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The Sustainability of Biofuels

A Comparison of EU and US Policy Debates

by Emanuela Bozzini

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For long ethanol and biodiesel made from corn, rapeseed, and sugarcane have been regarded a win-win solution to a series of intractable issues about oil dependency, greenhouse gas emission reductions and revitalization of rural areas. Both the European Union and the United States started ambitious programs to incentivize the production and consumption of biofuels, supporting crop productions with subsidies and tax exemptions and setting standards for blending them with conventional fuels. The initial enthusiasm for the technology however has been somehow downplayed in more recent times. New scientific evidence on the impact of biofuels on deforestation, on their real effectiveness in reducing greenhouse gas emissions and economic evaluations of the influence of biofuels on the 2008 and 2011 steady increase in food prices have been presented to both European and American policy-makers. On the whole, a growing number of experts and activists have channelled doubts about the sustainability of massive biofuels production and claims to revise current policies. The advantages and disadvantages of biofuels have been widely discussed both in EU and US policy processes, leading to different policy decisions. While the EU progressively reduced the initial targets for biofuel production and introduced a series of sustainability criteria to regulate production, the US confirmed and increased over time its initial policy goals. The article aims at accounting for such differences in policy by comparing the evolution of the biofuel debates in EU and US from the late 1990s to date. The paper is based on extensive analysis of public hearings held by the European Commission and the US Congress and argues that differences in policy

outputs can be explained making reference to differences in criteria for dealing with uncertain and contrasting evidence on the economic and ecologic sustainability of biofuels.

The article is structured as follows: the next section provides an illustration of biofuels technology and briefly reviews the technological and policy development occurred in the past decades. The second section describes the theoretical approach and the research design adopted for this article. The third section describes the policy decisions and the debate around biofuels in the US context, providing evidence of different positions and argumentations advanced by policy-makers, experts and stakeholders in Congressional debates from 2005 to 2011. The fourth section describes the EU biofuel policy and analyses the competing discourses that animated the debate in Brussels in the same period. The final section provides some concluding remarks on the differences in EU and US biofuel policies.

The Technology and the Policy of Biofuels

Biofuels – ethanol, methanol, biodiesel – are fuels that are produced from various organic materials – like crops, waste, and wood. A central characteristic of all these biomass types is that they can be grown and therefore constitute renewable sources of energy. In this sense they are clearly distinct from gasoline and diesel made from petroleum that is a finite source. Biofuels are of particular importance because they are the only available fuel alternative to gasoline and diesel that can be used in transport, given the current technical characteristics of this sector. This is the most important reason why biofuels gained a growing relevance in the last decade, when oil price was rising at unprecedented level, and experts started talking about the peak of oil production and the likely shortages that will characterise the coming decades. Biofuels thus experienced a recent boom, but are not a new technology: for example the first car built by Henry Ford in 1896 was fuelled with ethanol, and Rudolf Diesel launched his engine in 1900 to be powered with fuel based on peanuts oil. The biofuel industry also was relevant and growing at the beginning of twentieth century. The productive capacity in the years 1917-1918 was over 50 million gallons in the US and reached almost 80 million gallons in France and Germany in the 1930s. Historically, the rising of the oil industry marginalised the economic and technological relevance of biofuels, to the point that after the Second World War biofuel production was rapidly decreasing and almost ceased by the 1960s. At that time the advantages of fossil fuels compared to biofuels were many: most importantly they were available in large quantities at reasonable prices. Further, they are relatively easy to process and

use, have a very high energy value and can be transported safely. These factors still help explain the continuing reliance on fossil fuels and the difficulties in finding convenient alternatives. They also explain the cyclical attention paid by policy-makers to biofuels: the political interest in biofuels generally arises in times of energy crisis. In particular the oil price shock in the 1970s prompted policy responses in the US, Brazil and a number of European countries based on incentives to alternative fuels. The Persian Gulf war and the uncertainties in the oil markets at the beginning of the 1990s also favoured alternative fuels. In such contingencies a flurry of policy initiatives could be observed and targets for biofuel consumption have usually been set at very ambitious levels. With reference to the US, the Energy Security Act signed in the early 1980s planned to replace 10% of gasoline supply with ethanol. The 1991 Energy Policy Act established to reduce the use of gasoline by 10% by 2000 and 30% by 2010, substituting it with alternative fuels. Both targets have been missed, and indeed the 10% target is still to be achieved. The analysis of past experiences reveals that – once the price of oil started to decrease – the biofuel industry collapsed,¹ as well as the political urgency to prioritize alternative fuels and renewable sources of energy more generally [Tyner 2008]. Data on production clearly reveals that despite these ambitious targets and generous public incentives, the industry did not really take off.² A niche market for biofuels however remained in place over the years because regulations on the quality of gasoline. In the US and Europe in the early 1970s the use of lead was phased out as an additive to gasoline for environmental reasons and the industry turned to biofuels and another substance called MTBE as octane enhancers. Further, the 1990 Clear Air Act required to oxygenate petroleum to reduce the concentration of ozone in the atmosphere, and again this could be obtained by blending biofuels and gasoline. Biofuels thus remained in production though they have been a fuel additive rather than a proper fuel alternative to gasoline. It is too early to say whether this time it will be different. The development that can be observed in the last 10 years in production is unprecedented and really impressive, leading to very optimistic projections on the future of biofuels, as we will see in the next sections. At the same time, serious questions have been raised around the overall sustainability of massive production and consumption of biofuels, suggesting a less favourable scenario.

The graph below reports data for US ethanol and EU biodiesel. The US production of ethanol made from corn has been growing steadily in the last years, reach-

¹Notably, the fall of oil prices by mid 1980s put the majority of existing US biofuel refineries out of business, despite generous public subsidies (set at 16 cents per liter in 1985).

² The exception here is Brazil, that consistently kept on supporting the biofuel industry. The Brazilian ethanol made from sugar-cane is currently the most price-competitive in the world.

ing 50 billion litres in 2011, and is by far the largest in the world.³ In Europe ethanol is rather marginal (3.7 billion litres) and the industry mainly concentrate on biodiesel produced from rapeseed oil. In Europe production of biodiesel increased in the 2000s, though the growth rate was slower compared to the American one and decreasing over time. Notably, in 2011 for the first time a decrease in biodiesel production has been registered.

Parallel to diverging production trends, policy decisions in EU and US are also characterised by growing differentiation. As noted, while in the US targets for biofuels have been increased, in the EU targets have been slightly decreased and new strict sustainability criteria have been introduced. The rest of the paper will explore and explain such policy differences, starting from the analysis of the characteristics of policy processes and deliberations that led to US and EU decisions.

FIG. 1. US Ethanol And EU biodiesel production (years 2003-2011).

The Debate on Biofuels in the US and EU: Who is Discussing, Where and When?

The article adopts a discursive institutionalist (DI) approach [Schmidt 2008; Schmidt 2009]. As part of the argumentative tradition in public policy analysis [Fischer and Forester 1993; Majone 1989], DI posits that policy argumentations are a independent explanatory factor, and that policy outputs depend on the capacity of actors “to persuade an audience that something ‘ought’ to be the case: that is a particular action should – or should not – take place, that an event should be interpreted in one way rather than another, and so on” [Fischer 2003]. How issues are interpreted, framed and proposed is thus of central importance in the analysis. In addition to the substantive content of discourses, DI pays attention to the set of formal and informal rules that structure the process of policy argumentation: who gets access to policy debates, when, to whom arguments are channelled and how the interaction among actors takes place are to be taken explicitly into account. In other words, DI proposes to explore “the substantive content of ideas and the interactive processes by which ideas are conveyed and exchanged through discourse” [Schmidt 2009]. My empirical analysis reflects these insights, and provides evidence on how the debates have been framed in the policy formulation stage and how they evolved in the context of formal deliberations on biofuel policy in US and EU. More specifically, empirical analysis is

³ The US ethanol production is over 12 times higher the European one.

based on contributions to discussions officially channelled to the US decision-makers during Congressional hearings and to the EU Commission during consultation procedures by experts, stakeholders, interested parties, activists. By focusing on formalised policy processes the analysis explicitly avoids to consider arguments advanced in lobbying activities, informal contacts between policy-makers and stakeholders as well as arguments advanced in the public sphere and media campaigns targeting the general public. Such analysis of official hearings and formal processes of consultations is relevant to assess the kind of evidence that is formally available to policy-makers. From a theoretical point of view, the analysis gives insights into the openness and inclusiveness of the current system of governance.

In the US renewable energy issues and more specifically biofuels have been extensively debated in the context of energy and agricultural policies. The Senate Committees “Energy and Natural Resources” and “Agriculture, Nutrition and Forestry” and the House Committees “Energy and Commerce” and “Agriculture” all organised extensive hearings to collect information on the potential for fuel production on domestic land and the advantages and disadvantages of renewable sources of energy. More specifically, the House and the Senate Committees devoted a total of 24 hearings on biofuels in the period from 2005 onwards. In addition, the debate on the Farm Bill addressed the issue, since a specific energy title was first been added in the 2002 Act and expanded in the 2008 Farm Bill.⁴ The empirical analysis carried out for this paper reveals that a total of 210 witnesses have been invited to present their ideas on ethanol and biodiesel to policy-makers in the Senate and in the House of Representatives. On the whole, the overwhelming majority of invited witnesses represents the renewable energy industry, the oil industry and farmers. Bob Dinneen – President of the Renewable Fuel Association – appeared for a total of 7 hearings. Further, academics – mainly with a background in engineering and economics – have been often invited to testify. During Senate hearings only two pro-environmental think tanks appear to have been invited to officially channel their position to Senators.⁵ During hearings by the House of Representatives four groups that can be considered representing general interests have been involved.⁶

In the EU biofuels have been discussed in the context of climate change policy. The European Commission – more specifically the DG Energy and Transport (TREN), the DG Agriculture, and the DG Environment – launched broad consultations to collect information from experts, stakeholders and interested parties, often

⁴ The list of hearings has been obtained from the official website: www.gpo.gov/fdsys

⁵ The World Resource Institute and the International Food Policy Research Institute (IFPRI).

⁶ Environmental Defense; Oxfam America; Natural Resources Defense Council; Public Citizen.

with a clear focus on the impact of biofuel production on climate change and on GHG emissions. Taking into account the period from 2005, DG TREN organised various consultation processes open to the general public: in 2007 the main consultation was on “Biofuel issues in the new legislation on the promotion of renewable energy,” and in 2009 the Indirect Land-use Change effects of biofuels. In addition, the Health Check of the Common Agricultural Policy (2008) and the “Future of the Common Agricultural Policy” (2010), paid attention to the impact of biofuels on European agriculture. On the whole, more than 500 contributions from a wide range of social and business actors have been submitted for consideration.

Finally, it is important to note that biofuels are also debated in international arenas. Leading international organisations – OECD, FAO, World Bank – published reports on the technological feasibility of large-scale biofuel production, on policy options, on the impact of biofuels on agricultural practices and global food prices. An unofficial report from the World Bank – known as the Mitchell report - concluded that biofuels are responsible for 75% of increase in world food prices. Later, the official World Bank report presented a more favourable view of biofuels, suggesting that a variety of factors are responsible for the spike in food prices. The FAO [2008] warned on the impact of biofuels on world hunger and the report drafted by the International Assessment of Agriculture Knowledge, Science and Technology report tends to present a critical view of the impact of biofuels on farming practices [IAASTD 2009].

On the whole, a wide range of topics have been analysed. Such insights influenced the on-going domestic debates in the US and EU, and as a result new topics and evidence have been added over time. Still differences can be noted in the way in which such ‘global’ topics have been addressed in the US and EU. The next paragraphs illustrate in details the US and EU biofuel debates, and to what extent the economic, social and environmental sustainability of biofuels have been put into question.

US Biofuel Policy: The Search for Energy Independence and Cheap Fuels for Americans

In the US the first program to launch the biofuel industry dates back to 1978. The Energy Policy Act passed by the Carter administration provided subsidy for a 10% gasoline-ethanol blend that stand at 10.6 cents per litre of ethanol produced. The subsidy mechanism has remained in place since then, and over the years the level of subsidy varied between 10.6 dollar-cent per litre and 15.9 dollar-cent per

litre. The 2004 American Jobs Creation Act changed the subsidy mechanism and introduced the Volumetric Ethanol Excise Tax Credit (VEETC), that expired at the end of 2011. Under the new system for every domestic or imported litre of ethanol blended with other fuel, a 13.5 dollar-cent tax credit can be claimed. Notably, there are no quantity limits to tax credit and the latter is awarded independently from gasoline price. Further, an ad valorem duty of 2.5% and a tariff are set to protect domestic manufacturers from international competition, in particular from Brazil imports.

To the existing, long-term fiscal incentives the 2005 Energy Policy Act (EPAAct) crucially introduced for the first time mandatory targets for the production and consumption of renewable fuels. The 2005 goal was to employ 4 billion gallons of renewables in transport in 2006 and then to progressively increase their use. The 2007 Energy Independence and Security Act (EISA) went further in this direction and established to significantly increase the mandatory production of biofuel: by 2022 the US domestic productive capacity has to total 36 billion gallons of biofuels per year. EISA also introduced a number of requirements in terms of GHG emission reductions, giving mandate to the Environmental Protection Agency (EPA) to establish precise rules for the life-cycle analysis of greenhouse gas emissions from renewable fuels, its monitoring and implementation. EPA proposed regulation in 2009 and eventually approved it in its final form in March 2010 (see below). Provisions relevant to biofuels are also included in the 2002 and 2008 Farm Bills. The 2002 “Farm Security and Rural Investment Act” and the 2008 Farm bill – significantly called “Food, Conservation and Energy Act” – both include subsidies for ethanol blenders, and start various programs to foster research and the development of the agro-industry.

In the context of US policy, biofuels have been primarily framed as a solution to the pressing problem of energy dependency from oil. The analysis of Congressional debates reveals that oil dependency has two main dimensions: first the US heavily rely on an increasingly expensive source of energy, a condition that in the view of the majority of witnesses makes US economy extremely vulnerable; second the US depend on imports of oil from foreign countries. Both arguments are repeatedly used in Congress to stress the unsustainable character of the current energy system and to emphasise that “the truth is we desperately need biofuels.” Indeed, the price of oil has been constantly on the rise in the 2000s. While in the 1990s the price for crude oil averaged less than 20\$ a barrel, from the early 2000s the price increased and averaged 60\$ a barrel in the years 2004-2007 to increase further to over 90\$ a barrel on average in 2008 and 87 in 2011. In particular during the summer in 2008 the price for crude oil was 140\$ a barrel and gasoline was sold to US consumers at around 4\$ a

gallon.⁷ This is a major concern for Congresspersons who devote substantial time to the analysis of causes and consequences of the oil crises. Their analysis of increase in oil prices in 2000s stresses the strong demand from China, India and slow adjustment on the supply side. Compared to previous energy crisis, the current increase in oil prices differs since it has been caused by structural factors. While the crisis in the 1970s was mainly due to political factors, today experts identify the main problem in shortages. The US Department of Energy in a 2005 report estimates that the peak in production will be reached in 2037 for petroleum and decades later for coal,⁸ and forecasts serious shortages and drastic oil price increase in the coming decades, mainly due to the rising demand for oil from China and India. The production of oil should be increased from 48 million barrels per day to over 110 million barrels to meet demand [International Energy Agency 2011]. In addition, new reserves are found in poorly accessible locations, thus rising costs for extraction and transportation. Further, as noted, oil security is in danger because of long-term political instability in oil-producing countries that can potentially discontinue oil supplies. A typical analysis that can be found in Congressional debates highlights that “Asian economies continue to boom, creating soaring demand. Several of the countries we import from, such as Nigeria, are experiencing political and social unrest. Venezuela is planning to nationalize oil production, and we have continued uncertainty in the Middle East – in Iraq, as democracy struggles to grow, and in Iran, as its regime preaches hatred and world domination.” [Sen. Chambliss, 2006].

Oil insecurity is thus analysed at length for its negative effects on the economy of the country, on the competitiveness of the productive system and ultimately on the American way of life, that is portrayed in serious danger. In turn, oil insecurity – high oil prices and unreliable imports – is said to result from a lack of a efficient energy policy able to assure energy independence. Congress is then invited to take immediate action and promote the domestic production of ethanol, since “this is money wisely invested in the American Midwest and not in the Middle East” [Senator Ben Nelson – D-NE, 2008].

The assumption here is that energy independence is feasible, that biofuels can substantially contribute to it, and that it will result in lower prices for consumers at the gas station. Overall the debate is characterised by a strong sense of challenge coupled with a strong optimism in the capacities of America as a nation to respond

⁷ The price approximately corresponds to 0.7 Euros per liter. In the same period (2008) the EU average price for gasoline was 1.45 Euros per liter.

⁸ There is a deep disagreement among experts as to the quantity of fossil fuels – and in particular petroleum – that will be available in the future. Some experts forecast that the peak in production has already been met, thus leaving the world with a serious and imminent problem of energy scarcity.

to it. It is not uncommon to hear Members of Congress as well as witnesses making a parallel between the Apollo program in the 1960s and the current energy challenge.

In short, biofuel policy is closely linked to the energy crisis. The rise in oil prices and oil dependency are linked to a series of contingent as well as structural causes and ultimately to the inability of the US political system to address the issue resolutely in the past. Biofuels then are a valid solution to such complex situation. In addition biofuels are expected to be positive for the agricultural sector: “The increased use of crops for biofuels is having, and is expected to continue to have, a sustained major positive impact on crop producers, rural areas, and the agriculture sector broadly, including fertilizer suppliers, seed suppliers, equipment suppliers, and so on” [Testimony Collins, USDA, Senate 2007, 110-117]. Finally, the environmental advantages of biofuels are mentioned, though not extensively discussed by actors, who tend to take for granted the “green” character of ethanol compared to fossil fuels. Analyses are mainly based on the concept of “carbon neutrality”: the quantity of GHG caused by the burning of ethanol in cars is assumed equal to the quantity of GHG absorbed by the corn used to produce it. The environmental benefits of the substitution of oil with ethanol are then a positive side-effect, though they are not linked to any specific environmental goal and the reduction in emission is not quantified.

In this context, no real opposition to biofuels can be found, and the debate revolves around a number of technical issues related to the long-term economic sustainability: the potential of the industry to produce enough ethanol to meet policy targets and thus to become a real alternative to oil, and the problems related to changes in infrastructures due to expanded biofuel use. Estimations on the productive capacity of US agricultural sector can vary. This is because the production of biofuels is one in several potential uses of biomass, that can actually be applied to a variety of purposes, and because of huge uncertainties on the commercial availability of cellulosic ethanol, at present still underdeveloped. As noted the majority of experts invited to Congress are linked to the renewable energy sector and on the whole the biofuel industry is very optimistic about the US productive potential. POET, a large renewable energy company estimates that 50 billion gallons per year are possible with no negative impacts on food prices and security in the US. An even more optimistic estimation is proposed by the influential 25×25 Renewable Energy Alliance, which affirms that ethanol production can reach 86 billion gallons by 2025. More problems seem to arise around the distribution of biofuels in the country.⁹ The extremely expensive

⁹ Data on ethanol production presented by USDA show that 91% of US production is located in the Midwest.

infrastructure built to stock and transport fossil fuels can not be used to distribute biofuels, which thus require new facilities to be installed or complex modifications to the old ones to be used. Ethanol must be transported by road and “mixed just prior to distribution” [Tabak 2009]. Further, gas stations have to upgrade their equipment and adapt to different kind of fuels. Congress thus addresses such issues in many debates, considering the problem of infrastructure a “chicken-and-egg” one: on the one hand you can not promote biofuels if you do not have the right infrastructure in place, on the other, you cannot invest in expensive infrastructure if you are not reasonably sure that the biofuel technology will be more and more relevant in the future.

The overtly optimistic tone that characterised Congressional debates until 2007 has been mitigated by the rising relevance in the global public sphere of critical arguments on the impact of biofuel production on food prices and on the environment. Both arguments have been used to channel critical remarks on biofuel policy. From the late 2007 onwards the consensus over targets and instruments that characterised the initial phase of the debate is no longer unanimous: representatives of oil refineries, and part of the farm community became vocal in expressing their criticism towards the very idea of having mandatory targets for biofuel production and highlighted the negative consequences for the farming sector and climate change. Rising criticism however did not change substantially the overall positive tone of the debate. In the context of Congressional debates, the “food vs fuel” controversy has been mainly discussed with reference to the US context. All but one experts called to express their opinion on the matter, note that American consumers spend around 10% of their income of food. Further, the share of crop prices on the final food price is very low. Taken together, these numbers suggest that US consumers are only marginally affected by rising food prices. Experts point out that high energy prices are more relevant for US consumers, and generally support the idea that biofuels have the potential to make fuel cheaper. At the same time, stakeholders representing the pig and poultry industry note that the increase in corn prices is going to become problematic since they rely on cheap and stable supply of corn to make their business profitable.

Climate change concerns surface in the debate from time to time. In general terms, biofuels are portrayed as a form of green energy and are said to play a positive role in cutting greenhouse gas emissions. The assessment of environmental sustainability of ethanol has been delegated to the Environmental Protection Agency, that was required by the 2007 Energy Act to perform the lifecycle analysis of biofuel production and in this context addressed the issue of direct and indirect land-use changes. A “notice and comment” procedure has been followed to collect stake-

holder views on the proposed regulation, made public in May 2009. In Congress, reactions to EPA's draft regulation were particularly negative. Senator Thune (SD-R), a major sponsor of both the energy bill and the energy title in the farm bill, strongly opposed the move, talking about a "Dr. Jekyll and Mr. Hyde" biofuel policy that on the one hand made biofuels a cornerstone in energy policy and on the other hand creates "artificial regulatory barriers" that "are having a negative impact on the profitability of existing ethanol plants and private sector investment in future advanced biorefineries" [Sen. Thune, Senate 2009, 111-794]. Similarly, all stakeholders representing the biofuel industry criticised EPA, asking to "reconfirm that the carbon neutrality convention for accounting of biogenic GHG emissions is both scientifically justified and appropriate for regulatory contexts" [Renewable Fuel Association 2010]. Further, the US Canola Association wrote that "the proposed rule as released contains unprecedented, untested, and far-reaching indirect land use assumptions and projections which will adversely impact markets for U.S. farmers and impede our national efforts to reduce dependence on foreign oil and thus impede efforts to improve our environmental footprint" [US Canola Association 2009]. Importantly, environmentalists also strongly criticised both the methodology and the results of EPA's analysis, stressing its inadequacy in taking full account of emission sources. In 2010 EPA eventually delivered its assessment. The final rule assesses that all advanced and cellulosic biofuels that will be produced in the future are likely to guarantee a reduction in GHG emissions by 50% compared to conventional fuels in their life-cycle and therefore comply with regulatory requirements. For ethanol in production, it is important to note that the 20% life-cycle requirement does not apply to facilities that have been put in production before 2007 and to facilities that are run with natural gas or biomass. For the remaining facilities, EPA concludes that according to its study 'ethanol produced from corn starch at a new natural gas, biomass, or biogas fired facility (or expanded capacity from such a facility) using advanced efficient technologies (ones that we expect will be most typical of new production facilities) will meet the 20% GHG emission reduction threshold compared to the 2005 gasoline baseline.' In other words, strict environmental standards apply to biofuels that are currently not in production and not available on the market (the cellulosic and advanced biofuels), while existing production is estimated to comply with Congress's requirements to guarantee a 20% reduction in GHG emissions compared to fossil fuels. On the whole, such environmental requirements are very weak if compared to European ones, where the debate developed along quite different lines of argumentation, as we will see in the next section.

The EU Biofuel Policy: Fighting Climate Change

The debate on energy issues has been limited in the European Union context because of Treaty constraints: energy security was not included among EU competences until 2009. In such juridical context, the Commission took action on a number of important but clearly delimited energy-related issues, like energy efficiency and renewables, that could be addressed under the environmental articles of EU treaties. From the very beginning then the debate on biofuels has been strongly linked and framed in connection to environmental sustainability and increasingly to the climate change agenda. The European Union made the fight against climate change a top policy priority. Ambitious commitments have been made from the early 1990s onwards, making of the EU a “laboratory for climate change politics” [Jordan *et. al.* 2010], and renewable energy and more specifically biofuels have been a cornerstone of the climate policy. The target for biofuels are ambitious: by 2020 the share of renewables – biofuels, hydrogen, electricity – in the transport sector must be of 10% in all 27 EU member states. Transport accounts for around a quarter of total EU emissions: if the sector has to contribute to emission reduction efforts, then biofuels have a very relevant role to play. It is of note however, that the target for biofuel use has been downplayed over time, so that it is arguable that the support of EU to this technology is decreasing. A brief review of policy targets reveals that the share of biofuels was first set at 5.75% by 2010 in the so-called “Biofuel directive” in 2003, then proposed to be set at 10% in 2006 but eventually downscaled when it was decided that the 10% share can be reached by 2020 by adding different technologies, including hydrogen and electricity. In addition, detailed regulation on the sustainability criteria for the production and commercialization of biofuels have been discussed and adopted. The Renewable Energy Directive and Fuel Quality Directive (28/2009) requires biofuel to produce 35% less greenhouse gases than fossil fuels, bans productions from forests, wetlands and nature protection areas. Such requirements are progressively more demanding: the GHG savings will increase to 50% in 2017 and 60% in 2018. In addition the directive requires certifications for biofuel import. Finally, the directive requires the Commission to “submit a report to the European Parliament and to the Council reviewing the impact of indirect land use change on greenhouse gas emissions and addressing ways to minimise that impact.”

In short, it seems safe to affirm that after an initial enthusiasm for the technology – the proposed share of biofuels was 20% in 2000 – in the EU a more cautious approach is emerging [Bozzini and Sicurelli 2010]. At the end of the 1990s, the Commission was prone to consider biofuels a win-win solution to problems of climate change, energy security and job creation. Specifically, the potential for reductions in

greenhouse gas emissions was of central relevance in the debate. Notably in 2000 the European Commission wrote that “in terms of environmental impact, biofuels are very attractive, emitting between 40 and 80% less in the way of greenhouse gases than other fossil fuels” [CEC 2000]. The benefits were thus mainly taken for granted and the regulation of biofuel production was at first framed in purely technological terms. In particular, the biofuel debate developed in connection to highly technical details on the quality of fuel and was mainly led by Joint Research Centre of the European Commission (JRC) – the in-house research centre for scientific advice – in cooperation with representatives of the car industry [Concawe *et. al.* 2003; Concawe *et. al.* 2007]. Taking the environmental advantages mainly for granted, the aim was to maximise the use of biofuels given the constraints due to existing engine technology. Critics were limited to stress technological constraints to the massive use of biofuels; for instance Europa – the umbrella organisation representing oil companies in Brussels – noted that ‘conventional biofuels, typically ethanol and biodiesel have different properties than conventional gasoline and diesel, and care is needed in their use to avoid vehicle performance problems’ [Europa 2006].¹⁰

Such narrow approach however attracted widespread criticism, and in particular the criteria for the estimation of emission reductions that can be obtained from biofuels have been questioned. From the very early stage of discussion, environmentalists advanced a set of counter-arguments contesting the effectiveness of biofuels in the fight against global warming. European Environmental Bureau – a leading EU NGO umbrella organisation – wrote in 2001 that promoting biofuel “produces no or little climate change or CO₂ benefits. Firstly, the production of biofuels is heavily dependent on the input of fossil fuels. Secondly, many life cycle analyses have been conducted and concluded that the potential of biofuels to combat climate change was often negative or neutral right away. This is also not cost effective compared to other options, like using public transport, smaller cars, or improving engine technology” [European Environmental Bureau 2001]. A broad range of arguments about the environmental sustainability of biofuels have been advanced since then, assessing the impact on wildlife, farming practices and intensification, soil erosion and similar.

The most relevant debate however is linked to the problem of the indirect land-use effects of biofuels production. Indirect Land Use Change (ILUC) refers to changes in land use which arise from the displacement of existing food/feed productions as a result of expanding cropland for biofuels. Such changes in land-use configuration are expected to adversely affect biodiversity, food supply, soil and water

¹⁰ This discussion led to set a 5% limit in blending, far below the US level of 10% recently raised to 15% by EPA.

quality and the level of GHG emissions. As far as climate policy is concerned, evidence is that GHG emissions are likely to increase because of land conversion, effectively outweighing the expected benefits from biofuels [Gallagher 2008; Searchinger 2008]. In 2008 the JRC estimated that biofuels that are produced in Europe (on unused and set-aside land) save between 18 and 50% GHG, if indirect effects are ignored. However, the JRC affirmed that the net effect of biofuels can be negative if additional emissions resulting from agricultural intensification, grassland conversion and deforestation are properly taken into account [Joint Research Centre 2008]. Such official recognition of the issue of ILUC proved influential in the debate and raised serious doubts on the overall effectiveness of the EU biofuel policy in contributing to the fight against climate change. As noted, the final version of the Directive 2009/28 requires the Commission to further investigate the issue and to propose a revision of existing regulation if needed. The debate on ILUC thus started immediately after the approval of the Directive, and in the context of public consultations environmentalists have been particularly vocal on this aspect. Greenpeace argues that “the EU’s plans for biofuels will result in the conversion of up to 69.000 square kilometres (km²) of land to agricultural use due to ILUC (...) Land conversion on such a scale will lead to the release of carbon emissions from vegetation and soil, making biofuels more damaging to the climate than the fossil fuels they are designed to replace” [Bowyer 2010]. Other environmental groups advanced similar arguments. However, the debate made also clear that an estimation of the indirect land-use effects of biofuels is extremely difficult to obtain, and contentious. Indeed, all estimations proposed by research centres and think tank are strongly contested, in particular by representatives of the biofuel industry. In general terms, the European Biodiesel Board and others pro-biofuel groups do not contest the need to curb GHG emissions, and their strategy is based on requests for more research to be carried out in order to fully explore cause-effect relations between land-use change and biofuel production. Ebio (European Bioethanol Fuel Association) notes that “the causes of land-use change (direct and indirect) and deforestation are often multiple, complex and interlinked. They relate to agriculture (commercial and subsistence), forestry (timber extraction and plantations), livestock (rangeland, pasture and feedlots), urbanization, infrastructure, environment and recreation. To single out one single human activity, i.e. production of biofuels, is an oversimplification of reality” [European Bioethanol Fuel Association 2009]. Other groups, for instance farmers organisations, go further in criticising the overall criteria for assessing advantages and disadvantages of biofuels. In particular such social and institutional actors focus on the opportunity to introduce social criteria in the evaluation of cost and benefits. In short, the debate reveals a division on the criteria of sustainability to be adopted for assessing biofuels technologies. On

the one hand, members of the Green10 alliance – an alliance between the 10 most important environmental umbrella organisations based in Brussels - clearly affirm that ‘promoting biofuels only makes sense if there are significant GHG benefits to be gained from it and this can be demonstrated’ [Birdlife *et. al.* 2007], suggesting that the evaluation of costs and benefits has to be strictly related to emission reductions. On the other hand, farmers and biofuel producers argue that the expected benefits of biofuels can go beyond their contribution to climate change mitigation. In particular agricultural organisations proposed a favourable view of biofuels, seeing a profitable opportunity to develop their traditional activity. In the view of Copa-Cogeca – the leading EU farmers’ organisation – the development of biofuels has a positive impact on job creation and is therefore of central importance for the revitalisation of rural areas [Copa-Cogeca 2008]. According to this view, the economic and social benefits for rural areas that are expected from the development of the biofuel industry have to be fully taken into account in the evaluation of sustainability. Pro-biofuel actors also expressed concerns for the introduction in Europe of ‘unilateral’ environmental sustainability criteria, because in their view they represent a constraint to competitiveness of EU economic actors on the world market and a limit to business opportunities. In short, how to assess the impact of biofuels became increasingly controversial and marked by high level of uncertainty. In this context, environmentalists strongly advocated the adoption of a precautionary approach to make sure that EU renewable energy strategy is delivered in a sustainable way.

A more global vision of the issue is proposed by organisations working on food security and poverty. They state that political incentives to biofuels is a trigger for the current food crises, jeopardizing efforts to eradicate hunger and poverty in poor countries. In this context issues related to justice and human rights have been raised, noting that “using food to feed cars” heavily impacts on food prices and availability and thus on living conditions of people in poor and marginal areas. As the production capacity of biofuels industry increases, the more crops are needed and the stronger the impact on world food security. The debate is open, though for the first time in 2011 the spike in food prices has been directly linked to biofuel productions and the national policies that support them. Such debate suggests that the global impact of EU biofuel production has a important role in the context of public deliberation on the matter. The sustainability schemes approved by the Commission in 2011, require monitoring of biofuel productions, in both the EU and abroad. Certification can be obtained only if guarantees are provided that no highly valuable land has been converted to produce biofuels. Social and business actors had mixed reactions to such proposals, generally arguing that they are a partial step in the right direction.

Comparison and Conclusions

A first relevant difference in the US and EU biofuel policies is that whereas in the US context biofuels have been framed in terms of energy security, in the EU the policy context for the development of biofuels has been the fight against climate change. As a consequence, advantages and disadvantages of biofuels have been interpreted and discussed according to very different criteria: while in the US the main relevant question was the potential of biofuels for achieving energy independence, in the EU the main contribution of biofuels was to meeting emission reduction targets. Relevant evidence and the actors with a legitimate say on biofuel policy have consequently been very different in the US and EU. In America, hearings involved representatives of the biofuel industry, farmers, car manufacturers with the aim to assess the physical and technological constraints to expansion of the industry and the economic sustainability of massive biofuel production. Experts in infrastructures have been called to explore solutions to distribution problems, as well as to monitor developments in engine technologies. As noted, public interest groups in general and pro-environment and consumer organisations in particular have not been present in official debates in Congress, despite their being particularly vocal in the public sphere on this issue.¹¹ The influence of critical arguments however has been limited, given the broad bi-partisan consensus on the view that biofuels are necessary for energy security and therefore constitute a core national interest. In Europe, consultation and subsequent policy processes mainly followed procedures used to approve environmental regulation, since biofuels were mainly framed in the context of climate change policy. Here the range of actors involved is considerably broad and cost/benefit analysis is only one among the possible criteria for the assessment of policy. As noted the most important scientific evidence that had legitimacy in this process was mainly provided by ecologists and climatologists working in the JRC, who asked to assess the benefits of biofuels in emission reductions. Social and economic considerations however have also been part of the debate, as well as issues linked to social justice and the protection of global biodiversity.

Formal rules for consulting stakeholders and experts thus proved important in determining the range of arguments that animated the debate. Chairs of Congressional Committees have a considerable degree of autonomy in the selection of relevant testimony. On the whole, hearings in Congress proved a highly selective process, that effectively filtered off many arguments present in the media and in other political

¹¹ In Washington DC there are at least 92 environmental organisations (Grossmann 2006) that are active as pro-environment advocates and many of them published critical position papers on US ethanol, warning about the overall environmental sustainability of the massive ethanol production.

arenas, like the United Nations and the European Union. In the EU, formal rules for consultation require the Commission to “cast their net as widely as possible in seeking appropriate expertise” [COM(2002) 713:11], and to collect evidence from a variety of sources, including minority and unconventional views. Such rules proved significant in granting access (if not influence) to policy-making to a variety of social actors.

Finally, a relevant difference between US and EU can be observed with reference to the scale at which biofuels are discussed. In the US debate a sense of urgency and concern for rising oil prices and the need to take drastic and urgent action was diffused among the general public, focusing the discussion on US national energy interest and the impact on American consumers. In the EU, the limitation in policy competences on energy contributed to make domestic and security issues less prominent. Rather, the focus on climate change contributed to put biofuel policy in a global rather than domestic dimension. As noted above, in the European version of the “food vs fuel” debate, the argumentation includes considerations about global food security and the impact of EU biofuels on developing countries.

In conclusion, the comparison of US and EU biofuel policies shows different emphasis on aspects of long-term sustainability, and divergent policy paths. It is somewhat premature to say whether such differences will have a substantial impact on ethanol and biodiesel productions and to technological development in the field. The incentives to advanced and cellulosic biofuels – supposed to be more environmental sustainable and not competitive with food – have been proposed and approved in both contexts, suggesting that crop-based biofuels are not to be considered the definitive answer to the oil crisis and that the debate will continue in the coming years.

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The Sustainability of Biofuels

A Comparison of EU and US Policy Debates

Abstract: For a long time ethanol and biodiesel made from corn, rapeseed, and sugar beets have been regarded a win-win solution to a series of intractable issues about oil dependency, greenhouse gas emission reductions and revitalization of rural areas. Both the European Union and the United States started ambitious programs to incentivize the production and consumption of biofuels, supporting crop productions with subsidies and tax exemptions and setting standards for blending them with conventional fuels. Recently however, a growing number of experts and activists have channelled doubts about the sustainability of the technology and claims to revise current policies. The advantages and disadvantages of biofuels have been widely discussed both in EU and US policy processes, leading to different policy decisions. While the EU progressively reduced the initial targets for biofuel production and introduced a series of sustainability criteria to regulate production, the US confirmed and increased over time its initial policy goals. The article aims at explaining such differences in policy by comparing the evolution of the biofuel debates in EU and US. The paper is based on an extensive analysis of public hearings held by the European Commission and the US Congress and argues that differences in policy outputs can be explained making reference to differences in criteria for dealing with uncertain and contrasting evidence on the economic and ecologic sustainability of this specific technology.

Keywords: Biofuels, European Union, United States, Sustainability, Climate Change.

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