



Competitiveness assessment of the biomass power generation industry in China: A five forces model study



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ABSTRACT

China is facing a number of energy related challenges including a shortage of electricity supply, depletion of fossil fuels and environmental pollution. These challenges make it important to develop renewable energy resources. As per other renewable energy industries, the biomass power industry is facing a series of opportunities and challenges. Utilizing Michael Porter's Five Forces Model theory for analyzing the competitive environment and the competitive situation of an industry, this paper establishes a Five Forces Model for assessing the competitiveness of China's biomass power industry. Inputs for this model include semi-structured interviews with biomass power generation enterprises and a critical analysis of the national policy framework along with relevant literature and official statistics. Five major stakeholders of China's biomass power industry, namely competitors, suppliers, buyers, potential competitors, and substitutes are assessed to determine their influence on the biomass power generation industry. This assessment highlighted the current status, existing issues and future prospects of the biomass power industry. Similarly, it provides assistance to develop procurement strategies for the sustainable development of the industry.

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1. Introduction

The 21st century has seen the rapid growth of renewable energy developments throughout the world as a response to the increasing threat posed by global warming and the energy crisis. As an important kind of renewable energy, biomass is a promising energy source alternative to traditional fossil fuel [1]. It is estimated that biomass will contribute somewhere between 15% and 50% of the world's primary energy consumption by the year 2050 [2]. Compared to wind and solar power, biomass power has a number of advantages such as a higher economic value and improved quality of electricity generation and a lack of volatility or intermittent failures [3]. Biomass power also plays a critical role in optimizing China's energy mix, in reducing carbon emissions and promoting sustainable development of the energy sector. As an emerging

industry in China, biomass power is developing rapidly. By the end of 2013, the cumulative approved capacity of biomass power projects in China had reached 12.22 GW with an annual growth rate of 40.74% since 2006 [4].

Apart from the significant opportunities created by this new form of energy its rapid growth has also led to some issues that need to be addressed. Some studies have been undertaken to investigate the performance and development of the biomass power industry in China. Hu and Cheng pointed out that the electricity production from bio-energy was at the early stage of development in China. They suggested that technology, policy, and finance were the main barriers to China's renewable energy industry [5]. Liu et al. analyzed the status of China's biomass power from multiple perspectives including energy mix, resource distribution and investment strength and identified some key issues such as an immature industry chain and limited financing channels [6]. Similarly, Zhang et al. systematically reviewed policies related to biomass power in China and argued that steady development was a critical issue that will in time reduce its reliance on fiscal subsidies from the government [7]. Yang et al. conducted a case study of a

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straw power generation plant built under the Clean Development Mechanism (CDM) scheme by considering the greenhouse gas emission reduction in the Shandong province of China. They also explored the relationship between the economic performance of the power plant and the prices of purchasing and storing straw [8].

However, there are very few studies dealing with competitive assessment at both the industry and corporation levels as well as the development of an associated implementation strategy. This has created an urgent need for a comprehensive review of the entire biomass industry thereby providing the opportunity to use the “Five Forces” model as an effective assessment tool. This research utilizes the “Five Forces” model to analyze the competitiveness of the biomass power industry in China. Five key stakeholders (industry competitors, suppliers, buyers, potential competitors and substitute) and their impacts on the biomass power industry in China are analyzed. The results provide a useful reference for the development of strategies for the biomass and other renewable energy industries as well as related enterprises in China. Similarly, the lessons learnt from China identified in this study will act as valuable guides for other countries when developing their own biomass power and other renewable energy industries.

2. Research methodology

The research procedure and methodology employed in this paper are demonstrated in Fig. 1.

This study consists of five stages and the “Five Forces” model acts as the core structure in the research process. The “Five Forces” model was developed by Professor Michael Porter in 1980 in his seminal book entitled “*Competitive Strategy Techniques for Analyzing Industries and Competitors*”. According to Porter, there are five major stakeholders for each industry, i.e. competitors, suppliers, buyers, potential competitors and substitutes. These five parties have significant impacts on the forces that join them, namely: the competitiveness of other industry players, the bargaining power of suppliers, the bargaining power of buyers, the threats from potential competitors and the threats from substitute products [9]. The intensity of the competition is determined by the status of

these “five forces” of the industry, which in turn affect the industry’s profit potential and capital flow. The “Five Forces” model provides an effective method to analyze the competitive environment and situation of an industry and consequently provides useful inputs when determining development strategies for both the industry and individual corporations.

A hybrid research methodology was adopted to conduct the research. Semi-structured interviews were undertaken with industry experts about various aspects of the biomass power sector. These included: biomass power generation corporations, raw materials, machines, power generation technologies, price and profitability of the industry, laws, regulations and policies. A snowball sampling method was adopted to recruit interviewees. Finally 28 industry experts were interviewed. They represented biomass power related companies located in Hebei, Henan, Anhui, Jiangsu, Jilin, Shandong, Inner Mongolia and Heilongjiang. These are regions that have the most developed biomass power sector. These interviewees held senior positions in their organizations, e.g. production manager, finance manager, general manager, senior project managers, and senior engineers. The semi-structured interviews were complemented with a critical analysis of regulations, government policies, official statistics and literature (see Fig. 1). The result was the establishment of a “Five Forces” model as the analytical framework for the Chinese biomass power industry (see Fig. 2). This model clearly describes the status quo of the Chinese biomass power industry, its competitive environment and its position within that environment. This provides a better understanding of how the various aspects of the biomass industry interact, and in turn provides useful inputs for decision making when looking to achieve sustainable development.

3. Analysis of the “five forces” factors for China’s biomass power industry

3.1. Industry competitiveness

3.1.1. Industry status

The biomass power industry has grown rapidly since the introduction of the “Renewable Energy Law” in 2006. The biomass

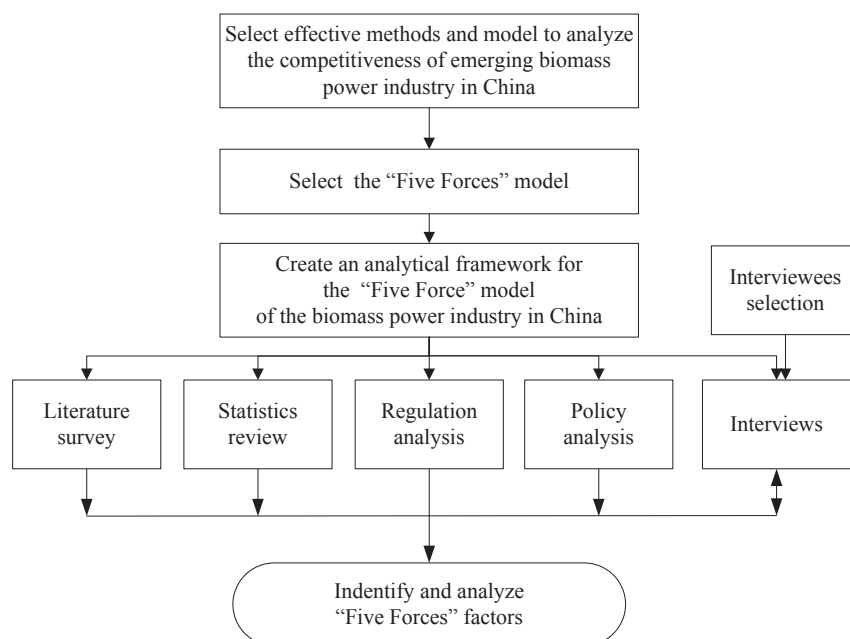


Fig. 1. Research procedure and methodology.

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