BEHIND BIOMASS

How to Ensure Responsible Wood Biomass Investments

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price	This guide has been produced in the context of the PRICE project. More information on the project can be found at the back of the guide, or on the project website: www.thepriceproject.org
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About ETIFOR	ETIFOR is an independent spin-off of Padova University and works to turn scientific knowledge into practical solutions in four areas of intervention: forest certification and supply chain, climate change and ecosystem services, rural development, and international cooperation. We apply ethics and environmental economics to multi-disciplinary natural resource consultancy and project management.

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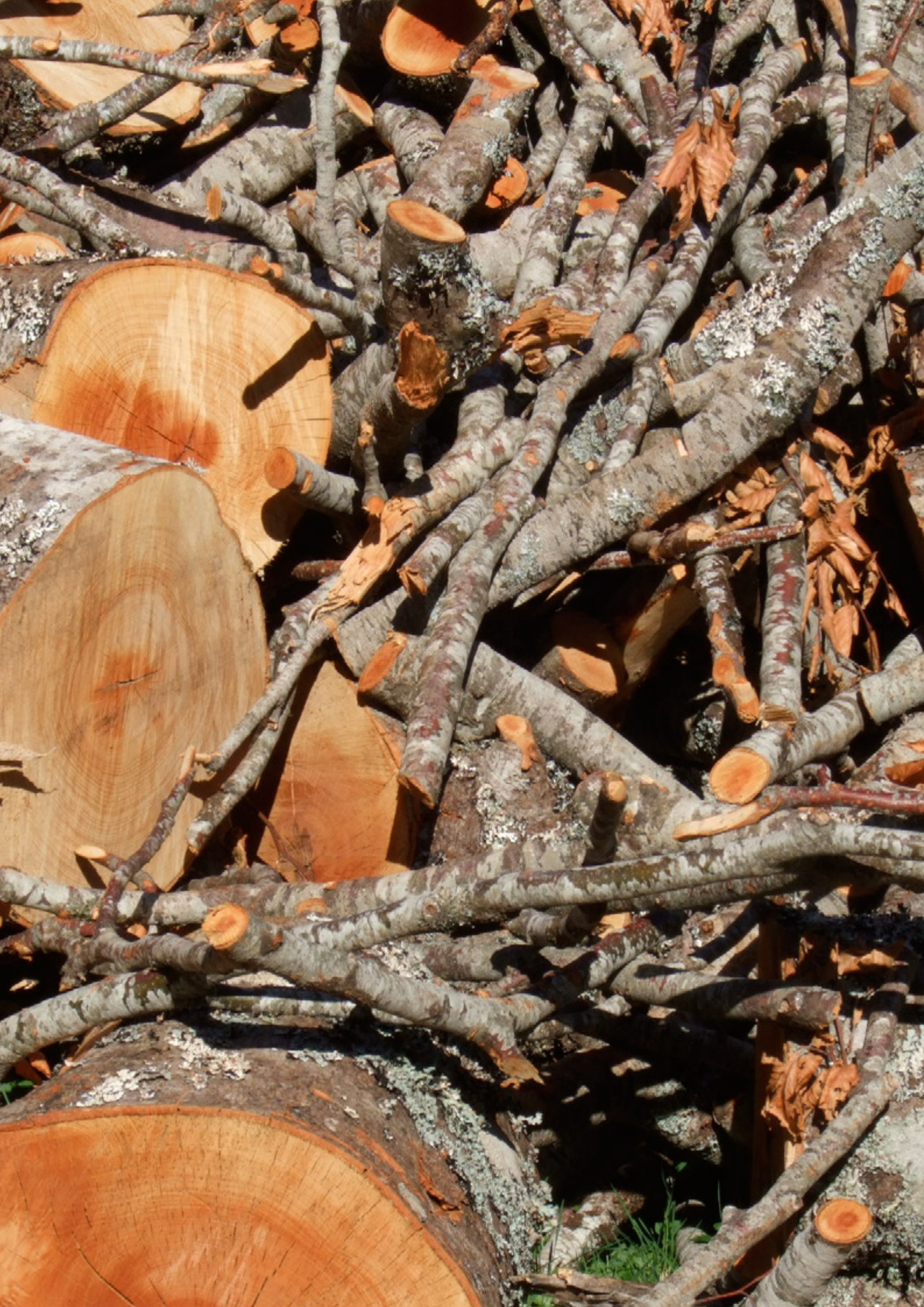


Introduction

1.1 WHAT IS THIS GUIDE FOR?

This guide is part of a publication series of thematic short guides on fair and responsible investments developed within the Promoting Responsible Investments and Commerce in Europe (PRICE) project: Fair Trade and Ethical Finance Respond to Global Crisis.

This guide is designed to inform civil society organisations and investment agencies on the environmental and social impacts of biomass production for energy purposes.This guide aims to raise awareness of the potential negative impacts involved in energy crop production - problems such as land grabbing, food insecurity and sustainability – and aims to promote responsible and locally sourced wood biomass as the most sustainable alternative.

It offers a straightforward set of principles and criteria which can be used by investment agencies and banks to screen for sustainability in wood biomass projects, in order to respect the law, minimise social and environmental impacts, and provide sound economic investment.

The EU aims to generate 20% of its energy from renewable sources, including biomass, by 2020. Many governments and banks are driving huge investments towards a very controversial sector. This guide aims to achieve renewable energy goals without compromising environmental sustainability, human rights and local development.

1.2 WHAT IS BIOMASS?

According to the Renewable Energy Directive (2009/28/EC)[1], the **definition of biomass** is:

> *"the biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste".*

This definition of biomass can include a wide variety of raw materials that can derive from various sectors, such as agriculture, forestry and the manufacturing industry.

Biomass can be processed in different ways (in specific biomass plant[2]) to produce energy and fuel.

It can be:

- Burned in power plants to produce heat or electricity.
- Fermented to produce fuels like ethanol, for cars and trucks.
- Digested by bacteria to create methane gas for powering turbines.
- Heated under special conditions, or "gasified," to break it down into a mix of gases which can be burned for electricity or used to make a range of products, from diesel to gasoline to chemicals.

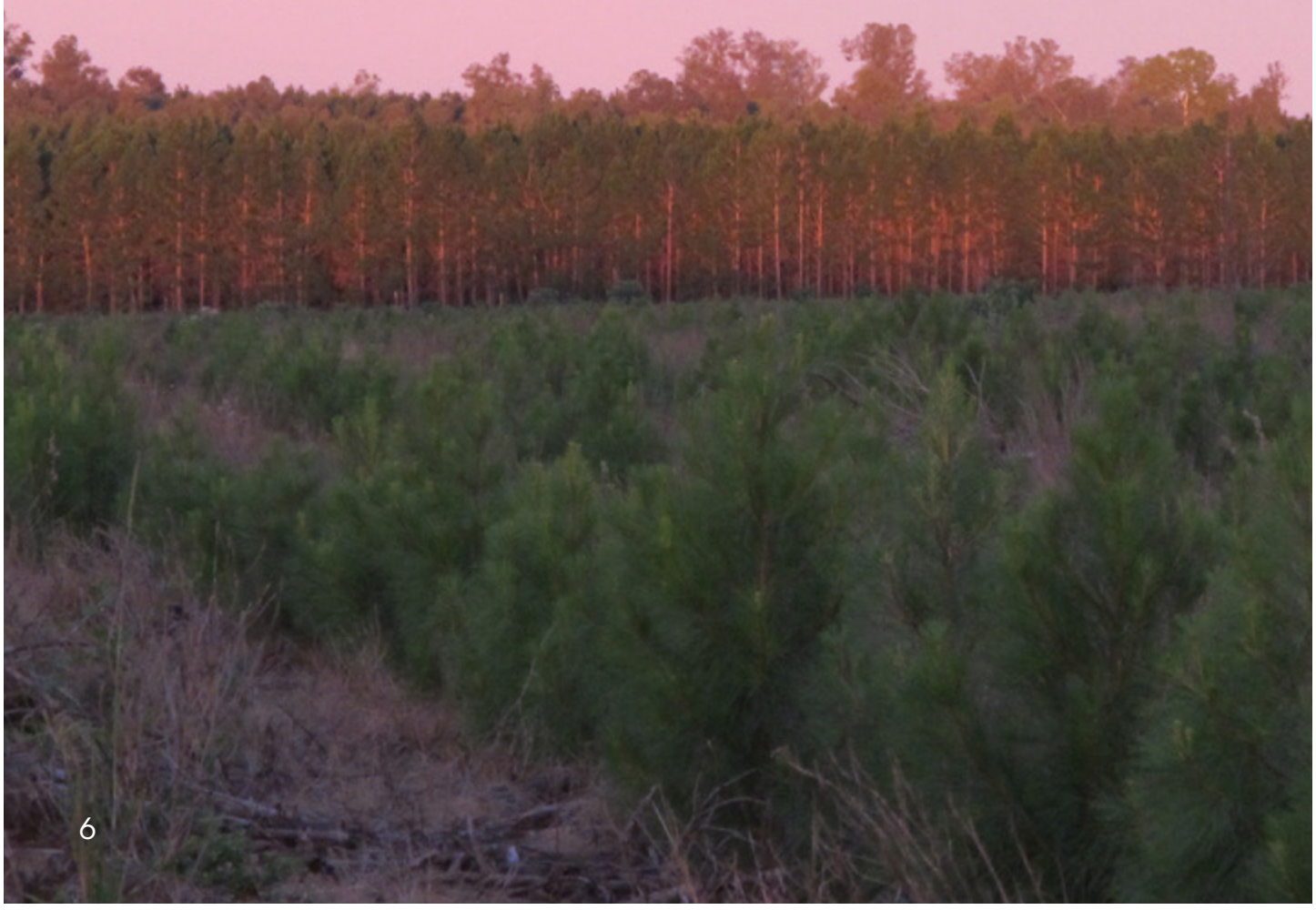
1. For the complete text of the directive: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32009L0028&from=en

2. In this document this term indicates all the different technological system to convert biomass resources into electricity and heat.

Box 1 - Which types of biomass does this guide cover?

The guide focusses on woody biomass – that is, the solid portion of stems and branches from trees or residue products made from trees. Woody biomass can come from a variety of sources, including:

- Non-timber tree removal: dead and dying trees, unwanted urban trees.
- Forest management harvesting: small diameter trees removed to reduce the hazard of wildfires, or from pre-commercial thinning (the removal of some stems to encourage the growth of the remaining trees) in commercial timber stands.
- Sawmill and other industrial wood manufacturing residues: including bark, undersized and defective wood pieces, sawdust, and other wood waste.
- Chaparral management: woody shrubs and plants removed for specific vegetation management goals.
- Dedicated forests (plantations): fast growing trees grown specifically for biomass markets.



Impacts of biomass production

2.1 BIOMASS: SILVER BULLET OR FOOL'S GOLD?

In Europe in 2012, biomass was the largest source of renewable energy. Indeed it constituted more than 93% of all renewable heat production (12.9% of the total heat demand) and 16.9% of all renewable electricity production[3]. The growth of the biomass sector has been dramatic. Between 2002 and 2011, European energy primary production from biomass increased from 115 to 190 million tons of oil equivalent (toe)[4]. This growth has been, in large part, driven by policies set by the EU to replace fossil fuels with renewable energies. In 2009, targets were set which aim for 20% of all energy consumed within the EU to be derived from renewable sources by 2020[5].

The favorable policy environment and push to increase biomass usage derives from a number of perceived benefits, including:

- Green House Gas (GHG) emissions reductions (to reduce reliance on fossil fuels and secure energy supplies), and;
- Poverty alleviation and rural development.

But analysing how some types of biomass are obtained, initial optimism towards biomass has given way to skepticism. Firstly, critics of biomass policies argue that the real costs of production for some kinds of biofuel in terms of GHG emissions, are not being captured because indirect land-use change (ILUC) is not sufficiently accounted for[6]. For example, the production of biomass can lead to exploitation of land traditionally used for food production, subsequently forcing farmers to clear new areas of adjacent forest land to grow crops and ensure their food supply. In addition many now question the economic viability of biofuels. When oil prices are low biomass may not be financially competitive and demand can plummet, requiring subsidies to keep producers afloat. Local socio-economic impacts of biofuels are also extremely variable. In some cases large biomass plantations provide much needed rural employment and higher wages. In other cases biomass schemes result in dispossession of land and food insecurity.

2.2 LAND GRABBING

High demand for biomass can lead to the purchase or sale of large areas of land to favor biofuel production. This phenomenon is called **land grabbing**. The term was initially coined by civil society organisations to highlight the negative impacts of transnational agribusiness corporations. Its application has since been widened to the extractive industries, forestry and biomass sectors.

3. European bioenergy outlook 2012, Aebiom

4. For Eurostat energy statistics: http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/introduction

5. European Commission, 2013. 'The EU Climate and Energy Package' [online]. Available at: http://ec.europa.eu/clima/policies/package/ [Accessed: 7th Nov 2013]

6. EEA, 2011. 'Opinion of the EEA Scientific Committee on Greenhouse Gas Accounting in Relation to Bioenergy'. Scientific Committee Report, Copenhagen.

Land grabs are defined as land acquisitions or concessions which are; in violation of human rights, not based on Free Prior and Informed Consent (FPIC) of affected land-users, not based on social, economic and environmental impact assessments and which do not have transparent contracts and binding commitments over activities, employment and benefit sharing[7].

Land grabbing is no longer a niche term used by environmental and social pressure groups, but is now recognised as a major issue regarding investment in land and natural resources, receiving international attention. Land is a vital resource for the production of food, collection of water and site for housing of billions of people around the world. **In developing countries the right to use land is often customary and not legally protected by the state. When investment is conducted without recognising the reliance of traditional land-users on land, extremely negative social and human rights impacts can occur.**

Besides the moral obligations of companies there are compelling business arguments for companies to 'do no harm' through their business activities. Adverse effects result in local conflict and damage to profits when inhabitants (sometimes violently) oppose investment projects by blockading sites or destroying crops. Land grabbing can also draw international media attention, damaging a company's corporate image, resulting in financial sanctions, loss of funding and ultimately endangering investment projects.

Box 2 - How biofuel investments can lead to land grabbing, the case of Uganda

Land grabbing is a hot topic in Uganda where the government has placed the natural resources sector at the centre of its national development plan, in order to increase economic growth by attracting foreign investment. This policy often collides explosively with social issues - high population growth, entrenched rural poverty and land shortages. In 2012 biofuel company BIDCO Uganda was drawn into this debate when Friends of the Earth (FoE) launched a damning media campaign against its Ugandan oil palm plantations. The project, located on 10,000 ha of Bugala Island, received funding from the International Fund for Agricultural Development (IFAD), the Government of Uganda and the World Bank.

FoE claim that inhabitants were evicted from their homes to make way for the plantation, communities were inadequately informed of the project prior to implementation, human rights abuses were caused when access to water and housing materials were curtailed and assessments highlighting the projects numerous negative environmental impacts were ignored.

2.3 THE FOOD VERSUS FUEL DEBATE

Some types of biomass used today are also important food crops; wheat, maize, sugar cane and oil seeds, such as palm oil, rapeseed and soy. The use of these 'flex crops' (crops which can be used for multiple purposes) has raised concerns regarding their impacts on global food prices and food security.

In financial terms, investing in flex crops can reduce risk, as crops such as wheat can be sold into the food industry if prices for bioethanol (of which wheat is a feedstock) plummet, and vice versa. However, for the 12% of the global population suffering from chronic hunger[8], diverting crops away from food markets causes prices to rise still further out of their reach.

Between 2007 and 2009, 20% of sugar cane, 9% of

7. ILC, 2011. 'Tirana Declaration "Securing land access for the poor in times of intensified natural resources competition"', Rome.

8. FAO, 2013. 'The State of Food Security in the World. The Multiple Dimensions of Food Security', Rome.

oilseeds and 4% of sugar beet produced globally went to make biofuels[9]. In 2013 42% of the total maize crop in the USA was used for biofuels[10]. This is particularly significant as the USA is the world's largest producer and exporter of maize and thus has a significant influence over global prices.

The perceived threat of biofuels to food price security is such that in 2013 the EU agreed to limit the amount of food-based biofuels contributing to its renewable energy targets.

Box 3 - The World food price crisis

In 2008 the world experienced a food price crisis when prices rose rapidly and unexpectedly. The World Bank Food Price Index increased 60% in a matter of months. Maize prices rose by 70%, rice by 180% and wheat 120% from 2007 levels. The price spikes had devastating effects on developing countries, by keeping or pushing 105 million people below the poverty line[11]. The crisis was thought to have occurred due to a variety of causes, including; drought, rising demand resulting from population growth, and increased oil prices. However an increasing body of evidence highlights the significant role of flex crop biofuels. In 2013 the Committee on World Food Security stated; "biofuels played an important role in recent food price increases"[12]. This supports earlier studies, including that by the FAO et al. in 2011 which stated that biofuels are a "significant factor" in food price rises.

2.4 LOCAL DEVELOPMENT: SMALLHOLDERS VERSUS MULTINATIONAL COMPANIES

Concerns over land grabbing and food security derive in many cases from the production model used in biomass projects. The majority of biomass projects currently use a large-scale plantation model, in which companies control all aspects of crop production and processing. This is referred to as the 'nucleus estate' model. Despite the dominance of this model there are at least three alternative production models.

Under contract farming (or 'outgrower') schemes, independent smallholders (or cooperatives of farmers) form contracts with biofuel companies to produce biomass crops. In Tanzania this model is used by biofuel company Diligent, which has contracts with over 4,000 individual farmers for the production of Jatropha. Farmers grow the plants as hedgerows surrounding fields so that the Jatropha production does not compete with food security considerations[13].

Hybrid models incorporate aspects of the nucleus estate and contract farming models. One example is the 'nucleus-plasma' model, in which the biofuel company holds a small estate where it produces its own crops (the nucleus) whilst also forming contracts for biomass production with surrounding small-scale farmers (the plasma). This model is documented in Indonesia where farmers retain some of their land for food production whilst committing to use the rest for palm oil production[14].

The forth type of model is the community-based model. In this type of model smallholder farmers act as both producers of biomass and owners of the processing plant. In Honduras the NGO Foundation for Rural Enterprise Development

9. FAO et al., 2011. 'Price Volatility in Food and Agricultural Markets: Policy Responses' Interagency Policy Report, Rome.

10. USDA, 2013. 'Corn supply, disappearance, and share of total corn used for ethanol' [online]. Available at: www.ers.usda.gov/datafiles/US_Bioenergy/Feedstocks/table05.xls [Accessed: 7th Nov 2013]

11. World Bank, 2013. 'Global Food Crisis Response Program. Quick Responses to Facilitate Longer-Term Solutions.' [online]. Available at: http://www.worldbank.org/en/results/2013/04/11/global-food-crisis-response-program-results-profile [Accessed: 7th Nov 2013]

12. HLPE, 2013. 'Biofuels and food security. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security', Rome.

13. Sulle & Nelson, 2009. 'Biofuels, land access and rural livelihoods in Tanzania.' International Institute for Environment & Development, London.

14. Quiñónez et al., 2012. 'Biofuel Partnerships: From battleground to common ground?', The Haugue.

supports 416 farmers to establish 599 ha of Jatropha. The community processes the seeds into Pure Plant Oil and sells the product as biodiesel feedstock through a community owned biofuel company[15].

Investors should be mindful that whilst large-scale plantations may provide higher financial returns in the short-term, community-oriented models can deliver greater equity, local development and long-term financial sustainability.

Box 4 - Fair Trade and biofuel

The concept of Fair Trade is designed to ensure that producers in the developing world receive a fair price for the goods they produce, and has proved to be successful in improving the lives of many families across the world for many other commodities. So far, however, the concept has not been widely applied in the biofuel sector. The Fairtrade Labelling Organisation could potentially use its certification standards to certify crops which supply raw material for biofuel production. Unfortunately, current Fairtrade standards apply only to specific commodities, (such as sugarcane and oil seeds) and not to processed derivatives, such as oils. There has been an attempt to develop and match Fair Trade standards with sustainable biomass criteria for Jatropha but without success[16]. Therefore, so far there are no biofuels which can carry the Fairtrade label. Despite this fact, some initiatives between developing countries and Europe have taken into consideration Fair Trade principles, to establish long term relationships and fair prices within specific biofuel supply chains. This is the case of the German government's investments in the District of Hoima, North-West Uganda, where a local project for Jatropha production is developed in agreement with the local communities and Fair Trade principles guarantee fixed prices and development opportunities for the local communities[17]. Similarly, the Swiss NGO Gebana has developed a direct organic and Fair Trade supply chain between a small soy bean farmers' organisation and MIGROL, a Swiss fuel retailer.

Fair Trade within biofuels may work as a "social compensation" for high social and environmental impacts of biofuel crops in developing countries. Existing initiatives and case studies are promising and offer a framework to develop new operational projects. However, existing Fair Trade standards cannot cover all principles and criteria for sustainability related to biofuel production and trade. This is because biofuel supply chains face specific commodity issues which need to be specifically addressed[18]. Therefore, an integration between Fair Trade initiatives and biofuel standard setting bodies will be required in the future.

15. Moes, 2010. 'Discovering new oil fields. Small-scale local biofuel production and use in rural Honduras.'

16. Fairtrade jatropha. Analysis of Low Indirect Impact Biofuels from jatropha, Tanzania: http://www.jatropha.pro/PDF%20bestanden/Ecofys%20-%20August%202012_Fairtrade%20Jatropha%20ILUC%20Report_final.pdf

17. http://www.advanced-trading.org/news-and-information/49-news-reports-and-background-information/129-investment-opportunity-development-of-a-fair-trade-with-sustainably-grown-bio-fuels-between-uganda-and-germany-

18. N. Scarlat and J.-F. Dallemand, "Recent developments of biofuels/bioenergy sustainability certification: A global overview," Energy Policy, vol. 39, no. 3, pp. 1630–1646, 2011. Available at: http://www.sciencedirect.com/science/article/pii/S0301421510009390

Box 5 - Why focus on wood biomass?

Unlike other types of biomass, which risk causing negative impacts such as land grabbing and food price insecurity, wood biomass has a number of key attributes. Namely, woody biomass is:

- A non-food material; thus changes in biomass markets risk neither diverting food crops away from hungry mouths nor flooding food markets with produce, affecting price stability.
- A potential partner, not competitor, to the industrial sector; by utilising waste products from manufacturing processes.
- A resource which is uniformly distributed over the world's surface; which favours the development of local supply chains.
- A resource that does not require specialised processing and combustion technology, and thus has the potential to be utilised for energetic purposes by a vast array of users around the world.

Local wood biomass: a true renewable energy?

3.1 INTERNATIONAL WOOD BIOMASS MARKETS AND EUROPEAN FOREST TRENDS

Within the biomass category, 68% of total primary production for energy purposes derives from woody biomass (forest residues, roundwood and manufacturing byproducts). In some European countries, such as Finland and Sweden, wood and wood-waste feedstock constitutes almost 20% of total gross inland energy consumption[19]. These figures demonstrate that this sector is already highly developed in Europe.

However, a recent assessment of 25 National Renewable Energy Action Plans indicates that by 2020 there will be a significant increase in bioenergy demand, three fifths of which will be met by forests[20]. In particular, the quantity of solid biomass used to generate electricity within the EU is likely to double between 2010 and 2020, while the quantity used for heating and cooling is likely to increase by about 50 per cent[21].

Today **the woody biomass sector in Europe is heavily dependent on stocks imported from non-European countries**[22]. Until 2007 the value of European woody biomass imports remained relatively stable, however imports have increased dramatically in recent years. In fact, **the import value of woody biomass more than doubled between 2007 and 2010, reaching around $584 million**[23]. Imported wood fuel represents the main resource for most large-scale biomass plants[24]. For example, the majority of the 2.5 million tons of wood pellets utilised by the biggest European wood biomass plant, in Tilbury, UK, come from non-European countries.

A document published by the Directorate-General for External Policies of the European Union indicates that, in the immediate future, developing countries in Central and West Africa (e.g. Republic of the Congo and Cameroon) and South America (especially Brazil) will have an increasing role in the export of wood biomass to Europe[25].

Commercial relations with these countries do not currently provide adequate guarantees regarding the legal origin of raw materials. Indeed, illegal logging - the harvesting, transporting, processing, buying or selling of timber in violation of national laws - is undoubtedly a huge problem facing imports from developing countries. Despite improvements in recent years, there are still clear anomalies in trade figures which suggest ongoing illegality. Indeed, the current value of this illegal trade is an estimated € 3.8bn, or around 15% of the total import value[26].

Despite clear evidence of illegal logging in

19. Aebiom, European bioenergy outlook 2012

20. Fanny-Pomme Langue, 2011 Biomass for Energy EU Policy overview, Central European Biomass Conference

21. Hewitt, 2011 Flow of biomass to and from UE, an analysis of data and trends, Fern

22. Ibid

23. Unece, 2009, Potential Sustainable Wood Supply in Europe

24. IEA bioenergy, 2013. Large industrial of energy biomass

25. EU DG External Policies, 2012, Impact of EU Bioenergy policy on developing countries

26. These information are available at www.barometer.wwf.org

developing countries and marked growth in the area of forest in Europe, the EU is still heavily reliant on imports of woody biomass. Between 2000 and 2010, woodland area in the EU increased through natural expansion and afforestation by a total of 3.5 million hectares, with a total rise of 2%. In 2010, at least 173 million square metres of available wood was left unharvested in European forests[27]. Utilisation of such neglected wood biomass stocks can contribute to meeting EU energy targets, whilst supporting small businesses and reducing the risk of illegality in supply chains.

Box 6 - Italy: the biggest wood biomass importer in the EU

Italy is the world's sixth largest, and Europe's second largest, importer of wood and wood products (in terms of volume of imports). In relation to woody biomass for energy purposes, Italy is the world's largest importer of firewood and the fourth largest importer of wood chips and waste wood[28]. The country maintains close trade relations with nations in which illegalities in the forest sector are well known. In particular, Italy is the largest trading partner for the export of wood and wood products from Cameroon, Côte d'Ivoire, Romania, Bosnia and Herzegovina, Albania and Serbia. Conservative estimates predict the percentage of illegal wood imported into Italy to be between 7 and 10% of total imports - with a value of € 1.3 to 2.8bn[29].

3.2 WHY SUPPORT LOCAL WOOD BIOMASS CONSUMPTION?

Current trends in the European wood-energy sector are likely to continue, with strong growth in the future, stimulated by significant public incentives to meet ambitious national biofuel targets. Adherence to stringent national targets risks promoting development of a biomass sector which suffers from a severe ethical deficit, where large biomass plants use raw material derived from long and non-transparent supply chains.

An effective response to such hazards is the increased utilisation of local resources. Sourcing locally is a way to increase transparency in the entire sector, create job opportunities in Europe and promote development of rural areas. Furthermore, given that the raw materials used for energy production can be forest residues or materials from silvicultural thinnings, development of the wood-energy sector favours improved forest management. Sustainable forest management can help prevent biodiversity loss, avoid hydro-geological risks, reduce the occurrence of man-made fires and improve conditions for the correct growth of high value timber species.

The growing demand for woody biomass for energy purposes can represent a great opportunity (with positive social, economic and environmental impacts) for the whole European forest sector if it is developed using ethical and responsible principles. Preferring local raw materials implies fewer imports, decreasing the risk of negative impacts associated with long supply chains. The negative impacts of long supply chains can be grouped into three categories: social, economic and environment (see Table 1 below). These deleterious impacts are not adequately addressed by existing certification systems and supply chain safeguards.

27. MANTAU, U. (2012): *Wood flows in Europe (EU27)*

28. For these data see http://faostat.fao.org/

29. Pettenella, D., Masiero, M., Kloehn, S., Secco, L., Ciccarese, L. (2009). Deforestazione e degrado delle foreste globali. La risposta del sistema foresta-legno italiano. Rapporto 97/2009, ISPRA, Roma.

Table 1 - Main negative impacts of complex supply chains for woody biomass

Aspect	Impacts	Causes
Environmental	High CO_2 emissions	Long distances involved
	Loss of important ecological functions of forests.	Lack of controls in forest management
Social	Worker injuries	Difficult controls on compliance with regulations regarding health and safety of workers
	Biomass plants opposed by local communities	Lack of transparency and benefit sharing in the supply chain
Economic	Poor remuneration to producers	Non equitable distribution of profits
	Local producers and stakeholders not involved in the supply chain	Preference for foreign producers/ suppliers

Sustainability principles for wood biomass plants

There is a necessity to identify tools and measures capable of assessing the sustainability of wood-energy biomass plants, in order to avoid investment in plants where negative impacts outweigh benefits.

At the European level, similar measures already exist for the biofuel sector. Indeed, directive 2009/28/EC[30] of the European Parliament requires compliance with certain criteria, (such as the minimisation of GHG emissions) in order to limit the negative impacts of supply chains.

Until now the wood-energy sector has been characterised by the involvement of actors with various competences and different types of raw materials. It has also not been subject to structured regulations about supply chain length and sustainability.

Measures for ensuring the sustainability of projects are often welcomed by supply chain actors, who lack the tools to guarantee fair competition between responsible companies and to discourage those who are not able to prove the legal origin of their raw materials. Such tools are also appreciated by consumers, who often seek out demonstrably transparent supply chains which offer guarantees on environmental, social and economic sustainability.

The first step in ensuring a sustainable project is the identification of general principles to which a woody biomass supply chain must adhere[31]. The four principles identified here are:

a) Legality and responsibility in social and environmental issues;

b) Environmental safeguards;

c) Local development;

d) Economic efficiency.

The first principle is connected with the aspect of legality in the supply chain. The next three principles are connected to the three dimensions (social, environmental and economic) that are usually considered by the concept of sustainable development.

4.1 LEGALITY AND RESPONSIBILITY IN SOCIAL AND ENVIRONMENTAL ISSUES

A wood-energy supply chain has to be characterised by **legality and responsibility in social and environmental issues**, with all actors involved demonstrating evidence of continuous compliance with legal regulations.

The main topics relating to the respect of laws and legal obligations are:

30. For a complete European directive see the following link: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0016:0062:en:PDF

31. The principles and criteria were adapted by those elaborated within the project Biomass Trade Center II http://www.biomasstrade-centre2.eu/Biomass-Trade-CentreII/

- **Occupational health and safety**, given that forestry work is generally characterised by a combination of natural and material risks to the health and safety of employees. The natural risks are associated with steep and broken terrain, dense crops and adverse working conditions, including extremes of climate. The negative effects of these natural features are often worsened by the inadequacy or absence of work site welfare facilities and appropriate clothing;
- **Traceability of raw materials**, due to the dominance of imported raw materials. It is important that all actors of the wood biomass sector respect EU regulation n.995/2010, that from 3rd March 2013 obliges all European operators, through specific procedures and actions, to reduce the risk of importing wood products of illegal origin;
- **Prevention of environmental damage**, given that supply chains involve issues relating to forest management and emissions of polluting substances into the atmosphere.

4.2 ENVIRONMENTAL SAFEGUARDS

The use of wood for energy is often encouraged (even by means of financial support) because of the many positive effects on the environment. Therefore it is extremely important to **monitor the real environmental impacts proceeding from the wood-energy supply chain**. Especially in the early stages of the supply chain (from the forest and wood-mill), it is important to ensure correct management of the raw materials, in order to safeguard forest ecosystems and biodiversity and to avoid wastage of biomass at the wood-mill.

In addition to the protection of the main ecological functions of forests, active forest management (through thinning and removal of logging residues), even in areas with severe difficulties of access, can reduce the risk of wildfires and soil erosion occurring.

Carbon (i.e. CO_2) neutrality is a fundamental characteristic that differentiates woody biomass from traditional fossil fuels and this feature is often the main justification of public incentives. It is therefore important to monitor and minimise emissions associated with the production and transportation of biomass along the supply chain. Relying heavily on imports and long-distance transportation of biomass increases the risk that the emissions derived from transportation negatively influence the carbon neutrality of woody biomass utilised for energy purposes.

Making the logistic of transport more efficient, ensuring for example that the trucks or ships are as full as possible or improving fuel efficiency of vehicles with advanced design and technologies can be others excellent tools to reduce CO_2 emissions.

4.3 LOCAL DEVELOPMENT

European forest resources are increasing, therefore it is feasible and desirable to use local raw materials. Favoring the development of local (or short) supply chains, where there is **a closer relationship between the consumer and the areas of origin of woody biomass, can contribute to create a more transparent image** and stimulate local economies. Furthermore, the creation of local supply chains also implies:

- Reduction of distances and relative trip-length for the transport of the material which contributes to decreased CO2 emissions;
- Reduction in the number of 'middlemen' involved in the process, which facilitates a fairer division of added value amongst the concerned parties, and a more equitable remuneration to producers;
- Supporting local producers, improving their integration into the social context, and incurring lower conflict risks with the local population, thus favour a positive attitude of local communities towards plants;
- Promoting new local markets which allow for the creation of jobs along the wood supply chain, which in turn slows rural depopulation and declines in the human capital required for harvesting, processing and transportation of wood.

4.4 ECONOMIC EFFICIENCY

As a result of increased wood-energy demand, the particle board industry, which exploits the same low-value raw materials utilised by the wood-energy sector, is facing increased competition for raw materials. This competition between the two sectors may not be impartial, given that public incentives are often allocated for wood-energy production. For equitable competition between different sectors, it is desirable that any new biomass project is supported by adequate economic planning to ensure independence from financial incentives.

In general, the wood-energy market and the rest of the forest sector **should not be seen as competitors**, but as partners. In fact, development of the wood-energy sector should be seen as an opportunity for the entire forestry sector, as active forest management (from which it is possible to obtain residues for energy production) can help provide high quality products as well as developing opportunities in other sectors, such as tourism.

Table 2 - List of Principles & Criteria for responsible and sustainable woody biomass supply chains

Principles	Criteria
a) Legality and responsibility in social and environmental issues	1. Ensuring safety in the workplace 2. Regular and qualified workers 3. Compliance with environmental regulations 4. Traceability of incoming material
b) Environmental safeguards	5. Reduced greenhouse gas emissions 6. Sustainable forest management 7. Avoided degradation of forest areas 8. Promotion of products with quality-certification
c) Local development	9. Involvement of local stakeholders 10. Reduced number of stages within the supply chain 11. Local destination of the sales
d) Economic efficiency	12. Rational choice for the product end-use 13. Continuity in economic relations with the suppliers

Investing in wood responsible biomass plants

Operational aspects, evaluation criteria and indicators

The four principles described in the previous section are general concepts. To support their implementation in operational terms there is a necessity to detail the contents of each of them in terms of specific criteria (see Table 2 below).

In addition, each criterion shown in Table 2 has a number of indicators associated with it. Indicators are suggestions of how each criterion may be assessed and help users identify sources of information which can be used to demonstrate commitment to criteria. The list of these indicators forms an operative tool to evaluate the sustainability of all actors included in the supply chain of raw materials.

The basic premise of using a hierarchical evaluation tool composed of principles, criteria and indicators is to ensure that a project is only financed when the raw materials used in the biomass plant derive from a supply chain in which the main actors (logging companies, saw mills, etc.) are assessed as sustainable.

5.1 CRITERIA & INDICATORS TO EVALUATE LEGAL, SOCIAL AND ENVIRONMENTAL RESPONSIBILITY

1. Ensuring safety in the workplace

Compliance with health and safety regulations, conformity of machinery in use and the correct use of personal protective equipment are essential aspects to prevent accidents and provide a guarantee of regular competition between forest companies. It is important to underline the importance of certification, such as SA 8000 and OHSAS 18001, which serves as verification of compliance with proper working conditions.

2. Regular and qualified workers

At each stage of the chain, all workers shall have an employment contract, in compliance with existing laws, to carry out all activities (from felling in the forest, to the transformation of products). Moreover, all parties involved in the supply chain shall demonstrate an appropriate level of competence with respect to their role in the wood-energy supply chain.

3. Compliance with environmental regulations

The wood-energy sector concerns aspects that may have direct links to the environment and

landscape. Therefore a sustainable supply chain must include only actors that are compliant with the current environmental regulations. For example, certifications such as ISO 14001 and EMAS are valid tools to guarantee the respect of environmental regulations.

4. Traceability of incoming material

The operators belonging to a sustainable wood-energy supply chain must guarantee adequate traceability (and characterisation) of raw materials, to ensure transparency, especially in markets characterised by a high proportion of imports.

From 3rd March 2013, the different European actors of the wood supply chain are required to comply with the Timber Regulation (Regulation (EU) No 995/2010) and therefore:

- They are **operators** when they are the first to place timber or timber products on the EU market. In this case they are required to exercise 'due diligence' when placing wood on the EU market in order to minimise the chances of the wood coming from, or being made of wood which comes from, illegally harvested sources.
- They are **traders** when they buy or sell, for commercial purposes, timber or timber products already placed on the EU market. In this case they are required to keep information for five years about suppliers and customers so that the wood that they handle can be traced as easily as possible.

For more information on the EU Timber Regulation visit the dedicated website at http://ec.europa.eu/environment/eutr2013/.

5.1 Possible indicators for the verification of compliance with this criterion	
1.1	The company[32] shall be able to provide all documentation necessary to carry out their activities in compliance with existing occupational health and safety regulations.
1.2	The company shall be able to provide the certificates of conformity of the machinery in use and evidence of periodic inspections for agricultural and forestry tractors.
1.3	The company shall choose suppliers based on the guarantees of their compliance with social and environmental regulations.
2.1	The company shall record the injuries of their operators and the actions taken to prevent the recurrence of accidents.
2.2	The company shall provide a self-declaration reporting the details of the contracts of all their employees.
2.3	The company shall provide a company chart, including the skills and responsibilities of each employee and proof of their correspondent qualifications.
2.4	The company shall provide a training program for their employees.
3.1	The company shall provide all documentation necessary to carry out their activities in compliance with applicable environmental regulations.
3.2	The company shall provide a register containing any complaint by private citizens as well as records of any lack of compliance with laws. The company shall also report how complaints are managed and actions taken based on registered complaints.
4.1	The company shall be able to demonstrate compliance with the EU timber regulation.

32. The term refers to all company stakeholders that may be included in the supply chain of raw material for the plant

5.2 CRITERIA AND INDICATORS TO EVALUATE ENVIRONMENTAL STEWARDSHIP

5. Reduced greenhouse gas emissions

Keeping the emissions of the supply chain (i.e. from the felling to the sale of materials) below given threshold values contributes to reducing global warming and air pollution. An analysis of the emissions at each stage of the supply chain (carbon footprint) allows improvements in logistics as well as reductions of direct and indirect costs[33].

Another factor which may contribute to reducing emissions is the utilisation of renewable resources for the production of energy.

6. Sustainable forest management

Preferring certified wood products ensures that they come from forests managed according to specific sustainability standards. At the global level, there are currently two main sustainable forest management certification schemes (FSC and PEFC) capable of providing independent, third-party verification that timber is sourced from sustainably managed forests. These schemes include mechanisms for tracing products from the forest of origin through the supply chain, to the end consumer.

7. Avoided degradation of forest areas

Europe's forests, especially in the Alps, are often underutilised and abandoned, partly because of the physical characteristics which do not favor forest operations. The use of raw material from under-exploited European forests contributes to reducing the ageing and degradation of forests, thus preventing biodiversity loss and increases in fire and hydro-geological risks. Preferring material from forests located in marginalised areas also has positive economic impacts, giving new opportunities to owners and managers.

8. Promotion of products with quality-certification

Compliance with technical standards such as EN 14961 and EN 15432[34] ensures traceability of materials along the supply chain and the respect of parameters relating to intrinsic product characteristics and performances (e.g. water content, size, ash content, etc.) and reduction of polluting emissions.

5.2 Possible indicators for the verification of compliance with this criterion	
5.1	The company shall monitor the average carbon footprint (CO_2 per tonne of output) along the supply chain.
5.2	The company shall ensure the purchase and/or the production of electrical or thermal energy from renewable sources.
6.1	The company should prefer forest raw materials/co-products from FSC or PEFC certified forests.
6.2	The company should have a FSC/PEFC chain of custody certification.
6.3	The company should prefer suppliers with FSC/PEFC chain of custody certification.
7.1	The company should prefer wood from under-exploited forests (areas where no forest operation was performed during the last 30 years). However, these must be not be forest areas of outstanding and critical importance due to their high environmental, socio-economic, biodiversity or landscape values.

33. About this thematic interesting ghg calculator are supplied by Enplus (http://www.enplus-pellets.eu/) and by the project Biograce II (http://biograce.net/biograce2/).

34. http://www.cen.eu/cen/Services/EHD/Sectors/Pages/EnergyandUtilitysector.aspx

5.2 Possible indicators for the verification of compliance with this criterion	
7.2	The company should prefer wood from forest areas characterised by difficult access conditions (i.e. large distance from forest roads or steep slopes) and difficult yarding conditions.
7.3	The company should NOT prefer raw material from monoculture tree plantations.
8.1	The company should favour the sale of products certified to the following technical standards: - EN 1496; - EN 15234.

5.3 CRITERIA AND INDICATORS TO EVALUATE LOCAL DEVELOPMENT

9. Involvement of local stakeholders

An active role within the local socio-economic context can encourage a useful exchange of knowledge and skills amongst different actors, (including the creation of labour opportunities at the local level). Additionally, this gives the opportunity for participatory and informed management of the supply chain, limiting potential conflicts related to the use of natural resources, as well as negative impacts associated with the construction of power plants.

Finally, the development of new projects appropriately sized for the potential supply of natural resources in a specific area allows for revitalisation of local economies, especially in marginal areas such as mountainous regions.

10. Reduced number of stages within the supply chain

Reducing the number of steps within the supply chain allows consumers to get closer to producers, thus contributing to a better remuneration for producers, a fairer sharing of value amongst stakeholders and the opportunity for consumers to easily recognise the origin of the raw material. For example, it is preferable that a company/plant use raw material from forests in which it can have a direct role in the management and is able to better monitor the employment conditions of workers.

11. Local destination of sales

For a company it is important not only to monitor the origin of raw material, but also the destination of final products. Preferring local destination favours the creation of short supply chains, with positive effects for local economies and the environment (reduced CO_2 emissions).

5.3 Possible indicators for the verification of compliance with this criterion	
9.1	The company shall be registered in the regional register/roll of forest service enterprises.
9.2	The company shall provide a clear, complete and up-to-date description of its network.
9.3	The company shall be involved in projects promoted by local authorities.
9.4	The company shall ensure the implementation of new projects with positive employment impacts for the local population.
10.1	The company shall prefer co-products produced from their own raw material.
10.2	The company shall prefer raw forest material that derives from forest sites managed by the company itself (forest stands which are leased or owned by the company). These sites shall not be farther than 70 km from the processing site.
10.3	The company shall prefer forest raw material that has not yet been transformed (roundwood or tops and branches).
11.1	The products sold by the company shall be preferably used in local plants that are not farther than 70 km from the company site.

5.4 CRITERIA AND INDICATORS TO EVALUATE ECONOMIC EFFICIENCY

12. Rational choice for products end-use

Whether material from forestry processes or saw-mill co-products, it is important to exploit waste materials (which have no economic value) for energetic purposes. This has positive impacts at both the economic level (through added value) and environmental level (by limiting emissions from combustion of waste materials outdoors).

Given that the manufacturing sector prefers high-value timber, exploiting products with little economic value is a way to decrease the competition between sectors.

An effective tool to facilitate the correct management of wood products and the identification of the most proper end-users is the implementation of logistic centres for the production and trade of woody biomass.

13. Continuity in the economic relations with the suppliers

Stipulating long-term supply contracts ensures stability in the supply chain and favours stable functioning of energy plants. Long-term contracts can contribute to the reduction of trade-offs with other sectors (e.g. with the wood-based panel industry). They can also positively influence the quality of supplies with respect to specific requirements and more generally, encourage investments in the wood-energy sector.

5.4 Possible indicators for the verification of compliance with this criterion	
12.1	The company shall prefer co-products from first processing industries.
12.2	The company shall prefer material that comes from biomass trade centres.
12.3	The company shall prefer raw material from forest operations with positive impacts upon forest ecosystems and productivity (e.g. thinnings).
13.1	The company shall prefer raw forest material/saw mill by-products purchased through long-term contracts (at least 5 years) with forest owners/managers.

Conclusions

Since the advent of the biofuel directive 2009/28/EC, the European Commission has tended to award biomass production from short supply chains. Indeed, according to this directive, the main tool to assess the biofuel sustainability is the GHG calculation, where the main component is the transport distance between producers and consumers. This view is motivated by the fact that the main reason to support bioenergy utilisation is the reduction of GHG emissions against traditional fossil fuels. It is therefore important to guarantee real GHG emissions decreases reducing, for example, the distance and relative trip-length for the transport of the material.

Also for the wood-energy sector, that will continue to experience strong growth into the near future, there is a need for new regulation and/or voluntary standards to ensure sustainability and fairer trade in order to avoid negative social and environmental impacts.

This guide aims to promote investment in responsible wood biomass as a sustainable alternative to other available biomass sources. It does so by providing strong arguments and by developing a list of principles and criteria that can be used by investors to assess the sustainability of investments. The biomass sector, particularly the wood-energy sector, will continue to experience strong growth into the near future: following this guide investors can help to achieve sustainability challenges and make wood biomass a real renewable energy source.

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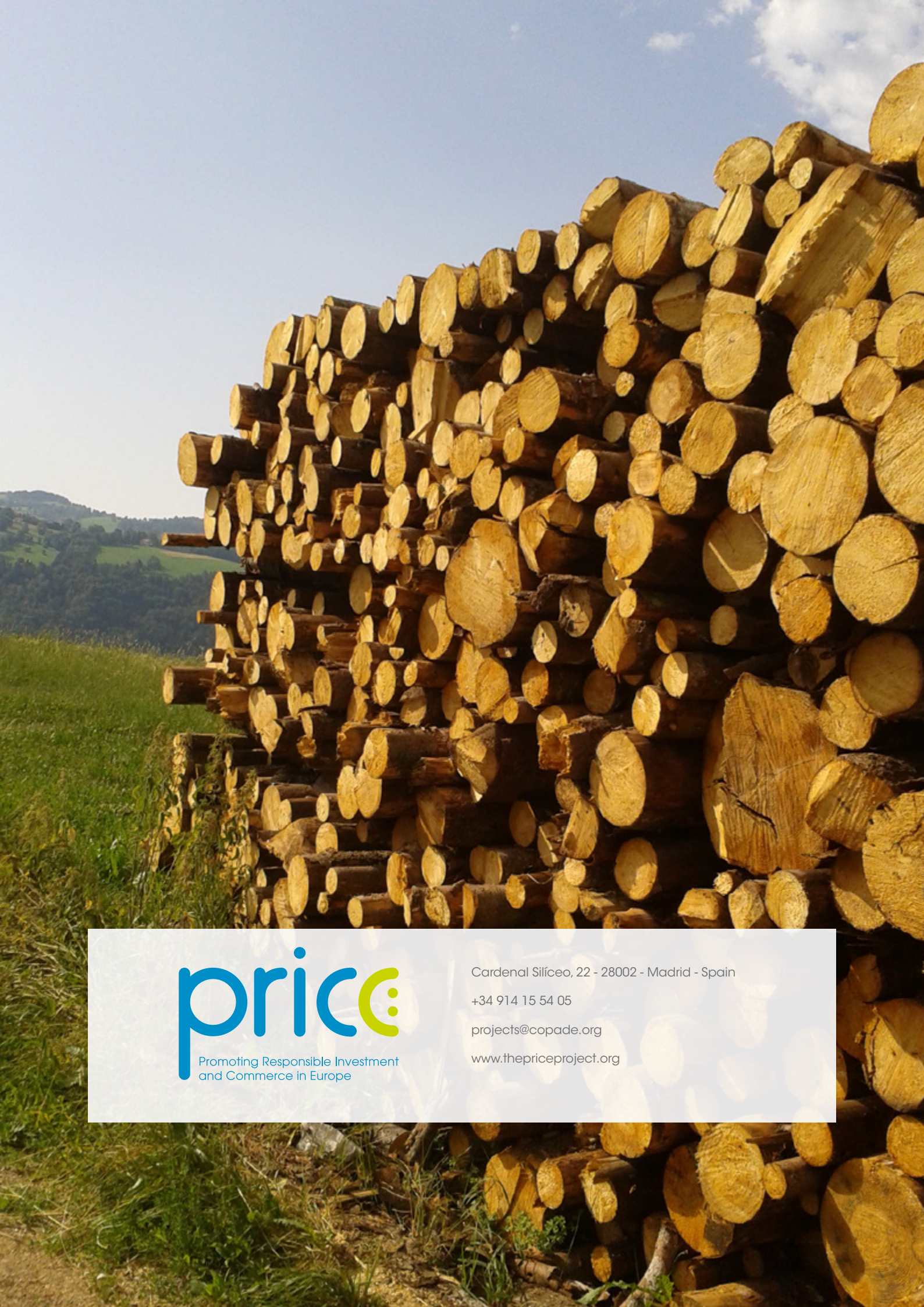

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