

# Powering Europe Sustainably

A discussion paper on the potential role of biomass in the EU



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## List of abbreviations

BAP	EU's Biomass Action Plan
CEPI	Confederation of European Paper Industries
CHP	Combined Heat and Power
EEA	European Environment Agency
EU	European Union
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
FAO	UN Food and Agriculture Organisation
FERN	Forests and the European Union Resource Network
JRC	Joint Research Centre
GHG	GreenHouse Gases
MJ	MegaJoules
Mtoe	Million Tons of Oil Equivalent
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaics
RES	Renewable Energy Sources
WWF	World Wildlife Fund

## An A to Z of biomass

At present, six per cent of the EU's energy consumption comes from renewable sources, 60 per cent of the renewable energy production comes from biomass.<sup>1</sup> Eighty per cent of the biomass comes from wood based products.

The EU aims for 20 per cent of its energy use coming from renewable sources by 2020. Biomass, and specifically woody biomass, is expected to account for the bulk of this increase.

**Bio-energy** is energy derived from biological material such as crops, forestry residues and organic waste.

**Biofuel** essentially refers to liquid or gas fuel derived from biological material, mainly used for transport. Environmental and social NGOs prefer to use the term '**agrofuels**' to describe the large-scale monoculture agricultural crops used for the production of liquid fuels from biomass.

The term **first generation biofuels** refers to current mainstream fuels made from sugar, starch, animal fats or vegetable oils using conventional technology.

**Second generation biofuels** are usually made from ligno-cellulosic fibres such as wood and agricultural waste, using advanced technical processes.

Biodiesel from algae is considered a **third generation biofuel**.

**Biomass** is essentially biological material originating in living, or recently living, organisms. It is obtained either directly from plants, indirectly from agricultural or domestic products, or from industrial or commercial production processes. Biomass can be divided into **non-woody biomass** and **woody biomass**.

**Non-woody biomass** includes:

- 1 animal waste;
- 2 industrial waste and co-products from manufacturing and industrial processes;
- 3 food waste ranging from substances discarded during food and drink manufacture and consumer waste;
- 4 agricultural residues;
- 5 energy crops grown specifically for bio-energy use (agrofuels).

**Peak oil** describes the point of maximum oil output, with production projected to decline sharply thereafter.

**Woody biomass** includes:

- 1 virgin wood from forestry;

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<sup>1</sup> For the EU 25

- 2 untreated wood products;
- 3 residues from wood processing, including black liquor;
- 4 wood based energy crops composed of quick growing trees such as willow or poplar (though these are often placed under the category of agricultural or energy crops).

**Black liquor** is the lignin residue left by the chemical pulping process when extracting cellulose from wood.

**Direct supply** of woody biomass is mainly made up of wood collected and used directly from the forest.

**Indirect supply** of woody biomass is made up of both processed and unprocessed woods from wood processing industries and its industrially generated co-products or residues, including sawdust pellets and wood liquids or black liquor.

**Renewable energy** is energy from sources that can be reused and renewed. Renewable Energy Sources (RES) include solar energy, geothermal energy, wind energy, wave and tidal energy, hydroelectric energy, and energy derived from biomass, or bio-energy.

## Summary

The EU has set highly ambitious targets for energy generated from renewable energy sources (RES) in comparison with other major consumer countries. At present the bulk of RES in the EU comes from biomass – and wood products and residues account for the main part of that portion. Yet what is referred to as woody biomass and its potential contribution to RES growth has so far received comparatively little attention. Crop based biofuels (or agrofuels) have been in the news – but for negative reasons. Wind, solar and wave power have also attracted considerable attention: while it is outside the realm of this report, it is likely that the bulk of new RES investment has gone into these comparatively new enterprises. Meanwhile woody biomass has been, to a large extent, left on the sidelines – the Cinderella at the RES ball.

There might be many reasons for this position: though the technology involved in transforming woody biomass into bioenergy is relatively straightforward and proven, the economic, social and environmental issues involved in sourcing wood in the EU are complex. Data is also a problem – it is often incomplete and outdated. Terminology is confused, loaded with various categories and terms. In short, when it comes to woody biomass, it is often difficult to see the wood for the trees. By comparison, wind and other RES – though highly expensive to put into operation – appear straightforward.

Despite this, it is the contention of this report that woody biomass, while in no way a panacea for all the EU's energy needs, should be recognized as an important player in RES. It outlines that the infrastructure for further development of woody biomass is already in place and shows why biomass should be used where it is most efficient – in combined heat and power plants for generating heat and electricity. It should not be used for fuel for transport, where it is both expensive to produce and of doubtful efficiency.

What is needed now is a comprehensive appraisal of this potentially large energy source within the context of EU energy policy. This discussion paper aims to be a first step towards that appraisal.



photo: [www.flickr.com/photos/asea](http://www.flickr.com/photos/asea)



# Introduction

***“The idea that economies constantly have to grow, that we all must consume more, has to be done away with. Yet such ideas are treated as heresy in most circles. When you attend official meetings and say that resources must be saved – it’s like calling for the devil in church.”***

*Torgny Östling from Via Campesina*

Europe is facing considerable challenges in relation to its energy use and supply over the coming decades. While global action on cutting back emissions and reducing consumption is still seen as inadequate, the EU has in many areas been at the forefront of setting targets for lowering emissions of greenhouse gas (GHG) and increasing the take up of RES.

A combination of factors, including rapidly rising global demand for energy, escalating prices and a real or perceived dwindling in supplies of fossil fuels, has resulted in energy supply questions being at the centre of national and international debate. Growing worries over energy security (focused within Europe on concerns about an over reliance on Russia for gas supplies) is another important factor in assessing future EU energy requirements.

Against this background, the race to find alternative energy sources is on. Threatened with energy shortages in the not too distant future, several EU countries are reconsidering their positions on nuclear generated power. Ambitious targets for RES, including solar, wind and wave power, have also been set, although an EU target for the use of biofuels in transport is proving highly controversial. Wood based energy already makes a sizeable contribution to the EU’s overall energy supply and the potential for developing woody biomass energy is slowly being recognised.

EU policy makers do not have an easy job. They have to take into consideration the views and needs of a multitude of different bodies – energy producers, industry, environmentalists, scientists working on climate change and other issues, the general public and the different needs and aspirations of various governments.

Policy makers are also faced with considerable uncertainties and imponderables such as the effect that climate change is going to have on Europe’s forest resources in the future. The

hot summer of 2003 not only saw thousands of heat related deaths, but also the drying out of many of Europe's plant species and, as a consequence, less carbon uptake from vegetation.<sup>2</sup> Climate change experts say that such periods of intense heat will become an ever more common feature of Europe's climate in future years – events which are bound to have a big impact on the state of European forests and the energy resources they might produce.

There is added uncertainty in relation to developments in science and technology. Both new discoveries in energy generation and unexpectedly adverse outcomes from energy resources already in use might mean policies need to be changed.

What is clear is that Europe needs to move to a low carbon economy and that woody biomass will have to play a role. This discussion paper aims to look at how woody biomass is used at present and the potential role it could play in a Europe that uses energy sustainably.

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2 <http://news.bbc.co.uk/1/hi/sci/tech/4269066.stm> – Viewed on 18/09/2008

## Chapter I

## The EU energy scene

***“There are clear dangers in further intensifying management, as a result of demand for biomass, especially in forests already characterized by intensive removal of annual growth. These include further decreasing amounts of valuable deadwood (a vital element for many forest dependent species), disturbance as a result of intensified transport, damage to the soil and decreasing nutrient levels.”***

*Laszlo Mathe from WWF*

While the outside world might often view the EU as a unified political entity and trading bloc with a set of coherent and coordinated policies, the reality is often very different, not least in matters of energy. Overall the EU depends on fossil fuels for approximately 80 per cent of its energy needs<sup>3</sup> with the major portion imported, particularly over recent years as production of oil and gas in the North Sea has declined. However, the energy mix within the EU varies widely from country to country and region to region, mainly due to historical factors, with individual governments traditionally setting their own priorities, paying little attention to wider, regional concerns.

For example, France at present uses nuclear power for 40 per cent of its primary energy needs and 80 per cent of its electricity generation, while the figures for nuclear power generation in the UK are nine per cent and 20 per cent respectively. Meanwhile Poland, with its vast coal reserves, depends on coal for 60 per cent of its primary energy and more than 90 per cent of its electricity generation. The uptake of RES between the various EU countries and regions is also marked by country and regional differences.<sup>4</sup> See *country studies* at page 35.

Developments in global energy markets, the need for action to combat climate change and the security of energy supply have all been major influences in the formation of a more unified and coordinated EU approach to energy policy. *“The energy challenges of the 21st century require a common EU response,”* says Jose Manuel Barroso, the EU Commission president.

3 <http://www.rics.org/NR/rdonlyres/413A59C4-9607-44DE-8E20-A2546CAEE8B6/0/MichaelDoranContributionofEnergyCropsinDisplacingFossilFuelsintheEU.pdf>

4 [http://ec.europa.eu/energy/energy\\_policy/doc/factsheets/mix/mix\\_fr\\_en.pdf](http://ec.europa.eu/energy/energy_policy/doc/factsheets/mix/mix_fr_en.pdf) [http://ec.europa.eu/energy/energy\\_policy/doc/factsheets/mix/mix\\_pl\\_en.pdf](http://ec.europa.eu/energy/energy_policy/doc/factsheets/mix/mix_pl_en.pdf) [http://ec.europa.eu/energy/energy\\_policy/doc/factsheets/mix/mix\\_uk\\_en.pdf](http://ec.europa.eu/energy/energy_policy/doc/factsheets/mix/mix_uk_en.pdf)



*“A common approach, articulated by a common voice, will enable Europe to lead the search for energy solutions.”<sup>5</sup>*

Leaving aside the question of addressing climate change, the 21st century energy challenges – for the EU and for the world – are enormous. The International Energy Agency (IEA) says that if present trends continue, world energy demand is set to increase by more than 50 per cent by 2030, fuelled in large part by the ever-increasing demands of developing countries – in particular the fast expanding economies of China and India.

In the past, the IEA, generally regarded as bullish on energy availability, said fossil fuel resources would be adequate to meet this large-scale increase in demand, providing significant investments in exploration and infrastructure were carried out. However it has recently warned that from 2012, oil supplies will be tight.<sup>6</sup> Others see the situation differently, stating that our world has grown dependent on oil and now faces a crisis.

Oil market expert Dilip Hiro says there will be an even greater battle for dwindling oil resources in the years ahead.<sup>7</sup> He points out that in recent years very few new discoveries have been made – four out of five barrels of oil produced in the world today come from pre 1973 fields. Peak oil will happen soon. Previous energy transitions – from wood to coal and coal to oil – have been relatively gradual and evolutionary. The peaking of oil, by contrast, will be abrupt and revolutionary.

In order to meet the twin challenges of shrinking and increasingly expensive supplies of fossil fuels and of combating GHG emissions and climate change, the EU has, over the years, set out a number of policies and energy targets. These include a 12 per cent overall share of renewable energy by 2010,<sup>8</sup> an indicative target for a 21 per cent share of renewable energy for electricity generation<sup>9</sup> and an indicative target of a 5.75 per cent share for biofuels in transport energy.<sup>10</sup> For an overview of bioenergy policies in the EU see Annex 1 and FERN's briefing, “When the solution is the problem: the EU and its policies on biofuels.”<sup>11</sup>

These policies and targets, aimed at achieving what the EU describes as a “*sustainable, efficient and diverse energy mix*”, have evolved over time. The EU is now developing a directive that aims to ensure 20 per cent of the total EU's energy consumption comes from RES by 2020.<sup>12</sup> The proposed directive establishes overall targets and lays down the principles for ensuring that those targets are met.

There are three main sectors in which renewable energy will be used: electricity, heating and cooling, and transport. Each Member State has discretion as to the mix of these sectors in achieving its national target. However, in tandem with these proposals, the EU has set a

5 Green Paper: A European strategy for Sustainable, Competitive and Secure Energy. COM(2006) 105

6 World Energy Outlook, 2007

7 Hiro, D. (2008). Blood of the Earth: the global battle for vanishing oil resources.

8 White Paper. Energy for the Future; COM(1997)599

9 Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal market.

10 Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport.

11 Available at [www.fern.org/media/documents/document\\_4245\\_4246.pdf](http://www.fern.org/media/documents/document_4245_4246.pdf)

12 Proposal for a Directive on the promotion of the use of energy from renewable sources. COM(2008)19

specific – and controversial – target of each Member State having at least a 10 per cent share of renewable energy in the transport sector (primarily made up of biofuels) by 2020.

Beyond this transport target, the composition of the EU's RES target has not been spelled out. There is, as yet, no specific target for the contribution in the RES mix of biomass or, by extension, for woody biomass. However, the main policy objectives were laid down: the securing of supply, the promotion of environmental sustainability along with combating climate change; job creation and the establishment of competitiveness and affordability in the market.

Taken together, overall policy made up the so called 20/20/20 package: a 20 per cent RES share in energy and a 20 per cent lowering of GHG emissions, all by 2020.

## Chapter II

## Renewables and biomass: what they are and how they fit into the EU's energy mix

***“Not nearly enough attention in the EU has been given to how more heat and electricity can be generated from wood based products, particularly through highly efficient combined heat and power plants. The technology might not be sexy but it's there – we know how to do it.”***

*Sten Nilsson from IIASA (International Institute for Applied Systems Analysis)*

In lay terms, renewables are what they say they are – energy sources which can be reused and renewed. Non-renewables on the other hand are energy resources, which are depleted and will eventually run out. RES include solar energy, geothermal energy, wind energy, wave and tidal energy, hydroelectric energy, and energy derived from biomass, or bio-energy.

Biomass is essentially biological material originating in living, or recently living, organisms. It is obtained either directly from plants, indirectly from agricultural or domestic products, or from industrial or commercial production processes.

In the broadest sense, fossil fuels are also biomass – made up of living matter, which has formed over millions of years. But the important difference between energy derived from biomass and energy derived from fossil fuels is one of time. If managed on a sustainable basis, biomass is harvested as part of a constantly replenished crop over a few months or years thereby forming part of the natural 'above ground' carbon cycle. By contrast, fossil fuels – though also derived from biological material – are the product of many millenniums and the CO<sub>2</sub> released when such fuels are exploited and burned will not be replenished – or, if at all, certainly not for millions of years.

Whether oil supplies are coming to an end is a hotly debated matter.<sup>13</sup> Supplies of gas – viewed as a 'cleaner' energy source than oil – are plentiful in some parts of the world but subject to access difficulties due to infrastructure and other constraints. The world is believed to still have plentiful supplies of coal but it is the most GHG harmful of the fossil fuels and its use needs to be drastically cut back in order to meet the challenges of climate change. Whatever the

<sup>13</sup> Hiro, D (2008). *Blood of the Earth: The global Battle for vanishing oil resources*. Politico's 2008. International Energy Agency (IEA). *World Energy Outlook 2007 & 2008*



arguments about the supply side, it seems we can no longer afford the profligacy of the past. The rush to renewables, including biomass, is on.

Biomass is carbon based, composed of a mixture of organic molecules containing hydrogen and usually atoms of oxygen, nitrogen and small quantities of other atoms. If plants are eaten by animals the material is converted into animal biomass. If not eaten, they are either broken down by microorganisms or burned.

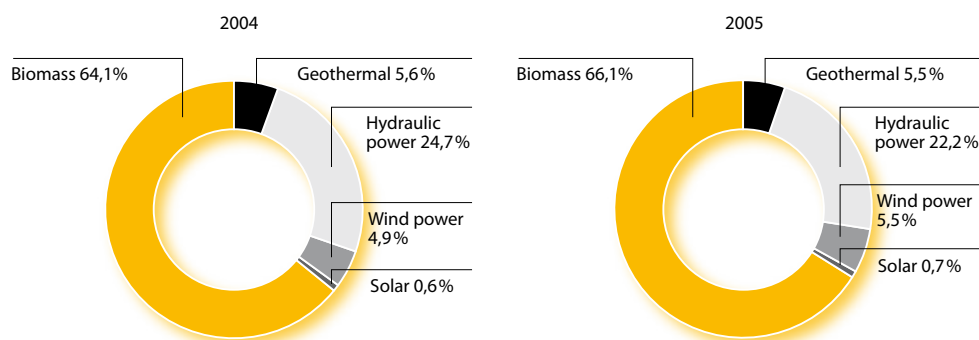
If biomass grown in an area over a 12 month period is more than the amount there before, it is known as the annual increment: therefore if the amount harvested and consumed or burned is less than the annual increment, this can be considered as a sustainable energy cycle.

If managed correctly, biomass is a fuel, which can be sustained and be capable of delivering significant reductions in net carbon emissions – especially when compared with fossil fuels. But biomass is not a perfect fuel – strictly speaking no fuel or energy source is ‘carbon neutral’. Biomass can however be a low carbon fuel as long as the carbon emitted during the biomass cycle (as a result of planting, harvesting, processing, transport or the use of fertilizers or pesticides) is kept to a minimum. As there is concern that first generation biofuels related to the transport sector may in fact produce more GHG emissions than they save, it is essential that a similar situation is not created with woody biomass.

At present, six per cent of the EU’s energy consumption comes from RES<sup>14</sup> – or 112 mtoe (million tons of oil equivalent) out of an EU total energy consumption of 1,756 mtoe. As Figure 1 shows, biomass constitutes by far the largest portion of RES power generation, followed by hydropower, wind energy – which is expanding rapidly – geothermal and solar.

**Figure 1: Share of each resource in the renewable energy production for the EU25 in 2004 and 2005.**

Source: European Commission energy website [http://ec.europa.eu/energy/res/index\\_en.htm](http://ec.europa.eu/energy/res/index_en.htm)



### The great biofuel debate<sup>15</sup>

In the debate concerning energy needs and climate change, few topics in recent years have raised quite as much controversy as biomass derived biofuels. Once heralded as one of the great energy sources of the future and a key element in cutting back on fossil fuel-based CO<sub>2</sub> emissions, biofuels have come under attack on a number of fronts – blamed for sharply escalating world food prices, the destruction of tropical forests and potentially increasing, not decreasing, GHG emissions.

The EU, at the forefront of a global drive promoting the use of biofuels, is setting a target of a 10 per cent use of renewable energy in transport by 2020, primarily made up of biofuels. The proposal has been strongly opposed, not just by a broad spectrum of NGOs but also by some of the EU's own advisory bodies.<sup>16</sup> Suddenly biofuels have gone out of fashion.

The main criticism of biofuels is that they have contributed to sharp rises in global food prices over the past year. Biofuels' role in these rises is subject to a number of views, but the UN's Food and Agriculture Organisation (FAO), the Organisation for Cooperation and Development (OECD), NGOs and others say taking land out of food production in order to cultivate agrofuel crops has been a major factor contributing to price increases and pushing millions round the world further into poverty.

Patterns of food production and consumption within the EU have, say the critics, also been disrupted by biofuels. Thoenes<sup>17</sup> points out that increasing amounts of land are being turned over to agrofuel crops such as rapeseed oil. This means that there is a growing gap in EU food supplies, which has resulted in increased imports of about 2.5 million tons of food oil since 2002, a significant jump on historic growth rates. The EU's Biomass Action Plan (BAP)<sup>18</sup> said that in 2005, there was a total of 97 million hectares of arable land in the EU25 (without Romania and Bulgaria who have joined since that time) of which, it said, about 1.5 million hectares were producing raw materials for agrofuels. But the BAP also said that if anticipated targets on RES were to be met, 17 million hectares of land would be needed to satisfy EU biofuel demand.

There are those, in particular the US administration, who say biofuel production has only had a minimal effect on food prices and production patterns: they say rising demand from the fast developing economies, especially China and India, is a key reason behind the ever increasing food prices.

Another criticism of biofuel production is that it has done very little to tackle GHG emissions and climate change. In fact, say the critics, it has only added to the problem. On a global scale, more and more land is being turned over to biodiesel production. All but a small portion of Brazil's Atlantic rainforest, a precious ecosystem, has already been lost, supplanted by sugar cane for biofuel production. The Amazon rainforest – a vital carbon 'sink' – is under threat not

15 see FERN's briefing 'When the solution is the problem: the EU and its policies on biofuels'. Available at [www.fern.org/media/documents/document\\_4245\\_4246.pdf](http://www.fern.org/media/documents/document_4245_4246.pdf)

16 For details see FERN's Briefing note 'When the solution is the problem' available at [www.fern.org](http://www.fern.org)

17 Thoenes, P. (2006) Biofuels and commodity markets – palm oil focus. Paper presented in AgralInforma conference, Brussels, 24-25 October 2006. Available at: [http://www.fao.org/es/esc/common/ecg/122/en/full\\_paper\\_English.pdf](http://www.fao.org/es/esc/common/ecg/122/en/full_paper_English.pdf)

18 Biomass Action Plan. Communication from the Commission. COM (2005)628

only from cattle ranchers but also from farmers anxious to grow agrofuel crops, particularly soybeans.

The same is the case in Southeast Asia; vast palm oil plantations are replacing tropical rainforest in Indonesia and Malaysia. On the island of Borneo, peat bogs that once underlay the forest are now being exposed and drying out. As a result, large quantities of GHG are likely to be released into the atmosphere. In tandem with these land use changes, people are being displaced, giving rise, in many cases, to increased poverty levels and more social conflicts.

Such developments – happening outside the EU but in part caused by demand from Europe’s biofuel industry – are referred to as indirect land use changes. Land is cleared, forests are burned down – and more GHGs are released. The EU’s Joint Research Centre (JRC) says GHG emissions arising from such indirect land use changes could outweigh any GHG savings made through the use of biofuels.<sup>19</sup>

*“For first generation biofuels made in the EU it is clear that the overall indirect emissions are potentially much higher than the direct ones whilst they are unlikely to be much lower”* says the JRC. The OECD has a similar view. *“The reduction of greenhouse gas emissions is a primary reason for current biofuel policies but the savings are limited... overall, the continuation of current biofuel support policies would reduce greenhouse gas emissions from transport fuel by no more than 0.8 per cent by 2015”*.<sup>20</sup> Yet the EU BAP states that as long as various sustainability criteria are abided by, biofuel use in the transport sector will have a positive effect on overall GHG emission levels.<sup>21</sup>

Another criticism levelled at biofuels is their impact on biodiversity. As noted, areas of tropical rainforest – home to a majority of the world’s species – are under threat from biofuel production. In Europe, areas of land designated as set-aside under the EU’s Common Agricultural Policy (CAP) have been turned over to rapeseed and maize crops. This means that valuable habitats of many European farmland birds have been lost. Habitats of many mammals might also be threatened.<sup>22</sup> Critics of the biofuels policy also say crops such as rapeseed do not encourage biodiversity and often demand large inputs of fertilizers and pesticides, affecting soil composition and water courses.

Then there is the question of the economics of biofuels. The EU has an extensive support system for biofuels. Both the JRC and the OECD have questioned whether this system is economically viable. *“The cost disadvantage of biofuels is so great with respect to conventional fuels (at least in the mix foreseen in the scenarios analysed) that even in the best of cases, they exceed the value of the external benefits that can be achieved,”* says the JRC.<sup>23</sup> Analysing overall spending on the support system, the JRC says the net cost to European taxpayers over the period 2007 to 2020 would amount to between 33 and 65 billion euros.

The question of support and subsidies has wider implications. When the EU first announced

19 JRC (2008). *Biofuels in the European Context: facts and uncertainties*.

20 OECD (2008). *Economic Assessment of biofuel support policies*.

21 Biomass Action Plan. *Communication from the Commission. COM (2005)628*

22 Birdlife International (2008). *Fuelling the ecological crisis. Six examples of habitat destruction driven by biofuels*.

23 JRC (2008). *Biofuels in the European Context: facts and uncertainties*.



its policy on biofuels and talked of targets for the transport sector, it was not only the farming sector that saw opportunities and started turning land over to crops such as rapeseed. Many investors also put considerable sums into the biofuel processing industry. Yet many of those early investment plans have been dashed – and not just by the growing opposition to biofuels from NGOs and others.

The problem for the EU biofuel industry has been the lavish subsidies – well in excess of those paid to EU producers – paid to the US biofuel sector which have, in many cases, served to undercut EU production. Approximately 1m tonnes of biofuels in the form of biodiesel were imported into the EU from the US last year,<sup>24</sup> competing with and undercutting EU producers. Furthermore, a proportion of that amount, about 10 per cent,<sup>25</sup> is believed to have been made up of so called ‘splash and dash’ biofuel – EU produced biofuel that is shipped to the US where small amounts of biofuel are added in order to take advantage of US subsidies, and then shipped back into Europe.

Such trade not only distorts the EU market. There are also concerns that amounts of biofuel are being imported into the EU via with the US which are of unknown provenance, potentially undermining attempts by Brussels to ensure that all imports come from sustainable sources.<sup>26</sup> The tankers to and fro across the Atlantic releases substantial amounts of GHG emissions. Meanwhile biofuel tanker owners say the trade is causing a worldwide tanker shortage.<sup>27</sup>

There is also the question of whether the subsidies driving the headlong rush into biofuel production – in the EU, the US and elsewhere – has diverted public funds from investment in other areas of biomass production, such as woody biomass.

Finally, there is the weather. In many parts of northern Europe, the summer of 2008 has been characterised by large amounts of rain. In some parts of the UK, one of the main source countries for oil seed rape in the EU, the wet weather has meant that crops have had to be left, unharvested, in the fields.

The bad weather has also threatened pollination connected with oil seed rape: bee experts say a combination of heavy rains and disease has resulted in less bee activity, causing not only serious shortages of honey but is likely to have big implications for rape and other crops.<sup>28</sup>

The result of this combination of factors is likely to be a shortage of agrofuels in the EU, price rises and more imports.

### The EU's biomass potential

The EU's renewable sector has to grow substantially if ambitious targets are to be met. While wind, wave and other RES are likely to grow over the years, biomass is still anticipated to account for the bulk of renewables by 2020. According to the EU BAP, there is the potential to

24 Guardian. April 1 2008. Undercut and under fire:UK biofuel feels heat from all sides

25 ibid

26 ibid

27 Lloyds Register, April, 2008

28 <http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2008/09/02/eahoney102.xml>

double biomass use over the 2003 to 2010 period: this would mean biomass energy production within the EU would increase from 69 mtoe in 2003 to about 185 mtoe in 2010. In so doing, says the BAP, not only would energy supplies be diversified, but GHG emissions would also be sharply reduced and thousands of jobs created in rural areas.<sup>29</sup>

The European Environment Agency (EEA) sees waste biomass, in the short term at least, as the main contributor to energy production in the biomass sector.<sup>30</sup> Such biomass includes waste from agriculture, industry and food. It also includes waste residues from the wood processing industry and black liquor. The EEA sees this waste related energy production rising substantially, reaching 100 mtoe by 2010.

However, in relation to wood based waste products, the EEA notes a paradox in such projections: while countries like Sweden and Finland have large paper and pulp installations, these industries might be scaled down over time as a result of high energy costs and GHG emissions requirements. Wood supplies might also be diverted to energy production. The result would be less industry throughput – and less residues and black liquor – and therefore less woody biomass production from indirect supply sources.

Both the BAP and the EEA project that after 2010 the total energy figure derived from waste remains more or less constant while the potential target figures for energy crops from agriculture – which include coppicing operations and other so called wood based energy crops – are far more ambitious, climbing from 2 mtoe consumption in 2003 to 45 mtoe in 2010, and between 76 and 94 mtoe in 2020, rising to 142 mtoe in 2030.

According to these projections, agrofuels will therefore account for about 50 per cent of the biomass share of RES in 20 years time – way above the present figure, yet, as noted, the promotion of agrofuels in EU RES policy, particularly in relation to targets on transport, is coming under increasing fire from a number of standpoints.

So, in this situation, what contribution can wood based biomass make to RES?

There are those who feel that due to environmental and supply related constraints, any large scale increases in energy supplies from indirect, industry based wood sources within the EU are limited,<sup>31</sup> but this view is by no means held by everyone. Europe's wood industry is becoming increasingly interested in the production of bioenergy. Others<sup>32</sup> say there is still a great deal of wastage in production of wood based raw materials and industrial processes. Considerable amounts of bioenergy could still be harnessed in the journey from forest to consumer, by changing production methods and taking account of by-products and waste products.

The direct supply sector is felt by many to have considerable potential, though here again, data is often limited or confusing. While in some countries forests are in state hands, as in the UK where the Forestry Commission controls about 50 per cent of total forest area, or are managed by large pulp and paper concerns as in some of the Nordic countries, around 50 per

29 Biomass Action Plan. Communication from the Commission. COM (2005)628

30 EEA (2006). How much bioenergy can Europe produce without harming the environment?

31 JWEE (2007). Wood Energy in Europe and North America : A new estimate of volumes and flows. February 2007.

32 Including Via Campesina, personal communication T. Östling.

cent of forests in the EU are controlled by many thousands of private owners<sup>33</sup>. Perhaps due to the complexity of dealing with multi-ownership and because of the various social and environmental factors in connection with forestry and wood based resources, clear policy guidelines and investor stimuli have been lacking, affecting the greater uptake of energy from these sources.

Several factors are cited in the EU's BAP and by the EEA in assessing the potential of wood based biomass. Though Europe has a high population density, a large area of its land – about 30 per cent – is covered by forest. Though about a quarter of this area of forest is under various protective measures to do with nature conservation, recreation, water supplies and related factors, there remain substantial stretches of forest which are, according to the EEA, under-exploited in terms of forestry biomass.

Europe, in contrast to many parts of the world, has timber growth in excess of its extraction rate. At present, according to the EEA, annual felling rates are approximately two thirds of the increment or growing back rate, though these figures have been disputed – there are those who say the increment is not nearly as large as calculated<sup>34</sup> and that in many areas of Europe the extent of forest has been overestimated. In its BAP, the EU says that about 35 per cent of annual growth in EU forests is not used.

Meanwhile, representatives of forest owners say that of a total annual increment of 600 million m<sup>3</sup> of wood in the EU, only between 60 and 65 per cent is used.<sup>35</sup> This means, in theory at least, that there is a considerable opportunity to exploit Europe's abundant forestry for biomass purposes. Not only is there potential in terms of direct supply of wood: the residues from processing could provide additional bioenergy, along with the further processing of felled wood remnants.

There is also the potential of using for bioenergy production increasing amounts of woody materials in the recovered wood supply category such as cast off furniture or building materials that might at present be going to landfill.

### Woody biomass and biofuels

As already noted, the first flush of enthusiasm for agrofuels has quickly evaporated. At present, EU policy makers seem intent on keeping to the transport fuel target but, aware of the criticism levelled at agrofuels and facing the challenge of meeting the 20 per cent RES target by 2020, attention is increasingly being turned to other biomass products.

In a 2006 EU document<sup>36</sup> it was calculated that 31 mtoe annually would be needed in order to meet the transport sector target on RES alone. Obviously, in order to generate such energy volumes and, based on the dominant role wood sourced materials play in the EU's present RES mix, a vast amount of wood and wood associated products would be needed – perhaps more

33 [http://www.unece.org/timber/docs/stats-sessions/stats-30/presentations/pfo\\_in\\_Europe\\_results\\_of\\_dp.pdf](http://www.unece.org/timber/docs/stats-sessions/stats-30/presentations/pfo_in_Europe_results_of_dp.pdf)

34 Mantau, U. UNECE/FAO Geneva Timber and Forest Discussion Papers 48. Jan 07

35 Statement of Eurofor, Copa-Cogeca, CEPE, FECOF, Nordic Family Forestry. Available on [www.pefc-norge.org/vedl/FP2112-3E.pdf](http://www.pefc-norge.org/vedl/FP2112-3E.pdf)

36 Communication from the Commission to the Council and the European Parliament. Renewable Energy Roadmap. Impact Assessment SEC(2006)1719



than the world, let alone the EU, would be able to satisfy. How to satisfy demand, according to some officials working on biofuels policy, is a key issue, and still unanswered.

A related factor is that the technology to produce liquid fuels from other biomass besides agrofuels – products referred to as second generation biofuels – is still in its early stages of development and is very expensive. In its 2008 report, the JRC concluded that even if second generation biofuel development continued and economies of scale were achieved through the building of several processing plants, these new biofuels would still be more expensive than first generation biofuels up to and after 2020.

The EU's critics say that the RES policy on transport is ill conceived and misguided and needs to be carefully rethought. If not, similar mistakes could happen again, for instance in connection with second generation biofuels and producing liquid fuel from woody biomass. Some say that the whole question of meeting energy targets is misplaced: what is needed is a revolution in the way we live and travel – comprehensive measures and policies have to be brought in aimed at saving rather than exploiting resources.

If there was a shift to producing biofuels from wood based products, then the competition for resources would intensify and prices would climb. More and more imports of wood resources would be likely. What is needed, say the EU's critics, is more efficiency in the transport sector.

Another question in relation to any big shift towards using wood based products for the production of biofuels is supply and demand in the market. As explained in the next chapter, nearly 80 per cent of biomass in the EU already comes from wood based products, mostly used either in heating or for electricity generation. One of the major users of wood – and also producers of wood based RES products – is Europe's large and well established pulp and paper industry.

## Chapter III

## Wood based energy or woody biomass within the EU

*“The quality and availability of data on Europe’s wood resources needs to be improved. We have seen recent studies from Germany, France and Italy which prove that domestic, unrecorded wood consumption has been higher than previously thought. Additionally we do not have a clear understanding of how implementation of the Natura 2000 network will influence harvestable levels.”*

*Laszlo Mathe from WWF*

Clear, up to date and reliable statistics on the production and use of wood based energy in the EU are difficult to come by, clouded by differing terminology and categories, and the presentation of various figures including or excluding particular Member States. An illustration of the general confusion is that only now is the EU in the early stages of a process aimed at coming up with a definitive inventory of the extent of its forests. It should be noted that the EU once had an ambitious programme ‘Forest Focus’ to collect and deliver data on Europe’s forests to guide improvements to climate and biodiversity policies. This programme was unwisely, and for unclear reasons slashed by DG Environment in March 2006.<sup>37</sup>

Confusion, and a lack of solid data in connection with forests and wood resources is not just a problem in the EU. Governments, UN organisations and NGOs around the world cannot, for instance, agree on a common definition of what does, and does not, constitute a forest. Is a forest a few trees, a plantation, does it have to be of a certain size and height? One study found that more than 500 different definitions for forests and wooded areas were in use – with some countries adopting several such definitions, all at the same time.<sup>38</sup> The official FAO definition does not make a distinction between a large-scale industrial tree plantation and a forest but chooses to describe a forest any area of trees with a crown cover of more than 10 per cent.<sup>39</sup>

Not only are these bodies confused: there is also the question of personal perception. For example an industrialist, a hunter, a conservationist – or a EU policy maker – might each look at and define forests and wooded areas in their own very different way.

37 Forest Watch March 2006, [www.fern.org](http://www.fern.org)

38 Lund, H. G. (2007). Definitions of Forest, Deforestation, Afforestation and Reforestation, <http://www.forestinfoservices.com/docs/DEFpaper.html>

39 For a critique of the FAO definition please see [http://www.rainforestfoundationuk.org/Irrational\\_Numbers\\_Why\\_the\\_FAOs\\_Forest\\_Assessments\\_are\\_Misleading](http://www.rainforestfoundationuk.org/Irrational_Numbers_Why_the_FAOs_Forest_Assessments_are_Misleading)

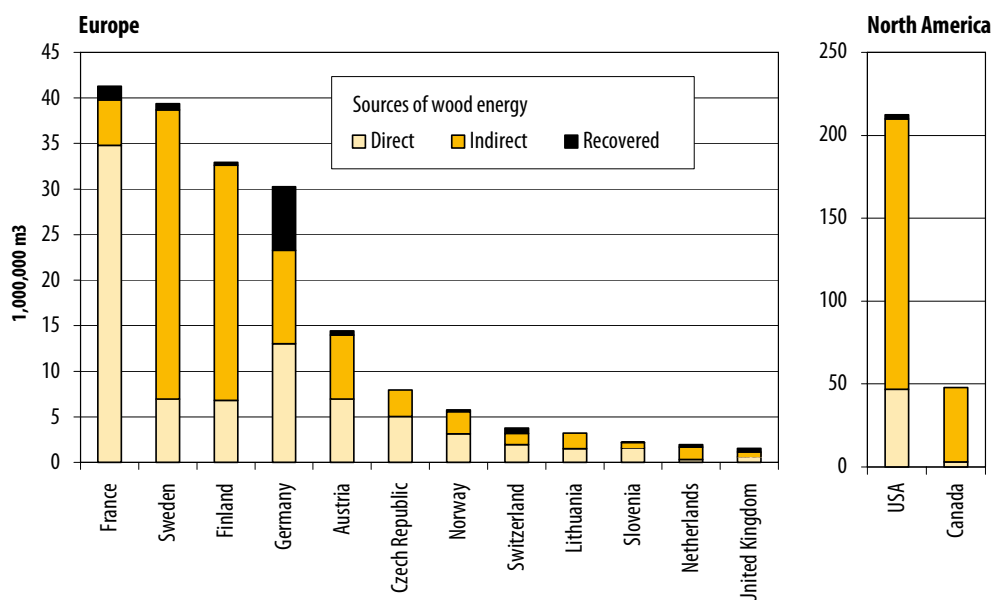
Sources of wood energy can be divided into three main categories, though again the situation is confused in that different organisations and bodies tend to use various definitions and terminology.

**Direct supply** is mainly made up of wood collected and used directly from the forest. **Indirect supply** is made up of both processed and unprocessed woods from wood processing industries and its industrially generated co-products or residues including sawdust pellets and wood liquids or black liquor. Together these two categories make up the bulk of the EU’s wood based energy: indirect supply accounts for 49 per cent of the total while direct wood supply – almost all made up of private household energy use – makes up 45 per cent.<sup>40</sup> A further six per cent is from a category termed **recovered wood supply** which is made up of recycled wood products such as pallets and wood used in construction and furniture, which is then used for energy production.

These general statistics on EU *wood based energy* are somewhat misleading however as they hide great differences and disparities between the countries concerned. Countries with large and well-established forestry industries and large forests, such as Finland and Sweden, tend to be the leaders in indirect wood energy use within the EU. On the other hand, countries with smaller, more traditional forest industries and with large forest resources, such as France, the Czech Republic and Slovenia, are more dependent on direct wood energy. In France, in particular, this is the case – and if that country was taken out of the equation, overall EU energy use from direct supply would be considerably smaller.

**Figure 2: Wood fuel sources for Europe and North America**

Source : JWEE (2007). Wood Energy in Europe and North America: A new estimate of volumes and flows. February 2007.



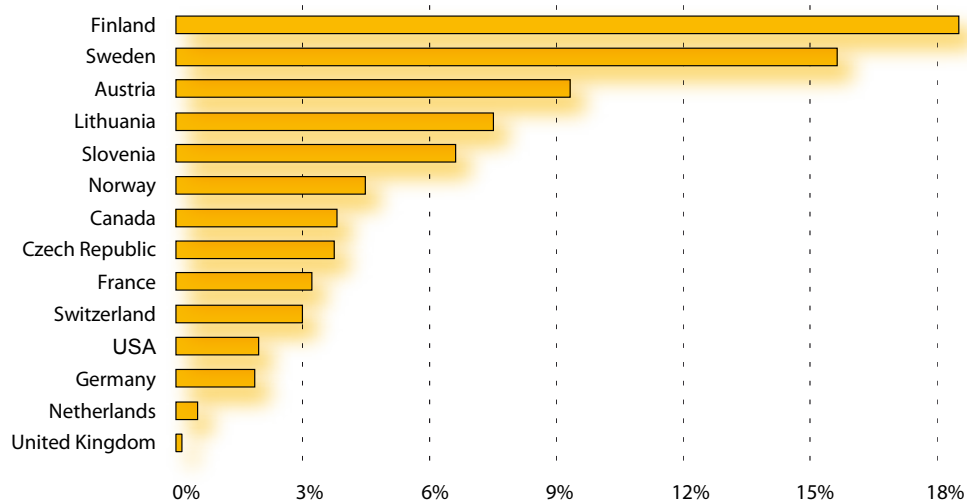
The amount of energy from the various categories of wood supply is influenced by other factors including the number of rural households and the policies of individual countries relating to support for wood based power systems. Also energy produced from coppicing and stands of trees such as willow planted specifically for energy generation is not taken into account. This sector – often placed in the category of energy producing agricultural crops – is seen by some to have great potential for energy production in the future.

In the main, wood based energy usage is expressed in terms of physical forest sector units (m<sup>3</sup>, tons, m<sup>3</sup> roundwood equivalents) or in energy terms (million tons of oil equivalent or mtoe). While more than 80 per cent of wood based energy in France comes from direct supply, in Finland the position is more or less reversed, with nearly 80 per cent of its wood based energy coming from indirect supply.

The FAO and others, in their Joint Wood Energy Enquiry published in early 2007, noted that shortcomings in data collection systems had severely underestimated energy generated from indirect sources. This was mainly attributed to analysts new to the sector tending to focus attention on direct – i.e. household firewood generated energy – while neglecting the very important role of the industrial sector. An overall picture of the relative importance of wood based energy in various countries' energy supplies is given in Figure 3.

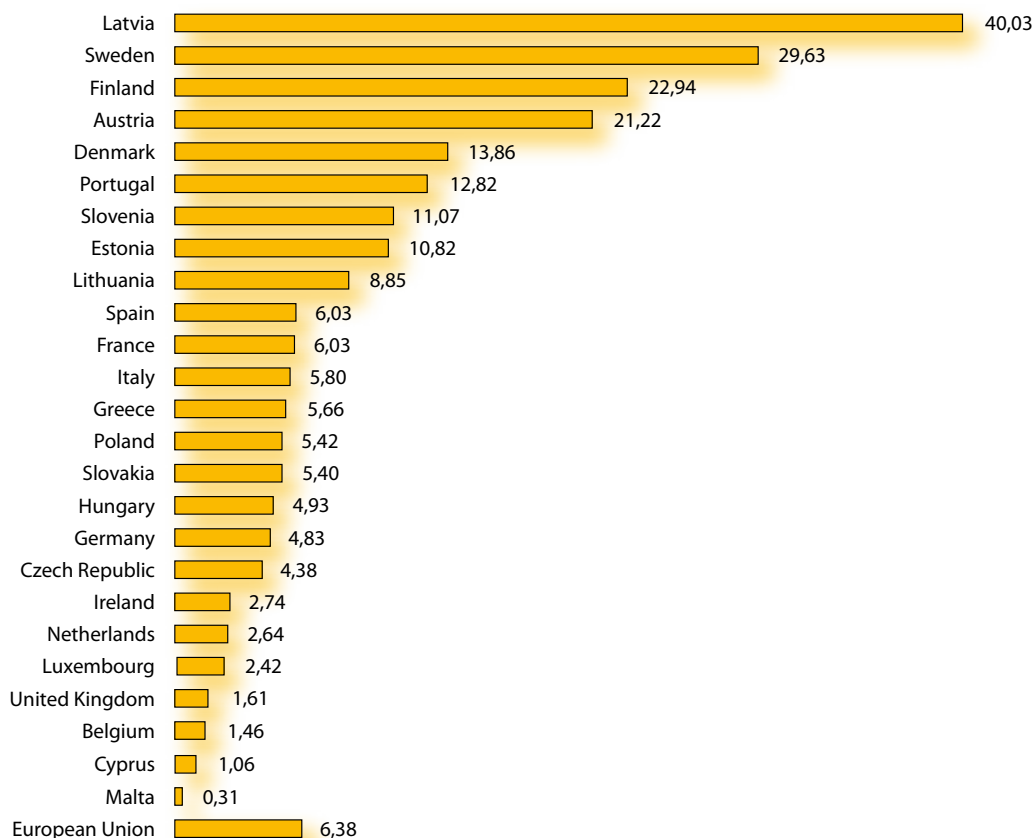
**Figure 3: Role of wood energy in Total Primary Energy Supply (in %).**

Source: JWEE (2007). Wood Energy in Europe and North America: A new estimate of volumes and flows. February 2007



**Figure 4: Share of renewable energies in primary energy consumption of European Union countries in 2005 (in %).**

Source : European Commission energy website [http://ec.europa.eu/energy/res/index\\_en.htm](http://ec.europa.eu/energy/res/index_en.htm)



Despite the lack of clear data and the statistical confusion, there is little doubt that, in terms of overall energy production, wood and wood based products play a critical role in the EU's present energy mix. According to the EU, in 2005 RES accounted for 6.4 per cent of primary energy consumed overall in the EU.<sup>41</sup> Figure 4 shows the wide variations: at one end of the spectrum Latvia is dependent on RES for 40 per cent of its energy consumption and Sweden nearly 30 per cent while, at the opposite extreme, in both the UK and Belgium the RES figure is barely 2 per cent.

Within the RES sector, as Figure 2 (page 23) shows, biomass made up around 65 per cent of RES produced in 2004 and 2005 – and within that biomass portion, the general consensus of various organisations and bodies is that up to 80 per cent of biomass is sourced from wood and wood based products.

41 [http://ec.europa.eu/energy/res/index\\_en.htm](http://ec.europa.eu/energy/res/index_en.htm)



## Chapter IV

## Competition for wood resources

***“European forestry alone cannot satisfy the growing demand for solid biomass for energy purposes...forest owners, forest based industries and others in the wood supply chain need the support of governments, both policy wise and with incentives, so that more wood and woody biomass can be effectively mobilised making the sector a key enabler for meeting the targets.”***

*The Confederation of European Paper Industries (CEPI)*

***“The major constraint on the expansion of wood based heat and electricity is competition for resources with the paper and pulp industry but as the sector matures this could well die away,”***

*Sten Nilsson from IIASA*

Europe’s paper and pulp industry is a major player in the overall economy. According to the Confederation of European Paper Industries (CEPI), the industry is responsible for 27 per cent of global paper and pulp production, employs nearly 260,000 people in Europe and, together with other forest-based industries, has an annual turnover of more than 75 billion euros.<sup>42</sup>

As noted, there has been a tendency for analysts of the EU’s woody biomass sector to concentrate on the direct supply side – wood from forests and associated products – while neglecting the indirect, mainly industrial supply area. Yet according to CEPI, the industry is both the largest producer and consumer of biomass based energy in Europe – producing 25 per cent of the EU total.<sup>43</sup>

Already there is competition between the industry and the bioenergy sector for wood resources. The many thousands of European forest owners – both big and small – and the woodworking industry also compete for wood resources.<sup>44</sup> Land availability is a huge issue. See also next chapter. CEPI says the EU’s ambitious RES targets will further increase the pressure on wood and woody biomass and, in regard to expanding demand for resources concludes that ‘energy efficient users’ – such as the paper industry – must be given priority in ‘the resource hierarchy’.<sup>45</sup>

<sup>42</sup> Fact and Figures on [www.cepi.org/content/default.asp?pageid=101](http://www.cepi.org/content/default.asp?pageid=101)

<sup>43</sup> CEPI (2007). Bio-energy and the European pulp and paper industry. Prepared by McKinsey & Company & Poyry Forest Industry Consulting

<sup>44</sup> Statement of Eurafor, Copa-Cogeca, CEPF, FECOF, Nordic Family Forestry. Available on [www.pefcnorway.org/vedl/FP2112-3E.pdf](http://www.pefcnorway.org/vedl/FP2112-3E.pdf)

<sup>45</sup> CEPI (2007). Bio-energy and the European pulp and paper industry. Prepared by McKinsey & Company & Poyry Forest Industry Consulting

European forestry alone cannot satisfy biomass demand, says CEPI: in order to meet RES targets, policies and incentives should be brought in that will stimulate biomass production – mobilising existing resources and encouraging new ones. It says more production of solid biomass on agricultural land through the planting of new long-standing energy crops including short rotation forests and energy grass is needed. While the paper and pulp industry has in the past been wary of EU biomass plans and policies, both EU officials and observers of the industry feel attitudes are changing. The industry is now aware of the large scale potential for the use of wood based products in the heating and electricity generating sectors.

Pulp and paper plants have been market leaders in Europe in establishing combined heat and power systems utilising wood resources. Moreover, due to the activities of the industry and other small wood processing enterprises, it is pointed out that much of the infrastructure for generating heat and electricity from woody biomass is already in place – therefore making such energy far cheaper than power generated from heavily capital intensive wind, solar or wave projects.

Due to recent price rises for fossil fuels, industry experts say energy from woody biomass can increasingly compete with oil and gas while costs of generating electricity with biogas from biomass can now undercut production at oil and gas fired power plants.<sup>46</sup>

The JRC, in its report on biofuels, says the efficiency of modern biomass burners is nearly as high as fossil fuel burners. In heating and electricity production, 1 MegaJoule (MJ), of biomass replaces about 0.95 MJ of fossil fuel. However the JRC notes that transforming biomass into liquid fuel is far less efficient, with 1 MJ of biomass replacing only around 0.35 to 0.45 MJ of crude in the transport sector.<sup>47</sup>

The EEA, while recognizing constraints in supply and the likelihood of rising prices for wood products impacting negatively on the paper and pulp industry in the future, says Europe has considerable wood based resources that can be exploited. These include various forest residues in central Europe and the United Kingdom and resources that can be harnessed through an increase in felling, particularly in central Europe, Italy, France and the United Kingdom.<sup>48</sup>

Yet heating and power generation from wood is subject to a number of constraints.<sup>49</sup> In some parts of Europe, large-scale heating systems are in place, which could be – or already have been – adapted to wood based Combined Heat and Power (CHP) systems. However in many parts of Europe, the market is scattered and there is a lack of neighbourhood heating schemes, making tie-ups to CHP plants difficult. Also, both in the case of heating and electricity generation from woody biomass, it would seem necessary to be close to forestry resources. Extended supply lines would not only increase costs but also mean substantial transport related GHG emissions.

46 Geneva Timber and Forest Discussion Papers 48 UNECE/FAO Jan 07

47 JRC (2008). Biofuels in the European Context: Facts and Uncertainties.

48 EEA (2006). How much bioenergy can Europe produce without harming the environment?

49 Biomass Action Plan. Communication from the Commission. COM (2005)628, pg 13

## Chapter V

## The environment and biomass

There are very few fuel sources – if any – which can be said to have absolutely no effect on the environment. In many cases wind generated power installations have come under attack for the noise they produce, for endangering birdlife and for their effect on the look of the landscape. Plans for large-scale wave and tidal power installations are being questioned in some cases for their potential effects on bird and aquatic life. As noted, fuels produced from agricultural crops, or agrofuels, have come under fire from a number of quarters. Biomass does not escape environmental criticism.

In relation to biomass, first there is the issue of land availability. As global population increases, there are ever more pressures on land – for food production, for fibres and, most recently, for fuel. If present levels of demand continue, the International Institute for Applied Systems (IIASA) calculates that by 2030 there could be a total world shortage of about 250 million hectares of land. They calculate that out of the 250 to 300 million hectares of available land, 25 million will be taken up by 2030 by the industrial forestry sector, 200 million will be required for agricultural demand and 290 for bio-energy production, totalling 515 million hectares, while only 250 to 300 is available.<sup>50</sup>

As already noted, Europe's thirst for agrofuels is likely to have detrimental environmental impacts outside the EU – in Brazil, in Indonesia, in Malaysia. Furthermore, it can lead to increased conflicts over precious land resources.

There has been much discussion recently of jatropha, a tropical shrub that grows on marginal lands with seeds capable of producing up to 40 per cent oil. Big investments have been made in India in what is cited as an ideal feedstock for biodiesel: yet studies have shown that while small scale jatropha planting is feasible, large, high yield production can have detrimental environmental impacts. It can also result in hundreds of thousands of people being displaced from marginal lands on which they depend for survival.<sup>51</sup>

Within Europe, various attempts have been made at calculating how much land is available for

50 Nilsson, S. (2008) Globalisation/competitiveness of the forest sector. Presentation at FTP Conference Kranjska Gora, Slovenia, 20 May 2008

51 Jongschaap, R.E.E., Corré, W.J., Bindraban, P.S. & Brandenburg, W.A. (2007) Claims and facts on *Jatropha curcas* L. – Global *Jatropha curcas* evaluation, breeding and propagation programme. Plant Research International, Wageningen, UR. Available at: [http://www.fact-fuels.org/media\\_en/Claims\\_and\\_Facts\\_on\\_Jatropha\\_WUR](http://www.fact-fuels.org/media_en/Claims_and_Facts_on_Jatropha_WUR)

biomass production and, as part of that calculation, how much is available for woody biomass production. The EEA, in its 2006 report, tried to come up with a definition of what is – and is not – regarded as environmentally acceptable in relation to the production of bioenergy, defined as the amount available for energy generation without any additional pressures being placed on biodiversity, soil and water resources. The EEA adds that such production must also be compatible with present and future environmental policies. Within its criteria, the EEA calculates that land available for biomass production could increase by 50 per cent to 19 million hectares by 2030 – 13 million by 2010. The available land is mainly in seven countries – Spain, France, Germany, Italy, the UK, Lithuania and Poland.

There are a number of caveats in the EEA's calculations: five million hectares of the 19 million total might be given over to food export crops, particularly in Germany and France. The EEA notes that within many parts of the EU there is already an intensive use of agricultural land. Increased production of biomass could cause additional pressures on agriculture and forestry biodiversity.

There are several other environmental impacts in relation to increased biomass production, some of which have already been noted. Both Birdlife International and the World Wildlife Fund have drawn attention to the large amount of fertilizer and pesticide inputs needed for such crops. Such applications can affect soil quality and water supplies. There is particular concern about increased levels of fertilizers giving off nitrous oxide (N<sub>2</sub>O), a considerably more powerful GHG than CO<sub>2</sub>. One study<sup>52</sup> concluded that biofuels production emitted more GHG in the form of N<sub>2</sub>O<sub>s</sub> than they saved as CO<sub>2</sub> in fossil fuels, though the JRC casts doubt on such findings. Such diverse views are not surprising as it's still not possible to conclusively estimate global nitrous oxide emissions from farming.

The EEA concludes that, within its environmental parameters, significant amounts of biomass are technically available: as already shown, projected biomass production will rise from 69 mtoe in 2003 to 190 mtoe in 2010 and 296 mtoe in 2030. Under this scenario, biomass would make a very substantial contribution to the EU's overall RES targets, making up between 15 and 16 per cent of the projected energy needs of the EU in 2030, compared to a 4 per cent share in 2003. (Romania and Bulgaria are excluded from the calculations.)

Meanwhile the JRC says pressures on land within the EU and other factors are likely to necessitate considerable biofuel imports. It says on present projections, up to 50 per cent of biodiesel feedstock might have to be imported by 2020.

In relation to wood, the EEA states that the potential of environmentally compatible bioenergy available from forestry would remain fairly constant over the 2003 – 2030 period, contributing about 40 mtoe annually to the RES mix. However an additional 16 mtoe annually could become available for bioenergy purposes from the forestry industry, as prices rise and CO<sub>2</sub> emission regulations impact on the EU's paper and pulp sector. This shift would however also mean a reduction in energy available from industry residues, including black liquor.

52 Crutzen, P.J., Mosier, A.R., Smith, K.A., and Winiwarter, W. (2008) N<sub>2</sub>O release from agro-biofuel production negates global warming reduction by replacing fossil fuels. *Atmos. Chem. Phys.*, 8: 389-395. Available at: <http://www.atmos-chem-phys-discuss.net/7/11191/2007/acpd-7-11191-2007-print.pdf>

Waste, including wood processing residues, offers big energy potential in the short term, contributing approximately 100 mtoe of RES each year up to 2030. However these EEA figures, and the basic data upon which the relationship between the production of woody biomass and the environment is based, are by no means universally accepted, with some believing the energy potential be a considerable overestimate.

Different countries often have very different methods for calculating forest inventories and for making estimates of wood supply and assessing the relative health of their forests. Yet the accuracy of such data would seem to be crucial when assessing relative environmental impacts of wood supply and extraction. For example, how is it possible to measure relative overall sustainability of resources when it is unclear just how big or small those resources are? There is also the concern that when projecting figures for years ahead it is not possible to know what the state of those resources will be in the future. What, for instance, will be the impact, both in terms of wood supply and the environment, of climate change and the likely drying out of Europe's forest areas?

Similarly, industry and others talk of the potential of logging residues from forest areas as a source for biomass. Yet deadwood performs an important role in forest and other ecosystems, serving as the habitat to various species of fungi and insect life that are a key ingredient in the food chain of a wide variety of species. Rotting deadwood also serves as important nourishment for the continued health of forests.

Further up the supply chain, there are issues connected with the transportation of wood from source to processing plant, then to heating or electricity generating system. If the geography of such enterprises is badly planned then large-scale transport related GHG emissions would be the result. Similarly, though the technology for efficiently converting wood products into bioenergy is available, it has to be properly managed and run. If not, problems arise, such as the release of toxic gases. Meanwhile, environmentally compatible short-term rotation forestry – which the EEA places in the category of agricultural bioenergy crops – is also expected to make a significant contribution to RES.

The EEA says these perennial energy crops, such as short rotation coppice and reed canary grass, generally have less adverse environmental impacts than most annual crops, needing less nutrient and pesticide inputs. They are also, says the EEA, high yielding in terms of energy and can add to landscape and crop diversity.

However, there is the question of just how environmentally friendly well-managed forest areas will be as the need for more woody biomass increases. If wholesale coppicing of willow and other species of fast growing trees capable of being harvested for biomass is carried out, then there is the possibility – as has been the case with agrofuels – that increasing areas of arable land will be turned over to wood based bioenergy production. Again, this could adversely effect food supplies and drive up food prices. Also, if coppicing and related activities are badly planned and managed, then soil erosion and nutrient depletion could be the result.

While industry might talk of harvesting stumps in order to be processed and turned into bioenergy, such activities involve heavy machinery and can result in considerable disruption



to the environment. In its report, the EEA says that roots and foliage should be left on site to prevent soil erosion and depletion.

In regard to coppicing and high yielding trees, there is also the highly controversial question of whether or not genetically modified or transgenic trees should be planted in the EU. Companies and scientists developing such trees use much the same arguments as are used in relation to GM crops.<sup>53</sup> They say the modified trees not only reduce pesticide and water use but also produce higher yields than non-modified varieties.

One of the driving forces behind the development of GM trees is their perceived potential for biofuel production. GM trees are being developed which have increased amounts of cellulose – tailored for ethanol and the production of liquid biofuels. Without such GM trees, argue those backing their wider use, the EU will become ever more dependent on imports: Europe will fall behind in the science and production of biofuels.<sup>54</sup>

However, there is strong opposition both in Europe and elsewhere to GM trees. Pollen from GM trees can be carried enormous distances and contaminate other species. Forests could be put in danger and due to the fact that trees are long lasting, unforeseen consequences associated with GM could appear in years to come. The World Rainforest Movement (WRM) says that the worldwide paper and pulp industry is one of the main promoters of GM trees: forests would be adapted purely to meet commercial needs and enormous plantations of transgenic trees – poplars, willows, eucalyptus and others – could be the result.<sup>55</sup>

53 <http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2008/08/20/eagm120.xml>

54 <http://www.telegraph.co.uk/earth/main.jhtml?xml=/earth/2008/05/30/eagm130.xml>

55 WRM Briefing. Transgenic trees.





photo: Leontien krul / FERN



## Conclusion

***“I believe woody biomass is of huge potential but it’s very important to establish proper standards for biomass production and draft proper policies which need to be linked to biodiversity, flood protection, erosion prevention and water purification. Over the years energy producing floodplain forests in the Czech Republic have been mostly cleared and converted to arable land. These days there is no political will to bring back these biodiversity rich multifunctional energy forests.”***

*Zdenek Postulka from Friends of the Earth, Czech Republic*

Agrofuels have given biomass a bad name. The EU policy on biofuel use in transport has contributed to global food price rises and caused hardship to many. Increasing areas of European farmland have been taken over by monoculture energy crops, threatening biodiversity. On top of this, there are serious doubts about whether the policy will result in a reduction in GHG emissions. Meanwhile Europe’s biofuel market has been distorted by imports of lavishly subsidised biofuels from the US.

In order to achieve ambitious targets for renewable energy, attention is now turning to other biomass sources of energy. Wood and wood sourced products at present account for a major share of Europe renewable energy generation – most of it either in the form of domestically used firewood or used in Europe’s large paper and pulp industry.

Wood based biomass, if resources are well managed and efficiently used – particularly in neighbourhood combined heat and power plants – could have great potential and contribute substantially to meeting the EU’s RES targets. On the other hand, producing liquid biofuels from woody biomass has so far proved to be inefficient as the technology is still undeveloped and expensive.

Because data on woody biomass is still limited and often confused, what is needed is a comprehensive appraisal of this potentially large energy source. Though woody biomass energy use can be expanded, it is by no means a solution to all the EU’s energy supply problems: the same mistakes that have been made in regard to the formation of policy with agrofuels must not be repeated. If that happened, there would be serious social, industrial and environmental consequences. There are also other interesting developments in bioenergy: increasingly algae are being seen as a potentially important of biomass source. But there is one important question that is still to be answered: can wood sourced biomass play a leading role - can woody biomass be the Cinderella, the star of the RES ball?

## Country by country

As noted, there are wide country by country differences in the use of RES within the EU. Figures are likely to change rapidly as EU countries put more emphasis on RES: at one end of the scale are countries like Latvia – which produces around 36 per cent of its primary energy from RES (mostly hydro). At the other end of the scale is the UK, which produces barely 2 per cent of total primary energy needs from RES.<sup>56</sup>

Historical factors, plus access to various resources, have to a large extent determined the energy take up of individual countries. For example the UK has historically used its large coal resources for energy: in the post war years it invested heavily in nuclear power and later utilized energy supplies from the North Sea as oil and gas fields came on stream.<sup>57</sup>

Access to locally based resources is perhaps in one sense less important than it once was: globalization and the liberalization of trade has meant that ever greater quantities of goods – including energy and related products – are transported sometimes vast distances, the main driving force behind such moves being price. Paradoxically, concerns of national governments concerning energy security and reliability of supply are now

prompting a rethink about relying on energy imports and promoting a drive towards more self sufficiency. Allied with this are concerns about transport related GHG emissions and, after a period of relatively cheap global energy supplies, big increases in the price of energy imports.

As with RES, disparities between EU countries are also evident in the take up of wood based energy. According to the JWEE about 18 per cent of the total primary energy supply in Finland comes from wood and wood based products while in the UK, the figure is less than one per cent. (see Figure 3, page 24).<sup>58</sup>

Further large scale differences are evident in how such supplies of wood energy are sourced. As Figure 2 on page 23 shows, Finland gets nearly 80 per cent of its wood based energy from the indirect or industrial sector while the rest comes from the direct sector – mostly private households gathering wood supplies from the forest. On the other hand, in France the situation is reversed: it gets about 85 per cent of its wood based energy from the direct sector and only about 12 per cent from industrial sources.

Meanwhile it's clear that the way in which wood sourced energy is used also varies

56 EU Renewable energy fact sheets. e.g. UK [http://ec.europa.eu/energy/energy\\_policy/doc/factsheets/renewables/renewables\\_uk\\_en.pdf](http://ec.europa.eu/energy/energy_policy/doc/factsheets/renewables/renewables_uk_en.pdf)

57 Hiro, D. *ibid.*

58 JWEE (2007). *Wood Energy in Europe and North America: A new estimate of volumes and flows.* February 2007.

considerably between EU countries. For example in 2005, of the total amount of wood pellets produced in Europe – approximately half for residential heating purposes and half for thermal power plants – almost all were used in only seven countries: Sweden, Denmark, the Netherlands, Belgium, Germany, Austria and Italy (AEBIOM website)<sup>59</sup>.

## Finland

Finland is near the top of the EU renewables league, with 25 per cent of its primary energy supply coming from RES.<sup>60</sup> The government has set a target of RES contributing 38 per cent of total energy supply by 2010. At present about 20 per cent of RES is sourced from hydro and more than 15 per cent from biomass. A substantial slice of Finland's energy is supplied by nuclear – a portion which is likely to increase in coming years as a new, large nuclear plant comes on stream. With its large and well developed pulp and paper industry, plus a population which has traditionally used direct wood supplies for energy generation, Finland depends on wood and wood based products for at least 50 per cent of its heating needs. It also generates about 35 per cent of its electricity from wood based products. However these are tough times in Finland's wood sector, which employs 10 per cent of the workforce. Stora, one of the world's biggest forest groups, recently announced sweeping job cuts and the closure of a number of mills due to price rises and increased competition in the market.<sup>61</sup> Other companies are making similar moves. Russia, which supplies a large part of the needs of Finland's paper and pulp industry and is an important player in the industry elsewhere in Europe, is raising taxes on wood exports. Over dependence on Russian gas supplies is already causing anxiety in many EU countries: similar concerns could apply to Russia's influence on EU wood supplies.

59 <http://www.bioenergy-business.com/index.cfm?section=lead&action=view&id=11401>

60 [http://ec.europa.eu/energy/energy\\_policy/doc/factsheets/mix/mix\\_fi\\_en.pdf](http://ec.europa.eu/energy/energy_policy/doc/factsheets/mix/mix_fi_en.pdf)

61 \*International Herald Tribune, Sept 10, 08 <http://www.iht.com/articles/2008/09/10/business/paper.php>



## Portugal

Portugal is relatively high up in the EU renewables league, with 15 per cent of its primary energy needs coming from RES. According to EU figures, the bulk of this was from hydro sources: however Portugal has in recent years been at the forefront of RES developments in a number of areas, particularly tidal and wave power. It has also invested heavily in wind and solar energies. Besides its RES, Portugal is totally dependent on imported energy for its power needs. As the economy has grown in recent years, those power needs have increased substantially – by more than 50 per cent since 1990. Portugal has a target of achieving nearly 40 per cent of its electricity supply from RES by 2010 but according to the EU is unlikely to meet this target in large part because projections for RES were based mainly on hydro energy generated in 1997 – an exceptional year for water based power generation. Solid biomass production and use is still on a relatively small scale, though growing and accounting for about 4 per cent of electricity power generation in 2005.

## Bulgaria

In 2006 the total share of RES in Bulgaria's energy consumption was 4.5 per cent. Large scale hydro projects have been the main source of the country's RES – to date there has been very little development in other areas of the RES sector. Bulgaria aims to have a total 16 per cent share of RES in its consumption of energy by 2020 and is encouraging RES related projects through various incentives, including 20 per cent grants and loans. According to the EU there are "good opportunities for biomass, since 60 per cent of land consists of agricultural land and there is about 30 per cent forest cover."

## Germany

Germany scores well as one of the leading countries in the EU in RES take up. The country aims for a 18 per cent RES share in total energy consumption by 2020: in terms of its short term target for RES based electricity production – 12.5 per cent by 2010 – it is already on course for or projected to surpass its goal. The ‘feed-in tariff’ system for RES related electricity production and incentives for RES heat production have been effective in mobilising RES uptake and a number of other EU countries are contemplating similar schemes. Germany has been particularly active in the take up of wind energy – its onshore wind capacity now amounts to about 50 per cent of the total capacity installed in the EU. It is also a leader in Europe – along with Austria – in PV, solar thermal installations and – more controversially – biofuel production, which is entitled to various tax exemptions. While Germany’s paper and pulp industry is not particularly developed, its chemical industry is likely to be a main driver in the production of bioenergy. The country’s big car industry is interested in the development of so called green fuels and is investing substantial funds in the development of biodiesel from wood sources (lingo-cellulose).<sup>62</sup> The country now has about 50 plants for processing biomass: many of these are geared to producing biofuels – with countries like the UK exporting rape seed oil and other agrocrops to Germany for processing – there are also a number of wood based energy processing facilities and efforts are underway to substantially increase the production of woody biomass sourced energy. There are also a number of small scale woody biomass heat generation schemes in operation around the country.

## United Kingdom

The UK has been one of the EU laggards when it comes to the uptake of RES. The EU has set a target for RES production in the UK of 15 per cent by 2020 – compared with only 1.5 per cent in 2005. On present projections, it seems unlikely the target will be met though substantial investment has been made in the RES sector in recent years, particularly in wind. Bioenergy makes up about 80 per cent of the UK’s RES production at present, of which only about six per cent is contributed by wood based biomass. However wood based products are also widely used in co-firing at power plants, burned along with fossil fuels. The government says<sup>63</sup> biomass use could be significantly expanded through harvesting wood from currently unmanaged woodlands in England and improving waste wood collection generally – with the goal of bringing an additional 2m ‘green tonnes’ of wood onto the energy market by 2020. At present the forestry sector, though seen to have considerable potential, is relatively undeveloped, limited mainly to areas of Scotland, northeast England and northern Wales. Experts say that in the absence of a well developed paper and pulp industry, wood based energy producers could step in to take up supply but at present there is a lack of processing capacity.<sup>64</sup> Several wood reliant biomass plants are planned though many of these, located in ports, are projected to be dependent on imports in the short term at least. Several thousand tonnes of wood waste – previously sent to landfill – are now being shipped to Germany each year for processing. The government<sup>65</sup> says that one of the main impediments to the growth of woody biomass use in the UK is a lack of knowledge and awareness of the considerable RES potential of wood based products.

62 \*This was from notes sent to me by Nilsson, 08

63 BERR/DEFRA UK Biomass Strategy,07  
<http://www.berr.gov.uk/files/file39040.pdf>

64 Nilsson, ibid, 08

65 BERR ibid,07

## Annex 1: An overview of bioenergy policies in the EU

- **Directive on crude-oil savings through the use of substitute fuel (1985):** stresses the role of biofuels in reducing Member States' dependence on oil imports and allows the use of 5 per cent ethanol in petrol.<sup>66</sup>
- **White Paper on Energy for the Future (1997):** sets a target for the EU of doubling the share of renewable energy in the total energy consumption to 12 per cent by 2010. The Paper deals with bio-energy but calls for specific measures in order to help increase the market share for liquid biofuels.<sup>67</sup>
- **Directive on the Promotion of Electricity produced from Renewables Energy (2001):** provides the framework for electricity generated from biomass.<sup>68</sup> It sets a 21 per cent indicative target for producing electricity from renewable energy sources by 2010.
- **Communication on alternative fuels for road transport (2001):** considers the increased use of biofuels in the transport sector.<sup>69</sup> It identifies biofuels, natural gas and hydrogen as possible future energy sources for transport.
- **Biofuels Directive (2003):** aims to promote biofuels and sets indicative targets for the use of biofuels for transport.<sup>70</sup> Reference values of a 2 per cent market share for biofuels in 2005 and a 5.75 per cent share in 2010 are included. This Directive was accompanied by the Energy Taxation Directive (October 2003) allowing Member States to exempt or reduce excise duties so as to promote biofuel production and use.<sup>71</sup>
- **Communication on 'The share of renewable energy in the EU' (2004):** concludes that if the EU renewable energy target of 12 per cent in 2010 is to be achieved, bio-energy's contribution will need to be more than doubled.<sup>72</sup> It proposes the creation of a dedicated Biomass Action Plan and a coordinated approach to achieve the 2010 Renewable Energy targets.
- **Biomass Action Plan (2005):** describes various measures to encourage the use of biomass for renewable energy production.<sup>73</sup> It explains that the EU will not reach the targets it has adopted in the Biofuels Directive (2003) and proposes "to bring forward a report in

<sup>66</sup> Directive 85/536/EEC

<sup>67</sup> COM(1997)599

<sup>68</sup> Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal market.

<sup>69</sup> COM(2001)547

<sup>70</sup> Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport.

<sup>71</sup> 2003/96/EG

<sup>72</sup> Communication on the share of renewable energy in the EU. COM (2004) 366.

<sup>73</sup> Biomass Action Plan. Communication from the Commission. COM (2005) 628.

2006 in view of a possible revision of the Biofuels Directive in which setting national targets for the market share of biofuels and using biofuels obligations would be addressed". It also encourages Member States to form national biomass action plans.

- **Biofuel Strategy (2006):** complements the Biomass Action Plan and looks at the role biofuels might play in achieving EU energy policy targets.<sup>74</sup> The strategy is the first step towards a possible revision of the Biofuels Directive (2003).
- **Renewable Energy Roadmap (January 2007):** this roadmap is part of a broader energy climate change package and sets out a long-term vision for renewable energy sources in the EU.<sup>75</sup> It proposes the EU establishes a binding target in which 20 per cent of the EU's energy consumption will come from renewable energy by 2020 and a binding target of 10 per cent for the share of renewable energy in transport fuels. EU Member States endorsed the Roadmap in March 2007, saying the biofuel target was appropriate as long as production was sustainable and that second-generation biofuels would become commercially available.
- **Proposed amendment of the Fuel Quality Directive (January 2007):** The Fuel Quality Directive was adopted in 1998 and sets specifications for petrol and diesel fuels used both on and off the road in order to protect human health and the environment. In January 2007, the Commission proposed revising the Directive in order to help combat climate change by promoting the development of lower carbon fuels, including biofuels.<sup>76</sup> The Directive sets a target of reducing GHG emissions by 1 per cent annually from 2011 onwards, thereby promoting an increase in the use of biofuels. The amendment also permits higher volumes of biofuels in petrol.
- **Proposal for a Renewable Energy Directive (2008):** this proposal aims to implement the roadmap (see above) by establishing an overall binding target of a 20 per cent share of renewable energy sources in energy consumption and a new 10 per cent binding minimum target of biofuels in transport to be achieved by each Member State, as well as binding national targets by 2020 in line with the overall EU target of 20 per cent.<sup>77</sup> The current provisions in the 2003 Biofuels Directive that set indicative targets of 5.75 per cent by 2010 remain in force until the end of 2011.

74 An EU strategy for Biofuels. Communication from the Commission. COM (2006) 34

75 COM (2006)848

76 Proposal for a directive of the European Parliament and of the Council amending directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and the introduction of a mechanism and reduce greenhouse gas emissions from the use of road transport fuels and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterways vessels and repealing Directive 93/12/EEC. COM(2007)18

77 Proposal for a Directive on the promotion of the use of energy from renewable sources. COM(2008)0019



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