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Assumptions in the European Union biofuels policy: frictions with experiences in Germany, Brazil and Mozambique

Jennifer Franco, Les Levidow, David Fig, Lucia Goldfarb, Mireille Hönicke and Maria Luisa Mendonça

The biofuel project is an agro-industrial development and politically contested policy process where governments increasingly become global actors. European Union (EU) biofuels policy rests upon arguments about societal benefits of three main kinds – namely, environmental protection (especially greenhouse gas savings), energy security and rural development, especially in the global South. Each argument involves optimistic assumptions about what the putative benefits mean and how they can be fulfilled. After examining those assumptions, we compare them with experiences in three countries – Germany, Brazil and Mozambique – which have various links to each other and to the EU through biofuels. In those case studies, there are fundamental contradictions between EU policy assumptions and practices in the real world, involving frictional encounters among biofuel promoters as well as with people adversely affected. Such contradictions may intensify with the future rise of biofuels and so warrant systematic attention.

Keywords: biofuels; agrofuels; rural development; greenhouse gas (GHG) emissions; energy security; bioethanol; biodiesel

Introduction

The European Union (EU) promotes biofuels policy in several ways. By 2020, 20 percent of energy used in the EU and 10 percent of each member state's transport fuel must come from renewable sources. The available arable land in the EU will not be sufficient to produce all the needed feedstocks for biofuels, so the EU will have to outsource its biofuels production to the global South. This has made the policy highly contentious regarding socio-economic and environmental impacts. EU biofuels policy assumes that these impacts will be largely beneficial, and that any potential harms can be managed (e.g. by self-regulation) and/or mitigated (e.g. by technological innovation).

Our study questions such optimistic assumptions. The discussion is organised as follows: (i) first we review the context within which the controversy over biofuels has arisen; (ii) next we look at the political forces and agendas that have turned biofuels into a priority for EU policy despite public opposition; (iii) next we analyse pro-biofuels arguments and assumptions; (iv) next we compare the assumptions with policies, practices and effects in three countries – Germany, Brazil and Mozambique.

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Finally (v) we summarise how our findings challenge policy assumptions and hold wider implications for biofuel critics.[1]

Background

Policy context

Behind today's search for alternative energy sources are centuries of exploiting fossil fuel – e.g. oil, coal and gas – which together account for 81 percent of world energy demand (IEA 2007). Intensifying extraction and use of fossil fuels since the Industrial Revolution, especially in recent decades, has left humankind with three major problems, briefly reviewed below.

First is the problem of peak oil, whereby reserves diminish, supply declines and prices rise sharply. For a long time, industry scientists have said that the point of peak oil is likely to come sooner rather than later, and that the oil industry has already discovered most of what exists (Campbell and Laherrere 1998, 81). New technologies to find and extract whatever oil deposits remain will thus never be enough to offset the fact of peak oil. *Second* is the problem of climate change and the imperative to reduce carbon and other greenhouse gas (GHG) emissions. Increasing levels of CO_2 result from burning fossil fuel and changing land use, especially clearing forests (IPCC 2001). To reduce anthropogenic CO_2 emissions, we must reduce fossil fuel use and reduce (if not reverse) deforestation.

Third is a huge, growing global transport sector that is extremely dependent on fossil fuel (Rajagopal and Zilberman 2007, 7). This sector moves people and goods globally, often across vast distances, implicating much of what we do and consume in daily life. EU biofuels policy takes for granted the future expansion of the transport sector (CEC 2007b, 2) – as a vulnerability that becomes an imperative for extra fuel sources.

According to an industry lobby for biofuels,

> The EU transport sector accounts for more than 30 percent of the total energy consumption in the Community. It is 98 percent dependent on fossil fuels with a high share of imports and thus extremely vulnerable to any market disturbance. The growing transport sector is considered to be one of the main reasons for the EU failing to meet

[1]The research leading to these results has been carried out by the Transnational Institute (TNI) with funding from the European Community's Seventh Framework Programme under grant agreement n° 217647. Carried out during 2008–10, the project called Co-operative Research on Environmental Problems in Europe (CREPE) had a part on agrofuels which aimed: (i) to facilitate interdisciplinary research by and with civil society organisations (CSOs) on agrofuels/agrofuel policies and their impacts; (ii) to identify, explain and interrogate the key assumptions underlying government policies promoting agrofuels; and (iii) to link these assumptions with accounts of sustainable development. We used a cooperative research approach to involve academic researchers and activist researchers based in civil society organisations, in the conceptualisation and design, data gathering and analysis, as well as in the validation and dissemination of our findings. The research had three phases: (i) desk study of existing policies, their underlying assumptions and understandings of the environment and sustainable development; (ii) case studies of how pro-biofuels assumptions compare with practices in three countries; (iii) an international workshop with civil society organisations to discuss preliminary results and to exchange ideas on possible directions for future research and advocacy; and (iv) a synthesis of results challenging EU policy assumptions.

> the Kyoto targets. It is expected that 90 percent of the increase of CO_2 emissions between 1990 and 2010 will be attributable to transport. (Biofrac 2006, 3)

This contributes to wider sustainability problems, according to the European Commission:

> Energy accounts for 80 percent of all greenhouse gas (GHG) emission in the EU; it is at the root of climate change and most air pollution. The EU is committed to addressing this – by reducing EU and worldwide greenhouse gas emissions at a global level to a level that would limit the global temperature increase to 2°C compared to pre-industrial levels. However, current energy and transport policies would mean EU CO_2 emissions would increase by around 5 percent by 2030 and global emissions would rise by 55 percent. The present energy policies within the EU are not sustainable. (CEC 2007a, 3)

These sustainability problems have become an argument for prioritising biofuels in EU policy, as means to sustain further growth of the transport sector. Less attention has been given to other options, such as making vehicles more fuel-efficient or slowing the sector's growth. To understand how and why this is so requires a closer look at the actors and logics that have been driving EU biofuels policymaking. Government and corporate business actors in particular have been playing important complementary roles.

Key actors and agendas

In the EU context, governments have been adopting and/or expanding mandatory targets for biofuels in transport fuel, as well as enabling corporate business actors to shape policy. In 2005 the Commission's Directorate-General for Research (DG Research) created the Biofuels Research Advisory Council (Biofrac), effectively a pro-biofuels lobby, to inform EU policy on biofuels. Biofrac proposed increasing the use of biofuels in transport to 25 percent by 2030. One of its main arguments for biofuels was that they use 'sustainable and innovative technologies', with the extra advantage of creating 'opportunities for biomass providers, biofuel producers and the automotive industry' (Biofrac 2006, 3).

This short-term body was succeeded by a longer-term one: the European Biofuel Technology Platform (EBFTP). Various business interests have sought to ensure policy outcomes favourable to large-scale biofuels production for the European transport sector (CEO 2008). Table 1 shows the steering committee of the European Biofuels Technology Platform (EBFTP). It includes 15 members from the oil, auto, biotech, biofuels and forest products industries. Also included is COPA-COGECA, representing the more affluent, industrialised, commercial-oriented farmers. It is affiliated with the International Federation of Agricultural Producers (IFAP) – a rival of La Via Campesina, a leading critic of corporate-driven biofuels (Borras and Franco 2009a). More recently the Steering Committee added an environmental consultancy whose website promotes renewable bio-energy, especially R&D investment into algae and marine plants (Bellona 2010).

In addition EU member states have been promoting biofuels through interventions in the global South, e.g. by providing technical assistance, brokering energy supply deals, facilitating corporate land acquisitions and promoting market-oriented land policies. Bilateral and multilateral development institutions – the World Bank, the Food and Agriculture Organization (FAO), GTZ, USAID, and

Table 1. Steering Committee of the EBFTP.

Member	Position	Organisation	Sector
Veronique Hervouet	Chair	Total SA	oil
Markku Karlsson	Vice-Chair	UPM-Kymmene	forest products
Anders Roj	Vice-Chair	Volvo Technology	auto
Rene van Ree	Vice-Chair	Wageningen University	academia
Ricardo Arjona Antolin	Member	Abengoa Bioenergy	biofuels
Olivier Appert	Member	IFP	biotech
Phil Bowen	Member	Cardiff University	academia
Dirk Carrez	Member	Europabio	biotech
Sandrine Dixson-Declève	Member	University of Cambridge	academia
Christian Dumas	Member	Airbus	aerospace
Henrik Erametsä	Member	Neste Oil	oil
Raffaello Garofalo	Member	European Biodiesel Board	biofuels
Frederic Hauge	Member	Bellona	environmental
Martha Heitzman	Member	Air Liquide	biotech
Dietrich Klein	Member	COPA-COGECA	farmers
Andrzej Kulczycki	Member	Institute for Fuels & Renewable Energy	biofuels
Charles Nielsen	Member	DONG Energy	oil
Eduardo Romero Palazón	Member	Centro de Tecnolgía Repsol	oil
Ulrich Schurr	Member	Julich Research Center	biotech
Steen Skjold-Jorgensen	Member	Novozymes North America Inc.	biotech
Wolfgang Steiger	Member	Volkswagen AG Wolfsburg	auto
Frank Seyfried	Member	Volkswagen	auto
Gianpetro Venturi	Member	Università di Bologna	academia

Source: EBFTP (2010).

AusAid – are paving the way by promoting formalisation, privatisation, and liberalisation of land property systems (Borras and Franco 2010), as well as by financing biofuels development. As Northern governments attempt to re-mould the South to suit big business needs, Southern governments anticipate increased biofuel demand from the North; they have been adopting pro-biofuel policies and brokering biofuel-related agreements involving North-South *and* South-South linkages, e.g. Brazil-Mozambique agreements (Dauvergne and Neville 2009). They too are linking with big business to promote biofuels. For example, a Brazilian state-industry coalition has been promoting conditions for Brazilian ethanol to gain an international market (Biofuel Digest 2008).

EU targets were opposed initially by radical environmental groups, backed up by some researchers and academics. Questioning the environmental benefits of biofuels, they have highlighted how GHG emissions can have uncertain or even negative balances – due to rainforest destruction, unsustainable agricultural practices and effects of indirect changes in land use. In early 2008, based on information from networks in the South, larger Northern-based environmental organisations began abandoning support for the targets.

Civil society groups and transnational networks converged to challenge key policy assumptions.[2] According to critics, promotional policies do not guarantee

[2]The controversy heightened when basic food commodity prices rose to unprecedented levels, sparking riots in several countries. UN Special Rapporteur on the Right to Food Jean Ziegler declared, 'it's a crime against humanity to convert agricultural productive soil into biofuel'

GHG savings and may even generate increases (Searchinger 2008); may compete with food production (African Biodiversity Network 2007, FAO 2008, Oxfam International 2008, Eide 2008); cause human rights violations (Mendonça 2006, FIAN International 2008, 2009, ICHRP 2008); and would spur further industrialisation of agriculture to serve needs of the North, to the detriment of the rural poor in the South. This coalition called for a moratorium on incentives and targeting, rallying opponents of biofuels globally.[3] Together these criticisms led biofuel promoters to alter their arguments, e.g. by emphasising management and mitigation measures.

Analysing global biofuels

'Biofuel' once referred to energy produced from bio(degradable)-waste, as in alternative energy proposals from some environmental groups (e.g. Alliance 90/The Greens 2006). But the term has acquired new meanings through links with agro-industrial systems and global trade. 'Biofuel' now refers to liquid fuel that is derived from plant material, even if it could be used instead for food.

Many critics of pro-biofuel policies reject the term, saying that the prefix 'bio' masks harmful social and environmental effects. Using 'agrofuel' instead, they stress the *threat* it poses 'because of the intensive, industrial way it is produced, generally as monocultures, often covering thousands of hectares, most often in the global South' (Econexus *et al*. 2007, 6). For them, biofuels development implies changes in land use and/or land property relations, in ways undermining ecosystems and/or poor people's access. Although this paper concerns 'agrofuel', it uses the term 'biofuel' because it is more familiar in the EU policy context.

The previous section sketched how government-business alliances have midwifed the current wave of biofuel-related interactions through promotional policymaking in the global North and South. So analytical tools are needed to understand biofuels as global dynamics. According to Arthur Mol, 'we can witness the emergence of a global integrated biofuel network (GIBN), characterised by less concentration of objects, actors and relations in specific locations/regions', and instead by greater transboundary flows (Moll 2007, 303). His concept stresses how the GIBN creates new spaces marked by (i) the growing power of multinational corporations; (ii) decreasing control by nation states, along with more global roles and dependences; and (iii) the marginalisation of local concerns. The GIBN 'also enhances the global sourcing for scarce (non-fossil fuel) energy resources. But all this is no evolutionary, deterministic development', further argues Mol (2007, 306–7). Indeed, the global dynamics create new conflicts – not only with people who are adversely affected, but also among biofuel promoters.

(The Independent, 2007). Analysts from a wide spectrum, including the World Bank (Mitchell 2008), pointed to biofuel expansion as a factor driving up food prices. As one article put it, 'Filling the 25-gallon tank of an SUV with pure ethanol requires over 450 pounds of corn – which contains enough calories to feed one person for a year. By putting pressure on global supplies of edible crops, the surge in ethanol production will translate into higher prices for both processed and staple foods around the world. Agrofuels have tied oil and food prices together in ways that could profoundly upset the relationships between food producers, consumers, and nations in the years ahead, with potentially devastating implications for both global poverty and food security' (Runge and Senauer 2007).

[3]See http://www.econexus.info/biofuels.html

Drawing on analytical insights from James Scott (1998, 4–5), biofuel policymaking can be understood as an 'administrative ordering of nature and society', dependent on coercive 'attempts at legibility and simplification'. In the context of intensifying fossil fuel use and related consequences, biofuel policymaking aims to sustain a broad pattern of producing, distributing and consuming transport fuels. As with many state schemes, however, the attempt carries seeds of possible failure. Much local practical knowledge ('*metis*') is rendered 'illegible' – meaning knowledge 'that could not be assimilated into an administrative grid without being transformed or reduced to a convenient, if partly fictional, shorthand'. In this way, administrative knowledge can be rendered legible and thus manageable (Scott 1998, 311 and 24).

Such administrative ordering has encountered many obstacles and conflicts, as will be seen in our country case studies. For instance, the interests of big biofuel business actors and small automobile owners can conflict, as in Germany. Or contradictions may emerge between national biofuel policymaking and previous national land policy, as in Brazil and Mozambique. Or, opposition alliances can arise to resist agro-industrial biofuel development. Each example suggests knowledge that was unanticipated, ignored or kept illegible by policymakers.

As these examples suggest, the GIBN is a dynamic process involving pro-biofuel actors *trying* to shape policy and transact business across numerous borders (e.g. sub-national, national and international) and many differences (e.g. agendas, aspirations, cultures, structures, social histories, practices, knowledge and measures). Those efforts generate conflicts, bringing unexpected turns and effects. These can be conceptualised as 'frictional encounters' – 'the awkward, unequal, unstable, and creative qualities of interconnection across difference', according to anthropologist Anna Tsing (2005). Her research on one particular 'zone of awkward engagement' – the rainforests of Indonesia – focused on how chains of legal and illegal entrepreneurs took over the land from previous claimants in the 1980s onwards, thus creating global commodities for distant markets. But as capitalist interests reshaped the Indonesian landscape, the encounter also produced surprising effects in terms of 'new arrangements of culture and power' (p. 5), which she traced to the frictional nature of the encounters and interactions.

A 'friction' perspective is useful for several reasons. It can illuminate actors and interactions that alter original plans, even slightly or temporarily. It can illuminate unintended or unexpected gaps in global biofuel networking, e.g. on state policy or international trade matters. Such gaps may be perceived differently by different actors – e.g. seen as threats by promoters of corporate-led biofuels, but seized as opportunities by opponents. Attention to friction can enable researchers to 'avoid the idea that new forms of empire spring fully formed and armed from the heads of Euro-American fathers' (Tsing 2005, 5); the concept can help instead to pose questions about whether, how and to what degree agro-industrial biofuel agendas translate into outcomes. It thus helps to analyse the global integrated biofuels network (GIBN) as an ongoing, fragile project.

EU biofuels policy: arguments, assumptions, and narratives

Pro-biofuels arguments

Since the 1990s EU biofuels policy has featured three main arguments. According to many policy documents, biofuels offer more secure energy supplies for Europe, GHG savings, and economic development in the rural places where they are

produced (CEC 1997, 2001, EC 2003, Biofrac 2006). The meaning and relative weight of these arguments has changed over time, mainly in response to wider policy agendas and public dissent. From an early concern with energy security, commitments to the Kyoto Protocol became increasingly important (CEC 1997, 2000). Given the EU commitment that ambitious targets should be met 'sustainably', EU policy was on a collision course, warned critics (CEO *et al.* 2007, 45).

Biomass originally was meant to come from European 'indigenous' sources, especially to reduce dependence on imports and so enhance security for Europe (e.g. CEC 1997, 4, CEC 2000, CEC 2006b). But prospective sources were later broadened to developing countries: 'The Community's external energy policy should ensure the common voice of the EU in support of intensifying its relationship with its energy partners, with a view to further diversifying sources and routes' (CEC 2008a, 4). More generally, raw materials should be obtained from 'resource-rich' tropical countries (e.g. CEC 2008b; cf. CEC 2006a). That shift responded to industry projections that half the EU biofuel supply could come from imports by 2030 (Biofrac 2006, 16). A parallel narrative promised that biofuels would offer opportunities for 'economic development' or 'rural development' in the global South (e.g. CEC 2006b, 4, Kojima and Johnson 2006, Dufey 2006, EuropeAid 2009), despite early evidence of destructive effects.

Indeed, the Commission's proposal for ambitious EU-wide targets provoked much dissent among staff in several Directorates-General,[4] as well as contrary evidence of many kinds, e.g. questioning the cost-benefit advantages for GHG reductions (Szekeres 2006). Nevertheless the proposal was pushed ahead. This has been analysed as 'policy-based evidence gathering', i.e. a process whereby evidence is collated to support a previously determined policy (Sharman 2009, 47). Its proponents cast biofuels as a 'win-win' opportunity to demonstrate Europe's commitment to addressing both climate change and future oil shortages, while developing rural economies, including in the global South.

Biofuel targets and criteria

Together these arguments justified the December 2008 'EU Energy Package', which was soon legislated as the Renewable Energy Directive (RED), with the following features. *First*, by 2020, 20 percent of all energy used in the EU must come from 'renewable sources' (including biomass, bioliquids and biogas), with different targets for individual member states. With an 'indicative trajectory', member states must show increasing use of 'renewable energy' over every two-year period. *Second*, by 2020, member states must ensure that 10 percent of their total road transport fuel comes from renewable energy – broadly defined to include biofuels and biogas, as well as hydrogen and electricity from renewable sources; there is also an interim target of 5.75 percent by 2010.

Third, sustainability criteria will apply to biofuels and biogas for transport and to liquid biofuels for heat and power. These criteria are purely environmental, stressing the percentage of GHG savings that must be achieved, as well as protection of 'highly biodiverse', 'primary forest' and 'continuously forested' areas – the latter defined by statistical criteria. Compliance will be assessed on the basis of company

[4]Interviews conducted by Les Levidow with European Commission staff, March 2010. See also Sharman (2009).

information, or through voluntary certification schemes or bilateral and multilateral agreements (EC 2009).

A Parliamentary committee had earlier proposed adding social aspects to sustainability criteria, e.g. land rights of local communities and fair remuneration of workers. But these were ultimately excluded from the mandatory criteria, partly on grounds that they would contravene WTO rules on trade barriers (EP Envi 2008a, CEO et al. 2008). 'These directives do not include mandatory social criteria (labour conditions, land tenure, etc.), nor food security criteria, because of the difficulty to verify the link between individual biofuel consignments and the respect of these particular criteria', according to a Commission document (EuropeAid 2009, 2). Any such issues were relegated to voluntary schemes or bilateral agreements (EC 2009).

For certifying compliance with sustainability criteria, originally the Commission had proposed that member states establish their own schemes (CEC 2008a). In a report for the Commission, however, the Biomass Technology Group argued that certification systems could be left to market forces through voluntary 'private certification' schemes (BTG 2008). These options were left open in the final directive.

The December 2008 Energy Package sent positive signals for biofuels investment, both inside and outside the EU. The EU incentives spurred national policies promoting biofuels, as well as actual land allocations and land-use conversions especially in the global South. Even beforehand, EU pro-biofuels signals had begun triggering wider harmful effects, according to substantial anecdotal evidence and research (EP Envi 2008b, 19). Such warnings led to a high-profile international campaign for a moratorium on biofuels promotion, especially the EU targets.

Although the targets went ahead in the 2009 Directive, the opposition campaign stimulated changes in sustainability criteria and in pro-biofuels narratives, which were elaborated as potential means to make biofuels promotion more acceptable to a sceptical public. Requirements for GHG savings became more stringent than envisaged a few years earlier – in response to industry lobbies as well as public controversy. At the same time, such narrow criteria facilitate a lucrative market for biofuels whose production can ignore indirect land use changes (ILUC) and wider socio-economic harm.

Environmental harm could become significant if EU usage of conventional biofuels rises much above 5.6 percent, according to a Commission-funded study that was initially kept confidential (Harrison and Dunmore 2010). In fulfilling the 2020 target that 10 percent of transport fuel must come from renewable sources, conventional biofuel production could trigger large-scale indirect changes in land use, thus undermining GHG savings from biofuels. According to the report, this harmful outcome can be avoided by obtaining nearly half the 10 percent from other sources, e.g. electric cars and second-generation biofuels from bio-waste material. Another optimistic assumption in the report is that only 55 percent of total biofuels would come from biodiesel, which has greater ILUC effects than bioethanol. The authors added a caveat: 'If the underlying assumptions should change, however, either because the mandated quantities turn out to be higher and/or because the model assumptions and parameters need to be revised, there is a real risk that ILUC could undermine the environmental viability of biofuels' (Al-Riffai *et al.* 2010, 67).

Thus the Commission's expert study took up long-standing warnings about ILUC (e.g. Econexus *et al.* 2007, T&E 2009), while also protecting EU targets through optimistic assumptions. These provoked disagreements in finalising the

report and then overt conflict after its publication (Harrison 2010). 'An unguided use of ILUC would kill biofuels in the EU', a Commission official reportedly wrote to a colleague in the energy directorate, which has driven the EU targets (T&E 2010). This comment anticipates future conflict over whether or how to broaden the EU's sustainability criteria.

Pro-biofuels policy assumptions

In generic terms, to assume something is to accept it without evidence for the purpose of argument or action. Policy assumptions take the form of narratives that portray a better future – in this case, by imagining how environmental, social or economic problems can be solved. Such stories make a potential future more thinkable and concrete, justifying measures that promise to realise it.

In such ways, societal problems or threats are always framed by storylines which selectively problematise aspects of physical and social reality. Such narrative devices include images, causal models and metaphors. These devices define problems and structure reality so that some futures seem plausible, while others are foreclosed (according to Hajer 1995; also Hajer and Versteeg 2005).

Narrative devices are informed by cognitive and normative frames. These

> refer to coherent systems of normative and cognitive elements which define, in a given field, 'world views', mechanisms of identity formation, principles of action, as well as methodological prescriptions and practices for actors subscribing to the same frame. Generally speaking these frames constitute conceptual instruments, available for the analysis of changes in public policy and for the explanation of developments between public and private actors which come into play in a given field. (Surel 2000, 496)

Such frames set up 'a causal explanation of the ongoing processes', as a basis for action (p. 501). This frame analysis goes beyond rationalist or instrumentalist models of policymaking (p. 506).

Within an overall narrative, assumptions can have several types: (i) predictive; (ii) normative; (iii) causal; and (iv) regulatory. Predictive assumptions involve promises or expectations about a policy's effects. Normative assumptions set criteria for what counts as good or bad effects, relative to analogous effects elsewhere. Causal assumptions identify causes of potential harms or benefits. Regulatory assumptions concern procedures or criteria that can ensure beneficial effects, while avoiding harmful ones.

EU policy emphasises three main benefits of biofuels: that they can contribute to (i) GHG savings, (ii) energy security, and (iii) rural development. These arguments structure our analysis of policy assumptions. Each claim for benefits can be disaggregated into one of the four types of assumptions outlined above. Table 2 summarises the main assumptions, by quoting or paraphrasing numerous policy documents. Although no one agency espouses all those assumptions, overall they provide a heuristic device for comparing putative benefits of biofuels with their drivers, practices and effects.

As the over-arching theme of the EU policy narrative around biofuels, sustainability has two main arguments – namely, energy security and environmental protection, especially GHG savings. Less clear is how the understandings of sustainability associated with these arguments and assumptions make sense *together* or along with the third argument that biofuels will contribute to rural development.

Table 2. EU policy assumptions disaggregated.

Argument	Environmental protection, especially GHG savings	Energy security	Rural development
Predictive assumptions	Biofuels produced either in the North or the South can contribute GHG savings by replacing fossil fuel in an expanding transport sector, although the amount of savings will vary according to certain factors that are identifiable and therefore manageable.	Biofuels will enhance energy security by diversifying sources beyond oil in an era when its supply becomes scarcer, more expensive and politically unstable.	Biofuels will spur rural development by invigorating livelihoods, creating new jobs and diversifying incomes in both global North and global South, including many countries where rural poverty is most concentrated and entrenched.
Normative assumptions	What constitutes adequate GHG savings, as contributions to statutory EC targets? The Renewable Energy Directive (RED) requires 35 percent savings by 2020, rising to 50 percent from 2017 for existing production, and 60 percent for new installations from 2017; assigns some emissions to co-products (e.g. usable for feed or electricity), rather than to the fuel, which thereby could have lower or no emissions; and awards a GHG savings bonus for biomass from a 'recovery programme aimed at improving severely degraded or heavily contaminated land', thus providing extra means for any consignment to reach the required percent savings (EC 2009). Beyond GHG savings, the RED also specifies measurable criteria for forests which must not be the source of biofuels eligible for the EC targets (EC 2009). Sustainability criteria omitted indirect land use change (ILUC) as a contributor to GHG emissions and possible negative balances, partly on grounds that ILUC criteria could be added later. By December 2010 the Commission must submit a report.	What constitutes energy security and for what purposes? The EU must: (i) secure a large volume and stable supply of liquid fuel for the European market, and thus (ii) fuel the transport sector upon which the European economy and its competitiveness depends. The importance and the vulnerability of the transport sector require that action is taken rapidly to reduce its malign contribution to sustainability and the insecurity of Europe's energy supply (DG Tren 2009). Biofuels are the only practical means to reduce EU dependence on oil use in transport (CEC 2007b). Biofuels are an ideal source for gaining energy security (defined in the above way). Compared to fossil fuels, biofuels are renewable and can be grown virtually anywhere and anytime.	What constitutes rural development? Rural development is measurable in exclusively economic terms, primarily in terms of income. Rural citizens can and will be incorporated into biofuel development processes as labourers in large-scale mono-crop biofuel production processes. Rural development also depends on including smallholders, e.g. through contract-growing schemes (EuropeAid 2009). Through biofuels development, new markets offer increased productivity, more profitable and diversified agricultural sectors, value-adding industries in rural areas, more rural employment and less migration to urban centres. Redistribution of the expected increased wealth will depend on the economic and social models in each country (CEC 2008c). What constitutes un/acceptable or un/desirable impacts of agrofuels promotion on rural societies? Removing the best land from food production. Competition between food and fuel uses of land. Reducing employment [understood as the formal economy].

(*continued*)

Table 2. EU (*Continued*).

Argument	Environmental protection, especially GHG savings	Energy security	Rural development
Causal assumptions	For any particular fuel consignment, GHG savings depend on the crop, cultivation method; land type, etc. Avoiding initial need for such knowledge, member states can use default values – average GHG emissions for a crop – but later must justify this basis for specific land areas (EC 2009). Through cultivation of biofuels feedstock, degraded or semi-arid land could be put back under vegetation cover by planting adapted species (CEC 2008c). Relative to the first generation, second-generation biofuels can (i) better save GHG emissions by more efficiently converting plant material to energy and (ii) better avoid competition with food by using non-food crops and/or being grown on land otherwise not used.	The European market for biofuels needs to be created because biofuels cannot (yet) compete with fossil fuels for transport. Securing a large volume and stable supply of biofuels requires sourcing raw materials beyond the EU, which has inadequate suitable land available (CEC 2008a). Many tropical countries in the global South are 'resource-rich' (CEC 2008b). They have much available land, e.g. marginal or degraded, and so offer ideal locations to grow the raw material needed for biofuels.	Contributing to rural development (defined as above) depends on directing FDI, ODA, as well as government-sponsored, market-oriented interventions to the target countries, to help establish large-scale industrial biofuel production units and tie them into global biofuels markets. Effective and balanced partnership between smallholders and agro-industrial companies should provide a solution to the cash problem (EuropeAid 2009). Competition for land use can be avoided by novel technologies which increase production efficiency (EuropeAid 2009).
Regulatory assumptions	Whatever environmental risks biofuels may pose for fragile, biodiverse ecosystems, such risks can be managed through (voluntary) adherence to some identifiable, measurable and enforceable standard set of sustainability criteria. Companies involved in biofuel production will voluntarily adhere to such criteria. Private certification schemes can be accepted for compliance with the EC targets.	A large European market for 'sustainable' biofuels can be created through incentives, targets, and subsidies. Large volumes and stable supply, sourced from outside the EU, can be secured (i) through joint ventures and foreign direct investment (FDI), (ii) by overseas development assistance (ODA) by market-oriented national biofuel and land policies in developing countries, and (iii) through 'free trade' and 'economic partnership' agreements with 'resource-rich' countries through their national governments.	Various harms could result but can be prevented through appropriate policies of the EU and/or producer countries. EU development policy will aim to help suitable developing countries capture the benefits offered by biofuels, while addressing these concerns [about harm] in an appropriate way (CEC 2006b). Any undesirable effects can be prevented by applying labour, human rights and environmental standards. Biofuels projects shall be designed and operated under appropriate, comprehensive, transparent, consultative, and participatory processes that involve all relevant stakeholders, especially those at local level (EuropeAid 2009).

There is a basic tension within the overall narrative between energy security, environmental protection, and rural development – as well as within each issue.

Diversifying energy supply, e.g. by blending or replacing oil with biofuels, may address sustainability in terms of energy security but not necessarily in terms of GHG reductions. From direct changes in land use, the GHG emissions depend on many factors – e.g. the particular crop, location, land type, as well as production, processing and distribution methods. Market incentives could encourage more energy-intensive cultivation methods, e.g. agrochemical usage, but the Directive initially avoids the need for detailed knowledge of such practices.

Instead GHG calculations are simplified through average 'default values' for each crop. These can be compared with emissions from fallow land, e.g. unfertilised grassland. This comparison determines whether any particular fuel source achieves the necessary savings to qualify for EU targets. But default values should not be used in places where cultivation could generate higher GHG emissions, according to the Directive. By March 2010 each member state must submit a list of its land areas where GHG emissions for biofuels 'can be expected to be lower than or equal to' the default values (EC 2009, 25, 40). This judgement may involve further simplifying assumptions about adequate knowledge and control of environmental effects.

Beyond direct changes in land use, global land use competition could mean that biofuels contribute little to either world energy supplies or GHG reductions (Searchinger *et al.* 2008). Moreover, 'Direct and indirect land use change due to biofuels has a high potential to eliminate or greatly reduce their greenhouse gas benefits' (Searchinger 2008, 1). After intense public and scientific debate on the impact of indirect land use change on GHG savings, the EC sustainability criteria deferred this issue; by December 2010 the Commission must report on ways to calculate such changes and to minimise their impact (EC 2009). This omission has shifted – into the future and down to local rural communities, mainly in the global South – the burden of monitoring, verifying, restraining or redirecting actors who appropriate land to produce biofuels for the European transport sector.

Likewise, diversifying Europe's energy supply does not necessarily address sustainability in terms of rural development. Many factors matter here as well, especially the terms under which biofuels become part of the local political economy. In general, such factors include how they are produced (who does what) and where (which lands), who gets what (division of income and profit), who owns the means of production (land, capital, processing plants), who is in control of key decision-making over production and post-harvest processing and trade, how and where the produced is actually used, as well as how and where the profits are directed (Bernstein 2010, Ch. 2, and in press). EU biofuels documents have been silent on these fundamental questions.

More compelling has been the impact of biofuels expansion on basic food prices, especially after the sharp rise in 2007–2008, which aggravated world hunger (FAO 2008). Attention focused on the potential of export-oriented biofuels to compete with local food production for the best land and water resources. In response to such criticism, pro-biofuels arguments elaborated the notion that biofuels could be beneficially produced on so-called marginal, degraded, or otherwise idle land.

To resolve (or at least manage) the tensions, EU policy combines narratives of technological innovation, 'good management', and greater land availability. To demonstrate a commitment to using biofuels that are produced sustainably, the RED states, 'The Community should take appropriate steps in the context of this

Directive, including the promotion of sustainability criteria for biofuels, and the development of second- and third-generation biofuels in the Community and worldwide, and to strengthen agricultural research and knowledge generation in those areas' (CEC 2009, 8).

This general approach can be called environmental management, or more precisely, market-oriented environmentalism. It assumes that the environmental and social impacts can be fully known and understood before any intervention, and that problems can be avoided or mitigated through technological innovations and proper management measures. Notably, many companies promoting biofuels in EU policymaking have been investing in research on 'next generation' biofuels, on grounds that they do not compete with food crops and offer greater GHG savings: 'In the future, biofuels must perform better, in terms of overall environmental sustainability, than the fossil fuels they replace and new biomass-conversion pathways have to be developed in order to reach the large volumes required to meet ambitious EC targets', according to the Biofuels Platform (EBFTP 2008, iii).

To support and stimulate such innovation, they also embrace sustainability criteria favouring future novel biofuels. The latter are considered means for harm prevention or damage control. Such narratives imply that any harmful social or environmental effects of biofuels are mere contingencies or deviations that can be avoided through corrective measures. Although recognising potential harm to food security and rural people's livelihoods, such a framing makes 'win-win' scenarios appear more plausible (von Braun and Pachauri 2006, Clancy 2008).

Land availability assumptions

Further helping to envision a future powered by sustainable, benign biofuels – e.g. biofuels that do not compete with food production, undermine biodiversity, or involve conversion of 'high-carbon-stock land' – is the notion that biofuels can be produced on marginal or degraded land. Satellite imagery 'provid[ing] the most comprehensive survey of global agricultural potential' has reportedly revealed a supply of such 'reserve agricultural land', most of it located in Africa and South America (e.g. Cotula *et al*. 2008, 19–20). Re-framing distant spaces as 'reserve land' serves to make tensions between energy security, environmental protection, and food security seem less relevant at the global level.

For such narratives, EU policymakers have drawn upon expert opinions that biofuels can be grown on so-called 'marginal' or 'degraded' land. According to one study, 'degraded and abandoned agricultural lands could be used to grow native perennials for biofuel production, which could spare the destruction of native ecosystems and reduce GHG emissions' (Fargione 2008, 1237). According to the UK's Gallagher Review, further pressures on agricultural land can be avoided by 'use of appropriately defined idle agricultural land, marginal lands, wastes and residues and intensification of current production', among others (RFA 2008, 12).

EU bodies have cautiously taken up those studies as cause for optimism on the availability of land: according to a European Commission development agency, 'The Gallagher Review has estimated however there is sufficient land available to satisfy demand for food, feed and fuel to 2020, but this needs to be confirmed in a local and regional context before global supply of bioenergy increases significantly' (EuropeAid 2009, 4). In its report on the draft RED, a European Parliament committee declared that, 'Idle, marginal and degraded lands must be defined in this

Directive', to ensure that such land 'does not have conservation value or high carbon stock value or is otherwise used in the production of food' (EP ITRE 2008, 14).

To justify its ambitious targets, EU policy need not overtly presume vast land areas 'available' for biofuels in the global South, especially given uncertainty and disagreement over the imports that will be needed. As a concept, 'degraded/marginal' land can play more subtle roles. It can be a means to normalise past degradation, such that agro-industrial monocultures become an improvement, or to devalue and/or conceal land uses 'marginal' to global markets. The concept can give policymakers a narrative device for imagining a benign role for biofuel production in the global South, as if experts can operationalise it by choosing the right regulatory-governance measures, whether to protect the best agricultural land for local food uses or to protect the most biodiverse or most 'high carbon stocked' land for environmental purposes. The concept of 'degraded/marginal' land is an ambiguous normative measure for investigating, classifying and colonising land in the global South (Borras and Franco 2009b, 2010).

In the context of rural poverty in the global South, the concept of 'degraded/marginal' land, together with the claim to support rural development, helps to overcome suspicion towards the EU's ambitious biofuel targets, which will require imports to fulfil. The biofuels-related land issue has different meanings for production in the North and South. In the US and the EU, large quantities of set-aside land – that is, land taken out of production for environmental and/or financial reasons – have been re-converted to monocultures, particularly bioenergy crops, due to the strong biofuel lobby and favourable commodity prices. In developing countries, assumptions about 'marginal' or 'degraded' land can be used to justify colonisation of land intended for agrarian reform.

Yet the more palatable narrative of environmentally and socially sustainable biofuels is also potentially vulnerable, since it depends on two conditions that can be changed through strategic research and public action. It depends firstly on the political weakness of those who already use and occupy the places targeted as 'degraded/marginal' land; and second, it depends on the unwitting ignorance of those who may benefit from their enclosure by producing biofuels for export. To go beyond optimistic assumptions, relevant knowledge would require investigating exactly which lands are targeted, what human activities are (or were previously) taking place there, and which/whose rights as well as whose food security would be threatened if an expansion of biofuels were to take place there.

The conceptual reframing of land ignores many contentious, fundamental issues related to land and how it is or ought to be used. These can be summarised in the following two questions: Who has what rights to use which land for how long and for what purposes? And who gets to decide these important and contentious matters? The issues involved here are complex, and the answers are neither obvious nor easy in practice, as shown by the countless conflicts that have taken place in societies across the globe.

Nonetheless EU biofuels policy takes a narrow economic conception of land – e.g. ignoring the wider social-political relations and cultural meanings that inhabit land, shaping individual and group claims to it in the real world. Such a narrow approach strips away the most messy and least manageable attributes of land from the standpoint of state bureaucrats and corporate managers. They can more easily use a simplistic account of how land is or has been used in order to determine 'availability' for biofuels. Exclusion of the awkward political questions – such as how

to regard pre-existing land-based social relations and pre-existing property relations, or who should use the land and, ultimately, who should decide any of these matters – exemplifies 'state simplification' (cf. Scott 1998). In simplifying rural space in this way, EU policy puts forward a 'win-win' narrative: that biofuels can serve to rehabilitate land that is unused or useless anyway, thereby helping communities and the environment without undermining local food security, and thus contributing to rural development.

Development policy

Given the resource conflicts and concerns about biofuels harming rural populations, 'EU development policy will aim to help suitable developing countries capture the benefits offered by biofuels, while addressing these concerns in an appropriate way', according to the Commission (CEC 2006b, 7; also EuropeAid 2009). Responsibility lies with its Directorate-General for Development (DG Development), as well as its External Cooperation Programme. The latter hosts a task force which has analysed conflicts over land use and land tenure in its many forms. According to its report:

> Land constitutes an asset and a source of wealth for families and individuals as well as for communities, with strong links to cultural and spiritual values. Ownership and control over land confer very significant political power, particularly where land is becoming scarcer and hence more valuable. Land issues and conflicts are deeply embedded in the long-term social, economic and political history of a country and must be understood in that context . . . . the rights of farmers to the land they cultivate often remain legally insecure and people may be excluded by government from access to natural resources upon which their livelihoods depend. (EU Task Force 2004, 2–3)

Later DG Development launched a consultation exercise on food security in developing countries, especially on the problem that large-scale land acquisitions undermine local food availability. The consultation document asked how to support efforts to meet 'food production challenges', e.g. through regional integration or rights-based approaches. It noted a policy gap regarding biofuels:

> Beyond the issues mentioned above, current European strategies on agriculture and food security do not systematically address other issues that only recently gained prominence such as: a) the impact on agricultural production and food availability of biofuels production and large scale land acquisitions . . . (CEC 2009, 5)

There are tensions between such concerns and biofuels policymaking. These tensions were indicated by interviews with staff members at DG Development.[5] For example, one staff member felt that mandatory labour standards could deter biofuel developments which create employment. By contrast, another criticised policy language about biofuel development creating 'employment' – an inappropriate term for the informal economic relations which characterise livelihoods in rural societies. Through negotiation, they could gain from biofuels, but they could instead lose livelihoods. These reservations remained self-consciously distant from any practical influence: 'If I make this argument, then who will listen to me?' In fact DG Development has no staff member dealing specifically with labour or employment issues.

[5]Interviews conducted by Les Levidow in Brussels in October and November 2009.

Some staff members acknowledged that agricultural producer companies often choose better-quality land – linked with infrastructure, for using the crop as either food or biofuels – not 'marginal' land. As they recognise, biofuels exemplify a wider problem: that investments in large-scale cultivation often threaten customary land rights and livelihoods. DG Development supports international initiatives to address this problem (e.g. ILC 2007, UNCTAD 2009). Staff recognised, however, that outcomes depend upon host countries respecting land rights; if the Commission disapproves of a government on such grounds, then it can find alternative donors or investors.

Staff views matter little anyway, since DG Development has gained no significant role in shaping European Commission policy on renewable energy. Nor does it have the financial resources or political power to shape biofuel developments in the global South, e.g. towards ensuring community consultation. Given its marginal role, official documents referring public concerns about biofuels to 'EU development policy' serve as an alibi for – or narrative diversion from – biofuel projects being subordinated to global commodities markets. These arrangements avoid the underlying issue: Who decides whether, how and where biofuels will be produced and processed, for what purposes, and for whose control of the product and profits?

Having surveyed EU policy arguments, assumptions and narratives, we now turn attention to our country case studies. Analogous features differ greatly across nation-states. For each policy aim or potential effect, policy assumptions may depend upon whether the biofuel input-output market is mainly domestic, or mainly from imports or mainly for export. In each case study discussion that follows, we briefly mention the respective national policies as relevant to practices and effects. But our cases were selected mainly for comparing different national experiences with EU policy assumptions, as this is the main focus of our study. We now compare EU biofuels policy assumptions with experience in three country cases.

Assumptions and experiences compared

Germany[6]

Biofuels have more than a 30-year history in Germany. During the 1970s oil crisis, biofuels were initially promoted as an alternative to fossil fuel, including by the country's emerging environmental movements. Low oil prices and lack of technology kept biofuel as a niche product for only a small group of consumers. More recently, growing consciousness about climate change and the importance of reducing GHG emissions gave biofuels new significance. The more recent push to promote biofuels began in 2003–04, with the introduction of tax incentives for biofuel production for both pure plant oil and biofuel blends. After 2005, under a new government and with German transport sector emissions growing at a rate of 1.4 percent per year, biofuels were portrayed as an easy way to help the country reduce its GHG emissions. Binding mixture quotas were added to tax incentives in December 2006, with Chancellor Angela Merkel declaring that Germany should go further than the EU targets.

This strong push from government has led to tremendous growth of the country's biofuel sector in recent years. Germany's production capacity increased five-fold

[6]Section based on research by Mireille Hönicke.

between 2004 and 2008 (e.g. from one to five million tonnes, mostly biodiesel), while the share of biofuels in consumption for transport increased as well – from 3.6 percent in 2005, to 6.3 percent in 2006 and 7.3 percent in 2007 (again, mostly biodiesel). So in Germany the EU target of 5.75 percent in 2010 was already surpassed several years beforehand (Eurostat 2009). Overall, in 2007, 70 percent of the total renewable energy used in Germany came from biomass, of which 20 percent was coming from biofuels.

Germany remains the leading producer and consumer of biofuels in Europe today. Given this success, Germany could be seen as a biofuels 'best case'. Yet a closer look at the German experience reveals numerous tensions and frictions, which together cast doubt on earlier optimistic assumptions about biofuels enhancing GHG savings and energy security.

Environmental protection versus agro-intensification

Like the EC Renewable Energy Directive, Germany's 2009 Biomass Sustainability Ordinance (BSO) set environmental criteria for biofuels production and use. These include protection of 'high conservation areas', sustainable cultivation of land according to good professional practice, and GHG savings of at least 35 percent at first, rising to 50 percent in 2017 (BMU 2009a, 13). Yet biofuel targeting and increased cultivation of energy crops, especially rapeseed and maize, have led to more intensive cultivation methods, with a greater use of pesticides and fertilizers. Meanwhile cultivation of energy crops on set-aside land has also increased, with almost 50 percent of set-aside land cultivated in 2007. Between 2003 and 2008 more ploughing, due partly to increased cultivation of maize and rapeseed, reduced permanent grassland by 3.4 percent (NABU 2009, DBFZ 2009). Considered a 'carbon sink', grassland fixes 60g carbon/m^2/year, but ploughing it releases about twice as much (DBFZ 2009).

Official sustainability criteria include all direct effects, but not indirect ones. As one expert report explained, 'the biofuel system encompasses the production of the biomass, all conversion processes, waste treatment, any transportation of goods and the use of the biofuels', including emissions from fertilizers and direct land use change (IFEU 2007). Even when biofuels are produced from domestic rapeseed, other domestic uses of rapeseed may substitute cheaper imports such as Asian palm oil (JRC 2008) – a chain that involves indirect GHG emissions not included in the BSO. Numerous studies show the uncertainties associated with calculating GHG savings, especially from indirect changes in land use (e.g. Searchinger *et al*. 2008, 3). These limitations raise doubts that similar emissions can be avoided or officially included on a global level, even with a certification scheme.

Any higher GHG savings in the future will depend on second-generation biofuels becoming available and more efficiently converting any biomass into liquid fuel, especially from non-food parts of crops. But the investment costs for second-generation biofuels are 10-fold higher than for current biofuels (VDB 2008). It is widely believed that second-generation biofuels will not be available in relevant amounts in Germany until at least 2020. Even then, they will have a share of only 2–3 percent of total fossil fuel supply, according to one projection (BMU 2008). Ironically, even biofuel proponents now point to the promise that future novel fuels will avoid conflicts with food security as grounds to delay an increase in the mandatory quota. First generation biofuels, based on starch and sugar crops, will

thus prevail for at least the next decade, despite their negative environmental effects and rising public scepticism.

Biofuels promotion in Germany has emphasised arguments about saving GHG emissions. According to expert reports, however, biomass conversion into combined heat and power offers significantly higher energy potential than its conversion into liquid fuels. The German Advisory Council on the Environment has advocated only a moderate expansion of biofuel use in transportation because biofuels do not sufficiently exploit the potential to mitigate climate change (SRU 2007). In 2008, renewable energies (in the electricity, heat and fuel sectors) facilitated CO_2 reductions totalling around 112m tonnes in Germany. Of this amount, biofuels contributed only 12 million tonnes, i.e. only 10 percent, while almost 50 percent came from biomass used as electricity (BMU 2009b). This gap suggests that environmental benefits are less important than other aims driving the priority for liquid fuels.

Energy security: limits of self-sufficiency

A key argument for biofuels in Germany is that their domestic production will improve the country's energy security. This argument became more prominent in 2007–08, when energy prices rose and assumptions about GHG savings from biofuels came under attack. The minimal GHG savings are often overlooked, with the argument that biofuels are the only alternative energy source in transportation. Yet the energy security argument too, in turn, has run up against its own resistances and frictions.

First, the Federal government had to adjust downward its own schedule of mixture quotas from originally higher targets. Originally, the government set a mixture quota target of 6.25 percent in 2009 and 8 percent in 2015 (Biofuel Quotas Act of December 2006), followed by a target of 17 percent in 2020 (Energy and Climate Program of August 2007). These levels were later adjusted to 12–15 percent by 2020 (announced in April 2008), and to 5.25 percent by 2009 and 6.25 percent in 2010–2014 (announced in October 2008, and approved in June 2009). Ironically, the adjustments were made mainly in response to pressure from the German Automobile Club (ADAC), rather than growing scepticism about their claimed environmental benefits. Germany's 2009 National Biomass Action Plan mandates a 10 percent bioethanol quota (BMU 2009a, 13). But at least three million cars are not technically adapted to use this mixture, according to ADAC, which called for a scaling back of mixture quota targets on grounds that many motor vehicles were technically unable to use higher fuel mixtures.

Second, there is the problem of limited land availability. According to the German Advisory Council on the Environment (SRU), 'Merely producing enough biomass for all petrol and diesel placed on the market to contain at least 6.75 percent biofuel by 2010 and even higher percentages in the future … would use up the entire potential available land' (SRU 2007, 102), thereby pushing the country toward imports. As a result,

> Further expansion of targets of the kind planned by the EU for the motor fuel sector (10 percent admixture by 2020) will further increase this pressure to import, even given increased yields in crop production or more efficient technologies. Thus the ambitious bioenergy expansion targets will boost imports of biomass and bioenergy sources

> without taking any account of possible adverse consequences of such imports. (SRU 2007, 41)

In 2007 Germany's rapeseed cultivation reached 1.53 million ha, with 0.7–0.9 million ha already used for biodiesel production (UFOP 2008). Experts estimate a possible increase in rapeseed production up to 1.8 million ha, but only by increasing the use of permanent grassland. Germany has already reached the maximum permitted five percent use of grassland under Common Agricultural Policy (CAP) cross-compliance rules. By 2007, 70 percent of total rapeseed production in Germany was used for biodiesel production. But that amount is not sufficient to satisfy the increased demand. Any increase of the current level of the defined quota would thus require more oilseed imports.

The larger potential of biofuels to substitute for fossil fuels is disputed. By 2007 biofuels contributed only 7.3 percent of total transport fuel, yet more than 10 percent of arable land in Germany was already used for cultivating crops for energy, and a great proportion of energy biomass was already imported. Even by increasing production of biofuels, their overall contribution will not significantly increase – unless the fuel mix is increased. Alternatively, biomass could be used more for heat and electricity, which has more efficient conversion than liquid fuels.

As the German government acknowledges, biomass imports will gain importance partly 'for competitive purposes' because domestic sources are more expensive (BMU 2009a). Already in 2006 Germany imported 60 percent of its biomass used for energy, mainly rapeseed from Eastern Europe (FIAN Germany 2008). In 2007 less than half of consumed biofuel came from domestic energy crops: 1.4 million tonnes rapeseed oil, 0.9 million tonnes palm and 0.3 million tonnes soy oil were imported (DBFZ 2009, 78ff). According to the German Biomass Research Centre (DBFZ), the domestic production of biodiesel will decrease further from its 75 percent level in 2007, and less rapeseed will be grown (only 0.83 million ha). In order to fulfil the mixture quota, all additional biodiesel will come from imports of palm and soy oil. If biomass-to-liquid (BtL) technology and biomethane do not provide significant contributions, then Germany will need even more imports (DBFZ 2009, 86 ff). Although biofuels can diversify the supply, they will contribute little to energy self-sufficiency, and proportionately less as transport uses more overall fuel.

As the foremost promoter of biofuels in the EU, Germany's experience has not been a 'best case' fulfilling the optimistic assumptions of EU biofuels policy. Rather, the difficulties suggest a need to rethink those assumptions, if not the policy altogether. To meet its own domestic targets, Germany has expanded cultivation on set-aside land, has intensified its use of chemical fertiliser and pesticides, and has begun to import additional supplies of raw material. Already in 2006, 60 percent of the biomass used for energy was imported, mainly rapeseed from Eastern Europe, suggesting that further advances toward higher targets would depend upon more imported oilseeds. On the one hand, imported oilseeds may help to diversify a small proportion of energy supply, while contributing little to energy self-sufficiency. On the other hand, the production conditions of imported oilseeds may well generate more GHG emissions than domestic oilseeds. Achieving the higher quotas in mixtures by 2020 with greater GHG savings would thus now appear to depend on overly optimistic assumptions about second-generation biofuels – e.g. that they will more efficiently convert non-food feedstock into liquid fuel and that they will become available sooner rather than later.

Brazil[7]

Brazil is a major producer, consumer and exporter of sugarcane ethanol. Brazil's bioethanol programme originated in a 1970s policy to substitute biofuel for fossil fuel, but has since greatly expanded beyond this original aim (Novo 2010, this volume). Today the Brazilian biofuels programme is also about gaining income from the export of biofuel and its related technology. Both at home and abroad, Brazil's biofuels promotion is closely intertwined with the expansion of agro-industrial monocropping. Apart from encouraging expansion of sugarcane monocropping into the Cerrado, for example, Brazil also encourages other countries in the global South to adopt this particular production model in biofuels, especially through technology transfer agreements.

Meanwhile its foreign policy seeks to extend access to biofuel markets, especially in the European Union, Japan, and the United States. Brazil's bioethanol exports face high tariffs in the USA and EU, so this barrier becomes another incentive to establish production in third countries – e.g. in Central America, Africa or Asia – whose exports can avoid such tariffs. Partly for this reason, Brazil and the EU have agreed to start studies on how best to develop bioethanol, biodiesel and bioelectricity projects in Mozambique, which has become a leading African biofuels producer in recent years (Reuters 2010).

Together with the Brazilian sugarcane industry association UNICA, the Brazilian government has been lobbying the EU – to drop tariff barriers, to raise the GHG savings requirement in the EC Renewable Energy Directive to 45 percent and at least 60 percent from 2015, and to make sugarcane ethanol the main component in meeting the target (CEO 2008). The tariff problem has been partially solved through bilateral agreements with individual EU member states. For example, the Germany-Brazil partnership agreement signed in May 2008 'establishes sustainability criteria for biofuels, and provides more than $140 million in financing for a renewable energy R&D partnership between the two countries, as well as rainforest preservation efforts in the Amazon'. Brazil also has bilateral co-operation agreements on biofuels development with Sweden, Netherlands, Germany, Denmark, UK, France, and Italy (Biofuels Digest 2008).

In this larger context, the Brazilian experience illustrates numerous problems that cast doubt on the validity of EU policy assumptions, especially regarding the social and environmental effects of biofuels. Investors prefer the best lands, with plentiful water and developed infrastructure; they rarely use 'marginal' or 'degraded' lands (Mendonça 2008). Sugarcane and soya plantations generate GHG emissions in several ways: by clearing forests or savannah, by applying agrichemical treatments, and by displacing cattle ranching into new forest clearances. Such plantations also cause wider environmental harm, especially by destroying soil fertility and polluting water sources, thus also undermining other livelihoods (Mendonça 2009). Exploitative labour conditions harm workers' health and often subjects them to 'slave labour'. This agro-industrial expansion undermines earlier agendas for land reform, while also depriving peasants of land by various means, especially environmental pollution and violence (see also Wilkinson and Herrera 2008, Fernandez *et al*. 2010).

[7]Section based on research by Maria Luisa Mendonça.

Environmental protection versus resource destruction

Brazil's biofuel production increases GHG emissions in both direct and indirect ways. Monocropping directly aggravates this problem, especially by extending the agricultural borders of the Amazon and the Cerrado, an enormous savannah area. In 2008 President Lula claimed that the Amazon has no production of sugarcane, yet this too is contradicted by expert reports. Such production increased from 17.6 million tons to 19.3 million tons between 2007–08, according to the National Supply Company (CONAB), an organ linked to the Ministry of Agriculture. This expansion has generated worldwide concern and criticism. Facing such criticism, the Brazilian government decided to create a zoning system to limit the expansion of sugarcane plantations. However, the government did not explain what will happen to current plantations in the Amazon, Pantanal and Cerrado.

In recent years the Brazilian government has targeted the Cerrado as a priority area for expanding sugarcane. This region has a favourable topography; it is level, with good-quality soil and has potential water supply. Spanning two million square kilometres, the Cerrado is known as the 'father of water', supplying the principal water basins of the country. The region is as important for rich biodiversity as the Amazon; it shelters nearly 160,000 species of plants and animals, many of which are endangered. Studies indicate that each year nearly 22,000 square km of savannah are cleared. More than half of the region has already been devastated; at this rate, its total destruction will be complete by the year 2030. Yet this threat has gained little visibility (Mendonça 2008).

The sugarcane industry has expanded rapidly and generated great environmental damage. In the 2007 harvest, sugarcane production occupied 5.8 million hectares of the Cerrado, according to the Brazilian Institute of Geography and Statistics (Fernandes 2008). To begin planting sugarcane, it is necessary to clear the native vegetation, and thus all of the trees are uprooted. In 2008, an agreement between the Ministry of the Environment and the Ministry of Agriculture resulted in softening the Law of Environmental Crimes. A presidential decree subsequently allowed the construction of sugarcane factories in the Pantanal. New sugarcane factories are being built in conservation areas, close to natural springs, according to data from the National Institute for Space Research (INPE), the Brazilian Institute of Geography and Statistics (IBGE) and the Ministry of the Environment (MMA).

Indirect changes in land use happen when farmers worldwide 'respond to higher prices and convert forests and fields into new plantations, to substitute plantations of grain which were used for biofuels', thus releasing stored carbon (Searchinger *et al.* 2008). In Brazil, new soybean farms use land that was previously cleared by cattle ranching, which in turn moves to frontiers in the Amazon forest. These outcomes undermine claims that Brazil's biofuels save GHG emissions.

Agro-industrial development destroying and degrading employment

Brazil's ethanol sector started with a government programme called Proálcool during 1972–95. In the name of 'modernisation', the government provided support for increasing the area of sugarcane plantations and structuring the sugar-alcohol (ethanol) complex with large subsidies and other incentives. The Sugar and Alcohol Institute was responsible for all commercialisation and export of the product in several ways – by subsidising undertakings, providing incentives for industrial and

land centralisation, as well as supplying fertile land, means of transport, energy and infrastructure.

Despite propaganda about its efficiency, the bioenergy industry is based on exploiting cheap, sometimes even forced labour. The expansion of the industry, as well as the new investments in technology, have not always brought better conditions to workers. The degradation of work has caused serious health problems and even deaths among sugarcane cutters.

In the state of São Paulo, the largest producer in the country, workers are expected to cut between 10 and 15 tons of sugarcane per day, which often proves to be beyond an average human capacity (Moraes Silva 2007). According to the Migrants' Pastoral Service (Serviço Pastoral dos Migrantes), 21 deaths were registered due to exhaustion from cutting sugarcane in the state of São Paulo just in 2005–07. 'Ethanol in Brazil is bathed in blood, sweat, and death', says researcher Maria Cristina Gonzaga of Fundacentro, an institute within the Ministry of Labor (Noticias Terra 2007; see also Mendonça 2008).

Officially called *trabalho escravo*, slave labour is common in the sector. According to Labour Ministry data, almost 6,000 slave workers were rescued per year by the teams of the Mobile Inspection Group. Half of those workers were found at sugarcane plantations (MTE 2010).

Properties of less than 10 hectares occupy less than 2.7 percent of the rural area, while properties larger than 1,000 hectares represent 43 percent of the total, according to the 2006 Agrarian Census by the Brazilian Geography and Statistics Institute (IBGE). Of the total jobs created in the Brazilian countryside, 87.3 percent are in the small production units, 10.2 percent in mid-sized units, and only 2.5 percent on the large ones. This study also demonstrates that the small and medium-size rural properties are responsible for the greater portion of food production for local markets, according to Oliveira (2007). Although aware of these data, government policy favours credit subsidies and rollover debt for large corporations and landholdings. The Brazilian agro-industrial complex also uses other privileges, such as *grilagem* (illegal land grabbing), quasi-slave labour, and violation of environmental and labour laws.

In many regions, the increase in ethanol production has caused small-scale farmers to lose their lands. It has also generated a dependency on the 'sugarcane economy', providing only insecure jobs in the sugar fields. Large landowners' monopoly on land blocks other economic sectors from developing, while creating unemployment, stimulating migration and degrading workers' conditions. Concentration of land ownership leaves the rural work force 'no alternative other than working for large exploitative enterprises' (Prado Jr. 2007, 58).

In promoting biofuels, the government emphasises opportunities for small farmers to gain extra income. The 2005 Biodiesel Program included the creation of the Social Fuel Seal (*Selo Combustível Social* – decree n° 5.297), which prioritises the cultivation of castor bean plants (*mamona*) and palm trees (*dendê*). Companies establishing partnerships with small producers of these plants receive the 'Social Fuel Seal', making them eligible for benefits and funding from BNDES (Brazilian Bank of Economic and Social Development), in addition to tax exemptions. In the north and northeast of the country, companies are exempted from the payment of PIS (Private Company Employee Fund) and Cofins (Social Security Financing Contribution) taxes.

There are serious doubts regarding the real advantages of the Social Fuel Seal for family farmers. The program predicted that they would produce 560,000 tons of castor

beans and 680,000 tons of sunflower seeds for the biodiesel plants of the northeast. But castor bean production reached only one-sixth of the target – 93,700 tons – and sunflower 106,100 tons in 2007 (CONAB 2007). In fact, soy continues to provide most biodiesel, comprising 80 percent of production, while 15 percent is derived from animal fat and only 3 percent from other sources. In this context, family farmers have a minimal role in biodiesel production. Big companies still emphasise the advantages of the soy industry, which is based on large-scale infrastructure and land holdings.

Mozambique[8]

Mozambique is a predominantly agrarian society with a majority rural population. Most are very poor, land insecure and lack access to electricity. Compared to the other country cases, the corporate-led biofuels model is still new to Mozambique, so looking at the local effects of this biofuel expansion, especially the role of international actors, provides an important contrasting case.

Biofuels promotion exemplifies a general policy shift towards economic development. During the period when Mozambique was deferring to Structural Adjustment Policies, its political elite had a predatory, often corrupt relation to state funds. The 2004 election marked a shift towards a 'developmental state', but economic development remains dependent on a political elite and foreign investors; the state gives little support to local small enterprises (Hanlon 2009).

Mozambique's biofuel sector has been expanding fast, attracting significant foreign aid and investment relative to other countries in the region. Output is based on non-food crops, mainly *Jatropha* and sugarcane. It is destined largely for export – mainly Europe and South Africa – despite official policy discourses about promoting domestic energy use. European, Brazilian and South African companies have been playing significant roles in driving a biofuel boom and expansion in Mozambique. At the same time, Mozambique has been undergoing a heavily funded 'land policy reform', i.e. towards liberalising land tenure – a process likely to be intertwined with the biofuel boom.

Mozambique exports energy – especially hydro-electricity to South Africa, as well as coal that is being mined by Brazilians for export – yet its countryside is extremely energy-poor. The rural population has little access to energy, prompting the national peasant union (UNAC) to take a relatively more nuanced official position on the issue than its counterparts elsewhere. UNAC opposes the corporate-led model, though not biofuels per se; it wants to explore the potentials of biofuels from an alternative community-based perspective and for different local purposes.[9]

As official aims for biofuels, the Mozambique government seeks means to enhance energy security, reduce GHGs and promote sustainable rural development. It declares,

> The fundamental considerations motivating the Government, in developing policy, are (1) the promotion of agro-energy resources for energy security and sustainable socio-economic development, at the same time contributing to the reduction of greenhouse gas emissions through the selection and adoption of more adequate technologies and

[8]Section based on research by David Fig. Thanks also to Joseph Hanlon for documentary material and advice.

[9]Interview with Diamantino Nhampossa, speaking for the união Nacional do Camponeses (UNAC), 2 September 2009, Maputo.

> production methods in agriculture and industry; and (2) the necessity to confront the instability, opacity and volatility of fuel prices in the international market, to reduce the country's dependence on imported fossil fuels and to reduce the amount of imports in the national economy. (Mozambique, *Boletim da República*, 2009)

The government actively encourages the development of biofuels for several aims. It seeks to save foreign currency, to reduce the environmental problems of the expanding transport sector, to reduce dependence on unpredictable and volatile world market oil prices, and to contribute to rural development by generating employment and increasing income opportunities (Mataveia 2009a). In order to achieve all those aims, key activities are 'Knowing the challenges linked to correct land use, avoiding community conflicts, and environmental negative impacts', according to the Agriculture Ministry (Mataveia 2009b).

In 2007 Mozambique and Brazil agreed to share resources in biofuel production, with the goal of replicating Brazil's purportedly sustainable model of biofuel production in Mozambique. The agreement would help generate income and employment for the Mozambican population, 'who have all the necessary conditions to help supply the growing global demand for bioenergy'. Mozambique President Armando Guebuza has stated that biofuel production will not be permitted to displace farmers from their land, but instead should be located in 'areas where they can help increase the income of Mozambicans, and that can industrialise our country' (Biopact 2007).

The government seeks to avoid competition between food and fuel, especially in the case of maize, which is the most important staple food in southern Africa. For biofuels feedstock, government policy instead favours four other crops – namely, sugar and sweet sorghum (for ethanol) and *Jatropha* and coconut (for biodiesel). Despite the government's stated aims, its policy has not avoided conflicts over food production and land use; nor has it much prospect to enhance energy security or access for most people. Rural livelihoods generally have not been advanced or protected by biofuel developments in Mozambique. Large land tracts have been allocated for biofuels, but few jobs have been created or sustained. Meanwhile optimal arable land, water resources and other public resources have been diverted from food production.

Environmental protection

GHG savings from biofuels depends partly on models, which evaluate an average tonne of feedstock for each crop (Econergy International Corporation 2008), not specific to any context or productivity levels. For the four crops favoured by the Mozambique government, models suggest that they all offer significant reductions in GHG emissions (Econergy International Corporation 2008, 178–82), but this potential is readily undermined by specific contexts.

Biofuels have been often celebrated as carbon neutral, on grounds that they add no GHGs to the atmosphere. This assumes that burning biofuels simply returns to the atmosphere the carbon dioxide that the plants remove while growing in the field. This assumption ignores several ways that the process generates GHG emissions. For example, Mozambique plans biofuel production in selected rural enclaves. These are (or will be) established *de novo*, with considerable installation of infrastructure, including capital equipment for manufacturing biofuels. In such remote locations, transport distances and thus fuel requirements are great. In the case of *Jatropha* cultivation, GHG emissions crucially depend on changes in land use and thus in

carbon stock. Cultivation of *Jatropha* on land with no prior vegetation gives a positive GHG balance from land use change. By contrast, cultivation on land with medium-level vegetation gives a negative GHG balance (Reinhardt 2008, 63).

Moreover, Mozambique plans to produce biofuels mainly for export, especially to Europe. So most GHG savings will be claimed at the export destination. Mozambique will gain little GHG savings in using biofuels, yet will incur high emissions in producing them, thus resulting in a negative balance for the country. This relationship extends a wider North-South pattern of outsourcing pollution to the global South.

Energy security for whom?

Mozambique's population is approximately 80 percent rural. Most rely on biomass (such as charcoal) to provide household energy supplies. Electricity seldom reaches beyond rural towns; even there it comes mainly from private diesel generators, not from a public service. Thus the rural population is still relegated to energy poverty. This severely inhibits peasant farm mechanisation, rural production (including agro-industry), and marketing of produce. Time spent collecting and transforming fuelwood (especially by women and children) is lost for other forms of gaining a livelihood or education.

Mozambique has significant energy assets. These include hydro-electric resources such as Cahora Bassa on the Zambezi, but this energy is mostly exported to South Africa. Two-thirds of the country's electricity supply is devoted to a single plant, Mozal, an aluminium smelter near the capital, Maputo. Mozambique has no bauxite, so the smelter uses imported raw materials. It benefits from cheap bulk electricity rates and lax pollution standards that fall below those of the EU. The plant operator is exempt from paying for any externalities.

Mozambique also possesses petroleum, not yet fully commercialised, as well as natural gas. The latter is exported by pipeline to Sasol, a large South African chemical company which uses the gas as feedstock to manufacture synthetic petroleum. So fossil fuels hardly benefit rural populations. Mozambique has a low level of industrialisation and a limited electricity grid, so the country uses little electricity. Nor does it use much hydrocarbon – 570 million litres in 2006, 66 percent of which was diesel (Ecoenergy International Corporation 2008, ES-1).

Like the country's current energy production, biofuels are aimed largely at export to EU countries and South Africa. There are plans to use some local production for blending ethanol (as E10, i.e. 10 percent) and biodiesel (D5) into imported hydrocarbons, eventually doubling to E20 and D10, respectively. However, this means that 80–90 percent of hydrocarbons will still need to be imported. So biofuels will play a very small role in import substitution, providing at most only 38 million litres of ethanol and 40m litres of biodiesel annually.

Rural development

Since 1997 Mozambique has had a land law protecting peasants' customary land rights from various pressures threatening those rights. This law resulted from an extensive public investigation, consultation and deliberation process. Foreign donors have pressured Mozambique to change its land law in order to facilitate privatisation, but its rulers have accommodated popular opposition.

Biofuels exemplify these conflicts. Rural livelihoods generally have not been advanced or protected by biofuel developments in Mozambique. Large land tracts have been allocated for biofuels, but few jobs have been created or are likely to be generated. Established operations have been unable to sustain their workforce in full employment. Initial investment has been adversely affected partly by the global economic crisis.

Government policy seeks to ensure that biofuel feedstock crops will be grown on 'marginal' land in order not to compete with food crops. The Mozambican state has been mapping land use in order to clarify which lands are marginal. According to the Energy Minister, speaking in August 2006, Mozambique had 36m hectares of arable land, of which only nine percent was in use. There is an additional 41.2 million hectares of marginal land: 3.3 million hectares have irrigation potential, but only 1.6 million hectares are currently being irrigated (Namburete 2006). To the contrary, much of the arable land is already settled and under traditional resource use and management, such as pastoralist routes.

The low utilisation of arable land may be due to weak incentives from uncertain markets or low prices. Marketing Boards formerly guaranteed minimum prices for some agricultural crops, thus providing incentives for cultivation, but such intervention has been prohibited by Structural Adjustment Policies. Thus IMF policies effectively keep some good land 'idle' – until investment in plantations for export markets.

Despite presidential declarations, biofuel crops face conflict with food crops. No crop can easily survive on marginal lands, nor can it be commercially profitable there. As crops in semi-arid southern Mozambique fail, e.g. *Jatropha*, growers have realised that they need fertile, well-watered land for cultivation to be commercially successful.

Land conflicts over biofuels are illustrated by the Procana sugarcane ethanol plantation, which sought control over 30,000 ha in order to produce sugar cane for ethanol. In 2007 Procana aimed to set up a sugar plantation in Massingir in Gaza province, with expectations of creating 7000 jobs. Claiming government permission, it began to plant the crop. Local people were asked by Procana to shift their cattle to pastures further afield, distant from water sources. One key issue there is how to resettle the communities of pastoralists and subsistence farmers who live in the 30,000 ha of land.

In addition, Procana's activities soon jeopardised farmers who had been resettled to farm on adjacent land (Ribeiro and Matavel 2009, 10). These families had once inhabited the section of Gaza province which was later declared to be the Limpopo National Park. The park's creation aimed to establish a trans-frontier park, shared by South Africa, Zimbabwe and Mozambique. Limpopo was part of Mozambique's contribution to this mega-conservation plan. Behind the plan lay the dilemma of the excessive elephant population in South Africa's Kruger National Park. As a possible solution to the problem, a much larger park was created out of contiguous zones in neighbouring countries, thus providing a greater range for the elephants in the park. Formed from an old hunting area called Coutada 16, Limpopo now had to function as a fully fledged national park. But the park had not been cleared of human inhabitants. Villages inside the park boundary underwent harassment from the elephant population, which raided their crops and sometimes even trampled their children. The park authorities, pressured by the villagers to do something about their elephant nuisance, eventually received German development money to relocate

villagers out of the park. Apparently some of the same land had also been promised to Procana.

A conflict was escalating. Some villagers accepted the Procana request, but others attempted to resist, feeling that they had not understood the full extent of the company's request. Procana needed riparian, well-watered land in order to ensure monocrop production under consistent conditions for its entire planting; thus it chose land adjacent to the Massingir dam. Only later did most of the people removed from the park understand this second assault on their land and livelihoods. During the last half of 2008, Procana's major investors, the Central African Mining and Exploration Company (CAMEC), withdrew its funds from the company. Procana managed to limp along for some months, but ultimately was unable to attract new finance to continue its plans for bioethanol. By late 2009 CAMEC withdrew its investment from the Massingir area and the government cancelled its contract (All Africa 2009).

Meanwhile, the Mozambican government has encouraged *Jatropha* cultivation for biodiesel production, on the assumption that it will not conflict with food needs. Energy companies have been establishing *Jatropha* plantations there. According to one study, however, *Jatropha* cultivation depends on irrigation and chemical inputs. It also attracts pests, which then spread to nearby food crops. In some places it replaced food crops which were otherwise cultivated by subsistence farmers. Limited resources 'force[d] subsistence farmers to replace one crop with another, rather than add acreage, which in the case of *Jatropha* would generate competition between a cash crop and food crops'. Given these conflicts,

> the dominant arguments about *Jatropha* as a food-security safe biofuel crop, a source of additional farm income for rural farmers, and a potential driver of rural development were misinformed at best and dangerous at worst. While further independent research will give more detail, this investigation seriously challenges Jatropha as providing for sustainable fuel and development in Mozambique. (Ribeiro and Matavel 2009, 41, 8)

Comparisons and interactions

A 'global integrated biofuels network' (Mol 2007) can help to explain some comparisons and interactions among the three country cases. Each in its own way, governments become global actors. They have attempted to expand, supply and/or diversify global markets, as a key reference point for domestic economic development. In so doing, they generate new conflicts over resources and development trajectories.

EU biofuels policy has been driven by a partnership between government and an emergent agro-energy business extending the agro-industrial model from commodity crops to energy uses. Similar alliances in the global South are increasingly important in promoting agro-industrial biofuel development at home or abroad. This is appropriately described as 'agrofuels', in contrast to earlier proposals for converting organic waste material into 'biofuels'.

Biofuels promotion has drivers that converge and interact across the three cases, as well as with the EU. As the European vanguard of biofuels promotion, Germany's policies overlap closely with the EU's and so become a test case for their feasibility. Brazil has its own policy drivers: starting from import substitution, those aims were extended to global export, along with efforts towards trade agreements to facilitate exports, especially to the European market. Brazil also seeks investment sites in Africa, partly as a base for avoiding export tariffs in the USA and EU.

Mozambique remains dependent on other countries for development aid and industrial investment; it has been influenced by Brazil and the EU via cooperation agreements. Their practices facilitate a convergence of North-South and South-South elite alliances promoting biofuels for 'rural development', i.e. incorporating land and labour into agro-industrial systems that supply global markets.

In each case, biofuel development involves state-led 'attempts at legibility and simplification' (Scott 1998, 2) as means to manage contentious developments. In Brazil and Mozambique, governments treat some land as marginal and thus benignly available for biofuels. In Mozambique this has led to conflict with subsistence farmers and pastoralists, especially over land and water resources. Germany depends on imports to fulfil its ambitious targets for biofuel use but counts only direct changes in land use regarding GHG emissions and savings.

To calculate emissions from direct changes in land use, the EU system initially simplifies complex variations in practices by making assumptions about average emissions. It also devises statistical definitions of 'forests' to be protected. Such methods render some environmental resources and effects selectively legible in the sense of administrative visibility, ordering and management (Scott, 1998). Wider types of harm – agricultural practices becoming intensified in response to biofuel markets, and indirect changes in land use – have remained illegible, i.e. officially invisible and irrelevant, at least in the 2009 legislation. As types of administrative ordering (cf. Scott 1998), these criteria complement narratives imagining beneficent biofuels as obvious and thus justifying measures to realise their promise.

Yet those promotional efforts encounter 'frictions' that can constrain the original aims (Tsing 2005). In Germany, agro-intensification methods conflict with environmental protection measures and domestic land availability, thus limiting biofuel production; engine designs are not fully adapted to use biofuels, thus limiting biofuel mixtures. Brazilian rainforest destruction, although officially denied, provokes demands to regulate agro-industrial expansion there. Brazil's ethanol exports encounter high tariffs in the global North, thus generating other global strategies to bypass the obstacle. In Mozambique, peasants have criticised the loss of good quality land and nearby water sources – which remained officially illegible until the protest. And a major bioethanol venture there has collapsed in a global context of lower fuel prices.

Pro-biofuel policy assumptions have some similarities between the EU and the three country cases. Drawing on our three case studies, this section compares policy assumptions with each other and with national practices in their global context. Although EU policy is not a main cause of those practices, they provide a basis to test the validity of EU policy assumptions. Many experiences contradict optimistic assumptions about environmental protection, energy security and rural development.

Environmental protection

GHG savings remain an official rationale of EU policy, as well as a basic criterion for evaluating whether a biofuel source qualifies for the targets. Governments in our three country cases make claims about environmental benefits. But their assumptions are contradicted by national biofuel practices.

Germany's biofuel usage reduces GHG emissions, but some potential savings have been lost by more intensive agricultural practices, e.g. clearing permanent

grassland for cultivation and spraying agrichemicals, whose production uses fossil fuels. As Germany attempts to increase its biofuel use, the country will become more dependent upon imports and thus will stimulate indirect changes in land use – generating GHG emissions elsewhere that are not officially counted.

In Brazil bioethanol from sugarcane has greater potential for GHG savings than other biofuel crops. But savings are undermined by sugarcane plantations destroying carbon sinks in the Cerrado savannah and Amazon rainforest, as well as by wider environmental harm. GHG emissions also result from soya plantations displacing cattle ranches which in turn clear more rainforest frontiers; yet these emissions are not counted by Brazil, much less by countries importing soya for biofuels. Moreover, Brazilian environmental law has been softened to facilitate sugarcane plantations, thus contradicting assumptions about self-governance protecting natural environments.

Likewise, in Mozambique, GHG savings from bioethanol are somewhat undermined by agro-industrial practices, e.g. land clearances and the extra infrastructure needed for *de novo* installations distant from metropolitan centres. For *Jatropha*, cultivation on land with prior medium-level vegetation gives a negative GHG balance. Mozambique plans to produce biofuels mainly for export, so most GHG savings will be claimed at the export destination.

In the three countries, then, national practices disappoint or even contradict EU policy assumptions about GHG savings.

Energy security

Energy security has been a key aim and assumption in EU policy; likewise in our three case studies. In the EU biofuels serve a huge, growing transport sector which will remain dependent mainly on fossil fuels. As our country cases show, biofuels feed industrial expansion by supplementing fossil fuels, thus effectively limiting the benefits for energy security as well as for GHG savings.

In Germany, biofuels were contributing to 7.3 percent of total transport fuel by 2007. Yet more than 10 percent of Germany's arable land was already used for cultivating crops for energy, and fully 70 percent of total domestic rapeseed production was used for biodiesel production. That amount was not sufficient to satisfy the increased demand. A great proportion was already being imported, especially from Eastern Europe; any increase in biofuel usage would require even more imports of oilseeds. So biofuels will contribute little to energy self-sufficiency, though they can diversify the supply beyond fossil fuels. As another constraint on replacing fossil fuels, the government adopted lower biofuel quotas in fuel mixtures than originally planned for 2009, under pressure from the German automobile association, on grounds that many motor vehicles were technically unable to use higher fuel blends.

Brazil's bioethanol programme originated in a 1970s policy to substitute for fossil fuels and thus enhance energy security. Although domestic production has been considerable, energy usage in domestic industry and transport has likewise expanded, being fed increasingly by biofuels. And the aims have expanded to maximise export income, thus driving environmental and social harm.

Mozambique's biofuel production is mainly for export to gain income, in line with the main role of its energy (coal, hydro, natural gas) sector. It also plans low fuel mixtures within the domestic market, but 80–90 percent of hydrocarbons will

still need to be imported. So biofuels can play only a small role in import substitution and thus energy security.

Rural development

As a promised benefit of biofuels, rural development involves optimistic assumptions about land use and employment. The EU policy presumes that biofuel development can be directed away from the best agricultural land, as a means to avoid conflict with local food production, thereby reconciling rural development with energy export. The concept of 'degraded/marginal' land serves to conceal or justify biofuels development taking over quality land that may have other uses for local people, as our case studies show.

Germany's aid agency promotes 'sustainable biomass' for biofuels in the global South, especially as an opportunity for rural development. Its strategy emphasises new value chains that include small-scale producers (GTZ 2009a, 2009b). In particular,

> sustainable land management in Mozambique ... will require the proper implementation of existing legal requirements, for example, the involvement of local people in land zoning agreements, and the adequate sharing of benefits from land management through benefit sharing agreements which reflect the local peoples' legal and customary rights. (Proforest/GTZ 2009, 15)

But small-scale producers have been marginalised in practice; agro-business interests have prevailed instead.

The Brazilian government treats millions of hectares as 'marginal', providing a basis for sugarcane plantations to expand on these lands without being perceived as harming the environment or food production. But in practice, biofuel producers seek and gain access to quality land, water sources and infrastructure. Such plantation developments devastate natural resources and local agriculture, as well as forest reserves in some places. They also destroy employment and degrade labour conditions, even through *de facto* slave labour; mechanisation reduces employment without improving its conditions.

Mozambique too makes claims about much land being available for biofuels cultivation and even carries out surveys of 'marginal' land. Yet land conflicts have arisen with local residents over plans for biofuel plantations. Large land tracts have been allocated for biofuels, especially sugarcane, but operations have been unable to sustain their workforce in full employment. *Jatropha* supposedly avoids competition with food production, but some plantation developments have displaced local food crops, diverted water supplies and/or attracted pests.

In Brazil and Mozambique, then, national practices have contradicted EU assumptions about societal benefits of rural development through biofuels.

Conclusions: frictions and contradictions

The EU policy on biofuels creates a market and thus incentives for agro-industrial biofuels development, both in the EU and in the global South. An emerging global biofuel market is illustrated here by interactions and inter-dependencies among Germany, Brazil and Mozambique. In these cases, the biofuel project encounters various frictions – inadvertent or intentional resistance to be overcome.

The EU pro-biofuels policy has elaborated a narrative about several societal problems finding solutions in beneficent biofuels. The policy rests upon arguments about societal benefits of three main kinds – environmental protection, especially GHG savings; energy security through import substitution; and rural development, especially in the global South. Each argument in turn involves several assumptions about what these putative benefits mean and how they can be fulfilled.

In major respects, such assumptions are contradicted by practices, experiences and effects. Policy aims are sometimes impeded by conflicts among biofuel promoters, as well as between others who may be adversely affected.

More than simply inconsistencies, here contradictions mean frictional encounters and practical dilemmas. For example, treating land as 'marginal' can justify its appropriation for agro-industrial biofuels, but may provoke protest from local poor people being dispossessed. Meanwhile, agro-industrial plantations may create 'employment' but then also degrade its conditions and readily undermine other livelihoods in the informal economy. Finally, promoting such agro-industrial development creates conflicts with environmental protection law, which undergoes pressure to be softened, as in Brazil. Such conflicts arise from a specific normative account of rural development and sustainability.

Opposing stringent proposals for EU sustainability criteria, many producer governments have argued that 'if all the relevant criteria are taken into account, biofuel production is not sustainable'.[10] From a different starting point, many activists have warned that biofuel production undermines legal protections of commons and encourages dispossession of rural communities, while government policies downplay negative ecological and human consequences. Environmental and agrarian justice movements converge around arguments that the potential for GHG-savings from biofuels is undermined by their link to the intensive agro-industrial model.

Together such critics face a practical dilemma. Should they enter into discussions with biofuel promoters and parliamentarians about how to establish an effective system of monitoring sustainability criteria, thus serving to legitimise the agro-industrial biofuel project? Alternatively, suspecting that massive industrial production of biofuels cannot be done in a sustainable way, should they resist any monitoring system as pointless? Would they miss a potential opportunity to slow down the biofuels boom – or at least to derail a few harmful projects?

Such strategic questions may have no clear, single 'right answer'. But most critics can agree that, at minimum, a critical perspective must continue to bring bottom-line sustainability criteria to public attention. Human rights organisations, for example, have thus focused on land use change and dispossession; they demand compliance with existing treaties and covenants protecting access to land and other productive resources and thereby access to food.[11]

[10]In 2008 the governments of Argentina, Brazil, Colombia, Indonesia, Malaysia, Malawi, Mozambique and Sierra Leone (though a joint Open Letter to the Council, Parliament and Commission of the European Communities) objected to proposed sustainability standards for biofuels. They are amongst the countries from which the EU is importing biofuels and biofuel feedstocks.

[11]Foodfirst Information and Action Network (FIAN International 2009) has identified specific human rights standards in international human rights law related to access to land, water and natural resources, as legally binding for parties to the treaties and covenants listed

The current contradictions are likely to intensify with any future rise of biofuels and so will continue to warrant systematic attention through critical research. Indeed, by early 2010 EU institutions were displaying more overt tensions between biofuels promotion and other EU policies. Biofuels promoters' optimistic assumptions will remain a key reference point in public debates.

By critically comparing those assumptions against practices, critical research can highlight harmful effects, their causes and deceptive language which may conceal or sanitise those effects. It can also question the fundamental development models that corporate-led biofuels serve, and illuminate how those models are promoted through supposedly benign biofuels. In these ways, critical research can help to deepen understanding of the key challenges facing those who oppose the current corporate-led agrofuels project. Such research can thereby contribute to building and strengthening advocacy efforts with several aims – holding policies accountable for resultant harm, finding intervention points for changing policy frameworks, and counterposing alternative development pathways.

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