Policy Briefings

BASQUE CENTRE FOR CLIMATE CHANGE
Klima Aldaketa Ikergai

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EUROPEAN BIOFUELS POLICY AND ITS CONTRIBUTION TO A LOW CARBON FUTURE

Iñigo Capellán-Pérez [1](UPV-EHU), Alberto Ansuategi [1](UPV-EHU), and Ibon Galarraga [2](BC3).

1 Introduction

Transport currently accounts for about a third of European Union (EU) energy consumption and a quarter of greenhouse gas (GHG) emissions, being 95% dependent on oil (EC, 2015). Moreover, whereas in other sectors GHG emissions have been decreasing, in transport they have grown by 29% between 1990 and 2009. Moreover, transport activity is expected to double by 2050. As a consequence, there is an increasing urgency of decarbonising the EU transport sector in the context of the overall 80–95% GHG emissions reduction goal (EC,2011a) and a reduction goal in the transport sector of at least 60% by 2050 compared to 1990 (EC, 2011b).

There are five primary means to reduce GHG emissions from transport: reduce traffic volume, increase fuel economy, develop cleaner engines, change transport modes and switch to fuels with a lower life-cycle carbon content. It is in this latter aspect where biofuels are expected to play a significant role in the transition towards a low-carbon economy. Consequently, biofuels have become a natural target for transport policy efforts in the EU in the short-term.

This policy brief is an updated version of the proceedings from the Low Carbon Programme Workshop on "European Biofuels Policy for a Low Carbon Future" (Bilbao, September 2013) in the light of the new ILUC Directive. In the workshop, sponsored by the Fundación Repsol, 50 international experts and stakeholders discussed and formulated proposals for the improvement of the European Biofuels Policy.

Key Points

- *There is an increasing urgency of decarbonising the EU transport sector.*
- *Biofuels are expected to play a significant role in the transition to a low-carbon economy.*
- *The EU has intensively promoted biofuels since 2000, reaching 5-6% of liquids consumption.*
- *Controversies have focused on indirect land use changes and competition with food production.*
- *In view of the scientific evidence, a new ILUC Directive was adopted in September 2015.*

2 Overview of the European Biofuels Policy

Although biofuel initiatives in Europe had existed at individual countries' level since the oil shocks of the seventies, the first formal European directive was adopted in 2003 (EC, 2003). This directive established an initial (voluntary) target of a 2% share of biofuels in energy content for all petrol and diesel for transport in the EU by 2005, to be increased stepwise towards a reference goal of 5.75% by 2010. This initial support to biofuels had three main objectives: the reduction of GHG emissions in order to address anthropogenic climate change, promotion of energy security and the creation of income and jobs in rural areas. The Directive pushed for the introduction of biofuels in the European market (See Figure 1). Thus, the total biofuel consumption in 2009, albeit short of meeting the targets set in 2003, represented 4% of the total fuel consumption in the transport sector. However, it also served to realize that the bioenergy potentials among Member States could hardly meet the expected demand for biofuels within the EU borders and increased imports of biofuels from third countries could also generate negative impacts, competition with food crops and even increase in GHG emissions due to indirect land use change (ILUC).A second step in the configuration of the European biofuels policy was the introduction of the Renewable Energy Directive (RED) in early 2009 (EC, 2009a). This directive did not only focus on biofuels, but rather on renewable energy in transport. Thus, a mandatory target of 10% renewable energy by 2020 was set specifically for the transport sector. This change was interpreted by some authors as a signal that policy makers refrained from picking technology winners and decided that technology choice between conventional and advanced biofuels, hydrogen and electricity had to be left to the market (Pacini and Strapasson, 2012). Nevertheless, the renewable energy action plans published by EU countries in 2011 indicated low expected shares of electricity and biogas in transport until 2020 and a clear dominance of liquid biofuels.

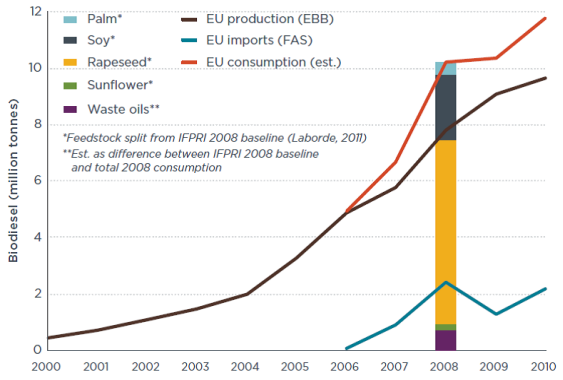

Figure 1. EU biodiesel production, imports and consumption 2000-2010, with 2008 feedstock mix (FAO stat, FAS, EBB). Source: ICCT (2013).

The third core element of the European biofuels policy was a new Fuel Quality Directive (FQD) published shortly after the RED (EC, 2009b). This directive effectively changed gasoline specifications, allowing a potential increase from 5% to 10% ethanol blends or 15% to 22% in Bio-ETBE blends. With regard to targets, the article 7 of the FQD established for up to a 10 % reduction in the (life cycle) emissions from fuel and energy supplied to the transport sector with a binding element of 6% by

This Policy Briefing was written by Iñigo Capellán-Pérez[1],Alberto Ansuategi[1] and Ibon Galarraga[2] , (UPV-EHU) [1] ,(BC3)[BC3, Basque Centre for Climate Change][2].
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2020. The main motivation of the FQD was contributing to a reduction of GHG intensity of fuels used in vehicles. However, as it will be explained in the next section, it also regulated the sustainability of biofuels.

3 The Challenges of Current Biofuel Policy Framework

The current European biofuels policy framework has been problematic to implement and controversial in terms of changes of the production and consumption patterns that has delivered. Four key issues under discussion are the effect on land use and biodiversity, the potential competition with food production, the difficulty to attract investment in low carbon fuel/energies, and lacking compatibility with existing engine designs and fuel distribution infrastructures. In what follows the four challenges are described separately.

3.1 ILUC

The ILUC impacts of biofuels refer to land-use changes around the world induced by the expansion of croplands for ethanol or biodiesel production in response to the increased global demand for biofuels. Thus, a higher demand for biofuels could contribute to further conversion of forests, pastures and wetlands into agricultural land, crowd-out native vegetation and species, conflict with land and labor rights and lead to an indirect increase in GHG emissions.

This debate has recently led the European Commission (EC) to design its own sustainability scheme for biofuels. The observance of such scheme is mandatory for EU Member States to be able to count such fuels towards renewable energy targets set in the RED. In brief, the EU sustainability criteria mandate that biofuels: (1) should deliver a minimum of 35% savings in GHG emissions, calculated on a lifecycle basis, when compared to their fossil equivalent (from 2017, 50% savings and 60% for new installations), (2) second-generation biofuels currently under R&D (those made out of ligno-cellulosic, non-food cellulosic, waste and residue materials) receive double credit, (3) cannot be produced in areas of high biodiversity, (4) cannot be produced in untouched forests, areas of protection and highly biodiverse grasslands, (5) should not be sourced from areas with high carbon stocks, wetlands and continuous forests, and (6) must be produced under work conditions which observe the Conventions of the International Labour Organization.

One way for companies to demonstrate that their biofuels comply with the sustainability criteria is to participate in voluntary schemes that have been recognised by the EC. Early 2011, it also was complex to demonstrate compliance with the RED. This improved when in July 2011 the EC recognised the first seven voluntary schemes. By December 2012, the EC had approved another six voluntary schemes. As of November 2015, in total 19 voluntary schemes have been approved, offering a variety of options for sustainability certification.

The knowledge of models is now advanced enough to estimate ILUC factors with the same order of uncertainties as for direct emissions (Von Renssen, 2011). As a consequence, harmonizing calculation tools of GHG emissions from biofuels such as BioGrace have been created. As shown in Figure 2, when accounting for ILUC factors all biodiesel production is over the 35% saving threshold proposed, while most ethanol is below that limit. Since biodiesel consumption accounts for around 80% in the EU, the implications of including ILUC factors are far from negligible.

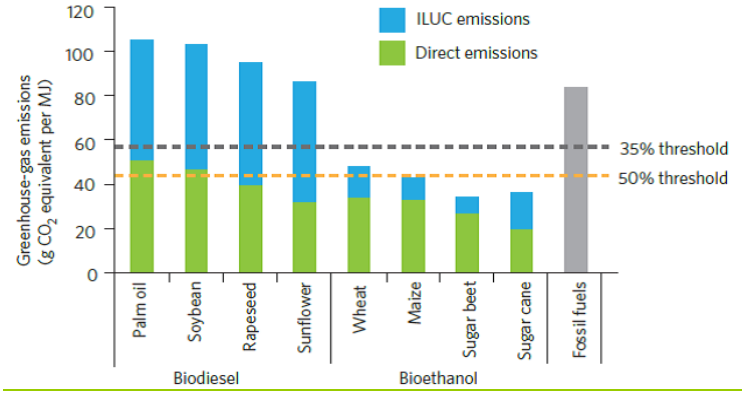


Figure 2. GHG emissions from direct and indirect land-use change for different energy crops. Source: Von Ressen (2011).

3.2 Food versus Fuel

World food prices increased dramatically in 2007-2008 creating a global crisis that caused political and economical instability and social unrest in both poor and developed nations. Different factors have been pointed out as driving forces: increased pressure on land competition due to the expansion of land requirements (growing population, bioenergy production etc.), strong correlation with increased oil price and speculative investments combined with bad weather conditions in those years. In fact, biofuels are currently produced from agricultural feedstocks, such as cereals, sugar crops and vegetable oils. Thus, biofuel markets are closely connected to agricultural markets. Although the contribution to the energy supply is still very modest, a certain consensus exists that points out that biofuels policies have a non—negligible influence on food prices, although quantitative evidence is lacking.

Kretschnmer et al. (2012) reviews the results of a selection of modeling-based studies examining the impacts of EU (and global) biofuel policies on agricultural markets and prices. They find that, focusing on the impacts of EU biofuel policies, the most significant price increases are projected for oilseeds and vegetable oils, with increases in world prices by 2020 typically ranging between 8% to 20% and 5% to 36%, respectively. Wheat prices are projected to increase by between 1% and 13% and the majority of studies project increases of cereal /maize prices of up to 8 % and of sugar prices of up to 2%. Many of the drivers of differences in results are those that have been under scrutiny in the ILUC debate.

In fact, due to the low power density of current biofuels (Smil, 2015), there has been a trade-off in the EU between energy and food security: although in the first years of promotion biofuel consumption was mainly covered by EU-production, from 2006 onwards the imports have risen considerably (ICCT, 2013). The same mechanisms that govern ILUC changes govern the import of agricultural crops to EU since the land

Note: The orange and grey dashed lines across the bars show the threshold for a 50% and 35% emission saving, respectively, compared with fossil fuels. Initially biofuels will have to deliver a 35% saving under EU law, but this will rise to 50% in 2017.

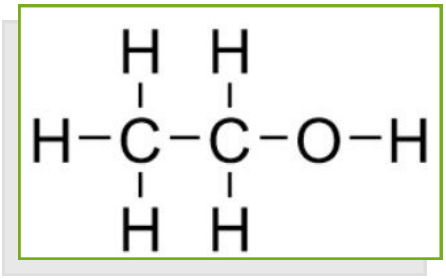
availability in EU is limited. According to OECD estimates in 2006 the EU-15 would require over 70% of its crop area to replace 10% of its transport fuel consumption by biofuels (OECD, 2006).

3.3 Regulatory Risk of Infrastructure Investment

Investment in biofuels production capacity across the EU has been politically driven. Prior to 2003 biofuels production capacity was relatively small, but following the implementation of the 2003 Directive investment in production capacity of biofuels increased very rapidly. Note that according to the International Energy Agency's estimate published in its World Energy Outlook 2012, EU biofuel subsidies stand at 8.4 billion euros annually.

However, in view of the mounting criticism of low efficacy in meeting the stated objectives of biofuel policies and of the unintended effects resulting from stimulated demand for biofuels in the EU, in October 2012 the EC made a legislative proposal to amend the RED and the FQD. Thus, the EC proposed to cap at 5% the contribution of first generation biofuels to the EU's 10% target for renewable energy used in transport fuel by 2020. Since then, the European biofuel industry claims that the uncertainty and potential risks of further future policy reversals are too great to encourage investment to take place. This has resulted in a slow-down in first generation capacity development with a very slight growth in second generation capacity from 2012 onwards.

3.4 Blend Walls



The so-called "blend wall" is reached when the blending of biofuels into regular fossil fuels faces constraints due to technical limitations of engines. Currently, most European countries require a blend of 5% of ethanol into gasoline and a mixture of 7% of biodiesel into diesel, which is close to the current technical blend wall limit derived from the gasoline and diesel standards (~6.5%). In fact, specific technologies developed by the oil industry to date in order to produce biofuels without compatibility problems in order to overcome the existing "blend walls" have lead to non cost-effective solutions. Some Member States such as France and Germany have already moved to a 10% mix of ethanol in gasoline. However, even a 10% mix may not be enough to meet the 10% target for the use of renewable energy, since it implies a 10% mix in volume, but not in energy content. This can be overcome by increasing the permitted volume of biofuels that can be blended or by increasing the volume of high-blend fuels, such as E85 (15% ethanol/85% gasoline) for flex-fuel vehicles or E100 (neat ethanol) for converted diesel engines. This requires an increase in the number of vehicles with engines that can run on higher blends of ethanol, investment in infrastructure to provide pumps for the fuel, and fuel priced at or below its energy equivalence to encourage consumers to use it.

CONCLUSIONS

The expanding contribution of transport emissions to EU's GHG footprint and the danger of transport accounting for a disproportionate share of emissions in 2050 explains the important role played by the biofuels policy framework in the overall European climate and energy strategies. The cornerstone of the EU legislation promoting the use of biofuels in Member States are the RED and the FQD. The RED establishes the target of 10% of energy in transport coming from renewable sources in each Member State by 2020. The FQD requires that all fuel suppliers must meet the 6% cut in GHG emissions by 2020 and establishes some limits in blends. Then, the EU Member States have employed various blending mandates and national-level subsidies and/or tax incentives to achieve these targets. Although there are other possible routes to the renewable energy target, including the widespread use of electricity from renewable sources in the transport sector, in practice the main burden of achieving the 2020 target has fallen on biofuels, since they can be used in existing engines and vehicles and therefore are compatible with most of the existing infrastructure. As a consequence of these policies, the share of biofuels in transport has increased significantly in the EU, growing from less than 0.5% in 2003 to more than 5% in 2012.

Nevertheless, the expansion in the use of biofuels has also led to controversy regarding the unintended environmental and social consequences of their use on such a large scale. Over the past years, there have been intensive debates on how to ensure that GHG accounting takes proper consideration of the emissions from ILUC associated with biofuel feedstock production. The RED and the FQD were originally based on attributional lifecycle analysis (LCA), that involves summing the emissions associated with producing all of the inputs to a fuel manufacturing process together with the emissions from the manufacturing process itself. In contrast, consequential LCA would involve comparison of emissions in some policy scenario with a baseline case. Attributional LCA's strength is that it is less subject to the uncertainty of consequential LCA, but the limitation is that it will not capture any change in behavior that will be caused by a new policy framework. Recently EU authorities have decided to combine elements of attributional and consequential LCA by adding ILUC factors to attributed lifecycle carbon intensities.

Another important argument for amendment of current biofuels policy is that it has failed to drive sufficient innovation in the biofuels sector. Conventional (first generation) biofuels, based mainly on agricultural crops, continue to dominate the market and the European biofuels policy framework has not been able to generate sufficient confidence in the advanced biofuel industry, using wastes and residues, to invest in new infrastructure on a sufficient scale. As pointed out by Sims et al. (2010), unless there is a technical breakthrough that significantly lowers the production costs and accelerates investment and development, the successful commercialization of the second generation biofuels should not be expected before 2020. Thus, there have been recently proposals to set sub-targets reserved for advanced biofuels and also public support programs both at the EU and the national level for pioneering plants in a similar approach to that for new carbon capture and storage (CCS) infrastructures.

Some of these controversies and debates have fructified in the approval on 28 April 2015 of the so-called "ILUC Directive", that limits the way Member States can meet the target of 10% for renewable in transport fuels by 2020. The key elements of the ILUC Directive, published the 25th of September, are that: (1) the contribution of biofuels produced from "food" crops is capped at 7% and (2) the other 3% will come from a variety of

multiple counted alternatives (e.g. biofuels from used cooking oil and animal fats are double counted, renewable electricity in rail is counted 2.5 times, renewable electricity in electric vehicles is counted 5 times and advanced biofuels are double counted and with an indicative 0.5% sub-target). The agreement also includes the reporting and publishing of data on ILUC-related emissions on both national and European level.

On the other hand, the effective capacity of biofuels to achieve greater levels of energy security in the EU is disputed due to their massive land requirements and the uncertainty on the performance of future advanced biofuels. In this context, it is argued that a better solution for decarbonizing transport would be to shift current road transport to electricity modes. This way, the more abundant renewable resources (i.e. hydro, solar and wind) could be used instead.

Some have interpreted the approval of the new ILUC Directive as an important staging point in the process to develop a stable, consistent and forward looking policy that promotes the best performing biofuels, whereas others note that plenty more remains to be done.

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Klima Aldaketa Ikergai

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