

A Multi-Level Perspective Towards Energy Regime Transitions: A Wind Energy Diffusion Case Study

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Abstract This short paper presents a literature review and develops a theoretical framework for developing a multi-level perspective towards energy regime transitions from fossil fuel to wind energy. By considering the case of wind energy diffusion in the UK and the Norfolk region in particular, this research aims to identify the technological, social and policy factors and actors that most influence the diffusion of wind energy within the region. By collecting and analyzing data from a range of stakeholders, the research proposes to develop a model which shows the relationship between the factors and actors involved. This is in contrast to much research in this area which tends to focus on a single perspective.

1. Introduction

Transition to renewable energy technologies can help countries to respond to significant growth in energy demand with less adverse impacts on the environment. Renewable energies have become one of the fast growing sources to meet worldwide energy demand in recent decades. Although they have the potential to meet a high percentage of energy demand, there is a need for technology development (BoroumandJazi et al., 2013) and public acceptance (Bell et al., 2013) to support this.

This paper presents the literature on enablers and barriers to wind energy diffusion, develops a theoretical model based on innovation literature, outlines the research aims and objectives and the proposed research methods to collect and analyze data to develop a multi-level model of the factors affecting wind energy diffusion.

2. Enablers and Barriers for Wind Energy Diffusion

Wind energy, one of the key renewable sources of energy, is counted as one of the world's fastest growing sources of energy generation (Slattery et al., 2012) as statistics show, the global wind market has a 10 percent annual growth rate (Global Wind Energy Statistics, 2012). Wind energy sources could produce 5 percent of the world's energy by the year 2020. To reach this position in the world energy market, innovative technological advancement by manufacturing efficient, powerful and economic wind turbines is required (Islam et al., 2013).

Although wind energy is a sustainable source of energy and free from carbon dioxide and other greenhouse gas emissions, it has not been considered as a key source of energy in many parts of the world where potential wind resources are considerable (Lee et al., 2013). For instance, the UK, in terms of having potential resources of wind, is one of the richest countries across Europe. Therefore, the UK's Renewable Energy Roadmap, with a particular focus on offshore and onshore wind energy, emphasizes the importance of capturing wind resources effectively to meet the UK's long term energy security and climate change target and the EU's 2020 green energy target (Department of Trade and Industry, 2007). However, the UK seems likely to miss the EU's 2020 target (the Guardian, 2013). This indicates that there are still considerable barriers to implement wind energy technology in the UK.

Public opposition has hindered wind energy development (wind farms), and has been recognized in the UK 'Energy White Paper' (2003) as a significant barrier to meeting wind energy targets. This is in contrast to national opinion surveys, where public support for wind energy is approximately 80 percent in the UK (Bell et al., 2013). Therefore, there is a discrepancy in the high public support for wind energy, as expressed in the national opinion surveys, and the low success rate achieved in planning applications for wind energy implementation and diffusion in the UK.

Policy and social factors; such as social responsibility and awareness about the environment, subsidies for different energy sectors, and constraints on institutional capacity are also increasingly having a considerable effect on the way in which a country pursues a different portfolio of technologies and regulations. These consequently force energy industries to promote the development of renewable energy sources. In addition to that, adopting a convenient balance between energy security, economic development, and protection of the environment are societies' aims to reach sustainable energy regimes (Shamsuzzoha et al., 2012 and Ohunakin, 2011).

By reviewing the literature, the main factors that affect the diffusion of wind energy technology have been identified and classified into three major groups: social, policy and technological factors.

3. Theoretical Framework

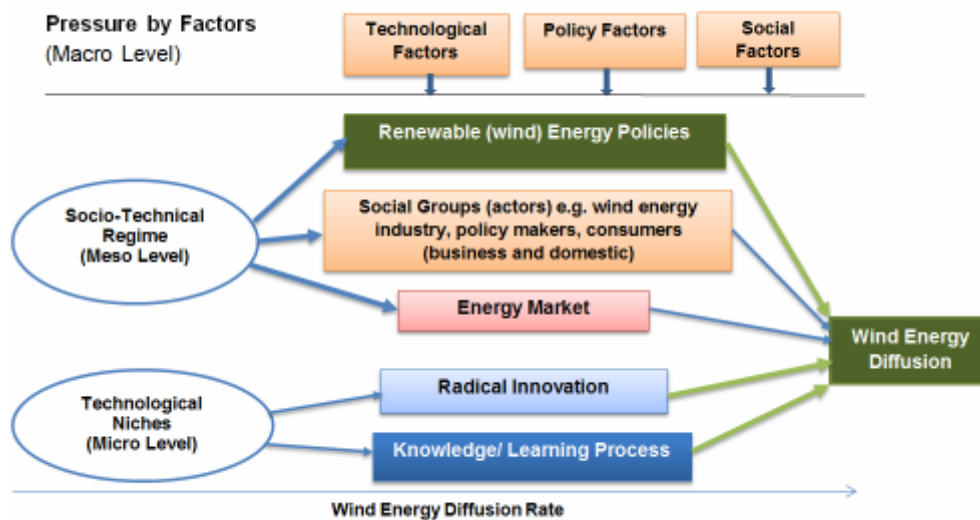
Climate change is one of the regional and global environmental issues that will require major changes to both technological and social systems. In order to find convenient solutions for these environmental issues, an understanding of the process of change within technology, institutions, policy, and society norms is extremely important. An understanding of the role of innovation development and diffusion of the new technological configurations in order to underpin a sustainable environment is required (Berkhout et al., 2004).

This research will use socio-technological theory to give a broad and comprehensive view of the implementation and diffusion of wind energy technology.

A broad understanding of the technological transition regimes is important to respond to the public effects of technology beyond the new product development process and use relationship. Policy makers, as a social group, attempt to control the unpleasant effects of new technologies by encouraging technologies with broad social benefits. Industrial societies are also concerned about the effective social control of technology; while, public bodies have adopted different ways to understand technological change and its effect (Berkhout et al., 2004). Geels (2002) defines technological transitions as major technological transformations in favour of social utilities which comprise technological changes and also changes in elements such as user practices, regulation, industrial networks, infrastructure, and symbolic meaning (Geels, 2002).

By developing a socio-technical model, the relationship between different social groups and factors that affect the diffusion of wind energy will be thoroughly explored. The preliminary research model is shown in Figure 1.

Figure 1. Research Model



The MLP model adopted and developed from Geels (2002).

4. Research Aims and Objectives

This research aims to develop a socio-technical model, analyzing the current energy regime by involving three key groups of social actors: industry, policy makers, and consumers. Research into wind energy implementation and diffusion tends to take a single perspective. The contribution of this research will be to consider multiple perspectives and groups of actors and factors. The main objective of this research is to study the diffusion of wind energy within the County of Norfolk in the UK. This empirical study will investigate the effect of technological, social, and policy instrument factors on the acceptance and usage of wind energy among three major stakeholders: industry, policy makers and consumers (public).

5. Research Approach

The research questions require that data are collected from three key stakeholder groups: the public (consumer), industry (wind energy suppliers and planners) and policy makers. It is envisaged that the research will focus on the implementation of wind energy in Norfolk, UK. Within this context, relevant research participants will be identified. Because this research would like to explore actors' perspectives on diffusion of wind energy technology, a qualitative approach with semi-structured interviews will be used for the industry and policy maker stakeholder groups. However, data relating to the social factors will be collected by questionnaire from different public and social stakeholders and actors. To provide more detailed information on policy and energy sector statistics and wind farm projects, and to supplement the semi-structured interviews and questionnaire surveys, secondary data sources, such as reports and energy databases will be used.

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