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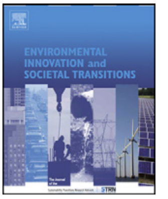

Explaining regime destabilisation in the pulp and paper industry

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ABSTRACT

A transition to a carbon neutral society will require a shift from fossil to renewable resources. This will affect the conversion of biomass and related industries such as the pulp and paper industry. The purpose of this paper is two-fold: first, to describe and analyse the transformation processes in the Swedish pulp and paper industry and the adoption of biorefinery options, and second, to demonstrate how conceptualisations from strategic management can be used to describe regime destabilisation. The industry's adoption of biorefinery options has been modest so far, but there is development along two trajectories. The first centres on gasification and the second on separation and refining. Such diverging strategies in response to external pressure can be explained by differences that exist between firms. Signs of increasing firm divergence, or 'regime fragmentation', might indicate the entry into a phase of regime destabilisation, and a critical point in a transition.

1. Introduction

A transition to a carbon neutral society that is less dependent on finite resources will require a massive shift from fossil to renewable sources of energy and materials. This in turn, will require radical change in many large socio-technical systems. One system of global significance is the system for conversion of biomass from forestry. In Sweden, bioenergy has a prominent position due to the large domestic resource base. Over the last 20 years, the use of bioenergy in Sweden has doubled, and

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in 2009, bioenergy accounted for 22 per cent of total energy supply (Swedish Energy Agency, 2010).[1] While 95 per cent of the bioenergy was used for heating, there is a growing interest in converting biomass also into electricity and fuels as well as chemicals and materials previously produced from fossil feedstock.

The development of biomass conversion is strongly linked to the pulp and paper industry since this industry is in control of a large share of the Swedish biomass flow and has extensive knowledge of biomass conversion as well as a capital intensive technical system in place for these processes. The industry is a large actor not only in Swedish society, where it contributes to 12 per cent of exports, but also in the world as Sweden is the second largest exporter of pulp, paper and sawn timber (Swedish Forest Industries, 2010a). A pulp and paper mill that converts biomass to chemicals, materials and energy together with, or instead of, conventional fibres for paper products is referred to as a biorefinery (Larsson and Ståhl, 2009). Thus, the biorefinery concept is analogous to an oil refinery, which converts crude oil into a range of products. The development of technologies that can be integrated in biorefinery configurations has been going on for decades, but implementation in commercial plants is still modest. However, the combined effect of several broad trends is now putting the industry under pressure to cut costs and find new business opportunities. Biorefinery concepts offer new opportunities, but some are radical and challenge core ideas in the industry.

Radical transformation of industries, or more broadly, of socio-technical systems (that explicitly include user practices, culture and institutions), has been termed socio-technical transitions (Rotmans et al., 2001). These transitions have been framed as multi-level change processes where a relatively stable socio-technical regime is challenged by changes at a broader societal (or landscape) level and by the emergence of novel technological options in niches (Rip and Kemp, 1998; Geels, 2002; Geels and Kemp, 2007). While many empirical studies within the multi-level perspective (MLP) tradition have focused on the emergence of novel technologies in niches and the role of outsiders, it is recognised that regime change can take many pathways (Smith et al., 2005; Geels and Schot, 2007). It has also been observed that incumbent actors may have critical roles in radical change processes (Malerba and Orsenigo, 1996; Geels and Schot, 2007). We argue that incumbent firms are of particular importance in scale-intensive industries (Pavitt, 1984) where tight relationships with suppliers of specific raw materials abound. While for example wind energy and solar energy firms can make use of resources that have not been used before, new biomass conversion technologies need to be linked up to biomass flows already governed by mature industries.

Hence, an analysis of the strategies of incumbent firms is required to understand the transformation of such industries. In much of the literature on socio-technical regimes, the regime is described at a highly aggregated level, as one stable coherent structure (Geels, 2002; Geels and Schot, 2007; Holtz et al., 2008). But the incumbent firms that are normally viewed as the backbone of a regime, in fact, show large differences. We argue that acknowledging this diversity is essential for an understanding of regime transformation. This is recognised also by Geels (2010) who argue that findings from the strategic management literature could enrich the MLP framework. A more fine-grained analysis that takes firm behaviour into account could potentially help describe and explain regime destabilisation. One aspect of, and a possible starting point for regime destabilisation is when firms begin to develop along diverging trajectories in response to external pressure. In the remainder of this text we will refer to this as *regime fragmentation*. A deeper understanding of this process is of importance for innovation and transition policy, since the effectiveness of any policy intervention will depend on how firms respond.

The primary purpose of this paper is to describe and analyse the transformation processes taking place in the Swedish pulp and paper industry with regards to the adoption of biorefinery options. In the analysis we apply concepts from MLP and the strategic management literature. An additional purpose is to contribute to the transition literature by providing a case that demonstrates how

[1] In 2009, bioenergy accounted for 127 TWh of a total supply of 568 TWh (Swedish Energy Agency, 2010). It is estimated that there is a potential to increase this to about 145 TWh by 2020 (Swedish Energy Agency, 2009b). However, preliminary figures indicate that 139 TWh was reached already in 2010 (Swedish Energy Agency, 2011).