TRANSATLANTIC PLATFORM FOR ACTION ON THE GLOBAL ENVIRONMENT (T-PAGE)[1]

Biofuels for Transport

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1 INTRODUCTION

Biofuels offer the potential for environmental benefit or environmental catastrophe. They have enormous potential for climate change mitigation, energy security, and economic development. Additionally, high concentration biofuel blends can produce fewer air pollutants than gasoline. If developed in unsustainable ways, however, biofuels can be a driver for land-use change, loss of carbon stores via deforestation and ploughing up grasslands, biodiversity loss via agriculture intensification and expansion, water and air pollution. The policies used to promote biofuels will determine which of these contradictory paths is followed.

Growth in the production of biofuels will occur regardless of whether the environmental community supports it. While the potential for reductions in carbon emissions is one driver, concerns over security of energy supply are driving ambitious targets for biofuels in both Europe and the US The International Energy Agency projects a growth rate for the production of biofuels of between 7% and 9% per annum up to 2030, increasing the use of biofuels for road transport fuel from 1% to between 4% and 7% globally.[i] The amount of land used to cultivate feedstock for ethanol is projected to more than double or even triple by 2030. Consumption of biofuels will be concentrated in the US and Europe. The US is already the largest biofuels producer and consumer by volume, having recently surpassed Brazil. It is expected to maintain the highest growth rate, although will be closely followed by Europe.[ii]

While biofuels are a significant element of climate change policy packages in both the EU and the US, perspectives on biofuels differ across the Atlantic. There is an acceptance in the US that biofuels production in inevitable, while in Europe there is still much more of a debate. Biofuels remain an expensive way of reducing greenhouse gas (GHG) emissions, but they remain one of only a handful of options available to curb the ever burgeoning emissions from the transport sector (the other key measure being to force carmaker's to reduce CO_2 emissions from the fleet by increasing efficiency of fuel use)[iii].

This paper is intended to introduce the current situation in terms of both policy and the market for biofuels in the EU and US We then examine the key issues of interest for civil society in the development of biofuels. There is obviously the fundamental question of whether biofuels should be supported at all, however, given the rapid expansion of the market it is important to consider:

- how sustainability requirements can be applied effectively;
- how GHG savings might be ensured;
- what the land use impacts of biofuel expansion might be and conflicts with other demands for biomass in terms of energy and food; and
- how, when and whether to support the push for second generation/advanced biofuels.

Analysis of biofuels for transport has been selected as a priority under T-PAGE following discussions in April 2007 with a small group of key representatives from environmental NGOs and academia. Civil society, on both sides of the Atlantic, was considered to be trying and struggling to address the biofuels question. The policy framework under development today will be of vital importance in ensuring the development of biofuels with a positive environmental and socio-economic impact.

2 EUROPEAN POLICY APPROACHES

2.1 Nature of the market

The EU is reliant on other countries for a huge proportion of its energy; approximately 48% of all energy is imported[iv]. The level of dependency upon imported fuels varies according to fuel type, but importantly many of Europe's existing oil fields are expected to become exhausted in the medium term; remaining reserves are relatively limited and expected to be more problematic to exploit. Meanwhile, energy consumption within the transport sector is growing exponentially, having increased by 22% between 1990 and 2000[iv]. Currently the transport sector is almost completely dependent on oil as its primary fuel source.

Aviation is the fastest expanding transport sector, but road vehicles account for a predominant 72% of transport's energy use (see Figure 1). Between 1990 and 2001, greenhouse gas emissions from Europe's transport sector increased by a comparable 21%[v]. This masks, however, very large disparities in emission increases between Member States. Over this period Ireland's emissions increased by 124% and Portugal's by 81%; meanwhile Finland's emissions only increased by 1%. Carbon dioxide accounts for 97% of the greenhouse gas emissions from Europe's transport. In turn, road transport is by far the largest contributor to CO_2 emissions, responsible for 92% in 2001. Emissions from the transport sector are expected to continue to grow, projected to be 39% above 1990 levels by 2010[v].

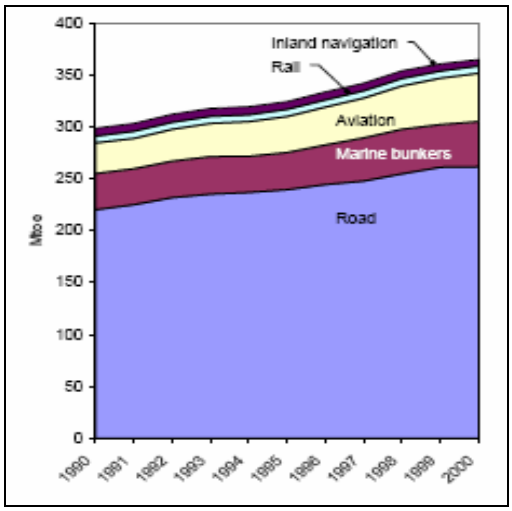

Figure 1 – Energy Use split by transport sector for the EU 15 plus Norway and Iceland (EEA 17). This demonstrates the increase in consumption between 1990 and 2000. It also demonstrates the dominance of road transport in terms of emissions and the growth still being experienced in this sector. [iv]

Unlike the US, Europe is making use of significant quantities of biodiesel as well as bioethanol. The EU is the world's biggest producer (although not all the feedstocks used for production come from within the EU) and user of biodiesel; 2 million tonnes were manufactured in 2004. Germany is by far the most prolific producer, followed by France and Italy. According to the European Commission, however, the EU has greater capacity to produce bioethanol than biodiesel[vi]. Currently bioethanol generation is concentrated in Spain, France and Sweden[vii]; however, overall EU production is far behind that of the major producers ie Brazil and the US: production of ethanol in Europe is less than a quarter of that in Brazil or the US.

The renewable transport fuel Directive[viii] sets out reference values, essentially indicative targets for the uptake of biofuels in Europe, of 2% by 2005 and 5.75% by 2010. Figure 5 shows the actual uptake of biofuels in reporting Member States by 2005; clearly the 2005

indicative target was missed in the majority of countries with only Germany and Sweden having significant biofuel market shares.

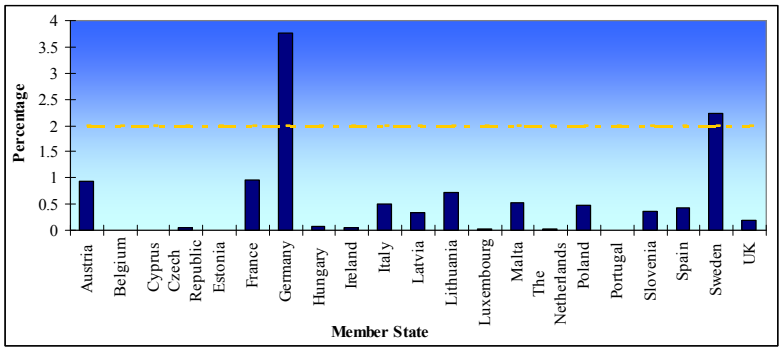

Figure 2 – Use of biofuels in Member States as a percentage of total fuel used in 2005. Dotted line marks the biofuels Directive reference value for 2005 ie the indicative target to fuel uptake[ix].

2.2 EU and Member State Policy Approaches

2.2.1 EU Approaches to Promoting Development of Biofuels

The Biofuels Directive

Directive 2003/30/EC for the promotion and use of biofuels or renewable fuels for transport[viii] (known as the biofuels Directive) requires Member States to ensure that a 'minimum proportion' of biofuels is put on the market. In order to do this Member States must set national indicative targets. 'Reference values' for these targets are set in the Directive at 2% at the end of 2005, rising to 5.75% in 1210. However these values are not legally binding, and the 2005 goal has already been missed in most cases as noted above.

The biofuels Directive did not have an easy birth. When the measure was first proposed by the European Commission it caught many by surprise. Despite previous requests for action on alternative transport fuels from the Heads of the EU Governments, many thought the Commission's Directorate General on Transport was uninterested in this issue. There were significant objections raised to the original proposal text, with the Commission accused of only involving a small group of vested interests in the proposal's development. Environmental groups reacted to the proposals with a mix of caution and dismay, concerned that the balance of biofuels' environmental costs and benefits had not been properly considered. The proposals were subsequently watered down and refined during codecision[3], where mandatory targets for biofuel uptake were converted to the much weaker system of reference values. Importantly, clauses were also added to counter concerns over biofuels' environmental impacts; as a result Member States have to take into consideration the 'overall climate and environmental balance' of different biofuels and are permitted to preferentially promote those with the 'most cost-effective environmental balance'[x.] There is, however, no consideration or guidance setting out how this should be done.

Future Biofuels Legislation

Since the adoption of the biofuels Directive pressure, particularly in terms of the security of energy supply, has mounted. The use of biofuels, and more generally biomass for energy, has increasingly been seen as a way of securing Europe's energy future, ensuring diversity in terms of energy sources and at the same time reducing carbon intensity. At the end of 2005 the Commission published an action plan on the use of biomass for

[3] The approval process where by the European Parliament and Council of the European Union (upon which all Member States are represented by their Ministers of State) negotiate the final content of a legislative measure amending the European Commission's original proposed text.

energy[xi]; this was closely followed by an EU strategy for biofuels in mid 2006[xii]. These discussion documents set the scene for more robust legislation encouraging the use of biofuels in the transport sector and importantly the proper consideration of sustainability and climate impacts within this.

On the 10 January 2007 the European Commission published (what has been termed) 'The Energy Package', which includes future targets and measures across the sphere of EU energy policy[xiii]. Importantly, it contained plans to adopt new, mandatory and much more ambitious targets for the uptake of biofuels ie 10% of all road fuels by 2020. This is well beyond what is either technically possible through current or envisaged levels of blended fuels, and beyond Europe's capacity to supply its own needs. In the March summit of 2007 Heads of European State and Government agreed in principle to this target at the European Council. They signed up to this ambitious and mandatory target, but emphasised that their support is subject to second generation fuels coming on stream and the adoption of measures to ensure the sustainability of the biofuels used.

On 23 January 2008 a proposal for legislation that would establish this new EU biofuels target in law, alongside equally ambitious requirements for renewable energy, was adopted[xx]. Within this formal requirements for the sustainability of biofuels entering the EU market place were set out. It should be born in mind that at the time of writing this measure is a proposal for a Directive put forward by the European Commission. This means it is essentially only a draft of what will actually become European law and must now go through the European Parliament and European Council approval procedures before being adopted. During this process, given the growing controversy in Europe over biofuel use, the biofuel provisions and explicitly the sustainability criteria are expected to be extensively amended and possibly strengthened.

There are several important features of the January 2008 proposal. Firstly it only contains proposed environmental sustainability criteria not social elements. This is because the Commission considered that the latter would be too difficult to report against and verify. However early indications strongly suggest that these will be added during the approval process by the Council and/or the Parliament. The environmental criteria proposed by the Commission relate exclusively to greenhouse gas reductions, protection of biodiverse areas and the protection of carbon stores – details of the different criteria are set out in Box 1 in Section 2.3. While non-compliant biofuels would not be banned from the European market place, only compliant biofuels would be deemed to count towards national and EU targets and energy obligations, or be eligible for financial support. An outright ban would be counter to international trade rules, but for the time being it is expected that these provisions should guard against non-compliant fuels entering the market in any quantity, given that the escalation in their use in being driven by policy measures rather than market forces alone. Importantly, under the proposals there would be only one approach to ensuring biofuel sustainability across Europe. Already there has been a multiplicity of schemes being developed at the national level by Member States, but under the current proposals Member States would have to allow biofuels produced in line with the EU-wide sustainability criteria to count towards national targets etc and would not be allowed to refuse such biofuels access on 'other grounds of sustainability'. This is to ensure that the EU market does not become totally fragmented, as a multiplicity of EU approaches could have led to major market uncertainty. Additionally, if the aim is to set a precedent for the sustainable production of biofuels and influence the global market place a combined EU effort will be more effective. It should, however, be noted that Member States will have control over systems to verify the compliance of biofuels

entering their domestic markets with the EU-wide criteria. This may give some discretion as to national level acceptance of different fuels.

Somewhat surprisingly, barely a week after the Energy Package was launched in January 2007; the European Commission also adopted a proposal to amend the EU's fuel quality Directive[xiv]. Historically this has been a technical measure concerned only with fuel quality parameters, but controversially the Commission's Environment Directorate used its review to radically extend the Directive's scope by inserting two new clauses relating to biofuels. The most important of these, mirroring developments in California although more restricted in scope, seeks to ensure the progressive decarbonisation of transport fuels. Under current proposals (the exact requirements may be amended as the measure is approved in codecision) as of 1 January 2011 Member States must ensure the progressive reduction of life cycle greenhouse gas emissions from transport fuels, by 1% per year between 2011 and 2020 such that by 2020 it will be 90% of the level reported in 2010. It is estimated that this measure would save 100Mt of CO_2 equivalent per year by 2020.

By inserting GHG requirements into the fuel quality Directive the Commission has been accused of pre-empting the debate under the energy package and complicating the future regulation of biofuels. Certainly the proposed 10% reduction target would be more demanding than the 10% consumption target set out in the package and subsequently the renewable energy Directive. To understand how these two parallel measures came to be launched at the same time, one must be aware of the political background to their development. The Commission's Environment Directorate General has, for a long time, had concerns about measures promoting biofuels use. The development of these measures has primarily been driven by the Directorates General for Agriculture and for Energy and Transport, which have promoted quantity-driven targets without initially much concern over the level of GHG savings that these would generate. There were also concerns that under this regime sustainability standards would not be as robust as deemed necessary by environmental groups. This measure attempts to provide a security mechanism to ensure that the unfettered expansion of the biofuels sector is at least subject to the requirement to continually improve performance in terms of GHG emissions across all transport fuels, albeit only after 2010. Additionally, it would potentially forestall the introduction into Europe of new synthetic fuels with very high life-cycle carbon emissions, such as those sourced from coal, oil shale or tar sand. It should be noted that since the proposal of the renewable energy Directive and its provisions on the sustainability of biofuels there have been discussions about harmonising sustainability requirements under the two Directives. It is, as yet, unclear how this will be achieved however. A working party has now been set up by the European Council to consider this and develop solutions before Autumn.

Funding Energy Crop Development and Adoption of Biofuels

Historically there has been financial support for growing energy crops in Europe, albeit to a much more limited extent than for food production. Set-aside measures in Europe require farmers to exclude a certain proportion of farmland from specific arable production. In return they receive a payment from the EU intended to prevent over-production and generation of the notorious 'food mountains' of previous years. While food crops cannot be grown on set-aside land, energy crops can without the farmer foregoing set-aside payment. As a result the cultivation particularly of rapeseed for biodiesel commonly occurs on set-aside land (although by no means all). Additionally, the EU provides a limited amount of subsidy supporting the production of energy crops in the EU. The funding structure for agriculture in the Europe and importantly energy crops looks set to dramatically change however. The level of set-aside has recently been reduced to zero, and the 'Health Check' scheduled for 2008 and 2009 on the EU's

Common Agricultural Policy (CAP) looks set to get rid of set-aside and alter the approach to funding energy crops.

There are other sources of funding helping to support the development of the biofuels industry in Europe. The year 2007 saw the commencement of a new funding period (which extends until 2013) under the EUI budget. Under this the Commission has specifically asked Member States to consider funding of biofuel and biomass development. This could be in the form of part-funding the construction of processing plant all the way down the supply chain to helping to educate farms about the growing of energy crops. Key mechanisms for the funding of biofuels projects are included under the new Rural Development Fund[xv] and the broader measure on Competitiveness and Innovation in the EU[xvi], which focuses on the development of new technologies.

2.2.2 Member State Approaches to Promoting Biofuel Development

The level of ambition in terms of developing and adopting biofuels for transport varies dramatically across European nations. Historically Germany, France and Sweden have been the main users. The former two have been particular protagonists calling for the support of biofuel development in Europe. Member States have, however, all struggled to adopt effective policies that would support the integration of biofuels into main stream fuel supplies. Historically, for example, much of the biodiesel usage was from the use of high blends for particular vehicle niches rather than low level blending across the economy. This picture is, however, changing; as it must do if Europe stands any chance of meeting the ambitious 2020 target. This would require much broader adoption across the whole vehicle fleet at lower levels of blend.

In response to this, and pressure to better consider second generation methods and sustainability of fuels, Europe is currently witnessing a shift in the nature of policy support for biofuels. Historically tax incentives and exemptions, albeit in a variety of different permutations, were most popular. These were intended to make biofuels, which are still more expensive than fossil fuels, competitive by relying on market pressures to bring about their broader use. As the market and policy has developed, however, there has been a rapid shift towards the use of obligations. These oblige fuel companies to blend a certain proportion of biofuels into petrol and diesel supplies. Each has an obligation to achieve a certain level of blending and faces financial penalties if they fail to do so.

Obligations are now the favoured mechanism for nation policy, as they drive the potentially rapid transformation of the entire fuel market. It is considered that they allow targets to be achieved more cost-effectively than tax exemptions and allow difficulties with tax exemptions (eg to what should they be applied to and how should quantities be controlled) to be overcome. Additionally, obligations suit the political mood as Europe's governments become less willing to provide tax exemptions generally due to spending constraints and other political pressures. Finally, and positively for the environment, obligations are believed to allow more scope for the favourable treatment of second generation fuels and fuels meeting sustainability standards[xvii]. The UK's obligatory system, termed the Renewable Transport Fuel Obligation (RTFO), is one of the most well-advanced. It looks likely that the Commission will support the use of obligations in their 2008 proposals.

2.3 Ensuring Sustainability

The sustainability of biofuels is a hotly-debated topic in Europe, with the terms of debate comparable but subtly different from those in the US. There are increasing concerns over

the impact that the rapid expansion in Europe's biofuel sector will have internationally. Both direct and indirect impacts, particularly upon biodiversity and water resources, both within and outside the EU, are a concern. Additionally, if biofuels are to be seen as a technology for the reduction of GHGs there is a need to be able to measure the reductions they deliver and ensure that these are maximised. Europe has been at the forefront of the movement pushing for the adoption of standards to ensure that biofuels are in fact the sustainable solution that they have the potential to be.

The proposals to amend the fuel quality Directive (discussed in section 3.2.1) are an attempt to ensure the reduction in GHGs from the whole transport fuel sector. Additionally, broader sustainability standards for biofuels have been proposed in the renewable energy Directive (also discussed in 3.2.1). Meanwhile, Member States have been very active in developing their own approaches to sustainability requirements with efforts well advanced in the UK, the Netherlands and Germany. This independent thinking is important as it has helped to further the debate over what is possible and practicable. However, it now looks likely that national schemes will have to be scrapped in favour of an EU-wide approach under the renewable energy Directive. The development of national level schemes has, however, heavily influenced the EU level approach, helping to stimulate informed debate and understanding as to what is acceptable.

Schemes under development in Europe would probably not ban unsustainable biofuels from the market place - ie biofuels could still be sold that do not meet the standards. They would, however, require compliance in order to meet any targets or qualify for subsidies or tax breaks. This is intended to minimise the use of the worst biofuels without contravening WTO rules, while hopefully adding value to the most sustainable fuels on the world market. At present such a system should act to influence the market because the latter is primarily policy driven ie the market is developing so rapidly not of its own accord but in order to meet an artificial demand generated by targets, tax breaks and obligations. If the biofuels market were ever to begin to operate on its own account ie if biofuels were cost-effective beyond the policy requirements, then this system would be far less effective and other measures might be needed.

The systems currently being favoured in Europe apply overarching principles that biofuels should comply with (see Box 1). In order to demonstrate compliance with these conditions there is not one specific standard or certification approach, but instead a 'meta-standard' approach. This reflects the fact that biofuels are heterogeneous and as such there is no one measure that demonstrates sustainability, or indeed a single available standard applicable to all aspects of the sustainability principles or all types of feedstocks and processes. This is because of the different nature of feedstocks, growing conditions, production processes, end products etc. A variety of standards will, therefore, be approved that are deemed to demonstrate compliance with the core principles set out (termed qualifying standards under the UK proposals). Under each standard there would likely be a complex of methods and approaches approved to demonstrate compliance depending on location etc. This essentially similar to the meta standards approach proposed by WWF and Ecofys[xviii] (see section 4.1).

Box 1 - Examples of proposed sustainability principles around which standards and certification efforts are being built in Europe

Principles set out in UK consultation on carbon and sustainability reporting[xix]	Environmental criteria biofuels on the European market would need to meet in order to contribute to national targets, energy obligations and be eligible for financial support as set out in January 2008 proposal for Directive on renewable energy[xx] [4]
	The greenhouse gas emission saving from the use of biofuels shall be at least 35%. In the case of biofuels produced by installations that were in operation in January 2008, the above shall apply from 1 April 2013. Biofuels and other bioliquids shall not be made from raw material obtained from land with recognised high biodiversity value, that is to say land that had one of the following statuses in or after January 2008, whether or not the land still has this status: (a) forest undisturbed by significant human activity, that is to say, forest where there has been no known significant human intervention or where the last significant human intervention was sufficiently long ago to have allowed the natural species composition and processes to have become re-established; (b) areas designated for nature protection purposes, unless evidence is provided that the production of that raw material did not interfere with those purposes; (c) highly biodiverse grassland, that is to say grassland that is species-rich, not fertilised and not degraded. The Commission shall establish the criteria and geographic ranges to determine which grassland shall be covered by point (c). Biofuels shall not be made from raw material obtained from land with high carbon stock, that is to say land that had one of the following statuses in January 2008 and no longer has this status: (a) wetlands, that is to say land that is covered with or saturated by water permanently or for a significant part of the year, including pristine peatland; (b) continuously forested areas, that is to say land spanning more than 1 hectare with trees higher than 5 metres and a canopy cover of more than 30%, or trees able to reach these thresholds in situ ; The provisions in this paragraph shall not apply if at the time the raw material was obtained, the land had the same status as it had in January 2008. 5. Agricultural raw materials cultivated in the Community and used for the production of biofuels, shall be obtained in accordance community rules on good agricultural and environmental condition within agriculture.

Environmental principles	
Principle 1	Biomass production will not destroy or damage large above or below ground carbon stocks
Principle 2	Biomass production will not lead to the destruction or damage of high biodiversity areas
Principle 3	Biomass production does not lead to soil degradation
Principle 4	Biomass production does not lead to the contamination or depletion of water sources
Principle 5	Biomass production does not lead to air pollution
Social principles	
Principle 6	Biomass production does not adversely affect workers rights and labour conditions
Principle 7	Biomass production does not adversely affect land rights and community relations

The UK's proposed scheme for ensuring sustainability under the RTFO is one of the most advanced in its thinking worldwide. In 2007 the UK Government ran a public consultation requesting comments on their proposed approach[xxi]. It was well received by the majority of stakeholders. There was a general feeling that the scheme was well thought through, having been developed via a series of working groups composed of environmental and industry representatives under the auspices of the Low Carbon Vehicle Partnership[xxii]. The UK system will require detailed reporting on the biofuels used to comply with the RTFO. Reports need to be submitted by fuel companies setting out details of the batches of biofuels being used in the UK, and where gaps in knowledge exist. In order to receive a credit under the RTFO they will also have to report on a monthly and annual basis. There are then ambitious, although currently indicative, targets set that will mean the fuel industry must rapidly ramp up the GHG reductions and the proportion of fuels achieving appropriate sustainability standards (see Box 2). Additionally, there will be targets for the reporting of sustainability and carbon requirements. The system will be overseen by a new government agency known as the Renewable Fuels Agency.

[4] It should be noted that these criteria are still under intensive debate with proposals and counter proposals being made almost daily to strengthen and alter proposals including to add social sustainability criteria.

Box 2 – Provisional targets under the UK's carbon and sustainability reporting system

Under this system indicative targets are set requiring fuel companies to source feedstocks with the following characteristics:

- A certain percentage of feedstocks must be in compliance with qualifying standards, ie standards deemed and approved by the UK government as delivering the principles of sustainability
- Deliver a certain percentage of greenhouse gas savings
- Provide data on the sustainability characteristics of fuels, not that this can be that they comply with specific qualifying standards or other standards.

Annual supplier target	2008-2009	2009-2010	2010-2011
Percentage of feedstock meeting a Qualifying Standard[1]	-	50%	80%
Annual GHG saving of fuel supplied	40%	50%	60%
Data reporting of sustainability characteristics[2]	35%	65%	80%

2.3.1 Moving to Second Generation Biofuels

Many in Europe are calling for a rapid transition from first to second generation biofuels. These advanced fuels offer much greater potential carbon savings and importantly a much higher ratio of useful energy to land area. This means that greater amounts of more climate-friendly fuels can be produced on the same area of land. This would address two of the greatest concerns in terms of the expanding use of fuels, ie the limited GHG savings some offer and the potential impact of land use change upon biodiversity. In Europe there is support for a shift to second generation fuels, however, it remains unclear how and when this might be achieved. Increasingly, it is also being highlighted that these are still not 'wonder fuels' or without their own set of potential environmental impacts and complexities. There are a variety of estimates as to when second generation fuels will be market ready and what fuel will offer the greatest potential benefits.

Within Europe there are a variety of demonstration projects that have been set up to develop second generation fuels. There are three pilot lignocellulosic processing plants. These are in Sweden, Spain and Denmark. Other technologies to covert biomass to liquid fuel include Fischer Tropsch biodiesel and bio-DME. Demonstration plants are in operation in Germany and Sweden working to develop these fuels[xi].

In terms of European policy, there are numerous statements highlighting the need to support second generation fuels but few concrete examples of how this might be done as yet. For example the European Commission's high level group of transport experts 'Cars21', identified second generation biofuels as particularly promising and recommended that their development should be given substantial support. They specifically called for R&D into second generation and for the establishment of market places and supply chains. This reflects concerns that, as the market for first generation fuels expands and such fuels become important commodities; the system will become 'locked in' to their use. This could make transition to potentially more beneficial second generation fuels even more problematic.

In relation to second generation key questions, however, remain. These include:

- how and when can market transformation be achieved;
- what are the potential environmental implications of a shift;
- what support is appropriate;
- who needs to take action; and
- when do actions need to be taken in order to best facilitate the establishment of an effective market?

2.4 Driving the Development of Biofuels

'The EU is supporting biofuels with the objective of reducing greenhouse gas emissions, boosting the decarbonisaton of transport fuels, diversifying fuel supply sources and developing long term replacements for fossil oil. The development of biofuel production is expected to offer new opportunities to diversify income and employment in rural areas.'[xxiii]

Action to promote the use of biofuels in Europe has stemmed from a combination of the following drivers: to reduce Europe's emissions of greenhouse gases; to ensure security in terms of oil supply; and to support rural development and Europe's farmers. As the biofuels debate has evolved, however, the relative importance of these drivers has shifted. Measures to support the use of biofuels in Europe originally emerged at a time when concerns about energy security were less acute. Measures were adopted before the most recent war in Iraq, when the Middle East was more stable, and prior to Russia's attempts to cut off the gas supplies to its European neighbours.

In the early 2000s climate change was on Europe's political agenda. While it was seen as a challenge, the Kyoto commitment period still felt a long way off and the debate was nowhere near as high profile or pervasive as today. Meanwhile, concerns were growing for Europe's farmers. With downturns in food prices, pressures to scale back subsidies and a general malaise in rural areas there was a concern that Europe's countryside might become depressed and destitute. The first measures on biofuels in Europe where, therefore, primarily driven by the desire to support Europe's agricultural businesses. This was promoted primarily by the farm lobby and agribusinesses, and the proposal for the original biofuels Directive[xxiv] was considered by Member States as primarily an agricultural measure, being debated not by energy or environment Ministers but by those for Agriculture.

Subsequently the emphasis has obviously changed again. While the farm lobby has remained strong, biofuels have increasingly been seen as an option for supporting security of supply and for addressing the ever burgeoning greenhouse gas emissions of the transport sector. Support for the development of biofuels has, however, primarily still been driven by the agricultural lobbies, the emerging biofuels sectoral interests and perhaps nervous politicians. Biofuels are still not wholeheartedly embraced by environmental groups who have acute concerns about some environmental impacts. Fuel and car companies, although initially reluctant about the uptake of biofuels, now appear to be increasingly supportive; not least because reducing GHG emissions via biofuels removes some of the pressure to address other more problematic and fundamental challenges ie to increase the efficiency of vehicle engines or to alter personal mobility preferences.

3 US POLICY APPROACHES

Although energy efficiency is the cleanest, cheapest, and fastest way to cut oil demand, it is only a part of the solutions package. Done right, these types of fuels—commonly known as biofuels——could lead to significant reductions in global warming pollution, save consumers money at the pump, and spur new jobs and industries.

3.1 Nature of the market

America's transportation sector is the key link between its ever-growing dependence on oil and global warming pollution.[xxv] The oil that powers cars and trucks in the US accounts for two-thirds of total oil use and generates one-third of the US's carbon dioxide emissions that cause global warming.

The transport sector produces a larger share of US GHG emissions and a much greater volume per capita than in Europe. America's cars, trucks, and buses account for 27% of US global warming emissions[xxvi] and transport as a sector (excluding international bunker fuels) accounted for approximately 31% of all US CO_2 in 2005[xxvii]. Overall, total US emissions of GHGs have risen by 16.3% from 1990 to 2005, transport sector emissions rose from 1467.0 Tg CO_2 Eq to 1,897.9 over the same period. Over 60% of the transport emissions resulted from personal vehicle use, the remainder being from other transportation activities, including the combustion of diesel fuel in heavy-duty vehicles and jet fuel in aircraft.

The US consumes 25% of the world's total oil production, but has only 3% of known reserves[xxviii]. Reduction in the use of automobiles cannot occur in the short term, thus other solutions are needed to reduce the GHG emissions from the transport sector. Biofuels are part of the answer, but they cannot be seen as just a technological fix; improving efficiency and reducing demand are other essential components of cutting emissions on both sides of the Atlantic. Under a scenario produced by the NRDC, when biofuels are combined with improved fuel efficiency and a reduction in driving from smart growth policies, demand for oil could be reduced from 30 million barrels per day in 2050 to less than 10 million barrels per day.[xxix]

While the primary biofuel in Europe is biodiesel, ethanol is the biofuel of choice in the US. In 2006 more than 4.8 billion gallons of ethanol were produced in the US (primarily corn based), compared with 250 million gallons of biodiesel (primarily from soy)[xxx]. NRDC research shows that ethanol made from cellulose could reduce global warming pollution as much as 88 percent compared to a gallon of gasoline. [xxxi]

Cellulosic and other advanced technologies also have the ability to increase total biofuels production capacity by unlocking new and more productive supplies of biomass. But simply using cellulose as a feedstock is no guarantee of good environmental performance. For example, cutting down our forests to create biofuels would increase global warming pollution and lead to a host of other environmental problems. Poorly managed, the cultivation of crops for biofuels threatens to deplete water tables; magnify pollution from fertilizers, pesticides, and herbicides; and undermine vital conservation programs like the Conservation Reserve Program. On farms and in forests across the country and abroad, imprudent biomass harvesting would cause soil erosion, water pollution, and habitat destruction. Advancing a biofuels policy that leads to land conversion and a subsequent loss in both stored carbon and carbon sequestration potential is a particularly perverse result for a policy that is intended to reduce global warming pollution.

Therefore, on many counts US produced biodiesel is superior to US produced ethanol: it produces more GHG savings, feedstock production is more environmentally benign, and biodiesel yields more energy than ethanol.[xxxii] However, the use of soybeans as a feedstock, the US's primary source for biodiesel, yields much less fuel on a per acreage basis. Due to constraints on land and a limited ability to grow high yield biodiesel feedstock crops in the US, biodiesel has limited market potential compared to ethanol.

3.2 Policy for Promoting Biofuels

A range of market-based policy options are available for prompting an increase in the production and consumption of biofuels. While Renewable Fuels Standards (RFS) have received a great deal of attention, a wide range of policies have been adopted to promote biofuels at the federal and state levels. Aside from standards, the federal and state governments have subsidized the production of biofuels through government purchases of biofuels, research, development, and demonstration funds, and tax incentives. However, policy implementation has been ad hoc and uncoordinated, resulting in a diversity of policies around the country.

Total subsidies for biofuels in the US are estimated to be in the range of $5.1-$6.8 billion annually for ethanol, and $.4-$.5 billion for biodiesel; though those numbers may be regarded as at the high end of a range.[xxxiii] The scale of these subsidies and their opportunity cost begs the question of how well tailored the current subsidy regime is to the stated objectives for biofuels, particularly climate change mitigation. One estimate places the current expense of biofuels subsidies at more than $500 per metric ton of carbon dioxide equivalent reduced from gasoline use.[xxxiv]

3.2.1 Federal Government

Tax incentives for ethanol production along with research and development funding for alternative fuels have been included in federal legislation since the 1970s. The federal government has also encouraged the development of flex-fuel vehicles since the passage of the 1988 Alternative Motor Fuels Act. That legislation still provides automakers a credit for up to 1.2 miles per gallon off their Corporate Average Fuel Economy obligation for manufacture of flex-fuel vehicles.

The current era of large scale subsidies for biofuels began with the 2002 farm bill. The bill developed a biofuels procurement program for federal government purchases of biofuels, authorised grants for research and development, and developed education programs to inform farmers and consumers about biofuels.[xxxv] Cellulosic ethanol was included in the bill, which called for a per gallon payment for the production of cellulosic ethanol of up to 1 billion gallons. While funds were authorized, appropriations for the biofuels programs over the past five years have been minimal. Additionally, the cellulosic ethanol program was never established by the US Department of Agriculture.[xxxvi]

The Energy Policy Act of 2005 included many more provisions for biofuels than the 2002 farm bill, and authorized programs have been funded through appropriations. The legislation included a package of RFS policies, research, development, and demonstration funding, and tax incentives for the development and deployment of biofuels. It is the leading source of federal policy on biofuels.

- *Renewable Fuels Standard:* The current guiding policy for biofuels in the Energy Policy Act of 2005 is a RFS. This standard serves as a production mandate rather than a consumption mandate, as is the case in the EU. Production mandates are useful at stimulating commercialization of technologies, but they can provide perverse incentives for locking in existing technologies. It can be argued that has been the case for corn-based ethanol thus far.
  The RFS in the Energy Policy Act of 2005 phases in a requirement that refineries increase the volume of ethanol produced per annum from 4 billion gallons to 7.5 billion gallons by 2012. To promote the market deployment of advanced biofuels, the RFS counts each gallon of cellulosic ethanol as equivalent to 2.5 gallons of the RFS volume. However, this mandate is largely irrelevant as the 7.5 billion

target is expected to be surpassed by 2009.[xxxvii] A targeted mandate for advanced biofuels is a requirement in the RFS for 250 millions gallons of cellulosic ethanol to be produced per annum by 2012.

- *Research, Development, and Demonstration:* RD&D programs authorized under the Energy Policy Act of 2005 total more than $3.25 billion between 2006 and 2015, though there are usually large differences between authorizations and appropriations in a given year.[xxxviii] The legislation also provides incentives specifically for the development of cellulosic biofuels, authorizing appropriations of $250 million with a production goal of 1 billion gallons of production by 2015.[xxxix] These funds are intended to support initial research into new biofuels technologies, improved cost competitiveness of biofuels, demonstration projects, and loan guarantees for market deployment. Implementing agencies include the Department of Energy, Environmental Protection Agency, and Department of Agriculture.
- *Tax incentives:* A tax credit of 10 cents per gallon can be claimed by produces of biodiesel for up to 15 million gallons and by ethanol producers for up to 60 million gallons. Fueling stations can claim a tax credit for up to 30% of the cost of installing refuelling equipment for biofuels blends above E85 and B20.[xl]

More recently, in December 2007, President Bush signed into law The Energy Independence and Security Act of 2007 ("The Energy Act"), a broad set of polices that promotes energy efficiency and clean energy. One of the Act's most important features is its increase in the Corporate Average Fuel Economy (CAFE) standards to a fleet-wide average of 35 miles per gallon by 2020, a 40 percent increase over the industry average. The law also increases the Renewable Fuels Standard (RFS) and makes a strong commitment to the development of cellulosic ethanol.[xli] Specifically, the enhanced RFS:

- *Substantially expands current RFS.* The RFS requires 36 billion gallons of renewable fuels to be produced in the US by 2022, nearly a five-fold increase over present levels. The 36 billion gallon requirement includes 21 billion gallons of advanced biofuels, which are defined as renewable fuels other than ethanol produced from corn starch. 16 billion gallons of the advanced biofuels requirement comes from cellulosic biofuels, which are produced from plant material such as switch grass or wood chips.
- *Reduces global warming pollution.* According to analysis by NRDC, the RFS would reduce global warming pollution by about 114 million metric tons per year by 2022, which is equivalent to about 1 percent of US emissions in 2005. The RFS achieves these reductions by establishing lifecycle greenhouse gas reduction standards for the renewable fuels covered by the RFS. The RFS requires all renewable fuels to have lifecycle greenhouse gas emissions at least 20 percent less than average emissions of fuel sold in the US in 2005. Advanced biofuels and cellulosic biofuels have to meet 50 percent and 60 percent reduction standards respectively compared to 2005 average emissions. Critically, lifecycle greenhouse gas emissions are defined as emissions resulting from the full lifecycle of the fuel production from the extraction of the feedstock used to produce the fuel to the use of the fuel in a vehicle. Including this full spectrum ensures that the RFS generates climate benefits instead of climate liabilities due to emissions associated with clearing of forests or other damaging production processes.
- *Includes safeguards essential to protect lands and wildlife.* The RFS establishes clear parameters for sustainable sourcing of biofuels feedstocks that guard against the loss of native forests and prairie, and protect threatened, imperiled, and endangered species, and public lands. While additional safeguards such as

conservation standards to preserve soil and water quality are needed, the RFS contains critical safeguards necessary to protect our natural resources.

- *Is an amendment to the Clean Air Act.* Placing the RFS under the Clean Air Act gives the Environmental Protection Agency (EPA) the responsibility to administer the program. Among federal agencies, EPA has the most experience and expertise related to transportation fuels, and is already responsible for implementing the current RFS program. The Clean Air Act also provides important checks and balances, including specific statutory requirements regarding record keeping and public participation in rulemaking.

The law also attempts to address efforts to reduce greenhouse gas emissions with provisions that include: requirements that state and regulatory commissions consider removing disincentives to utility investments in energy efficiency; incentives in the form of grants and loan guarantee programs to encourage development and production of elective drive transportation technologies; an expanded federal R&D program for carbon capture and sequestration technologies; and more stringent national energy efficiency standards for light bulbs (by 30 percent in 2008 and phase out of incandescent bulbs by 2014), appliances and buildings (reduction of fossil-fuel-generated consumption on all new or renovated federal buildings by 55 percent in 2010 and 100 percent by 2030). While the legislation does no include a Renewable Portfolio Standard (RPS), which would mandate utilities to get 15 percent of their power from renewable sources, the fight for such standards in the US has just begun.

The US Congress is also currently working on reauthorizing the nation's farm legislation that will enact agricultural policies that ensure clean and affordable use of alternative fuels. The Senate farm bill proposes putting $2.3 billion in federal support to biofuels, specifically to develop cellulose as a companion to corn as a feedstock for fuel ethanol. Their version would put the US on the path to produce 60 billion gallons of biofuels by 2030, according to Agricultural Committee chairman Tom Harkin.[xlii] Differences between the Senate and the House version of the bill, which has generally less rigorous standards and support for biofuels production, are now being worked out in conference between the two chambers.

3.2.2 State Governments

At the state level, the most common policy used for biofuels promotion has been a renewable fuels standard. Seven states have adopted RFS policies for all motor fuels sold in-state, while three others have adopted RFS policies for the state-owned vehicle fleet. These measures have only recently been developed; eight of the states have adopted RFS policies since 2006 and another seventeen states are considering RFS proposals. The design of the policies varies significantly from state to state:[xliii] The standards adopted at state level all, however, refer specifically to the use of bioethanol or biodiesel failing to leave the way open to meet requirements using second generation/advanced fuels.

- *Requirements:* Hawaii requires that at least 85% of gasoline sold be at least E10; Iowa requires that 25% of all gasoline sold contain some renewable sources (either E10 or E85); Minnesota requires that total gasoline sales must contain 20% ethanol and total diesel sales contain 2% biodiesel; Missouri and Montana require that total gasoline sales must contain 10% ethanol by volume; and Louisiana and Washington state require that total gasoline sales must contain 2% ethanol by volume and total diesel sales must contain 2% biodiesel by volume. For states that have adopted RFS policies for state-owned vehicles, Colorado requires all vehicles to be fuelled with B20; Maryland requires half of its fleet to use a

biodiesel blend of at least B5; and Ohio has adopted annual minimums of consumption (based in gallons) for ethanol and biodiesel.

- *Compliance Dates:* The compliance date for a given state does not necessarily match the stringency of its RFS; for instance Hawaii, Missouri, and Washington State all have a compliance date of 2008. Other compliance dates range from 2008 to 2020.
- *Market Trigger:* Two states have adopted a threshold for in-state production of biofuels before the state requirement goes into effect. The Louisiana RFS will not go into effect until 2015 or until in-state production reaches 50 million gallons per year of ethanol and 10 million gallons per year of biodiesel. Montana's market trigger is the production of 40 million gallons per year of ethanol. In contrast Louisiana has adopted a price cap, requiring that the wholesale price of ethanol must be less than gasoline before the policy takes effect.

Other state policies for the promotion of biofuels include tax credits for biofuels production, tax cuts for the sale of gasoline-biofuel blends, grants for the development of biofuels infrastructure, and funding for public education campaigns.[xliv]

3.3 Ensuring Sustainability

California was the first government in the world to implement a low carbon fuels standard. In January 2007, Governor Schwarzenegger announced an executive order committing California to a 10% reduction in the carbon intensity of vehicles by 2020.[xlv] Such a standard has the advantage over a RFS in that it promotes the use low GHG biofuels and provides an incentive to develop advanced/second generation fuels. The California Air Resources Board is currently writing rules for the order and establishing methodologies for determining "well to wheel" emissions. Twelve other states have now adopted California's low carbon fuels standard, including Florida, Vermont, New York, New Jersey, Massachusetts, Connecticut, Maine, Rhode Island, Pennsylvania, Maryland, Washington and Oregon.

According to figures from the US EPA ethanol produced from corn has the potential to reduce GHG emissions for every gallon of gasoline by up to 60%, but meeting this potential depends on how ethanol plants are developed. If not properly orchestrated utilising GHG-reduction measures, ethanol can actually have greater lifecycle emissions than gasoline. Currently, the EPA estimated that use of ethanol in the US reduces GHG emissions by 21% for each gallon of gasoline it replaces, on average.[xlvi] It is hoped greenhouse gas performance standards would help to illuminate the most inefficient conversion processes. Other proposed policy solutions includes linking subsidies and renewable fuels standards to the use of sustainable farming practices. More broadly there are concerns that the use of particularly low blend biofuels can negatively impact on air quality increasing the production of low level ozone by elevating levels of precursors ie nitrogen oxides and volatile organic compounds.

While there is public support for the expansion in the use of biofuels in the US there are still concerns regarding the impact of this upon the environment in other ways. The production of feedstock contributes significantly to a biofuel's environmental footprint. Farming impacts include: use of chemicals and fertilizers, waste management, soil erosion and exhaustion, water quality impacts, and biodiversity loss from monocrop agriculture. The farming of corn in particular is associated with significant localised environmental impacts. The promotion of sustainable farming practices goes beyond biofuels, so recommendations for reducing farming impacts are neither new nor limited

to biofuels feedstock crops. Solutions to the challenges faced by the expansion of biofuel production within the US include the following.

- The federal government controls a large amount of rural land in the US, particularly land that is used for farming. Wild and ecologically sensitive lands controlled through federal agencies, like the Bureau of Land Management, can be kept off limits from feedstock production.
- The federal government also operates the Conservation Reserve Program, which subsidizes farmers who take sensitive land out of production to reduce soil erosion. Under current law it may be possible for farmers to escape their commitments without penalty when the price of corn is greater than the subsidy. That loophole can be rectified in farm legislation.
- Incentives for sustainable agriculture have been written into federal and state agriculture subsidies, but appropriations for conservation programs usually fall short of their authorizations. The biofuels boom provides an opportunity to refocus attention on conservation programs. With the price of biofuels feedstock crops rising due to demand, subsidies can be shifted entirely from commodity payments to "green payments" that encourage sustainable farming practices, including conservation tillage, soil erosion controls, limited use of fertilizers susceptible to runoff, and reduction and recycling of farm waste.[xlvii]
- A certification scheme measuring and reporting the environmental impacts of biofuels production can be used for consumer education and regulation of feedstock farming practices.
- Conversion of land to monocrop agriculture for biofuels feedstock farming has the potential to harm biodiversity, especially if native plants are replaced or conservation land is farmed. Limited data is available on these impacts, but federal and state wildlife agencies can monitor them.

US environmental interests have also been active in terms of promoting the development of international systems of voluntary standards for the production of biofuels. Having learned from the experience of promoting sustainable forestry in the developing world, many NGOs are proposing that a system of best practices be adopted for biofuels through the use of a sustainability certification scheme. Similar to the Forest Stewardship Council, a comparable organisation for biofuels could promote sustainability by working directly with producers and by certifying sustainable biofuels for consumption in the US. Efforts in terms of promoting international standards are focused very much on developing nations and the use of biofuels in these countries or those that might be imported into the US in future.

3.4 Driving the Development of Biofuels

The current political climate in the US is extremely conducive for the political support of biofuels, specifically corn-based ethanol. In the debate over federal energy and agriculture legislation, biofuels provisions are one of the least controversial areas of policy. The dynamics producing support for biofuels include:

- *Strong agriculture lobby in the US* While agriculture represents a small share of US GDP and employment, agricultural sector production is relatively uniformly distributed among political constituencies across the country. Some of the political constituencies that wield a large amount of clout in the US political system are also dominated by the agricultural sector, such as Iowa; the first state to hold a nominating caucus for the US Presidential primary process. The agrarian

ideal of the family farmer continues to be a popular political image, even when large agribusiness runs the industry and provides large donations to candidates.

- *Framing of biofuels as energy security.* The rhetoric of energy independence has become very popular issue in US elections of late. With concerns about US foreign entanglements and the rising price of energy, Americans are very inclined to support measures that will reduce foreign oil imports. So far this rhetoric has been used to support biofuels, more ominously this agenda is also being used to support an increase in the extraction of fossil fuels and production of coal-to-liquids.
- *Potential economic development for rural communities.* Most Midwestern states, the biggest agricultural producers in the country, have experienced years of slow economic growth and population decline. Supporters of rural development have seized on the potential for economic opportunities presented by biofuels processing as a way to stimulate rural economies.[xlviii]
- *Large stock of available farmland and corn production.* A combination of a low population density (less than a third of the EU), highly productive farm land, and advanced farming practices makes the US a prime candidate for expanding biofuels feedstock production. Furthermore, corn is a largest crop grown in the US in terms of acreage. The planting of corn grew by 15% in 2007 to more than 90 million acres, growth primarily driven by ethanol production.[xlix]
- *Public support.* The production of biofuels consistently receives high levels of popular support. A January 2007 poll shows 55% of American respondents want the government to increase funding for research and development of alternative fuels, and 40% of respondents believe ethanol will eventually replace the use of hydrocarbons.[l]
- *Reliance on technological fixes.* Much has been written about the American tendency to rely on technological fixes to solve environmental problems, and support for biofuels fits that rule. The implicit message about biofuels is that they offer as a way for Americans to continue their current driving habits while improving energy security and mitigating climate change.

4 THE CHALLENGES

4.1 Ensuring Sustainability

Systems for ensuring sustainability of biofuels are evolving rapidly and are a key topic of debate among environmental groups. It is now widely agreed that some system must be put in place to ensure that biofuels used in the EU and US do not have large and adverse impacts on the environment, both at home and abroad. If this imperative is implemented, biofuels hold significant potential as a transitional fuel over the next few decades until long-term zero-carbon energy sources for vehicles, such as hydrogen, can be developed and deployed widely. Produced sustainably, they could allow the world to constrain or reduce emissions sooner in the vast and rapidly growing transport market. Ultimately, the need to establish sustainability standards and incentives around the production of biofuels must occur without delay if they are to make a contribution to the fight against global warming.

Developing systems for ensuring biofuel sustainability is, however, complex. This is because:

- supply chains are long and complex making fuels difficult to track;
- fuels and their raw materials are traded purely as commodities at present based on price;

- biofuels can be produced all over the world from different feedstocks under hugely different conditions meaning there is no one standard for fuel that can be termed sustainable;
- both fuels and raw materials can be traded and imported;
- there is no clear system of governance that can control biofuel production across the many regions of the world, and it would be very difficult to establish one;
- to produce large quantities of biofuels unavoidably requires a large land take, with potential indirect impacts upon land use due to displacement;
- many biofuels are currently produced from food crops, causing prices of staple foods to rise or fluctuate, thereby threatening the diets of the world's poor;
- the regulation of biofuels overlaps with that of the agricultural sector more broadly, notoriously a politically sensitive issue;
- the quantities of biofuels and feedstocks traded and used is expanding rapidly[li].;and
- attempts to protect markets from the importing of 'bad biofuels' run up against complex, uncertain and untested WTO rules.

A multiplicity of schemes are currently being developed to try to overcome these issues; different interest groups are supporting varying approaches from voluntary standards based on FSC requirements to more formalised regulatory approaches (primarily being developed in Europe). Schemes for covering broad sustainability issues from the protection of high nature conservation areas to ensuring the rights of plantation workers are being developed in parallel, coupled with specific attempts to decarbonise fuel use – led by California in the US and set out in the revision of the fuel quality Directive for Europe. The challenge for all schemes, however, is the same: how can compliance be ensured and verified, giving confidence that the worst biofuels are not entering the market place?

As biofuels standards are developed in different regions, for different feedstock crops, and for different processing methods, synchronising standards and certification schemes becomes a significant challenge. To enable the development of standards to meet the heterogeneous needs of biofuels, many are looking towards a meta-standards approach; as set out in work by Ecofys for WWF.[lii] Certainly, the European-wide approach appears to be adopting this model. Instead of applying one standard to all biofuel production, a meta-standard approach would adopt multiple, already existing qualifying standards; a system of standards to meet standards, or standards within standards.

Meta-standards are a pragmatic solution to the multi-dimensional biofuels market. They allow flexibility to develop new standards and for countries to apply different standards according to their needs. They do, however, raise some issues of accountability and comparability. For meta-standards to work there is a need for:
- clearly defined principles that can produce a working definition of sustainably produced biofuel, upon which decisions as to what qualifying standards are appropriate can be based;
- procedures for benchmarking criteria for different qualifying standards to allow their comparison; and
- approved systems for auditing/verification that requirements under the standards are being met and ways of benchmarking/comparing audit approaches which may be different across schemes.

Ideally these conditions should be set at an international level, but no institution has the competence or resources to take control of this. While efforts are being made at the

national level to define this it looks set that a European wide approach will be adopted. As set out above, under current proposals Member States would not be allowed to prevent access to their market on grounds of the sustainability of biofuels additional to the criteria set out in Box 1. This is pragmatic; in a trading market such as the EU it is impractical to have a multiplicity of approaches all operating simultaneously. However, this does put intense pressure on the development of EU level criteria. At present proposals are being approved by the European Council and Parliament that will fundamental in setting the ambition and scope of European requirements for biofuels. This will be supported by the target that would require 10% of all transport fuels to be sourced from biofuels by 2020. Meta standards would be used in the EU to demonstrate compliance with the overall criteria and requirements with each Member State responsible for verifying compliance of the biofuels entering its own market place.

The meta-standards approach by no means solves all the problems, however, and there are difficulties that emerge from the use of this flexible approach. Some examples are set out below. While these problems should not prohibit the use of meta-standards their application must be well thought through and monitored to ensure that impacts are understood and minimised.

- The meta-standards based systems will only ever be as strong as the sustainability schemes that they rely upon. While Governments will have control over approving which schemes they deem to demonstrate sustainability, they will have limited oversight over the schemes themselves, which will most likely be run independently.
- The system will not provide one recognisable standard with which, for example, the public or organisations can associate the sustainability of biofuels. Explaining what is potentially a complex system to a sceptical public may be difficult.
- The meta-standards approach should discourage the worst fuels, but it is not a system that will actively promote best practice as currently being formulated in Europe for example. In order to do this it needs to have a very strong administrator capable of continually reviewing the standards that are deemed acceptable and being able to wield power or influence over those developing subsidiary standards to force them to continually improve their systems and the ambition of their schemes.
- Buy-in from the commodities traders and fuel companies is essential. Meta-standards work well with a system that obliges fuel companies to blend biofuels. This means that essentially responsibility for sourcing sustainable biofuels is left down to the individual companies, and they will necessarily have ownership of the reputation problems if they are found to be using unsustainable sources. However the oil companies are unlikely to want to involve themselves directly in the making or shipping of biofuels, so both in terms of ensuring appropriate fuels are on the market and that adequate quantities of appropriate fuels are entering the market place, a more active role for commodities traders becomes essential. Currently they buy, sell and manage production levels in their sector purely via price signals, but in future they will need to become involved in sustainability certification as well.
- There are serious issues to be addressed in monitoring the supply chains and demonstrating compliance in a rigorous but un-bureaucratic way. Supply chains are often long and difficult to track, especially as raw materials and biofuels are traded on open commodity markets where they may change hands many times.
- Meta-standards will still not allow broader, indirect land use change issues to be addressed, and this remains a serious concern.

Meta-standards are a potential solution, and one of the few put forward that might ensure the sustainability of this complex market. But, how can this system be made to work effectively, and what role can NGOs and environmental groups play?

4.2 Interactions: Bioenergy, Food and Land Use Change

The indirect impacts of the rapid development of the biofuels sector are as great a concern, in terms of sustainability, as those directly attributable to growing the feedstocks. Biofuels could have potentially huge impacts upon current land use patterns, the production of food and its pricing, and the development of other solid biomass solutions. Expanding the biofuels sector essentially increases the pressure on land as a resource. In practice there is very little unused land in the world, and demands on it are growing as global populations increase; while land may be out of direct cultivation for agriculture it is often being used to provide other less tangible benefits ie providing valuable habitats or local amenities.

The development of biofuels will impact on land use patterns not only in the locality where they are grown but across the entire globe through knock-on effects. The worst outcome will be increased pressure for land leading to the destruction of important assets, both in terms of biodiversity and carbon storage. This is not only caused by direct destruction of a habitat to produce feedstocks, but importantly increased land pressure may mean that biofuels cultivation displaces other land uses. In turn these may be taken up elsewhere by converting biodiverse areas into farmland. More broadly the same crops may be being produced as a biofuel feedstock and simultaneously for other uses eg palm oil is used for food, soap production etc. While the biofuel feedstocks might be qualifying as being sustainability produced, their production might displace the same crop for other uses into other areas that are less suitable. This may result in a situation where sustainable crops are used for biofuels but unsustainable forms of the same crop will simultaneously be sold on other markets where there are less stringent requirements. In this way the rainforest may still be destroyed by palm plantation developments –not specifically those providing palm oil for biofuels, but displaced crops previously grown where the biofuels now are.

Importantly, the systems for ensuring sustainability currently being put forward, for example meta-standards, would not be capable of taking into account this sort of indirect land use shifts. Indeed it is difficult to see how any form of certification focused on a particular piece of land or batch of materials could capture such knock-on effects adequately. Mechanisms for overseeing land use change across the globe do not currently exist and there is a lack of workable solutions being put forward to solve this problem. Therefore, the question remains how can land use change be monitored and addressed?

If the use of biofuels is to expand very significantly, a huge area of land will be needed to support this industry. If biofuels become a valuable commodity the production of feedstocks may replace the cultivation of other crops. Additionally, the current generation of biofuel feedstocks are also often food crops. Increased demand will most likely drive up prices of specific energy crops, but also of other food crops due to increased competition for land resources, or to competing uses for a particular crop. Alternatively, it may push production of a particular food crop into other countries which can produce it more cheaply. The production of biofuels within Europe and the US has the potential to affect crop production patterns globally.

Food-fuel competition is a particular concern in the US due to the reliance on ethanol produced from corn. Corn is used throughout the US food industry, so rising prices of corn from ethanol production raise prices throughout the market.[liii] Increased costs for food producers will either be passed on to consumers, or substitutes for corn will be used if they are cost competitive. US corn is also traded in international markets, so price increases there have ripple effects overseas. Due to increasing costs, the Mexican

government recently instituted price controls on corn, a staple for many Mexicans. The primary concern over rising food prices is their impact on the poor, a concern raised in particular by environmental justice groups.

Potential conflict with developing solid biomass energy systems is also a concern, particularly in Europe. The EU is looking to double the contributions of biomass to heat and electricity production, at the same time as ramping up biofuel use. 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 the cheapest[liv]. Also, it is difficult to persuade farmers to grow biomass for any purpose if grain prices are also being driven to highly profitable levels as described above. Expanding all sectors simultaneously presents potential conflicts in terms of land use but also potentially increases pressure to bring new land into production.

4.3 The Challenge of Second Generation

A transition to advanced/second generation biofuels is a potential solution to some of the problems posed by current biofuels production. It should, however, be noted that the dilemma as to how the worst fuel solutions can be discouraged and the best encouraged will remain. The rapid adoption of second generation fuels is widely supported due to their advantages over first generation fuels, set out below.

1. They can significantly increase the carbon dioxide savings of switching from gasoline: processing measures are more energy efficient, feedstock crops can produce much more energy per acre, potentially fewer fossil fuel-based fertilizers are required to grow them and the feedstock crops can help sequester carbon in the soil.
2. The localised environmental impacts are potentially much less severe. Native plants can often be used as feedstock, which creates the potential for less runoff, greater soil health, less biodiversity loss, and less pesticide and fertilizer use.
3. Feedstock crops are not used as food, produce more energy per acre and they can be grown on more marginal land, reducing the potential impact on food prices from first generation biofuels. One scenario shows that advanced biofuels could produce 75% of total gasoline used in the US, requiring 100 million acres of farmland out of the 450 million acres currently used for cropland and 580 million acres used for grassland pasture and range.[lv]

Minimising the environmental impacts and maximising climate change mitigation from second generation/advanced biofuels will depend on choosing the right feedstock and using the best farming practices. One feedstock that offers great potential for development in the US is switchgrass, a native grass to much of the US Midwest. Compared with corn and soy, switchgrass produces between one-half and one-eighth the nitrogen runoff, between 74 and 121 times less soil erosion, an increase in soil carbon levels rather than a decrease, and provides habitat for between two and five times as many species of birds.[lvi]

Despite a number of potential benefits, second generation fuels are not the perfect solution they might appear from many policy statements. They have their own set of potential shortcomings. While they may produce high energy yields per unit of land, they will still potentially increase land pressure (although to a lesser extent). In order to achieve carbon savings they must still be produced without destroying major carbon stores contained in forest areas, permanent grasslands etc. Feedstocks can, in theory, be grown with less local environmental impacts, but productivity may still be enhanced by use of pesticides and fertilisers, meaning that some controls over cultivation will be needed.

In Europe particularly many farmers are already nervous about committing to the cultivation of pure energy crops, as their options in terms of sale are more limited than for food crops. This may inhibit the development of supply chains. The development of second generation fuels will still require the planting of large swathes of new crops, the designation of areas to do this in etc. Importantly, second generation/advanced fuels are not yet market ready, nor are they likely to be until 2015 at the earliest.

Given the potential of second generation/advanced fuels what can NGOs do now to guide decisions being made about investment in them? What needs to be in place to ensure their swift adoption once the technology is market ready? What requirements and regulatory systems will need to be in place to ensure that, unlike for first generation, the development of the best fuels is favoured from the start and that we are locked into the best performing technologies and options?

5 CONCLUSIONS AND QUESTIONS FOR DEBATE

Assuming biofuels are a chosen route for reducing greenhouse gas emissions from the transport sector, there is much the environmental community can and must do to minimize the environmental impacts of biofuels and maximise the climate change mitigation benefits. While controversy may still remain as to whether biofuels are a good solution, they are already on the market and the expansion of their use looks set to go ahead. Bearing this in mind there are some pressing issues that need to be addressed and on which civil society needs to act on both sides of the Atlantic.

1. It is essential to find workable solutions for ensuring the biofuels in use are sustainable and carbon reductions are maximised:
    a. What are the optimum solutions for doing this?
    b. Given a meta standards approach how can clarity and effectiveness be ensured?
    c. How can meta standards be made operationally effective and what are the problems associated with them?
    d. How can the challenge of dealing with land-use issues, especially indirect impacts, be dealt with?
2. If second generation/advanced fuels are the solutions for the future, what measures need to be taken now to:
    e. Ensure their development in a sustainable way;
    f. Ensure that once the technology is market ready they can be swiftly introduced, avoiding lock-in to first generation fuels?
3. What steps can be taken by the US and EU collectively in order to improve the sustainability of biofuel solutions and the transport sector more broadly? How can we work together better on these issue, there are ongoing dialogues between our governments but these tend to focus on quality issues at present?

The US and EU are both currently at a crossroads in terms of their biofuels policy. Both have committed to significantly scaling up production and consumption by 2020, but are challenged in relation to increasing production while preserving natural capital. Cooperation and policy dialogue will be critical for promoting effective policies on both sides of the Atlantic, especially for not repeating mistakes already made elsewhere. Moreover, collaboration will be essential to the development of effective biofuels standards and certification programs.

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