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Analysis

Sweet dreams (are made of cellulose): Sociotechnical imaginaries of second-generation bioenergy in the global debate

Magdalena Kuchler

Centre for Climate Science and Policy Research, Department of Thematic Studies - Environmental Change, Linköping University, 58183, Linköping, Sweden

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ABSTRACT

This paper critically examines the sociotechnical imaginaries of second-generation bioenergy technology in the global debate, exemplified by the deliberations of international organizations specializing in food and agriculture, energy security, and climate change. The analysis is guided by two objectives: first, to identify and illuminate visions of future advanced biofuels by implementing the concept of sociotechnical imaginaries; second, to scrutinize these imaginaries using a critical and diagnostic utopian method to determine whether the projected visions entail the promise of radical change and hope for socioeconomic transition to a "green" future, or instead manifest an ideological stranglehold striving to perpetuate the status quo. The article demonstrates that sociotechnical imaginaries of advanced biofuel technology superficially project the illusion of utopian potential. On closer examination, however, visions of future second-generation biofuels are limited by the necessity of cost-effectiveness that underpins market competitiveness. They manifest utopian impotence to imagine the future beyond the ideological closure of the currently dominant socioeconomic system.

1. Introduction

The last three decades have seen intense scholarly, expert, and policy debate on the potentials of and obstacles to bioenergy production in global efforts to transition to a low-carbon economy. These often contentious deliberations have resonated in a much wider discussion of reimagining and reconfiguring the current global socioeconomic configuration into a more socially equitable and sustainable world (Bradshaw, 2013; Smith, 2010).

This discussion has focused largely on first-generation — i.e., traditional or conventional — bioenergy in the form of ethanol and biodiesel processed from edible crops. First-generation, conventional biofuels processed primarily from sugar, starch, and oilseed crops represent a production pattern existing since the late nineteenth century (Worldwatch Institute, 2007). With the rapid rise of the automotive industry in the early twentieth century, biomass-derived energy briefly rose to prominence, being labeled the "fuel of the future", but the discovery of large reserves of abundant and cheap oil eventually marginalized the role of biofuels (Bernton et al., 2010). International interest in energy production from biomass was later revived twice: during the 1970s oil crisis and in the recent boom starting at the end of the twentieth century. In both instances, the resurgence of first-generation biofuels as an important alternative source of energy was triggered primarily by a sharp rise in oil prices (Bernton et al., 2010). However, apart from energy security concerns, two more major factors contributed to the latest biofuel rush, namely, agricultural stagnation and climate change. Simultaneously, the rapid increase of interest in first-generation bioenergy, particularly in developed countries, has prompted intense debates on how the growing production of biomass for fuel could affect world food security and land use (Kuchler and Linnér, 2012; Popp et al., 2012; Runge and Senauer, 2007), environmental protection (Pimentel, 2012; Smith, 2010), and trade relationships between the global north and south (Kuchler, 2010; Matondi et al., 2011).

In the shadow of this controversial and polarized debate on conventional bioenergy production, second-generation technology has attracted increasing attention in expert and policy-decision circles, as it is considered a more efficient and less problematic alternative solution to the global problems of energy insecurity, agricultural stagnation, and climate change. Second-generation, advanced biofuels can be produced from cellulosic feedstocks — wood, tall grasses, forestry and crop residues, and other organic wastes — using two currently available processes: enzymatic conversion and gasification (Worldwatch Institute, 2007).

However, advanced bioenergy is still immature and claimed to be "waiting around the corner" for the industry to kick start it, making it commercially available on a large scale. Following the *World Energy Outlook 2011* of the International Energy Agency (IEA, 2011c), the latest final draft report of the Intergovernmental Panel on Climate Change (IPCC, 2014) notes that "advanced biofuels are in development, but may need another decade or more to achieve widespread commercial use" (p. 21). As such, second-generation biomass energy depends on future innovation and technological progress.

E-mail address: magdalena.kuchler@liu.se.

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As Alf Hornborg (2014a) points out, though "a successful technical experiment does not provide sufficient evidence that a new technological system is 'feasible' or 'within reach'", nevertheless, "such conclusions are very frequently drawn in both academic and public debates" (p. 12). Based on examination of the global discussion epitomized in reports and other expert documents issued by three major international organizations (IOs) in the 1990–2013 period, the overall objective of this paper is to chart and scrutinize sociotechnical imaginaries of second-generation biofuels by questioning whether the envisaged promise of change for a better "green" future through technological development is a symptom of the utopian impulse to provide a radical alternative, or instead manifests the ideological stranglehold that strives to perpetuate the dominant socioeconomic structure, and is therefore devoid of utopian potential.

More specifically, the analysis has two aims. First, by drawing on the concept of "sociotechnical imaginaries" introduced by Jasanoff and Kim (2009, 2013), I seek to identify and illuminate visions of future second-generation bioenergy in the global debate. The first objective is guided by questions regarding how advanced biofuel technology is imagined, the prescribed futures associated with the examined visions, and the premises on which these futures are based in reports and other expert documents issued by selected IOs.

Second, I scrutinize the utopian potential of these advanced biofuel imaginaries by employing the concept of "utopia" as a reflexive, critical, and diagnostic method as postulated by Fredric Jameson (1994, 2004, 2005, 2010) and Ruth Levitas (2000, 2003, 2007, 2011, 2013). The second objective is to identify differences and retrieve signals of otherness by determining how "green" and innovative the proposed future visions of advanced bioenergy technology are and how radical a transition they indeed promise (Jameson, 1994; Levitas, 2011). More specifically, I concentrate on three aspects of deliberations pursued by selected IOs: the premises on which the new and innovative character of second-generation biofuels is based and construed; the boundaries — beyond which the organizations do not go in their conceptualizations — drawn in these future imaginaries; the purpose of envisioning advanced bioenergy technologies as new and innovative and whether the purportedly better and greener impulse that could bring radical change is only illusory.

The analysis centers on the global biofuel debate in the 1990–2013 period as exemplified by three distinct but interrelated major IOs: the United Nations Food and Agriculture Organization (FAO), the International Energy Agency (IEA), and the Intergovernmental Panel on Climate Change (IPCC). Serving both developed and developing countries, the primary role of the FAO is to lead international efforts to achieve global food security. This specialized body of the United Nations serves as a neutral platform for negotiating and debating agricultural policies and arguments. Set up in response to the 1970s oil crisis, the IEA represents the collective response of a group of high-income countries to energy challenges and aspirations for energy security. The agency focuses on coordinating the implementation of energy cooperation between members through promoting energy efficiency and diversification. The IPCC is an intergovernmental scientific body that leads in assessing knowledge of and information on climate change. Open to all member states of the United Nations, the Panel plays a prominent role in supplying decision makers with expertise on the environmental and socioeconomic impacts of climate change. These three key global agencies were selected because the issues of food and agriculture, energy security, and climate change are integral to the bioenergy discourse. This is reflected on how each selected institution discusses biomass-derived energy, referring not only to its own area of expertise, but expanding the debate beyond its own scope into the spheres of the other two IOs, overlapping their agendas.

The article is structured as follows. In Section 2, I present two distinct analytical perspectives, namely, those of sociotechnical imaginaries and of utopia. In Section 3, I explain how the empirical data were collected and processed. In Section 4, I discuss the analytical findings in three sub-sections: the first examines how advanced bioenergy imaginaries are sharply differentiated from their predecessors, the second examines how the shift from first- to second-generation biofuels is envisioned, and the third scrutinizes the limited nature of the future sociotechnical imaginaries provided by the organizations. Finally, I present the conclusions in Section 5.

2. Theoretical Perspective

Introduced and developed by Jasanoff and Kim (2009, 2013), "sociotechnical imaginaries" is a hybrid term that straddles meaning-making and sense-making processes, linking them by means of socioeconomic structures and technological choices. In their cross-national study of nuclear energy policy in the United States and South Korea, these scholars define the concept as "collectively imagined forms of social life and of social order" reflected in "the design and development of innovative technological projects, goals and strategies" (Jasanoff and Kim, 2009: 120). In other words, sociotechnical imaginaries are powerful visions that serve as both the ends of policy-making and as tools for legitimizing specific technological paths and/or shaping social responses to innovation (Jasanoff and Kim, 2013). Furthermore, Jasanoff and Kim (2009) argue that "imaginaries are at once descriptive of attainable futures and prescriptive of the futures that ought to be attained" (p. 120). As such, the concept serves as an interpretative envelope that helps us address how the imaginary of advanced bioenergy technology, together with prescribed futures regarding its shape and role in society, is construed in the deliberations of selected IOs.

Apart from cross-national studies of nuclear power conducted by Jasanoff and Kim (2009, 2013), in recent years, the concept of sociotechnical imaginaries has been applied in research into biofuels. For example, Levidow and Papaioannou (2013) explore current state imaginaries contained in policies promoting bioenergy innovation in the United Kingdom. These scholars identify three major visions through which biomass-derived fuels are promoted in the country: localization of energy production, diversification of agricultural practices, and substitution of oil (Levidow and Papaioannou, 2013). Eaton et al. (2013) study the development of local energy production from wood biomass in Michigan, United States, claiming that their paper "contributes to theories of imaginaries by showing how key framings of the past also frame future possibilities" (p. 26).

My take on Jasanoff and Kim's (2009, 2013) analytical framework requires two modifications. First, the scholars assume that "sociotechnical imaginaries can be identified, illuminated and critiqued through cross national comparison" (Jasanoff and Kim, 2009: 121). However, I argue that not only national policies but also, particularly in our increasingly globalized world, international policy-making and policy-envisioning can serve as useful sites for examining visionary practices. In this paper, my focus on the formation of sociotechnical imaginaries therefore shifts from the national to global levels. More specifically, I highlight IOs, which not only reflect the desires, goals, and priorities of their state-members but also provide expert- and science-based imaginaries that can influence both political leaders and societies at the national level (Barnett and Finnemore, 2004; Jasanoff, 2012). In this sense, global agencies exercise their influence and power in the form of epistemic authority "based on having special knowledge and moral expertise" (Zürn et al., 2012: 86).

Exemplifying this argument, FAO provides policy assistance and information, particularly to developing countries, about improving food production and access. Among many documents issued by the organization, the major flagship publications are yearly scientific and statistical reports entitled *The State of Food and Agriculture and The State of Food Insecurity in the World*. By providing expertise in the form of assessments, analyses, and statistics, IEA is at the center of global dialogue