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Modeling and evaluation of the wind power industry chain: A China study

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ABSTRACT

The wind power industry is a complex industry involving many different types of enterprises from diverse fields loosely working together to form both internal and external associations. As a complicated system it is necessary to detect the location of the various industry components, their operation characteristics and the various relationships between the many sectors of the wind power industry. Using the general industry chain theory, this paper develops a wind power industry chain model and examines the operation mechanisms of the industry. This leads to the establishment of three perspectives for the wind power industry, these are the supply chain model, the technology chain model and the value chain model that respectively reflect the supply–demand relationship, technology transfer and value creation of wind power related industries. The models can be used to analyze: the resources distribution, the supply and demand and production relationships amongst related enterprises, the relevant technology systems and the value increase process of the wind power industry. Using China′s wind power industry as an example, this study uses: (1) the supply chain to analyze the construction, equipment supply and the on-grid connection of wind power; (2) the technology chain to evaluate the technical status of China′s wind power industry from the perspective of the level of technology, the source of the technology and the technology standard; and (3) the value chain to analyze the value distribution of China′s wind power industry. The results suggest that over capacity, lack of core technology and an incomplete follow up service system are the major obstacles to China′s wind power industry development. The models form an effective tool to analyze and evaluate the development status of the wind power industry in different countries, and support the concept of formulating a sustainable development strategy.

Contents

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1. Introduction

With fossil fuel energy resources becoming increasingly depleted and with the specter of climate change on the horizon, there is an increasing global trend towards the development of more renewable energy. Wind power generation has become recognized globally as a renewable energy technology with a large-scale commercial development value. According to the wind power market data published by the Global Wind Energy Council (GWEC), the new installed capacity of global wind power was 40.6 GW in 2011 and the total global wind power installed capacity was 237.7 GW. Globally some 75 countries are using wind power as a commercial operation with 22 of these countries having an installed capacity over 1000 MW [1]. In China, wind power development has become an important part of the national sustainable development strategy. By the end of 2011, China's wind power installed capacity increased by a further 17.9 GW, accounting for 44% of the total global increment. Thus, China's wind power installed capacity with 62.3 GW maintained its world leading position [2].

Wind power development involves a wide range of industries including consulting, research and development, manufacturing, construction, operation and electric power transmission. All of these form a type of industry chain based on their supply relationships and economic and technical links. Analyzing the industry chain model can do more than reveal its operational mechanisms and external environment; it also helps to better understand the development characteristics and competitiveness of the wind power industry.

Based on the characteristics of each link in the wind power industry, this paper builds a wind power industry chain model and analyzes its components and their relationships. The aims of the study are to gain an understanding of the current development status of China's wind power industry, to determine the problems in each link and to provide a reference for enterprises to use when determining their sustainable development strategy.

2. The wind power industry chain

2.1. Industry chain

The industry chain can be used to describe an enterprise's cluster structure in a certain industry according to their internal relationship and value adding process [3]. The enterprises in an industry chain can be divided into three separate streams namely, upstream, midstream and downstream. In general, the upstream enterprises deliver products and services to the mid steam and downstream enterprises thereby reflecting the resource processing and value creation processes. The downstream enterprises, on the other hand will deliver feedback information to the upstream and midstream enterprises. The length of the industry chain represents the level of segmentation of the industry and the depth of resources processing.

This paper describes the wind power industry chains according to their different characteristics as shown in Table 1.

2.2. The wind power industry chain model

The wind power industry chain involves wind power generation enterprises, the downstream electricity transmission and distribution enterprises and also the upstream raw material suppliers, equipment manufacturers and the related consulting services enterprises. The development of the wind power industry has led to the formation of an industry chain where its components form a complete and dynamic cycle i.e. the upstream enterprises provide products and services to the downstream enterprises; while the upstream enterprises obtain feedback information from the downstream enterprises. This process helps to promote the development of the wind power industry chain. This paper proposes the following model (see Fig. 1) for the wind power industry chain.

2.3. Classification of the wind power industry chain

The wind power industry chain provides a general description of the industry distribution (various components) and cooperation relationships amongst the enterprises. To understand the essence of the wind power industry chain, it is necessary to subdivide it into its various components. From the perspective of product supply, technology transfer and value creation, this paper divides the wind power industry chain into the supply chain, the technology chain and the value chain. The supply chain is the foundation and visible expression of the industry chain; the technology chain shows the connection between the core and general technology whereas the value chain provides the process of value adding and goal achievement of the industry. Table 2 provides a detailed comparison analysis.

This paper uses the Chinese wind power industry as a study to establish the supply chain model, the technology chain model and the value chain model thereby analyzing the current development situation and problems facing the wind power industry in China. By learning from China's experience, these models and studies will provide references for other countries to use, analyze and improve their wind power industry.