Energy Research & Social Science 14 (2016) 13–21

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Seeing forests as fuel: How conflicting narratives have shaped woody biomass energy development in the United States since the 1970s

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ARTICLE INFO

Article history:
Received 5 June 2015
Received in revised form
15 December 2015
Accepted 17 December 2015

Keywords:
Historical perspective
Biomass/wood energy
Conflicting narratives
Land management

ABSTRACT

This article provides an historical analysis of arguments for and against using forests for fuel since the 1970s energy crises, and explores the relationship between public narratives and the implementation of renewable energy technologies. I argue that different ideas about the use of forest resources created narrative conflict between stakeholder groups, and this conflict influenced the development of biomass energy systems by limiting private investment and shaping public policy. Promoters and opponents of forest fuels both worked to achieve political goals as well as economic and environmental ones, and debates about biomass energy reflected these different views. Although this paper focuses on public perceptions about wood energy in the US, biomass advocacy in the US was influenced by efforts in other countries, particularly by innovation in Sweden and Finland. By providing an historical investigation of the cultural barriers to developing decentralized renewable energy systems in the US, and explaining how this experience compared with biomass development in other countries, this research demonstrates how conflicting narratives have shaped energy and environmental policy since the 1970s. This historical perspective contains valuable lessons about how different social groups' values and beliefs have affected – and continue to affect – decisions about new energy technologies.

1. Introduction

The chainsaw may seem like an unlikely tool for sustainable energy production, but since the energy crises in the 1970s, renewable energy advocates in industrial countries have worked to rekindle interest in the use of forests for fuel. Yet like with other decentralized sources of energy, the embers of support for biomass development have been slow to ignite. Instead, the topic has sparked conflict and debate about appropriate energy sources and the size and scope of renewable energy technologies. On a deeper level, like energy transitions in other times and places, debates about biomass development have often involved clashes between fundamentally different visions of the future. These conflicting visions were expressed through narratives that also suggested different relationships with existing power structures and scales of governance. Arguments for or against the development of biomass were often tied to political questions about the decentralization and centralization of power. These arguments were influenced by different cultural norms and attitudes towards resource extraction. An examination of the narratives employed by biomass advocates and critics since the 1970s reveals how conflicting perceptions about land management and political control have shaped, and in some ways, have failed to shape, energy decisions and policy.

Biomass energy is a large category that includes all energy produced from plant material. Liquid biofuels like ethanol or methanol can be produced from corn or perennial grasses like switchgrass. Plant-based feedstocks can also be burned to produce electrical power. This paper focuses on energy derived from wood and used primarily for heat and/or electricity, including domestic woodstoves, wood boilers, combined heat and power facilities, and large industrial-scale power plants. Aside from domestic firewood, most wood used in these applications has come as a byproduct of other forest products, and in some cases as municipal solid waste. Although in the 1970s and '80s, the US government pursued research on the economic potential of methanol, a liquid transportation fuel that can be derived from wood, this paper does not focus on debates about liquid biofuels. In addition to the unique technological factors involved in the production and distribution of liquid biofuels, methanol and ethanol have their own set of political and cultural challenges that are beyond the scope of this article [1].

Although there are several technological and economic reasons why the development of energy systems based on renewable fuels like woody biomass has been limited, less is known about the cultural barriers to decentralizing energy. This research explores

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http://dx.doi.org/10.1016/j.erss.2015.12.023
2214-6296/

public debates about biomass development and decision-making processes involved with renewable energy development since the 1970s. This historical examination adds to a growing pool of research that acknowledges that our energy problems are not only technological; they are also deeply social and political [2]. Using an historical approach reveals the often hidden cultural barriers to developing renewable energy systems, and helps to illuminate the complex interaction of ideas, attitudes, and policy. As historians Richard F. Hirsh and Christopher F. Jones note, historical perspectives on energy transitions provide a deeper understanding of the nontechnical aspects of emerging technologies, and can help to explain why new technologies sometimes fail, "even when they appear to have appealing technical attributes [3]." The history of woody biomass since the energy crises in the 1970s provides a compelling demonstration of this phenomenon.

Most of the literature on energy transitions in the top three energy journals has focused on markets, policy mechanisms, climate change, and pricing [4]. Moreover, Frank Laird and Kathleen Araújo have noted that the literature on energy transitions has emphasized changes in dominant fuel sources and technologies; less has been written about the social and political dynamics surrounding distributed power systems [5]. Hancock and Vivoda suggest that although the field of international political economy began in the 1970s and has concerned itself primarily with global dynamics involved in the fossil fuel-based economy, future energy scholars should pay more attention to community interests and renewable energy [6]. On a related note, Araújo advocates for paying greater attention to the sociopolitical aspects of distributed power systems and the agency of a wider range of actors involved in energy transitions [7]. This paper aims to help fill some of these research gaps by employing human-centered methods and historical perspectives to help shed light on the cultural barriers involved in energy transitions.

More specifically, this historical analysis of different ideas and attitudes towards woody biomass energy since the 1970s helps to illuminate how public narratives about forest-based fuels were linked to broader ideas about political power, pollution, and resource management. In this way, the paper reveals the "interpretive flexibility" of emerging biomass-based energy systems, where the meaning of new kinds of energy technologies arose from the negotiation of different groups' ideas and values [8]. These conflicting ideas and values contributed to a sense of uncertainty about biomass technologies. That sense of risk limited private investment and, in combination with the relatively low price of fossil fuels, worked to prevent the widespread adoption of biomass-based energy technologies in the US in the late-twentieth century.

This research primarily focuses on the US, but discusses how wood energy innovation in Nordic countries and conflict over biomass development in the UK shaped public debate in the US. Although most energy research has focused on North American countries and there is need to explore other parts of the globe – developing nations in particular – because energy decisions made in the US have played such a significant role in affecting global economics and climate, studies like this can help to illustrate how cultural factors helped to reinforce centralized, fossil-fuel-based energy systems. As the leading consumer of fossil fuels, the US has played the most significant role in affecting the earth's climate and resources in the past half century. Between 1970 and 2013, the US produced more carbon dioxide emissions than any other country, and over 4/5th of the energy consumed in the US during that time came from fossil fuels [9]. In contrast, by 2009, 2.5 billion people – over a third of the global population – continued to rely on wood as a primary energy source, and most of those people lived in developing nations [10]. Because the political and cultural dynamics surrounding decision-making processes in the US were completely different from those in places where most of the world's wood energy users lived, this research may not translate into direct policy prescriptions for decision-makers in developing countries. Instead, the study shows how different ideas about centralized versus decentralized energy technologies reflect underlying values and political ideals. This broader lesson has important implications that extend beyond any one nation's borders.

This paper begins with a brief history of wood energy and the international context within which renewed interest in biomass energy arose in the US in the 1970s, first after the oil embargo in 1973 and then more strongly after the decline of Iranian oil output produced fears of fuel scarcity in 1978–1979. It then explores the arguments made by biomass advocates – those who promoted a range of new wood-burning technologies such as residential woodstoves, wood boilers, combined heat and power (CHP) facilities, and municipal electricity stations – for relocalizing energy systems through the use of wood. Like the rhetoric and rationales promoted by energy entrepreneurs in other times and places, biomass advocates had visions about how the revival of wood energy would help to rearrange social and political relationships [11]. The paper then examines narratives constructed by critics of wood energy, and explains how conflicting narratives contributed to the sense of risk surrounding biomass-based energy systems, and inadvertently limited private investment and influenced public policy. I conclude by exploring the implications of this historical analysis for current renewable energy initiatives and policy makers in the US and elsewhere.

2. Discussion

2.1. Forest fuels: from wood energy to biomass advocacy

Like most nations until the nineteenth century, the US's energy economy was powered primarily by wood. Trees provided fuel to heat homes and businesses, to move trains and goods, and, through the creation of charcoal, to make iron. From domestic use to early industrial production, to railroad construction and operation, wood sustained nearly all aspects of life, and fueled the great accumulation of wealth by industrialists by the end of the nineteenth century. The rise of the railroads was inextricably linked to the growth of the timber industry, and the federal government contributed to wood-based economic growth by providing financial payments and land grants. Timber barons' ability to take advantage of these kinds of federal subsides played a key role in establishing wood as the basis of the US economy in the nineteenth century, and provided precedent for federal involvement in wood-powered industries [12].

As the population increased and industry expanded after the Civil War, concern about the fear of timber famine spread. Just as renewable energy advocates in the twentieth century worried about peak oil, energy entrepreneurs in the nineteenth century expressed concern about the decline of the wood supply. Concerns about timber famine inspired many of the conservation reforms of the Progressive Era, and Gifford Pinchot's work to develop a national forest system. By the early twentieth century, however, coal began to replace wood as the nation's primary energy source, and the public's fears about running out of energy were assuaged by boosters' promises of the quality of life and sense of connectedness that would come from more concentrated forms of energy [13].

Although wood continued to heat homes in many rural, forested communities throughout the twentieth century, its role as a major economic driver subsided as coal and oil took on greater importance [14]. After World War II, the suburbs sprawled, the middle class grew, and the American automobile transformed lifestyles and landscapes [15]. This growth and prosperity was largely based upon