



# Possibilities of sustainable woody energy trade and impacts on developing countries

## Final Report for GIZ

prepared by

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## Note on this Report

This is the **full final report** of the study concerning “Possibilities of sustainable woody bioenergy trade and impacts on developing and emerging countries” prepared by IINAS for GIZ.

The **Annexes** provide more detail and results from interviews with resource persons.

A special country case study for Brazil was carried out by CENBIO through a subcontract with IINAS, and is available as a separate document<sup>1</sup>.

A summary report with key data and findings from the study is also available as a separate document<sup>2</sup>.

## Acknowledgments

This study benefited from many inputs, especially those from interviewees (see Annex to Full Report) and discussions with colleagues from GIZ, BMELV, BMU, BMZ, IEA Bioenergy, and GBEP.

All views expressed here and any omission or errors are the sole responsibility of the authors.

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<sup>1</sup> CENBIO (Centro Nacional de Referencia em Biomassa) 2013: Possibilities of sustainable woody energy trade and impacts on developing countries: Country Case Study Brazil; Coelho S, Escobar J; prepared for GIZ under subcontract with IINAS; Sao Paulo [http://www.iinas.org/tl\\_files/iinas/downloads/CENBIO\\_2013\\_Brazil-Case-Study\\_GIZ.pdf](http://www.iinas.org/tl_files/iinas/downloads/CENBIO_2013_Brazil-Case-Study_GIZ.pdf)

<sup>2</sup> IINAS (International Institute for Sustainability Analysis and Strategy) 2014: Possibilities of sustainable woody bioenergy trade and impacts on developing countries - summary report; Fritsche U, Iriarte L, Gress HW; commissioned by GIZ; Darmstadt, Madrid  
[http://www.iinas.org/tl\\_files/iinas/downloads/IINAS\\_2014\\_Sust\\_Woody\\_Bioenergy\\_summary\\_report\\_GIZ.pdf](http://www.iinas.org/tl_files/iinas/downloads/IINAS_2014_Sust_Woody_Bioenergy_summary_report_GIZ.pdf)

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## Acronyms

ADB	African Development Bank
AEBIOM	European Biomass Association
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit (German Federal Ministry for Environment, Nature Protection and Nuclear Safety)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BRACELPA	Brazilian Pulp and Paper Association
CEN	European Committee for Standardization
CFS	Committee on World Food Security
CNI	National Confederation of Industry – Brazil
DECC	UK Department of Energy & Climate Change
DENA	Deutsche Energie-Agentur
DIRET	Education and Technology Directorship – Brazil
DME	Department of Minerals and Energy, South Africa
EC	European Commission
ECN	Energy Research Center of the Netherlands
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Regional Centre for Renewable Energy and Energy Efficiency
EDF	Environmental Defense Fund
EEA	European Environment Agency
EFI	European Forest Institute
ENDA	Energy, Environment, Development
ESMAP	Energy Sector Management Assistance Program
ETS	EU Emissions Trading System
EU	European Union
EUEI PDF	European Union Energy Initiative Partnership Dialogue Facility
FAO	Food and Agriculture Organization of the United Nations
FLEGT	Forest Law Enforcement, Governance and Trade
FSC	Forest Stewardship Council
GBEP	Global Bioenergy Partnership
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH



GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
IC	Imperial College
IEA	International Energy Agency
IDB	Inter-American Development Bank
IFEU	Institute for Energy and Environmental Research
IIED	International Institute for Environment and Development
IINAS	International Institute for Sustainability Analysis and Strategy
INC	Intergovernmental Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
IRENA	International Renewable Energy Agency
ISO	International Standardization Organization
ITTO	International Tropical Timber Organization
IWPB	Initiative Wood Pellet Buyers (now SBP)
JRC	Joint Research Centre
M	Million
MS	Member States
NEN	Nederlands Normalisatie-Instituut
NRC	Natural Resources Canada
OECD	Organisation for Economic Cooperation and Development
PIC	Pinchot Institute for Conservation
PISCES	Policy Innovation Systems for Clean Energy Security
PFEC	Programme for the Endorsement of Forest Certification Schemes
RED	Renewable Energy Directive (EU 28/2009)
REDD+	Reducing Emissions from Deforestation and Forest Degradation
REEGLE	Clean Energy Info Portal
RSB	Roundtable on Sustainable Biomaterials
SBP	Sustainable Biomass Partnership (formerly IWPB)
SEI	Stockholm Environment Institute
SFM	Sustainable Forest Management
t	tones
tOE	tonnes of oil equivalent
TERI	The Energy and Resources Institute
TFCG	Tanzania Forest Conservation Group

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TR	Timber Regulation (EU 995/2010)
UN	United Nations
UN GA	United Nations General Assembly
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNREDD	United Nations Collaborative Programme on Reducing Emissions From Deforestation And Forest Degradation in Developing Countries
VGGT	Voluntary Guidelines on the Responsible Governance Tenure of Land, Fisheries and Forests in the Context of National Food Security
VITO	Flemish Institute for Technological Research
WB	The World Bank
WBGU	German Advisory Council on Global Change
WHO	World Health Organization
WTO	World Trade Organization
WWF	World-Wide Fund for Nature

## EXECUTIVE SUMMARY

Many OECD countries, particularly within the EU, have set ambitious plans for the use of woody bioenergy. While the woody biomass consumed for household use is most likely to be sourced locally and is quite independent from public support, large-use consumption, especially for co-firing, is driven by policy and energy sector decisions and requires trade of large amount of woody biomass. The volume of imports of woody biomass in the EU will depend on a range of factors such as the capacity and price to mobilize domestic resources, on policy support measures as well as the price of fossil fuels, and CO<sub>2</sub> certificates.

In developing countries, about 2.6 billion people rely on inefficient, unhealthy and often unsustainable consumption of mostly woody biomass to cover basic energy needs such as cooking. Despite international and multilateral initiatives to reduce dependency on unsustainable wood supply and use, the amount of people dependent on woody biomass is not expected to change much in the coming years.

At present, increasing global demand and international trade of woody bioenergy (mainly in form of pellets) is met by well-positioned countries such as Canada, USA and Russia. These countries have not only the largest forest areas, but also infrastructures, expertise and capabilities to continue being suppliers to international woody bioenergy markets.

Particular emerging countries, especially Brazil, may enter the global woody bioenergy market if bioenergy costs are competitive. The higher the international demand, the easier emerging and developing countries might enter the market, with impacts on:

- Offering opportunities of investment and economic development
- Recognizing the importance of sustainable woody bioenergy for domestic supply both at small-scale and large-scale. This may lead to improve governance of the forest sector in general and contribute to achieve domestic renewable energy goals.
- Moving woody bioenergy higher on the international renewable energy agenda.

To avoid negative impacts and maximize benefits for emerging and developing countries, the production and trade of woody bioenergy need favorable national and international framework conditions and agreed sustainability criteria need to be applied.

The sustainability of woody bioenergy from forests and plantations depends on forest and land use management, and fuelwood demand in households. The “domestic fuelwood first” principle needs to be respected.

As a way forward this study suggests a three-fold approach:

1. **Importing** countries - especially in the EU - need to conditionalize preferential treatment of woody bioenergy in their renewable energy support policies to establish **mandatory sustainability safeguards**, building upon current international forest and timber trade regulations and private sector initiatives to avoid illegal logging and deforestation. To avoid divergence of national sustainability schemes and respective proliferation which would hamper international trade, the legally binding sustainability requirements of the EU Renewable Energy Directive **need extension** to also cover woody bioenergy for electricity and heat.
2. **Exporting** countries in emerging and developing countries need improved domestic forest and land tenure policies to address **social and environmental risks**. Given the rising demand of woody bioenergy, this needs better recognition in international processes such as the EU FLEGT Action Plan, GBEP and REDD+.
3. International **finance institutions** such as the GEF, the World Bank and bilateral donors should **require sustainability safeguards** - including social aspects - for woody bioenergy projects, and expand **funding for capacity building** on and implementation of the Voluntary Guidelines on the Responsible Governance Tenure of Land, Fisheries and Forests, and on voluntary forest certification standards as useful tools.

## Study Objectives and Methodology

This study commissioned by GIZ Program Social and Environmental Standards on behalf of the German Federal Ministry for Economic Development and Cooperation (BMZ) Division for environment and sustainable use of natural resources.

The objectives were to

- analyze demand for and developments of woody bioenergy trade
- give an overview on and influence of national and international regulations and support instruments as well as market based standards on the sustainable production of and trade with woody bioenergy
- identify options to mobilize sustainable woody bioenergy in emerging and developing countries for an exemplary country
- develop recommendations to further sustainable woody bioenergy use.

To achieve these objectives, the study used the following methodologies:

- Compilation and assessment of data on relevant governmental and private sector regulation;
- structured interviews with key stakeholders, and
- Qualitative scenario development on mobilizing sustainable woody bioenergy.

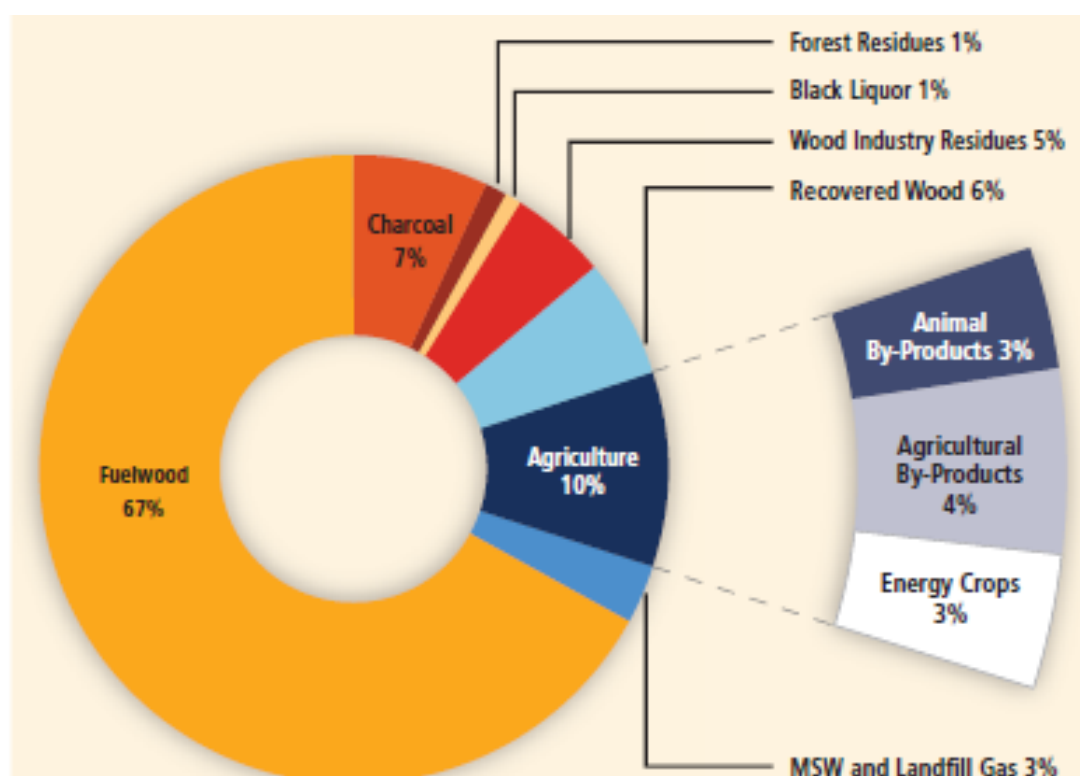
An extensive review of literature provided the base for the overall analysis and assessment.



# 1 The Current Role of Woody Bioenergy and its Prospects

Bioenergy is the most important renewable source of energy providing 10 % of global primary energy supply (IEA 2011), with fuelwood<sup>3</sup> dominating (Figure 1).

Figure 1 Shares of biomass sources for global energy



Source: IPCC (2011)

Currently, most bioenergy comes from forests and is consumed in developing countries, particularly in rural households as fuelwood for cooking and heating, representing the major energy source especially in African countries (IEA 2012a).

In the OECD, the use of woody bioenergy is quite different: typically, it accounts for less than 5% of primary energy, and is used in modern heating systems and powerplants (IEA 2012a). However, several industrialized countries - especially in the EU - have ambitious plans to **increase woody bioenergy** use:

<sup>3</sup> In this study, “fuelwood” describes unprocessed woody bioenergy harvested or collected from forests and woodlands (logs, twigs, branches). “Woody bioenergy” comprises a variety of woody biomass used for energy: from roundwood and forest residues to deadwood and salvaged wood, and from sawmill and pulp & paper residues to post-consumer wood. “Woodfuels” refers to all types of bioenergy originating directly or indirectly from woody biomass (FAO 2007).

The EU Renewable Energy Directive (RED) established the mandatory target of producing 20 % of the final energy demand from renewables by 2020 (EU 2009), in which bioenergy - especially woody biomass from forests - is expected to double its contribution (IC et al. 2012).

Other countries in Asia, the Americas and Southern Africa also promote the use of biomass, and plan to increase the use of woody bioenergy. As not all of these countries could fulfill these demands with domestic feedstock, international trade is projected to increase significantly (Section 2.4).

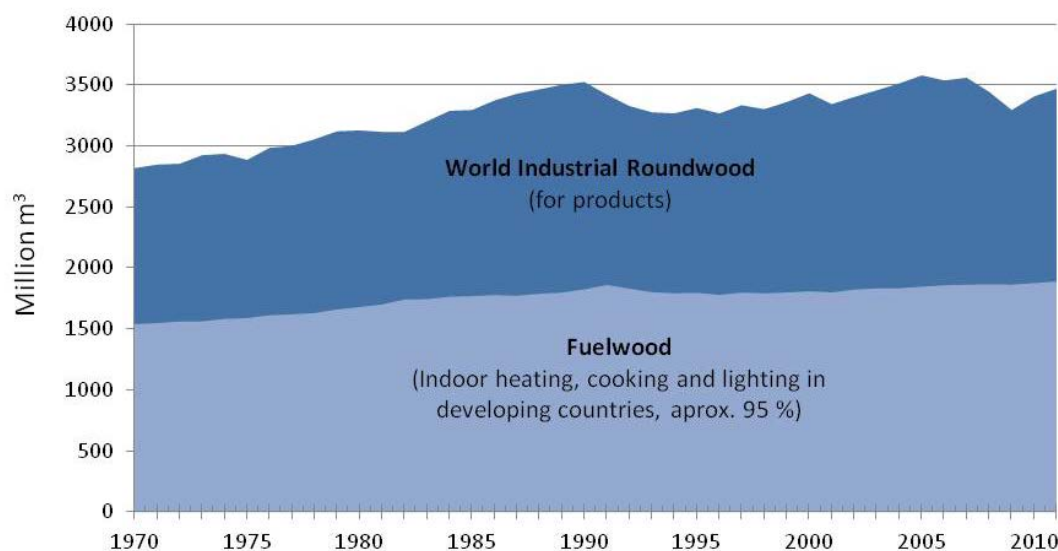
Many developing and emerging countries in the tropics and subtropics have **vast potentials for bioenergy** due to high productivity. Considering the dependence of many developing countries on fuelwood and the ambition to increase woody bioenergy in the OECD - at least in part through imports - there is a need to consider both opportunities and risks of these developments.

### 1.1 Woody Bioenergy in Developing Countries

In many developing countries, the so-called “traditional” biomass use, mainly fuelwood for cooking and heating, is often supplied from unsustainable informal harvests, risking deforestation and forest degradation. Using woody bioenergy in traditional cookstoves is very inefficient and the combustion also leads to emissions amounts of fine particles, carbon monoxide and other toxics, causing more than 1.5 million of deaths per year (WHO 2006; IEA, UNDP, UNIDO 2010).

Fuelwood provision is import for forests and livelihoods, and at global scale, fuelwood demand is higher than wood used for products (Figure 2).

*Figure 2 Fuelwood and industrial roundwood production*



Source: Own compilation from FAOSTAT (2013); roundwood= saw logs/veneer and pulpwood



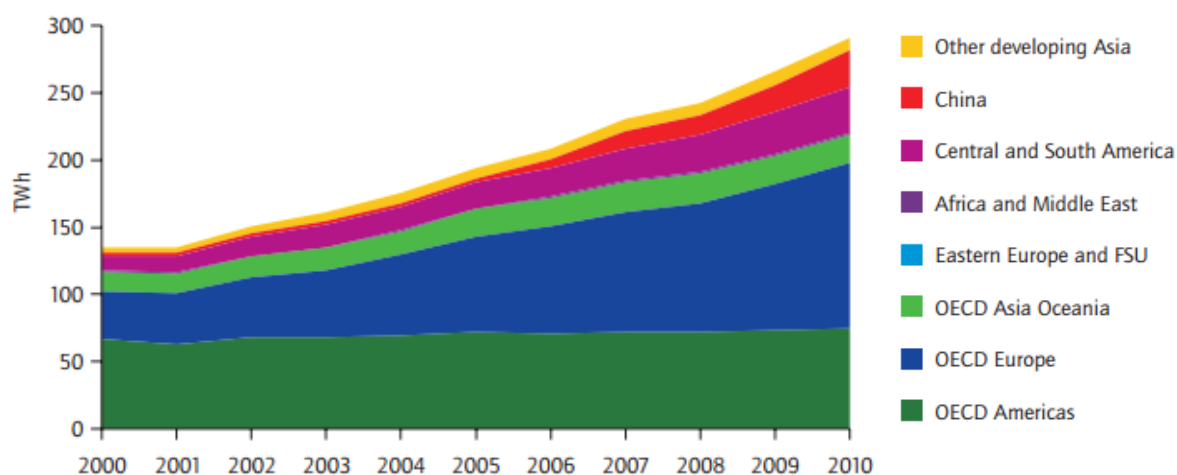
The overall trend is a slightly increase in total roundwood consumption due to increase in fuelwood. It has to be acknowledged that forest statistics, mainly those regarding fuelwood, are quite weak and might be inconsistent.

## 1.2 Woody Bioenergy in Industrialized Countries

In OECD countries, woody bioenergy is also used for heating, but with more efficient systems and lower consumption levels. Woody bioenergy competes with fossil fuels such as oil and natural gas, and especially for small-scale residential heating, energy prices of fossil fuels are quite high (IEA 2012a) so that woody bioenergy is often competitive<sup>4</sup>.

In addition to this decentralized use, woody bioenergy is increasingly used for larger-scale (district) heat and power generation where the competing fossil fuel typically is low-cost coal or natural gas which, depending on the country, can also be comparatively low-cost. In consequence, the use of woody bioenergy in larger-scale plants - especially for electricity generation (Figure 3) - depends on subsidy schemes, or regulation which requires industry and utilities to make use of renewables through quota systems, CO<sub>2</sub> taxes or CO<sub>2</sub> emission trading schemes which increase the price of fossil competitors (see Section 2.5).

Figure 3 Global electricity generation from bioenergy



Source: IEA (2012a)

<sup>4</sup> Still, investment in modern bioenergy systems such as pellet boilers is more expensive than in those for gas or oil.

**Several industrialized countries, especially in the EU-28, are promoting the use of woody bioenergy to meet their renewable energy targets. Incentive schemes for bioenergy drive demand especially for larger-scale use.**

### 1.3 Global Woody Bioenergy Potentials

Most studies give the sustainable global bioenergy potential as a range from 100 to 300 EJ by 2050, although there are many uncertainties playing a role when biomass potentials are determined<sup>5</sup>. IEA (2012a) projects global primary bioenergy to increase from 50 EJ today to 160 EJ per year by 2050, with 100 EJ for electricity and heat, mainly from woody bioenergy. In fact, it seems feasible to extract 60 to 100 EJ of additional wood from existing managed forests without reducing the re-growth potential.

Thus, woody bioenergy will play a **more important role** in the future. However, woody bioenergy can only contribute to energy supply in the long term if it is sustainably produced, and its conversion efficiency is improved (WBGU 2009).

**Despite the uncertainties around biomass potentials in general and woody bioenergy in particular, there is significant room to increase woody bioenergy use if sustainably produced.**

### 1.4 Is Woody Bioenergy Cost-effective in Reducing GHG Emissions?

Mitigating climate change is one of the main reasons why renewable energies receive policy support. Thus, the potential of GHG emission reductions from woody bioenergy systems is a key factor of its attractiveness, but - as there are alternative options to reduce CO<sub>2</sub> such as wind and solar energy or efficiency measures - also respective costs have to be considered.

The cost-effectiveness of GHG emission reductions by woody bioenergy depends on the source of the woody biomass, the reference system it is compared with, and the time horizon for the comparison (short- versus long-term).

Currently, co-firing woody bioenergy in coal powerplants is among the most cost-effective near-term options in terms of GHG reduction (see Section 2.5).

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<sup>5</sup> See i.e.: IPCC 2011, Lysen, Egmond 2008

Given the variety of situations influencing woody bioenergy's cost and GHG emissions it is not possible to make general statements on this issue, but some aggregated findings can be given:

- If wood is sourced from residues (e.g. forest thinnings, harvest leftover) and processing wastes (e.g. sawdust), the GHG mitigation compared to coal is typically higher than 60%, with up to 90% for local sources.
- For international trade, pelletization of wood is required, and shipping adds to the carbon footprint so that net reductions compared to coal are 60-70%.
- Bioenergy derived from stemwood harvested in boreal forests has comparatively long regeneration periods which reduce net GHG reduction in the near-term significantly.
- If the biomass comes from temperate forests, net GHG reduction is higher, while woody bioenergy from tropical forests show the highest GHG reduction (and potentially shortest payback time) due to high annual forest growth.
- There is plenty of salvage wood (e.g. from insect infestation and storms) for which net GHG reduction is similar to that of woody residues.
- Woody bioenergy from short-rotation plantations cultivated on non-forested land can achieve direct GHG reductions far higher than 60%, but possible **indirect** effects due to displacement of earlier land-use must be considered<sup>6</sup>.

**The cost-effectiveness of GHG emission reductions by woody bioenergy depends on source of wood, the reference system it is compared with, and the time horizon for the comparison (short- versus long-term). At present, co-firing woody bioenergy residues in coal powerplants is among the most cost-effective near-term options in terms of GHG reduction.**

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<sup>6</sup> The GHG implications of indirect land use changes (iLUC) can be significant (EEA 2013) and can offset CO<sub>2</sub> reductions. To avoid iLUC effects, plantations need to be established on under- or unused (e.g. fallow) land.

## 2 Production and Trade in Woody Biomass and Bioenergy

Woody biomass can be used for materials and energy production. Supply and international trade are well established for material use whereas only a small part of total woody bioenergy production is being traded internationally - but this share is expected to grow significantly in the near future.

### 2.1 Production and Trade of Woody Biomass for Materials

Global production and international exports shares of forest products in 2011 are shown in the following table.

*Table 1 Global production and trade of forest products in 2011*

Product	Unit	Production	Exports	% (Exports/ Production)
Roundwood	Mm <sup>3</sup>	3469	123	3.6
- Fuelwood	Mm <sup>3</sup>	1891	8	0.4
- Industrial roundwood	Mm <sup>3</sup>	1578	115	7.3
Sawnwood	Mm <sup>3</sup>	406	120	29.6
Wood-based panels	Mm <sup>3</sup>	288	71	24.6
Wood and other fiber pulp	Mt	191	54	28.3
Recovered paper, paper and paperboard	Mt	614	171	27.8

*Source: FAOSTAT Forestry database (2013)*

The construction sector is the principal driver for the demand of forest products so the availability of co-products such as pellets is linked to the demand for “material” forest products (UNECE, FAO 2011). Currently, fuelwood is the least internationally traded forest product with a share of exports in relation to production of less than 1 %. Northern Europe, Russia and North America are the main exporting countries of wood-based products. As importers, EU and Asian markets play the central role.

**International markets for timber products are well established, while new bioenergy products such as pellets are increasing. Fuelwood is mainly traded and used locally.**

## 2.2 Production and Trade of Certified Wood Products

Interest in procurement of sustainably produced woody products is growing, as retailers and public procurers and consumers want to make positive social and environmental contributions when buying these products.

The development of green-building codes in the EU, the US and Asia-Pacific countries also fosters certified wood products (UNECE, FAO 2012).

In 2012 the share of roundwood from certified forests was 26.4 % with an uneven distribution among regions (see Table 2)<sup>7</sup>. The same year nearly 10% of the world forest area was certified (UNECE, FAO 2012)<sup>8</sup>. Western Europe and North America account for the majority of certified forest area.

*Table 2 Global and regional supply of certified roundwood in 2012*

Region	Total forest area (Mha)	Certified forest area		Estimated industrial roundwood from certified forest	
		Mha	% in region	Mm <sup>3</sup>	% of total
North America	614.2	198.0	32.2	224.0	12.7
Western Europe	168.1	95.4	56.7	224.7	12.7
CIS (incl. Russian Federation)	836.9	47.5	5.7	9.1	0.5
Oceania	191.4	13.2	6.9	3.8	0.2
Africa	674.4	7.3	1.1	0.8	0.0
Latin America	955.6	14.7	1.5	2.9	0.2
Asia	592.5	9.5	1.6	3.2	0.2
<b>World total</b>	<b>4,033.1</b>	<b>385.5</b>	<b>9.6</b>	<b>468.6</b>	<b>26.5</b>

*Source: UNECE, FAO (2012). The year 2012 covers May 2011 - May 2012*

Other relevant players are Brazil and Malaysia, with 7.8 Mha and 5.1 Mha of certified forests, respectively, while China, Chile and the Democratic Republic of Congo have certified more than 2 Mha each (UNECE, FAO 2012).

<sup>7</sup> More detailed information about the state of the art on forest certification can be found in the literature (e.g. UNECE, FAO 2012) and on the website of FSC ([www.fsc.org](http://www.fsc.org)) and PEFC ([www.pefc.org](http://www.pefc.org)).

<sup>8</sup> If only larger-scale forest operations are considered, the global certified share in 2010 was approx. 50 % (Liedeker 2012).

**Interest in the procurement of sustainably produced woody products is growing and roundwood production from certified forests primarily located in developed countries was 26.4 % in 2012.**

## 2.3 Production and Trade of Woody Bioenergy

In 2011, fuelwood represented about 55 % of the total roundwood produced globally, but its significance differs regionally (Table 3).

In Africa, fuelwood represented 90% of total roundwood production in 2011, in South America and in the Caribbean 73 % and in Asia 57 %, respectively.

However, in Europe and North America, woody bioenergy amounted only to 24 % and 9 % of total roundwood production in 2011, respectively.

Total exports of fuelwood accounted for less than 1% of total roundwood production. Thus, most fuelwood is produced and consumed locally.

*Table 3 Global production and trade of woody bioenergy (2011)*

Region	% Fuelwood/ roundwood	Roundwood Production (Mm <sup>3</sup> )	Exports (1,000 m <sup>3</sup> )	Import (1,000 m <sup>3</sup> )	Consumption (Mm <sup>3</sup> )
Europe	24	162	6980	5022	160
- EU-27	22	92	4361	4680	93
- Russia	22	44	271	0	44
Africa	90	631	28	9	631
Asia	73	756	52	256	756
- China	64	185	2	4	185
- India	93	309	0	5	309
- Indonesia	49	57	1	26	57
North America	9	44	631	207	43
Latin America	57	288	12	4	288
- Brazil	51	144	0	0	144
Oceania	15	11	1	1	11
<b>World</b>	<b>55</b>	<b>1891</b>	<b>7704</b>	<b>5,499</b>	<b>1,889</b>

*Source: FAOSTAT Forestry Database (2013); consumption is calculated as production + imports - exports*

The international trade of woody bioenergy is dominated by **pellets for large-scale users**, mainly between Northern America and Europe (IEA Bio 2013), and has significantly increased over the last years.

Canada, the US and the Russian Federation, followed by European countries such as Austria, Germany and Sweden, show the highest increase in production capacity.

In 2010, the **European** pellet industry covered 81 % of the demand, but the gap between production and consumption in the EU is growing. Wood pellets imports mainly come from North America and Russia to the EU (Figure 4).

*Figure 4 World wood pellet trade streams in 2010*



Source: Lamers et al. (2012); only trade flows above 10 kt are shown

The main feedstock to produce pellets are residues from sawmills (Cocchi et al. 2011). As producers are interested in a more diverse supply, other feedstocks such as forest residues, thinnings, salvage materials and “surplus” roundwood are being used or under consideration in some regions.

As regards certified woody bioenergy, there is **no international data** available. Some pellet producers in the Southeast of the US source their material from certified forests, and domestic pellet production in the EU (e.g. Austria, Germany, Finland, Sweden) also uses feedstock from forests certified by FSC or PEFC, but quantitative figures are not available.

Given the interests of electric utilities in Europe to procure sustainable woody bioenergy (see Section 2.4) and the discussion on sustainability requirements for woody bioenergy in the EU (see Section 5.2) it can be expected that sustainability certification will **become more relevant** in future international woody bioenergy trade.

**Pellets for large-scale use in Europe dominate international woody bioenergy trade and are expected to increase. Today, there is not date on trading certified woody bioenergy, but sustainability certification will play a key role in the future development of the market.**

## 2.4 Future Demand for Woody Bioenergy Imports

To meet GHG mitigation and renewable energy goals, a number of (mainly industrialized) countries introduced policies to increase the share of bioenergy in their national energy mix, including an increasing demand for imports of woody bioenergy to these countries (IEA 2012a). Accordingly, global markets developed strongly over the last decade, with the EU as a key driver. Countries such as Canada, Japan, South Korea and the US, as well as emerging economies such as China and India announced to increase the share of biomass in their national energy systems.

The EU used about 113 MtOE of primary biomass in 2010 of which 9.5 MtOE were imported and 4.2 exported (AEBIOM 2012). The future EU primary biomass consumption is expected to reach 178 MtOE by 2020, of which 119 MtOE would be solid biomass<sup>9</sup> (ECN 2011). It is projected that the gross final energy consumption from biomass is composed of 20 MtOE for electricity, 90 MtOE for heat and 30 MtOE for biofuels. Thus, solid biomass is and is expected to be the most consumed type of bioenergy (see Annex 2 for details).

Both Canada and the US not only export woody bioenergy, but increasingly use this resource also domestically: The Canadian “Go Pellets” initiative promotes developing a domestic pellet market, and Quebec announced to increase co-firing of domestic wood in its coal plants by 2020. In the US, pellet use for heating is increasing, but comparatively low oil and gas prices hamper markets. As there is not (yet) a domestic policy on GHG mitigation, exports to Europe yield higher revenues.

The final demand will depend on policy support measures, in particular for co-firing, as well as the price of fossil fuels, and CO<sub>2</sub> certificates (see Section 2.5). Another driving force might be the development of the bioeconomy, including bioproducts and respective demand of woody feedstocks.

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<sup>9</sup> According to EurObserver (2012) solid biomass refers to wood, waste wood, other plant and animal-based biomass



The IEA Bioenergy Task 40 developed scenarios for future EU wood pellet imports (“low” and “high” variants in Figure 5 and Figure 6). According to the results of the interviews<sup>10</sup>, the low scenario seems more realistic, though. Under this scenario the only emerging economy that could play a role is Brazil. In the high scenario developing countries such as Mozambique, Western African countries and Uruguay could participate as exporters.

Furthermore, the price dynamics for CO<sub>2</sub> certificates under the European Emission Trading System (ETS) will determine to what extent co-firing will be of interest for utilities and industrial emitters. The evolution of large-scale industrial use and co-firing is uncertain, as policy frameworks such as the RED and the ETS do currently not give adequate price signals. Major utilities such as e.on, RWE and Vattenfall have reduced their ambitions for co-firing due to low CO<sub>2</sub> certificate prices, and lack of EU regulation on the sustainability of woody bioenergy.

As comparatively low-cost import options exist for pellets from Canada, the US Southeast and Russia, utilities will use these options once future CO<sub>2</sub> certificate prices and EU sustainability regulation for woody bioenergy become clear.

This implies that overall prices for internationally traded woody bioenergy, especially to the EU, will remain low so that other potential market suppliers e.g. from developing countries would face low revenues for risky investments.

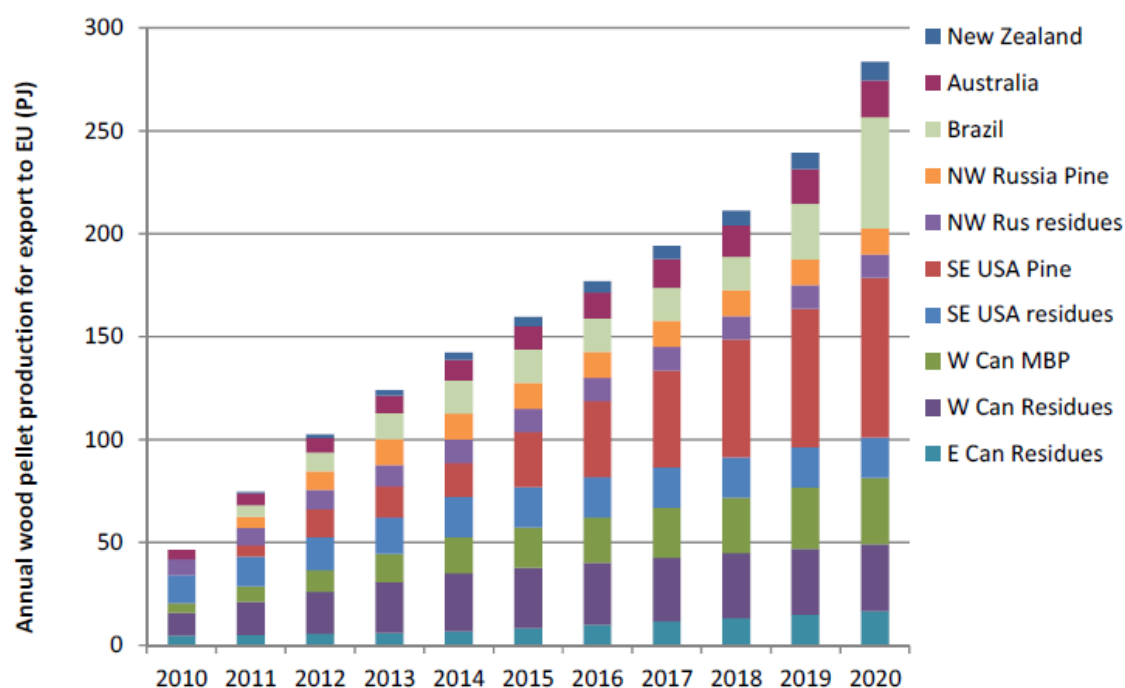
With regard to Russia it is noteworthy that although its Forestry Code was revised in 2006, it is still unclear how possible exports to the EU could comply with the due diligence requirement of the EU Timber Regulation (FERN 2011). Russia has vast forest resources but only about 25 % of annual allowable cut is harvested (Solberg et al. 2010).

Aiming at encouraging value-added exports, Russia imposed high tariffs on roundwood exports. However, it is foreseen that Russia increases its export of woody bioenergy to EU as part of its new policies as a WTO member.

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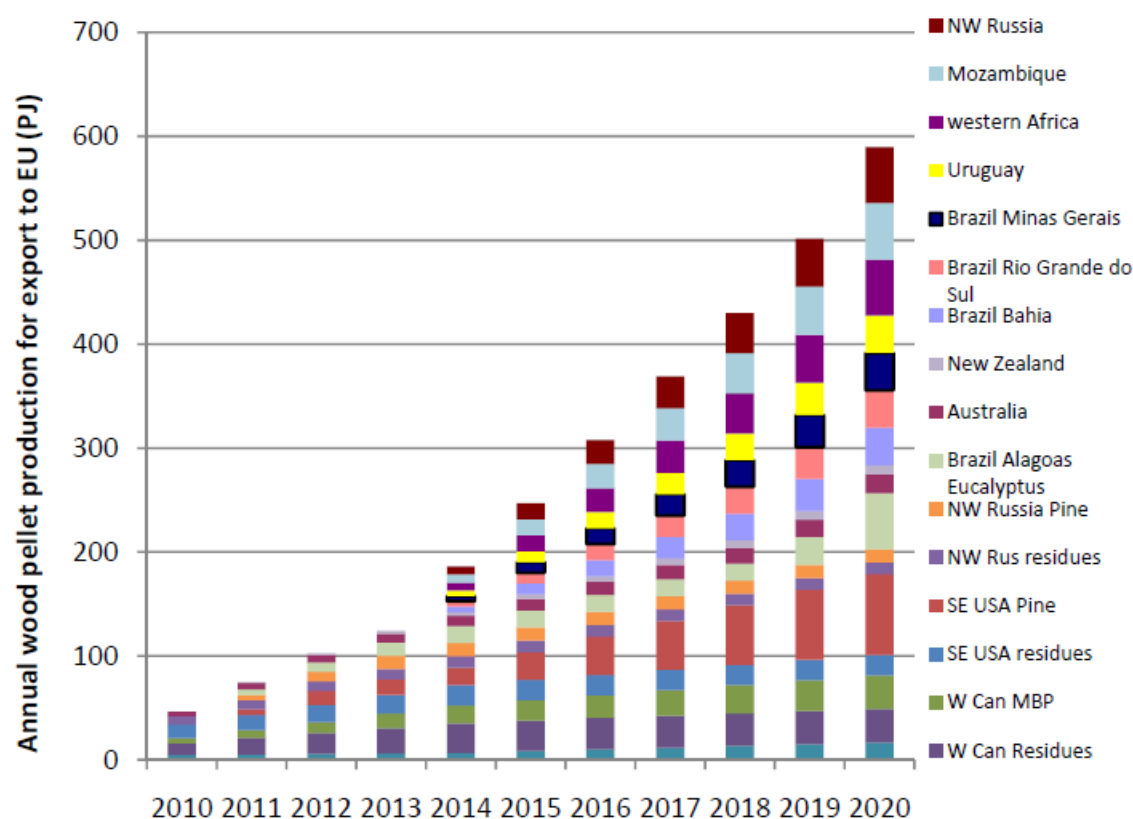
<sup>10</sup> See Annex to the Final Report, available at [http://www.iinas.org/tl\\_files/iinas/downloads/IINAS\\_CENBIO\\_2013\\_Sustainable-Woody-Bioenergy\\_GIZ.pdf](http://www.iinas.org/tl_files/iinas/downloads/IINAS_CENBIO_2013_Sustainable-Woody-Bioenergy_GIZ.pdf)

Figure 5 Growth in global wood pellet exports to the EU - Low scenario



Source: Cocchi et al. (2011); NW = Northwest; Rus = Russia; SE = Southeast; W= West; Can = Canada; E= East; MPB = Mountain pine beetle; residues = from wood industry

Figure 6 Growth in global wood pellet exports to the EU - High scenario



Source: Cocchi et al. (2011); residues = from woody industry; MPB = Mountain pine beetle

**Woody bioenergy demand in industrialize countries depends on policy support measures (in particular for co-firing), as well as fossil fuel prices, and cost of CO<sub>2</sub> certificates. The US (South-east), Canada and Russia are well established markets with possibilities of supplying low-cost products.**

## 2.5 Cost-Effectiveness of Co-firing Woody Bioenergy

The cost of bioenergy from woody biomass depends on the wood source and the conversion technology. Typically, there are three types for this:

- biomass power plants using local forest residues,
- biomass co-generation unit using local wood chips, and
- large-scale co-firing in coal powerplant with imported pellets.

Electricity generation costs<sup>11</sup> are in the range of 90-120 €/MWh<sub>el</sub> for small-scale plants using local forest residues, 75-100 €/MWh<sub>el</sub> for cogeneration plants (depending on revenue from heat sales), and around 80 €/MWh<sub>el</sub> for co-firing in existing coal plants, i.e. co-firing is typically the cheapest option.

However, co-firing is still **more expensive** than electricity from coal which has generation costs of 40-50 €/MWh<sub>el</sub>. Under current circumstances, prices for bioenergy from European woody feedstocks do not allow for co-firing to be economic.

This situation could change if biomass from other (developing) countries could be supplied at considerably lower prices, but such prices only seem possible if sustainability, CO<sub>2</sub> mitigation and also social criteria are not fully taken into account.

Another possibility to make co-firing economic is higher prices for CO<sub>2</sub> certificates under the ETS. DENA (2011) gives a more detailed overview on co-firing for the situation in Germany, with high efficient and high capacity steam power plants. In this case it was calculated that the prices for CO<sub>2</sub> certificates should reach at least 40 to 57 €/t CO<sub>2</sub> to make biomass co-firing competitive to coal - this is about 10 times the value of current CO<sub>2</sub> certificate prices.

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<sup>11</sup> The values given are estimates using mean reference values. Costs can vary up to ±30% depending on local conditions.

However, it is currently open if the historical minimum CO<sub>2</sub> certificate prices can be increased through “back-loading” the carbon emission allowances so that it is difficult to foresee how attractive the ETS will become for woody bioenergy<sup>12</sup>.

If the CO<sub>2</sub> prices remain low, alternative support and financial aid would be needed to make co-firing competitive. This could be done, for example, by higher feed-in tariffs for electricity from biomass co-firing. In Germany, higher feed-in tariffs can only be claimed by cogeneration plants with a capacity of less than 20 MW, and only if the generation plant operates **exclusively** on bioenergy, i.e. **no co-firing** is allowed.

There are various support schemes for renewable energies in the UK, but the main policy measure for stimulating growth of electricity generation from renewable energies is the Renewables Obligation (RO). It is applicable for renewable energy plants larger than 5 MW. Those plants receive Renewables Obligation Certificates (ROCs) depending on the technology and size of the plant. For electricity from biomass, ROCs also depend on the type of biomass. Plants which use “dedicated biomass”, i.e. whose consumption consists of more than 90% biomass, receive 1.5 ROCs/MWh. ROCs are tradable and prices vary.

The average ROC price from Nov. 2012 to Jan. 2013 was about 41 £/MWh (1.5 ROCs = 61.5 £/MWh). In addition to the earnings from the ROCs, plant operators get revenues if they sell the electricity at the UK power exchange. Average electricity prices were 50 £/MWh. Thus, the total price per MWh adds up to approx. 128 €/MWh. This is a good price and makes investment in large-scale biomass power plants attractive.

The UK government decided to establish sustainability requirements for woody bioenergy being co-fired under the ROC scheme which applies also to imported woody bioenergy (DECC 2013a+b).

**At present, co-firing with European wood is uneconomic, while sourcing pellets from e.g. Canada and USA is competitive under governmental support schemes. If CO<sub>2</sub> prices under the EU ETS increase to 20 €/t, co-firing using imported pellets could be economic without further support.**

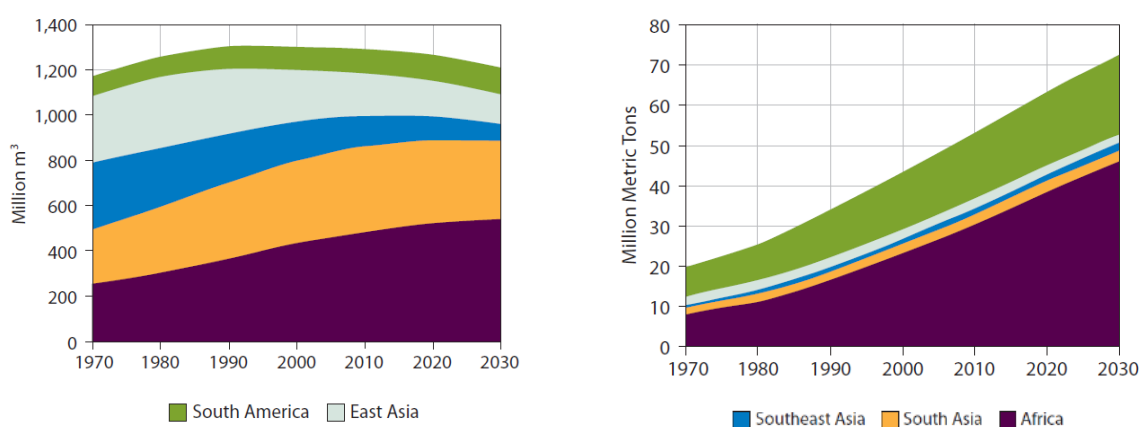
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<sup>12</sup> In April 2013, the European Parliament voted against a “back-loading” of the carbon emission allowances under the EU ETS, but reversed this decision in July 2013. The Council has now to decide on the issue.

### 3 Wood Supply and Demand in Developing Countries

People relying on woody bioenergy account for 68 % in Africa, 51 % in Asia and 14 % in South and Central America (IEA 2012b) and despite the various international initiatives to improve access to clean energy in developing countries such as the Sustainable Energy for All (UN GA 2011), traditional bioenergy use is projected to increase globally, mainly due to increasing charcoal demands (Figure 7).

**Figure 7**      *Projections for traditional bioenergy use in developing regions for fuelwood and charcoal*



Source: Boucher et al. (2011); fuelwood (left); charcoal (right)

**Charcoal** is often used in cities and as energy source for industries, especially in developing countries. Global charcoal production increased by 30 % over the last 10 years. Most charcoal is produced in Africa, Asia, Central America and the Caribbean. Latin America, Africa and Asia are main exporters while Europe and Asia are main importers.

The population share without clean cooking facilities in developing countries will decrease from 49 % in 2010 to 39 % by 2030, but the number of people relying on traditional bioenergy uses will increase to 2.6 - 2.8 billion (IEA 2012b; ESMAP 2011). At the same time, demand for modern woody bioenergy is expected to grow significantly in East Asia and Pacific (IEA 2012b).

**Traditional bioenergy consumption is projected to increase globally, mainly due to increasing charcoal demands, with more than 2.5 billion people relying on traditional bioenergy by 2030.**

### 3.1 Potentials for woody bioenergy in developing countries

Currently, there is no comprehensive database available on wood bioenergy potentials in developing countries, but some analysis exists for a few countries<sup>13</sup>. Furthermore, the availability of woody feedstocks at country level does not give the amount of bioenergy potentially available for international exports. Thus, other issues affecting the capacity of developing countries to supply woody bioenergy to the international markets are:

- **Development of infrastructure** (roads, harbors, communication, etc.) - a lack of handling and port infrastructure and resulting inefficient logistics are a key barrier to enhanced international trade of bioenergy (IEA 2012a).
- **Governance** - in terms of social stability, forest governance and securing foreign investments - affect the opportunities for private investments.
- **Technology development** - developing countries are far from EU markets and transport cost for woody bioenergy is an important part of total cost. Implementing processes to make transport cheaper (e.g. torrefaction) will improve competitiveness on international markets.

The most promising feedstocks are roundwood from plantations and wood waste and residues. In fact, natural forests don't seem to be a source of woody bioenergy since harvesting costs might be high.

The potential of **existing** forest plantations<sup>14</sup> to provide woody bioenergy is determined by the profitability of products on the respective markets. For example, pulp & paper industries could divert current production to bioenergy markets if this rewards higher revenues, and profits. In case of **new** plantations, cultivation area could come from existing forests or degraded lands, since food production on agricultural land provides higher benefits<sup>15</sup> and, therefore, is not likely to be displaced by woody bioenergy cultivation. The extent to which land use change from natural forests to plantations could happen will depend on the

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<sup>13</sup> Among the various tools and methodologies in place to determine woody biomass potentials, the WISDOM methodology developed by FAO assesses supply and demand of fuelwood in a given region in order to support planning and policy formulation. This methodology has been applied in Southeast Asia Countries, Rwanda and Argentina. See for more details <http://www.wisdomprojects.net/global/pub.asp>

<sup>14</sup> Currently, planted forests account for about 300 Mha (7 % of global forest area), providing more than half the industrial wood produced worldwide, and their extent and productivity increase (FAO 2006a)

<sup>15</sup> See (Cushion, Whiteman, Dieterle 2010). For details on returns for various land uses see e.g. IIED (2008).

economic and regulatory situation<sup>16</sup>. Also, marginal and **degraded land** in some areas could be used but its adequacy has to be evaluated locally<sup>17</sup>.

Another feedstock for bioenergy is the utilization of **wood waste and residues**. Efficiency of wood processing industry in the tropics could be increased: For example, logging residues in the Amazon region are estimated as 45 % of the total biomass extracted, and in the wood processing industry more than 50 % with a total for tropical timber producers of 162 Mm<sup>3</sup> (ITTO 2006). However, investment in technologies for wood waste and residues and infrastructure would be higher per hectare compared to plantations.

**The amount of woody bioenergy available from developing countries for export depends - beyond feedstocks availability - on several factors such as infrastructure, governance and technology.**

### **3.2 Woody bioenergy demand in developing countries and domestic consumption trends**

Although global fuelwood demand in developing countries will slightly decrease until 2030, it will still be growing in some regions, especially in Africa and South Asia. In Africa there is also a growing demand for charcoal (Figure 7).

Some of these countries show a very high share of fuelwood production related to total roundwood. This means that national wood production is mainly used for fuelwood demand mainly rural areas. Only a small percentage of fuelwood in developing countries comes from plantations - the majority is either gathered from forests or from open land with low tree density.

IEA (2012a) assumes that in most countries the demand for fuelwood increases despite national programs to replace traditional bioenergy use by other options such as gas, liquid fuels and electricity. Taking into account the precautionary principle, countries where the fuelwood consumption represents a high share

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<sup>16</sup> Woody bioenergy from new (short-rotation) plantations would require land and might imply risks of “land grabbing”.

<sup>17</sup> Marginal land can be used for fuelwood plantation, as has been demonstrated in the Philippines (FAO 2009d). For degraded land see Fritsche et al. (2010) which presents 3 country studies (Brazil, China, South Africa). Global estimates on degraded land for bioenergy production vary, but up to 100 EJ/a could come from these lands by 2050 (IINAS, IFEU 2012)

over the total roundwood consumption, should pay particular attention in case that bioenergy would be promoted. The introduction of safeguards in order to avoid market distortions that impact local people should be encouraged. Thus, shortages in domestic fuelwood supply should be prevented and avoided even if economic incentives in importing countries might be appealing.

This study assumes possible woody bioenergy exports only for countries with a fuelwood share < 80% of domestic roundwood production, and also considers if deforestation rates are high. This precautionary approach is a proxy for a more detailed analysis using bottom-up country data, and can give only a rough indication of export possibilities, or respective restrictions.

**With the aim of avoiding market distortions and woody bioenergy shortages, this study proposes as a proxy that only where fuelwood production share is less than 80 % of total roundwood production, a country has sustainable export potential. Considering this constraint, only few countries in Asia, Africa and Latin America could become sustainable woody bioenergy exporters.**

### 3.2.1 Woody bioenergy demand in Asia

**China** has very ambitious plans for the use of renewable energy and biomass plays an important role within the renewable energy mix (see Annex 3.1).

But contrary to the current dominance of biomass for heat production in rural residential areas, the Chinese renewable energy plan for biomass is mainly focused on power generation. Under China's Medium and Long-Term Development Plan for Renewable Energy and the 11<sup>th</sup> Five-year Renewable Energy Development Plan, the updated goals for 2010 comprised a biomass power generation capacity of 5.5 GW and an annual solid biomass briquetting of 500,000 tons.

The targets for 2020 include the total biomass power generation reaching 30 GW, from which agro-forestry biomass should reach 24 GW, the rest should come from waste and other sources. But according to reports (Gibson 2013) it seems unlikely that these targets will be met, because construction of small and medium-sized plants is not getting on as expected. It can therefore be assumed that co-firing will become dominant.

All scenarios in the WEO (IEA 2012b) show that the woody bioenergy demand can be met by domestic biomass resources only if additional plantations will be established (see Annex 3.1).



Given the high value of land for food production and the poor transport infrastructure, it can be expected that China will import biomass especially for powerplants located in its coastal areas as long as prices for imported biomass are competitive compared to other renewable energies. Hence, it is **very unlikely** that China will be an export nation for biomass but might well choose **to import** biomass in the future to support its energy plan.

**India** is the country with the largest population relying on traditional biomass supply. More than 70% of the Indian population lives in rural areas and nearly 800 million people use biomass for cooking. Almost half of this firewood and chips are obtained through “free” collection and 42 % is procured from forests (TERI 2010). Also, fuelwood collection serves as an economic livelihood option for millions of people (PISCES 2011).

The government is making efforts to increase renewable energy supply and has launched over 2000 CDM renewable energy projects (REEGLE 2012) and the National Biomass Cookstoves Initiative aims to improve residential energy use (Venkataraman et al. 2010).

Still, India faces massive constraints on available land and water, and with the priority of food and feed production, it could achieve its energy goals only by massive imports of biomass and by establishing new biomass plantations (see Annex 3.2).

As both China and India are likely to **import** bioenergy in the future, and both Malaysia and Indonesia have high deforestation rates (FAO 2010a), only Thailand remains as a possible export candidate in Asia. This country has established a renewable energy targets (25 % of consumption by 2020; Haema 2011) and set up environmental laws and regulations for bioenergy (FAO 2009a). Key activities include promoting plantation of fast growing trees, developing production of and standards for pellets, and promoting establishment of distributed generation from biomass at community levels. Still, it is rather unlikely that Thailand could become a major woody bioenergy exporter, given the growing domestic demand, the restricted wood area, and infrastructure constraints.

**South Korea** will rely on bioenergy imports in the future (see Annex 3.3), while for **Japan**, domestic resources will be used first, and the role of possible imports are still unclear (see Annex 3.4).

### 3.2.2 Woody bioenergy demand in Africa

The total demand for woody bioenergy in Africa is given by IEA as about 13 EJ in 2008, with 10 EJ (78 %) for residential use. The **total** fuelwood production in Africa in the same year was 6 EJ - i.e. nearly half of the total woody bioenergy demand. Until 2011, fuelwood production rose only a little to 631 Mm<sup>3</sup> (6.3 EJ). The share of roundwood used as fuelwood in Africa is about 90 %.

The country with the highest roundwood production is Ethiopia where 97% of the production is used as fuelwood. South Africa shows the highest potential of wood not used as fuelwood, with about 19 Mm<sup>3</sup> per year. Considering restrictions and local use dynamics, only three African countries are potential export candidates: South Africa, Gabon and the Democratic Republic of Congo (DRC). For South Africa, a rising domestic demand is expected due to its renewable energy policies, while DRC and Gabon are low in infrastructure and governance, with deforestation becoming an issue (WB 2013a). Mozambique and Tanzania, despite the fact that don't fulfill the "80 %" criterion, have a particular context so might become exporters.

### 3.2.3 Woody bioenergy demand in South America

In South America, most countries are interested more in biofuels (e.g. biodiesel in Argentina, sugarcane bioethanol in Brazil) and have achieved lower levels of residential woody bioenergy in households (IEA 2012b). Due to restrictions in available time, no further analysis of South American countries was possible, but the case study of Brazil<sup>18</sup> indicates relevant options for woody bioenergy.

## 3.3 Challenges of woody bioenergy in developing countries

Developing countries face intrinsic challenges in woody bioenergy sector:

On the **supply side**, making wood supply from forests and other wooded lands more **efficient and sustainable** is fundamental. Various approaches exist for this such as community forest management and improving harvest operations.

Wood plantations present a wide range of advantages but have failed so far to achieve their potential due to limiting factors (tenure security, governance

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<sup>18</sup> See Section 4 and Brazil Case Study [http://www.iinas.org/tl\\_files/iinas/downloads/CENBIO\\_2013\\_Brazil-Case-Study\\_GIZ.pdf](http://www.iinas.org/tl_files/iinas/downloads/CENBIO_2013_Brazil-Case-Study_GIZ.pdf)

deficits) and unfavorable economics, as fuelwood is underpriced and wood can be diverted to other uses that offer higher revenues (EUEI PDF, GTZ 2009).

On the **demand side**, substituting existing fuelwood use on household levels with clean, more efficient cookstoves is promoted globally<sup>19</sup> which may contribute to reductions in black carbon and GHG emissions as well as to health improvements through reduced indoor air pollution (IIED 2013).

Furthermore, time needed for fuelwood collection is saved, thereby lowering opportunity costs of bioenergy (ESMAP 2011).

**Integration** of supply- and demand-side issues is needed to foster sustainability (Macqueen, Korhaliller 2011; IIED 2013).

**Developing countries face challenges in the supply and demand side of woody bioenergy value chains.**

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<sup>19</sup> See e.g. the international public-private partnership for clean cookstoves (<http://www.cleancookstoves.org>)

## 4 Country Case: Brazil<sup>20</sup>

Brazil is among the most promising countries in the tropical region to play a role in international trade of woody bioenergy. The relevance of wood (fuelwood + charcoal) in Brazil's energy supply is significant as well.

Fuelwood and charcoal consumption totaled 84 Mt in 2010 of which about 28 Mt for charcoal mainly for iron & steel, 23 Mt each for the industrial and residential sectors and 8 Mt for rural areas. In 2011, 61.7 Mm<sup>3</sup> of wood for energy came from planted forests, with 44.7 Mm<sup>3</sup> fuelwood and 17 Mm<sup>3</sup> charcoal.

Wood residues in Brazil are estimated as 30 Mt, with the timber industry as main source, contributing to 91% of woody residues and wastes. Black liquor represents 46.6% of industrial energy demand (BEN 2012).

### 4.1 Fuelwood and charcoal

According to the National Energy Balance, biomass (including sugarcane, oil crops etc.) currently supplies about 27% of primary energy (MME 2012), and woody bioenergy provides more than 10% of primary energy. The consumption shares are 34% charcoal (for iron/steel sector), 28% industrial (mainly for heat/power in pulp and paper industries), 10% in agriculture (mainly for heat), and 28 % residential sector (cooking).

The reason why residential consumption for cooking is relatively low in Brazil is because fuelwood stoves were replaced by LPG in most households<sup>21</sup>. About a third of wood energy was aimed at families and rural household's consumption is native forest, but in 2011 the domestic consumption lowered by 3.4% (MME 2012).

Estimates in SAE (2011) indicate that consumption of bioenergy from wood could triple in less than 20 years, reaching 2.9 EJ (70 MtOE) by 2020 and 3.8 EJ (90 MtOE) by 2030.

Wood still occupies a central role in terms of strategies related to the production and use of energy.

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<sup>20</sup> The full Brazilian Case Study is available at [http://www.iinas.org/tl\\_files/iinas/downloads/CENBIO\\_2013\\_Brazil-Case-Study\\_GIZ.pdf](http://www.iinas.org/tl_files/iinas/downloads/CENBIO_2013_Brazil-Case-Study_GIZ.pdf)

<sup>21</sup> In some cases, wood stoves co-exist with LPG stoves (Lucon et al. 2004).

The key feature of Brazil's bioenergy use is that most of it is for industrial uses in the pulp and paper and especially iron and steel sectors (MME 2012). Brazil is the world's largest charcoal-based pig iron producer.

The charcoal demand from the industry sector is still higher than the amount of charcoal produced from plantations. Thus, still 57 % of charcoal produced in Brazil in 2009 came from native forests (AMS 2013). Moreover, it has been reported that 25 % of charcoal did not have a declared origin (AMS 2013, IBGE 2005). An expansion of nearly 1 Mha of planted forests would be needed for a sustainable supply of wood for charcoal.

Also, it is necessary to invest in new technologies and methods to produce charcoal more efficiently, as charcoal production uses the same technology of the last century and charcoal represents 60% - 70% of pig iron production costs (Muylaert, Sala, Freitas 1999).

The charcoal-based steel industry includes large integrated steel mills that produce steel in various forms and have their own Eucalyptus forest base to produce charcoal for the reduction of iron ore.

The native forest resources are increasingly scarce especially in regions close to centers of pig iron producers, considering that much of the development of agriculture has occurred in these areas. As a result, the distances between the sources of charcoal and steelmakers are increasing. This prompted the producers of pig iron to develop programs of reforestation with fast-growing species, e.g. in the state of Minas Gerais (Coelho, Goldemberg, Uhlig 2008).

Although there is an increase in reforestation, in Minas Gerais, the main producing state of pig iron, surveys of the state Department of Finance (FAO 2012a) show that at least 12% of charcoal production still comes from illegal sources and, in last three years at least 6600 hectares were illegally cleared to produce charcoal.

## **4.2 Wood plantations**

Brazil is the largest producer of wood from planted forests (mainly eucalyptus) and nowadays reforestation has become a viable business from the technological, economic and environmental point of view.

In 2011, plantations accounted for a total of 7 Mha, with 4.9 Mha of eucalyptus and 1.6 Mha of pine (0.5 Mha were planted with other species). Under current conditions, the area of planted forests could increase to over 12 Mha by 2020 mainly from degraded pasture land.

### 4.3 Wood pellets

Brazil operates 12 industrial pellet plants with a capacity of 240,000 t/a and a production of 60,000 t/a, and new projects are planned in the South. Brazilian production, consumption, import and export of pellets are still minor; however, demand tends to grow, especially for exports. Before this occurs, the charcoal deficit needs to be balanced by new plantations.

Large private companies such as Suzano Renewable Energy (Suzano 2013) announced massive investments in the construction industry for the manufacture of wood pellets in the Northeast. The bold project foresees the construction of one of the largest manufacturing plants of wood pellets in the world, with an estimated production of 1 Mt per year.

### 4.4 Wood residues

A third of the volume of wood residues generated in logging industries in the Amazon is simply burned in the so-called "open" or industrial incinerators (MMA, 2009). The lowest levels of utilization of wood waste are checked in the small timber industries. To the extent that the size of the timber industry increases, higher levels of use of wood waste are seen in the industrial processes (e.g. drying, baking timber, pressing, etc.). The thermal power generation in the Amazonian wood industries represents 20% of the wood residues.

However, such situation is shown quite different when it comes to industrial wood residues generated in Southern and Southeastern Brazil. In this case, industrial wood residues are utilized mainly for production of reconstituted products (pulp and wood panels) and for power generation (thermal and electrical), or in the field for nourishing the soil. Here 10% to 20% of forest residues remain in the field. The pulp and paper industry is the most intensive in the use of residual biomass for self-generation power, with an installed capacity of about 1,500 MW (Muller 2005).

Only 10% of the volume of wood waste generated by enterprises in the timber sector in the Amazon region is used for generation of electric power (co-generation power). In the States of Mato Grosso and Para, co-generation of energy from waste wood has been widely used, given the existence of larger timber industries.

Around 15% of the volume of waste generated from industrial wood burning is intended for generation of thermal energy in brick kilns, cement, refrigerators and dairies.

In regions where agribusiness is in full development, for example the state of Mato Grosso, the woodchip market is well developed, widely used for generation of thermal energy, especially in the crushing and drying of grains in replacement to diesel oil as fuel. The main incentive for the substitution of diesel oil and low cost biomass associated with the high price of fossil fuels.

#### **4.5 Land available for plantations**

There are 105 Mha of degraded areas available in the country for growing energy forests as well as for other uses. There are species of eucalyptus that can be grown on degraded or considered unsuitable land for the production of other cultures. Due to the intensification of livestock and improved breeding techniques, it is expected that about 70 Mha of former pasture will be available for other purposes. Of this amount, 10 Mha might be occupied by soybean and other grains, 5 Mha might be diverted to meet family farmers needs and 25 Mha could be available for crops for energy purposes (sugar cane, oil palm, elephant grass, etc).

#### **4.6 Environmental zoning**

Concerns about the impacts of land use change due to the recent expansion of sugarcane production and other biofuels such as palm oil have led federal and state governments to adopt policies with the aim of determining the appropriate areas for these crops known as “environmental zoning”. This zoning, which is translated into a national regulation, allows a guidance to credit policies and use for public banks as a condition for project financing.

This approach can be considered also for plantations of woody bioenergy in Brazil.

The State of Minas Gerais was the pioneer in this process and launched its economic-environmental zoning in 2007, based on social, economic and environmental data that show regional characteristics, potential and vulnerabilities. This tool aims to support policy makers and entrepreneurs from different sectors.

Later, the Federal Government launched two national agro-ecological zonings: for sugarcane in September 2009 (EMPRAPA 2009) and for oil palm in 2010 (EMPRAPA 2010). In this process maps were produced classifying in detail yield potentials, based on minimum productivity and showing soils, climate and rainfall and topography. It considers environmental regulations and areas to be preserved and it seeks to reduce competition with areas devoted to food production.

This zoning resulted in the prohibition of sugarcane cultivation in 92.5% of national territory and it also identified 64 Mha (EMPRAPA 2009) that comply with environmental and productivity requirements, mainly from the intensification of cattle raising which is very inefficient at present (less than 1 head/ha). The zoning did not consider economic issues and social issues that are already covered by the existing legislation.

There are several public policies to promote woody biomass production such as PROINFA Agroenergy Policy 2006-2011 MME, National Agroenergy and BNDES-Forest but further policies are needed to incentive wood biomass production. The incentives for other bioenergy crops such as biodiesel ones are available but not for wood plantations.

#### **4.7 Final considerations**

While fuelwood is not traded internationally, 0,11 Mt of charcoal were imported in 2012 (Faostat 2013) to fulfill the huge deficit in the demand of the Brazilian industries (Leite, Roque, Macedo 1997).

A significant share of charcoal used in iron/steel industries is produced from wood from deforestation of native forests. Particularly, for the period 2005-2009 the deficit of charcoal from planted wood was 14.7 million m<sup>3</sup> and it is expected that for the period 2009-2014 there would be a deficit of charcoal from planted forest in the iron/steel sector.

Regarding logistics, the Brazilian ports are not able to export woody biomass yet and storage facilities are not appropriate for pellets.

Still, Brazil intends to enter the international trade of wood pellets, and Brazilian industries are already preparing to export, as the market is expected to grow rapidly.

It will be possible to both expand domestic consumption and to increase exports of woody bioenergy because Brazil can sustainably and economically competitive provide more wood, due to favorable cost of raw materials and the absence of significant technological barriers to production.



## 5 Developing Countries Role in Woody Bioenergy Trade

The international development of the woody bioenergy market depends on a number of factors and dynamics, not just on availability of resources. From the results of the interviews (see Annex) and various recent studies, the role of various regions for supplying woody bioenergy to EU countries can be derived:

- **Boreal and temperate OECD countries** have a long tradition and availability of forest resources and are currently suppliers to Europe, especially Canada, the Southeast of the USA, and Northwest Russia. They can increase their supply capacity in the coming years. Assuming continuation of domestic energy price trends, exports of woody bioenergy from those countries to Europe appear competitive and might continue to allow higher revenues than domestic use of bioenergy<sup>22</sup>.
- **The “Global South”**, i.e. developing countries especially in Latin America and Asia **could** play a smaller role in providing international markets with woody bioenergy, depending on supply cost, and investments in infrastructure. Still, investments in these countries face higher risks and higher interest rates so that expected lower bioenergy cost may be offset. Currently there is little risk of massively replacing fuelwood in developing countries with exports, at least from an economic point of view (Cushion, Whiteman, Dieterle 2010; EUEI PDF, GTZ 2009).
- Most woody bioenergy imports to the EU - which dominate current international woody bioenergy trade - are expected to be used for co-firing. At present, European utilities reduced their co-firing targets so that the low-scenario projections of IEA Bioenergy for growth in global wood pellet exports to the EU seem more realistic for 2020. However, the scenarios show most likely regions of supply (see Figure 5 + Figure 6 in Section 2.4).
- Brazil might become an exporter if investments in pellet production materialize, but other Latin American or African countries such as Mozambique or DRC could only play a role in the longer-term as well.

The current pellet exporters in OECD countries have a large resource base for bioenergy feedstocks as well as respective expertise, infrastructures and

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<sup>22</sup> This is relevant, as domestic fossil energy prices in North America and Russia are currently significantly lower than in the EU, and this is projected to remain in the medium-term (IEA 2012b).

capabilities to continue supplying international woody bioenergy markets, and they do not face structural problems prevalent in developing countries.

At present, one of the main barriers for sustainable woody bioenergy exports from developing countries is lack of infrastructure (i.e. harbors, rail, roads), as logistics play a fundamental role in bioenergy trade. Additional barriers are limited financial resources, lack of skilled labor and lack of formal land ownership structures and unstable policy frameworks (IEA 2012a).

Another challenge is the limited knowledge and interest in sustainable forest management and ecosystem services by decision makers in the energy sector in developing countries (Masera 2012).

In any case, the availability of developing countries to produce and export woody bioenergy must be seen in the context of local necessities which **need to be met first** - it would be counterproductive to export woody bioenergy to replace coal in other countries without improving forest management and woodfuel value chain and hence reducing domestic GHG emissions.

Thus, **sustainable supply** of bioenergy in developing countries is **the key issue**, disregarding if woody bioenergy is used domestically, or exported. For this, strong policies and safeguards are needed (see Section 6.2).

**Because of the favorable position in the forestry sector of countries such as Canada, USA, or Russia, a “boom” in exports of woody bioenergy from developing countries is not expected even if a few countries such as Brazil were to promote international woody bioenergy trade.**

**However, no effort should be spared in promoting the improvement of woody bioenergy value chains in developing countries.**

## 6 Implications of increased Woody Bioenergy Trade for Developing Countries

### 6.1 Opportunities and Risks for Developing Countries

Developing countries are not expected to quickly enter into international bioenergy markets, but interest of private actors such as electric utilities and traders for woody bioenergy could affect developing countries in various ways. Table 4 synthesizes respective key issues, opportunities and risks.

*Table 4 Issues, opportunities and risks of woody bioenergy development for developing countries*

Issues	Opportunities	Risks
Governance	Improvement of implementing policies and regulations	Policies and regulations are ignored to foster exports
Competitive industries	Improving efficiency and reduced operation costs	Low capacity for new technologies
Infrastructure development (e.g. road, rail)	Improved national and international market access	Inadequate infrastructure development
Energy security and trade balance	Increased energy security and better trade balance	Reduced access due to competition for resources
Forestry sector	Diversification	Promotion of monocultures
Pressure on forests	Sustainable Forest Management	Forest degradation, illegal logging
Land Use	Use of marginal and degraded land, re- and afforestation	Deforestation
Waste management and resources efficiency	Improved utilization of underused resources	Displacement of informal waste use
Access of local people to resources	Improving local resources through better management	Competition, limited access, displacement
Employment	Rural employment and respective income in rural areas	Potential exclusion of small farmers and women
Fuelwood prices	Higher value for forest products	Price increase, market disturbance

*Source: own compilation based on FAO (2007 + 2009b), Masera (2012) and Clancy (2013)*

To a great extent the impacts depend on the feedstocks used for woody bioenergy production (forest residues, current or new plantations etc.) and how their governance and management is performed. The impact assessment of any initiative should be performed at local level.

Aiming at reducing costs and risks, FAO (2007, 2009b-d) recommended giving priority to established forest operations and proven technology and to utilize residues and by-products from wood processing industry and suggested that in a **second stage**, new plantations and technologies would be considered.

Contrary to what occurs with the biofuel sector, the impact of expanding woody bioenergy markets is unlikely to have significant effects on altering agricultural production or increasing food prices (Cushion, Whiteman, Dieterle 2010), but could raise prices of fuelwood, charcoal and roundwood (Buongiorno, Raunikar, Zhu 2011). New export markets could pose risks on local access to woody products, but this must be assessed at local level (see Box).

**Box: The Vattenfall/Buchanan Renewables project in Liberia**

In 2010-2011, Vattenfall planned a project together with Buchanan Renewables to export woodchips from Liberian rubber tree residues for co-firing in Germany. Most of the Liberian rubber plantations are old and unproductive and replacement started at larger plantations. The project planned to fund road and harbor infrastructures and a local wood-fired powerplant, and considered various sustainability schemes such as FSC and RSB.

According to some authors, charcoal was previously produced from rubber tree residues and sold in urban areas so that the planned project would displace this product, causing price increases (Wunder et al. 2012). Other studies found that charcoal is only a minor part of unproductive rubber tree residues, and moderate price effects are in line with rising costs for other commodities (Forestry for Development 2012; IFEU 2011).

In May 2012 Vattenfall decided to cancel the project due to unfavorable reactions in Germany, and overall low economic prospects.

**The impacts of promoting export-oriented woody bioenergy in developing countries depend on several factors including feedstock type, governance system and its effectiveness. This should be assessed at national/local levels.**

## 6.2 Sustainability Schemes for Woody Bioenergy

International stakeholders, especially those in Europe, increasingly demand that bioenergy markets are developed in a sustainable way, and also the global discussions around bioenergy trade focus on the sustainability of biomass sourcing (e.g., Abid 2012; FAO 2011). Sound environmental and socioeconomic practices along the feedstock production could be promoted directly or indirectly through various policy instruments such as mandates with sustainability requirements, national standards for certification and financial incentives (FAO 2012a). The various initiatives address different concerns and are inconsistent. Considering that voluntary forest certification schemes do not recognize each other even if aiming at sustainable forest management (SFM), it is not surprising that approaches from forest and energy sector have different understanding of which sustainability criteria have to be addressed.

The criteria established in the RED for biofuels and bioliquids (EU 2009) and the current discussions to require similar ones for solid and gaseous bioenergy used for electricity, heating and cooling (EC 2010 + 2013) aim to protect biodiversity and carbon storage in forests and other relevant zones. However, SFM is not only based on determining “no-go” areas but on assuring sound management of productive (and protected) areas.

The variety of voluntary certification schemes developed for biofuels show **different** targets and, hence, different ambition towards sustainability. It has been acknowledged that the development of several sustainability certification schemes - if not properly aligned - could represent a trade barrier (IEA 2012a) so that it is necessary to harmonize the schemes (Cocchi et al. 2011). This is the reason why large European electric utilities interested in international woody bioenergy trade have called for EU-wide harmonized sustainability criteria (e.g. Bjerg 2012), and initiatives such as the IWPB exist.

With the EU being the main focus of international woody bioenergy trade (see Section 2.4), the calls for mandatory sustainability criteria for woody bioenergy are substantiated, and respective suggestions for a harmonized scheme have been made (Fritsche et al. 2012). An internal draft of an EC proposal on sustainability requirements for woody bioenergy was leaked in August 2013 (EC 2013) - it uses the same approach as the RED provisions for biofuels and bioliquids, but considers mandatory sustainable forest management plans. Due to ongoing discussions on the EU level about biofuel regulation (especially indirect land-use changes), no legislative proposal from the EC is expected but a report on the issue in early 2014. Table 5 summarizes the various sustainability schemes at international and European levels.

**Table 5** *Overview of sustainability schemes related to woody bioenergy*

<b>Activity</b>	<b>Brief Description</b>
GBEP	The Global Bioenergy Partnership endorsed Sustainability Indicators for Bioenergy in 2011, aiming at national policy development
REDD+	Reducing Emissions from Deforestation and Forest Degradation aims to create financial value for carbon stored in forests
CDM	The Clean Development Mechanism allows implementing projects in non-Annex I parties of the Kyoto Protocol to reduce GHG emissions
International Forest Processes	Non-legally binding instrument for all types of forests and on-going Criteria and Indicators processes for Sustainable Forest Management
Voluntary Forest Certification	Emerged in early 90s to mainly limit tropical deforestation, key are FSC and PFEC as international umbrellas of national standards
ISO	The International Standardization Organization works on a standard addressing sustainability issues related to bioenergy production (ISO 13065), expected to be published in April 2014
Voluntary schemes	Various schemes promoted by different stakeholders, e.g. ISCC, RSB and SPB (formerly IWPB)
FAO Sustainable Woodfuel	These general guidelines (FAO 2010b) give principles, criteria and indicators for developing sustainable woodfuels with a holistic approach.
Voluntary Guidelines	The Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (CFS 2012) aim to contribute to the achievement of food security by acknowledging the central role of land to development.
Responsible management of planted forests	The voluntary guidelines for responsible management of planted forests (2006) provide 12 guiding principles Based on the institutional, economic, social and cultural, environmental and landscape approach realms.
Extension of the RED	Internal draft of EC proposal on extending the RED criteria to solid and gaseous bioenergy - no official document available yet.
CEN	The European Committee for Standardization TC 383 "Sustainably produced biomass for energy applications" elaborates a European standard (prEN 16214) for sustainable biomass for energy applications
FLEGT and EU Timber Regulation	The EU introduced in 2003 the Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan, in order to reduce deforestation (EU 2003). The EU Timber Regulation entered into effect in March 2013, aiming to avoid entrance of illegally harvested timber products into the EU
Forest Europe	International process for developing principles, criteria and indicators; legally binding agreement on forests in Europe possibly in 2014

Source: own compilation

**There are several initiatives on sustainable woody bioenergy procurement which could mitigate risks that exports from developing countries might pose.**

## 7 Conclusions and Recommendations

### 7.1 Conclusions

Developing countries will continue consuming large amounts of bioenergy for domestic uses so that increasing the efficiency of bioenergy use at household level should be a priority on the international agenda.

Most industrialized countries have incentives and targets to promote woody bioenergy so that their demand is projected to grow as well. Furthermore, demands from China and India become relevant for international trade.

The well-established forest industries in Canada, USA and Russia dominate current woody bioenergy exports to international markets, especially to the EU. Given their production base, they will continue to offer comparatively low-cost feedstocks unless domestic climate policies become stronger<sup>23</sup>.

This implies that conditions for developing countries to take part in the growing international woody bioenergy market on a large scale **will remain unlikely** in the **short-term**. Still, some countries with high potentials and favorable infrastructures for exports such as Brazil might enter into this business.

Growing trade and opportunities for higher revenues could create interest in other developing countries to shift domestic uses of wood to bioenergy exports, and investors might seek to develop attractive “local spots” even in countries with low woody bioenergy potentials, and less favorable conditions.

**If** renewable energy targets in countries such as South Africa or high CO<sub>2</sub> prices in Emission Trading Schemes (i.e. in the EU, and Australia) drive international woody bioenergy trade further, market players **will** seek opportunities beyond established suppliers. Then developing countries with access to international trade routes **may become areas** for such activities.

In order to maximize the benefits that - private or governmental - investments in improved and verified sustainable supply chains of woody bioenergy could generate and to avoid negative tradeoffs, the governance of woody bioenergy **needs to be improved**, and respective policies be put in place.

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<sup>23</sup> This seems, unfortunately, not realistic in the near-term: Canada withdrew from the Kyoto Protocol, the US so far failed to introduce respective national legislation, and Russia opposed the Kyoto-II process.

## 7.2 Recommendations

### 7.2.1 Securing Fuelwood Supply

Similar to biofuel feedstock cultivation which implies additional pressure for food supply and prices, increased woody bioenergy demand for electricity and heat generation can imply **additional** pressure on fuelwood supply.

The livelihoods of rural - and especially poor and vulnerable - people could be significantly affected **both** positively and negatively from increased supply of woody biomass for modern uses - thus, a fundamental principle similar to the “food first” logic for biofuels is needed: **domestic fuelwood first**.

From the social sustainability point of view it is fundamental to secure and improve the fundamental **access** to clean energy of the rural and urban poor before considering further supply for other domestic or international markets.

### 7.2.2 Improving Sustainable Forest Management and Governance

Many studies analyzed causes for forest degradation and deforestation, indicating that to revise current trends will require secured land and forest tenure rights, capacity building for sustainable forest management, and local economic development to improve the income situation.

Inclusive smaller-scale and “bottom-up” approaches to sustainable forestry can deliver secure and increased fuelwood supply and foster rural development.

Larger-scale woody bioenergy collection (from existing forests) and cultivation of new plantations could, in principle, deliver similar results, but are prone to corruption and displacement of vulnerable groups so that improvement of (local) forest management and the establishment of (larger-scale) new forest projects require **adequate governance**.

**Without** further (domestic and foreign) investments in **both** forest management and new forest projects, the fuelwood demand will not be met in many countries unless the governance of energy access, and forest and land tenure is improved. Given the uncertain future of domestic bioenergy markets in developing countries and global trade opportunities, such investments are **risky** for the private sector, and may face low attractiveness.

Thus, public-private partnerships to ensure sustainable investments in forest management and new forest plantations are important, in parallel to strengthening people-oriented forest policies, and improved forest value chains.



### 7.3 A Way Forward

Based on the analysis of the current governance of the forestry sector with regard to woody bioenergy, review and assessment of international initiatives on sustainable bioenergy and results from ongoing research, this study recommends **a three-fold approach**:

- 1) **Importing** countries (e.g. DE, DK, NL, SE and UK) and the EU as a whole need to **conditionalize** preferential treatment of woody bioenergy in their bioenergy support policies (e.g. feed-in tariffs, green certificates, quota systems etc.) to establish environmental **safeguards**, covering also **imports**. To avoid divergence of national sustainability schemes and respective proliferation which would hamper international trade, the legally binding sustainability requirements of the RED **need extension** to also cover woody bioenergy for electricity and heat, and respective proposals (Fritsche et al. 2012; EC 2013) should be taken into account accordingly.
- 2) In parallel, **exporting** countries in the developing world need to improve their **domestic forest** and **land tenure** policies, building on existing voluntary guidelines (CFS 2012). Sustainable forestry certification could facilitate private sector involvement and improve access to preferential bioenergy markets, e.g. in Europe.
- 3) **International institutions** - especially for finance (e.g. World Bank, regional development banks) - and **donors** (e.g. GEF, bilateral agencies) should require specific **sustainability safeguards** for any woody bioenergy project (e.g. based on existing voluntary certification schemes such as FSC and PEFC), and expand funds to support implementation of voluntary guidelines on the governance of land (CFS 2012) <sup>24</sup>.

Furthermore, existing approaches such as the IDB Sustainability Scorecard, the GEF Guidelines for Biofuel Projects (Franke et al. 2013), or the UN Decision Support Tools for Sustainable Bioenergy (UN Energy, FAO, UNEP 2010), the Bioenergy and Food Security approach (FAO 2012b) need to be developed further to explicitly address woody bioenergy. In this, GBEP should expand its dialogue to support respective exchanges and cooperation to allow for coherent policies.

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<sup>24</sup> For further information on the implementation of the VGGT see [www.fao.org/nr/tenure](http://www.fao.org/nr/tenure)

All three recommendations aim to recognize and endorse the “fuelwood first” principle suggested in this study, and call to implement respective policies.

Regarding recommendation 1) it is noteworthy that the EU Timber Regulation (TR) entered into force in March 2013, sanctioning the first placement of illegal timber and timber products on the EU market - an important first step for better governance in exporting countries which could help with regard to recommendation 2).

As the EU TR does not specify environmental or social criteria, the extension of the EU RED to woody bioenergy is crucial to establish environmental criteria for woody bioenergy imports to the EU (Fritsche et al. 2012).

If the Forest Europe negotiations on a legally binding agreement on forests in Europe are successful, the results need to be transferred into the criteria of a legislative proposal to extend the RED to solid bioenergy.

However, even an extended RED would **lack social** safeguards for imported bioenergy - but social criteria are necessary, as displacement of local people or non-timber use of forest products, changes in availability of woody bioenergy for traditional use, and related price effects could imply significant social risks against which safeguarding is needed.

With international trade law currently excluding key social concerns from mandatory regulation, and few perspectives to “reform” the WTO in that regard in the near-term, strengthening social safeguards **in exporting** countries is key<sup>25</sup>.

Regarding recommendation 2), the typically weak governance of forests/land and respective low enforcement/implementation of regulation in many developing countries need to be considered. First, improving the overall woodfuel situation requires an integrated coordination strategy of the supply and demand side in which the implementation of the VGGT should be a priority. Respective donor programs should support this to improve the conditions for sustainable woody bioenergy on the national and local level, and include (international) investors, possibly in form of public-private partnerships<sup>26</sup>.

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<sup>25</sup> It should be noted that a more radical - and in the near-term less promising - approach would be to reform the WTO/GATT trade rules so that social safeguards could be implemented without violation.

<sup>26</sup> There are already some GEF projects on this (GEF 2010 + 2012) and several bilateral donors (e.g. Germany, Netherlands) have “bottom-up” projects in e.g. Madagascar and Senegal. These examples should be expanded to other countries, and multiplied within the respective countries.

Many voluntary certification schemes for bioenergy have been promoted by various stakeholders during last years. These schemes vary depending on the purpose for which they were developed and the background of the organization working on it resulting in a great diversity in terms of ambitions. Most of them are focused on liquid biofuels but some have considered all types of biomass for bioenergy.

Here, **forest certification**, with long tradition in the forestry sector and as a voluntary and private-sector approach is a useful tool to assure sustainable forest management<sup>27</sup>, as it is independent of the final use of forest biomass - it will be of value for the timber (i.e. non-energy) markets now, and for the (future) bioenergy markets as well:

At least within the EU it **cannot** be expected that co-firing of woody bioenergy will receive preferential treatment (via ETS or renewable energy legislation) **without** generally accepted sustainability certification - as can be seen in BE, NL and UK where national sustainability requirements for woody bioenergy are already formulated.

As co-firing of bioenergy is typically uneconomic without preferential policies (see Section 2.5), certified sustainability of wood should be a **pre-requisite** for large-scale wood production for exports to the EU. In parallel, the EU timber regulation requires proof of "legality", and forest certification can deliver on this, too.

Regarding recommendation 3), countries such as DE, NL and UK should establish adequate safeguards for **their own donor programs** and agencies, and use their voting power in the international finance institutions (GEF, IFC, World Bank, Regional Development Banks etc.) to initiate and support similar activities.

The upcoming review of the World Bank Safeguards in 2014-2015 will be a key opportunity for this.

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<sup>27</sup> Some specific adaptations of the schemes are needed to address particular concerns related to the use of biomass for bioenergy (see Fritsche et al. 2012).

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## Annex 1. Activities on Sustainable Woody Bioenergy

This annex examines the activities developed at different levels by various stakeholders: First, international processes related to bioenergy are depicted. This mainly includes activities in the forest and bioenergy sector. Second, initiatives at European level are considered. Third, selected developing countries were chosen to see in detail the regulations in terms of woody bioenergy. After that, the efforts from developed countries are briefly depicted. Finally, the most relevant regulations are discussed.

Various interests from governments, markets and civil society may generate pressure in opposite directions so reaching agreed international commitments is not easy and many attempts have failed - but as the woody bioenergy market is still in its infancy, there is room to apply lessons learned from other sectors and prevent risks instead of waiting for their cure.

FAO (2012b) recognizes that the emergence of too many national standards and the lack of harmonization could undermine stakeholder confidence. At the moment this represents a potential obstacle to international trade due to confusion among market actors and high transaction costs.

**International processes** provide the framework for some environmental considerations. For example, many developing countries have subscribed the international conventions such as KP, CBD, UNFCCC, etc.<sup>28</sup> and they are part of some of the International processes on criteria and indicators for sustainable forest management<sup>29</sup>. However, the implementation of these processes at national level is not equal and doesn't provide sustainability guarantees.

When new projects are promoted in developing countries, some **ex-ante tools** exist to evaluate their performance. In addition to the Bioenergy Decision Support Tool (UN-Energy, FAO, UNEP 2010), the FAO launched the BEFSCI initiative that supports countries in developing policies based on evidences derived from country level information and cross institutional dialogue involving relevant stakeholders for the development of a bioenergy policy and implementation process (FAO 2012b). The BEFSCI initiative also provides a tool at operator level to assess food security.

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<sup>28</sup> See FAO (2010a) for more details

<sup>29</sup> See Fritsche et al. (2012) for more details

## **A-1.1 International initiatives**

This section includes international conventions, regulations, voluntary guidelines and other initiatives.

### **A-1.1.1 GBEP**

The GBEP sustainability indicators aim to guide the bioenergy analysis undertaken at domestic level in order to inform decision making. The list of indicators shall not be applied so as to limit trade in bioenergy in a manner inconsistent with multilateral trade obligations. This initiative seeks to build consensus among a broad range of national governments and international institutions on the sustainability of bioenergy.

In addition, supporting information relating to the relevance, practicality and scientific basis of each indicator, including suggested approaches for their measurement, is presented in the methodology sheets.

The set presents 24 voluntary sustainability indicators, doesn't feature thresholds or limits and doesn't constitute a standard. The utilization of temporal measures will show how the indicators evolve towards a sustainable development. The list of indicators, grouped under the three sustainability pillars are (GBEP 2011):

- Environmental (GHG emissions, productive capacity of the land and ecosystems, air quality, water availability, use efficiency and quality, biological diversity, land-use change, including indirect effects)
- Social (price and supply of a national food basket, access to land, water and other natural resources, labour conditions, rural and social development, access to energy, human health and safety)
- Economic (resource availability and use efficiencies, economic development, economic viability and competitiveness, access to technology and technological capabilities, energy security/diversification of sources and supply, energy security/Infrastructure and logistics).

### **A-1.1.2 REDD+**

Since 1850, emissions from land use changes amounted to 1/3 of the total anthropogenic C emissions, mainly due to deforestation and expansion of agricultural production for food (IEA Bio 2011), primarily in developing countries (WRI 2005).

The UN-REDD Programme (2012) assists developing countries to prepare and implement National Reducing Emissions from Deforestation and Forest

Degradation (REDD+) Strategies. Currently 46 countries are supported by the Programme and pilot projects are running in several of them (UN REDD 2012).

This initiative is still in its infancy and to present many rules on how mechanisms will be governed haven't still agreed and governance problems have aroused (Rayner, Buck, Katila 2010). Another difficulty observed within the REDD+ is the way to safeguard the social and environmental values which economically value is difficult to express. During the Doha Convention the need to ensure funds and not to complicate measures and verification processes aroused (Accra Caucus on Forests and Climate Change 2012; FERN 2012).

#### **A-1.1.3 Voluntary Forest Certification Schemes**

Despite the fact that the initial purpose of the forest certification was to protect tropical forest from deforestation, most of the certified forests are located within the northern hemisphere; just 1.42 % of the forest area was certified in Asia, Latin America and Africa (UNECE-FAO 2012). However, the situation is different in Brazil where 2.7 Mha of 5.1 Mha of the pulp and paper sector (native and planted forests) are currently certified (CNI, DIRET, BRACELPA 2012). Since 2006, the pace of international certification has slowed as, on the one hand, most forests in the northern hemisphere are already certified (except in Russia) and, on the other, the lack of price premium for certified forest products (UNECE-FAO 2011).

Although FSC and PEFC have remarkable differences in their governance and there is mutual recognition (UNECE-FAO 2012), it seems that some convergence between FSC and PEFC is taking place over time - standards and thresholds set for various indicators with regard to woodfuel issues differ more between countries than between the general FSC and PEFC systems (Stupak et al. 2011).

#### **A-1.1.4 ISO**

This standard on sustainability criteria for bioenergy will not be a management system standard and will neither replace national legislation nor certification systems on sustainability but it will make bioenergy more competitive and will help producers in developing countries to compete (ISO 2011).

The fields of action of the standard are: compliance with national and/or regional legislation; respect the Universal Declaration of Human Rights; use natural resources in a rational and sustainable way; sustainability in terms of biological diversity along the value chain; reduce GHG emissions in relation to the fossil energy source; promote economic and social development; bioenergy production should be economically and financially viable in the long term (ISO 2011).

### A-1.1.5 FAO Criteria and Indicators for Sustainable Woodfuel

FAO (2010b) developed a general set of criteria and indicators to structure the implementation and monitoring of sustainable woodfuel production, applicable at national, regional and local levels with the adaptations needed, including local knowledge and broad stakeholder input, as follows:

*Table 6 FAO Criteria and Indicators for Sustainable Woodfuel*

Principles	Criteria
1. Policies, laws, institutional frameworks and capacity exist and are clear and consistent	1.1. Woodfuel production is consistent with international commitments and follows domestic laws. 1.2. Forest and energy policies address woodfuel issues. 1.3. The instruments of woodfuel policies are consistent across and within ministries, agencies and levels of government. 1.4. Information on the status and use of woodfuel resources is available. 1.5. The capacity to manage and regulate woodfuel production and consumption exists.
2. Human and labour rights are respected and social and cultural values are maintained or enhanced	2.1. Land-use rights and ownership are clearly defined and established. 2.2. Woodfuel production is planned and implemented in a transparent and participatory manner involving all relevant stakeholders. 2.3. Workers' wages and working conditions comply with all applicable laws, international conventions and collective agreements. 2.4. Woodfuel production contributes to the social and cultural development of local, rural and indigenous communities. 2.5 Woodfuel production minimizes negative impacts on food security.
3. Economic sustainability is ensured	3.1 Woodfuels represent the most beneficial use of woody biomass resources. 3.2 Woodfuels are economically viable. 3.3 Woodfuels contribute to local/rural economic prosperity and the livelihoods of local residents.
4. Landscape and site productivity and environmental values are sustained	4.1 Ecological resistance and resilience at the landscape level is maintained or enhanced. 4.2 Woodfuel production does not degrade ecosystems and landscapes. 4.3 Biodiversity is maintained or enhanced at the landscape level. 4.4 Woodfuel production contributes to a net reduction in greenhouse gas emissions.

Source: FAO (2010b)

#### **A-1.1.6 Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT)**

The VGGT aims to contribute achieving food security by acknowledging the central role of land for development (CFS 2012). In particular they seek to improve tenure governance, support the improvement and development of the policy, legal and organizational frameworks, enhance the transparency and improve the functioning of tenure system and strengthen the capacities and operations of stakeholders.

They include general principles for states and non-state actors as well as principles for implementation. A list of safeguards and particular observations regarding indigenous people and other communities with customary tenure systems are included.

Investments are addressed in a specific section. They recognize public and private investments as essentials to improve food security and recommend that states should support investments by smallholders as well as public and private smallholder-sensitive investments.

Transactions in tenure rights should be done transparently according with related policies and be consistent with sustainable human development focusing on smallholders. Responsible investments should respect and do not harm human rights, working in partnership with appropriate levels of government and local holders of tenure rights to land and respecting their legitimate tenure rights.

A responsibility of the states should be to provide transparent rules on the scale, scope and nature of allowable transactions in tenure rights and to establish the safeguards to protect legitimate tenure rights.

States should secure that all initiatives are consistent with their existing obligations regarding indigenous peoples and their communities.

#### **A-1.1.7 FAO Guidelines on responsible management of planted forests**

The guidelines released by FAO in 2006 result from a process of multi-stakeholder consultations and they should contribute to help ensure that cultural, social, environmental and economic dimensions be considered and incorporated into planted forest management in a balanced manner (FAO 2006b). They are based in 12 guiding principles which are shown in the following table.

**Table 7**      *Guiding principles on responsible management of planted forests*

<b>Institutional</b>	<b>Economic</b>	<b>Social and Cultural</b>	<b>Environmental</b>	<b>Landscape approach</b>
1: Good governance	4: Recognition of the value of goods and services	7: Recognition of social and cultural values	9: Maintenance and conservation of environmental services	12: Management of landscapes for social, economic and environmental benefits
2: Integrated decision-making and multi-stakeholder approaches	5: Enabling environment for investment	8: Maintenance of social and cultural services	10: Conservation of biological diversity	
3: Effective organizational capacity	6: Recognition of the role of the market		11: Maintenance of forest health and productivity	

*Source: FAO (2006b)*

## **A-1.2 European Initiatives**

### **A-1.2.1 Work of CEN**

The CEN Technical Committee 383 for “Sustainably produced biomass for energy applications” is elaborating a European standard (prEN 16214) for sustainable biomass for energy applications (CEN undated). CEN/TC 383 will also address additional sustainability issues beyond those defined in the RED: social, environmental and economic aspects, both direct and indirect. This standard is strictly bound to the RED which means that e.g. social issues, indirect effects and requirements specifically related to solid biomass are going to be handled as soon as the according RED amendments are adopted.

### A-1.2.2 FLEGT and Timber Regulation

In order to reduce deforestation, the EU introduced in 2003 the Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan (EU 2003)<sup>30</sup>. It aims to exclude illegal timber and timber products from markets, to improve the supply of legal timber and to increase the demand for responsible wood products. Trade accords with timber exporting countries, known as Voluntary Partnership Agreements (VPA), and a ban on illegally-produced wood and other wood products, known as the EU Timber Regulation (EU 2010), are a central element of the strategy.

FLEGT VPAs are bilateral legally binding agreements between the EU and timber exporting countries, which aim to guarantee that the wood exported to the EU is from legal sources. In general, VPAs apply to all exports and domestic market and they cover fuel wood, including pellets, sawdust, briquettes and wood chips (FERN 2013). Moreover, they support partner countries in improving their own regulation and governance of the sector (EFI 2012a).

Currently six countries are developing the systems agreed under a VPA (Cameroon, Central African Republic, Ghana, Indonesia, Liberia, Republic of Congo-Brazzaville) and eight countries are officially negotiating with the EU (Democratic Republic of Congo, Gabon, Guyana, Honduras, Malaysia, Vietnam, Lao PDR and Cote d'Ivoire). Furthermore, there are 13 countries from Africa, Asia and Central and South America that have expressed interest in VPAs.

The EU Timber Regulation (EU 2010) came into effect on March 2013, requiring all operators to be able to demonstrate due diligence. Moreover, it includes specifically to fuel wood and wood in chips or particles whether or not agglomerated. It is assumed here that respective bioenergy co-products of such timber harvest and bioenergy products derived from downstream processing of such timber (e.g. pellets) is be subject to FLEGT regulation.

### A-1.2.3 Forest Europe

Among the various international processes for the development of principles, criteria and indicators, at European level the former MCPFE, currently namely Forest Europe has developed the set that describes the different aspects of SFM

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<sup>30</sup> Already in 2008, the USA introduced an equivalent regulation through the amended Lacey Act which concerns the import and trade of illegally sourced wood - see [http://www.aphis.usda.gov/plant\\_health/lacey\\_act/](http://www.aphis.usda.gov/plant_health/lacey_act/)

in Europe (Forest Europe 2012). Quantitative criteria, composed by 35 indicators, are:

- Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles;
- Maintenance of forest ecosystems' health and vitality;
- Maintenance and encouragement of productive functions of forests (wood and non-wood);
- Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems;
- Maintenance, conservation and appropriate enhancement of protective functions in forest management (notably soil and water); and
- Maintenance of other socio-economic functions and conditions.

In the qualitative side a set of 17 indicators monitoring status and changes in policies, institutions and instruments related to SFM as well as policies, institutions and instruments by policy area are included.

At the time being, forest regulations at European Level are based on a country level. However, in 2011, the commitment to elaborate a legally binding agreement on forests in Europe by 2013 was reached and 46 European states are participating in the intergovernmental committee, including the Russian Federation. The final goal is to address, inter alia, SFM in Europe and the long-term provision of a broad range of goods and forest ecosystem services (Forest Europe). A draft negotiating text for a legally binding agreement on forests in Europe based on using the abovementioned criteria as guiding framework for policy development on forests and their management is already available (INC 2013).

### **A-1.3 National regulation in selected developing countries**

This section summarizes policies related to wood-based bioenergy generation, both from the energy and forestry perspective for selected developing countries and emerging economies that most likely may become exporters.

#### **A-1.3.1 South East Asia**

The **Thai** forest policies are based on the following national plans and Acts (FAO 2009a): The Forest Act (1941), includes the basic principles for the long-term exploitation forests to benefit the state, with measures providing for environmental protection and promoting reforestation; The National Forestry Policy (1985) establishes targets of maintaining forested land for economic



forests (15 %) and protected forests (25 %). The Community Forest Bill (2007), provides legal rights to communities to preserve and manage their adjacent forest lands. Thus, several forest policies impact proposed expansion of energy crop plantations.

Some of the measures put in place to improve the situation regarding fuelwood are the development of fuel briquettes, promotion of agricultural residue stoves, improved cooking stoves and improved charcoal kilns (FAO 2009d).

**Indonesia's** Agency for Coordination of National Energy launched in 2005 the Green Energy Initiative 2020, aiming at increasing the share of biofuels and biomass in the national energy mix to 20 percent by 2025 from the former 0.2 percent (FAO 2007). A large potential of bioenergy, particularly cogeneration in agribusiness has been estimated (REEGLE 2012).

Indonesia's government has designated the concept of an energy self-sufficient village, which aims to community generation of more than 60 % of the electricity and fuel demands from renewable energy using local resources (Kumar et al. 2010). An "environmental momentum" has been created in Indonesia with several players from the international arena working on several forestry issues (Accenture 2011b) since relevant efforts are put in place in this country to combat against deforestation and forest degradation and it is piloting REDD+ programs. It is noteworthy that deforestation rate in Indonesia is one of the highest in the world.

### **A-1.3.2 Latin America**

In Latin America biomass accounts for less than 20 % of the primary production, lower percentage than in other developing regions. Energy reforms realized in Latin America and the Caribbean during last decade's haven't considered neither the energy access of the poor people nor environmental concerns (Fundacion Bariloche 2010).

**Argentina** accounts with a relevant potential of woody biomass (FAO 2009c). There are various policies related to the bioenergy development such as the promotion and use of renewable energy (Law Nº 26.190/06); regarding biofuels (Law 26.093) and the promotion of the bioethanol production (Law 26.334) (FAO 2009c).

Due to the high deforestation rates, the Law 26.331 the Minimum Standards of Protection for Native Forests was passed in 2007, requesting all provinces to adopt a land use planning strategy for the protection of some native forests during 2008, through a participatory process. The Native Forests Law also establishes that all conversion of native forests will require a permit by local

authorities and an environmental impact assessment and following public participation procedures. The implementing instrument of this law is Decree 91/2009 (FAO 2009a).

### **A-1.3.3 Sub-Saharan Africa**

At present traditional biomass sums 70% of the total energy consumed in Africa (ECOWAS, GBEP 2012a) and it is predicted to maintain at current levels or even continue to grow (WB 2011). In recent years Governments have recognized the role that biomass could play to meet the most basic energy needs (WB 2011). More than 80 % of African households rely on traditional biomass, and wood fuels represent the basic fuel for 70 % of the people both in rural and urban areas in all social segments (WB 2011). Fuelwood is mostly used in rural areas and charcoal used to be commercialized in urban areas.

This high dependence on biomass has been attributed to the following factors (ECOWAS, GBEP 2012a): the lack of policy in most countries, the absence of effective tools for sustainable planning and SFM, deficiencies in forest ownership and the lack of competence in alternatives to traditional biomass.

The extraction of fuelwood from forests is characterized by weak policies likely with a “command and control” structure instead of promoting SFM. Furthermore these scarce regulations are enforced just partially or easily bypassed (WB 2011). At present, licensing systems dominated by oligopolistic market structures, are not linked to sustainable harvests (WB 2011). The policy enhancement and long term land tenure and exploitation rights for local communities are some of the measures needed.

### **A-1.3.4 West Africa**

In this region, over 90 % of the population relies on woodfuel and charcoal for domestic cooking. This dependence on natural forest resources and unsustainable utilization is a driver of deforestation and desertification (ECREEE, GBEP 2012). The ECOWAS Regional Bioenergy Strategy Framework seeks “to enable and promote domestic and foreign investments that help address energy poverty prevailing in the region both in rural and peri-urban populations, without compromising food security and environment” (ECOWAS, GBEP 2012b).

Various bioenergy projects, including the distribution of modern cookstoves, have been implemented in most of the ECOWAS countries with diverse funding and business models (ECOWAS, GBEP 2012c).

In **Senegal**, a major cause of forest degradation has been the wood-fuel production (ENDA 2010). There is a gap between the demand and supply side.

The controlled production of charcoal has increased exponentially during last years and it is estimated in about 50,000 tons while the consumption accounts for 300,000 tons. A market oriented strategy to transform this trend has been promoted, including the coordination of the wood-energy supply, the improvement of the energy efficiency at domestic level and the consolidation of the institutional environment of the households energy sub-sector.

A Renewable Energy Law was passed in 2010 aiming at securing sufficient supplies and the best quality, durability and cost, as well as increasing people's access to modern energy services and reducing vulnerability to exogenous risks (REEGLE 2012). SFM through greater responsibility by local authorities is promoted. Currently, investments in renewable energies are benefited with a tax break on the income or corporate income tax and on the value-added tax but other financial support schemes are still limited. A Rural Electrification Agency has been constituted.

The Forest Policy of Senegal (2005) is characterized by a decentralized approach with responsibilities related to natural resources and environment management transferred to local authorities (ENDA 2010). The vision of the forest policy is that by the year 2025 Senegal will succeed in: "Contributing to poverty reduction thanks to the conservation and sustainable management of forestry potential and biodiversity, maintaining socio-ecological balance so as to meet the needs of populations in timber and non-timber specially through, the coherent implementation of regionalization/decentralization policy".

The Forestry Code gives the rights to side-forest populations to obtain firewood from side-forest. For charcoal production the State fixed for each forest campaign a national quota but firewood is not submitted to formal quota (ENDA 2010).

Participatory and integrated management plans have been implemented to prevent removals and degradation of forest formations. These plans have enabled the increase in forest assets and the valuation of forest products with a better organization of local communities as well as the increase of their income.

In **Mali**, the Agency for the Development of Household Energy and Rural Electrification (AMADER) was created in 2003, aiming at managing domestic energy consumption and ensuring community forest conservation, among others (ADB 2010).

A priority working area of the Agency was to establish wood energy savings. Among the strategies are the empowerment of rural communities' through the creation of rural markets, the improvement of the institutional and legal

framework of the forests management and the promotion of alternative energy sources, such as liquefied petroleum gas (REEGLE 2012).

Mali enacted the National Energy Policy, which governs the energy sector (REEGLE 2012). Also the *National Strategy for Renewable Energy* and the *National Strategy for the Development of Biofuels* which contains sustainability criteria (Fofana 2012) have been passed (ENDA 2010). The National Energy Policy emphasizes the development of biofuels within the framework of the *national strategy of reforestation*, including a particular program for the promotion of *Jatropha*. It should be noted that improved cook stoves and substitution of fuels have been promoted. Also, for development of new projects, environmental impacts have to be considered during all phases (ENDA 2010). Mali is vigilant with respect to food security concerns and on the priority for modern bioenergy to insure local communities' needs instead of international markets.

In **Ghana**, the annual woodfuel production is estimated at 18 Mt and it is currently used as firewood or charcoal. Vast areas of degraded lands are available within the country.

The Renewable Energy Act was passed in 2011 and established some incentives for bioenergy promotion such as feed-in-tariff and renewable energy purchase obligation (Otu-Danquah 2012). Also, technical standards for biodiesel and bioethanol as well as a Licensing/Permitting Manual for RE industry have been developed. The draft Bioenergy Policy Strategy has been developed and is being subjected to Strategic Environmental Assessment (Agyarko 2012). Also, the National Woodfuel Policy is in place (Energy Commission (Ghana) 2010).

Export of charcoal is permitted only from sustainable sources (offcuts, wood waste and certified woodlot) and regulations on production, transportation, storage and marketing of charcoal are currently being done.

Some challenges that arise for the bioenergy promotion is the competition with food, the absence of land use policy or management plan (Chiefs/traditional authorities are mostly the custodian of land) (Otu-Danquah 2012).

#### **A-1.3.5 East Africa**

The East African Community (including Tanzania) adopted the Regional Strategy on Scaling up Access to Modern Energy Services in 2006 to fight poverty, improve living conditions and to support the achievement of the MDGs (EUEI PDF 2011, East African Community 2009). Providing modern cooking practices to enable the use of modern fuels for 50% of those who at present use traditional

biomass for cooking is within the commitments (EUEI PDF 2011, East African Community 2009).

In **Tanzania**, various laws and policies indirectly address relevant issues to bioenergy (FAO 2009a) and the development of a Biomass Energy Strategy is ongoing (EUEI PDF 2012b). The availability of land is one of the reasons for the potential of the expansion of the bioenergy sector in the country (FAO 2009a).

The Energy Policy, passed in 2003, states the need to ameliorate the development and use of domestic and renewable energy sources and technologies (FAO 2009a). An enabling environment to various players to operate, including private companies is being created by the National Biofuels Task Force, established in 2006 (FAO 2009a). Moreover, the Rural Energy Act of 2005 established the Rural Energy Board, Fund and Agency responsible for promotion of improved access to modern energy in rural areas (REEGLE 2012).

The Forest Policy of 1998 remarks that the uncontrolled consumption of woodfuels led to an underestimation of the contribution of the forest sector to the national GDP (FAO 2009a). Also, the Forest Policy encourages the establishment of forestry-based industries and foreign trade and makes restrictions regarding exportation, including the compliance with certification measures. Sustainable management and conservation of forest biodiversity is aimed in the Forest Act. Access to woodfuels varies depending on the type of forest and it is usually free for household purposes in villages but some royalties have to be paid for commercial purposes, varying with the arrangements in place.

Commercial exploitation of forest is regulated through the development of plans. Also, criteria governing concessions are provided by the plan. Management Plans should be established, including the proposal of particular zones for local community's access and protection of practices and customs. The figure of "Joint Forest Management", aims to regulate community access to woodfuels and other products and it is based on various levels of governance. Local communities agree on the share of management rights and responsibilities as well as costs and benefits. Other pieces of legislation aim to prevent present land uses and land grabbing. Thus, investments in land acquisition for bioenergy are regulated and rights to investors through leases and sublease arrangements but protection to property rights is established through a bottom-up approach.

There are experiences on the improvement of the charcoal sector such as the project transforming Tanzania's Charcoal Sector which aims to establish commercially viable value chains for legal, sustainable sourced charcoal (TFCG 2012).

### A-1.3.6 Southern Africa

**Mozambique's** Biomass Energy Strategy and Action Plan (ongoing) have focused both in the supply and the demand sides, with particular focus on the charcoal sector (EUEI PDF 2012a). It aims to ensure a more sustainable supply of biomass energy and to promote access to modern cooking fuels and biomass combustion technologies for households and small enterprises.

Due to its large land resources, favorable environmental conditions and low population density this country is seen ideal for bioenergy production (Prasad 2010). The national biofuels directive (2009) considers mandatory blending requirements (FAO 2009a) and creates business opportunities for private local and foreign investors and communities.

The Forestry and Wildlife Law was passed in 1999 and the Law Regulations in 2002 (Johnstone et al. 2004). Through these pieces the legal rights and benefits of the forest dependent rural population were set, including wood harvesting (simple license). Granting and management of concession areas is an important element of the development of the forestry sector and licenses are provided for this purpose. Shortcomings have been detected and proposed solutions to overcome them are a successful implementation and enforcement of the existing legal provisions (Johnstone et al. 2004).

Decentralized community management of forest resources in addition to efficient extension services would make forests a sustainable source of income and employment for the rural unemployed and in addition create tax revenue for the government (Prasad 2010).

In **South Africa**, approximately 20 % of people use solid fuels, with a share of consumption in rural areas of 41 % and just 7 % in urban areas. Due to the magnitude or other problems such as HIV/AIDS, the woodfuels issues were not a priority for households or governments (Accenture 2011a). Scarcity of fuelwood resources due to commercialization of fuelwood and charcoal has been observed in many parts of the country (Prasad 2010).

Various pieces of policies have been developed, among others, the Renewable Energy Initiative launched in 2011 and feed-in tariff policies (IRENA 2012). It is expected that about 9 to 16% of the total energy demand could be met with biomass, including cuttings from forestry operations and energy crops (REEGLE2012).

It is worth to highlight the Biofuels Industrial Strategy (2007) promoting the biofuels penetration in the national pool and excluding the utilization of crops

that could impact on the food security. However, the production of biofuels has not been stimulated by the strategy (Prasad 2010). A small amount of indigenously-produced biomass (263 ktoe) is also exported (REEGLE 2012).

The National Forest Act (last implementation in 1998) acknowledges that natural forests and woodlands have to be conserved and developed according to the principles of sustainable management (WRI undated). The White Paper on Sustainable Forest Development in South Africa, into force since 1997, includes measures to small-scale afforestation (WRI undated).

Most of South African forests are allocated in state land or in protected areas and they are well protected (Prasad 2010). There are policies, strategies and programs focused on environmental, social and economic aspects aiming at sharing ownership and benefits of natural resources with people relying on biomass.

In particular, the White Paper on Energy Policy recognizes the need of some interventions in degraded areas to manage woodlands for the benefit of rural households and a strategy on managing wood supply in the rural areas is in preparation (DME 2002).

### **A-1.3.7 Summary**

Selected countries established - with different purposes and to various extents - different regulations. However, most developing countries lack the institutional capacities to enforce these regulations. Thus, governance capacities are weak, and regulations face the risk of being disregarded.

According to Ecofys et al. (2011) the impacts of the RED on protected areas as well as clearing of forests was positive, while other impacts were poorly considered. Therefore, if legislation is sufficiently enforced, the general legislative readiness for producing biofuels complying with the RED seemed to be good for some criteria but poor for others, as shown in Table 8.

However, the assessment concluded that among the countries analyzed, none has a high enforcement potential. Among the countries examined in this report, Mozambique and Tanzania demonstrated low enforcement potential while in countries such as Argentina, Brazil, India and Indonesia the potential was intermediate.

**Table 8** Global overview to consideration of RED sustainability criteria in biofuel related legislation

	Impacts on protected areas	Clearing of forests	Impacts on threatened species	Conversion of wetlands	Conversion of grasslands	Drainage of peatlands
Asia	+	+	---	---	---	---
America	+++	+++		---	---	---
Africa	++			--	---	---

	Social Sustainability	Land-use	Water	Bio-diversity	Soil	Eco-system services	Carbon stock	Air	GHG emissions
Asia	+++	++	+			-	-	--	---
America	+++	+++	+++	++	+		-	-	---
Africa	+++	+	++			-	-	--	---

+++ Universally well, ++ Generally well, + Relatively well, - Relatively poor, -- Generally poor, --- Universally poor

Source: Ecofys et al. (2011)

This assessment, even if not specifically addressing issues related to woody bioenergy in detail (such as forest management), implies that national legislation in several countries is not “enough” to ensure sustainable sourcing of biomass. Thus, additional - mandatory or voluntary - sustainability requirements and schemes should be considered when biomass is being exported.

Notwithstanding that, developing countries should develop **their own** regulations framework regarding woody bioenergy, independently of exporting or domestic use. The relevance of woody biomass in domestic uses makes it important enough to be addressed, preferably by means of specific regulations.

### A-1.4 National regulation in selected OECD countries

Due to the lack of an EU-wide binding regulation for woody biomass, several member states have taken steps towards the assurance of biomass sustainability, even if the approaches are quite different. Here the most relevant regulations of the largest consumers of the EU are detailed.

Other OECD countries such as Canada and the US have established sustainability requirements for some types of biomass, and included regulations to ensure sustainable forest management for biomass procured from forests on the state



level. Also, many OECD countries - with the prominent example of Japan - promote the use of local biomass sources (IEA 2012b).

**Belgium** has promoted electricity generation through biomass by means of various approaches (energy balance or avoid GHG emissions) depending on the region (Goh, Junginger 2011). Some acts include: wood pellets for use in non-industrial heating installations have to be chemically untreated wood from certified forests. Small scale heating systems have to comply with minimum requirements for efficiency and emission levels; Flemish Green Power Certificates promotes green electricity but excludes woody resources and wastes if they could be used for other applications.

In **Germany**, solid biomass consumption has been promoted through the Renewable Energy Sources Act and the Renewable Energies Heat Act (Fritsche et al. 2012). Approximately 55 Mm<sup>3</sup> of wood (equals roughly 27.5 Mt dry) is consumed by the energy sector in Germany, procured mainly from domestic sources (Fritsche et al. 2012). However, imports become increasingly important, though at very low level.

The promotion of biomass consumption is regulated through various acts: feed-in tariffs for electricity from renewable energy resources, contemplating bonuses for use of cuttings from landscape preservation; higher payments are provided to sustainable feedstocks with less competition in the usage and forest residues from certified forests get more grants than other forest wood; minimum efficiencies requirements (VITO et al. 2011).

In September 2013, the National Energy Agreement for Sustainable Growth was agreed in **The Netherlands** with the signature of more than 40 organizations (Nellen 2013). Among the provisions, the co-firing ambitiousness limit was established at 25 PJ, now it is 14 PJ. With regards to sustainable use of biomass, cascading use is the starting point for biomass for bioenergy uses.

The Commission Corbey will lead the discussion on how to extent the requirements on sustainability from the NTA8080 to include, among others, sustainable forest management. The NTA 8080 is the Dutch voluntary norm developed for all biomass sources (NEN 2009) and includes social, economic and environmental criteria. In April 2011, the “Dutch assessment protocol for voluntary sustainability schemes for solid biomass” (the Biomass Protocol) was developed as a draft national framework for sustainability criteria and to perform pilot assessments of voluntary certification systems against the requirements in the protocol. This Biomass Protocol is based on the criteria set in the EU-RED for biofuels and bioliquids, including criteria on sustainability, the mass balance system and audit quality, with some additions on soil quality.

District heating in **Sweden** is widely spread. The legal frameworks conditions are based on an electricity certificate system combined with renewable obligations and exemptions from CO<sub>2</sub> taxes (Cocchi et al. 2011). The ordinance (2003:120) on electricity certificates states which biomass is eligible for green certificates - some types only receive certificates when burned in CHP (VITO et al. 2011).

In **Finland**, the National action plan to promote energy from renewable sources includes energy subsidies for small sized wood in connection with the Sustainable Forestry Act and Heat premium for CHP installations on wood and biogas. Also, the act on the Financing of Sustainable Forestry supports the harvesting of young plantations and forestry transport.

**The UK** provides various incentives to generate electricity and heat from biomass with special attention to co-firing i.e. the Renewable Obligation, the Electricity Market Reform, the Feed in Tariff and the Renewable Heat Incentive. Especial focus on co-firing and heat has been developed. Respective criteria for bioenergy for heat were recently endorsed (DECC 2013a+b). The UK Government's Timber Procurement Policy states that timber and wood-derived products must be procured from a legal and sustainable source. To show evidence of compliance with this definition, two categories have been established (Fripp 2013): Category A, by means of a forest certification scheme approved by the Central Point of Expertise on Timber Procurement and Category B, that comprises equivalent credible evidence.

**Canada** aims to manage its forest in a sustainable way and special efforts are being doing in order to assure that biomass harvesting is performed in a sustainable manner (NRC et al. 2012). To do so, many provinces have developed, for example voluntary harvesting guidelines (WWF CA 2010).

In the **US**, bioenergy policy related to SFM relies primarily on laws, regulations and other guidance that are not bioenergy-specific. However, policies are evolving to specify bioenergy in renewable energy mandates. Federal, state, and local governments have passed various regulations that encompass both public and private lands, which hinder any easy generalization (Endres 2013). The type of biomass that may be harvested and the amount of biomass that should be left on the ground are the most controversial questions for which some states have developed Best Management Practices<sup>31</sup>.

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<sup>31</sup> See e.g. EDF, PIC (2012) and for more details

## A-1.5 Assessment of Sustainability Schemes for Woody Bioenergy

This section is developed with the purpose of providing an overview of the advantages and drawbacks of the main European regulations and voluntary initiatives. Table 9 summarizes the compliance of most relevant approaches at EU level against criteria that should be considered for woody bioenergy<sup>32</sup>. It is not a rigorous analysis, though<sup>33</sup>.

**Table 9** *Benchmarking approaches to sustainability of solid biomass*

Origin of the approach		Energy			Forest	
		RED (biofuels and bioliquids)	RED possible extension to solid biomass	Industry approach (SBP, former IWPB)	EU TR	Forest certification
Environmental criteria	Definition of “no-go” areas (for biodiversity and C conservation)					
	GHG emissions reductions					
	Sustainable Forest Management					(some adaptation might be needed)
Socio-economic criteria						

Not included     Included in a variety degree of compliance     Fully included

Source: own compilation; RED: Renewable Energy Directive; EU TR: EU Timber Regulation; IWPB: Initiative of Wood Pellets Buyers; SBP: Sustainable Biomass Partnership

The table shows that no scheme complies with all criteria that a holistic approach to woody biomass sustainability should take into account.

<sup>32</sup> See Fritsche et al. (2012) for a comprehensive review of environmental issues of bioenergy from forests.

<sup>33</sup> For more detailed benchmarking see e.g. Martikainen, van Dam (2010); NEN (2011); IC, UU (2011)

This is due to their different background and purposes. Generally speaking, SFM and socioeconomic considerations are the less in-depth examined issues in the whole approach to sustainability but there are significant differences between schemes.

At European level, the RED (current sustainability criteria for biofuels and bioliquids with potential extension to solid biomass) is a milestone in the development of **mandatory** policies with sustainability requirements within the EU, and beyond.

However, the lack of social considerations in the RED (only monitoring) implies room for improvements both in terms of issues to consider and the way in which they are considered.

The **possible extension** of the RED to solid biomass gives the opportunity to address specific problems that arise from sourcing this type of biomass. The ongoing EC work on extending the RED sustainability criteria to solid biomass is supposed to be based on biodiversity protection (i.e. protection of areas with high biodiversity) and to a certain extent sustainable forest management requirement (Volpi 2012; EC 2013).

Thus, further expansion of the RED is expected to address most relevant environmental concerns. On the other hand, it should be considered if the achievements of the Forest Europe negotiations on a Legally Binding Agreement on Forest in Europe **could** be transferred to the extension of the RED.

Regarding the private sector efforts on supplying sustainable woody biomass, the SBP (former IWPB) include the compliance with the criteria established by the RED and also states further criteria to be assessed and improved in time, including: Protection of soil, water and air quality, competition with local biomass applications and local socio-economic performance<sup>34</sup>.

The forestry sector has long tradition working on sustainability issues due to respective risks that global forests face. Despite the numerous efforts, it has not been possible to agree on an international binding commitment on forests, though.

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<sup>34</sup> Note that as a voluntary scheme, the IWPB initiative is not restricted by the international trade law (WTO), as the mandatory RED is. Thus, social and “local” sustainability issues can be addressed without violation of WTO rules.

A milestone in the forestry sector is the **EU Timber Regulation** which aims to prevent the entrance of illegally logged wood and wood products into the EU markets.

The FLEGT approach does not provide criteria regarding sustainable procurement, but it indirectly covers those to the extent to which such environmental and social criteria are included within the **national** legislation of a country. This voluntary approach might be also useful.

**Forest certification** finds its origin in the need of promoting more sustainable forest management globally, particularly preventing deforestation in developing countries. As a voluntary concept, the approach to SFM by the various standards in place is different and it results in no mutual recognition between the most relevant ones. FSC and all the regional schemes under the PEFC consider to a certain extent environmental and socioeconomic criteria.

None of them has developed specific requirements to address the risks that the procurement of woody biomass presents, though.

#### **A-1.5.1 Environmental Effects**

None of the most relevant schemes addresses all the environmental effects that have to be considered in solid biomass for bioenergy. The EU TR establishes the principles for compliance with legality, but the definition of legality is in the responsibility of the country (EC 2007). The application of this regulation to woody bioenergy assures that a minimum threshold in the direction of sustainable forest management is met.

A logical approach could be to base the forest management on the criteria and indicators developed by the international processes on SFM and the voluntary forest certification schemes because they are the most experienced in this sector. Maybe some adaptations regarding “no-go” areas could be needed but an agreement seems achievable. This pathway should explore the possibilities to find minimum convergence among the schemes.

#### **A-1.5.2 Socioeconomic Effects**

Particularly in developing countries, the growing population and the competition for natural resources, including, e.g., land and water, give concerns about potential of human sustainable development.

Land tenure and ownership and land grabbing and the associated displacement it may generate, are issues gaining more recognition. Also, it has to be mentioned that environmental and social issues are not isolated factors and there are interactions between them (IC, IFEU, WIP 2012).

Some voluntary schemes developed to show compliance with the RED sustainability criteria for biofuels and bioliquids have included social sustainability. However, the poor coverage of some critical social sustainability components, the presence of schemes lacking any social sustainability requirements and gaps in procedural rules are the reasons why it is likely to undermine the achievement of social sustainability through these schemes and the EU sustainability policies lending credibility to them (German, Schoneveld 2011).

The extent to which forest certification addresses it varies among schemes. The FSC scheme details some principles that particularly affect socioeconomic issues, such as (FSC 2012):

- Compliance with laws
- Workers' rights and employment conditions
- Indigenous peoples' rights
- Community relations
- Benefits from the forest.

On the other hand, the PEFC International Standard (PEFC 2010) specifies that national standards endorsed by PEFC have to comply with legal requirements as well as to maintain other socio-economic functions and conditions.

The approach to the socioeconomic issues, if existing, is variable among the various schemes.

The EU Global BioPact project, aiming at developing and harmonizing global sustainability certification systems for biomass production, conversion systems and trade in order to prevent negative socio-economic impacts, has proposed a set of impact indicators for the production of biofuels in relation with the following issues (IC, IFEU, WIP 2012):

- Contribution to local economy
- Working conditions and rights
- Health and safety
- Gender
- Land rights and conflicts
- Food security.

## **A-2 EU27 Demand for Woody Bioenergy**

The EU used about 113 MtOE of primary biomass in 2010 of which 9.5 MtOE were imported and 4.2 exported (AEBIOM 2012). The future EU primary biomass

consumption is expected to reach 178 MtOE by 2020, of which 119 MtOE would be solid biomass<sup>35</sup>, 21 MtOE biogas, 8 MtOE bioliquids, and 30 MtOE biofuels (ECN 2011). Thus, solid biomass is and is expected to be the most consumed type of bioenergy.

## A-2.1 EU-27 Bioenergy Demand and Potentials

The demand for solid bioenergy in Europe is given by the IEA to be 3.5 EJ in 2010 (IEA 2011). Only 5% of this demand was covered by imports. Although the demand for wood pellets in the European Union has been growing steadily over the last years, there is still enough potential within these countries to cover the rising demand. Pellets imports, mainly from Canada and the US, are due to lower prices and could increase if co-firing in coal powerplants became more economic (see Annex 7).

*Table 10 Gross final energy consumption from biomass in the EU*

in MtOE	2010	2020
Electricity	9	20
Heat	62	90
Biofuels	14	30
<b>Total</b>	<b>85</b>	<b>140</b>

*Source: NREAPs as compiled by ECN (2011)*

To reduce the costs for traded biomass, all elements of the process chain have to be optimized. Among these, transport costs play a crucial role, especially when biomass has to be transported over a long distance. Therefore it is important to reduce volume and increase specific weight. This can be done by pelletizing or torrefying biomass which allows solid biomass transport over long distances, e.g. from developing countries, at reasonable cost (IEA Bio 2013)<sup>36</sup>.

<sup>35</sup> According to EurObserver (2012) solid biomass refers to wood, waste wood, other plant and animal-based biomass

<sup>36</sup> Torrefaction offers a good quality fuel, but has a lower overall efficiency, even when energy demand for transport is considered. Therefore, torrefied biomass can only be economic if prices for primary biomass are low.

Furthermore, the price dynamics for CO<sub>2</sub> certificates under the European Emission Trading System (ETS) will determine to what extent co-firing of solid bioenergy will be of interest for utilities and industrial emitters.

As these influences can only be projected based on assumptions, a near-term base for future biomass demand are the National Renewable Energy Action Plans (NREAP) of the EU countries.

*Table 11 Consumption of solid biomass in the EU in 2011 by use*

Use	Consumption
Heat consumption from solid biomass	64.9 MtOE
- Processing sector	6.9 MtOE
Heat plants	2.7 MtOE
CHP plants	4.2 MtOE
Electricity produced	72.8 TWh
- Electricity only plants	30.6 TWh
- CHP plants	42.2 TWh
Primary energy production	78.8 MtOE

Source: EurObserv'ER (2012)

In 2011 the consumption of solid biomass within the EU was about 79 MtOE, i.e. 2.4 MtOE less than in 2010. This reduction was due to the mild winter, which decreased the demand of solid biomass. Total production has more than doubled over the 1990-2010 period (Euroobserver 2012).

In 2010, the share of all woody biomass supply used for energy purposes was between 42% (AEBIOM 2012) and 55 % (Mantau 2012), with half of the total being used in the residential sector, and 25% each by wood industry, and powerplants (UNECE-FAO 2012).



## A-2.2 Scenario Studies on EU 27 Bioenergy Demand

Within the Biomass Future project (IC et al. 2012) data has been gathered and put together to calculate the total demand for woody biomass of all the EU 27 member states in the year 2020. The result is shown in the following table.

*Table 12 Woody biomass demand in the EU27 by 2020*

		Rural heat (boilers, stoves)		Urban heat, district heating		Electricity		total
		resid.	comm.	resid.	comm.	Industry, CHP	Utilities (incl. co- firing)	
Feedstock	Unit							
Final energy from wood	TWh	82	76	63	50	67	19	357
Energy efficiency	%	80	85	85	85*0,5*)	25	40	
energy demand from feedstock	TWh	103	89	74	29	268	48	611
Feedstock demand	MtOE	9	8	6	3	23	4	53
Feedstock demand	Mm <sup>3</sup>	37	32	27	11	96	17	220

*Source: own calculation based on data from Biomass Futures project (IC et al. 2012)<sup>37</sup>* Note: it is estimated that 50% of the district heating is produced in cogeneration plants and therefore appears among electricity

The total demand in 2020 can be estimated as 611 TWh or roughly 53 MtOE. For this demand, an annual feedstock volume of 220 Mm<sup>3</sup> would be needed.

Compared to this demand, the biomass potentials were calculated for different bioenergy resources (see following table).

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<sup>37</sup> The demand given in the table refers to the final energy demand and is given in energy units. To calculate the feedstock demand to produce this final energy, one has to take into account the average efficiencies for each technology and the lower heating value (LHV) of the feedstock.

Table 13 Potentials per bioenergy resource in the EU 27 for 2020 and 2030

Data given in MtOE			Scenario 2020		Scenario 2030	
resource	Description	current	Reference	Sustainability	Reference	Sustainability
Roundwood production <sup>b</sup>	Stem wood from forest harvests	57	56	56	56	56
Additional harvestable roundwood <sup>b</sup>	Additional potential for harvesting of stem wood within sustainable limits	41	38	35	39	36
SRC <sup>b</sup>	Dedicated energy crops providing lignocellulose material	0	58	52	49	37
Landscape care wood <sup>a</sup>	Residues, i.e. cuttings etc. from landscape management	9	15	11	12	11
Primary forestry residues <sup>a</sup>	Logging residues, early thinnings and extracted stumps	20	41	19	42	19
Secondary forestry residues <sup>a</sup>	Residues from wood processing industry, e.g. black liquor, sawdust and other industrial residues	14	15	15	17	17
Tertiary forestry residues <sup>a</sup>	Post-consumer wood waste, i.e. from households, building sites	32	45	45	38	38
total woody biomass		173	268	233	253	214

Source: own calculation based on Biomass Futures data; <sup>a</sup>: denotes potential resources that could be deemed as waste materials or residues; <sup>b</sup>: denotes potentials based on primary production either through agriculture or forestry systems to deliver resource

Comparing the EU bioenergy demand projections (Table 12) with the potential supply (Table 13) one can see that the total bioenergy demand for 2020 from the NREAP is **considerably lower** than the bioenergy potentials for 2020 and 2030.

The Biomass Futures study also developed alternative scenarios for biomass deployment in the EU that will lead to an increased biomass utilization compared to the NREAP: the “RED scenario” using the bioenergy supply curves based on RED sustainability criteria for biofuels.

**Table 14**      *The RED scenario of Biomass Futures*

		Heat rural (boilers, stoves)		District heat, urban		Electricity		total
		resid.	comm.	resid.	comm.	Industry, CHP	Utilities (incl. co-firing)	
<b>Feedstock</b>	<b>Unit</b>							
Primary forestry residues	TWh	0	92	77	61	81	23	334
Sawmill by-products	TWh	20	19	16	13	17	5	90
Landscape care wood	TWh	23	21	18	14	19	5	100
SRC	TWh	114	106	88	70	94	26	498
Final energy from wood	TWh	157	238	199	158	211	59	1022
Feedstock LHV	TWh	196	280	234	93	844	148	1795
	MtOE	17	24	20	8	73	13	154
Feedstock volume	Mm <sup>3</sup>	71	101	84	33	304	53	646

Source: own calculation based on data from Biomass Futures project (IC et al. 2012)

With this the total demand for 2020 will be roughly 1,800 TWh or 154 MtOE with an annual feedstock volume of 646 Mm<sup>3</sup>.

**Table 15**      *The RED+ scenario for EU27 by 2020*

		Heat rural (boilers, stoves)		District heat, urban		Electricity		total
		resid.	comm.	resid.	comm.	Industry, CHP	utilities (incl. co-firing)	
<b>Feedstock</b>	<b>Unit</b>							
Primary forestry residues	TWh	0	0	35	28	37	10	110
Landscape care wood	TWh	22	20	17	14	18	5	96
Sawmill by-products	TWh	20	19	16	13	17	5	90
SRC	TWh	41	38	32	25	34	10	180
Final energy from wood	TWh	83	77	100	80	106	30	476
Feedstock LHV	TWh	104	91	118	47	424	75	858
	MtOE	9	8	10	4	36	6	74
Feedstock volume	Mm <sup>3</sup>	37	33	42	17	153	27	309

Source: own calculation based on data from Biomass Futures project (IC et al. 2012)

Here the total demand for 2020 adds up to 858 TWh or 74 MtOE with an annual feedstock volume of 309 Mm<sup>3</sup>.

*Table 16 Solid bioenergy potentials and demand of the EU27 by 2020*

Source	TWh	MtOE	Mm <sup>3</sup> (solid)
Potential "Reference"	3,117	268	1,187
Potential "Sustainability"	2,710	233	1,032
Demand from NREAPs	611	53	220
Demand in Sustainability Scenario	858	74	309

*Source: own calculation based on data from Biomass Futures (IC et al. 2012)*

All scenarios and NREAPs have demands for woody bioenergy which are lower than sustainable woody bioenergy potentials. However, potentials do not describe markets (Hetemäki 2013):

- Demand depends on **prices of fossil energy and CO<sub>2</sub> certificates**, and availability of comparatively cheap woody bioenergy imports, demand from overseas might increase without higher domestic production. On the other hand, utilizing woody resources within Europe could displace domestic feedstocks, creating demand for timber and other wood products (such as pulp & paper, fiber and chipboard). In this case, new demand could be met by imports, as in the pulp and paper industry.
- Well-established supply chains are vital for the larger-scale use of biomass, especially for co-firing in coal power plants for which utilities might choose a single-track supply with imported biomass rather than collecting feedstock from a large number of small-scale regional suppliers.
- So far, European farmers are reluctant to commit to growing perennial crops such as short rotation coppice, given the higher investment cost compared to annual crops, and the unclear longer-term bioenergy market development compared to the currently high prices for traditional agricultural commodities.

In the EU scenarios, co-firing is not a prominent option, as it is currently far from being economic due to low prices of coal or lignite, and parallel low prices for CO<sub>2</sub> certificates in the European Emission Trading System (ETS). Nonetheless, co-firing will be extended once CO<sub>2</sub> certificate prices increase and if low-cost bioenergy feedstocks become available, especially from imports (see Annex 7).

Accordingly, there are various utility plans for importing woody bioenergy, especially in the form of pellets, to increase co-firing in the EU.

The analysis by Cocchi et al. (2011) shows that global wood pellet production to 2020 is likely to increase considerably, with Canada, the US, and Russia all expected to markedly increase their production capacity.

This analysis suggests that depending on actual demand for pellets, between 16 Mt (low trade scenario) and 33 Mt (high trade scenario) of wood pellets per year could be imported to Europe by 2020.

Given the results from stakeholder interviews (see Annex 5), the “high” import scenario seems unrealistic, as major utilities such as e.on, RWE and Vattenfall have reduced their ambitions for co-firing due to low CO<sub>2</sub> certificate prices, and lack of EU regulation on the sustainability of woody bioenergy.

As comparatively low-cost import options exist for pellets from Canada, the Southeast of the US and Russia, utilities will use these options once the market development in terms of CO<sub>2</sub> certificate prices and EU sustainability regulation becomes clear.

This implies that overall prices for internationally traded woody bioenergy, especially to the EU-27 market, will remain low so that other potential market suppliers - e.g. from developing countries - would face low revenues for risky investments.

## A-3 Demand for Woody Bioenergy in other Countries

### A-3.1 China

China is sharply increasing its energy demand and it is becoming dependent on imports of raw materials, including energy, largely based on fossil fuels. Almost 400 million people rely on traditional use of biomass for cooking (IEA 2012b). In rural areas, traditional biomass accounts for about 98 percent of the total bioenergy (ERI 2010). Biomass-based energy generation is based in heat and power generation rather than in biofuel production (REEGLE 2012).

About 60% of the population lives in rural areas but - unlike other developing countries - electrification is high with 99% of the population having grid access. Nonetheless, more than half of the energy for cooking and heating in rural residential areas comes from straw and other solids (UNDP 2007b).

According to FAO statistics (Faostat 2013), the total roundwood production in 2011 was 288 Mm<sup>3</sup> of which 185 Mm<sup>3</sup> (64%) were used as fuelwood, representing 44 MtOE. IEA statistics for China (IEA 2011) give a biomass consumption of 206 MtOE with more than 97% used in the residential sector, mainly in rural areas<sup>38</sup>.

The Chinese National Development and Reform Commission estimated available biomass resources of 108 MtOE in 2010 from energy forest and forestry residues that can be produced sustainably, potentially rising to 355 MtOE in 2030 (see Table 17).

*Table 17 Existing and future biomass resources in China*

<b>Available biomass (MtOE)</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>
Forest residues	101	130	166
Energy forest	7	117	189
<b>Total</b>	<b>108</b>	<b>247</b>	<b>355</b>

*Source: ERI (2008); data derived from National Development and Reform Commission*

<sup>38</sup> One reason for this difference - besides incomplete statistics is a high percentage of non-woody biomass such as straw. It can be supposed that FAO data mainly refer to traded biomass, whereas IEA numbers include woody biomass that is freely collected and not commercially traded.

The IEA World Energy Outlook (WEO, see IEA 2012b) projects the energy demand under three different scenarios, a so-called Current Policies Scenario (CPS), a New Policies Scenario (NPS) and a 450 Policies Scenario (450 PS).

The CPS models the future energy demand under the assumption that the current energy policies will continue in the future. The NPS assumes that the measures that have recently been announced by governments will be followed and implemented whereas the 450 PS follows the target of a maximum CO<sub>2</sub> content in the atmosphere of 450 ppm. Biomass data can be regarded as reliable as IEA introduced a new tool to the WEO model to analyze supply and trade of bioenergy<sup>39</sup>.

The WEO data for the Chinese New Policies Scenario are shown in Table 18.

**Table 18** *Chinese energy demand and bioenergy supply within New Policies Scenario*

	Energy demand (MtOE)							Share in %		ann. increment %
	1990	2010	2015	2020	2025	2030	2035	2010	2035	2010-35
TPED*)	881	2 416	3 020	3 359	3 574	3 742	3 872			1.9
Bioenergy supply	200	206	205	217	219	219	227	9	6	0.4
- for electricity	-	5	15	41	59	74	93	1	5	12.4
- for biofuels	-	1	2	6	10	16	22	1	4	12.4
- for heating	200	200	188	170	149	129	111	44	19	- 2.3

Source: own compilation based on IEA (2012b); TPED = total primary energy demand

The NPS expects total bioenergy supply to increase only slightly until 2035 and the share of bioenergy will by then decrease to 6% from 9% in 2010. However, by 2035 about 40% of the biomass shall be used for power production. At the same time, biomass use in residential areas will be reduced by 45%.

<sup>39</sup> "The new model includes 25 regions with detailed representation of bioenergy supply potentials and conversion technology costs for the power sector and biofuel production. In order to meet demand for bioenergy in each sector and region, domestic resources are given priority (after taking account of existing trade) and compete with each other on the basis of conversion costs (including feedstock prices). Regional resources are treated as "bioenergy available for energy purposes", where agricultural demands are met before supplying the energy sector. If domestic bioenergy resources cannot satisfy all demands in a given region, supplementary supplies are obtained on the global market. Regions with available resources beyond food and domestic energy needs supply the global market. The model uses a global trade matrix for ethanol, biodiesel and solid biomass pellets to match unsatisfied demand with available supply on a least-cost basis, including transportation costs." (cit. from IEA 2012)

Although the three scenarios differ considerably concerning the total primary energy demand (TPED), they give approximately the same results for bioenergy residential heating and cooking. A big difference can be seen for bioenergy power generation, where the target for 2035 in the 450 PS is double the amount as in the current policies scenario (see following table).

*Table 19 Chinese energy demand and bioenergy supply in the WEO 2012 scenarios*

	Energy Demand (MtOE)		
	2020	2030	2035
TPED CPS	3.519	4.144	4.406
TPED NPS	3.359	3.742	3.872
TPED 450 PS	3.106	3.077	3.070
NPS Bioenergy supply	217	219	227
CPS Bioenergy supply	216	205	197
450 Bioenergy supply	219	256	281
CPS Bioenergy for electricity	42	67	74
NPS Bioenergy for electricity	41	74	93
450 PS Bioenergy for electricity	44	106	142
NPS Bioenergy residential	170	129	111
CPS Bioenergy residential	170	127	108
450 Bioenergy residential	167	124	107

*Source: IEA (2012b); CPS = current policies scenario; NPS = new policies scenario; 450 PS = 450 policies scenario*

Depending on the scenario, Chinese biomass demand for power generation will be between 74 and 142 MtOE per year. All scenarios show that the woody bioenergy demand can be met by domestic biomass resources only if additional plantations will be established.

Given the high value of land for food production and the poor transport infrastructure, it can be expected that China will import biomass especially for powerplants located in its coastal areas as long as prices for imported biomass are competitive compared to other renewable energies.

Hence, it is **very unlikely** that China will be an export nation for biomass but might well choose **to import** biomass in the future to support its energy plan.



### A-3.2 India

Household use of biomass is about 90 % in rural households and nearly 40 % in urban areas (TERI 2010). Fuelwood consumption in household's sums 58 % of the total energy consumed by households and it is projected to account for 37 % in 2031-2032 (TERI 2010).

According to FAOSTAT (2013), about 93% of the roundwood production is used as fuelwood, i.e. 309 Mm<sup>3</sup>/year in 2011, equivalent to 74 MtOE. However, IEA data for bioenergy demand of residential areas is nearly twice (140 MtOE)<sup>40</sup>.

The IEA World Energy Outlook 2012 indicates only a small increase in bioenergy use: with overall energy demand growing at 3.2% per year, it would double by 2035, compared to 2010. At the same time, bioenergy supply will only increase at 1% per year, i.e. growing by 30% until 2035.

The residential bioenergy demand will be reduced slightly (0.4% per year) and it is expected that power generation from bioenergy increases rapidly (14.6% per year) to 36 MtOE in 2035.

IEA expects India to remain the largest population without electricity access, with still around 150 million in 2030.

*Table 20 Indian energy demand and bioenergy supply in the WEO 2012 New Policies Scenario*

	Energy demand (MtOE)					Share (%)		annual increment
	1990	2010	2020	2030	2035	2010	2035	2010-35
TPED	317	691	974	1300	1516	100	100	3.2
Bioenergy supply	133	170	192	209	219	25	14	1.0
- for electricity	-	1	6	24	36	0	5	14.6
- for biofuels	0	0	2	6	10			
- for heating	111	140	146	136	127	71	47	-0.4

Source: IEA (2012b); TPED = total primary energy demand

A comparison of the WEO scenarios shows only little differences. In any case, demand for bioenergy will increase as domestic resources will stay restricted.

<sup>40</sup> It can be assumed that the difference is due to the fact that large parts of biomass comes from non-wood material such as straw and dung, or is not traded but "freely collected".

**Table 21** *Indian energy demand and bioenergy supply for the three WEO 2012 scenarios*

	Energy Demand (MtOE)		
	2020	2030	2035
TPED CPS	1013	1407	1680
TPED NPS	974	1300	1516
TPED 450 PS	904	1089	1233
CPS Bioenergy supply	190	201	205
NPS Bioenergy supply	192	209	219
450 Bioenergy supply	191	215	228
CPS bioenergy for electricity	6	18	25
NPS bioenergy for electricity	6	24	36
450 bioenergy for electricity	8	35	53
CPS residential bioenergy	147	139	131
NPS residential bioenergy	146	136	127
450 residential bioenergy	144	131	121

*Source: own compilation from IEA (2012b); CPS = current policies scenario; NPS = new policies scenario; 450 PS = 450 policies scenario*

At the present it cannot be foreseen to what extent India will be able to put up additional plantations which are suitable to meet the domestic biomass demand.

But it is rather clear that India will not be able to provide additional biomass for export to co-firing facilities in Europe or other industrialized countries if the domestic energy targets will be pursued. Therefore it is more likely that India will become an importer of bioenergy.

### A-3.3 South Korea

The Republic of Korea, or commonly called South Korea, has a forest area of 6.3 Mha of which 1.4 Mha are plantations (Gumartini 2009). The fuelwood production in 2011 was 2.5 Mm<sup>3</sup>, i.e. nearly half of the total roundwood production of 5.7 Mm<sup>3</sup>. With an annual growth of 6 m<sup>3</sup>/ha in forests and 15 m<sup>3</sup>/ha for plantations, the total energy yield of Korean forests is 10.4 MtOE (436 PJ).

The total primary energy demand in Korea was 250 MtOE (10.5 EJ) in 2010. So far, biomass does not play an important role: Bioenergy production was only 14.5 PJ and the bioenergy consumption in residential areas 1.4 PJ, which is a share of the national energy demand of only 0.14%.

Table 22      *Energy Demand and bioenergy in South Korea 2010*

	PJ
Total primary energy demand (TPED)	10,468
<b>Bioenergy supply</b>	<b>14.5</b>
- for power plants	2.8
- for heat plants	1.8
<b>Bioenergy consumption</b>	<b>10.0</b>
- industry	7.6
- commercial	1.0
- residential	1.4

Source: IEA Energy statistics from OECD countries 2012b

Until recently, biomass had only a very little importance in the Korean energy market although there are huge potentials for biomass deployment. Currently this situation is about to change. The national energy plan aims at a share of bioenergy in the total energy demand of 3.4% by 2030.

For this reason, Korea will mainly import pellets, as the development of domestic biomass resources can play a minor role only.

The estimated growth rates for pellet imports are high: by 2020, Korea plans to use 5 Mt of pellets of which 4 Mt should be imported and 1 Mt should come from domestic production.

At least some of these pellets will come from Indonesia: In 2010, Korea signed an agreement with Indonesia to produce wood pellets on 200,000 ha from forest land, without giving details which forests would be the source.

### A-3.4 Japan

After the Fukushima nuclear accident, Japan is re-orienting its energy policy towards more renewables, and bioenergy could play a major role. Yet, renewables in general and biomass in particular have a very modest share in the overall energy as well as the electricity mix of Japan, so that even a sharp increase would translate in comparatively low total amounts of bioenergy. Furthermore, the national policy favors use of domestic biomass for rural heating, and has currently no plans for importing biomass for co-firing.

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## A-4 Additional Country Data

The following data for Asian wood production were gathered from FAO statistics and Gumartini (2009). The latter gives an overview of the roundwood and fuelwood production for all Asian countries as shown in the following table.

*Table 23 Roundwood and fuelwood production in Asia and Oceania (2011)*

Countries	Total Forest area	Primary forest	Plantation	Roundwood production	Woodfuel production	Share of fuelwood in total roundwood	Percent of urban population
	in Mha			Mm <sup>3</sup>		%	
India	67.7	-	3.2	328.7	305.485	92.9	28.7
China	197.3	11.6	31.4	286.1	191.042	66.8	40.5
Indonesia	88.5	48.7	3.4	106.2	73.720	69.4	47.9
Myanmar	32.2	-	0.8	42.5	38.286	90.0	
Viet Nam	12.9	0.1	2.7	31.6	26.350	83.4	26.7
Pakistan	1.9	-	0.3	29.3	26.500	90.5	34.8
Thailand	14.5	6.4	3.1	28.6	19.866	69.5	32.5
Malaysia	20.9	3.8	1.6	28.2	3.068	10.9	65.1
Bangladesh	0.9	-	0.3	27.9	27.662	99.0	25.0
Philippines	7.2	0.8	0.6	15.8	12.950	81.9	62.6
Nepal	3.6	0.4	0.1	13.9	12.692	91.0	15.8
Cambodia	10.4	0.3	0.1	9.3	9.221	98.8	19.7
Korea, DPR	6.2	0.9	-	7.3	5.797	79.4	80.8
Lao PDR	16.1	1.5	0.2	6.3	5.944	93.8	21.6
Sri Lanka	1.9	0.2	0.2	6.3	5.584	88.9	21.0
Bhutan	3.2	0.4	0	4.7	4.546	97.2	9.1

*Source: FAO (2010c); Faostat (2013); Gumartini (2009); data shown in order of production values*

## A-5 Results from Stakeholder Interviews

### A-5.1 List of interviewed organizations

EC – European Commission, Brussels

- Directorate General Agriculture and Rural Development (DG AGRI)
- Directorate General Energy (DG ENER)
- Directorate General EuropeAid Development & Cooperation (DEVCO)

ECREEE – ECOWAS Centre for Renewable Energy and Energy Efficiency, Praia

EU FLEGT Facility – European Union Forest Law Enforcement, Governance and Trade Facility, Barcelona

FAO - Food and Agriculture Organization of the United Nations, Forest Division, Rome

GIZ Senegal, Dakar

GIZ PERACOD Senegal, Programme for the promotion of renewable energy, rural electrification and sustainable supply of household fuels, Dakar

FSC – Forest Stewardship Council, Bonn

UN-ECE, United Nations Economic Commission for Europe, Forests, Geneva

Utilities:

- Dutch utility: Essent
- German utility: Vattenfall
- UK utility: Drax

## A-5.2 Notes from the stakeholder interviews

### Interview 1

- 1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Some countries, such as the UK, have ambitious plans to use biomass in order to meet the RED. As the UK doesn't have local resources, the Drax H&P plant in the UK aims to replace 9 Mt of coal with biomass so 10-12 Mt pellets will be needed in a timeframe of 3-4 years.

Efficiency should also be considered and not only use electricity but H&P as well. The transport of biomass is very important because it is very expensive. Producing facilities with easy access to harbors are an advantage.

The US has huge availability of pine resources planted some decades ago (20-30 years) for the pulp & paper industry. These plantations received subsidies for planting and management activities. As the pulp and paper industry never required the resources they are available for other purposes, like biomass for bioenergy.

Modern heating systems fed with biomass are cheaper than heating oil systems, especially in Southern countries such as Greece or Italy. The price of using pellets for heating could be one third of the systems based on fossil fuels. Hence, wood is a high cost effective measure.

Canada, especially British Columbia, has a great amount of resources but the transportation to Europe is very expensive. This is the reason why they are researching on torrefaction. Potential markets for these resources will be South Korea and Japan (Japan is promoting the use of its own domestic resources).

Russia could export through the Baltic Sea but the cost of road transportation limits this potential. Maybe they could promote their domestic market.

- 2. Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

Power plants need to assure their supply security and, hence, they will require:

- Reliable partners
- Organized and enabling infrastructure (for example, a port deep enough for the cargo ships).

There are many steps that have to be considered to feed energy plants in Europe (production, transformation, transport,...) so the most reliable for procurement seem to be those in the Southeast US (Georgia, etc..). Additionally, chip imports are more limited as they have to meet phytosanitary measures that pellets do not have to. At present, there doesn't seem to be a market to import to Europe from Africa. Within the continent, countries aiming at increasing the electrical applications with biomass should examine their own resources availability to determine the competence with traditional biomass uses. This could be the case of South Africa. Likely, the collection of fuelwood will be too expensive to generate competence.

It is noteworthy that, contrary to what occurs in developed countries, developing countries don't have the means to offer subsidies, which limits the potential for exports. Thus, biomass, i.e. from the US to Europe, is subsidized in two ways:

- Grants provided by the US to the plantations and management
- Benefits offered by the EU to the biomass consumption

In Brazil there are some favorable conditions:

- High productivity (for example in SRC, as eucalyptus, 20-30 odt ha<sup>-1</sup> yr<sup>-1</sup>)
- The management expertise acquired with the plantations for the pulp & paper industry.
- The good location to export to Europe.

There is news that one industry has the objective of producing 3 Mt of pellets in this country.

In developing countries, potentials and framework conditions should be estimated at the national level. Charcoal is a very convenient carrier of energy in some contexts because it can be purchased in small amounts, even if it is expensive (on the contrary, natural gas is cheaper but it has to be purchased "at once"). Africa is going to increase charcoal demand as its urban population is growing. The woodfuel demand will also keep growing in Africa (although other fuels are promoted, population growth will drive the demand). However, in other regions, for example, in Asia, the demand of woodfuels is decreasing.

### *3. Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

The pellet market for the industrial sector is stable as it has to sign long-term contracts. At the household level there is high competition, so the prices will be stable.

From the environmental point of view, SFM is not in trouble in the EU, USA or Canada, but Russia could be challenging.

The Southeast US pine plantations are not highly biodiverse and biomass harvesting for bioenergy could reduce the fire risk. In Canada, biomass harvesting from Mountain Pine Beetle affected stands in BC could be favorable for changing the species at stand level. In the plantations of Brazil biodiversity is also very low.

Regarding land use, promoting the use of efficient pathways (considering both the productivity and the transformation into energy) could reduce the need of land.

Pellets for household usages are of high quality so they are done with industrial waste.

*4. Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

At the European level, the RED, the Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (the LCP Directive), the EU Directive on Energy Efficiency (2012/27/EU), and other feed-in-tariff for combined H&P plants are relevant measures.

In the US, the Clean Air Act and the Biomass Crop Assistance Program have to be highlighted.

In developing countries, the price of electricity (diesel based generated) used to be very high. Technology transfer to developing countries (for example, biomass gasification) should be promoted.

Regarding the use of traditional biomass in developing countries, the Global Alliance for Clean Cookstoves is doing a great job. Although encouraging people to change their traditional means of cooking (open-fires or „three stone fires“) to other means, is challenging. Thus, this is not only a question of prices, taste and traditions also play a role. Hence these changes will be slow and in the long-term.

There are no real conflicts among the various policies but some small contradictions could be detected. At the European level, policies are consistent but the situation is different at the Member State level. For example, the UK is not promoting energy efficiency and, although they are promoting the use of biomass, they have to import it because of the lack of domestic resources.



*5. What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

The perspective of the biomass producers and buyers is different. Buyers aim to ensure also the quality of the biomass, i.e. pellets. It is noteworthy the Initiative of Wood Pellet Buyers (IWPB). The set of criteria that they have developed has to be verified by a third party.

For industrial biomass applications, utilities will demand certification to protect themselves against public pressures. The household level is less critical as their pellets are made with residues or by-products.

Regarding voluntary forest certification:

- At present, the FSC doesn't seem to play an important role because main feedstock will be procured from plantations. Maybe the FSC could develop a concrete standard for Energy.
- PEFC could be a feasible standard.

## **Interview 2**

*1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Due to various policies such as EU RED, climate change and other national policies, an increasing demand in woody biomass for bioenergy is foreseen. The different needs that various countries face require different approaches. For example, countries with low forestry resources like UK, and The Netherlands will import relevant quantities, presently mainly from North America, for large scale applications. On the contrary, countries from North Europe use domestic products for small scale applications, for example, district heating and in public buildings. Canada and US are important pellet suppliers to Europe. Another relevant player in the pellet market could be Russia, which has plans for increasing the capacity of exporting. Woody bioenergy could be an option for some countries but not for all.

It is noteworthy that the official customs classification of some new products like pellets became official in 2012, so official data are new. Pellets are becoming a new commodity.

The trend of the North America wood energy domestic market (Canada and USA) is difficult to predict. They have important amounts of cheaper fossil fuels (incl. shale gas) so woody biomass is not a competitive option for domestic consumption at present but for exporting.

Wood for bioenergy is theoretically available but its mobilization remains challenging and will depend on the policy environment. The mobilization of all woody resources is challenging because forest owners/managers don't have incentives, or can't find the market for timber which is physically linked to energy wood (energy wood, in most case, is a by-product of timber harvesting). Lack of accessibility in some areas (e.g. no roads) and mobilization costs are also serious obstacles considering the low price for wood energy. Additionally, although plans for new wood energy facilities are based on sourcing plans and business models, not all implications are taken into account and many problems may arise when they start producing.

*2. Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

First, local users (logs or high quality pellets) and large scale (chips, pellets) plants utilize different supply chains. It seems that potential conflicts are more likely to develop between different uses of wood fiber. The panel and the pulp (or even sawmill) sectors may feel threatened by the increasing need for resources of the woody bioenergy sector. This competition between sectors could in some cases be positive for forest owners if it leads to an increase in prices. However, consequences for wood-processing industries can also be positive as they may benefit from government subsidies for the production of green energy generated from their wastes and residues.

From the resource mobilization point of view, it is important to bear in mind that all wood types/qualities have to be considered together (timber, pulp and paper and wood for bioenergy). If timber can't be mobilized then it is challenging the access to wood energy. The European Forest Sector outlook shows that all possibilities to source wood have to be considered (forestry, forest industry residues, landscape care, recycling...).

Short Rotation Coppices are a very effective way of producing solid bioenergy. Its expansion will depend on the market prices and the availability of land for such production. It is neither very likely nor desirable to convert natural or semi natural forests for such a use. When planted on agricultural land, SRC could also endanger food security or further deteriorate it. Long-term contracts needed by large-scale utilities, that are more common in the agri-food sector, could promote the development of SRC as the mobilization of small forest holders is difficult, but may be an option in countries with numerous small-size forest holdings.

Some developing countries could present the potential of developing a woody market for exporting. In this case, learnt experiences from previous projects should be considered aiming at minimizing risks in these projects. Socio-economic factors as well as land tenure issues are very important in these contexts.

However, as developing countries are far away from markets (e.g. Europe), their infrastructure is not well developed and the governance systems are weak, it is difficult that they could become competitive with other closer exporting countries with big potentials, such as Canada, USA and Russia.

In addition, developing countries or emerging countries request large quantities for their domestic uses (cooking, heating especially). For example, Brazil could increase the production of woody bioenergy for auto consumption but it would be risky for this country to become a major biomass exporter, as it uses already a lot of its bio-capacity for exporting crops or animal products.

### *3. Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

Sustainability is a major key issue and should be considered for all products used in the bioenergy sector as well as for every material uses. This should apply to all sectors participating in this market, e.g. equal conditions should be ensured for the biomass coming from forestry and agriculture.

Biodiversity could not be challenged so the definition of no-go areas should be considered such as primary forests or areas with high carbon stock. SRC could cause some impacts and the competition with other resources should be also considered.

The need of access for the mobilization of some resources in the pan-European region and North America could imply the development of infrastructure (roads, facilities for multimodal wood transport).

Emissions from combustion can become a public health problem when not properly addressed. Policy should consider, e.g. the need of proper filter installation, to avoid undesired and harmful emissions.

Conversion efficiency should be maximized. Thus, turning wood energy into heat is much more efficient than producing electricity with wood. However, in some countries there are incentives for building plants that produce only electricity and do not foresee applications for the remaining residual heat which is lost (e.g. industry steam or district heating). Policy makers should consider not

favoring this kind of partial use, even if they can make sense in some specific cases where there is a need for electricity and none for heat.

Cascading production and use approach could be promoted to favor the energy use of wood at the end of the process life.

From the socio-economic perspective, it is important to mention that, currently, attractiveness of the forestry workforce is decreasing for many reasons, which is expressed by e.g. aging of forestry workforce. The promotion of woody bioenergy markets could contribute to local development of rural areas and the provision of sustainable livelihoods. Also, the biomass for bioenergy chain generates more non-relocatable jobs than other energy sectors (but less than timber processing).

*4. Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

It is important to mention that the energy sector still considers forest resources like a fossil resources but the forest sector is different and more complex than other sources of energy in that market. In addition, it is important that different sectors (foresters, industry, energy specialists) talk to each other and share information.

Governments have too often focused their incentives only on the demand side. Thus, they should work on the supply side and promote cross-sectoral incentives.

At national and even local levels, priorities for forests and trade-offs between those should be set up, i.e. fossil fuel substitution, carbon sequestration, biodiversity enhancement, development of the wood share in the building sector etc... National forest plans should be coherent and bear in mind that wood for bioenergy is only a part of all the resources and services that forests provide. In order to achieve the EU 20/20/20 targets, sound policy based on reliable forest resources information and transparent processes is needed, considering, for example, green energy and resource uses.

*5. What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Certification for forest products is a useful tool and a good way for the promotion of sustainable wood products including for the energy sector. It has a strong tradition in the wood markets. The certification of wood has an

additional cost that may not be affordable for the exclusive use of wood for bioenergy. Certification could be more accessible if it is done for more or even all products, not just for wood energy.

In addition to voluntary forest certification schemes, there are other specific schemes, like WPBI or other national standards. Those schemes focus more on standardization of the product than on its production process.

Forest ownership plays a role on the certification. Public owners can use certification schemes but, for costs reasons, it is more challenging for private owners especially for small holders.

Wood energy markets are highly political. Certification, which was developed as a voluntary, marketing tool, could be seen as a measure in which governments delegate the assurance of sustainability and put its cost on forest owners, instead of doing it by themselves.

Finally, forestry differs from other primary sectors (time scale, ownership, multiplicity of products and services....). It can be said that policy makers outside the forest sector often do not understand well how forestry works, in particular the complexity and variety of services that are provided.

### Interview 3

*1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Woody biomass demand is foreseen to increase in developed countries, both Europe and North America, substantially during the next 5-10 years. In Europe last year was already the first year when more wood was used for energy production than for other uses it is expected that more wood will be used for bioenergy than for other uses, displacing feedstocks currently used for other purposes, such as pulp & paper. Therefore, more timber and pulp & paper would be imported from overseas, impacting on global markets.

The increasing demand for imports to Europe will be satisfied through forest plantations in the Global South, generating an effect on local supply. It is foreseen that more plantations will be established at the expense of natural forests, affecting local markets.

*2. Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

As result of the increasing demand in Northern Countries and imports from the Global South, tropical regions will be impacted. In this game, Russia might also increase the supply to Europe. At present, China plays a critical as a manufacturer/processor, i.e. they don't produce feedstock but they import resources from third countries like wood from plantations in East Asian countries and process it into material (such as furniture) that is later exported to other markets such as North American, European or Asian markets. As previously mentioned, plantations have a relevant role to play in the wood energy market, especially those of Latin America and Asia (to a lesser extent Africa, maybe something in South Africa and Mozambique).

Solid biomass has an important role to play but not all applications have the same potential and interest. Thus, local and decentralized uses for heat and power are the most promising applications since biomass is readily available throughout Europe and is easy to transport and use. Policy goals should be focused on this use of biomass instead of promoting large-scale use of wood energy. Thus, industrial large-scale heat and/or power generation is much easier from garbage and other urban residues, and also, there is a big market. In summary, biomass has an important role to play but not all applications have the same potential and interest.

*3. Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

Whatever promotion of woody bioenergy markets is encouraged, it should be carefully examined. In addition to legality, also sustainability for all products (not only products for bioenergy) should be considered not exclusively for overseas imported products but also for domestic production.

In several European countries the establishment of forest plantations (i.e. pine plantations) has been reluctant. An adequate policy for fast growing plantations is needed as they can generate feedstocks for bioeconomy. At the same time, if the policy approach is adequate, plantations don't generate conservation problems. In Central Europe (i.e. Germany, France, Czech Republic, etc...) the conservation movement obliged the elimination of forest plantations so now it is challenging to reintroduce them but necessary for the provision of materials.

In Mediterranean countries, the productivity in natural ecosystem trends to be very low but, thanks to the cultivation intensification, higher yields could be

achieved. In this region some big companies have purchased land for the establishment of fast growing plantations for the pulp & paper industry generating several problems with local population (see, for example, the case of the eucalyptus plantations in Spain and Portugal). Forest tenure has to be carefully considered since, if it is transferred to utilities, it will generate conflicts with the integration of local economies (small land owner management is much more sustainable and provide more jobs than those that big companies could generate). Additionally, small-scale management by local people at the local level poses less risks on environmental issues since access to some chemicals (pesticides, fertilizers, etc..) is more limited than for big utilities. In general terms, this situation is currently happening in developing countries. In summary, land tenure and land managers are key questions for the development of the market.

It is worth mentioning the sharpening demand for land either for agriculture purposes or forestry uses. In this respect, wood energy is an additional pressure in the “race” for land. As more profit can be obtained in agricultural land with various crops, nobody will establish forest biomass plantations on former agricultural lands and it is foreseen that the land needed for the establishment of plantations would be at the expense of natural forests. Some degraded land (part of that one which quality is not very bad) could be employed for these purposes; although problems could arise with owners. Nonetheless, woody bioenergy could be great if land ownership is respected and left in the hands of the communities. Although this is not easy, it is possible to do.

Parallel dynamics to those observed in the pulp & paper sector are foreseen for the wood energy market. In the 80s and 90s the pulp & paper sector expanded dramatically at the expense of plantations that many companies made on bought lands in several areas of Latin America and Asia. Thus, the production in Europe was displaced to sources produced in these regions. At present, wood energy is economically more attractive than the pulp sector due to its cheaper production, easier forest management (wood quality is not needed) and easier transport as well. As the price of wood energy is higher than that of the pulp & paper sector, this new business is highly profitable. This is the reason why some pulp and paper companies are moving on the wood energy market.

Some developing countries such as several countries in Latin America, Indonesia and Malaysia are establishing new forest plantations. These practices are not exempt from negative consequences that need to be overcome through creative policies that counteract negative effects. A good solution would be to combine regulatory systems within Europe with strengthening of governance systems in developing countries (such as in the FLEGT-VPA processes).

- Regulatory systems as the RED (Renewable Energy Directive within the EU) which require that biofuels and bioliquids that account for their objectives comply with certain environmental criteria are relevant, although the safeguards specified are rather weak, because, among other reasons, they don't include social criteria (social issues only have to be reported and ugly practices don't have any trade consequences).
- Strengthen the governance systems in social and environmental sustainability with developing countries. At this respect, the FLEGT action plan has to be mentioned. It is based on assurance of the legality of wood and wood products with third country partners that have signed VPAs. This initiative should also move to consider social and environmental sustainability.

It is suggested that the extension of the RED to solid and gaseous biomass should be based on international standards instead of on creating their own social and environmental criteria that could violate the World Trade Organization (WTO) agreements as they could hamper trade. Thus, as third countries don't participate in the development of the criteria within the EU process, the final regulation could be subject to WTO agreements. International Standards, applied in many sectors including forestry, are accepted by the WTO and hence are not considered as a technical barrier to trade (WTO, TBT Agreement). In the forestry sector, the FSC certification scheme has been recognized as the international standard (exclusively one standard is recognized within each sector). Therefore, the utilization of the FSC scheme related to the forest sector could facilitate the international acceptance of the regulation and prevent problems with the WTO. It is noteworthy that the EU could just use some selected indicators within the standard without the necessity of applying the standard as a whole. There are many more international standards such as those related to indigenous people and labor to which any extension of the RED sustainability criteria regulation should be referred.

The next generation of RED sustainability criteria should consider stronger indicators both in terms of environmental and social concerns and should apply equally to all biomass produced within Europe and elsewhere.

It is not needed to reinvent the wheel since all the structures required to assure sustainable procurement of wood energy in terms of social and environmental concerns already exist. When utilizing accepted international standards regarding both their content and their implementation the discussion is much easier.



4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

There might be some linkages between the wood energy sector and the REDD+ (this program doesn't seem to be very optimistic).

Policies that apply to the forestry sector are neither consistent nor harmonized because they were targeted for other purposes.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

It is worth mentioning that private certification covers all forest products and wood production, either from natural forests or plantations. The WTO has no effect on these private voluntary schemes.

A good approach, although there are some technical weaknesses, is that the EU defines the minimum acceptable level regarding sustainability and that private actors use voluntary certification systems to demonstrate compliance with them. The accreditation of the systems is done both at European (the European Body of Accreditation; European co-operation for Accreditation) and national levels. This multiple accreditation generates conflicts as member states have to recognize each other's national schemes.

In economic terms, compliance with voluntary certification is the most challenging part as the most costly measures are those related to management (if forest management is not well done it is very expensive to change). Certification and verification expenses themselves are not very relevant and in most cases, if actors desire to receive certification/verification, they can do so.

It is important to look at the whole picture of the forest sector. It would be very beneficial that the EC approach to the sustainability of the woody bioenergy were based on existing systems and built on them. Both the regulation (with minimal requirements) and the voluntary certification schemes that can be used to comply with the binding criteria as well as for demonstrating higher performance have a role to play.

## Interview 4

### *1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

About 60 % of the AAC (annual allowable cut) at European level is harvested every year so technically there are resources available, although various sectors compete for the same cheap resources. Additionally, it is important to manage the biomass availability in the forests of the Mediterranean area to protect from fires. Great amounts of solid biomass could be mobilized but economic factors play a role on the real potential of the mobilization.

The EC has adopted soft measures to mobilize domestic resources, i.e. best management guidelines. At a political level there are concerns to protect the forest from environmental impacts of solid biomass harvesting<sup>41</sup>.

Most of the consumed wood and energy wood within Europe is produced locally. Currently imports come from Russia followed by the US and Canada. Some countries such as UK and The Netherlands have announced in the NREAPs that they intend to substantially increase imports of biomass. Tropical countries such as Brazil and some African countries could become exporters of woody biomass for bioenergy in the mid or long term, but not in the next years. Prices will be a key factor for the mobilization.

The bioenergy sector is using feedstocks that had lost part of the market (for instance, resources previously used in the pulp&paper industry). The problem can arise from the competition for the same cheap resources and not from the technical availability of resources.

In general terms, the forestry sector doesn't show high profitability and there is not much information available about prices. DG Enterprise and Industry contracted out a study on wood supply and demand in the EU, including price developments (contractor: Indufor Oy), but no final results are available yet.

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<sup>41</sup> Good practice guidance on the sustainable mobilization of wood in Europe:  
[http://ec.europa.eu/agriculture/fore/publi/forest\\_brochure\\_en.pdf](http://ec.europa.eu/agriculture/fore/publi/forest_brochure_en.pdf)

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

not addressed

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

It is necessary that the Forestry Sector will be implied in the mobilization of resources and in the development of sustainability criteria. Otherwise, the energy sector will tell what they need and, thus will do forest policy. Sometimes stakeholders look to imports without having examined the local resources.

Measures to promote domestic use are needed.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

Improving the communication between stakeholders is very important. From the RED perspective, the proofs provided by the forest sector (EU Agriculture and Rural Development/Forestry) are not enough to demonstrate sustainability. The forestry sector should work on demonstrate its sustainability.

At present, the European Forest Strategy is under revision (the new Forest Strategy is scheduled for adoption in 2013). Here, the woody biomass for bioenergy is also to be addressed. Even though the European Forest Strategy is not binding, efforts should be done regarding:

- To increase its relevance at political level
- To be a useful work.

There were different groups that have already concluded its work, for instance dealing with the following issues related to bioenergy:

- contributing to the development of the new forest strategy (including a chapter on bioenergy)
- forest information and monitoring (addressing information needs related to biomass)
- climate change
- public procurement

- mobilization and efficient use of wood and wood residues for energy.

*5. What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Voluntary forest certification schemes have a role to play but have to adapt their criteria to the specific concerns of the bioenergy field (e.g. GHG).

To enhance SFM should be the final objective. Later, SFM should be demonstrated and proofs provided.

Also, other ways to demonstrate SFM should be allowed (certification is a relevant expense in some cases such as small owners).

## **Interview 5**

*1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Quite important. According to estimates from 24 NREAPs an additional 95 Million cubic meters (Mm<sup>3</sup>) of wood is expected to be mobilized by 2020 compared to 2006 (from 336 M m<sup>3</sup> to 431 M m<sup>3</sup>), mainly from wood felling and wood logs – so-called direct wood supplies (+83 Mm<sup>3</sup>), followed by residues of the wood-based industries such as sawdust and sawchips (+12 Mm<sup>3</sup>). This overall increase corresponds to the current wood mobilisation in Finland and Sweden for energy uses.

*2. Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

I cannot exclude possible case of such conflict, particularly in those regions where there is significant household consumption of wood energy. But better analysis would be needed on this.

*3. Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

There is a wealth of research about barriers to bioenergy development. There are challenges related to the establishment of secure and cost-effective supply of raw material. There are barriers related to the integration of bioenergy installations into buildings. There is lack of awareness and also concerns about sustainability of biomass supplies.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

This is a vast topic. Though their national renewable energy action plans, European MS are tackling some of the above mentioned challenges. MS are required to mobilize additional biomass supply; The EU is supporting these mobilization efforts through the Rural Development regulation. Concerning sustainability, in order to avoid unintended consequences MS are increasingly adopting national schemes. The EU is considering whether an EU harmonized scheme is needed. Sustainability of woody biomass is also addressed through MS/EU environmental/agriculture and forest policies and regulations. For instance the EU Timber Regulation is addressing illegal logging. Forest Europe and the forthcoming LBA on forest aims at strengthening SFM in European countries.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Voluntary certification is already playing a key role but it needs to be further developed to cover carbon issues.

## **Interview 6**

1. *What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

It is foreseen that wood energy will continue being used in local villages of developing countries for cooking during the following 10 years at least. In these regions people have to walk longer distances for fuel procurement, especially around urban areas. We have financed some projects aiming at generating wood fuel through sustainable forest management. Currently, exporting options for wood fuel are not foreseen.

In the long term some developing countries could become suppliers of wood energy but it is difficult to foresee.

*2. Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

Yes, there could be conflicts between traditional uses and large-scale uses of wood energy. The experience of the biofuels development, for example the palm oil plantations, has to be examined. Thus, large-scale production of biofuels has caused land-grabbing problems and also interferences with local people. Not only direct impacts could be observed but indirect impacts, such as indirect land use change.

It is worth mentioning the recent attempt to correct the impacts of the ambitious targets for biofuels sharing laid down within the RED (Directive 2009/28/EC) through the “iLUC” proposal (Proposal for a Directive of the European Parliament and of the Council Amending Directive 98/70/EC relating to the Quality of Petrol and Diesel Fuels and Amending Directive 2009/28/EC on the Promotion of the Use of Energy from Renewable Sources).

This demonstrates the negative impacts that the development of a biofuel sector might generate, so all these lessons learnt have to be taken into account if a wood energy market is promoted.

*3. Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

Direct and indirect impacts have to be taken into account. Social and environmental impacts have to be considered, including land use and biodiversity.

*4. Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

EU Timber Regulation, RED and FLEGT are relevant instruments. FLEGT is focused on the imports to Europe of legally procured timber but it may be transferred to wood energy.

*5. What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Voluntary forest certification schemes (e.g. FSC or PEFC) are seen as a first step, as they are in place so they could be used quicker. Both civil society and the

private sector can be involved and play a role in their use. Once that the lessons learnt are identified and a strategy established, a regulation could be developed. Such a regulation could later recognize these schemes.

## Interview 7

Preliminary remarks:

ECREEE is working on sustainable production and utilization of woody biomass in Western Africa. At the moment, biomass utilization is not sustainably produced nor utilized because in many countries the demand exceeds the supply. Therefore ECREEE focusses not only on sustainable, and efficient biomass utilization on the demand side but also encourages forest management on the supply side. One main target of ECREEE is the encouragement of widespread deployment of clean and efficient cooking fuels and devices for everyone.

At the moment there are very little areas where sustainable forest management is applied. Generally, resources are not conserved as needed. An unknown part of the wood that is being traded stems from illegal logging. Forest is also being damaged by criminals who lay bush fire, but local people and administration don't have the means to do anything against it and they have no authority of prosecuting people who do illegal actions.

There is very little woody biomass from plantations because this is not economic in comparison to orchard farming (cashew, mango and so on). As orchard farming is growing there is even more pressure on the remaining forests.

### *1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Woody biomass will certainly continue to play a big role in the near future, but mainly for domestic use. As resources are even scarce for domestic use, export will not play a major role, at least as long as wood is legally harvested.

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

There are use conflicts because resources are not enough to satisfy both basic needs and large-scale use or export for our regions.

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

SFM is urgently required. This can't be reached without the empowerment of the people, both legally and financially, in order that they have some authority and can take care of their issues and stop illegal actions. People must have interest in forest conservation and they must be given the means to do something. This could also prevent illegal logging which is a big problem. Also efficiency measures are needed.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

Policy framework alignment that empowers the people and of the forest administration. Prosecution of illegal actions. Resources are needed for forest management programs and efficiency measures.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

I am not aware of forest certification schemes and do believe they can play a big role in West Africa. Therefore African countries should find their own solutions for sustainable forest management. Only organizations commissioned by ECOWAS or other African economic blocks should therefore be allowed to certify biomass for export. Apart from certification there are also other issues that should be discussed, above all provision of basic needs and moral responsibility. As woody biomass is needed within the African countries itself, large scale biomass export to Europe or to other industrialized countries is seen to be morally wrong.



## Interview 8

### Preliminary remarks:

Senegal has very little natural resources. Main products are peanuts, fish, phosphate, and (unofficially) drugs. Land is very dry and often degraded by long-time cultivation of peanuts. Some of the peanut succession areas are sparsely covered with trees and are used as resources for fuelwood. Primary forests consist mainly of low quality wood with little growth rates due to low rainfall (9 months of drought per year) and bad soil conditions. There are virtually no plantations and no wood processing industries. There were some re-/afforestation programs in the last century, which mainly aimed to stop desertification and not to produce marketable biomass.

Nonetheless, woody biomass plays the major role for energy supply in rural areas in Senegal. In urban areas, charcoal is also important. As wood is the main energy source, there is a lot of pressure on the forests. About 40.000 ha forest area is lost each year.

In rural areas there is nearly no existing market for woody biomass. People collect fuelwood freely by themselves. In 2 regions there are approaches to use participatory forest management tools, but only on relatively small areas. Within these programs, some areas are allocated for utilization whereas in other areas harvesting is not allowed.

There are national and international programs for rural electrification and energy efficiency in households. The national electrification program aims to increase the electrification rate from 54% to 70% (at national level) and in rural areas from 24% to 50% by 2017, but the target is unlikely to be met.

### *1. What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Fuelwood will remain the major energy source in the next future. There will be no imports of biomass because the country is not able to afford it. There will also be no considerable exports of woody biomass, because there is no surplus of biomass.

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

Local woody biomass is not suitable for export because quality and density of trees are too low. The ecological circumstances (low rainfall, soil degradation, salt water intrusion) don't allow for the establishment of plantations.

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

The national forest department tries to avoid further degradation of the forests. Forest management programs aim rather on the preservation of forests than on establishing new plantations. Most of the forest areas are managed by the local people (participatory management approach), but there are little money resources to support these aims. This creates conflicts between short- and long-term targets. Money and more international cooperation would be needed to foster a sustainable utilization of forest resources. But even then, there will only be enough woody biomass for the local market.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

Energy efficiency measures and electrification could take off pressure on forests. Forest management programs could help to avoid forest degradation. Woody biomass production for export is not an issue in Senegal.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Certification doesn't play any role on local markets in Senegal and will most probably not do it in the foreseeable future.

## Interview 9

1. *What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Very important role, about 50-90% of the final energy (e.g. Senegal, 50%), here almost only domestic use, but strong trading within the country in the form of charcoal.

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

Not currently in Senegal. In most countries in Africa, the significance for households is so high that power generation is disapproved

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

SFM. We recommend participatory forest management through local villages.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

See 3. In many countries, due to the lack of money, the natural regeneration is preferable to planting, since this is several times less costly. The rights should be transferred away from state institutions to local community level. Only in this case there is a chance of sustainable management.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

I don't know about this issue.

## Interview 10

1. *What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

In the Netherlands we are discussing an Energy Transition Agreement with the Government (SER akkoord). The outcome isn't clear at the moment. That been said, the Government increased the renewable energy target 2020 from 14 to 16 %. For this they will need co firing. But they must also support this with subsidies otherwise the utilities will no longer co-fire. The coal tax is also a barrier and has to be skipped. If everything goes well we need three times the volume comparing with the volume we co-fire today. The national biomass is too expensive. That means that we have to import all the biomass which is needed. Pre-treatment will also play a role in this game!

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

No, if we do it in a smart way, it's my view that we have enough biomass, subject that we work with a multi-fuel portfolio (wood, agri residues, waste etc etc.)

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

Binding sustainability criteria in addition to long term policies and commitments from the Government and also a good working ETS. Furthermore, support attention for innovation (biorefinery).

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

See ad 1.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

A must, we can't do it without. But only on at EU or international level.

## Interview 11

1. *What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Mainly imports, significant opportunity

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

Essentially yes if sourcing occurs from countries with local problems (e.g. fuel poverty in Scotland).

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

Currently DECC holds a consultation on green public procurement for timber which might add to the issue.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

Carbon accounting with appropriate methodologies, possibly overcome monoculture plantations (biodiversity), e.g. New Plantation approach of WWF. UK/EU policies for sustainable forestry are consistent, but not for bioenergy from forests. Not enough confidence for investments. Utility has own scheme in place, but societal acceptance is questionable. Certification needs to be aligned (no proliferation of certificates).

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Good option so long as companies can afford it. Small-scale suppliers have high additional costs which need to be passed on to the product, and sourcing must face this cost.

Depends on policy-making if it includes forest certification schemes, and if NGO deem "those good enough"

## Interview 12

1. *What role do you foresee for woody bioenergy in the near future (domestic use, ex- or imports)?*

Export not an issue, domestic use dominant, import only very little (case by-case base).

2. *Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

No conflict, economic threshold for decentral uses.

3. *Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

Regulation for non-sustainable sourcing is needed, harmonized sustainability requirements (currently many) plus harmonized promotion (currently only UK). A transparent, cost-effective supply chain would benefit.

4. *Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

See 3.

5. *What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

This is a starting point only, as regulation is required (see 3.)

## Interview 13

At present, FSC hasn't developed any specific standard or policy neither for the production of biomass for bioenergy nor for green electricity generation. Furthermore, FSC is playing an "observer" role, awaiting new policy developments, especially those related to the extension of the RED sustainability criteria for solid biomass.

### *1. What role do you foresee for woody bioenergy in the near future (domestic use, exports or imports)?*

Biomass for bioenergy is seen as an interesting new market. Due to fossil fuels constraints there is a potential for the development of an international biomass market.

In this respect, developing countries could be suppliers of developed countries as they have huge potential for natural resources at a competitive price. However, developing countries will need to build new infrastructure that allow exports. Also, transport costs from developing countries to feed industrialized northern markets could be a constraint. In this regard, the development of second generation biofuels could make transport cheaper, giving a more favourable scenario for developing countries. These countries could be interested in looking at exports but they also have to consider their domestic needs. Reaching readiness for exporting will depend on political decisions.

In developed countries, short rotation coppices (SRC) could be an attractive alternative for wood energy supply. SRC gives the opportunity of diversifying agricultural production and it doesn't have counter side effects.

Bioenergy is a very interesting option for local communities and rural areas in northern countries to become energy self-sufficient so they could become independent of international fossil fuel-fed energy markets.

### *2. Do you foresee use conflicts between woody bioenergy for local/traditional uses (fuelwood, cooking), and larger-scale use (co-firing, power generation, export)?*

On the one hand, it should be born in mind that the wood energy sector in developing countries is not well regulated. On the other, exporting options pose risks to these countries. In order to approach readiness for exporting in developing countries, this sector needs to be professionalized. Furthermore, landscape planning should be considered. Also, the introduction of clean

cookstoves (including solar or biomass-fed cookstoves) is a measure to promote more efficient consumption.

Since some conflicts between biomass for exporting and domestic consumption could arise, some measures should be in place to prevent people in developing countries from becoming the losers in this game. Regarding this, forest certification is seen as a tool that could prevent this from happening.

*3. Which key issues need to be addressed to foster sustainable market development of woody bioenergy?*

The development of an international bioenergy market offers opportunities and constraints. The resource based – productive land – is finite, creating challenges particularly when it comes to fair and socially just allocation of resources. Land tenure issues and custom rights are relevant aspects to be considered if developing countries are considered as suppliers.

To address these problems an integrated approach with proper instruments is needed. Here, good governance and monitoring have a role to play. Thus, measures to prevent risks have to be considered. In this respect, it is noteworthy that developed countries have the responsibility to introduce safeguards to avoid undesirable effects on developing countries.

*4. Which are the most relevant policy and legislative measures (local, national, international) in place or under consideration to address those issues? Are they consistent with each other?*

REDD+ (Reducing Emissions from Deforestation and Forest Degradation) is a relevant program, even if it is not a binding policy and it is not still in place.

EU Timber Regulation is a powerful tool, although it is not clear if it affects all forms of chips. This regulation was laid down with an aim to comply with the legality of wood supply.

The RED (EU Renewable Energy Directive) and other policies from the USA don't address social issues among their sustainability criteria, creating a loophole. Social issues, including land use, the use of water and the competence for food can generate large conflicts in the future so these questions should be taken into account. Also, the best way of using the biomass should be examined.

Several of these policies (these related to bioenergy, forests, and climate change) are interlinked but they are not consistent with each other. Both international and national instruments have to be consistent. These



international programs use, for example, different reporting schemes, with the additional burden that it carries. A holistic approach is needed and forest certification can contribute to a move in this direction.

*5. What role do you foresee for voluntary forest certification in the future development of woody bioenergy?*

Forest certification covers the production of any products from the forest (timber, pulp & paper, NTFPs, etc..) and can further be expanded to include the provision of ecosystem services which we are currently exploring. Forest certification provides confidence that undesirable impacts by forest management are avoided but where a participatory approach like in FSC is followed, the standard is not a guarantee for “sustainability” per se, but more a balanced representation of societal needs and expectations towards forest management practices. The use of previously unlogged natural forests as well as the establishment of large-scale plantations are some of the challenges that forest certification faces.

“We don’t need to reinvent the wheel”. Considering the difficulty in reaching international agreements, policy makers should at least recognize the role that forest certification played over the last twenty years in global efforts to identify safeguards and good practices for forest management worldwide. Moreover, the role of forest certification and political measures could be used complementarily, that is, minimal political measures to assure sustainability could be complemented with forest certification schemes that have higher standards regarding forest management.

It is worth mentioning that RED sustainability criteria exclude certain land uses for biomass cultivation but it doesn’t require a responsible management of the procurement areas. From this point of view, it is important to recognize that there are not only higher safeguards in the forest certification schemes than in the RED, but also that the overall approach towards sustainable sourcing is fundamentally different.

Overharvesting, i.e. lack of respect for sustainable harvest limits, is seen as a relevant and massive problem that could happen in the near future in which forest certification could help.

FSC is focused on certifying all the aspects that are affected in forest management, considering environmental issues and local people.

Instead of developing a specific certification scheme for each aspect of the forest, a holistic scheme should be promoted. The development of a bioenergy

market offers the opportunity of recognizing the central role of forest certification. It is true that forest certification involves an extra cost (both in terms of direct and indirect cost) and demand management efforts, but it is achievable. Forest certification is not an easy option but it provides benefits, especially for the international markets. These benefits include the assurance that there has been an “operational governance” (consultation with the stakeholders and minimization of conflicts), benefits for local people and environment, the access to international markets and price premiums. Also, certification contributes to enhance the management systems of the producers. In summary, forest certification is seen as a tool that assures proper and reliable forest management.

A bigger role for forest certification in the future is foreseen.

Due to the increasing demand for some natural resources, land use conflicts will need to be addressed in the future so a more comprehensive approach for all types of biomass will be needed.