while the other five (soil, air, water quality, competition with local resources and local socioeconomic performance) are considered harder to prove compliance but are still important to the IWPB group (IWPB 2011). Demonstrable efforts to ensure compliance with those principles is required through reporting or other verification means (IEA Bioenergy Task 40 2011, IWPB 2011). A long-term goal of this initiative is to gain EU approval or possible acceptance as an official EU standard (IEA Bioenergy Task 40 2011).

EN 14961 standards

Several other initiatives aim to create standardization or harmonization with the pellet industry as well. The European Committee of Standardization released the EN 14961 standards in 2010, with the aim of creating a classification system for pellets in Europe (Junginger et al. 2010, van Dam et al. 2010). Specifications are different for industrial pellets and pellets used for residential heating (known as non-industrial) (Alakangas 2010). Information on origin and source, moisture and ash content, calorific value, additives and mechanical durability is required and used to create different pellet classes. This system guarantees the traceability of the entire supply chain (Alakangas 2010). The EN 14961 classification system is now required for all pellets produced or consumed in the EU, since 2010 (Junginger et al. 2010).

ENPlus/ENPlus GREEN

The European Biomass Association (AEBIOM) is now working on quality standards known as ENPlus (ENPlus 2012). Through a project called "PellCert," which involves the collaboration of a number of national pellet associations and Laborelec, the group intends to develop a set of uniform quality standards, building on those of the EN 14961 (ENPlus 2012). Along with those standards, they will introduce a set of sustainability measures known as "ENPlus GREEN" which are expected by late 2012 (ENPlus 2012).

ISO 13065

The International Organization for Standardization (ISO) has commissioned a technical committee TC 248 to develop a standardized set of sustainability criteria for global application of wood pellets (ISO 2012, Junginger et al. 2010). This scheme is currently in development and details are limited as to its publication date, but it will provide criteria for production, supply chain and application of bioenergy (Junginger et al. 2010). It will also provide guidance and standardization on terminology, verification and auditing, indirect effects, greenhouse gases and criteria to ensure environmental, social, and economic sustainability (ISO 2012, Junginger et al. 2010). The scheme will be known as ISO 13065.

CHAPTER 6

Policy shifts and sector developments

A race is under way in the EU to create the preferred standard for sustainability. Substantial and prolonged efforts are being undertaken to harmonize various standards (i.e., ISO 13065, PellCert group, and IWPB group). Predicting which schemes will become the norm is difficult at this time. Collaboration among the different groups will help reduce duplication of efforts and decrease confusion in the market. It is also important that any new standards align with the requirements outlined in the EU-RED and Report COM (2010)11 to ensure that developments on the part of the EU do not disqualify certain schemes from gaining broad acceptance. It will be equally important that any new standards provide meaningful sustainability safeguards to ensure public support for the years to come.

The results of a study by Junginger et al. in 2010 to discern the major market barriers and opportunities for bioenergy concluded that most groups supported the move toward harmonized sustainability and quality schemes as a way to reduce trade barriers (Junginger et al. 2010). The EU findings from a recent public consultation agreed with the need for additional

Photo courtesy Green Circle Bio Energy

Wood pellet producers chip round wood (i.e. the whole logs stacked in the center left of photo) into wood chips prior to making wood pellets for export to Europe. Sustainability requirements being developed in the EU will likely influence how roundwood is harvested and how U.S. forests are managed.

sustainability requirements for solid biomass (Directorate-General for Energy 2011). Although there were differences on the details of sustainability requirements (who they should be applicable to, and level of rigor), most respondents believed that minimum binding sustainability requirements at the EU level was important and would benefit biomass trade positively. Respondents indicated that minimum binding criteria should be consistent with those outlined in the RED requirements (Directorate-General for Energy 2011). Interestingly, those respondents that didn't agree with additional sustainability measures were mostly public authorities from forest-rich Member Countries (Directorate-General for Energy 2011). The EC remains under pressure to provide some sort of minimum binding criteria. The report due in 2012 should provide additional clarity for this debate.

Biogenic carbon emissions have been given a zero carbon score in most European biomass policies but many NGOs have expressed concern over the validity of this practice.

One remaining cross-cutting issue is the debate over biogenic carbon accounting and GHG balance methodology. Biogenic carbon emissions have been given a zero carbon score in most EC biomass policies but many NGOs have expressed concern over the validity of this practice (L. Mathe, WWF, pers. comm. 01-11-2012, V. Dossche, FERN, pers. comm. 01-24-2012). The EU has been clear in its requirements for GHG balances, but there is still much debate internationally on which GHG methodology is most appropriate and many certification schemes have different methodologies (van Dam et al. 2010). How to measure and include indirect effects in sustainability schemes is another major issue that many certification systems currently have not addressed (van Dam et al. 2010, Biomass Technology Group 2008). These issues will, hopefully, be resolved by certain international initiatives like the ISO TC 248. The Global Bioenergy Partnership (GBEP) is an international group of organizations, including the FAO, IEA, and UNDP, that developed 24 scientific-based indicators to measure bioenergy sustainability. These indicators are designed for use by policy makers to help develop national bioenergy policies and may be useful in resolving some of these issues (GBEP 2011).

Another likely development in the EU is the diversification of feedstock types. Many countries such as Poland, Denmark and the Czech Republic are expanding development into agro-pellets (IEA Bioenergy Task 40 2011). These agro-pellets are being used to co-fire power plants. This is likely in response to the EC-RED, which encourages Member States to develop domestic biomass as much as possible (European Commission 2009) and may also be influenced by the controversy over forest-based bioenergy feedstocks (Greenpeace Canada 2011, V. Dossche, FERN, pers. comm. 01-24-2012). Wood chips are increasing in importance (IEA Bioenergy Task 40 2011). Many countries are also expanding into biogas and waste-based bioenergy (e.g., Danish NREAP 2010, UK NREAP 2010). Short-rotation energy plantations on unused agricultural land may increase as well to meet RED targets (Sikkema et al. 2011).

CHAPTER 7

Conclusions

While there is much uncertainty in pellet demand projections for the next 5–10 years within Europe, it is likely that imports will remain important and will continue to increase, especially in countries such as Denmark, the Netherlands, Belgium, Italy, the UK, and Sweden. Within the scope of the reports studied here, import projections range from 16 million to 60 million tonnes. It is also possible that new markets will develop, particularly in Germany and Austria. Demand for pellets for CHP and district heating will likely increase, as those technologies are considered highly efficient and are strongly encouraged in several EU policies. The mandatory development of National Heating and Cooling Plans for all Member Countries should provide an additional stimulus. Demand for pellets for electricity generation will likely increase as well, as some countries are implementing mandatory co-firing regulations, or encouraging dedicated biomass firing in power plants through financial schemes. The large potential capacity for pellet production in the U.S. (currently estimated at 6 million tonnes) could be made available for increased EU demand, but will require production practices and supply chain logistics meet sustainability and quality requirements for the EU markets.

The general trend is toward harmonization of sustainability requirements, yet it remains to be seen whether this will be industry-led or through EU legislation.

Sustainability is likely to remain a pivotal issue into the future. The general trend is toward harmonization of sustainability requirements, yet it remains to be seen whether this will be industry-led or through EU legislation. Topics such as carbon accounting and indirect land use changes need to be resolved, if possible with a global consensus, in both certification schemes and national or international agreements on sustainability requirements. This will help to decrease trade and market barriers globally while ensuring climate goals are met through bioenergy development.

It is probable that certification of pellets will become the norm within the EU, and U.S. producers need to consider how they might begin to meet those requirements. Within the Southern U.S., only 17% of commercial forest land is certified sustainable through one of the major U.S. schemes: Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), and American Tree Farm System (ATFS) (Lowe et al. 2011). Of that 17%, FSC certified land makes up 1%, while SFI and ATFS represent 16% of the total certified land within the southern U.S. (Lowe et al. 2011). Whether or not forest management practices within North America are generally considered to be "sustainable," it is necessary to ensure that specific sustainability requirements for wood pellets in the EU are met or exceeded by U.S. forestry practices.

Sustainability requirements laid out in the EC-RED and Report COM (2010)11 likely will remain the baseline for future policies. Domestic producers need to examine how sustainability pathways, whether through certification, biomass harvest guidelines, or other conservation programs, might be consistent with the sustainability requirements of the EU. See the companion report *Pathways to Sustainability* by Environmental Defense Fund and Pinchot Institute on this topic. The upcoming report from the EU examining the different national sustainability schemes should provide additional guidance as to which European schemes will be appropriate in the near future and will further define what sustainability standards will be required for production of wood pellets in the United States.

Appendices

Appendix 1: Relevant EU level policies influencing biomass

Appendix 2: Relevant national schemes influencing biomass in the EU

Appendix 3: Relevant industry led sustainability schemes

Appendix 4: Supply and demand projections for pellets by country or region

Appendix 5: Possible EC policy actions for three different areas (production of biomass, GHG performance across life cycle, conversion of biomass to energy

APPENDIX 1

Relevant EU level policies influencing biomass

Policy	Description	End-use application	Eligibility requirements	Timeframe	Sustainability requirements	Additional notes (upcoming changes, etc.)
Directive 2009/28/EC	Renewable Energy Directive. 20% final energy consumption from RE (10% RE for transport) and 20% decrease in GHG emissions by 2020. Mandatory compliance for all Member States. Member States must write RE Action Plans and bi-yearly progress reports during the period of implementation.	Solid and liquid biomass for transport, heat and electricity	n/a	2009–2020	• Sustainability criteria given for biofuels and bioliquids but not solid biomass. Includes: (1) GHG savings of at least 35%, up to 50% by 2017, and 60% by 2018, (2) No production in land of high biodiversity value, (3) No production from the conversion of land with high carbon stock, (4) No production in converted peatland. Biofuels produced and consumed in the European Community must adhere to these criteria. • Certain approved independent sustainability schemes may demonstrate compliance with the above criteria. Only biomass that meets the above criteria can be counted toward Member Countries RE targets. • Indicates that the "mass-balance method" should be used to verify compliance and the "energy allocation method" for calculating GHG emissions.	• Certification schemes for boilers and stoves must become available by Dec. 2012 according to Annex 4 • EC recently concluded that binding criteria at EU level on sustainability requirements for solid biomass for electricity and heating wasn't necessary but recommend that all sustainability schemes developed within the EU align with requirements in RED (late 2011) • Several certification schemes for biofuels and bioliquids have been approved by EC, incl. ISCC, RTRS, RSB, Bonsucro, Greenergy, etc.
Report COM (2010) 11	Provides recommendations for sustainability requirements for solid biomass pursuant to Article 19 of RED. They are not binding, but national or industry-led schemes are encouraged to ensure criteria are complimentary.	Solid biomass for electricity or heating	Plants over 1 MW capacity should adhere to these criteria	2010–2020	• Stipulates that LCA methods must include conversion efficiencies to final energy to be valid. • Criteria are essentially identical as those for biofuels and bioliquids, with the following exceptions: (1) GHG requirements aren't necessary for wastes because of complexity of calculations, (2) GHG methodology of solid biomass must be extended to include conversion efficiency of end use, and (3) compliance may be demonstrated through voluntary sustainability schemes, bilateral or multilateral agreements with third countries, and Member States' national verification methods.	• Recommends Member States encourage uptake of highest-efficiency technologies, such as CHP or pellet boilers to stimulate increased efficiency • EU will publish a report reviewing all relevant national sustainability schemes that are in agreement with RED criteria, and make further decision whether to incorporate binding criteria, pushed back to early 2012
Emissions Trading System	"Cap and Trade" emissions program operating within the EU. Emissions caps are lowered each year to achieve a 20% reduction below 1990 levels by 2020 by 2020. Currently operating in 30 countries (EU-27 plus Iceland, Liechtenstein, and Norway).	Power stations or combustion plants using biomass	Power stations, combustion plants, oil refineries and iron and steel works, and other industrial factories	2005–2020	• Must record all emissions and pay for emission allowances or pay heavy fines • Emissions data is verified by an independent auditor yearly • Biomass plants are considered carbon neutral in accounting scheme (biomass share is carbon neutral, dedicated biomass plants are exempt)	• Changes in 2013 introducing an auctioning system for allowances, and expanding allowances to include different gases • Airlines joining in 2012

Policy	Description	End-use application	Eligibility requirements	Timeframe	Sustainability requirements	Additional notes (upcoming changes, etc.)
Energy Efficiency Directive (COM (2011) 370)	Meant to stimulate energy efficiency measures in order to reach 20% reduction in consumption by 2020. Involves such measures as requiring public sector to retrofit buildings to increase energy efficiency, industry to perform energy audits and save a minimum amount of energy a year, and measures to promote district heating (or CHP).	District heating and CHP plants	All Member States must have national heating and cooling plans by 2014, encouraging the development and expansion of CHP and district heating	Initiated in 2011, in effect by 2014		• Member Countries are encouraged to set energy efficiency targets (non-binding) • If the Commission thinks that by 2014 they are not likely to achieve the 20% target, they will impose binding national efficiency targets
EU (Illegal) Timber Regulation (Regulation No. 995/2010)	Banning the entry of illegally logged timber into the EU. Importers will have to use due diligence and perform risk assessments to ensure incoming timber isn't being illegally logged. Member States are required to check operators for compliance periodically.	Applies to all raw timber and wood products. Not paper products until 2018.	All importers of wood and wood products	Entering into effect 2013	n/a	• May affect sourcing of biomass from third countries (i.e., Russia might have a problem) • European Commission to release more detailed rules (expected July 2012) before regulation comes into effect

APPENDIX 2

Relevant national schemes influencing biomass in the EU

Policy	Country	Description	End-use application	Eligibility requirements	Timeframe	Sustainability requirements	Additional notes (upcoming changes, etc.)
Market Incentive Program	Germany	Subsidies on purchase and installation of pellet stoves and boilers	High quality pellets for residential use	Minimum boiler efficiency of 89% when used with pellets	Started 1999 ends 2012	n/a	
Biomass Power Sustainability Ordinance	Germany	Regulates raw material production within and outside of the EU	Industrial power plants or CHP using liquid biomass	n/a	Initiated 2009	• Uses RED requirements • Mandatory 35% GHG emissions reduction • no land-use changes associated with biomass production from 2005 onward (instead of 2008 as in RED) • Proof of sustainable production must be provided (through certificate)	n/a
Green Electricity Act	Austria	To stimulate all forms of green electricity	Electricity producers	n/a	2002	n/a	
Energy Action Plan	Austria	Goal of 100% heating by renewables, 39% reduced demand, –65% CO_2	n/a	n/a	2010–2030	n/a	
Fossil Fuel Tax (Sulfur, CO_2 and NO_2)	Sweden	Tax on heat produced from fossil fuels, incentivizes use of biomass for production.	CHP, district heating plants	n/a	1991–present	n/a	
Green Certificate Schemes	Belgium	Provides guaranteed value for electricity generated from biomass. Goal of emission reduction of 7.5% by 2012, and 6% renewable electricity by 2010. Regional standards for eligibility differ slightly.	Industrial co-firing power plants, and biofuels users	Eligibility determined by percentage of green electricity provided, or by meeting minimum efficiency measures	n/a	Yearly evaluation of CoC for biofuels, doesn't mention verification for solid biomass	• Since 2010, co-firing stations will only receive 50% of the GEC, and dedicated biomass generating stations will receive 100%
MEP Subsidies	Netherlands	Feed-in tariffs for industrial power plants. Soon to be replaced by SDE and SDE+ which focus more on small-scale electricity production.	For all industrial co-firing power plants	n/a	Ending 2012–2014	Producers must comply with NTA 8080/8081 in order to qualify	• Netherlands has proposed requirements to mandate minimum level of biomass to be used in all power plants by 2022

Policy	Country	Description	End-use application	Eligibility requirements	Timeframe	Sustainability requirements	Additional notes (upcoming changes, etc.)
NTA 8080/8081	Netherlands	This is a certification scheme to ensure sustainability of biomass, to promote sustainable biomass use within the Netherlands. This criteria is also being considered in development of CEN TC 383 (CEN standards for biofuels and bioliquids).	Voluntary, but mandatory for all electricity operators and transport industry who wish to apply for MEP subsidies	n/a	2009	• Certification audits are done by an independent certifying body • Electricity and heating: mass balance, track and trace or book and claim methods all acceptable for CoC verification • Group certification is possible	• Dutch government hoping to promote wider adoption of this criteria in the future • Corbey Commission is working on addressing new topics within this scheme: iLUC, solid biomass and is a principlal advocator for an EU wide binding criteria for solid biomass
Tax Incentives for RE in Heating and Cooling, Subsidies for RE Electricity	Denmark	Economic incentives to stimulate RE usage for electricity and heating and cooling	RE developers & investors	n/a	Amended 2009	n/a	• Tariffs ending 2012–2015, may affect demand of pellets
Biomass Regulations	Denmark	Biomass Agreement • with large utilities required them to co-fire a certain amount per year • Green Growth 2.0 to promote biomass use in smaller generating stations, also has other initiative to promote biogas, and energy crops	Co-firing industrial power plants, combined heat and power	For Green Growth 2.0: Co-gen plants <2 MW	Biomass Agreement initiated in 1993, GG 2.0 Planned	n/a	• Biomass Agreement ended in 2008, replaced by Green Growth
Renewable Obligations & Renewable Transport Fuel Obligation	UK	Regulatory measures to increase percentage of RE in energy generation. Goal is to increase RE to 30%. CHP is one of the most supported technologies, offers 2 ROCs per MW produced.	Large scale electricity and CHP (ROs) and transport industry (RTFO)	n/a	Initiated 2002, in effect until 2037	• Uses other standards to prove compliance with their own meta-standards. Requires companies to report on carbon emissions savings and sustainability of biofuels or biomass being used.	• Tariffs for electricity generation are also in development • RFTO is under review, to see if it can become more aligned with the RED
Renewable Heating Incentive	UK	Financial incentives to increase heat production from RE technologies to 12%	Businesses, individuals generating heat at all levels	n/a	Initiated 2011	n/a	

APPENDIX 3

Relevant industry-led sustainability schemes

Name of Scheme	Developer	Region	Description	Sustainability Criteria	Link/ Reference
SWAN Ecolabel (Nordic Ecolabel)	Nordic Council of Ministers in 1989	Sweden, Denmark, Norway, Iceland, Finland	Most well-known ecolabel in Nordic countries. Criteria for solid biomass and biofuels, as well as 61 other product groups. Mostly intended for pellets for district and residential heating. Criteria are updated every 3–5 years.	• Criteria address manufacturing methods, transport and storage. Must identify proportion of certified product, origin, type of material (whether residue or virgin wood material) and energy consumption due to manufacturing. If pellets are made from virgin wood, a minimum of 70% raw material must come from certified forest. • A number of new criteria may be introduced in the future; such as lowering energy consumption during production, controlling emissions of stored pellets, different quality specifications based on production process and feedstock type	van Dam et al. 2010 http://www.nordic-ecolabel.org/about/
Green Gold Label	RWE-Essent in 2002	Originated in Netherlands—Green Gold Label now worldwide (certification in 9 countries, 25 companies)	Independent from Essent, moving toward multi-stakeholder certification. Has been recognized formally by the EU, Dutch Emissions Authority (Netherlands) and the UK as a valid certification system.	• Has 8 separate standards for different aspects of biomass production (whether ag or forestry, processing and trade, GHG calculations, etc.). Meant to ensure sustainability from utilities to the source. GGL is waiting to get approval for a new GGL-RED standard. • Uses the mass-balance verification system, and yearly audits	http://www.greengoldcertified.org/site/pagina.php?id=11 van Dam et al. 2010
SGS/Laborelec Certification System (LBE)	GDF-SUEZ & Electrabel	Belgium, initiated 2005	Complies with Belgium policies and Green Certification Schemes. Looking into updating the LBE to include Cramer Criteria in the near future. This is a business-to-business initiative. Mostly aimed at woody residues, but some agricultural residues included. Laborelec also involved in PellCert and IWPB, which may become dominant in future.	Feedstock must be from sustainably managed forest (certified or evidence to prove), comply with legislation, protect environment, meet energy/CO_2 balances, identify origin of raw material, and be traceable. Emphasis on full traceability of resources used (incl. electricity used, fossil resources used, and transport) and carbon/energy balances.	van Dam et al. 2010 http://www.laborelec.com/ENG/wp-content/uploads/PDF/Biomass/LBE-YR-Certification-Biomass-short.pdf
EN 14961	European Committee of Standardization (CEN), finalized in 2010	EU-27	Classification system for wood pellets within EU. Industrial and non-industrial, must be declared on bulk pellet products since 2010.	Includes origin and source, moisture and ash content, amount of fines and additives, calorific value, and mechanical durability, among other criteria	Junginger et al. 2010, van Dam et al. 2010
ISO 13065	International Organization for Standardization (ISO) Technical Committee 248	International—29 countries involved, 14 observing. Initiated in 2009, project committee set until 2015.	Status is "in development" but lists the goal of standardization of "sustainability criteria for production, supply chain and application of bioenergy. This includes terminology and aspects related to the sustainability (e.g., environmental, social and economic) of bioenergy."	n/a	http://www.iso.org/iso/iso_technical_committee.html?commid=598379
Drax Sustainability Policy	Drax Power Limited, 2011	UK	Principles for responsible procurement. Mandate that all suppliers adhere to these principles and provide evidence to demonstrate compliance. Drax commits to working with organizations to develop international standards and improvement of principles, including using 3rd party auditors to ensure compliance. Also committing to reduce GHG emissions by 70%.	Minimum: suppliers must comply with sustainability requirements of the UK government. Principles address GHG emissions, carbon stock, biodiversity, competition with food and water resources, soil, water, and air quality, local prosperity and social well-being.	http://www.draxpower.com/biomass/sustainability_policy/

Name of Scheme	Developer	Region	Description	Sustainability Criteria	Link/ Reference
ENPlus	European Biomass Association (AEBIOM), through the European Pellet Council (EPC) with input from 10 national pellet associations and Laborelec	EU-27	Continuation on EN-14961 quality standards, attempting to create a uniform quality standard for all pellets coming into/produced in the EU. All certification bodies are in the EU. Producer-based standards, meaning producers may choose to apply.	Developing sustainability criteria for this "ENPlus GREEN" which will be added by autumn 2012. Sustainability requirements as of right now: state GHG emissions associated with production, or use default values supplied by EPC. Must also document the origin of feedstock, how much is certified and by what scheme.	http://www.enplus-pellets.eu/
IWPB (Initiative Wood Pellet Buyers)	Initiated by Laborelec, with the participation of 7 major utilities: Vattenfal, DONG Energy, E.ON, Drax Power, Delta, RWE-Essent, GDF-SUEZ	EU-27	Agreement on sustainability principles for 7 major utilities. Takes the meta-standards approach, and makes use of other certification schemes to demonstrate compliance. In draft form, currently serves as a guide only. Purpose is to ensure trade within major utilities is guaranteed sustainable.	8 principles: GHG Balance, Carbon Stock, Biodiversity, Soil Quality, Air Quality, Water Quality, Competition for Food and Water, and Local Socioeconomic Performance. First three principles must be explicitly verified by an independent auditor, last five must be addressed in reports and meet minimum legal requirements. Certification can be used to prove these criteria (e.g., FSC, Laborelec, RSPO, SFI, PEFC)	IEA Bioenergy Task 40 2011, http://www.laborelec.com/pages_files/2011-11-09-IWPB-Sustainability%20principles.pdf

APPENDIX 4

Supply and demand projections for pellets by country or region

	Use	Current demand	Current imports	Current supply (domestic)	Projected total demand	Projected imports	Projected supply (domestic)	Notes
North America								
Sikkema et al. 2011	Export, some residential heating (Northeast USA)	n/a		3.2 million tonnes (2008)	n/a	n/a	n/a	
Society of American Foresters 2012	Export, some residential heating (Northeast USA)	n/a		1.6 million tonnes (2010)*	n/a	n/a	n/a	*To the Netherlands, UK and Belgium
Sweden								
Cocchi & Marchal 2011	District heating, CHP	2.3 million tonnes (2010)	695,000 tonnes (2010)	1.65 million tonnes	n/a	n/a	n/a	
Beurskens et al. 2011/ Country NREAPs	District heating, CHP	n/a	360,530 tonnes (2008)	n/a	27.029 million tonnes (2020)	660,584 tonnes	n/a	
Germany								
Cocchi & Marchal 2011	Residential heating	1.2 million tonnes (2010)	n/a	1.7 million tonnes (2010)	n/a	n/a	n/a	Exports to Austria, Denmark, Italy, Sweden & France
Beurskens et al. 2011/ Country NREAPs	Residential heating	n/a	n/a	n/a	77.69 million tonnes (2020)	22.1 million tonnes (2020)	55.6 million tonnes (2020)	These numbers are for total biomass, not woody biomass or pellets specifically
Austria								
Cocchi & Marchal 2011	Residential heating	630,000 tonnes (2010)	n/a	850,000 tonnes (2010)	n/a	n/a	n/a	Net exporter
Beurskens et al. 2011/ Country NREAPs	Residential heating	n/a	n/a	n/a	9 million tonnes (2020)	1.63 million tonnes (2020)	7.37 million tonnes (2020)	The imports are listed as "woody biomass, usually waste products like sawmill, pulp and paper residues"
Denmark								
Cocchi & Marchal 2011	District heating, CHP, co-firing	1.72 million tonnes (2010)	1.58 million tonnes (2010)	137,000 tonnes (2010)	n/a	n/a	n/a	
Beurskens et al. 2011/ Country NREAPs	Co-firing power plants	n/a	n/a	n/a	4.28 million tonnes (2020)	3.85 million tonnes (2020)	428,000 tonnes (2020)	Numbers from Danish NREAP Memorandum
Italy								
Cocchi & Marchal 2011	Residential heating	1.4 million tonnes (2010)	1.05 million tonnes (2010)	n/a	n/a	n/a	n/a	
Beurskens et al. 2011/ Country NREAPs	Residential heating	n/a	n/a	n/a	10.0 million tonnes (2020)	n/a	n/a	No information on imports or projected domestic supply in NREAP or Beurskens et al. 2011 report

	Use	Current demand	Current imports	Current supply (domestic)	Projected total demand	Projected imports	Projected supply (domestic)	Notes
Belgium								
Cocchi & Marchal 2011	Co-firing mostly, residential heating	940,000 (2010)	n/a	300,000 tonnes (2010)	n/a	n/a	n/a	Not a lot of info on imports, although acknowledgment that imports are important
Beurskens et al. 2011/ Country NREAPs	Co-firing mostly, residential heating	n/a	n/a	n/a	9.11 million tonnes (2020)	7.21 million tonnes (2020)	2.23 million tonnes (2020)	
UK								
Cocchi & Marchal 2011	Industrial co-firing	683,000 tonnes (2010)	550,000–884,000 tonnes (2010)*	197,000 tonnes (2010)	n/a	n/a	n/a	* Lower estimate is from UK Forestry Commission, higher estimate is from Eurostat
Beurskens et al. 2011/ Country NREAPs	Industrial co-firing	n/a	n/a	n/a	12.5 million tonnes solid biomass (2020)	n/a	5.225 million tonnes solid biomass (2020)	No info on imports, states that "imports are market driven and can't be predicted"
Netherlands								
Cocchi & Marchal 2011	Industrial co-firing	1.5 million tonnes (2011)	1.4 million tonnes (2010)	n/a	n/a	n/a	n/a	
Beurskens et al. 2011/ Country NREAPs	Industrial co-firing	n/a	n/a	n/a	18.6 million tonnes (2020)	3.95 million tonnes (2020)	11.63 million tonnes (2020)	Numbers are for total biomass, not wood pellets, except for the imports, which includes all solid biomass for co-firing

APPENDIX 5

Possible EC policy actions for three different areas: production of biomass, GHG performance across life cycle, conversion of biomass to energy

	Effectiveness in achieving objectives	Efficiency (cost-effectiveness)	Consistency (with policy structures and socioeconomic developments)
Option A1: No new EU action	Ineffective in avoiding negative land-use changes	Not relevant	Inconsistent with biofuels policy
Option A3: Minimum biodiversity and land-use criteria	Effective in ensuring further safeguards against negative land-use changes	Administrative costs minimized as verification scheme for origin of biomass is required under RES Directive	Consistent with biofuels policy
Option A4a: Option A3 + mandatory reporting and monitoring SFM	Effective in ensuring further safeguards against negative land-use changes and effective in informing decisionmakers about future trends	Administrative costs can be minimized where reporting is based on existing voluntary reporting tools (e.g., MCPFE)	Consistent with biofuels and with global SFM policies
Option A5: Option A3 + SFM obligation	Effective in avoiding negative land-use impacts as well as ensuring SFM	High administrative costs for monitoring implementation of SFM criteria and for certification of SFM	Consistent with EU policy objectives to tackle deforestation and forest degradation
Option B1: No new EU action	May lead to some biomass pathways not achieving high GHG performance	Not relevant	Inconsistency of accounting GHG emissions for agricultural biomass under the RED
Option B2: Labeling of GHG performance	Effective only for consumer products not large-scale plants	Some costs to administrations and to economic operators	Not relevant
Option B3: Minimum GHG savings threshold for agricultural and forestry pathways of 35% (increasing to 50–60% in 2017/2018)	Effective in avoiding pathways with low GHG performance	Some costs for verification of GHG performance	Consistent with biofuels policy
Option B4: Minimum GHG performance in accordance with GHG performance potential (except for waste biomass)	Effective in avoiding worst practices and lowering GHG emissions	Some costs for verification of GHG performance	Consistent with GHG emissions reduction policy, but not with biofuels policy (e.g., second generation biofuels)
Option C: No new EU action	Some improvement due to existing policies	Not relevant	Not relevant
Option C2: Bonus or penalty	Effective as bio-energy producers receive a direct incentive, but the effect depends on bonus/ penalty structure	Cost for governments can be significant	Easily included in existing policy framework and in line with general approach to reward good behavior
Option C3: Minimum efficiency performance standards	Effective in excluding poor performing installations, but difficult to set unambiguous thresholds	High compliance costs to economic operators if applied to existing installations	Requires development of new policy instrument and may conflict with aims of other policies (promotion of renewables vs. fossil, waste treatment, rural development, security of supply)

Positive effect Moderate effect Negative effect

taken from European Commission 2010a, p. 50

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