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Managing the ecological and social ambivalences of bioenergy – sustainability criteria versus extended carbon markets

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The use of bioenergy for the generation of electricity and heat as well as for the production of biofuels is growing at impressive pace. While some ecological advantages of the use of biomass are well-known, critics stress the negative ecological and social impacts of an intensive use of biomass. Existing legal regulations, whether on a European or national level, do not seem to solve these problems. The role sustainability criteria play in overcoming the ambivalences of global bioenergy use naturally is a limited one, as these criteria are not suited to accurately reflect the complexity of the matter. Also, sustainability criteria may not avoid effects of shifting or indirect land-use, i.e. the production of e.g. meat or non-regulated biomass instead of regulated biomass in areas that do not match sustainability criteria. Finally, some of the most important aspects, as for example the world's nourishment problems, are not representable at all in sustainability criteria – and especially not in the current EU criteria. Instead, a radical policy shift to energy efficiency would and strict greenhouse gas caps prove a lot more effective in overcoming these ambivalences of the use of bioenergy. A far-reaching policy of energy efficiency and strict caps would reduce global energy consumption and thus lead the way to a future zero carbon economy run exclusively on renewable energies. The text analyses the ambivalences of the use of bioenergy and at the same time provides a short overview of the law of bioenergy in die EU (also including some aspects of WTO law).

Keywords = bioenergy, renewable energies, ambivalences of bioenergy (ecological/ social), sustainability criteria, carbon markets, law, emission trading, land use, environmental law, European law, international law, biomass

1. Introduction: climate policy, renewable energies, and bioenergy

Despite manifold public and political debate on climate change, global climate gas emissions have increased by 40 % since 1990. The Kyoto Protocol, however, does not even impose any obligation to reduce greenhouse gas emissions. And leaving aside the de-industrialization due to the economic collapse that hit Eastern Europe in 1990, even the emissions in the OECD counties have increased by 10 % since 1990. Wicke/ Spiegel/ Wicke-Thüs (2006, pp. 62 ff.) demonstrate that there are diverging numbers (on the general problems of climate policy Ekardt 2009c; Ekardt 2010). The actual reduction of Germany, for instance, amounts to only 7 % since 1990, while the rest of the commitment to reduce greenhouse gas emissions by 21 % (which is the German commitment under the Kyoto Protocol) has already been "accomplished" by the collapse of industrial production in the former GDR. If the 7 % will be accomplished is not even clear; in 2008, Germany's climate gas emissions have been on the increase again. Although German politics often refer to Germany's climate policy as being on the global lead and despite a large number of European and German legal instruments, the average German still emits about three times more greenhouse gas emissions than the average Chinese – and multiple times more than someone from Africa (cf. Baumert, Herzog, Pershing 2005, p. 22), At the same time, according to the IPCC, Western countries will need to establish zero carbon economies, i.e. economies that basically do not emit any greenhouse gases (or compensate their emissions), by 2050. In Europe many people speak of „80 % less greenhouse gases in Europe (!) until 2050 compared to 1990“. The IPCC, however, speaks of reducing greenhouse gases worldwide (!) by 46-79 % until 2050, if we accept a maximum global warming of 2 to 2.4° C. Due to „feedback effects“, the IPCC even characterizes this prognosis as possibly too conservative (IPCC 2007, p. 15, chart SPM.5). With a continuously growing world population the necessary greenhouse gas reduction would mean CO_2 emissions of as little as 1.3 to 0.4 tons per capita worldwide (without deforestation) – compared to actual 4,6 tons today. For the industrialized nations, this adds up to reducing greenhouse gases by about 87-96 %. And the situation becomes even more dramatic considering (1) the „feedback effects“ and (2) the fact that even a warming of 2 to 2.4° C could have dramatic consequences. Furthermore, due to research done by the NASA, the IPCC has recently begun to realize that (3) climate change is happening at an even faster pace than predicted. Considering that climate policy (4) so far still clings to steady economic growth and thus to steadily increasing consumption of resources, it begins to show that the IPCC stipulates the goal of a zero-emissions-economy until 2050 (cf. on the NASA research Hansen 2007). Apparently, a zero carbon economy would be technically feasible and would at the same time help to lower our dependency on energy imports, to minimize the risk of armed conflicts over resources and to create new jobs and other first move advantages. Taking into account questions of global justice, one also has to consider (a) that Western countries still bear per capita emissions multiple times as high as the per capita emissions of most Southern countries and (b) that Western countries efforts may even have to go beyond just levelling out the global emissions between all countries, since Western countries’ historic emissions since the 19th century are still fueling climate change today (Ekardt/ von Hövel 2009).

Being the world’s largest market, the European Union recently claimed to try to break with the interconnection of economic growth and energy consumption (European Commission 2006c, p. 11). However, the European Commission’s roadmap envisions only very small steps that will not yet lead the way to a zero carbon economy. One of these steps is the controversial attempt to promote the use of bioenergy in the electricity, heat and transportation sectors (cf. European Commission 2006c; European Commission 2006a; Wissenschaftlicher Beirat Agrarpolitik 2007; KBU 2008; Schlegel/ Kraemer/ Schaffrin 2005; The German Council of Environmental Advisors 2007; BUND 2006; Ekardt 2007; from the dawn of the debate (although not yet including the clear ambivalences) Bachofen/ Snozzi/ Zürrer 1981). This contribution deals with the ambivalences of bioenergy and with legal conceptions to solve this problem.

2. Bioenergy and its environmental, social and economic ambivalences

Biomass has different meanings. It either refers to any energy carrier that derives from raw materials of animal or vegetal origin, such as animal fat, rape seeds, sugarcane, potatoes, sun flowers, and different types of wood, such as forest waste woods, including all secondary and waste products and all residues.[1] Art. 2 e) of the European Directive on Renewable Energies (Directive 2009/28/EC) also includes the biodegradable fraction of industrial and municipal waste. The same wording can be found in Art. 2 b of the Directive 2003/30/EC. The use of organic waste is, however, not yet very common (cf. European Commission 2005). Many different techniques are used to produce bioenergy (more about the different techniques: The German Council of Environmental Advisors 2007, p. 5 f.; Kaltschmitt et al 2007, pp. 511 ff.). Biofuels[2], including fuels for heating purposes, include bio-diesel und bio-ethanol (cf. Duffield et al 2005, pp. 231 f.), biogas, biomass-to-liquid-fuels (BtL), bio-butanol und bio-hydrogen. A distinction is drawn between different generations of biofuels. First generation biofuels (plant oil, bio-ethanol, bio-diesel) are produced from sugar, oil and starch of energy crops. Second generation biofuels (biogas, BtL, and bio-ethanol from lignocellulose) can be produced from any sort of biomass, including waste products. Techniques for the generation of biogas include anaerobic fermentation and the less common thermochemical gasification (cf. Institut für Energetik und Umwelt 2007, p. 41).[3]

Considering its environmental, economic and social impacts, the prevailing boom of bioenergy in Europe - and also worldwide - brings along both assets and drawbacks (cf. OECD 2008). Alongside with wind power, biomass is the most intensively debated renewable energy source (further on wind power, among others: Hornmann 2006; Oschmann/ Sösemann 2007; Ekardt 2009b). Generally speaking, the use of renewable energies proves advantageous, for instance in regard of security of energy supply: Fossil fuels will not last forever and may increasingly lead to military clashes. Also, in the ideal case, the use of biomass for energy production emits only the amount of climate gases the biomass used to grow. Fossil fuels, on the other hand, have extracted the carbon dioxides we are about to set free in a few hundred years in the course of millions of years. Thus, biomass is superior in terms of climate policies to e.g. coal, oil or natural gas. However, energy production from biomass is not yet very energy efficient, as second generation crops and second generation biofuels have not yet reached marketability. Similar to biogas from anaerobic fermentation, second generation energy crops and biofuels make use of the whole plant (and not only of the seeds) and are more energy efficient that way. Due to the energy intensity of biomass production and refinement, the overall *climate balance* of bioenergy (and especially biofuels) is often little better then the climate balance of fossil fuels. As the production of biomass is cost efficient especially in tropical regions, biomass, for instance palm oil from Indonesia or Malaysia, often comes from plantations that comprise clearance of rain forests and therefore emitted large amounts of greenhouse gases. Also, some other forms of biomass use, e.g. the collection of small pieces of wood scattered out in the forests, does not necessarily make sense from a climate protection perspective. Lastly, the production of nitrogen fertilizers used in the cultivation of biomass is very energy consuming (cf. for instance Gellings/ Parmenter 2004; Haberl/ Erb 2006, p. 180) and the fertilization itself as well as the operation of bioenergy facilities apparently sets free large amounts of nitrogen oxides. Nitrogen oxides are highly effective greenhouse gases and

[1] Other forms of wood usage for energy production include waste from sawmills, e.g. bark, and plantation wood, including wood from short rotation plantations. The thermochemical gasification of wood from short rotation plantations is also very promising.

[2] Primary biomass products originate directly from green plants' photosynthesis, whereas secondary biomass products derive from the degradation of other organisms; cf. Reshöft 2009, § 8 ref. 7, 8. The chemical basis is carbon and cellulose; cf. Reitter, Reichert (1984) p. 5.

[3] Interestingly, several surveys are based on different facts concerning e.g. the input materials (solid biomass, bio oils, biogas) for biomass plants; see the comparison in Wuppertal-Institut/ Rheinisch-Westfälisches Institut für Wirtschaftsforschung 2008 and Zimmer/ Berenz/ Döhler et al 2008.

have their share in climate change.

In order to produce more efficiently, biomass is generally produced by means of *conventional agriculture*, thus aggravating its negative effects on the environment. This especially applies to dangerous long term negative effects on water bodies and on the soil, such as erosion, eutrophication, overfertilization and the contamination with pesticides. Even expert groups very often ignore the fact that the quality and usability of European soil is endangered. The German government's commission on soil conservation (Kommission Bodenschutz der Bundesregierung, KBU) organized a symposium at the end of 2008. According to the symposium, these problems may occur even more often in the context of energy crops then with food crops, simply because energy crops are not meant to be eaten, potentially resulting in even less public sensitivity. In either case, increasing cultivation of energy crops intensifies the economic pressure on areas of unspoiled nature such as tropical forests and on near to nature management areas: A number of calculations on the availability of areas for energy crop cultivation do not take into account that the cultivation of energy crops contravenes many other political aims, e.g. nature conservation, the promotion of less efficient eco-farming[4] and the conservation of *biodiversity*. The latter was subject matter of a world conference in 2008 (COP 9/ Conference of the Parties to the Convention on Biological Diversity, Bonn, 19-30 May 2008). The cultivation of energy crops can be very harmful in this respect, as it often relies on monocultures, intensive use of pesticides and fertilizers, and the up-ploughing of grasslands.

There is one more aspect to be mentioned. Since genetic engineering may ostensibly bring about amongst others yield increase and less need for pesticides, the cultivation of energy crops may accelerate the spreading of *genetic engineering* for agriculture, despite the reluctance Europeans show in this matter, (cf. European Parliament Committee on Agriculture and Rural Development 2006). In this respect, it is important to know that, contrary to the assertions of the law of genetic engineering, the co-existence of genetically engineered and conventional agriculture will not last very long: As the cultivation of genetically modified energy crops does not encounter the same reluctance, it is just a matter of time until this supposedly less hazardous form of genetic engineering will spread out and, by way of pollen flight and jumping genes, will affect a 100 % of the food crops as well (unless we consequently cultivate non-hybrid crops only). That is why it is about time for a democratic decision based on a sufficient public debate of the risks and possible consequences of biotechnology – instead of a subtle, bioenergy-fueled establishment of green genetic engineering.

There are also a number of ambivalences in context of the *economical and social effects* of bioenergy. While biomass undisputedly is an important alternative to oil, natural gas and coal, it will certainly not bring the same benefits to European security of energy supply as wind and solar radiation power (even considering that solar radiation power is still very expensive – we yet have to wait and see if solar energy will be utilized in a decentralized manner or if large-scale installations in deserts and alike will dominate in the long run), since biomass can be produced only to a limited extend within in the European Union. On the other hand, the increase of biomass use may strengthen the European agricultural sector and revitalize underdeveloped rural regions in Europe. This ambivalent balance can be continued on an international level: *On the one hand*, the global food situation might be further worsened if we start

[4] While e.g. Wuppertal Institut, Rheinisch-Westfälisches Institut für Wirtschaftsforschung 2008, passim, recognizes the basic competition of different forms of land use, their paper ignores the problem of eco-farming.

feeding the enormous energy needs of Western countries by importing biomass from developing countries. This might very well be the strongest single objection to bioenergy. The cultivation of energy crops for Western countries will increase dramatically and eventually displace the economically less attractive cultivation of food crops for the local population. Although the main reason for the rise of global food prices can be seen in the change of alimentation patterns in China and other emerging countries, biomass growing has its share in these developments. Additionally, the rise of bioenergy in Western countries concurs with Southern countries' traditional forms of biomass usage. In many developing countries, especially those with insufficient grid access, biomass is traditionally used for heating and cooking etc. (often causing serious health problems due to indoor air pollution), especially where there is no grid access. *On the other hand,* biomass may yield economic and social development and reduce poverty on Southern countries, e.g. by building up refinery industries (especially since bioenergy may be more profitable than exporting food). However, the economical advantages of bioenergy may, as usual, benefit the upper middle class, while the short-term food shortage would hurt the poorest. This does not exclude some positive counter-examples of small-scale economic development that benefits the local population.

Nevertheless, contrary to large-scale coal or nuclear based power generation, biomass favours a decentralized energy sector, whether in the North or the South, and thus tends to support the set-up of an *innovation friendly market economy* shaped by a multitude of small competitors. An energy sector structured in such a way could be of utmost importance for Southern countries' economy; concerning Western countries, this could also imply democratic advantages as it weakens the oligopoly in energy markets. Not to mention nuclear power's finite nature and the problems of final disposal as well as the risk of terrorist attacks and accidents. Also, the heat from nuclear power plants cannot easily be used, as nuclear power plants are generally not located in proximity of a residential area. Nuclear power is not even cheap, if you take into account the large-scale subsidies for research and development and the risk of liability irregularly shifted to the public (or to the public authorities). Additionally, biomass is – as are coal, natural gas, nuclear energy and geothermal power – base load capable and does not depend very heavily on storage technology or on a heavily upgraded electricity grid. In this respect, biomass is preferable to other renewable energies such as wind and solar radiation power, and may very well substitute fossil energies. It is important to notice in this context that the fuels for transport and heating will become less important in the long run, as we expect a shift to electric cars and low energy housing.

As fossil fuels show quite a few ambivalences, too, one might be tempted to demand sufficient environmental and social standards for production processes in oil, coal and uranium, before going about to criticize bioenergy. However, this line of argumentation does not seem very convincing. First, we should rather focus on reducing fossil fuels in the short term and on *abolishing* fossil fuels altogether in the long term, e.g. by setting up efficiency standards (we will come back to these in a minute). Second, an equally controversial discussion of the production processes of coal and oil would of course be very welcomed, especially in view of the fact that e.g. oil exploitation will become increasingly harmful to the environment once e.g. oil sands are exploited. We could answer along this line to the note that the meat consumption in Western countries is just as problematic as bioenergy, since meat production emits large amounts of methane (Hirschfeld/ Weiß/ Preidl/ Korbun 2008, pp. 16 ff.) and often comes along with rainforest clearance (cf. IPCC 2000, Chapter 3).

In regard of the ambivalences of bioenergy, it neither seems very convincing to argue that the standards for the food production ought to be sufficient for bioenergy. First, existing standards are not even satisfactory relating to agricultural food production. Second, energy crop farming actually aggravates some of the problems of conventional agriculture, for instance the problem of monocropping (cf. KBU 2008, passim; Haberl/ Erb 2006, pp. 177 ff.). Third, energy crops appear in addition to food crops, thus increasing the total amount of problematic implications of crop farming (cf. Nonhebel 2004).

3. Approaches: Sustainability criteria, energy efficiency in bioenergy usage, general energy efficiency, promotion of solar energy, new forms of land use

Let us now examine if the existing regulations, incentives and quality standards can actually manage the ecological and social ambivalences of bioenergy. Both, binding "sustainability criteria" as well as financial incentives for biomass that is produced and used in accordance with a given set of quality standards may help here. However, compared to a general efficiency policy, any specific bioenergy "sustainability criteria" is of limited effect. This is especially true for national or European regulations but generally applies to international regulations, too[5]:

- *First,* it seems very difficult to address all aspects concerning e.g. the climate balance of bioenergy and its production chain by regulatory instruments (e.g. „bioenergy has to achieve a reduction of greenhouse gas emissions of XY % compared to fossil fuels").
- *Second,* there is a high risk of a mere shifting of the problems addressed. How, for instance, could sustainability criteria possibly address the problem of indirect land-use? If biomass from areas once covered by rain forest is not admitted by sustainability criteria, the production of animal feed may be shifted to these areas. To put it simple: climate protection does not benefit at all, if – in favour of Western meat consumption – animal feed soy is cultivated in the (former) rainforests. The same problem occurs if the "good" biomass, i.e. biomass from other then former rainforest land, is reserved for Europe, while the export of the "bad" biomass is simply shifted toward other countries, e.g. USA, India and China. In this scenario, the European sustainability criteria would have virtually no effect on the total amount of "bad" biomass produced. Just like the first problem, this problem occurs especially when trying to include imported biomass in the regulations in question. A global emission trading system with a global carbon price (hereinafter referred to as C-price) would avoid these difficulties (as well as those we will speak about in a minute). As the carbon price would curb our primary energy consumption, it would address a number of other problems that sustainability criteria or other regulatory instruments are not capable to resolve, e.g. the increasing ploughing up of grassland and the problems of security of energy supply we already mentioned.
- *Third,* it is very difficult to represent social aspects, for instance, food security, in a list of sustainability criteria, no matter if it be a list for a regulatory or an incentive instrument. We cannot measure the impact an individual bioenergy producing region might

[5] Wissenschaftlicher Beirat Globale Umweltveränderung 2008 does not consider the following problems and does not explicitly propose a global carbon price, although the statements made in this direction often go along with our point of view.

have on the global food market. Nonetheless, there probably are statistical impacts that we should not lose sight of. A global C-price would help in this respect, at least if assumed that land use can be covered by emissions trading.

- *Fourth,* enforcement of any bioenergy criteria will be very difficult, especially outside the EU.

These difficulties show that in theory we need distinct rules in order to use biomass in a helpful way. These could include regulations on the minimum efficiency of biomass, by taking into account the climate balance of cultivation, processing and transport of the biomass. Also, an increase in CHP usage and a moderate usage of biofuels would make bioenergy a lot more efficient, thus reducing its negative implications whilst keeping its benefits (European Commission 2005, p. 7; The German Council of Environmental Advisors 2008). But we should regulate these ambivalences by using another approach than sustainability criteria. Anyway, any kind of regulation ought to apply world-wide in order to have actual impact on the bioenergy producing countries. What kind of global "non-criteria" regulation do we mean?

A more cross-cutting, global approach to climate change, resource management and security of energy supply would ideally be suited to direct bioenergy in the right direction and to set up proper limits. Needless to say, this approach does at first glance not seem to be easily acceptable from a pragmatic perspective (whereas this proposal would actually benefit most countries concerned), although there are some advocates of it in the sphere of IPCC (cf. Edenhofer et al 2008; Wicke 2005; in more detail Ekardt 2009a, chapter 19-22; Ekardt/ von Hövel 2009; Ekardt/ Exner/ Albrecht 2009; the same basic intentions show Kartha et al 2007). Our idea of a cross-cutting and truly global approach is conceived as a post-Kyoto protocol and aims at the enormous and economically attractive potentials of solar energy, energy efficiency and a general reduction of primary energy use as well as a limited, highly efficient use of bioenergy, including energy savings by demand-side management (energy sufficiency/ *Suffizienz*). Our approach consists of a steadily decreasing and rigid global (!) cap on greenhouse gas emissions in conjunction with an emissions trading between all countries, based on an initial allocation of emission certificates according to the principal of world-wide equal emissions rights per capita, starting with approximately 5 tons of CO_2 per capita and arriving at 0.5 tons per capita in 2050 (cf. on the philosophical justification Ekardt 2009a, chapter 28-39). The emission certificates for all inhabitants of a country are initially held by the government of each participating state and are tradable between countries. Each country's government (or a regional government like the EU Commission) then auctions the certificates among companies that market primary energy with a relevant greenhouse gas balance (like coal, oil, gas, bioenergy etc.). Our approach also includes some monetary compensation for developing countries and for the socially weak within the industrialized countries.

Thus, the emissions trading would actually cover all greenhouse gas emissions, especially if land use is included here. Fertilization with chemical fertilizers produced from mineral oil would already be covered by the C-price for fossil fuels. In order to include land use in this model, we would need to include certain actions, e.g. the ploughing up of greenland, in the general obligation to get a correspondent carbon certificate. The carbon certificate would be based on the greenhouse gas emissions we typically expect from the specific action. In case of land use, this would include methane and nitrous oxides. By this means, emitting greenhouse gases would quickly become increasingly expensive due to the strictly decreasing emissions cap. The market-based price for an emission certificate would therefore offer the right incentives for climate protecting conduct, since the primary energy companies (and land-users) would hand down the prices for electricity, natural gas, fuels and land-use to all end consumers and companies. Contrary to hitherto existing climate policy, this model would go beyond a cursory impact on individual conduct and economic activities. Instead, this model would strongly induce a conduct that would be energy efficiency, produce only very little greenhouse gases and save energy by measures of energy sufficiency. The Western model of continuously increasing prosperity for the last 200 years would come to an end – mainly in the interest of climate protection and equal treatment of developing countries (and respecting the fact that the world is not physically endless and therefore does not allow unlimited growth). Without a rapidly decreasing cap on greenhouse gas emissions, energy efficiency as well as the promotion of renewable energies are likely to activate an "additional" use of the fossil fuels that were "saved" before (rebound effect). The additional use will occur either in the occident or in Southern countries.[6]

As a result of global emission trading the primary energy consumption would decrease substantially due to increased energy efficiency (a). Energy sufficiency (see above) would play a role here, too (b). At the same time, global emission trading would minimize the problems of indirect land-use and other effects of shifting (c) and favour solar power as the most preferable renewable energy source[7] (d), although solar power might still seem more expensive than bioenergy, at least from a short-term microeconomic perspective. All of this would at the same time help to establish a more decentralized energy sector (about the import dependency of the European Communities, see European Commission 2000). Admittedly, the implementation of a global emission trading system will only succeed if global surveillance and enforcement can be guaranteed. We acknowledge that an enforcement policy similar to the one of the WTO is not exactly what a number of countries would like to see. However, unlike a (truly effective) certification system (which would not find much favour in energy crops growing countries, either), this model would indeed be a fair trade-off, respecting the interests of developing countries in an explicit and permanent manner (cf. Ekardt 2009a, chapter 19-22).

The decrease in primary energy consumption and the actual energy savings help to protect the climate and at the same time support security of world sustenance and ecological land use, the latter being achieved by including land use in the emission trading system and thus strictly limiting the cultivation of energy crops. Furthermore, only a global carbon emission cap can ensure that bioenergy actually replaces fossil energies and its greenhouse gas emissions instead of being used in addition to it. Altogether, a global emission trading system would strengthen climate protection and security of energy by channeling bioenergy in the right direction without denying its opportunities. That way, a unique price would represent the climate balance of e.g. cars made from bio plastics, thermal insulation of buildings, CHP bioenergy and show at what moment these measurements' climate balance is superior to the climate balance of biodiesel and bio heating oil. Moreover, this model would help to overcome the flaws of the existing international and European emission trading system that is rather bureaucratic and has so far not been very effective. New aspects include: (1) more stringent goals; (2)

[6] Despite problematic exaggerations, this is correctly noted by Sinn 2008; however, Edenhofer/ Kalkuhl 2008 offer a more sophisticated view.

[7] To practitioners, this may appear unlikely. However, we need to take into account the following: First, the production costs for solar installations would decrease at a much higher rate once we truly reach mass production. Second, our global emissions trading conception is not about raising prices for greenhouse gas emitting fossil fuels by 10 or 20 % but about multiplying the prices. In return, the energy consumption would be reduced considerably.

avoiding effects of shifting; (3) less bureaucracy, since the administration of a primary energy emissions trading is easier and (4) would not stipulate any exceptions and (5) no CDM, the latter's ecological advantage being quite doubtable. Of course, the EU emission trading system which is not very effective at all is often seen as an indication for a general weakness of this instrument. However, this assumption is not correct. The weakness of the EU emissions trading is due to its very moderate goals and the great number of exemptions. This does not tell us anything about the instruments' general qualities (in detail on the European emissions trading, sharing important aspects of our approach: Hentrich/ Matschoss/ Michaelis 2009, Hansjürgens, 2009, pp. 137 f. – Winter 2009, Wegener 2009 and Beckmann/ Fisahn 2009 ignore the possibility of further developing the emissions trading).

Needless to say, the idea of a global emission trading system is based on the inconvenient but inevitable insight that an effective climate protection policy cannot coincide with the idea of unlimited economic growth (cf. Daly 1996; Ekardt 2009a, chapter 1; Wuppertal-Institut 2008). Although solar radiation is inexhaustible, even an extremely rapid development of solar energy would not totally change this diagnosis, since economic growth is not based on energy alone but depends on other, undoubtedly limited resources, particularly raw materials and land as well. Of course, we acknowledge that there are a number of obstacles to the implementation of this model. However, the *existing* legal instruments are equally difficult to execute and have - despite many good intentions - not yet been very effective, if you compare the actual per capita emissions to the requests of the IPCC. Besides the general reluctance towards radical climate policies, the existing mix of legal instruments can hinder a radical shift, as it is well established and has created employment in legal and economic consulting, lobbying and other sectors. This may unconsciously and latently favour objections towards a medium-term general change of climate policy, as economists or psychologists would probably acknowledge – unlike jurists who tend to dislike even the most clear-cut anthropologic statements. However, the purpose of climate law cannot be to ensure steady growing of a certain policy field, field of law or an area of life. Instead, society needs to solve the problems it is facing in an effective manner and then make sure the correspondent policy field, field of law or area of life is downsized again.[8] Nevertheless, the idealism of many people involved in climate change policy gives reason to hope that the problems just mentioned will not be grave in the end.

A few sustainability criteria, e.g. criteria for the approval or non-approval of green genetic engineering, could still be relevant in a new global emission trading system. Limiting the total bioenergy production by introducing a unique carbon price, however, would already address a number of environmental problems besides climate change. Even so, we will obviously still need regulatory instruments in order to pursue other goals of environmental policy, e.g. in biotope protection.

4. The new EC Directive on Renewable Energies and the Sustainability of Bioenergy

To what extent do existing European regulations (including sustainability criteria) actually manage the ambivalences of bioenergy? And can we optimize the existing legal framework, given the fact that the European Union currently does not intend to establish anything even close to a radical efficiency policy but rather clings to very moderate intentions? Indeed, the

[8] For a "classical" analysis of the impending self-perpetuation of any new organization or administrative field see Weber 1978. This aspect is not mentioned by e.g. Müller 2009.

European Union’s current intentions do not aim at effectively setting up a carbon free economy and do not even address e.g. agricultural subsidies and the enormous problems of the agricultural sector in general.

Let us start with the European framework for renewable energies. Besides more specific biofuel regulations that we will discuss later, the European Union initially passed a Directive on renewable energies (Directive 2001/77/EC) in 2001. This directive, however, was not very focused in general and did not include any positions towards the specific problems of bioenergy. The new Directive on renewable energies (Directive 2009/28/EC) sets more ambitious goals: For the sake of climate protection and energy security, the general share of renewable energies ought to increase to 20 % by 2020 (cf. Art. 3 of the Directive; European Commission 2006b). However, the affordability of energy, yet another (economic) goal set by the Directive, is in conflict with the goal of climate protection and resource conservation because cheap energy tends to result in an increase of energy consumption. Furthermore, the Directive does not broach the issue of the social ambivalences, apart from reporting requirements of the Commission. While this is indeed disappointing, it is at the same time not very astonishing, as social ambivalences cannot really be covered by bioenergy criteria alone. However, it would be possible to come up at least with *some* social criteria, e.g. „biomass has to come from family farms“ (whereas it is not even clear whether the advantages or disadvantages of such criteria prevail from a food policy perspective).

Apart from these goals, the directive does not lay out any concrete instruments for the promotion of renewable energies. As a consequence of this, the EU member states can choose between different instruments e.g. feed-in tariffs and quota and certificate systems. However, the directive sets out some ecological (not social) criteria that have to be met when using bioenergy. In accordance with the directive’s focus on the goals, these criteria are not meant as regulatory instruments but more as an incentive: bioenergy not matching the criteria will not count for the fulfilment of the national targets for renewable energies. This way, the directive motivates the member states to allow for “ecological” biomass only and to ensure that only this type of biomass will be rewarded any financial aid. At the same time, member states will need to direct their demand for imported biomass in the same direction, although the Directive does not stipulate any explicit import ban (cf. Ekardt/ Hennig/ Steffenhagen 2010 for more detail on the conformity of bioenergy related import restrictions and import bans with WTO law). As a matter of fact, the Directive is even less detailed and precise than one would expect in view of the general difficulties of bioenergy sustainability criteria. It basically stipulates only three requirements: (a) compliance with general rules of proper agriculture, (b) no use of nature protection areas and areas with high biodiversity value or carbon stock, e.g. wetlands, (c) a greenhouse gas emission saving from the use of biofuels and bioliquids of at least 35 % (cf. Art. 17-19 of the Directive). A lot of aspects are missing in this list of criteria. The impact of bioenergy on biodiversity, nature, ground water and soil cannot be reduced to a few valuable areas. Genetic engineering is not even mentioned. Furthermore, an energy saving requirement of only 35 % (or even a little bit more) compared to fossil fuels is a rather limited inducement to bring e.g. new energy crops and more efficient production methods onto the market. Furthermore, this criterion allows for a rather large amount of greenhouse gas emissions and therefore is not suitable to pave the way for a zero carbon economy. Also, the Directive fails to address the problems of indirect land-use (meat production etc.), as the attempt to standardize the calculation of the climate balance is not very promising and will not be capable of covering all of these effects. The criteria and regulations (that are – as we have seen –

of limited scope) will be applicable to imported biomass by means of international treaties and international certification. While the international applicability is indeed necessary, it does not solve any of the problems mentioned above. Additionally, it will be very difficult to enforce the criteria and regulations, especially if the private sector is to set up certification systems for the quality of biomass. At last, the sustainability criteria thus far are only applicable to liquid biomass (biofuels for transport and heating).[9]

Thus, the approach the EU has taken in order to manage the ambivalences of bioenergy is unsatisfactory, even if we leave aside the more general criticism of bioenergy sustainability criteria as opposed to a global strategy for energy efficiency. During the legislative procedure leading to the Directive, the European Parliament favoured sustainability criteria for all sorts of biomass and not just liquid biomass; apparently, the Commission is going to come back to this. Also, many members of Parliament favour higher energy saving requirements compared to fossil fuels and more precise definitions and standards that whenever possible relate to multilateral environmental agreements. These ideas are part of a more general efficiency strategy and are a step in the right direction. However, instead of promoting fossil fuels for public transport, it would have been much more effective to promote the use of bioenergy in CHP. Further environmental criteria and a general efficiency policy, e.g. with a more radical emissions trading, are necessary. Some members of Parliaments called for a priority of food supply, respect for the property and land rights of the local population and fair payment. It remains an unsolved problem, however, how bioenergy criteria can ever effectively deal with problems of food supply, shifting effects and problems of survey and enforcement.

A national regulation like the German Ordinance on the Sustainability of Electricity from Biomass (Biomassestrom-Nachhaltigkeitsverordnung/ BioSt-NachV, cf. Ekardt/ Hennig 2009) and the rather identical ordinance for the fuel sector (Biokraftstoff-Nachhaltigkeitsverordnung) are mostly just the implementation of European law, as the EU aims at a consistent regulation in Europe and as the new Directive mostly prohibits additional sustainability criteria on national level. Accordingly, German regulations mostly just copy the criteria of the Directive, as meeting these criteria is a pre-condition for achieving the German binding goals concerning renewable energies. (It seems unclear whether this interdiction complies with Art. 95, 176 EC Treaty. This problem will be analysed in a separate essay.) According to the Biomassestrom-Nachhaltigkeitsverordnung, the fulfilment of the criteria has to be verified by a certificate; this applies to imports as well. A new strategy paper by the German Federal Ministry for the Environment (hereinafter referred to as BMU) seems a lot more ambitious and promising. In this paper, the BMU considers a general resource policy partially in line with our approach mentioned above. BMU wants to “radically shift” agricultural aids and ban animal feed from rainforest clearance areas. We should deliberate further in this direction and emphatically demand this strategy on the EU level.

5. Bioenergy and the German national electricity feed-in system[10]

Taking Germany as an example, let us examine now whether the current law of bioenergy

[9] This is not meant to be understood as a general criticism of a regulation at EU level (in view of the structure of the climate problem, this level is just right in order to avoid a “race for the lowest standards”; cf. Ekardt/ von Hövel 2009; for the same reasons, it is not advisable to rely on CSR solutions. Our criticism rather aims at the faulty “sustainability criteriology” and the general problems of “criteriologies”.

[10] On some of these aspects: Oschmann/ Sösemann 2007; Ekardt/ Richter 2007; Stephany 2006, pp. 5 ff.; Ekardt/ Hennig 2010.

offers additional regulations (as far as it is allowed by EC law). Let us start with the electricity sector. According to the Renewalbe Energy Sources Act (Erneuerbare-Energien-Gesetz, hereinafter referred to as EEG) grid system operators are obliged to grant grid access to any renewable energy plant and – as a sort of financing – to pay a legal minimum feed-in tariff for the electricity fed into the grid. The costs of the feed-in system is to be paid for by all consumers of electricity (§§ 34 ff. EEG). Generally speaking, the EEG has proven to be a very effective instrument for the promotion of electricity from renewable energy sources. The feed-in tariffs vary depending on the kind of energy and technology used, the location and size of the power plant and the input materials. Thus, the government can effectively direct the development of the renewable energies in the power sector. Regarding bioenergy, for instance, small installations will get a higher compensation per kilowatt hour than larger installations, thus promoting the idea of a decentralized energy sector with many competitors beneficial to security of energy supply and democratic structures. (Other reasons for higher feed-in tariffs for smaller installations include avoiding long-distance biomass transports larger installations depend on.) Once an installation is commissioned, the feed-in tariff for the power produced in this installation generally stays the same for 20 years plus the year of commissioning, thereby offering a very high investment protection that is one of the main reasons for the effectiveness of the EEG.

Also, biogas plants with an electric capacity of more than 5 MW need to be operated in CHP, using the waste heat in an economically and environmentally effective way (§ 27 para 3 No 1 EEG). According to § 27 para 4 No. 2 and Annex 2 EEG, operators of biogas plants receive a special bonus if the electricity is generated from energy crops or manure (energy crop bonus). According to annex 2, energy crops mean plants or parts of plants which originate from agricultural, silvicultural or horticultural operations or during landscape management and which have not been treated or modified in any way other than for harvesting, conservation or use in the biomass installation. § 27 para 4 No. 3 EEG and annex 3 stipulate a bonus for installations operated in CHP. Further on, § 27 para 4 No. 1 and annex 1 provides for a “technology bonus” for the use of innovative, especially energy-efficient, and thus, environmentally friendly and climate saving techniques. According to § 20 para 2 No. 5 EEG, the feed-in tariffs decrees by 1 % p. a. for plants commissioned from 2010 on. Thus, a plant commissioned in 2010 will still get a feed-in tariff that is stable for 20 years; however, this feed-in tariff is 1 % lower than the feed-in tariff for a plant commissioned in 2009. Especially the CHP bonus helps to manage the ambivalences (climate protection and reduction of the demand for fossil fuels) and therefore is unequivocally to be welcomed, as well as the “technology bonus” most probably will rise the efficiency of plants. Also, a number of more technical regulations in annexes 1 and 3 seem very useful. For instance, – in case biogas is conditioned in order to feed it into the natural gas grid – the technology bonus is only granted if this process emits very little methane (for more details on the technology bonus see von Bredow 2009). The annual degression (even though it is little) supports energy efficiency at all levels of biomass use, too. In regard to the greenhouse gas balance and the biomass production conditions, § 27 EEG relies on the new Directive on renewable energies and the BioSt-NachV. However, as we mentioned before, the regulations of the new Directive and thus the BioSt-NachV were not designed with enough ambition and comprehension and do not pay enough attention to problems of shifting effects and enforcement.[11] If there was a

[11] The German Energy Tax Act (Energiesteuergesetz) grants tax concessions to CHP. The Electricity Tax Act (Stromsteuergesetz) in some situations grants tax exemption to electricity from renewable energies.

demanding and broadly applicable Renewable Energies Directive, the EEG would be an important complement to this. The EEG alone, on the contrary, cannot manage the ambivalences.

6. Heat from bioenergy according to the Renewable Energies Heat Act

The Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz, hereinafter referred to as EEWärmeG) aims at increasing the use of renewable energies in buildings. In contrast to the EEG and its equivalents in other European countries, the EEWärmeG of 1 January 2009 does not focus on electricity, but on heating, and to some extent, on cooling. The EEWärmeG aims at raising the share of renewable energies in the heat sector from 6 % in 2009 to 14 % in 2020 – a goal, by the way, that is not very ambitious and should not prove very difficult to achieve (BUND 2008, p.1). According to the EEWärmeG, new buildings have to rely to a specific percentage on heat from renewable energies: 15 % for solar energy, 30 % for biogas and 50 % for other renewable energies, e.g. solid and liquid bioenergy (§ 5 EEWärmeG). While the legal obligation to rely on heat from renewable energies is to be welcomed, this obligation unfortunately and contrary to earlier intentions only applies to new buildings, hence affecting only 20 % (cf. once more BUND 2008, p. 1) of the overall potential of renewable energies in the building sector – contrary to the Renewable Energies Heat Act of the land Baden-Württemberg (www.landtag-bw.de/WP14/Drucksachen/1000/14_1969_d.pdf). In accordance with § 3 para 2 of the prevailing EEWärmeG, this act stipulates the obligation to retrofit certain existing buildings. As far as existing buildings are concerned, there is no legal obligation but a “market incentive program” (Richtlinien zur Förderung von Maßnahmen zur Nutzung erneuerbarer Energien, Marktanreizprogramm of 20 February 2009) with an annual budget of € 500 million, granting investment subsidies for e.g. solar panels, pellet heating and heat pumps. Nevertheless, the EEWärmeG will most probably increase the demand for liquid bioenergy. Therefore, there is need for an ambitious European Directive on renewable energies or an ambitious national sustainability directive in order to manage the ambivalences of bioenergy. It is, in this context, very reasonable that the quota for solar energy is lower and can thus be more easily and fulfilled then the quota for bioenergy. The differentiation may have other reasons as well, though, e.g. the higher investment costs and performance of a bioenergy heating system and the fact that in many cases rooftop installations will not allow for more than 15 % solar heat. It is also helpful that CHP use is allowed to replace the use of bioenergy according to the EEWärmeG. Nevertheless, the EEWärmeG should force solar energy and energy efficiency even more.

7. German and European Legal Framework for Biofuels[12]

In this chapter we are going to examine if there are any mechanisms besides the European Directive’s criteria that help to manage the ambivalences of biofuels. In the context of biofuels, the German Biofuels Quota Act (BiokraftstoffquotenG; more about this act: Jarass 2007) made important changes to the Energy Tax Act (EnStG) as well as to the Federal Immission Control Act (BImSchG). The BiokraftstoffquotenG stipulates a particular quota for diesel and gasoline as well as a much higher and steadily increasing general quota that fuel marketing companies have to comply with by blending biofuels with fossil fuels or by

[12] Cf. Wuppertal-Institut/ Rheinisch-Westfälisches Institut für Wirtschaftsforschung 2008 and Jarass 2007.

marketing biofuels. Compliance with the quotas is subject to legal sanction (§ 37c BImSchG). According to § 37a BImSchG, the quotas exceed even the European Directive on Biofuels (Directive 2003/30/EC). Additionally, § 50 EnStG provisions tax reductions for biofuels. This tends to compensate for the higher production costs of biofuels and to accent the technically advanced biofuels (§ 50 para 5 EnStG). However, tax reductions will no longer be granted for biofuels used for fulfilling the compulsory quota (§ 50 para 1 p. 4-5 EnStG). All of these mechanisms promote the least efficient form of bioenergy, i.e. the biofuels (although biomethane is comparatively efficient). In this respect, a more strident directive on renewable energies would be necessary in order to manage the ambivalences. At least, the German government has recently opted not to expand the biofuel quota as originally planned (cf. Gesetz zur Änderung der Förderung von Biokraftstoffen).

8. Approval of Bioenergy Facilities in the German Federal Building Code and in the German Federal Immission Control Act[13]

The law applicable to the approval of bioenergy plants (cf. e.g. Klinski 2005) deserves closer consideration, although its role is very limited in regard to climate policy and social ambivalences, cultivation standards and alike. According to §§ 4 and 6 BImSchG, for example, installations that are particularly liable to cause harmful effects on the environment are subject to licensing. The types of installations that are subject to licensing are listed in the Verordnung über genehmigungsbedürftige Anlagen in the version of the proclamation of 14 March 1997 (4. BImSchV). The license shall only be granted if precautions are taken to prevent harmful effects on the environment, including remote effects. However, remote effects (*Vorsorgeaspekte*) are left aside in regard to numerous smaller installations not subject to licensing under the BImSchG according to §§ 22, 23 BImSchG. Hence, the limit for contaminants laid out in the TA Luft do not apply to these installations, thus giving rise to the issue of nitrogen and climate gases already mentioned in the introduction of this essay.

§ 5 BiomasseV stipulates only a few requirements in addition to those set by the BImSchG. Please note that we do not have the space to cover additional requirements set by the 1. BImSchV and 17. BImSchV, for instance for waste using installations. – When using animal by-products not intended for human consumption, i.e. offal, liquid manure etc., the operator needs a license according to Art. 15 of the EC Regulation No 1774/2002 laying down health rules concerning animal by-products not intended for human consumption. This license is included in the license according to the BImSchG (§ 13 BImSchG).

Introduced in 2004 by the EAG Bau, § 35 para 1 n° 6 BauGB - the BauGB being the German land use and zoning law - favours small agricultural facilities that use biomass from the same farm. As mentioned above, the promotion of small facilities bears advantages as well as disadvantages: regional improvement of security of energy supply vs. a less efficient energy production.

9. Biomass cultivation and legal regulation concerning soil and nature conservation, waste and fertilizers; subsidy law

In terms of ecological and social ambivalences, the rules covering energy crop farming

[13] On this topic Ekardt/ Kruschinski 2008; Mantler, Baurecht 2007; Lampe 2006; Hinsch 2007, p. 401; on wind energy plants see Ekardt/ Beckmann 2007.

(please note that we will not cover the law of genetic engineering) are even more important (on this chapter cf. KBU 2008, chapter 3.5, under participation of Felix Ekardt; similar Ginzky 2008 – however, both not fully covering the ambivalences). The relevant regulations are to be found in the rather general context of agricultural and silvicultural land use and are not specifically designed for the regulation of bioenergy. The main problem in this context is that energy crops share the problems of conventional agriculture, including large-scale subsidies, and will augment the overall land use, aggravating the existing problems of conventional, non-ecological agriculture. All of this will turn out to be particularly problematic, if we do not – by means of a more rigid Directive on renewable energies or a more general regime of efficiency – manage to sufficiently promote the development of highly efficient energy crops and at the same time reduce other problematic forms of land use, e.g. excessive meat production,

We will know briefly describe some aspects of the European Union's subsidy system (Ginzky 2008, p. 193; Raschke/ Fisahn 2006, p. 57; Ekardt/ Heym/ Seidel 2008). The first pillar of the EU's agricultural aid comprises the basic subsidization of farmers, while the second, not yet very important pillar stipulates special subsidies for environment protection measures.[14] The second pillar is laid out in EC Regulation No. 1257/1999. Art. 88 EC Regulation No. 1782/2003 grants direct financial aid of € 45 per ha for the cultivation of biomass. This subsidy was originally limited to 1.5 million ha. By the end of 2006, however, the limit was raised to 2.0 million ha. In case the applications exceed this limit, Art. 89 EC Regulation No. 1782/2003 stipulates a pro-rata reduction. However, there was a controversial discussion of this energy crop bonus and apparently the EU has stopped it by now. In regard to the first pillar, energy farmers will still be eligible to the single farm payment according to the EC Regulation No. 1782/2003. By 2013, the single farm payment will be reshaped into an acreage payment, without any substantial changes. Additionally, there are subsidies for sugar beet growing.

According to Art. 4 EC Regulation No. 1782/2003, the subsidies we just mentioned are only granted if the farmers meet particular environmental requirements (cross compliance). On cultivated farmland, these requirements do not go beyond the statutory management requirements (annex III of EC Regulation No. 1782/2003). The requirements to keep set-aside land in good agricultural and environmental condition by ensuring a minimum level of maintenance (annex IV of EC Regulation No. 1782/2003) are noticeable. However, agricultural set-asides were paused lately due to inter alia the increase of bioenergy production EC Regulation No. 1107/2007. More important, the European subsidy law is not designed to prevent long-term contamination of soil and ground water due to over-fertilization, excessive use of pesticides and deterioration of biodiversity and many more (for a general discussion on this cf. Ekardt/ Heym/ Seidel 2008). The German Federal Soil Protection Act (Bundes-Bodenschutzgesetz, hereinafter referred to as BBodSchG), for instance, does not add anything essential to the rather moderate rules of cross compliance. The Act's and its ordinance's precautionary requirements mostly do not apply to agriculture and silviculture. The precautionary requirements for soil stipulated in § 17 para 1-2 BBodSchG are the only requirements for agriculture. The "Principles and recommendation for the good agricultural practice" (Grundsätze und Handlungsempfehlungen zur guten fachlichen Praxis der landwirtschaftlichen Bodennutzung, published in the German Federal Gazette of 20 April 1999) substantiate these re-

[14] The complex system of Regulations and Directives is comprised in the Council Regulation (EC) No 1782/2003 of 29 September 2003 establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers and amending certain Regulations.

quirements. In practice, these requirements do not really have any effect, due to a lack of legal enforcement and of substantiation of the principles of good agricultural practice. Agriculture and forestry are privileged when it comes to avoiding soil contamination and decontaminating. Generally, other legal stipulations, which do not necessarily bear any result in this case, have priority (cf. § 17 para 3 BBodSchG and Ekardt/ Heym/ Seidel 2008, p. 169; Notter 2008; Ekardt/ Seidel 2006).

National regulations, such as the German Plant Protection Act (Pflanzenschutzgesetz, PflSchG), the Regulation on the Usage of Fertilizers (Düngeverordnung, DüngeV), the Regulation on Biological Wastes (Bioabfallverordnung, BioAbfV) and the Regulation on Sewage Sludge (Klärschlammverordnung, AbfKlärV), as well as their counterparts in other countries are not of very much help in managing the ambivalences of bioenergy, either, as they do not provide for any regulations specific to bioenergy. Instead, some of the regulations promote the utilisation of some problematic biomass waste products as raw material and fertilizer. The AbfKlärV, for instance, allows for the utilisation of sewage sludge as fertilizer. While the utilisation of waste products of bioenergy use as fertilizers may help to achieve a good balance of nutrients, this may lead to further pollutant accumulation in soil: Firstly, the amount of pollutants permitted by the BioAbfV depends on the amount of pollutants in the dry mass and on the amount of dry mass per hectare. This way, further pollutant accumulation is likely to occur, since the amount of pollutants brought out onto the fields may surpass the amount of pollutants absorbed by the plants. Secondly, the limit set by § 4 DüngeV (170 kg nitrogen per hectare and year) only applies to livestock manure only and unfortunately not to biomass waste products.

Agriculture and forestry and thus the cultivation of energy crops are also privileged in regard of conservation law. According to § 18 para 2 of the Federal Nature Conservation Act (Bundesnaturschutzgesetz, hereinafter referred to as BNatSchG), agricultural and silvicultural land use is not considered as environmental intervention (*Eingriff in Natur und Landschaft*) as long as the principles of good professional practice and all legal regulations are observed. However, these principles are of limited scope. The good professional practice in agriculture is defined in § 5 para 3 BNatSchG from a conservation perspective. (The BNatSchG names site-specific cultivation, sustainable crop rotation and ensuring long-term usability; avoidance of any avoidable impact on habitats; preservation of the interconnectedness of habitats and landscapes; good balance of livestock breeding and crop production as well as avoidance of harmful effects on the environment; no ploughing up of grassland in especially sensible areas; no disproportionate exploitation of resources; documentation of fertilizer and pesticide use.) However, this definition is not very concrete and limited in scope and it is unclear how the principles of good professional practice can be enforced. Even if public authorities had the right to enforce precautions, they would probably be reluctant to make any use of their rights. According to the prevailing opinion, third parties generally cannot enforce precautionary obligations in Germany. Certainly, the prevailing opinion is not convincing, and the question may be asked whether this opinion coincides with new tendencies in European law (cf. Ekardt/ Schmidtke 2009; Ekardt/ Schenderlein 2008).

The environmental liability law shows the same difficulties as the agricultural regulations in resolving the ambivalences of bioenergy. According to the German Environmental Damages Law (Umweltschadensgesetz, hereinafter referred to as USchG), which we will take as an example in the following analysis, a person causing an environmental damage generally is obliged to take the necessary actions in order to limit the negative effects and to redevelop the affected areas. However, according to § 2 Nr. 1 lit. a und c USchG only damage to species and natural habitats that has significant adverse effects on reaching or maintaining the favourable conservation status of such habitats or species – or, in case of land damage –, only damage by impacts on soil functions as a result of the direct or indirect introduction of substances, preparations, organisms or micro-organisms on, in or under land, that creates a threat to human health is included. However, the definition of environmental damage seems too narrow, as – apart from fertilization and waste management – not all agricultural and silvicultural activities are included. This aspect as well as the fact that a threat to human health is, according to the USchG, a pre-condition for any environmental damage and the fact that energy-cropping is not even mentioned, illustrate that the USchG so far does not have any effect on the ambivalences of bioenergy and therefore needs to be changed. Also, § 9 USchG which allows the *Länder* to grant cost release for pesticide use, could be deleted. It is important to keep in mind, however, that liability regulation is only an accompanying measure, whereas the focus of our endeavours should be on the remodelling of the subsidy system, preferably within the framework of a cross-cutting resource efficiency approach.

10. Global bioenergy regulation and WTO law

Existing international public law is still very far from a radical climate protection and resource efficiency policy as, for instance, a comprehensive global emission trading in the sense of „one human, one emission right“ would represent. Instead, existing international climate laws as well as the currently debated further developments post-2012 include only half-hearted and very consensual goals and only insufficient penalties for unwilling countries. Due to globalization, it seems as if the majority of countries are in competition for low taxes and low social and environmental standards. This competition increasingly constrains at the same time an effective climate policy and a balanced legal framework that could address the social and environmental ambivalences of bioenergy. Nevertheless, in the interest of both North and South, climate protection and the ambivalences of bioenergy have to rely on *global* policy solutions with global social and environmental standards in order to control the global economy and to avoid the disastrous competition for the lowest standards (“race to the bottom”). These global policies would also have to impose a more rigid climate protection and go far beyond existing and forthcoming European standards, for instance by introducing an emission trading system according to the principle of “one human, one emission right” (which would, however, have to take into account the historic emissions of Western countries). By trading emission certificates, developing countries will get the financial support necessary for climate protection and poverty reduction (cf. Ekardt/ von Hövel 2009). The “second best” solution would be a global convention on bioenergy, ending the race to the bottom – a problem we encounter permanently in context of global climate change.

If this proves unfeasible due to the current reluctance of developing countries in particular, the European Union should get in the lead by taking unilateral actions (on climate change as well as on bioenergy). In context of a general climate policy, emission trading would be one way to go, provided it includes a more definite cap and reduction path and is based on primary energy consumption (including land use). In order to reduce the competitive advantage of biomass not being within the scope of such a new EU emission trading scheme (in case of implementing a new EU emission trading without implementing a new global emission trading at the same time), the EU could charge the import of such biomass, instead of opting for import bans. In fact, the EU commission has already considered the introduction of a similar charge by 2011 in view of the EU emissions trading. For instance, this charge would apply to cheap "rainforest-clearing" biomass (on this general topic cf. in more detail Ekardt/ Schmeichel 2009; Ekardt/ Hennig/ Steffenhagen 2010; Ekardt/ Susnjar/ Steffenhagen 2008). In the reversed situation, i.e. if a European company exports a specific product, this company could be exempted from a percentage of the higher costs that are due to EU climate policy. However, this reversed situation does not seem very realistic in regard to bioenergy (unlike many other products).

This kind of border adjustment is also in accordance with WTO law. This way, the EU could lead the way in climate change policy (as well as in bioenergy policy) without suffering from competitive disadvantages and thus demonstrate to e.g. China, India or the USA that climate protection and economic prosperity are not mutually exclusive. Without the unilateral border adjustment charge last mentioned, a more ambitious European climate policy aiming at a zero carbon economy (and thus being far more radical than the current EU policy) would probably simply shift the greenhouse gas emissions to non-European countries. This is especially true as far as a general efficiency policy is concerned; regarding bioenergy, the European sustainability criteria would not have any effect at all without a border adjustment charge. The revenues from the border adjustment tax could then be turned towards developing countries according to ecological and social criteria, optimizing the "Southern" management of the ambivalences. Also, let us keep in mind that these unilateral measures would press for global rules against climate change and that climate change would harm the developing countries in particular.

If the European Union does not opt for emission trading, we would at least need a new and more strident Directive on renewable energies that stipulates strident criteria for imported (and domestic) biomass, including import restrictions for biomass non-consistent with the criteria. This would conform to WTO law (cf. Ekardt/ Hennig/ Steffenhagen 2010).

11. Conclusions

In accordance with the results of our general analysis, the analysis of different legal regulations within the law of bioenergy has shown that selective approaches are unsuited to resolve the ambivalences of bioenergy. Instead, climate policy has to bear a comprehensive approach that addresses reduction of greenhouse gas emissions, energy efficiency, energy sufficiency and renewable energies by introducing a global carbon price and a global cap on greenhouse gas emissions. This approach would at the same time help to deal with the ambivalence of bioenergy, since it would slow down the bioenergy boom and help avoid indirect land-use.

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