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EMERGING ISSUES IN BIOFUEL POLICIES AND GOVERNANCE PROCESSES: THE CASE OF UNITED STATES RENEWABLE FUEL STANDARD [U.S. RFS], AND THE EUROPEAN UNION RENEWABLE ENERGY DIRECTIVE [EU-RED]

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ABSTRACT

Biofuels are currently at the Centre stage of attention for policy makers and climate concerned end-users seeking more sustainable energy source for sustainable environment. This is because of its potential as an alternative and/or cleaner source of energy. However, questions are being raised about the capability of biofuels to achieve the dual goal of environmental and energy security without jeopardizing global food security. To set realistic target for future biofuel options, it is important to assess biofuel sustainability based on their prospects and implications on critical emerging issues such as energy supply security, climate change mitigation, biodiversity and ecosystem preservation, and food security. This paper presents a review of different governance approaches undertaken by the key actors in the biofuel industry (U.S. and EU) to address these emerging issues and regulate the sustainability of biofuel production. Two of such programmed were examined - The United States Renewable Fuel Standard [U.S. RFS], and the European Union Renewable Energy Directive [EU-RED]. Efforts were made to examine the related environmental and economic implications of their policy initiatives and governance processes with a view to determining their outcomes across a wide range of stakeholders. Emphasis was placed on binding regulations and standardized mechanisms of bilateral and multi-lateral agreements at the global level.

KEYWORDS: Biofuels, climate change, renewable energy, sustainability, food security, and biofuel police.

1. INTRODUCTION

Global challenges around 1970s such as oil crisis volatility, energy supply insecurity, and climate change mitigation prompted world nations to look for alternative/cleaner source of energy (Sexton et al., 2006). Biofuel was found to be a major solution to these challenges (Sorda et al., 2010). Since then, several efforts, mandates, and targets have been made to expand output. However, the use of food crops such as corn, sugar cane, soybean, wheat, palm oil, etc to produce energy has generated controversy and clash of interests among various stakeholders (World Energy Council, 2010). For example, while environmental stakeholders uphold biofuels as an alternative/cleaner source of energy that would not only mitigate the negative impacts of fossil fuels, but also contribute to ensuring global energy supply security, stakeholders in the food industry sees it as a threat to global food security (FAO, 2009; Timilsina and Shrestha, 2011). These conflicting interests have made the sustainability of biofuel production a contested subject (Lima and Gupta, 2013).

According to Timilsina (2014), biofuel policies and governance processes are aimed at reducing the emission of green house gases (GHGs) from fossil fuels, and at the same time contribute to global energy security (Ölz et al., 2007). However in recent times, questions are being raised about the capability of biofuels to achieve these environmental and energy security goals. As a result, sub-national, national, regional and international governments began to initiate biofuel policies and programmes that would address the emerging issues. The aim of this paper is to critically examine the strength and weaknesses of two of such programmes - The United States Renewable Fuel Standard [U.S. RFS], and the European Union Renewable Energy Directive [EU-RED]. Here, efforts shall be made to examine their governance processes, with a view to determining their outcomes across a wide range of stakeholders.

Goulder and Parry (2008) suggest that understanding the nature and framework of a problem that policy seeks to address is a prerequisite to understanding the governance processes and outcomes of that policy. Based on this assertion, attempt would be made to first, briefly discuss the key issues of debate surrounding biofuel governance, which forms the framework of the U.S. and EU biofuel policies, such as energy supply security, climate change mitigation, biodiversity implication and land uses changes, and food security. In the second section, the paper would critically examine how the U.S. RFS and the EU-RED has attempted to address these issues of debate.

1.1 Energy Supply Security

The debate here has been; will the current fossil fuel be enough to meet the increasing demand for energy? Available scientific findings show that fossil fuels as a non-renewable energy source lack long-term sustainability (Ölz et al., 2007). It has been reported for instance that crude oil reserves are vanishing at a rate of 4 billion tonnes per year, and by 2052, there would be no more oil reserve (World Energy Outlook [WEO], 2014). The Natural Resource Defence Coincil (2013) reveals that after 2060, the age of fossil fuel energy may be over, and if alternative energy sources are not developed today, the world may run into energy crisis. Another reason why major biofuel producers or importers such as the U.S. and the EU are keen on biofuel is to reduce the over dependence on imported oil (Bruce, 2011; Gerasimchuk, 2013).

However, the sustainable supply of biofuel sufficient for global energy need remains a source of concern. Recent studies have shown a considerable decline in biofuel production in the last decade (International Energy Agency, 2012; Timilsina, 2012). This decline might not be unconnected to the policy shift from the first generation biofuel using edible agricultural crops such as corn to the more advanced second generation biofuel using crop residues. At the moment, the commercial production of the second generation biofuels is yet to commence started, although countries like US, Canada, India, Brazil and EU members are investing in pilot research for its commercialization. As noted by Timilsina (2014), the growth in global ethanol and biodiesel production has significantly slowed down since after 2010. Even when global biofuel production was at its peak between 2000 and 2010, it accounted for only 2.7% in the global fuel supply (Renewable Energy Network, 2012).

The Food and Agriculture Policy Research Institute of Iowa State University projected that by around 2025, biofuel contribution to global demand for transportation fuel will not be more than 5%. Some other studies suggested that at most, it can only contribute just a quarter to the global demand for transportation fuel (Timilsina, 2014; BP Energy outlook, 2012). This shortage in the global biofuel production becomes more worrisome in the face of dwindling global production. If this condition is to continue, biofuel may not be relied on for global energy supply security. This is more so as the economic comparison between the market price of biofuels and its counterpart petroleum products in both U.S and Europe shows that on an equal energy content basis, biofuels are less competitive relative to the price of gasoline and diesel (International Energy Agency, 2012; National Agency of Petroleum, 2012; Nebraska Energy, 2012). The high cost of biofuels which makes it less competitive in the energy market may be traced to the high production cost of feedstock and processing technology. Although the cost varies between different feed stocks, studies have suggested that breakthroughs in technology can reduce the costs of biofuel production (Timilsina, Shrestha & Mevel, 2011; International Energy Agency, 2006). This perhaps, might be one way through which biofuels can become more competitive in the global market for energy supply.

1.2. Climate change mitigation

Apart from contribution to global energy security, biofuels, unlike fossil fuels are clean sources of energy that has little or zero emission of GHGs to the environment. Proponents of biofuel have hinged on this point to advocate for more production of biofuel either as a substitute to fossil fuels, or as an additive that could be blended with fossil fuels to reduce pollution (Bruce, 2011; Westberg and Johnson, 2013; Gerasimchuk, 2013). Their argument is that the world cannot continue to rely on self-destructive fossil fuels to power its economy. Several studies have found that efficient biofuel production from food crops can reduce GHGs emission up to 20 to 60% (Timilsina and Shrestha, 2011; Lima and Gupta, 2013; Anon, 2014). The level of emission reduction varies from feedstock to feedstock and from country to country. In Brazil, ethanol produced from sugar cane have been found to reduce carbon emission up to 70 to 90% (Moser et al., 2014).

The Organization for Economic Cooperation and Development [OECD] (2008) estimates put ethanol GHG emission reduction from sugarcane at 90% when compared with gasoline. From second generation cellulosic feed stocks, biofuel was found to reduce GHG emission by about 70 to 90% (International Energy Agency, 2006). In Thailand, ethanol produced from cassava and molasses when compared with conventional gasoline can reduce GHG emission by 49% and 64% respectively (Silalertruksa & Gheewala, 2010). Depending on the country of production, yield level and farming practices, ethanol derived from wheat can reduce GHG emission from as low as 18% to as high as 90% (Fischer et al., 2009). Jatropha when planted with minimal nitrogen requirement and high seed yield can reduce GHG emission by 66-68% (Dehue & Hettinga, 2008). Further, although the GHG reduction potential of corn-based biodiesel was found to be poor, its emission reduction varies and can be as high as 50% when compared with gasoline (Wang, Wu & Huo, 2007).

However, although biofuels generally have lower green house gas emissions relative to petroleum products, its emission reduction drastically diminishes once land use change is taken into consideration (Timilsina, 2014). This is because the large scale production of biofuel needed to meet the energy demand could trigger an unintended biodiversity change through land clearing and/or land conversion for crop production. When natural forest lands are cleared to expand biofuel production, it reduces the regenerative capacity of the ecosystem to sequester carbon and support human existence. Several studies have shown that the 'carbon payback period' – the period of time needed to offset fossil fuel emissions by replacing with biofuels will take so many year to happen when land use change caused by biofuel expansion is considered. For example, it has been estimated that it will take about 400 years, 300 years, 48 years, and 30 years to recoup the emission reduction benefit of biofuel if tropical peatland rainforest in Malaysia or Indonesia, Amazonian rainforest in Brazil, US conservation land reserve program, and woodland forest in sub-Saharan Africa respectively are all converted for biofuel production (Timilsina & Mevel, 2013; Havlík *et al., 2011*). Since it may take so long to reap the emission reduction benefit of biofuels by clearing up natural forests, its environmental benefits might as well be lost within those long time lags. Thus the GHG emission reduction claim of biofuels may only be true when land use changes are ignored. Once land use change is introduced, the benefits are swallowed up in the long 'carbon payback period'. Timilsina (2014) even argued that further large scale production of biofuel would in the long run increase, rather than decrease GHG emission.

1.3. Biodiversity and ecosystem distortion via direct and indirect land use change

Similar to the GHG emission debate, one other challenge of biofuels is the tendency to distort natural biodiversity through direct and indirect land use change. The cultivation of biofuel feed stocks will create new demand for land which will have impact on global land supply (Lange, 2011). According to Timilsina (2014), this new demand and supply of land created by biofuel feedstock cultivation will result to reallocation of land, and can occur in three ways: i) conversion of crop lands meant for food production to feedstock lands for biofuel production. For example, conversion of rice land into corn or sugarcane land, which is a direct land use change that replace food crops; ii) clearing of forest lands for biofuel feedstock production. This is another direct land use change that results from large scale expansion of biofuel production; and iii) conversion of forest or pasture lands into agricultural crop lands. This is known as indirect land use change (ILUC), and occurs when agricultural lands are expanded to make up for crops displaced by large scale biofuel feedstock production. When agricultural lands have been converted for biofuel production, it pushes agriculture to clear up natural ecosystems and new land areas of biodiversity such as forest lands, in other to meet up with the demand of food and feedstock production (Ernst and Young, 2011). This according to (Bailis and Baka, 2011) could lead to deforestation, loss of biodiversity hotspots, and consequent increase in the emission of GHGs. These direct and indirect land use changes caused by biofuel thus cast doubt on the environmental sustainability of biofuels.

For example, the United States Agency for International Development in 2009 reported that the expansion of sugarcane and Soy bean plantation for biofuel production is a serious threat to the Mata Atlantic region in Brazil – one of the world's foremost biodiversity hotspot. Furthermore, some promising second generation biofuel feed stocks such as jatropha has been classified as invasive species (Amigun, Musango & Stafford, 2011). Large scale cultivation and expansion of such feed stocks into new land area for biofuel production may have unintended harmful effects on the environment. Another potential challenge of biofuel feed stock expansion is water requirement. Agriculture is already taking about 70% of the global fresh water (Food and Agriculture Organization, 2008). Large scale expansion of biofuel feed stocks thus imply more water requirement, most of which will come through irrigation. The overall effect of this may be more pressure on global fresh water supply.

2. FOOD SECURITY

The use of agricultural food crops to produce biofuels is unarguably the most contested issue that casts doubt on the sustainability of biofuels (Westberg and Johnson, 2013). FAO (2009) notes that biofuels undermines the ability of the agricultural system to produce enough food for the ever increasing population. Both first and second generation biofuel affects food security, although at a varying degree which seems to be more on the first generation biofuels. While the impact of the first generation biofuels occurs by conversion of food crops such as wheat and corn into biofuel food stocks thus reducing global food supply, and the second generation impacts food security by displacement and conversion of crop lands into feedstock lands meant for biofuel production. Either ways, biofuel production threatens global food security by causing global food supply shortage and consequently increasing the prices of food commodities in the market. Many analysts have attributed the 2007-2008 food price escalation which led to food crisis in many parts of the world to the increasing scale of biofuel production (Sorda et al., 2010; Lima, 2009; Timilsina and Shrestha, 2011). According to the International Monetary Fund (2015), growth in biofuel production accounts for over 12% increase in the global food price index, with about 60% and 15% coming from the US and EU respectively.

Several studies that estimated the influence of biofuel production on historical global food prices shows that biofuels have had a large impact on food prices, especially between 2000 and 2010 which coincides with the boom period of biofuel production. For example, *Baier* et al. (2009) attributed the 17% and 16% rise in the global prices of corn and soya bean respectively between 2006 and 2008 to expansion in biofuel production. Out of this, U.S biofuel production accounted for 14% and 10% rise in the price rise of corn and soya, while EU biofuel production accounted for 2% increase in the price of both crops (*Baier* et al., 2009). Using partial equilibrium, Rosegrant (2008) estimated that biofuel production was responsible for the 30% increase in the average grain price between 2000 and 2007. Similarly, Mitchell (2008) provided strong claim that biofuel expansion was the major cause of the 70-75% increase in the market price of food commodities between 2007 and 2008. In the same vein, Hochman *et al.* (2011) noted that biofuel expansion between 2001 and 2007 was the primary cause of inflation in the market prices of corn, soya bean, and rapeseed upto 19.8%.

However, the methodological approach of these empirical studies may have affected results. For example, they adopted the 'partial equilibrium' approach, which modeled the food and agricultural sector in isolation while ignoring the interaction effect of other sectors. This exclusion of other sectoral variables may have put more weight on biofuel expansion as being responsible for the rise in food prices. Moreover, those studies were either working papers or technical reports, and so may not have passed through the rigorous scrutiny of peer review process for authenticity. Furthermore, some other studies have contested the attribution of rise in food prices to biofuel. Ajanovic (2011) for example argued that the hike in the prices of food commodities was more due to volatility of oil prices than biofuel expansion, while Baffes & Haniotis (2010) were of the view that index fund activities may have contributed more to the rise in the price of food commodities than biofuel. Also, the continuous rise in food prices after 2011 could not be explained by biofuel expansion since biofuel production started declining after 2011. Other studies that estimated the projected impact of biofuel expansion on global food prices suggest just little impacts (Timilsina et al., 2012; Al-Riffai, Dimaranan & Laborde, 2010; Fischer et al., 2009; Kretschmer, Narita & Peterson, 2009). On the overall however, majority of historical and projected impacts of biofuel all indicates that it does have impact on the global price of food commodities at different scales.

The second section of this paper would therefore examine how the U.S. RFS and the EU RED has attempted to address the above issues.

a. The U.S. Renewable Fuel Standard (U.S. RFS)

The U.S. RFS policy was enacted in 2005 by the Energy Independence and Security Act (EISA) (Bracmort, 2006). The aim is to provide alternative source of energy that would not only reduce America's dependence on imported oil, but also provide an energy source that would reduce the emission of GHGs (Bracmort, 2006) . To achieve this, it established a mandate on the amount of transportation fuels that must be blended with biofuels as an additive (Bruce, 2011). The Environmental Protection Agency [EPA] (2014) reported that by 2013, the U.S. transportation fuel (gasoline) has achieved a 10% blend of ethanol as a fuel additive as a result of this policy. Furthermore, Stock, (2015) identified that between 2005 and 2013, the amount of biofuel blended in the U.S. fuel supply has increased from about 2 million to about 14 billion gallons.

According to Lima and Gupta (2013), the RSF governance process is characterised by a hybrid of command and control (C&C), and economic incentive policy instruments formulated and implemented from the state level. The C&C policy comes in the form of mandates given to fuel producers and importers to blend at least 10% of their fuel products with biofuels (EPA, 2014). The U.S. RSF policy has a target to blend 36 billion gallons of biofuels with gasoline by 2022 (Bracmort, 2006). According to Lima (2009), RSF is required by the EISA to use a renewable volumetric requirement to determine the quantity of biofuels that must be blended with transportation fuels. The parties bounded by this regulation are the fuel importers and refineries. The volumetric requirement is set every year by the Environmental Protection Agency (EPA). Compliance is achieved through market mechanism called Renewable Identification Number (RIN). However, one major disadvantage of this C&C instrument is the high cost associated with administering RIN which has driven up the cost of blended fuels (Murphy, 2007). The economic incentives according to Lampe (2007) uses two tool: First, subsidies and direct payments offered to bio-crops farmers and manufacturers of biofuel production facilities; and the second tool is a tax related incentive. The tax incentive comes in two forms: tax credit offer to biofuel blenders, and imposition of import duty on ethanol to encourage local production (Lima, 2009).

As at 2010, the RFS policy could be said to be a success in increasing the production of U.S. biofuel, and reducing U.S. dependency on imported oil by 50% (Havlík *et al., 2011)*. But on the other hand, it not only drove up the cost of U.S. fuels, but also the cost of corn in the U.S (Bailis and Baka, 2011). This implies that at this stage, the RFS policy failed in reducing the competition between biofuel and food security- one of the major reasons why the policy was formulated. In fact Mukhtarov (2014) argued that the policy has achieved little in reducing the emission of GHGs. This according to Perosa, 2012) was because the policy has concentrated in the production of first generation biofuels- which are biofuels produced from food crops such as corn. The problem with first the generation biofuels is that they are not only too expensive to produce, but also their life cycle analysis shows that they indirectly encourage emission of GHGs through ILUC (Bailis and Baka, 2011).

To correct these lapses in the policy, The RSF was modified in 2012. The modified RFS (known as RFS2) mandated a reduction in the production of biofuels from feed crops such as corn, and commissioned the development of technologies to produce biofuels from inedible sources, such as corn stover, wood chips, biogas, energy grasses like miscanthus grass and algae (WEO, 2014). These are known as the second and third generations of biofuels.

In general, the U.S. RFS policies has been criticised for poor stakeholder's engagement. According to (Stock, 2015), U.S. biofuels policies under RFS are made at the national level of government, and at times augmented by some state specific policies. Hence, most decisions are made without involving other stakeholders (non-state actors) in the biofuel industry, such as the private oil companies, the labour union in the transportation industry, and the local corn farmer, etc (Timilsina and Shrestha, 2011). This finding was supported by Bailis and Baka (2011) who noted that major biofuel policies are taken by the U.S. EPA, and imposed on other stakeholders, whose interests are often not catered for in the policy. This lopsided scale of governance is one major reason why RFS has been inefficient in maintaining a biofuel policy that would serve the multi-faceted interests of stakeholders that cuts across social, economic, and environmental sphere.

3. EU RENEWABLE ENERGY DIRECTIVE (EU-RED)

Concerned that the increasing demand for biofuels may lead to the clearing of forested land areas for more bio-crops production, the EU-RED was established in 2001 to enforce sustainability criteria that would guide biofuel production (European Commission, 2002). This was also in compliance to the Kyoto Protocol of the United Nations Framework Convention on Climate Change to reduce the emission of GHGs. Just like the U.S. RFS, EU-RED also has a target to achieve 10% of biofuel energy in the transport sector of all member states by 2020 (European Commission, 2002). But, these biofuels must first meet the sustainability criteria. These criteria are targeted towards reducing GHGs emission, prohibiting the conversion of peat-lands and other areas of high biodiversity for biofuel feedstock cultivation, in other to prevent ILUC.

Unlike the U.S. RSF, the EU-RED governance process is characterized by hybrid governance arrangement and multiple stakeholders' involvement (Hatch, 2006); such as voluntary schemes, bilateral and multi-lateral agreements, and various national systems. Although among all these governance mechanisms, so far more emphasis has been laid on voluntary schemes for sustainability certification, with little attention paid to other approved mechanisms in the EU-RED act (Westberg and Johnson, 2013). The proliferation of different voluntary schemes in the governance of biofuel policies has its own inherent disadvantages. Jordan (2008) found that the number of divergent voluntary schemes under the EU-RED has led to the problem of uncoordinated and discordant policies, which has complicated issues for policy makers, investors, and other market actors in the biofuel industry. He suggested that for the EU-RED to effectively meet its target, there is need for harmonization and coordination of schemes among the EU member states. One other major limitation of relying on voluntary schemes for sustainability certification is the high cost of certification associated with it, which limits the participation of developing nations and small scale producers in the developing biofuel standards (Gerasimchuk, 2013). Furthermore, Stock (2015) reveals that voluntary certifications are normally characterised by poor scope definition, such as promoting biofuel as an economic good instead of as a sustainable development agenda.

To address some of the problems emanating from the EU-RED's over reliance on voluntary schemes for certification, (Ponte and Daugbjerg, 2014) recommended the development and implementation of bilateral and multi-lateral agreements in other to widen the acceptability of sustainability criteria among both developed and developing nations. The need to engage more nations to participate in the enforcement of biofuel sustainability criteria stem from the fact that the issue of climate change mitigation which the EU-RED sustainability criteria seeks to address is a global problem (Ackerman, 2004). As Holmes (2011) would put it, most environmental problems are by nature trans-boundary and multi-casual. The theory of the public good explains that the climate is a common resource with non excludable benefits and consequences (Forsyth, 2011). For instance, GHGs emitted in one nation would have a global effect. Thus climate change has no boundary restriction. Therefore, the efforts of the EU-RED to mitigate climate change can only yield more fruitful results when all nations and stakeholders are committed to it. If not, the effort to mitigate climate change by the EU member states and the U.S. would be frustrated by the emission of more GHGs from other less committed nations.

This, according to Ponte and Daugbjerg (2014) calls for a transnational hybrid governance that would promote global institutional coexistence in the biofuel industry. Westberg and Johnson (2013) noted that although some major world biofuel players like the U.S. and the EU have initiated some multilateral agreements on biofuels, such as the Global Bioenergy Partnership (GBEP), and several multi-stakeholder voluntary roundtables, such as the Roundtable on Sustainable Biofuels (RSB), such initiatives lack legally binding power on members to elicit commitment from them. In fact, Timilsina and Shrestha (2011) argued that so far, these global initiatives provides only a weak neoliberal institutional system where actions and commitments are just voluntary.

4. CONCLUSION

This review has so far shown that the main consumption markets in the biofuel industry (U.S. and EU) are taking different governance approach to regulate the sustainability of biofuel production. While the U.S focuses on the use of national schemes, the EU has been dominated with voluntary standards. However, at the global level, there is lack of binding regulations, and the mechanisms of bilateral and multi-lateral agreements are yet to be standardised. Although governance does not necessarily demand a consensus at the global level (McCarthy, 2005), however, according to Lima and Gupta, (2013), transboundary environmental issues with common global consequences such as biofuels requires the collective involvement of all stakeholders from local to global. Thus, drawing from this assertion, and in line with Ponte and Daugbjerg (2014), a transnational hybrid governance with legally binding regulations on all stakeholders is recommended to efficiently tackle emerging issues in the biofuel sector.

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