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Unravelling the argument for bioenergy production in developing countries: A world-economy perspective

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ABSTRACT

This paper offers a critical look at how energy security-, food and agriculture-, and climate change-oriented international organizations discuss and frame biomass energy production in developing countries, in particular, ethanol production in Brazil. Using the world-economy system as a theoretical lens, the paper raises a concern as to whether the way these global institutions frame bioenergy's role in developing regions not only creates internal contradictory arguments but also manifests energy and ecological inequalities between the core and the periphery. Simultaneously, these organizations frame Brazil as a semi-peripheral state that, while successful in finding a niche concurring with the core's demand for cheap energy and cost-effective decarbonization strategies, is not necessarily a suitable role model for the periphery's socio-economic development.

KEYWORDS

bioenergy, developing countries, Brazil, FAO, IEA, IPCC

1. Introduction

The central aim of this paper is to critically analyse and unravel how specific international organizations (IOs) argument and frame biomass-derived energy in developing countries, in particular, Brazil with its “successful” sugar-cane ethanol production. The rationale for this is twofold. First, over the past several years, intense discussion has focused not only on how to produce energy from biomass, but where this should be done. This has highlighted the role of developing countries, most notably Brazil, in the policy formation processes of IOs, especially if the high bioenergy requirements of developed countries are to be met. Second, I am especially interested in scrutinizing and exposing the specific roles of organizations in framing and advocating policy options for biomass energy, since any potential development

and implementation of bioenergy policies, particularly in developed countries, has different socio-economic and environmental consequences for other actors around the world.

The choice of international organizations was based on the fact that three problematic areas, i.e. energy security, food and agriculture, and climate change, are integral to the current bioenergy debate. The International Energy Agency (IEA), together with its specialized offshoot, IEA Bioenergy, is concerned with the full scope of energy policy and security. The Food and Agriculture Organization of the United Nations (FAO) provides a platform for a global agenda for food production and rural development. The United Nations Framework Convention on Climate Change (UNFCCC) and Intergovernmental Panel on Climate Change (IPCC) together provide a forum for international climate change negotiations. Before embarking on the theoretical portion of this paper, I must stress that the selected institutions either have different memberships that involve only a narrow group of countries or have experienced problems with equitably representing various actors and their interests. However, while these institutions do not necessarily espouse views that are commonly accepted by the global community, they still have powerful means to influence global policies.

IEA was set up in the midst of the 1970s oil crisis, to bring together a small cluster of high-income countries to devise formal joint policy responses to global energy challenges (Podobnik, 2006, p. 120). Most importantly, Podobnik notes that the agency evolved into an institution able to influence international energy markets and industries (Podobnik, 2006, p. 10). The case of FAO is different, since the purpose of this specialized UN body is to serve both developed and developing countries. However, it is designed to lead international efforts to alleviate food scarcity, a problem commonly occurring in poor countries. For many years, FAO has been the target of strong public criticism, mostly of the institution's failure to alleviate hunger and bring food security in poor regions of the world (The Ecologist, 1991; NGO FORUM, 1996; GRAIN, 2004; Oxfam, 2006; Via Campesina, 2006; ETC Group,

2008). Similarly, UNFCCC also involves developed and developing countries in international climate change efforts. Nevertheless, the negotiations pursued under the Convention are constantly plagued by great inequalities in the participation of various actors and in the representation of their different socio-economic interests, bargaining power usually being in the hands of industrialized nations (Roberts and Parks, 2006; Friman and Linnér, 2008). While the IPCC's agenda is restricted to assessing global scientific and socio-economic information for the purpose of the negotiation process, the Panel is indirectly prescriptive in advocating different climate change policies and affecting the political conduct of member countries (Elliott, 2004; Axelrod et al., 2005). Thus, IPCC plays a prominent role in climate change negotiations as a consultative scientific body, and policy makers rely greatly on the facts and related policy implications its researchers provide; nevertheless, the Panel has been critically scrutinized for also perpetuating the gaps between developed and developing nations (Kandlikar and Sagar, 1999; Biermann, 2001; Agarwal, 2002).

The paper is structured as follows. In section 2, I begin by briefly presenting my theoretical approach. In section 3, I explain the data collection process and examine methodological aspects of the analysis. Section 4 consists of three subsections in which I discuss the findings grouped according to separate framing blocks. Finally, I lay out my conclusions in section 5.

2. World-economy as a theoretical lens

According to the main theoretical assumptions of the heterogeneous world-systems approach (Wallerstein, 1979, 1984, 2004), the modern world-system is a world-economy that “gives priority to the endless accumulation of capital” and whose structure is unified by “the division of labour which is constituted within it” (Wallerstein, 2004, pp. 23-24). The *world-economy* (WE) perspective is used here as a theoretical lens through which I critically analyse how

selected international bodies frame the role of biomass energy in developing countries, with a special focus on Brazil – the country most frequently mentioned by IOs in the bioenergy debate. WE analysis is used here because it is a useful tool for exposing power structures and other forms of domination imposed and reinforced by various actors in global institutional arenas.

The main assumption of the world-economy system is that its structure is built on a capitalist, market-based production economy aiming to maximize profits and accumulate capital (Hopkins and Wallerstein, 1982; Wallerstein, 1979, 1984, 2004). Due to inequalities caused by asymmetric exchange of raw materials, goods, and services between different regions of the world-economy, particular states constitute a strong and developed core, whereas weak and underdeveloped nations find themselves on the periphery. In this dichotomy, only a narrow group of countries that have attained great wealth and industrialization is considered the powerful core, whereas the majority of developing countries find themselves in the periphery (Hopkins and Wallerstein, 1982; Wallerstein, 1979, 1984).

However, the layered structure of the world-economy has an additional circle situated between the core and the periphery. According to Immanuel Wallerstein, “the middle stratum is both exploited and exploiter” (Wallerstein, 1974, p. 405). The so-called semi-peripheral countries of this stratum are in the most difficult position “because, under ... pressure from core states and putting pressure on peripheral states, their major concern is to keep themselves from slipping into the periphery and to do what they can to advance themselves toward the core” (Wallerstein, 2004, p. 28). Moreover, as Grant and Lyons elaborate, “this middle zone is one to which peripheral states can aspire, and it can insulate former core states from descending into periphery status” (Grant and Lyons, 1990, p. 125). The semi-periphery is a significant element of the world-economy because it is both a battleground of the two

opposing layers of the three-stratum hierarchy and simultaneously a stabilizing factor allowing the capitalist system to persist (Hopkins and Wallerstein, 1982; Martin, 1990; Wallerstein, 1976). Based on Wallerstein's assumptions, Brazil is a semi-peripheral developing country with strong trading routes directed to peripheral regions, "but that also regularly relate to the core zones as importers of more 'advanced' products" (Wallerstein, 2004, p. 30; see also: Wallerstein, 1979, 1984).

Central to the world-economy concept is the unequal exchange of raw materials, goods, and services, which results in surplus value being extracted from the peripheral regions and transferred to the core (Hopkins and Wallerstein, 1982; Wallerstein, 1984, 2004). In this paper, I focus on two dynamics of this phenomenon: unequal energy exchange (Hornborg, 2001; Podobnik, 2002) and unequal ecological exchange (Lawrence, 2009; Roberts and Parks, 2006). While both concepts can be considered as two sides of the same coin, the distinction is made in order to emphasize that particularly appropriation of energy plays a crucial factor to determine capital accumulation in the WE. Since capital accumulation, understood here as economic growth achieved through technological development, cannot continue without appropriately increasing the amount of energy consumption (Hornborg, 1998), the main rationale of the world-economy is international trade that transfers energy and other resources from developing, peripheral regions to the industrialized core where the accumulation takes place (Hornborg, 2001). In this unequal energy exchange embedded in the capitalist WE, core states – with their industrially intensive economies and advanced technologies – have access to energy sources, control them, and in turn consume more energy than do (semi)peripheral countries, which are forced to use less efficient energy carriers and less-sophisticated technologies to meet their needs (Podobnik, 2002).

Based on the assumption of unequal exchange embedded in the world-economy, peripheral regions export to core countries large amounts of cheap raw materials and products

that are priced to exclude the external environmental costs of extraction, processing, and transport. Consequently, environmental impacts are distributed asymmetrically between the system's layers. In other words, different "biophysical metabolisms" of poor and rich nations shape the global distribution of environmental damage (Roberts and Parks, 2006, p. 164). According to Joan Martinez-Alier (2007), it is because capital accumulation requires not only technological change and labour exploitation, but, more significantly, claims "more and more materials and energy, produces more and more waste, and thus undermines not only its own conditions of production but the conditions of existence of peripheral peoples" (p. 234). This unequal ecological exchange between poor and rich nations has also an inverse image expressed through the problem of environmental justice in global efforts to mitigate climate change. Core countries emit more carbon dioxide than do (semi)peripheral ones (Bartley and Bergesen, 1997; Burns et al., 1997; Lawrence, 2009), raising the question of responsibility for socially distributed ecological risks (Hornborg, 1998, p. 128). Thus, this highly contested issue is one of the most disputed topics in international climate change negotiations (Roberts and Parks, 2006).

These two manifestations of the world-economy in the form of energy and ecological inequalities, as well as Brazil's specific position as a semi-peripheral country, give important leverage to issues that might otherwise be concealed. Therefore, these theoretical perspectives are applied to the findings to provide more persuasive insight into the bioenergy debate as pursued by the selected international organizations.

3. Data and frame analysis

Empirical data spanning the 15 years from 1994 to 2009 were collected from the websites and online databases of FAO (<http://www.fao.org>), IEA (<http://www.iea.org>), IEA Bioenergy (<http://www.ieabioenergy.com>), IPCC (<http://www.ipcc.ch>), and UNFCCC (<http://unfccc.int>)

based on the following search terms: “agrofuel”, “agroenergy”, “biofuel”, “bioenergy”, “biomass energy”, “biomass fuel”, “biodiesel”, “biogas”, “ethanol” and “energy crop”, “first-generation”, and “second-generation”. The scope of research was not limited to a particular type of biomass energy, because doing so would convey a partial image of the framings provided by selected international organizations. This delimitation of the analysis made it possible to scrutinize IOs’ documents from different perspectives, not necessarily focusing on a single aspect of bioenergy production and use. It is important to note that, while IEA and FAO have produced a substantial range of material on biomass energy, there is a lack of significant empirical data from UNFCCC; however, this lack has been compensated for by scientific assessments from IPCC, which in recent years has been increasingly active in discussing biomass energy.

However, my research is not primarily focused on how the organizations construct and frame biomass energy itself, but on how they construct and frame the biofuel debate in the context of developing countries, with an emphasis on Brazil. Thus, after pre-selecting the data sources, the second selection step entailed further scanning and analysing of the material, narrowing the pre-study scope, to extract fragments discussing bioenergy in connection with the following search terms: “Africa”, “Asia”, “Latin America”, “South America”, “Sub-Saharan Africa”; “Brazil”, “sugar-cane”, “ethanol”, “developing”, “underdeveloped”, “poor”, “warm”, “tropical”, “Southern”, “peripheral”, and “non-OECD”. Before applying the WE theoretical lens, the texts chosen in the second selection were subjected to a comparative frame analysis of horizontally linked institutions.

Since international organizations determine the outcomes of their members’ behaviours translated into various socio-economic strategies and policy choices (Young, 2002), it is of special interest to examine how FAO, IEA, and UNFCCC plus IPCC promote different concepts of biomass energy depending on the particular region, supply/demand, use, and

destination. Frame analysis (Goffman, 1974; Fisher, 1997; Klotz and Lynch, 2007) is the methodological approach that lets us concentrate on how the selected institutions construct meanings, understood here not only as bundles of new ideas, concepts, and norms but, more significantly, as sources of influence, impact, and even pressure channelled through these international bodies from particular groups of member countries toward others in order to gain advantage or sustain a powerful position. By analysing the content of selected documents, I noted similarities and differences between particular words, terms, and expressions that revealed characteristic, repeatable patterns. The templates exposed in the texts of one organization were further scanned for potential overlapping with the content of texts from other selected institutions, and so on.

4. The double role of biomass energy in developing countries and the case of Brazil

By applying frame analysis, I identified three distinct but interlinked *framing themes* that the scrutinized international organizations promote in a similar fashion. First, the international organizations suggest that there is a need to switch from traditional to so-called modern commercial biomass energy in poor regions of the world. Second, the IOs also advocate setting up an international biofuel market with production located in the developing world, mostly to satisfy the energy demand of developed nations. Third, the given institutions cite Brazil as a special case: a biofuel production pioneer and a role model for other developing countries. These three framing themes were identified in the empirical data and are discussed below.

4.1. Traditional versus modern biomass energy

FAO, IEA, and IPCC all report that biomass – mostly in the form of fuelwood, charcoal, or dung – burned for household needs is and will probably continue to be a significant source of

energy in developing countries, particularly in rural areas of Africa, Asia, and Latin America (FAO, 2001, 2005, 2006, 2007a, 2008a, 2008b, 2008d, 2008f, 2009a; FAO/GBEP, 2007, 2008; IEA, 1994, 1997, 1998a, 1998b, 1999, 2000, 2001, 2002, 2004c, 2005; IPCC, 2001a, 2001b, 2007a, 2007b).

While discussing biomass use for heating and cooking in poorer regions of the world, the three organizations equally refer to such activities as traditional (FAO, 2005, 2006, 2007b, p. 43; 2008b, p. 4; 2008f, p. 4; 2009a; FAO/GBEP, 2007; p. 1; 2008, p. 2; IEA, 1994, 1998b, p. 198; 2001, p. 327; 2002, pp. 33, 366–367, 369, 386; 2004c, pp. 62, 227; 2005, p. 86; 2006b, p. 46; 2007, pp. 104–105; IPCC, 2001b, p. 245; 2007b, pp. 253–254, 276, 417, 679, 725). Furthermore, the IOs perceive traditional biomass energy used for household purposes in a strikingly negative light, describing it pejoratively as inefficient, unhealthy, unsustainable, environmentally harmful, non-commercial (thus non-profitable), and causing socio-economic underdevelopment (Domac et al., 2005a, pp. 8–9; Domac et al., 2005b, p. 6; FAO, 2005, 2006, pp. 14, 17, 28–29; 2007b, p. 43; 2008a, p. 1; FAO/GBEP, 2008, p. 39; IEA, 1997, p. 271; 1998a, pp. 269, 295–296; 2001, p. 327; 2002, pp. 366–367, 369; 2004c, p. 226; 2005, p. 86; 2006b, p. 46; IPCC, 2001a, p. 388; 2001b, pp. 243, 374; 2007a, pp. 419, 442, 449; 2007b, pp. 397, 417; Jürgens et al., 2004, pp. 48, 50–52).

FAO regards traditional biomass use as harming the environment and aggravating poverty (FAO, 2006; FAO/GBEP, 2008) and as causing “indoor air pollution which counts among the major causes of ill-health and death in developing countries, and the large time commitment needed ... for collecting and transporting wood” (FAO/GBEP, 2007, p. 39). In its 2002 World Energy Outlook, IEA states that “the extensive use of biomass in traditional and inefficient ways and the limited availability of modern fuels are manifestations of poverty” (IEA, 2002, p. 366). Furthermore, traditional biomass uses not only restrain economic and social development, but also result in ecological damage, scarcity of local supplies, and reduced

agricultural productivity (IEA, 2002, pp. 366–367). In the IPCC’s view based on its assessment of scientific research, the use of traditional biomass fuels for cooking and heating in developing countries “remains significant, which has added to deforestation and environmental destruction in some places but not others” (IPCC, 2001a, p. 388). In its AR4 report, the Panel states that traditional biomass energy has “low combustion efficiency and a significant, but unknown, portion is harvested non-renewably, thus contributing to net carbon emissions” (IPCC, 2007a, p. 419).

On the other hand, FAO, IEA, and IPCC equally and strongly suggest that traditional bioenergy use in developing countries has to be replaced with modern types of bioenergy use (Domac et al., 2005a, pp. 8–9; 2005b, p. 6; FAO, 2005, 2006, 2009a; FAO/GBEP, 2008, pp. 22, 39; IEA, 1997, p. 57; 1998a, pp. 269, 295–296, 2004c; 2006b, p. 46; 2007, pp. 104–105; IPCC, 1995c, p. 10; 2001b, pp. 243, 245; 2007b, pp. 253–254, 522). Simultaneously, modern biomass energy is depicted by the organizations as clearly antithetical to traditional types. According to the IOs, modern bioenergy use reduces fossil fuel dependency and is clean, healthy, renewable, sustainable, environmentally friendly with near zero net carbon emissions, commercializable (thus profit yielding), competitive, and socio-economically beneficial (Domac et al., 2005a, pp. 8–9; Domac et al., 2005b, p. 6; FAO, 2005, 2006, pp. 28–29, 43; 2007c, pp. 3, 6; 2008a, p. 5; 2008f, pp. 14, 26; FAO/GBEP, 2008, p. 39; IEA, 2001, pp. 327–328; 2004c, pp. 226–227; IPCC, 1995b, p. 12; 1995c, pp. 10, 13; 2001b, pp. 243, 245, 376; 2007b, pp. 371, 725, 729).

A myriad of benefits is cited by the selected institutions. For example, various FAO documents describe modern biomass energy as a critical contributor to the Millennium Development Goals, including economic development, eradication of poverty and hunger, improvements in health and education, gender equality, and the revitalization of rural economies (FAO, 2005, 2006, pp. 28–29; 2007a, 2009b, p. 5; FAO/GDEP, 2008, pp. 22, 39).

Moreover, FAO states that burning biomass using modern technologies may reduce emissions of pollutants relative to those emitted by fossil fuel use, thus contributing to climate change mitigation efforts (FAO, 2006, p. 43; 2008f, p. 26) and providing “alternatives to expensive, imported fossil fuels” (FAO, 2006, p. 29). According to the IEA paper prepared for Bioenergy Task 29, modern bioenergy is the most promising renewable energy for developing countries “as its mobilization can provide large employment generation schemes, can be linked to ecosystem conservation, and even rehabilitation; furthermore, investments in biomass energy can be an effective tool to combat desertification, can have a significant impact on global climate change and can become a valuable tool in promoting gender equity within the associated natural resources management activities” (Domac et al., 2005b, p. 6). For IPCC, implementing modern bioenergy applications in developing countries leads to better and more efficient resource use and thus helps prevent emissions (IPCC, 1995a, p. 12; 2001b, p. 245). Furthermore, in its 2007 report, the Panel concludes that “rural areas of developing countries rely primarily on traditional bioenergy and consume comparatively small amounts of fossil fuels”, suggesting that “the use of improved cook stoves is one way to reduce biomass and fossil fuel use” (IPCC, 2007b, p. 725).

Interestingly, this juxtaposition of traditional versus modern and the push to switch from one type of biomass energy to another in the periphery coincides with organizations’ awareness that economic and population growth in the periphery increases urbanization and per capita incomes, forcing developing countries to use more efficient conventional energy carriers, in particular a growing amount of fossil fuels (FAO, 2006, p. 13; 2008d; IEA, 1994, 1997, p. 23; 1998a, 2001, p. 307; 2002, p. 297; 2004c, pp. 225, 227; IPCC, 2001b, p. 188; 2007b, pp. 251–322). What FAO, IEA, and IPCC do not explicitly mention or discuss in their documents is that the more hydrocarbons the periphery uses, the less will be left for the core

(effectively limiting its control over these resources), whose energy demand is growing as well (Podobnik, 2006; Simmons, 2005; Smil 2008).

The question is whether the suggested switch from traditional to modern bioenergy in developing countries has more to do with rural development, reducing oil dependency, environmental protection, sustainability, and climate change mitigation in the periphery, or with the core's desire for energy security and energy control and with perpetuating an energy inequality pattern that restricts economic growth in poor regions of the world. According to FAO, "wood, dung and other biomass fuel are the lowest rungs on the energy ladder" and "charcoal, coal and kerosene represent higher steps" (FAO, 2006, p. 13). However, the greater the periphery's ambitions to climb the energy ladder, the more difficult modern fuels are to procure. Distributing improved cook-stoves in the rural regions of developing countries could lower indoor pollution and attendant health risks as well as slightly improve the efficiency of energy use. However, the extent to which poor populations can develop thanks to such improvements could be considered limited.

Though the international organizations suggest that developing countries switch from traditional to modern biomass use to realize the Millennium Development Goals, alleviate poverty, create jobs, etc., the questions remain to what extent could modern use of what is essentially a traditional biomass base allow these countries to develop and what economic growth would be achieved by such use. Moreover, more advanced methods of extracting energy from biomass are often too expensive for people in peripheral regions, usually requiring the transfer of advanced technology and know-how as well as substantial investments from the industrialized core (FAO, 2006, p. 2; 2007c, 2007d, 2008d, pp. 45–46; IEA, 2002, 2007, 2008, p. 78; IPCC, 2001b, p. 376; 2007b, pp. 344, 365–366), keeping the periphery further in dependency. Arguably, traditional and modern biomass energy uses in the periphery, although depicted as antithetical by the organizations, actually represent two sides

of a coin that, from the WE perspective, is manifested in the form of an unequal energy exchange (Hornborg, 1998; Hornborg, 2001; Podobnik, 2002, 2006). It is this unequal exchange that maintains the core's industrial development, while peripheral regions are given a narrow choice subordinated to the core's advanced technology and substantial investments. Furthermore, the IOs' framing of the switch from traditional to modern biomass use in developing countries is also a manifestation of inverted unequal ecological exchange: carbon intensity in the industrialized nations (Burns et al., 1997; Roberts and Parks, 2006; Lawrence, 2009) mirrors energy use intensity, whereas developing countries – currently not required by the Kyoto Protocol (KP) to offset their carbon emissions – are nonetheless strongly encouraged to switch to biomass fuels used in a “modernized” way.

These two parallel issues are invoked by IEA's explicit position on the subject. The agency suggests that policies must be put in place to ensure bioenergy's “full contribution to socio-economic development as a modern fuel” (IEA, 1998a, p. 312). Why, one may ask? Because biomass is not a transitional energy source but one that will stay with us forever, particularly in developing countries (IEA, 1998a, p. 312; 2002, p. 33; 2006b, p. 46), “unless there are drastic changes in the world energy trading patterns” (IEA, 1997, p. 58; see also: IEA, 2006b, p. 46). In other words, the inequalities embedded in the global energy market are projected to stay in favour of the core, while the choice of energy source in peripheral regions is reduced to *modern* biomass organized and controlled according to world-economy market rules.

4.2. *International biofuels trade*

The international organizations' framing of the issue reveals a specific modification or rather continuation of the recent construction of bioenergy's future as starting with a switch from traditional to modern biomass systems in developing countries, in the interest of establishing a

global bioenergy market scheme. The IOs equally observe that the domestic production of transport biofuels in the core has been rapidly attracting interest and will increase in significance due to high crude oil prices and carbon offsetting requirements under the Kyoto Protocol (FAO, 2007c, 2007d, 2008f; IEA, 2004a, 2004b, 2006b; IPCC, 2001b, pp. 159–160; 2007b, pp. 209–211, 304–305; OECD/FAO, 2008, 2009). However, meeting the high energy demand in the core, particularly for transportation, calls for large areas of available and cheap cultivable land (IEA, 2004c, p. 404; IPCC, 2001b, p. 157). This realization prompted the idea of creating an international biofuel market with export areas located in the periphery (FAO, 2004, 2007c, 2008a, 2008b 2008d, 2008f, 2009b; FAO/GBEP, 2007, 2008; FAO/IIED, 2008; Heinimö et al., 2007; IEA, 2004a, 2004b, 2004c, 2006b, 2007; IPCC, 2001b, 2007b; Müller et al., 2007; OECD/FAO, 2009; Walter et al., 2007).

According to an FAO report, “an internationally agreed approach is also indicated, as demand for biofuels is concentrated in developed countries and the supply potential lies primarily in developing countries” (FAO, 2008a, p. 10). IEA bluntly suggests that “since both greenhouse gas emissions and oil import dependence are essentially global problems, it makes sense to look at these problems from an international perspective”; therefore, developed countries “could invest in biofuels production in countries that can produce them more cheaply, if the benefits in terms of oil use and greenhouse gas emissions reductions are superior to what could be achieved domestically” (IEA, 2004a, p. 22). For IPCC, the main focus is reducing the cost of climate change abatement. Since biofuels – considered low-carbon energy – are common options in all future mitigation scenarios, “a high potential supply of biomass energy would ameliorate the burden of carbon emission reductions” (IPCC, 2001b, p. 160). The required amount of biomass could be produced in parts of Africa and South America that, according to the Panel, “may develop into important biofuel exporters” (IPCC, 2001b, p. 158).

The peripheral regions that are generally mentioned in the context of expanding potential biofuel production for export are Africa, Asia, Caribbean, Eastern Europe, Latin America, and Oceania (FAO, 2008b, p. 15; 2008f, 2009b, p. 2; FAO/IIED, 2008, p. 22; Heinimö et al., 2007, p. 12; IEA, 2004a, 2006b, pp. 397, 413; IPCC, 2001b, pp. 157–158; 2007b, pp. 342, 511, 629; Müller et al., 2007; OECD/FAO, 2009; Walter et al., 2007). However, the warm, tropical and subtropical regions of Africa, Asia, and Latin America are particularly emphasized. Moreover, since the focus is especially on biofuels' cost-effectiveness, the organizations suggest that producing feedstocks for liquid biofuels in such peripheral regions would be cheaper, often attributing this to climatic conditions that favour effective biomass cultivation and to the greater availability of cheap land and low-cost farm labour (FAO, 2007c, p. 1; 2008b, p. 15; 2008f, p. 79; 2009b, p. 2; FAO/GBEP, 2008, p. 53; FAO/IIED, 2008, p. 22; Heinimö et al., 2007, p. 7; IEA, 2004a, 2004b, p. 11; 2006b, p. 33; IPCC, 2001b, p. 160; 2007b, pp. 209, 511, 519–520; Walter et al., 2007, pp. 8–9).

For example, FAO states that “in the long-term, tropical countries will likely play an increasingly important role in feedstock production, due to favourable biophysical conditions and generally lower costs of land and labour, so long as suitable trade agreements and stable conditions for investment prevail” (FAO, 2008b, p. 15; FAO/IIED, 2008, p. 22). In another report, FAO suggests that “several developing countries – with land to devote to biomass production, a favourable climate to grow them and low-cost farm labour – are well placed to become efficient producers” (FAO/GBEP, 2008, p. 53). According to the paper prepared for IEA Bioenergy Task 40, “developing countries have a reasonable good potential for biofuels production due to the availability of land, better weather conditions and the availability of cheaper labour force” (Walter et al., 2007, pp. 8–9). IPCC is not as explicit on the matter as are the other two organizations. However, when looking for ways to meet the biofuel demands outlined in its climate change mitigation scenarios, the Panel points out that cost

reduction is possible by linking the introduction of non-carbon technologies in the core with biofuel exports from the periphery (IPCC, 2001b, p. 158; 2007b, pp. 326, 365–366, 511, 629).

Interestingly, although the selected international organizations emphasize that it would benefit the core to produce cheap biofuels in the periphery, this potential global biofuel market scheme, with export centres located in the periphery, is framed as gainful for developing countries as well (Cohen et al., 2008; FAO, 2007c, 2007d, 2008a, 2008c, 2008d, 2008f, 2009b; FAO/GBEP, 2007, 2008; IEA, 2004a, 2006b, 2007, 2008; IEA Bioenergy, 2008; IPCC, 2007b; Müller et al., 2007; Walter et al., 2007). In other words, the IOs imply that the core has problems (i.e., oil dependency and climate change mitigation) it wants to solve cheaply, and that by getting involved in solving these problems cheaply, the periphery could benefit as well. FAO assumes that “developing countries in particular have much to gain from increased global demand for biofuels if they can diversify their agricultural output with energy crops, especially if they can grow feedstocks that may be used for both food and fuel markets” (FAO, 2007c, p. 18; 2007d, p. 22). Moreover, FAO suggests that “the emergence of biofuels as a major new source of demand for agricultural commodities could thus help revitalize agriculture in developing countries, with potentially positive implications for economic growth, poverty reduction and food security” (FAO, 2008f, p. 79). This new stimulus coming from the core will, according to IEA Bioenergy, “offer development opportunities for countries with significant agricultural resources” (Müller et al., 2007, p. 15). Thus, biofuel production in the periphery can have a positive impact on rural development and rural labour employment (IEA, 2004a, p. 99; IEA Bioenergy, 2008, p. 11; Müller et al., 2007, pp. 7, 15). According to IPCC, “non-mitigating countries producing low-carbon or alternative fuels will see an increase in demand and prices, with potentially positive effects on the markets for bioenergy” (IPCC, 2007b, p. 667), whereas “increased production of biofuels

for transportation, or energy production in rural areas is expected to protect existing employment and to create jobs in rural areas” (IPCC, 2007b, pp. 730–731).

However, there is one major inconsistency in how the three IOs frame biofuel production for export in developing countries. Looking at the issue from the world-economy perspective, the concern is whether the cheap production of biofuels for the rich core can actually benefit poor farmers in the periphery. Since the main consideration of the capitalist world-economy is realizing maximum profit, it is difficult to run such a designed system on expensive energy sources. Cheap fuels are essential, and these could include biofuels if they can compete with crude oil in price. Similarly, for the world-economy to mitigate climate change while maintaining profit accumulation, the various alternative energy options must be cost-effective. Economic growth and technological development are therefore matters of energy availability, which is in turn a matter of price (Hornborg, 1998, p. 132). To keep its dominant position in the WE system, the core requires the ongoing flow of cheap energy extracted from regions where fuels can be produced with low-cost inputs. While developed countries might benefit from acquiring additional cheap energy that could also lower the cost of climate change abatement, poor rural populations in developing countries would scarcely benefit from such an unequal exchange.

This would not only be a manifestation of unequal energy exchange. The fact that developed nations want to fix their carbon emission problem as cheaply as possible by cost-effectively exploiting the land and biomass resources of the periphery can be considered an unequal *ecological* exchange having negative environmental consequences in the periphery (Roberts and Parks, 2006; Martinez-Alier, 2007). Whereas developing regions have little choice but to be exploited and potentially exhausted of their natural resources, including biodiversity, land, and water, the industrialized nations are to improve their environmental

performance in the form of greenhouse gas reductions achieved within their own borders (Giljum and Eisenmenger, 2004).

Additionally, meeting the high energy demand in industrialized nations – particularly in their transportation sectors – requires extracting energy not only cheaply but also in substantial amounts, so large-scale production processes must be implemented. While FAO and IEA in particular suggest that small-holder farmers of developing regions could benefit by switching to energy crop production, cost-effectiveness would tend to require the large-scale use of rural regions. This would result in the capitalization of agriculture, manifesting itself in concentrated land ownership and production and in increased mechanization that would limit rather than expand employment opportunities (Hopkins and Wallerstein, 1982). Finally, biofuel demand in the developed world could push developing countries into a situation in which profit determines the importance of producing energy crops over food. Whereas unimproved and undercapitalized rural production in peripheral countries must meet the growing food demand of their populations, the institutions are directing the core's investment interest to producing biomass for energy, justifying this as fostering an agricultural *renaissance* in poor regions.

It is worth noting here that among the scrutinized international organizations, FAO and IEA postulate changes in international trade, to be made through the core-dominated World Trade Organization, that would allow opening domestic bioenergy markets in the developed world to biofuels produced in the periphery (IEA, 2004a, p. 18; 2006b, pp. 397, 416–417; FAO, 2007c, 2007d, 2008a, pp. 3, 12; 2008c, 2008f, 2009b, p. 9; FAO/GBEP, 2008, p. 62; Walter et al., 2007, p. 62). For example, IEA states that trade barriers “are restricting access in many industrialized countries to imported biofuels, which is holding back the growth of the industry in countries with the lowest production costs” (IEA, 2006b, p. 397). FAO believes that “a reduction of trade barriers would not only facilitate more efficient and sustainable

production patterns in both economic and energetic terms, it would eventually produce welfare gains in both developing and developed countries” (FAO, 2008a, p. 12). Most interestingly, however, in another document from the same year, FAO suggests that the removal of tariffs and subsidies in developed countries would lead to a decline in global liquid biofuel production and consumption (FAO, 2008f, pp. 51–52), while IPCC briefly notes that the benefits of the large-scale production of modern bioenergy crops “will not necessarily flow to the rural populations that need them most” (IPCC, 2007b, p. 522).

4.3. The case of Brazil as a role model of biofuel production for export

One developing country, in the view of the selected international organizations, stands out as a “self-made” success story and role model for peripheral regions. Semi-peripheral Brazil plays a particularly important role in the IOs’ discussion of biomass energy. The Brazilian sugarcane ethanol production programme, together with its historical development, present success, and future potential, are notably described and commented on in the documents of the selected organizations (FAO, 2006, 2007c, 2008b, 2008c, 2008f; FAO/GBEP, 2007, 2008; FAO/IIED, 2008; IEA, 1998a, 1999, 2000, 2001, 2002, 2004a, 2004c, 2006a, 2006b, 2008; IEA Bioenergy, 2004a, 2004b, 2008; IPCC, 2001b, pp. 85, 147; 2007a, p. 769; 2007b, pp. 326, 341, 344, 371; Müller et al., 2007; OECD/FAO, 2007, 2008, 2009). Moreover, the institutions equally describe the development of the Brazilian ethanol market as a significant success achieved thanks to such advantages as: favourable government policies and industry incentives, opportunities for large-scale production, efficient technology, propitious world sugar market conditions and high crude oil prices, favourable climatic conditions, as well as low land, feedstock, and labour costs (FAO, 2006, p. 19; 2008b, p. 5; 2008c, pp. 4–5; 2008f, pp. 24–25; FAO/GBEP, 2008, pp. 64–70; IEA, 2000, p. 222; 2001, p. 324; 2004c, p. 242; 2006b, pp. 400–401; 2008, pp. 19–20; IPCC, 2001b, pp. 100, 197; 2007b, pp. 326, 371, 341).

In the organizations' description of biofuel production in Brazil, sugarcane ethanol is framed as an alternative fuel that has reduced both domestic oil imports and oil dependency (FAO, 2008f, p. 26; FAO/GBEP, 2008, p. 67; IEA, 1998a, pp. 87, 269, 296; 2004c, p. 394; 2000, p. 222; 2006b, pp. 400–401; IEA, 2007, p. 155; IPCCb, p. 85). Moreover, the IOs consider Brazilian ethanol as a renewable technology that is capable not only of significantly reducing greenhouse gas emissions, but of providing other positive environmental impacts as well (FAO, 2009b, p. 2; FAO/GBEP, 2008, pp. 38, 69; IEA, 1998a, p. 87; 2004a, pp. 38, 94; IPCC, 2001b, p. 100; 2007a, p. 769; 2007b, pp. 272, 344; Jürgens et al., 2004, p. 50). Additionally, sugarcane ethanol production in Brazil is praised for its commercial viability, energy efficiency, job creation ability, cost-effectiveness, lack of need for subsidy, and competitiveness with crude oil prices (FAO, 2008a, p. 3; 2008e, p. 8; 2008f, p. 7; 2009b, p. 2; FAO/GBEP, 2008, pp. 38–40, 69; IEA, 1998a, p. 87; 2004a, 2006b, pp. 44, 405; 2008, pp. 19–20, 28; IPCC, 2001b, p. 85; 2007b, p. 314; Müller, 2007, p. 2; OECD/FAO, 2009, pp. 21–22).

Interestingly, since the international organizations regard sugar cane ethanol as Brazil's well calculated achievement, the country is not seen as a significant role model when the institutions debate the switch from traditional to modern biomass energy in developing countries. On the contrary, as FAO actually reports that “energy crops produced in Brazil are mainly used as fuel for transportation”, and that “many rural areas still rely on traditional biomass products in order to cover their energy needs, thus modern renewable energy sources are still not available for the rural population” (FAO, 2006, p. 19). Brazilian ethanol is described by the IOs primarily as an example of biofuel production for the transportation sector (FAO, 2006, p. 19; FAO, 2008f; FAO/GBEP, 2007, 2008; IEA, 2002, pp. 312–313; 2004a, 2004c, p. 394; 2006b, p. 44; IPCC, 2001b, pp. 85, 197; 2007b, pp. 326, 344, 371, 522), additionally framing the country's biomass fuel as a model for potential exports and for the

expansion, liberalization, and standardization of international biofuel trade (FAO, 2008f; FAO/GBEP, 2008; IEA, 2004a, 2006b; IEA Bioenergy, 2008; IPCC, 2007a, p. 769; 2007b, p. 522).

Nevertheless, it has been suggested that Brazilian ethanol production could serve as a model for other developing countries. For example, IEA states that sugar cane ethanol “is already being successfully produced in several African and South American countries based on the Brazilian model” (IEA, 2008, p. 14). According to FAO, biofuel production in developing countries is set up and expanding rapidly, “following the lead of Brazil’s already well-established industry” (FAO/IIED, 2008, p. 11). IPCC regards Brazilian ethanol as a business and industry model of biofuel production that could play an important role in addressing greenhouse gas emissions in the transportation sector (IPCC, 2007b, p. 344). Moreover, the Panel states that the “large-scale production of modern bioenergy crops, partly for export, could generate income and employment for rural regions of world” and further cites Brazilian biofuel production as exemplifying that “major socioeconomic benefits can be achieved” (IPCC, 2007b, p. 522)

Scrutinizing the organizations’ framing of Brazil through my theoretical lens, I observe that this semi-peripheral country is playing an ambivalent role, to repeat Wallerstein’s words, being exploited by the core and while exploiting the periphery (Wallerstein, 1974, p. 405). On one hand, Brazil is the only developing country that has managed to achieve high-level production of cheap biofuel (FAO, 2008f, p. 6; 2009b, p. 2). Struggling between upward and downward mobility, Brazil looks for an innovative economic activity that could help the country move up the ladder, not only within the middle stratum but also beyond it, thus advancing itself to the core. However, as Wallerstein points out, “the problem of breakthrough for a semi-peripheral country is that it must have a market available large enough to justify an advanced technology, for which it must produce at a lower cost than

existing producers” (Wallerstein, 1979, pp. 84–85). So far, it can be concluded that Brazil has achieved these objectives by creating and enlarging its domestic ethanol market not only due to conducive natural conditions, but mostly thanks to various state-driven controls and incentives. However, based on my analysis of how the selected institutions frame Brazil’s role in biofuel production, I argue that the country’s specialization in cheap sugarcane ethanol production reached international “breakthrough” only after substantial attention from the core, since such a production pattern and location suits the current needs of industrialized nations trying to deal cost-effectively with their oil-dependency and climate change concerns. Thus, the IOs’ advocacy of the Brazilian biofuel production model is not so much about the innovative success that could help this semi-peripheral country advance in the world-economy system, but rather reflects simply another adjustment to the core’s requirements.

On the other hand, the selected institutions cite and discuss the Brazilian model extensively, and not just because it so perfectly serves as a conceptual niche for the cheap alternative fuel and cost-effective mitigation option. Most importantly, this particular template serves as a potential driving force in developing an international biofuel trade that would direct the flow of low-cost energy from poor to industrialized nations. Thus, if the core requires a global biofuel market with cheap biomass production concentrated in the developing world, there is a need to transfer a “successful” biofuel production pattern to the peripheral regions to tempt them to follow the trend. However, my claim here is that, apart from its own motives and ambitions, Brazil’s achievement is deliberately framed by the selected international organizations as an example for other developing countries. These countries will not necessarily benefit from exporting biofuels on the international market, especially if they are situated in a lower stratum of the world-economy system and lack the financial and technological means to pursue large-scale production patterns.

For peripheral regions being “hooked” by the Brazilian model and pulled into the global scheme of biofuel production intended for exports to the core, this developmental path could entail three problems. First, it would require putting more pressure on poor rural areas even though, as Wallerstein points out, developing countries “have been undertaking to produce a larger and larger food surplus on land which has been unimproved by technology, and this process has led to massive erosion on a world scale” (Wallerstein, 1979, p. 128). Second, the promise of revitalized agriculture through biofuel production in the periphery would be highly dependent on external resources from either semi-peripheral Brazil or core producers providing know-how, technology, and investment. However, this suggests that feedstock production and biomass processing would not be entirely controlled by the peripheral countries, but that control and ownership would be concentrated outside their borders. Finally, Brazil is a developing country where resource extraction is growing faster than GDP (Giljum and Eisenmenger, 2004), reflecting the world-economy assumption that international trade is instrumentally used by industrialized nations to ensure access to natural resources from developing countries, which are further pushed deeper into poverty in the lower stratum of the system.

5. Conclusions

Since bioenergy is advocated as a solution to the problems of energy security, agricultural development, and climate change, it should come as no surprise that fuel production from biomass is a topic eagerly discussed by organizations that include these three issues in their agendas. However, what is most interesting in light of the findings presented here is that the selected international institutions frame the potential role of developing countries in a similar way, at the same time instrumentally using semi-peripheral Brazil as a decoy. Any potential differences between these conceptualizations result from the organizations’ tendency to twist

these similar bioenergy framings to fit their own specific agendas that define particular long-term objectives. Nevertheless, based on the assumption of the WE theoretical perspective, these institutions' framings indicate that current challenges (such as decarbonization and defossilization) in the socio-economic structures of core countries are prompting corresponding changes in the periphery, which might permit further exploitation of poor regions rather than providing them benefits.

Moreover, the analysis also demonstrated that these particular framings do not tend to form simply a loose patchwork of various concepts and suggestions attached to specific institutional agendas. Rather, they constitute an explicitly uniform ensemble channelled through the international organizations by a specific group of countries. The IOs' internal contradictions regarding cost-effectiveness of bioenergy production in the developing world versus economic opportunities for producers in developing countries is a striking example of the uniform argumentation that is fundamental to maintaining unequal energy and ecological exchange. It becomes evident that the selected international bodies advocate global policies that have in fact been framed mainly on the basis of the core's requirements, only temporarily creating socio-economic niches for semi-peripheral nations such as Brazil, while imposing restrictive long-term options on the peripheral regions. Thus, the IOs' conceptualization of the (semi)periphery's role in global bioenergy production reflects a continuation of the status quo embedded in the capitalist world-economy. The question remains whether it is more important or reasonable for developing countries to change themselves to adjust to the suggested models or to pursue changes in the international institutions that conceptualize them.

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