

## COMMUNICATION FROM THE COMMISSION

### Biomass action plan

#### {SEC(2005) 1573} TABLE OF CONTENTS

1.	INTRODUCTION.....	3
1.1.	Biomass potential .....	4
1.2.	Costs and benefits .....	4
1.3.	Biomass use in transport, electricity and heating.....	5
2.	BIOMASS HEATING .....	6
2.1.	Legislation on renewable energy in heating.....	6
2.2.	The renewal of district heating.....	7
3.	ELECTRICITY FROM BIOMASS.....	7
4.	TRANSPORT BIOFUELS .....	8
4.1.	Implementation of the biofuels directive .....	8
4.2.	The vehicle market .....	8
4.3.	Balancing domestic production and imports.....	9
4.4.	Standards .....	9
4.5.	Removal of technical barriers .....	10
4.6.	Use of ethanol to reduce demand for diesel .....	10
5.	CROSS-CUTTING ISSUES .....	10
5.1.	Supply of biomass .....	10
5.2.	EU financial support for biomass energy.....	13
5.3.	State aids .....	14
6.	RESEARCH.....	14
7.	CONCLUSION .....	15

ANNEX 1 – Biomass action plan: summary of measures .....	16
ANNEX 2 – EU biomass production potential .....	19
ANNEX 3 – A scenario to increase biomass energy using current technologies .....	21
ANNEX 4 – Environmental impacts.....	22
ANNEX 5 – Renewable energy and the directive on the energy performance of buildings ...	24
ANNEX 6 – Biomass for electricity generation.....	25
ANNEX 7 – Transport biofuels: background .....	26
ANNEX 8 – Biofuels: progress at national level .....	27
ANNEX 9 – Implementing the biofuels directive: fuel tax exemptions and biofuel obligations .....	28
ANNEX 10 – Trade in bioethanol.....	31
ANNEX 11 – Achieving the 5.75% biofuels target: the balance between domestic production and imports.....	36
ANNEX 12 – The Commission’s perspective on biomass and biofuel research.....	41
ANNEX 13 – Results of consultation .....	44

# COMMUNICATION FROM THE COMMISSION

## Biomass action plan

### 1. INTRODUCTION

Energy is key in helping Europe achieve its objectives for growth, jobs and sustainability. High oil prices put the spotlight on Europe's increasing dependency on imported energy.

The Union needs to respond strongly to this challenge. The central importance of energy policy in helping Europe to meet the challenges of globalisation was confirmed by the Union's heads of state and government at the informal Hampton Court summit in October 2005.

With this in mind, the Commission is carrying out a fundamental review of its energy policy. This will be the subject of a Green Paper in spring 2006, with three main objectives – competitiveness, sustainability and security of supply.

Essential elements of this policy are, within the context of stronger economic growth, the need to reduce energy demand<sup>1</sup>; increase reliance on renewable energy sources, given the potential to produce them domestically and their sustainability; diversify energy sources; and enhance international cooperation. These elements can help Europe to reduce dependence on energy imports, increase sustainability and stimulate growth and jobs.

Success requires a coherent management of these objectives, within appropriate timetables. The process will include mechanisms to involve Member States, representatives of the European Parliament and stakeholders.<sup>2</sup>

It is in this wider context of an integrated and coherent energy policy and, in particular, of the promotion of renewable energy sources that the Commission is presenting this action plan. It is just one component of the measures needed to achieve the objectives set out above – but an important one, since biomass presently accounts for about half of the renewable energy used in the EU<sup>3</sup>.

In its 2004 communication on the share of renewable energy in the European Union, the European Commission committed itself to produce a biomass action plan, highlighting the need for a coordinated approach to biomass policy.<sup>4</sup> The Spring Council of 2004 concluded that increased use of renewable energy is essential for “environmental and competitiveness reasons”<sup>5</sup>, while the European Parliament recently noted “that biomass has many advantages over conventional energy sources, as well as over some other renewable energies, in

---

<sup>1</sup> Addressed in the recent energy efficiency Green Paper “Doing more with less”, COM (2005) 265

<sup>2</sup> These mechanisms will include the Energy and Transport forum, the “Amsterdam” sustainable energy forum, the “Berlin” fossil fuel forum, the “Florence” regulatory forum for electricity and the “Madrid” regulatory forum for gas. In addition, the Commission recently decided to set up a high level group for competitiveness, energy and the environment.

<sup>3</sup> 44% according to the “substitution approach”, 65% according to the “classical approach” – see impact assessment, section 2.

<sup>4</sup> “The share of renewable energy in the EU”, COM (2004) 366, section 4.3.1.

<sup>5</sup> Brussels European Council, 25 and 26 March 2004, Presidency conclusions.

particular, relatively low costs, less dependence on short-term weather changes, promotion of regional economic structures and provision of alternative sources of income for farmers”<sup>6</sup>.

This action plan sets out measures to increase the development of biomass energy from wood, wastes and agricultural crops by creating market-based incentives to its use and removing barriers to the development of the market. In this way Europe can cut its dependence on fossil fuels, cut greenhouse gas emissions and stimulate economic activity in rural areas. The measures are listed in annex 1.

This action plan is a first, coordinating step. It sets out measures to promote biomass in heating, electricity and transport, followed by cross-cutting measures affecting biomass supply, financing and research. It is accompanied by a general impact assessment. As a second step, individual measures will be brought forward subject to specific impact assessment in line with Commission rules.

### **1.1. Biomass potential**

The EU currently meets 4% of its energy needs from biomass. If it made full use of its potential, it would more than double biomass use by 2010 (from 69 mtoe<sup>7</sup> in 2003 to about 185 mtoe in 2010) – while complying with good agricultural practice, safeguarding sustainable production of biomass and without significantly affecting domestic food production.<sup>8</sup> Bulgaria and Romania’s accession will improve availability<sup>9</sup>, and imports offer more potential still.

In the Commission’s judgement, the measures in this action plan could lead to an increase in biomass use to about 150 mtoe in 2010 or soon after.<sup>10</sup> This is less than the full potential; it is in line with the indicative renewable energy targets.<sup>11</sup>

### **1.2. Costs and benefits**

It follows from several scientific and economic studies that this increase in biomass use could bring the following benefits in 2010:

- diversification of Europe’s energy supply, increasing the share of renewable energy by 5% and reducing reliance on imported energy from 48 to 42%;<sup>12</sup>
- a reduction in greenhouse gas emissions of 209 million tonnes CO<sub>2eq</sub> a year;<sup>13</sup>
- direct employment up to 250-300 000 people, mostly in rural areas. Different studies produce widely different figures;<sup>14</sup>

---

<sup>6</sup> Resolution on “Renewable energy in the EU”, plenary session of 28 September 2005.

<sup>7</sup> Million tonnes of oil equivalent

<sup>8</sup> European Environmental Agency, “How much biomass can Europe use without harming the environment”, briefing 2/2005; see annex 2.

<sup>9</sup> For example, Bulgaria and Romania each have 0.7 hectares of agricultural land per capita, compared to 0.4 in the EU25.

<sup>10</sup> See annex 3 and impact assessment.

<sup>11</sup> These targets are a 12% overall share for renewable energy, a 21% share in the electricity sector and a 5.75% share for biofuels in 2010. Through the measures in the action plan, the Commission estimates that these shares can be achieved – in the case of the overall share, if not in 2010 then within a year or two of that date.

<sup>12</sup> See impact assessment, section 5.

<sup>13</sup> See impact assessment, section 5.

- potential downward pressure on the oil price as a result of lower demand for oil.

Assuming fossil fuel prices about 10% lower than today's, the directly measurable cost can be estimated at €9 billion per year - €6 billion for transport biofuels and €3 billion for biomass in electricity generation (biomass in heating is often cost-competitive).<sup>15</sup> This is equivalent to an increase of about 1.5 cents per litre of petrol or diesel and 0.1 cents per kWh of electricity.<sup>16</sup>

Benefits can also be expected in extending the EU's technological leadership in these sectors.

These benefits can be expected to be obtained without additional pollution or other forms of environmental damage.<sup>17</sup>

The Commission is assessing the contribution that renewable energy could make to the energy mix by 2020. This action plan could underpin an increase in renewable energy's contribution by 2020.

### 1.3. Biomass use in transport, electricity and heating

Oil prices have tripled over the last four years. Transport is a key economic sector; nearly all the energy it uses comes from oil. Liquid biofuels, as the only direct substitute for oil in transport, have a justifiably high political priority.

Moreover, constant growth in the transport sector has not yet permitted the stabilisation of greenhouse gas emissions, despite considerable efforts undertaken by the industry. Biofuels are an expensive way of reducing greenhouse gas emissions, but within transport they are one of only two measures that have a reasonable chance of doing so on a significant scale in the near future (the other being the carmakers' agreement to reduce CO<sub>2</sub> emissions from new cars— see section 4.2).

In early 2006, the Commission will bring forward a communication dealing specifically with biofuels.

While transport biofuels have the highest employment intensity and the greatest security of supply benefits, biomass in electricity has the greatest greenhouse gas benefits and biomass in heating is cheapest. Biomass should be promoted in all three sectors. At least up to 2010, there will be no major competition for raw material: biofuels rely mainly on agricultural crops while electricity and heating rely mainly on wood and wastes.

---

<sup>14</sup> This figure assumes that 70-90% of biomass is produced in the EU. In terms of direct employment, biofuels are typically 50-100 times as employment intensive in the EU as fossil fuel alternatives; biomass electricity 10-20 times as employment intensive; biomass heating twice as employment intensive. Commentators are divided on the indirect effects. Some point to multipliers or export opportunities which could double the size of the direct effect. Others argue that jobs in bio-energy will replace other jobs, and the net employment effect will be zero. (See impact assessment, section 5.)

<sup>15</sup> See impact assessment, section 5.

<sup>16</sup> Oil costs about \$60/barrel or (at today's exchange rates) €48/barrel. To be competitive, biodiesel needs an oil price of about €75/barrel while bioethanol needs a price of about €95/barrel. If the price of fossil fuels reflected their external costs, more forms of biomass would be cost-competitive.

<sup>17</sup> See annex 4.

## 2. BIOMASS HEATING

Technology for biomass use in residential and industrial heating is simple and cheap. There are strong traditions of biomass use and this is the sector where most biomass is used. New techniques are available to turn wood and clean residues into standardised pellets that are environmentally safe and easy to handle.

Nevertheless, biomass is growing slowest in heating.

As well as carefully monitoring the implementation of Community legislation on cogeneration<sup>18</sup> - an important outlet for biomass - the Commission will tackle this through the following measures:

### 2.1. Legislation on renewable energy in heating

This is the missing piece of the jigsaw, alongside existing directives covering electricity and transport. The Commission will work towards this legislation in 2006. It needs to take a different approach from earlier directives, because the key problems lie in market confidence and attitudes rather than costs. Elements to be examined will include:

- New specific legislation on renewable energy in heating, based on a critical review of the potential contribution of:
  - measures to ensure that fuel suppliers make biomass fuels available;
  - the establishment of efficiency criteria for biomass and the installations in which it is to be used;
  - equipment labelling to enable people to buy clean and efficient devices;
  - other technical measures ;
  - the appropriateness of setting targets;
  - voluntary agreements with industry.
- Amendment of the directive on the energy performance of buildings to increase incentives for renewable energy;<sup>19</sup>
- A study of how to improve the performance of household biomass boilers and reduce pollution<sup>20</sup>, with a view to setting requirements in the framework of the eco-design directive.<sup>21</sup>

---

<sup>18</sup> Directive 2004/8/EC on the promotion of cogeneration, 11.02.04

<sup>19</sup> Directive 2002/91/EC on the energy performance of buildings, O.J. L1, 4/01/2003; see annex 5.

<sup>20</sup> If biomass is burnt without proper controls, it can be a major source of pollution. This can result from illegal incineration of waste, or from the use of biomass boilers without adequate combustion control and pollution prevention. Modern pellet boilers and district heating plants cause much less pollution.

<sup>21</sup> Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products, O.J. L191, 22/07/2005

## **2.2. The renewal of district heating**

District heating (collective heating) can manage the use of renewable fuels more easily and burn more types of fuel with lower emissions. It is easier to develop biomass use in district heating than in individual heating.

56 million EU citizens are served by district heating, 61% of them in the new Member States. The accession of Bulgaria and Romania will add more. District heating faces problems in competing with individual heating. Many schemes need modern plant, infrastructure and management to improve their fuel use and cost-efficiency and make them more convenient to use. Schemes need to be converted to use biomass as fuel. The Commission encourages district heating schemes to develop in this way.

The Commission urges the Council to agree to its proposal to add the supply of district heating to the list of goods and services to which Member States may apply a reduced rate of VAT.<sup>22</sup> It would then recommend Member States to extend to district heating any reduced VAT rate already applied to natural gas or electricity.

The Commission may also bring forward a legislative proposal on tax issues affecting district heating. It will examine whether other measures should be proposed at the same time.

## **3. ELECTRICITY FROM BIOMASS**

Electricity can be generated from all types of biomass using several technologies (see annex 6). The Commission encourages Member States to harness the potential of all cost effective forms of biomass electricity generation.

The directive on renewable energy in electricity generation provides the framework for electricity from biomass.<sup>23</sup> Member States have committed themselves to targets for electricity from renewable energy. In most cases, it looks impossible to achieve these without using more biomass.<sup>24</sup> Implementation of the directive is therefore the key to the development of biomass use in electricity. The Commission will continue to pay close attention to this.<sup>25</sup>

In combined heat and power plants, biomass can provide heat and electricity at the same time. The Commission encourages Member States to take this double dividend into account in their support systems.

---

<sup>22</sup> In COM(2003)397 of 23.07.2003

<sup>23</sup> Directive 2001/77/EC of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market, O.J. L283, 27/10/2001

<sup>24</sup> In last year's communication on the share of renewable energy the Commission pointed out that, among the three main renewable energy sources for electricity generation, the share of hydropower is nearly static, biomass is growing slowly and wind power is growing fast. The targets in the directive will not be met unless biomass starts to grow faster.

<sup>25</sup> See separate Communication on support for electricity from renewable energy sources (COM(2005) 627).

## 4. TRANSPORT BIOFUELS

### 4.1. Implementation of the biofuels directive

As in electricity generation, a framework is set by Community legislation: the biofuels directive<sup>26</sup>, which sets as reference values a 2% market share for biofuels in 2005 and 5.75% share in 2010.<sup>27</sup>

The 2005 reference value will not be achieved. There is substantial variation in Member States' efforts<sup>28</sup>; if all Member States achieve the targets they have set, biofuels will attain a share of only 1.4%.

To implement the directive, many Member States are relying on fuel tax exemptions.<sup>29</sup> These are subject to state aid control. In line with the guidelines on environmental state aids, the Commission has taken a generally favourable attitude to the notifications received. However, a number of practical problems have arisen. A number of Member States have recently turned to biofuels obligations, requiring fuel supply companies to incorporate a given percentage of biofuels in the fuel they place on the market. More details of the two approaches are given in Annex 9. Biofuels obligations seem a promising way of overcoming difficulties with tax exemptions and ensuring that targets are achieved cost-effectively. They also make it easier to give favourable treatment to second-generation biofuels, which the Commission encourages.

In accordance with the biofuels directive, the Commission will bring forward a report in 2006 on the directive's implementation, with a view to a possible revision. It will address the issues of:

- national targets for the market share of biofuels;
- using biofuels obligations;
- requiring that, through a system of certificates, only biofuels whose cultivation complies with minimum sustainability standards will count towards the targets.<sup>30</sup>

The system of certificates would need to apply in a non-discriminatory way to domestically produced biofuels and imports.

### 4.2. The vehicle market

The Commission will soon bring forward a legislative proposal to encourage public procurement of clean vehicles, which could include those using high biofuel blends.<sup>31</sup>

The Commission is examining the scope for the use of alternative fuels, including biofuels, to count towards CO<sub>2</sub> reduction targets for light duty vehicles as part of its review of how to

---

<sup>26</sup> Directive 2003/30/EC of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, O.J. L123, 17/05/2003

<sup>27</sup> See annex 7.

<sup>28</sup> See annex 8.

<sup>29</sup> These are facilitated by Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, O.J. L283, 31/10/2003

<sup>30</sup> The Commission will also look into how minimum sustainability standards could also be applied for biomass used for other energy purposes.

<sup>31</sup> Public procurement also has an important role in promoting other forms of biomass, especially for heating.

move towards the Community objective of average emissions of 120 g/km. The future strategy, to be proposed in 2006, will be based on an “integrated approach”. This means that measures such as the use of biofuels, fiscal incentives, consumer information and congestion avoidance will be considered in addition to car manufacturers’ efforts on vehicle technology. This strategy will take into account of the strategy on the future of the automobile industry, which will also be proposed in 2006.

### **4.3. Balancing domestic production and imports**

Biofuels and their raw materials are traded on world markets. An autarkic approach to meeting the EU’s needs is neither possible nor desirable. However, the Union has some discretion about how far to encourage domestic production or imports. Annex 10 describes the current situation as far as trade in bioethanol is concerned. Annex 11 assesses three routes to a 5.75% market share for biofuels:

- minimum share for imports
- maximum share for imports
- balanced approach.

The Commission prefers the balanced approach. Therefore, it will:

- Propose the amendment of standard EN14214 to facilitate the use of a wider range of vegetable oils for biodiesel, to the extent feasible without significant ill-effects on fuel performance;
- Address the issue of amending the biofuels directive so that only biofuels whose cultivation complies with minimum sustainability standards count towards its targets;
- Maintain market access conditions for imported bioethanol that are no less favourable than those provided by the trade agreements currently in force;
- Pursue a balanced approach in ongoing free trade agreement negotiations with ethanol-producing countries/regions. The EU must respect the interests of domestic producers and EU trading partners, within the context of rising demand for biofuels.
- Support developing countries that wish to produce biofuels and develop their domestic markets. This is of particular importance in the context of the sugar reforms.<sup>32</sup>

The Commission will take these objectives forward in bilateral negotiations (e.g. with Mercosur) and multilateral negotiations (e.g. the Doha World Trade Organisation round and discussion on trade in environmental goods).

### **4.4. Standards**

The fuel quality directive<sup>33</sup> establishes limits on the content of ethanol, ether and other oxygenates in petrol. It limits the vapour pressure of petrol. Standard EN590 states that diesel

---

<sup>32</sup> This aspect will be addressed further in the forthcoming communication on biofuels.

<sup>33</sup> Directive 98/70/EC of 13 October 1998 relating to the quality of petrol and diesel fuels (O.J. L350, 28/12/1998), as amended by Directive 2003/17/EC of 3 March 2003 (O.J. L76, 22/03/2003)

must contain no more than 5% biodiesel by volume (4.6% in energy terms). These limits constrain how increased use of biofuels can be achieved..

The Commission is reviewing the fuel quality directive. It will assess the impact of options to address the above issues. The Commission is considering a variety of factors, taking into account the costs and benefits of the affected sectors. In reviewing these options, the Commission will, inter alia, consider:

- impacts on health and environment (including pollutant emissions and greenhouse gas emissions);
- impacts on the achievement of the objectives in the biofuels directive and the cost of achieving them.

#### **4.5. Removal of technical barriers**

There are technical barriers to the introduction of biofuels. For example, industry has argued that

- petrol blended with ethanol cannot be carried in oil pipelines;
- it is not practical to offer a petrol basestock with a reduced vapour pressure suitable for the direct blending of ethanol.

The Commission will ask the industries concerned to explain the technical justification for these barriers and will also seek the views of other interested parties. It will monitor the behaviour of the relevant industries to ensure that there is no discrimination against biofuels.

#### **4.6. Use of ethanol to reduce demand for diesel**

The European vehicle fleet is biased towards diesel vehicles. However, Europe has greater capacity to produce bioethanol than biodiesel, using less land and with more room to reduce costs through economies of scale. There is also scope for increased imports of ethanol from third countries.

The Commission will encourage the use of ethanol to reduce demand for diesel, including the use of 95% ethanol in modified diesel engines. As part of the re-examination of standard EN14214, it will propose evaluation of a change to allow ethanol to replace methanol in biodiesel production.

### **5. CROSS-CUTTING ISSUES**

#### **5.1. Supply of biomass**

The measures described above depend on the availability of an adequate supply of biomass. This section sets out measures to promote this.

## **Common agricultural policy (CAP)**

The 2003 reform of the CAP means that income support for farmers is no longer linked to the crops produced. As a result, farmers can respond freely to increasing demand for energy crops. This reform also introduced a special “aid for energy crops”<sup>34</sup> and maintained the possibility of using mandatory “set-aside” land for growing non-food crops (including energy crops). In 2006 the Commission will report to the Council on implementation of the aid for energy crops, accompanied, if appropriate, by proposals taking into account the Union’s objectives for biofuels.

In the past, only a limited range of energy crops could benefit, through the set-aside regime, from support. The reform paved the way for farmers to grow more energy crops, including short rotation coppice and other perennial crops. Decisions about the appropriate energy crops to grow are best taken at a regional or local level. The Commission will finance an information campaign about the properties of energy crops and the opportunities they offer.<sup>35</sup> Fast-growing wood, in particular, needs a changed approach because farmers have to tie up land for several years and at least 4 years must pass before the first harvest.

## **Forestry**

About 35% of the annual growth of wood in EU forests is not used<sup>36</sup>. In many countries there is only a limited market for small size thinnings, which can be used to produce heat and electricity. Most of the unused resources are in small private holdings, making their mobilisation difficult. Some countries have tackled this problem by setting up supply chains coupled to existing plants, and by supporting the organisation of logistics systems, forest owner cooperation and transport. The Commission will seek to disseminate the lessons learnt from this experience and support similar initiatives in other countries.

The Commission is preparing a forestry action plan, to be adopted in 2006; this will address energy uses of wood.

The Commission will review the impact of the energy use of wood and wood residues on forest based industries.

## **Waste**

Waste is an underused energy resource. The Commission is developing a thematic strategy on the prevention and recycling of waste and preparing a proposal on the revision of the waste framework legislation. Options under consideration include:

- promotion of waste management techniques that reduce the environmental impact of using waste as a fuel;
- taking a market approach to recycling and recovery activities;
- developing technical standards to enable recovered materials to be considered as goods (making it easier to use them for energy purposes);

---

<sup>34</sup> The “energy crop payment”, under which a premium of €45 per hectare is available, with a maximum guaranteed area of 1.5 million hectares as the budgetary ceiling, for the production of energy crops.

<sup>35</sup> The campaign will also cover forestry.

<sup>36</sup> (Not counting forests in protected areas such as Natura 2000 areas.)

- encouraging investment in energy-efficient techniques for the use of waste as fuel.

## **Animal by-products**

Animal by-products not intended for human consumption are increasingly being recovered for energy, especially in biogas and biodiesel. Technological and scientific progress constantly lead to the development of new production processes. The Commission will review the regulatory framework for the authorisation of such processes, so that new sources of energy may be opened up, while a high level of protection for public and animal health is maintained.

## **Standards**

European standards for solid biomass fuels are needed to facilitate trade, develop markets and increase consumer confidence. The European Committee for Standardisation (CEN) is working on them. The Commission will encourage it to give high priority to this work.

## **Improving the supply chain**

A European trading floor for pellets and chips has been initiated with support from the EU Intelligent Energy for Europe programme. Volumes are low. The Commission will look at how the results can be improved, with a view towards an EU-wide trading system (if technically and economically feasible).

## **National biomass action plans**

National biomass action plans can reduce investor uncertainty by assessing the physical and economic availability of biomass of different kinds, including wood and wood residues as well as wastes and agricultural crops, identifying priorities for the types of biomass to be used and how biomass resources can be developed, and indicating the measures that will be taken at national level to promote this. They can also be linked to consumer information campaigns on the benefits of biomass. Regions can usefully do the same thing. The Commission encourages the development of national biomass action plans.

## **5.2. EU financial support for biomass energy**

Many of the regions assisted by the structural and cohesion funds have high potential to pursue economic growth and employment creation or stabilisation through biomass. This is particularly true for rural regions in central and eastern Europe. Low labour costs and high resource availability can give these regions a comparative advantage in the production of biomass. Supporting the development of renewable and alternative energy sources such as the production of biomass is therefore an important objective for the structural and cohesion funds, as set out in the Commission's proposal for Community strategic guidelines for cohesion.<sup>37</sup> These funds can support the retraining of farmers; the provision of equipment for biomass producers; investment in facilities to produce biofuels and other materials; and fuel switching to biomass by electricity and district heat producers.

The Commission calls upon Member States and regions, when preparing their National Strategic Reference Frameworks and operational programmes, to ensure that the potential benefits of biomass have been thoroughly taken into account.

Investment on or near farms, for example in biomass processing, can be supported through the rural development policy, as can the mobilisation of unused biomass by forest holders. The

---

<sup>37</sup> COM (2005) 299 of 5.07.2005

Commission has proposed Community strategic guidelines for rural development which emphasise renewable energy in general and biomass supply chains in particular.<sup>38</sup> The Commission encourages Member States to take up these opportunities for the development and diversification of the rural economy through their national rural development programmes. The Commission proposes a specific ad hoc group to consider biomass opportunities within these programmes.

### **5.3. State aids**

Official support for biomass production and use must comply with Community state aid policy. The Commission can authorise investment aid and operating aid on the basis of the Community guidelines on State aid for environmental protection.<sup>39</sup> The rules in these guidelines take into account the beneficial effects that energy produced from biomass may have compared to energy production on the basis of fossil fuels. Aid for investments in assisted areas may be found compatible with the common market under the guidelines for national regional aid.<sup>40</sup> There should not be undue distortions of competition. See also annex 9.

## **6. RESEARCH**

The Commission's proposal for the Seventh Framework Programme gives a high priority to biomass research. It includes several actions with a biomass component:

- “Biomass for fuels, electricity, heating and cooling”, with the objective of developing and demonstrating a portfolio of technologies;
- “Smart energy networks”, including the integration of biomass installations into electricity grids and feeding biogas and synthetic gas into the natural gas grid;
- “Life sciences and biotechnology for sustainable non-food products and processes”, including the use of biotechnology to improve the productivity, sustainability and composition of biomass raw materials and develop new bio-processes.

Some of the most important areas of work will be:

- The development of an industry-led “biofuel technology platform”;
- The “bio-refinery” concept, getting the most out of all parts of plants;
- Research into second-generation biofuels, where a substantial increase in Community funding is expected.

The Commission will consider how best to take forward research into the optimisation of agricultural and woody crops for energy purposes, and into conversion processes.

Through the Intelligent Energy for Europe programme, the Commission will support the dissemination of techniques that have been proven through research.

---

<sup>38</sup> COM (2005) 304.

<sup>39</sup> OJ C37 of 3.2.2001, p.3.

<sup>40</sup> OJ C74 of 10.3.1998, p.9.

More details are given in annex 12.

## 7. CONCLUSION

Europe needs to break its dependence on fossil fuels. Biomass is one of the main alternatives. Cost effective measures in favour of biomass need to be developed at European level to:

- draw maximum advantage from national and local innovation;
- provide a clear way forward for major industries organised on a European scale;
- share burdens fairly.

This communication sets out a coordinated programme for Community action, including measures to improve demand for biomass; improve supply; overcome technical barriers; and develop research.

The action plan has taken nearly a year to develop. It draws on widespread consultations with interested parties.<sup>41</sup> Their response to the idea of a vigorous Community approach in this area has been largely, and often powerfully, positive. The next step is to put the programme into practice. Next spring's Green Paper on a coherent European energy policy will address progress and further developments.

---

<sup>41</sup> See annex 13.

## ANNEX 1 – Biomass action plan: summary of measures

### Biomass for heating and electricity

The Commission will:

- work towards a proposal for Community legislation in 2006 to encourage the use of renewable energy, including biomass, for heating and cooling;
- examine how the directive on energy performance of buildings could be amended to increase incentives for the use of renewable energy;
- study how to improve the performance of household biomass boilers and reduce pollution, with a view to setting requirements in the framework of the eco-design directive;
- encourage district heating scheme owners to modernise them and convert them to biomass fuel;
- encourage Member States that apply a reduced VAT rate to gas and electricity to apply such a rate to district heating too;
- pay close attention to the implementation of the directive on electricity from renewable energy sources;
- encourage Member States to harness the potential of all cost-effective forms of biomass electricity generation;
- encourage Member States to take into account, in their support systems, the fact that, in combined heat and power plants, biomass can provide heat and electricity at the same time.

### Transport biofuels

The Commission will:

- Bring forward a report in 2006 in view of a possible revision of the biofuels directive. This report will address the issues of:
  - setting national targets for the share of biofuels;
  - using biofuels obligations on fuel suppliers;
  - ensuring, through certification schemes, that the biofuels used to meet the targets satisfy minimum sustainability requirements.
- Encourage Member States to give favourable treatment to second-generation biofuels in biofuels obligations.
- Bring forward a legislative proposal promoting public procurement of clean and efficient vehicles, including those using high blends of biofuels.
- Examine how biofuel use can count towards the CO<sub>2</sub> emission reduction targets for car fleets.

- Pursue a balanced approach in ongoing free trade agreement negotiations with ethanol-producing countries/regions. The EU must respect the interests of domestic producers and EU trading partners, within the context of rising demand for biofuels.
- Propose amendments to the “biodiesel standard” to facilitate the use of a wider range of oils, including imported oils, to produce biodiesel, and allow ethanol to replace methanol in biodiesel production.
- Assess the impact of options to address the issues of limits on the content of ethanol, ether and other oxygenates in petrol; limits on the vapour content of petrol; and limits on the biodiesel content of diesel.
- Ask the relevant industries to explain the technical justification for practices that act as barriers to the introduction of biofuels and monitor the behaviour of these industries to ensure that there is no discrimination against biofuels.
- Support developing countries by helping them to produce biofuels and by maintaining market access conditions that are no less favourable than those provided by the trade agreements currently in force.
- Bring forward a communication dealing specifically with biofuels early in 2006.

#### Cross-cutting issues

The Commission will:

- Assess the implementation of the energy crop scheme.
- Finance a campaign to inform farmers and forest holders about the properties of energy crops and the opportunities they offer.
- Bring forward a forestry action plan in which energy use of forest material will play an important part.
- Review the impact of the energy use of wood and wood residues on forest based industries.
- Consider how the waste framework legislation could be amended to facilitate the use of clean wastes as fuel.
- Review how the animal by-products legislation could be amended in order to facilitate the authorisation and approval of alternative processes for the production of biogas and other biofuels
- Encourage the European Committee for Standardisation to speed up work on standards for the quality of biomass fuels.
- Explore how to develop a European spot market in pellets and chips.
- Encourage Member States to establish national biomass action plans.

Encourage Member States and regions to ensure that the benefits of biomass are taken into account when preparing their national reference frameworks and operational plans under the cohesion policy and the rural development policy.

### Research

The Commission will:

- Continue to encourage the development of an industry-led “Biofuel technology platform”.
- Consider how best to take forward research into the optimisation of agricultural and woody crops for energy purposes, and biomass to energy conversion processes.
- Give a high priority to research into the “bio-refinery” concept, finding valuable uses for all parts of the plant.
- Give a high priority to research into second-generation biofuels, with an aim of improving their efficiency and cost-effectiveness; a substantial increase in Community funding is expected.

## ANNEX 2 – EU biomass production potential

The table assesses the EU’s potential to produce biomass for energy use. These estimates are conservative because they are based on the following assumptions:

- no effect on domestic food production for domestic use;
- no increase in pressure on farmland and forest biodiversity;
- no increase in environmental pressure on soil and water resources;
- no ploughing of previously unploughed permanent grassland;
- a shift towards more environmentally friendly farming, with some areas set aside as ecological stepping stones;
- the rate of biomass extraction from forests adapted to local soil nutrient balance and erosion risks.

The first column of the table shows the quantities of EU-produced biomass used for energy purposes today. The following columns show the potential contribution in 2010, 2020 and 2030. The potential for 2010 is 2½ times the contribution today. The potential for 2020 is 3 to 3½ times the contribution today, and the potential for 2030 is 3½ to 4½ times that of today. Forests, wastes and agriculture all make a big contribution to this potential for growth. The increase from forestry comes from an increase both in fellings and in the use of residues. The increase from agriculture is driven by the reform of the common agricultural policy.

### EU biomass production potential<sup>42</sup>

<i>Mtoe</i>	<b>Biomass consumption, 2003</b>	<b>Potential, 2010</b>	<b>Potential, 2020</b>	<b>Potential, 2030</b>
<b>Wood direct from forest (increment and residues)</b>	67 <sup>43</sup>	43	39-45	39-72
<b>Organic wastes, wood industry residues, agricultural and food processing residues, manure</b>		100	100	102
<b>Energy crops from agriculture</b>	2	43-46	76-94	102-142
<b>TOTAL</b>	<b>69</b>	<b>186-189</b>	<b>215-239</b>	<b>243-316</b>

<sup>42</sup> Sources: 2003 data from Eurostat; projections for 2010, 2020 and 2030 from European Environmental Agency, “How much biomass can Europe use without harming the environment”, briefing 2/2005

<sup>43</sup> This figure includes 59 Mtoe of wood and wood wastes; 3 Mtoe of biogas; and 5 Mtoe of municipal solid waste.

It should be underlined that due to lack of data, this table only covers the EU25. It does not include the contribution of Bulgaria and Romania. These countries will be EU members by 2010, and have high biomass production potential. Nor does the table include imports. Most regions of the world have higher potential to produce biomass, relative to their energy consumption, than the EU. Potential EU consumption is therefore significantly higher than these figures would suggest.

### ANNEX 3 – A scenario to increase biomass energy using current technologies

<i>mtoe</i>	<b>Current (2003)</b>	<b>Future (2010)</b>	<b>Difference</b>
<b>Electricity</b>	20	55	35
<b>Heat</b>	48	75	27
<b>Transport</b>	1	19	18
<b>TOTAL</b>	69	149	80

This scenario is drawn from the 2004 communication “The share of renewable energy”, expanded to the EU25. It is compatible with achievement of the Community’s targets of: a 12% overall share of renewable energy; a 21% share of renewable energy in electricity generation; and a 5.75% market share for biofuels.

The Commission believes this scenario can be achieved in the three sectors – electricity, heat and transport – through the measures in this action plan – if not in 2010, the year for which these targets were set, then within a year or two of that date.

This is the scenario that serves as the basis for the impact assessment on this communication.

## ANNEX 4 – Environmental impacts

Biomass has three main environmental impacts:

- Avoidance of greenhouse gas emissions

The Commission estimates that the scenario in Annex 3, if achieved, would reduce greenhouse gas emissions by 209 million tonnes of CO<sub>2</sub>-eq per year.

- Environmental impact of the production of raw materials

Agriculture can have significant effects on the environment, positive and negative. In general, the level of harmful effects varies with the intensity of the agriculture. This is true whether crops are used for food or energy purposes. It can be particularly harmful to bring previously uncultivated land (permanent grassland) into agricultural use.

On the other hand, using grass cuttings from such land for biomass production can help to prevent the decline of biodiversity on species-rich grasslands due to land abandonment.

Energy crop cultivation can help to improve the overall profitability of the farm business, contributing to the maintenance of farming in areas where this may be useful from an environmental (or wider sustainable development) perspective. This is important in a number of regions to improve soil stability and prevent irreversible landslide damage. Another potential positive aspect of energy crop production is its contribution to the establishment of new crop rotation systems that are more advantageous from a wider environmental point of view (for example, alternatives to the monoculture of maize).

If energy crops are grown on agricultural land that was previously used for food production, the change in environmental pressure depends on which biomass crops are cultivated.

The plantation of tree crops to enhance soil cover on degraded land can also have a globally positive impact. However this should not take place on steppic or mountain habitats that have a high biodiversity value.

The use of wastes and residues for energy purposes often gives an environmental bonus compared with other means of disposal. For forest residues, the environmental impact depends on the local soil nutrient balance and the risk of erosion, which may require a certain amount of the residues (especially foliage) to be left on site. In some regions, however, their extraction help to reduce the risk of fire.

- Environmental impact of the use of biomass

Like fossil fuels, biomass emits pollutants. Advanced emission control equipment can virtually eliminate this, however. Such equipment is already standard in transport and, increasingly, in electricity generation. The situation is less favourable with heating, particularly home heating.

This analysis points to two priorities:

- the need to guarantee that site-specific environmental requirements are observed when producing biomass – this will be addressed in the Commission’s 2006 report on the implementation of the biofuels directive
- improving the pollution performance of household biomass burning – this will be addressed as part of the measures proposed in this action plan to develop biomass heating.

The Commission will also take steps to improve understanding of the costs and environmental impacts of all transport fuels, including conventional biofuels.

## **ANNEX 5 – Renewable energy and the directive on the energy performance of buildings**

The directive on the energy performance of buildings<sup>44</sup> requires Member States, when calculating the energy performance of buildings, to take into account the positive influence of "heating and electricity systems based on renewable energy sources". The relative importance attached to different kinds of renewable energy will be decided by the Member States in their transposition of the directive, allowing them, in principle, to attach substantial premia to the use of biomass in their calculation methods.

Moreover, for new buildings larger than 1000 square meters, Member States are required to carry out technical, environmental and economic feasibility studies on the use of decentralised energy supply systems based on renewable energy, on CHP and on district or block heating or cooling. This also gives Member States considerable leeway to promote biomass. In many Member States, biomass heating is one of the most practical and cost-effective options.

During 2006, taking into account comments received on the energy efficiency Green Paper<sup>45</sup>, the Commission will decide how it thinks the directive should be further developed. The possibilities it will consider could include:

- amending the annex to the directive to ensure that calculation procedures allow greater weight and more active promotion to be given to biomass heating and other forms of renewable energy;
- reducing the thresholds in the directive so that many more new buildings would have to be considered for renewable energy before construction starts, and many more renovation projects would need to meet minimum efficiency requirements based on energy performance calculations that include the positive influence of renewable energy sources, including biomass;
- setting EU-wide minimum energy performance standards and criteria that could also promote the use of biomass where it is technically feasible and economically interesting.

At the same time, the Commission will examine other options for development of the directive, including *inter alia* the use of energy-efficient building materials.

---

<sup>44</sup> Directive 2002/91 of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, O.J. L1, 4/01/2003

<sup>45</sup> COM(2005)265 final of 22/06/2005

## **ANNEX 6 – Biomass for electricity generation**

Electricity can be generated from all types of biomass. Several reliable technologies are available. These technologies can be used to “co-fire” biomass, by mixing it with coal or natural gas, or to run freestanding power stations.

Large centralised power plants, like those used to burn straw in Denmark or forest residues in Finland, offer the best economic performance, especially if they are also used for heat (combined heat and power, CHP). Co-firing biomass with coal is another good centralised option in existing large power plants.

It is more efficient, when electricity is generated from biomass, to make use of the heat that is produced as well. Member States can support this in the design of support schemes for electricity generated from renewable energy sources, or through CHP support schemes developed in accordance with the harmonised European efficiency reference values for CHP which will come into force in February 2006 in accordance with the CHP directive.<sup>46</sup>

Smaller decentralised plants burning solid biomass or biogas tend to cost more, but often have advantages for the environment and for rural development. The EU structural funds or its rural development programme can be used to study their optimal location in relation to biomass availability, transport infrastructure, grid connection possible and labour markets.

The Commission encourages Member States to harness the potential of all cost-effective forms of biomass electricity generation rather than focusing on one form alone.

---

<sup>46</sup> Directive 2004/8 of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC, O.J. L52, 21/02/2004

## **ANNEX 7 – Transport biofuels: background**

In 2001 the Commission adopted a communication on alternative fuels for road transport, identifying three fuels (biofuels, natural gas and hydrogen) that could play a big part.<sup>47</sup> It was accompanied by legislative proposals requiring Member States to promote biofuels and making it easier to use fuel tax exemptions to do this. These proposals were adopted, in amended form, in 2003.<sup>48</sup>

Since the adoption of the communication the market share of biofuels has increased from 0.2% in 2000 to 0.8% in 2004. About 90% of biofuel consumption is covered by domestic raw materials, 10% by imports. Out of the EU25's total arable land of 97 million hectares, about 1.8 million hectares were used for producing raw materials for biofuels in 2005. As expected, there has been a shift towards low blends and away from the high blends or pure biofuels that prevailed in 2001. Biodiesel's share of total biofuel consumption has stayed at 70 to 80%.

The rise in the oil price and a growing interest in new markets for agricultural products in the light of the reform of the common agricultural policy - and the sugar regime in particular - have led to a wider appreciation of biofuels' advantages at European level and have provoked widespread discussion in Member States.

“Second-generation” biofuels from wood and wastes are currently more expensive than first-generation biofuels from agricultural crops and have not yet been fully demonstrated on a commercial scale. Once that has been achieved, they will widen the range of raw materials that can be used and could also further improve biofuels' environmental profile. It should be underlined, however, that first-generation biofuels already offer significant benefits and that any significant contribution from second-generation biofuels will not materialise until after 2010. Therefore, the emphasis of this action plan is on first-generation biofuels.

---

<sup>47</sup> COM (2001) 547

<sup>48</sup> Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport, O.J. L123, 17/05/2003, and Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity, O.J. L283, 31/10/2003

### ANNEX 8 – Biofuels: progress at national level

Member State	Market share 2003	National indicative target for 2005	Targeted increase, 2003-2005
AT	0.06%	2.5%	+2.44%
BE	0	2%	+2%
CY	0	1%	+1%
CZ	1.12%	3.7% (2006)	+ 1.72% (assuming linear path)
DK	0	0%	+0%
EE	0	2%	+2%
FI	0.1%	0.1%	+0%
FR	0.68%	2%	+1.32%
DE	1.18%	2%	+0.82%
GR	0	0.7%	+0.7%
HU	0	0.4-0.6%	+0.4-0.6%
IE	0	0.06%	+0.06%
IT	0.5%	1%	+0,5%
LA	0.21%	2%	+1.79%
LI	0 (assumed)	2%	+2%
LU	0 (assumed)	not yet reported, assume 0	not yet reported
MT	0.02%	0.3%	+0.28%
NL	0.03%	2% (2006)	+0% (promotional measures will come into force from January 2006)
PL	0.49%	0.5%	+0.01%
PT	0	2%	+2%
SK	0.14%	2%	+1.86%
SI	0 (assumed)	0.65%	+0.65%
ES	0.76%	2%	+1.24%
SV	1.32%	3%	+1.68%
UK	0.03%	0.3%	+0.27%
<b>EU25</b>	<b>0.6%</b>	<b>1.4%</b>	<b>+0.8%</b>

#### *Sources*

**2003:** National reports under the biofuels directive except Belgium: Eurostat (figure for 2002) and Italy: EurObserv'Er

**2005:** National reports under the biofuels directive.

National reports under the biofuels directive are available at [http://europa.eu.int/comm/energy/res/legislation/biofuels\\_en.htm](http://europa.eu.int/comm/energy/res/legislation/biofuels_en.htm)

## ANNEX 9 – Implementing the biofuels directive: fuel tax exemptions and biofuel obligations

Member States are using two main tools to implement the Biofuels Directive: tax exemptions and biofuels obligations.

### Tax exemptions

Member States make a good deal of use of fiscal policy to promote biofuels. The energy taxation directive establishes the framework for the consequent tax exemptions.

Under Article 16 of this directive, Member States can reduce taxes on biofuels or completely exempt them from taxes, without needing the Commission's prior approval (on fiscal grounds), as long as they respect certain strict conditions.

The tax reduction or exemption cannot exceed the amount of tax which would otherwise be payable on the volume of biofuel present in the product that is eligible for the reduction. In addition, it should be emphasised that the tax reductions or exemptions introduced by Member States must be modified in line with changes in the price of raw materials, in order to ensure that the reductions do not lead to overcompensation of the additional costs of biofuel production. The fiscal advantage (exemption or reduction) granted to a fuel of renewable origin cannot exceed the difference between this fuel and an equivalent fossil fuel.

These fiscal measures no longer need the prior, unanimous approval of other Member States. However, they remain subject to state aid control. The Commission has taken a generally favourable attitude to the notifications received. The exemptions that have received state aid approval are listed in the table.

*Table - Biofuel tax exemptions that have received state aid approval*

Case	Biofuels concerned	reference
C64/2000 FR	ETBE	OJ L 94 of 10.4.03, p.1
N461/01 IT	Biodiesel	OJ C 146 of 19.6.02, p.6
N480/02 SE	All CO <sub>2</sub> -neutral fuels	OJ C 33 of 6.2.2004, p.7
N804/01 UK	Biodiesel	OJ C 238 of 3.10.02, p.10
N512/02 SE	Biofuel pilot projects	OJ C 75 of 27.3.03, p.2
N685/02 DE	Bioethanol, biodiesel and vegetable oils	OJ C 86 of 6.4.04, p.15
N717/02 IT	Bioethanol and ETBE	OJ C 16 of 22.1.04, p.22
N407/03 UK	Bioethanol	OJ C 193 of 28.4.05, p.17
NN43/04 AT	Bioethanol, biodiesel and vegetable oils	Not published yet
N187/04 SE	Biofuel pilot projects	Not published yet
N206/04 CZ	Biodiesel	Not published yet
N427/04 HU	Biodiesel and ETBE	OJ C133 of 31.5.05, p.2
N582/04 IT	Biodiesel (prolongation of N461/01)	Not published yet
N599/04 IRL	Biodiesel, bioethanol and vegetable oils	OJ C 98 of 22.4.05, p.10
N44/05 LT	Biodiesel, bioethanol, vegetable oils and ETBE	Not published yet
N223/05 CZ	Biodiesel	Not published yet
N314/05 EE	Bioethanol, biodiesel and vegetable oils	Not published yet

*All decisions not to raise objections can be found on the Commission's website: [http://europa.eu.int/comm/secretariat\\_general/sgb/droit\\_com/index\\_en.htm#aides](http://europa.eu.int/comm/secretariat_general/sgb/droit_com/index_en.htm#aides)*

However, the Commission is aware that the system of tax exemptions, as implemented, is giving rise to three problems:

- 1) The risk of **unnecessarily high cost to the state and unnecessarily high payments to undertakings**. Biofuels producers have different costs but, under the tax exemption system, all receive the same level of compensation. If the level of compensation is enough to bring high-cost producers into the market, there is a risk that it overcompensates lower-cost producers. The risk of overcompensation appears to be widespread, both within the Community and internationally. The services of the Commission are presently looking into several possibilities, including the limitation of detaxation to undenatured bioethanol (which is subject to the highest import duty) and/or making the rate of detaxation depend on the raw material used.
- 2) Insufficient **investor certainty**. The Energy Taxation Directive limits the duration of tax exemptions to six years. Among the schemes adopted to date, only the French scheme lasts as long as this. In general, Member States could consider taking coordinated measures to create a stable investment climate, in particular by making full use of the possibility under Community law to adopt six-year tax reliefs and to arrange for their extension well before the term has expired. However, stakeholder consultation has clarified that even this period of certainty is less than needed for some investments, particularly in second-generation biofuels but also in first-generation ethanol plants.
- 3) While some Member States use open aid schemes, available to all, others have opted for a **quota-based approach**, limiting the quantity of biofuel that will qualify for the tax exemption and setting up a process to choose the firms that will benefit from it. The Commission sees risks of non-transparency, arbitrary allocation and increased market concentration in quota-based schemes.

### Biofuels obligations

At present there is increasing interest among Member States in the use of **biofuel obligations**, requiring fuel supply companies to incorporate a given percentage of biofuels in the fuel they place on the national market or face a penalty.<sup>49</sup> Obligations are in force in France and Austria and will come into force in Slovenia in 2006 and in the Czech Republic and the Netherlands in 2007. The UK and Germany have recently said that they will introduce them. Schemes vary in relation to: the point in the distribution chain where the obligation is placed; whether individual types of biofuel are distinguished; how compliance is monitored; whether they are implemented through a system of tradable certificates; and whether they coexist with fuel tax exemptions.

Obligations have a number of advantages. They place responsibility for addressing the problem of excessive oil dependence on the sector where it originates – while implying only a negligible increase in the cost of fuel. They give fuel supply companies an incentive to push down the cost of biofuels – and it follows that they are more cost-efficient. They can include a

---

<sup>49</sup> Obligations that take this form are compatible with the Fuel Quality Directive (Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC (O.J. L350, 28/12/1998), as amended by Directive 2003/17/EC of the European Parliament and of the Council of 3 March 2003 (O.J. L76, 22/03/2003)). By contrast, an obligation to incorporate a given proportion of biofuel in each litre of fuel sold would not be compatible with the Directive..

premium for second-generation biofuels. Unlike state aids, they are not subject to a time limit and so could be a good way to establish the stable framework that investors want.

#### Compatibility between obligations and exemptions

It is important to point out that Article 16.6 of the energy taxation directive states that if Community law requires Member States to comply with legally binding obligations requiring them to place a minimum proportion of biofuels, the option for Member States to reduce excise duties under fiscal control (that is, without needing specific authorisation from the Council under unanimity) would disappear.

## ANNEX 10 – Trade in bioethanol

### 1. Current trade in bioethanol

There is currently no specific customs classification for bioethanol for biofuel production. This product is traded under code 22 07 which covers both denatured (CN 22 07 20) and undenatured alcohol (CN 22 07 10). Both denatured and undenatured alcohol can then be used for biofuel production. It is not possible to establish from trade data whether or not imported alcohol is used in the fuel ethanol sector in the EU.

An import duty of €19.2/hl is levied on undenaturedalcohol, while an import duty of €10.2/hl applies to denatured alcohol.

Table I

Imports under code 2207 (in hl)			
	Av. 1999-2001	Av. 2002-04	% of total (02-04)
<b>Undenatured alcohol</b>	1 167 935	2 383 239	93%
<b>Denatured alcohol</b>	279 904	180 988	7%
<b>Total</b>	1 447 839	2 564 226	100%

Overall imports of alcohol under code 2207 averaged 2 564 226 hl over the 2002-04 period, up from 1 447 839 hl over 1999-2001. Over 93% of them came under code 22 07 10 (undenatured alcohol).

The principal trade trends are summarised in Table II:

Table II

Total imports of alcohol under code 22 07 (in hl) by type of duty					
	2002	2003	2004	Av. 2002-04	% of total
<b>Reduced duty</b>	227 285	182 940	288 364	232 863	9%
<b>Duty-free</b>	980 693	2 027 632	1 709 282	1 572 536	61%
<b>MFN</b>	657 011	494 771	1 124 699	758 827	30%
<b>TOTAL</b>	1 864 989	2 705 344	3 122 345	2 564 226	100%

- average imports of bioethanol increased by 77% over 2002-2004 compared to the previous three-year period (1999-2001) when they totalled 1 447 839 hl;
- over that period 70% of these imports were traded under preferential conditions, out of which almost 61% were duty-free, while 9% benefited from some type of duty reduction;
- 30% of EU trade under code 22 07 takes place under MFN (most favoured nation) conditions.

With respect to the largest exporting countries:

- a) over the 2002-2004 period, Pakistan was the largest duty-free exporter with an average of 501 745 hl followed, at a distance, by Guatemala with 223 782 hl;
- b) Brazil is the only country capable of exporting large quantities as MFN with an average of 649 640 hl over the same period, with the second MFN exporter, the USA, on only 20 109 hl;
- c) one country - Ukraine - accounts for the vast majority of imports at reduced duty with 107 711 hl over the 2002-04 period. Egypt came second with over 43 000 hl.

## 2. Preferential imports of bioethanol into the EU

The EU's preferential trade basically comes under two regimes: the Generalised System of Preferences (including, among others, the Everything But Arms (EBA) initiative) and the Cotonou Agreement. The main preferences accorded by each of them are summarised in Table III and described in detail in the following sections.

Table III

Import conditions under code 22 07 under EU's main preferential agreements					
	GSP normal		GSP+	EBA	Cotonou
<b>Duty reduction</b>	15% up to 31.12.2005	0% as of 1.1.2006	100%	100%	100%
<b>Quantitative restrictions</b>	NO		NO	NO	NO
<b>Beneficiaries</b>	All GSP beneficiaries if not graduated.		Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Panama, Peru, El Salvador, Venezuela, Georgia, Sri Lanka and Mongolia	LDCs	ACPs

### 2.1. GSP

The current Council Regulation (Regulation (EC) 2501/2001), in force until 31 December 2005, classifies denatured and undenatured alcohol under code 22 07 as a sensitive product. According to article 7.4 of the regulation, imports of this alcohol from all GSP beneficiary countries qualify for a 15% reduction of the MFN duty.<sup>50</sup>

Under the special drugs regime envisaged by Council Regulation (EC) 2501/2001, which was in force from the early nineties until repealed on - 30 June 2005, exports from a number of countries (Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Peru, Pakistan, El Salvador and Venezuela) qualified for duty-free access under code 22 07.

The new GSP Regulation (Council Regulation (EC) No 980/2005 of 27.06.2005), which will apply from 1 January 2006 to 31 December 2008, no longer envisages

<sup>50</sup> Article 7(4) of Council Regulation (EC) No 2501/2001 of 10.12.2001.

any tariff reduction for either denatured or undenatured alcohol under code 22 07 (still classified as a sensitive product). This Regulation put in place a special incentive arrangement for sustainable development and good governance (the new GSP + incentive scheme) which has been applying on a provisional basis since 1 July 2005 and will apply on a permanent basis from 1 January 2006 to 31 December 2008. This new incentive arrangement grants unlimited and duty free access (suspension of Common Customs Tariff duties) to denatured or undenatured alcohol under code 2207. It includes all the countries which already benefited from the previous drugs scheme, with the exception of Pakistan which is subject to the full MFN duty.

The new incentive arrangement now also includes Georgia, Sri Lanka and Mongolia, which have not so far exported bioethanol to the EU.

Moreover, a special arrangement for least developed countries (the EBA initiative) provided for by the new GSP Regulation offers an unlimited duty-free access to denatured or undenatured alcohol under code 2207.

## 2.2. Cotonou Agreement

Under the Cotonou Agreement, ACP countries qualify for duty-free access for denatured and undenatured alcohol under code 22 07 with the sole exception of South Africa. According to Regulation (EC) 2501/2001, South Africa enjoys a 15% reduction in customs duties. From 1 January 2006 it will therefore have to pay full MFN duty. During the ongoing European Partnership Agreement (EPA) negotiations with ACP countries, the customs duties of alcohol under code 22 07 will need to be negotiated.

## 2.3. Other countries with preferential arrangements

Egypt currently has unlimited duty-free access to the EU under the Euro-Mediterranean Agreement. Before that, it qualified for a 15% reduction under the GSP scheme.

Norway, which ranks among the top ten exporters with a total of 89 375 hl under code 22 07 in 2004, has been granted duty-free access to the EU within the framework of tariff rate quotas (TRQs) since the mid-nineties. In 2005 the TRQ will total 164 000 hl for exports under code 22 07 10 (up from 134 000 hl the previous year) and 14 340 hl under code 22 07 20, up from 3 340 hl.

## 3. Trade analysis

Table IV sums up trade under the various preferential arrangements.

Table IV

Imports under preferential conditions 2002 – 2004 (in hl)					
	2002	2003	2004	Av. 2002-04	% of total trade 2002-04
<b>GSP normal</b>	227 285	182 940	288 364	232 863	9%
<b>GSP +</b>	553 156	1 569 005	1 412 896	1 178 352	47.5%

<b>ACP</b>	291 055	268 784	154 663	238 167	9%
<b>EBA</b>	30 018	86 247	18 956	45 074	1.5%
<b>Others</b>	106 464	103 597	122 768	110 943	4%
<b>Total preferential</b>	1 207 978	2 210 573	1 997 646	1 805 399	70%
<b>Total MFN</b>	657 011	494 771	1 124 699	758 827	30%
<b>Grand total</b>	1 864 989	2 705 344	3 122 345	2 564 226	100%

### 3.1. GSP

Trade data for 2001–2004 show a dramatic increase in bioethanol exports from the countries benefiting from the special drugs regime in previous years. Although these countries have benefited from the same regime since the 1990s, the unlimited duty-free access enjoyed under it at a moment of rising demand for alcohol under code 22 07 can be considered the single most important factor underlying the doubling of bioethanol exports from these countries to the EU. All major exporters under code 22 07 over the last three years benefit from such a scheme: Pakistan, Guatemala, Peru, Bolivia, Ecuador, Nicaragua and Panama.

Altogether, exports of ethanol from the GSP plus beneficiaries totalled 1 412 896 hl in 2004: practically all duty-free exports to the EU and 46% of all exports under code 22 07 to the EU over the 2002-2004 period.

Thanks to its lower production costs, Pakistan took a big lead over the other GSP beneficiaries with 1 008 656 hl in 2004 (the second largest exporter in the world) followed, at a distance, by Guatemala with over 250 000 hl.

Under the new GSP an exclusion of Pakistan from the list of countries having unlimited duty-free access to the EU market, will remove from the market one of the most aggressive and competitive producers. All old direct competitors under the GSP drugs regime will continue to enjoy duty-free access to the EU market and might be expected to fill the gap left by Pakistan as they have relatively low production costs too.

Nevertheless, at US\$14.52/hl, Pakistan has production costs closer to Brazil's which, with production costs of US\$13.55/hl, manages to export substantial quantities to the EU paying the full MFN duty. Pakistan might therefore be expected to continue to be able to export significant quantities of ethanol to the EU, albeit not at the same pace as before, thus utilising the increased production capacity built over the last couple of years.

By contrast, the 15% reduction offered by the normal GSP regime opened access for approximately 9% of exports of the same product to the EU market. Unlike the obvious favourable impact of the GSP drugs regime, the impact of the 15% duty reduction is more difficult to assess. The two largest exporting countries benefiting from such a reduction are Ukraine and South Africa. In the case of Ukraine, the introduction of the 15% reduction coincided with a dramatic increase in exports over the 2002-2004 period. For South Africa, on the other hand, the last two years showed exports stable on approximately 50 000 hl, with a dramatic decrease over the 2000-2001 period. Under these conditions, it is difficult to predict the impact of removal of

the 15% import duty reduction although it seems fair to say that even such a small reduction seemed to provide a competitive advantage over the countries paying full duty.

### **3.2. EBA**

So far, exports of bioethanol from countries benefiting from the special arrangement for the least developed countries (the EBA initiative) under the GSP (EC) Regulation 980/2005 to the EU have been negligible and have primarily come from one country - the Democratic Republic of Congo - which already qualified for duty-free access as an ACP country. At the moment, the Democratic Republic of Congo is the only LDC with sizeable, though erratic, exports of alcohol to the EU under code 22 07 since 1999. In 2004 exports totalled 18 956 hl after peaking at 86 246 hl the year before.

It is fair to recognise, however, that EBA dates back to only 2001 and that some of the countries which did not have duty-free access under other earlier regimes (notably Bangladesh, Laos, Cambodia, Afghanistan and Nepal) might find new ways of access to the EU in the medium or longer term.

New opportunities might emerge in these countries - which generally do not produce (or are not very competitive at producing) sugar cane or any other raw material for bioethanol production from their own resources – in the form of processing molasses imported from their competitive, sugar-producing neighbours. This might be the case with Cambodia which could use raw material from Thailand, or with Bangladesh and Nepal which might process raw material from India. At the moment it is difficult to quantify future potential production from these countries but investments are known to have been made in some of them, like Bangladesh.

In this respect it is important to stress that under Council Regulation (EC) 2501/2001, imports are subject to the GSP rules of origin plus regional cumulation. The Commission is currently examining a proposal for a new regulation which would introduce the principle of determination of the preferential rules of origin based on the value-added method. Distillation should continue to be considered an operation with sufficient added value to confer origin on the finished product.

### **3.3. Cotonou Agreement**

- On the whole, ACP exports to the EU under code 22 07 have so far been limited. Over the last couple of years they have, however, been fairly stable at 238 167 hl despite a low of 154 663 hl in 2004 (excluding South Africa: 48 728 hl).
- Swaziland and Zimbabwe are by far the leading exporters with an average of 85 562 hl and 120 261 hl respectively over the 2002-04 period. A number of ACP countries are likely to consider bioethanol production as an alternative to sugar production as part of the restructuring resulting from the EU sugar reform. However, bioethanol production from sugar cane might remain relatively low and limited only to countries where sugar production is competitive, such as Swaziland and Zimbabwe, which have production costs close to Brazil's and India's and which are already exporting substantial quantities to the EU under code 22 07.

## ANNEX 11 – Achieving the 5.75% biofuels target: the balance between domestic production and imports

One of the key variables in biofuel policy is the balance between domestic production and imports. Biofuels and their raw materials are traded on world markets. An autarkic approach to meeting the EU's needs is neither possible nor desirable. But the Union still has a degree of discretion about how far to encourage domestic production and/or imports. The purpose of this annex is to set out the facts and assess the pros and cons of different options.

### Tools for shifting the balance between domestic production and imports

The starting point is to understand the tools that can be used to shift the balance between domestic production and imports.

In the case of **bioethanol**, the main tool for shifting the balance is the duty paid. EU-produced bioethanol can be expected to cost about €900/toe by 2010 (costs are currently higher because most production plants are rather small). The cheapest imported bioethanol (from Brazil) can be bought in Europe at around €680/toe. Bioethanol imports are subject to duties ranging from zero (for imports from certain countries and/or under certain conditions) to about €376/toe (for undenatured ethanol imported at the maximum tariff). Consequently, imported bioethanol is cheaper than European if no import duty is paid, and more expensive if the maximum tariff is paid. If all tariffs on bioethanol were removed, it would be difficult for domestic producers to stay in the market.

In Germany, only fuel containing undenatured ethanol is eligible for fuel tax exemption. Even imported bioethanol needs the exemption in order to be price-competitive with petrol (currently around €457/toe<sup>51</sup>).

More details on trade arrangements affecting bioethanol are given in Annex 10.

Imports of **biodiesel** or of the vegetable oils used to make it are subject to low or zero tariffs.

Biodiesel can be made from most types of vegetable oil, notably rape oil, soya oil and palm oil.

EU rape oil competes at the world market price. Imported soya oil and palm oil are cheaper. However, biodiesel made predominantly from one or another of these oils does not comply with the “biodiesel” or “FAME” standard, EN14214 – and it needs to comply with this standard if it is to be sold for use in unadapted vehicles. Biodiesel made predominantly from rape oil does comply with the standard, even if blended with a small amount – around 25% – of one of the other oils.

The Commission believes that the limits in standard EN14214 could be adapted to allow a higher proportion of other oils – perhaps 50% – to be used in biodiesel.

### Scenarios for assessment

Three theoretical models must be assessed:

- 1) Minimum share for imports;

---

<sup>51</sup> Assuming oil at \$60/barrel and the € at \$1.25.

- 2) Maximum share for imports;
- 3) Balanced approach.

Scenario 1: Minimum share for imports

The first point to assess is the technical feasibility of this option and, in particular, whether sufficient land is available to produce the necessary crops.

The Commission estimates that in order to meet the biofuel directive’s objective of a 5.75% share of the petrol and diesel market in 2010, 18.6 mtoe of biofuels will be needed. Most domestic biofuel production will come from three crops: sugarbeet and cereals (for bioethanol, replacing petrol) and rape (for biodiesel, replacing diesel). Average biofuel yields per hectare vary widely, depending on the characteristics of the crops, the soil and the climate. The following averages have been assumed:

Sugarbeet	2.9 toe/ha
Cereals	0.9 toe/ha
Rape	1.1 toe/ha

On the basis of this it can be estimated that about 17 million hectares of EU agricultural land would be needed to meet the directive’s objective entirely from domestic production.

This can be compared with total EU arable land of 97 million hectares.

In the present context where crop production per hectare is rising steadily and the reform of the sugar regime will release resources currently used for food production, this appears to be technically feasible in principle. The Union is technically capable of meeting its biofuels targets for 2010 from domestic production, although it should be noted that there are agronomic limits on the cultivation of individual crops (e.g. the frequency with which rape can be included in crop rotation cycles)..

However, it should be pointed out that: existing trade arrangements and World Trade Organisation commitments do not permit the EU to close the door to imports of biofuels and biofuel raw materials; these materials are already being imported today; and there is no proposal to increase tariff protection for these goods. Therefore, the scenario of 100% domestic production is a theoretical one and would not be possible in practice.

Even interpreted as “minimum imports” rather than “no imports”, this scenario would have two disadvantages.

First, it would expose the EU food and biofuels sectors to excessive increases in the price of raw materials. By creating a new market that could be served only by domestically produced crops, the biofuels policy would drive up their prices, particularly for cereals and rape which are currently traded at world market prices.

Second, it would do nothing to encourage the production of biofuels elsewhere in the world where the creation of new biofuels industries – partly serving foreign customers like the EU, partly domestic needs – can bring benefits to developing countries. In addition, to the extent that increased consumption of biofuels is a tool to exercise downward pressure on the oil price, this is a global phenomenon – and the EU therefore has an interest in promoting biofuel production globally.

## Scenario 2: Maximum share for imports

By encouraging amendment of the biodiesel standard, the EU would ensure that the maximum proportion of its biodiesel consumption is met from imports. The Commission believes that, with an appropriate amendment, imported vegetable oils would capture about 50% of the biodiesel market. However, much of the processing is likely to continue to take place in the Union.

By removing all tariffs on bioethanol, the EU would ensure that the maximum share of its bioethanol consumption is met from imports. The Commission believes that bioethanol made from agricultural crops in Europe will not be able to compete on price with bioethanol made from sugar cane from tropical countries. Therefore, the result of this policy would be that 100% of EU bioethanol consumption would be covered by imports. There would be no domestic bioethanol industry.

On the hypothesis that 56% of biofuel consumption will be biodiesel (in line with diesel's current share of the petrol and diesel market), these steps would lead to imported biofuels (or their raw materials) taking about 70% of the EU biofuel market.

For biodiesel, this approach has merit. It would enable both EU producers and developing countries to benefit, in a balanced way, from the growth of biofuel consumption in the EU. It is an appropriate response to the limits on expansion of rape production in the EU. An EU industry would continue to exist.

But this strategy would not address the serious concerns that the present expansion of vegetable oil production – such as palm oil and soya – in developing countries could be responsible for destruction of natural habitats and deforestation and that increased demand from the EU could translate into an increased rate of deforestation. If this is true, it would be an important factor to set against the greenhouse gas emission reductions that the increased use of biofuels would deliver. If such doubts cannot be removed, public support for biofuels will be undermined. Therefore, it would be wrong to maximise the import of biofuels/raw materials for biofuels without paying attention to the environmental impact of their cultivation.

For bioethanol, this is not a good approach for the EU to follow. If the EU obtains its bioethanol from imports rather than domestic production, the cost will be about 25% lower and the global greenhouse gas benefits will be greater. However, there will be no rural development benefits for Europe. And the security of supply benefits will be less, because Europe will not have the advantage of developing a new domestic fuel source. From a practical point of view, it must be remembered that implementation of the Union's biofuel policy depends on the efforts of Member States. If there is no prospect of domestic involvement in the production of bioethanol, it is likely that many of them will focus their efforts on biodiesel instead – eroding the market into which developing countries hope to sell. Finally, if the least developed countries are not able to compete on price on the world sugar market, there is no reason to believe that they will be able to do so on the world bioethanol market if trade is made completely free.

Environmental concerns are also raised about the cultivation of sugar cane for bioethanol. Against this, it is argued that most bioethanol comes and will continue to come from land that has been under cultivation for a long time.

## Scenario 3 –Balanced approach

The Commission believes that an intermediate approach would avoid the disadvantages of the first two options.

This approach should have five elements:

- i) Amendment of standard EN14214 to facilitate the use of a wider range of vegetable oils for biodiesel, to the extent feasible without significant ill effects on fuel performance;
- ii) Maintain market access conditions for imported bioethanol that are no less favourable than those provided by trade agreements currently in force;<sup>52</sup>
- iii) Pursue a balanced approach in ongoing free trade agreement negotiations with ethanol-producing countries/regions. The EU must respect the interests of domestic producers and EU trading partners, within the context of rising demand for biofuels;<sup>53</sup>
- iv) Address the issue of amending the biofuels directive so that only biofuels whose cultivation complies with minimum sustainability standards count towards its targets;
- v) Support developing countries in the production of biofuels.

The system of certificates would need to apply in a non-discriminatory way to domestically produced biofuels and imports. In particular, it would need to be non-discriminatory in relation to the requirements of the World Trade Organisation. It would need to be developed in line with other initiatives for certification of agricultural and forestry produce and could require EU support in its introduction. The potential impact on developing countries would be taken into consideration before any system of certification is introduced.

The Commission estimates that under this approach:

- price increases for agricultural crops could be kept in an acceptable range;
- a sufficient share of the market for biodiesel raw materials, a majority of the market for biodiesel production, and a majority of the market for bioethanol would remain domestic;
- least-developed countries, including those for whom the reform of the EU sugar regime is a particular challenge and whose bioethanol is not subject to tariffs, would gain a share of the EU biofuel market;
- the promotion of biofuels would not cause deforestation and habitat destruction.

### **Notes on the production of biofuels in developing countries**

Support for developing countries in the production of biofuels is in the EU's interest both for development policy reasons and to maximise downward pressure on the oil price. It could

---

<sup>52</sup> In particular, under the Everything But Arms, Generalised System of Preferences (+) and Cotonou agreements, which presently provide free access to the EU for ethanol imports.

<sup>53</sup> Note: existing trade agreements, notably Everything But Arms (EBA), Generalised System of Preferences (GSP) + and Cotonou, which presently provide free access to the EU for ethanol exports, will maintain this level of access..

contribute in specific countries, as in the EU but often in more critical situations, to greater energy security and access to energy, improved foreign exchange and trade balances, economic development and employment in rural regions, and environmental benefits. To the extent that the development of biofuel consumption will exert downward pressure on the global oil price, consumption in developing countries will contribute in the same way that European consumption does. EU development policy, as well as other EU policies such as research and energy and the clean development mechanism under the Kyoto Protocol, offers a number of instruments that can be used.

The positive and negative impacts of cash crops for biofuels on food production and food security have been the subject of extensive discussion. The costs and benefits depend on the site, the way the crop is produced and how it is integrated in the local production system. There is no general rule. Sugar cane has almost always been cultivated as a cash crop in developing countries, and a switch in the end-product from sugar to ethanol should not affect the food supply of the region. Some biofuel raw materials like jatropha could allow the sustainable use of low-value land and, in the process, contribute (via earnings) to an improvement in food security.

## **ANNEX 12 – The Commission’s perspective on biomass and biofuel research**

### **1. Introduction**

Research, technological development and demonstration have potential to support the use of biomass. The Commission intends to capitalise on this. Its proposal for the Seventh Framework Programme – Specific Programmes, adopted in September 2005, gives a high priority to biomass.

An industry-led European biofuel technology platform is under development.<sup>54</sup> This is intended to develop and implement a European vision and strategy for the production of biofuels, in particular for transport. Once the technology platform is established, the EC will explore the need to propose a possible joint technology initiative in this area.<sup>55</sup>

Other technology platforms will also play an important role – for example, those dealing with “Industrial biotechnology”, “Plants for the future”, “Road transport” and “Forest-based sectors”. Under the framework of the Seventh Framework Programme, there is a need for increased coverage of the following topics: biomass availability and logistics ; energy crops for the production of biomass;<sup>56</sup> and combustion, gasification and pyrolysis of biomass covering co-firing, recovered fuels and combined heat and power.

This research and development activity under the Seventh RTD Framework Programme will be complemented by non-research action in the “Intelligent Energy – Europe” programme. The main focus here is to support soft measures and to remove non-technological barriers to the widespread market deployment of already demonstrated biomass and biofuel technologies.

### **2. Research priorities – biomass in general**

The following actions related to biomass, with their corresponding objectives, are included in the Seventh Framework Programme.

#### *- Biomass for electricity, heating and cooling*

The objective is to develop and demonstrate a portfolio of technologies for electricity, heating and cooling from biomass, including the biodegradable fraction of waste. This research aims at increasing overall conversion efficiency, achieving cost reductions, further reducing the environmental impact and optimising the technologies in different regional conditions. A broad range of research topics are considered including biomass availability and logistics; conversion technologies, such as combustion, co-firing and gasification; emission abatement; and land use.

The Commission will propose to the “Zero Emission Power Generation” technology platform that co-firing be included in its scope.

---

<sup>54</sup> Technology platforms are channels to involve industries in defining research priorities.

<sup>55</sup> Joint technology initiatives are a new way to create public-private partnerships at European level. They have their foundation in technology platforms. They may take the form of a joint undertaking.

<sup>56</sup> With emphasis on woody crops (short-rotation coppice, grasses and miscanthus); on new crop breeds and novel cropping systems optimised for non-food use; on improving the energy content of the agricultural crops used for first-generation biofuels; and on machines and techniques for planting, harvesting, storage, transport, pre-treatment and conversion into material that can be fed into conveyor systems.

### *- Smart energy networks*

To facilitate the transition to a more sustainable energy system, a wide-ranging R&D effort is required on the EU electricity and gas systems and networks. Research aims at effective integration of biomass installations into electricity grids and feeding biogas and synthetic natural gas into the natural gas grid.

### *- Life sciences and biotechnology for sustainable non-food products and processes*

The objective is to strengthen the knowledge base and develop advanced technologies for terrestrial or marine biomass production for energy and industry. Biotechnology will be applied to improve the productivity, sustainability and composition of biomass raw materials and to develop new bio-processes.

The Commission also attaches high importance to the “biorefinery” concept to maximise the value derived from biomass feedstocks by making full use of their components. Biorefineries could be built up by adding further fractionation and conversion steps to current biomass processing facilities (sugar, grain, pulp mills, oil refineries, etc.) to obtain a broad range of products such as food, feed, sustainable polymers, chemicals, fuels, and heat and power. Improving the cost-efficiency of biofuels through the biorefinery concept will be an important element of the biofuel technology platform.

## **3. Second-generation biofuels: state of play**

Producing bioethanol from cellulose delivers a gasoline substitute which is identical to bioethanol produced from sugar or cereals. Synthetic enzymes provide the key to unlock the cellulose molecules and break them down into simpler substances, which are subsequently fermented to ethanol and purified (distilled) the same way as conventional bioethanol. It is hoped that energy balances and, hence, CO<sub>2</sub> emission reductions will be largely enhanced.

The first demonstration plant was taken in operation by Iogen (4 million litres per year in Canada) and this was followed by ETEK (150 thousand litres per year pilot plant in Sweden) which was supported by EU regional funds. A third facility is under construction by Abengoa (5 million litres per year in Spain) and this plant is supported by the Fifth Framework Programme. Enzymatic hydrolysis is expected to become competitive in the medium term due to the decreasing price of the enzymes and low cost of the raw material (such as straw or even wood); being one of the most critical parameters in the overall cost of the biofuel.

Second-generation biodiesel is chemically different from vegetable-oil-based biodiesel. Gasification of biomass (anything works, but the drier the better) produces a “synthesis gas” consisting mainly of carbon monoxide (CO) and hydrogen. Exposing this gas to a suitable catalyst converts it into hydrocarbons (Fischer Tropsch synthesis), which will subsequently be treated to deliver a mixture of gasoline, jet fuel and diesel. Because of the high price of jet fuel, the excellent quality of the diesel fraction and the low quality of the gasoline fraction (low octane number), the process is normally optimised towards the production of jet fuel/diesel.

The different steps in the process have all been demonstrated to work commercially for Fischer Tropsch synthesis gas derived from coal or natural gas. Optimisation still remains to be done on gasification of biomass from different raw materials and gas purification to synthesis gas quality. A large-scale pilot plant (15 000 t/year) is being constructed in Freiberg (Germany) by the company Choren. In addition, Choren and Shell are in the process of

developing a full-size prototype commercial plant with a capacity of 200 000 t/year which optimistically, depending on the experience with the pilot plant, could be operational in 2009/10. In parallel to the experience to be gained from this “biomass-to-liquid” (BTL) process, a number of large-scale “gas-to-liquid” projects, several in Qatar, will deliver technology experience on the second stage (Fischer Tropsch) of the process in the years ahead.

Alternatively the synthesis gas can be converted to bio-dimethylether (DME), which can also be used to replace diesel in modified diesel engines. DME, a gaseous fuel under ambient conditions, can be of particular relevance in heavy-duty applications.

The advantage of second-generation biodiesel is partly that the basic treatment of the raw material (gasification) allows virtually any organic material to be used and partly that it delivers a premium-quality diesel fuel, whether to be used in its own right or as a blending component in petroleum-based diesel. Its CO<sub>2</sub> emission profile depends on whether the energy source for conversion is biomass only or whether an external energy source is used, and whether the biomass is a waste product (e.g. straw) or an energy crop. This also affects the cost. Here too, significant CO<sub>2</sub> gains and energy balance improvements are hoped for.

Hybrids between first- and second-generation biofuels are also in preparation. Fortum (Finland) is planning to expand its Porvoo refinery to use vegetable oil and animal fat as a raw material in a conventional hydrogenation process. This delivers the same high-quality diesel as BTL with lower investment, but higher raw material costs (close to conventional biodiesel).

#### **4. Research priorities - transport biofuels**

The main area of research is second-generation biofuels made from various biomass resources and wastes, e.g. bioethanol, biodiesel, DME. The technical feasibility of converting cellulose material (straw/wood) and organic wastes into bioethanol and biodiesel has been demonstrated. But costs need to be brought down and technology needs to be further developed and demonstrated for commercial-scale production (over 150 000 tonnes a year). If this can be done, second-generation biofuels should offer three major advantages:

- they will secure a higher market share for biofuels by allowing the use of a wider range of raw material;
- the cultivation process (if any) could be less environmentally intensive than for ordinary agricultural crops;
- this lower intensity will be reflected in lower greenhouse gas emissions from cultivation.

Second-generation biodiesel production has a fourth advantage: the fuel is of better quality than conventional diesel.<sup>57</sup>

The price of these fuels will depend on technical developments and the price at which the raw material can be obtained. At this stage there is no reason to assume that they will be substantially cheaper than first-generation biofuels.

The Commission plans to substantially increase its support for the development of second-generation biofuels through its research budgets.

---

<sup>57</sup> The process can also be used to produce a (good) substitute for jet fuel or a (poor) substitute for petrol.

## **ANNEX 13 – Results of consultation**

This communication and the impact assessment published alongside it take into account the results of extensive consultations. These began with the Commission's analysis of the various policies affecting biomass and an extensive public consultation campaign using all possible means, such as a public questionnaire via the Internet, numerous meetings with stakeholders, and bilateral meetings with Member States that have developed national Biomass Action Plans and with biomass experts.

The main conclusion drawn from the consultations was that the Commission should push strongly on all fronts, at EU level and national level, in order to overcome the non-technical barriers facing biomass.

Several more specific conclusions can be drawn from the consultation process:

- Sufficient biomass resources are available in the Union to meet the needs for an additional 80 mtoe per year by 2010 without major effects on forest products industries and food production. Energy crops can make a significant contribution while providing a new market outlet for agriculture and contributing to rural development. Any shortfalls can be addressed by imports.
- There are competitive, reliable and efficient European technologies to convert biomass resources into energy vectors (electricity, heating or cooling and biofuels for transport). Nevertheless, RTD work on biomass (supported by appropriate national and EC funds) has to be intensified in order to meet new challenges.
- European (as well as international) solid and liquid biofuels markets are in their infancy and have to be developed further to commodity level. In order to develop them successfully, work on standards and norms has to be accelerated.
- Biomass is generally more expensive than comparable fossil fuel energy. However, in some areas (such as household heating by pellets and industrial CHP based on residues) biomass is already competitive.
- There is an urgent need to start a professionally managed campaign to inform European citizens more fully about the benefits of biomass. This information barrier, as well as the absence of more effective representation of biomass at all levels, is also due to the lack of a strong European biomass association with industrial involvement.
- The main problem that appears to be holding back the penetration of biomass on the energy markets is the lack of demand. The only way to increase demand is through appropriate policies implemented at national level.
- Biomass is the only renewable energy source that does not suffer from intermittency problems and can potentially provide energy for heat, power and transport from the same installation.
- Biomass in the form of solid, liquid or gaseous biofuels is the only renewable energy source that can directly replace solid, liquid and gaseous fossil fuels, either fully or in blends of various percentages, in which case often there is no need for equipment modifications.

- Biomass is the only renewable energy source that cannot be found free; it necessitates a long chain of activities such as planting, growing, harvesting, pre-treatment (storage and drying) and upgrading to a fuel and, finally, mechanical, thermochemical or biological conversion into an energy carrier (power, heat or biofuels for transport). Therefore, biofuels (with the exception of untreated municipal waste) always have an associated cost that has to be borne by the final user.
- Since land availability is limited there could come a point in the future when biomass for energy will have to compete with food, materials, bio-chemicals and carbon sinks. However, this point in time is beyond 2020, and if international trade in biomass fuels becomes effective could lie beyond 2050.
- Environmental concerns must also be addressed whenever biomass is grown for food, products or fuels. This has to be done by taking an overall systems approach and by comparisons with other alternatives and not in isolation.