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Business structure in renewable energy industry: Key areas

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ABSTRACT

Diffusion of renewable energy utilization is difficult because of its entrepreneurial nature and related technological, investment, political, and market uncertainties. Therefore, evaluation of business structure based on traditional business models is difficult in this industry. Although many countries have actively developed renewable energy technologies by both governments and private sector, business professionals are not still assured about participation and investment. Understanding the areas of business structure that lead to successful commercialization of renewable technologies has suitable research scope in this industry. The objective of this article is to identify key areas of business structure to allow newcomers to enter successfully in the renewable energy industry from engineering, policy, and business aspects. The innovative analysis leads to identification of seven sides of renewable energy business.

Contents

1. Introduction

Today a meaningful growth exists in energy demand and consumption caused by economic and social development especially in developing countries. The limitations of carbon-based fuels as the main supply source of energy consumption have motivated scientists, politicians, and economists to think of ensconced alternatives with lower potential risk. For instance, the carbon-based fuels are not harvestable in all countries, nor are they sustainable in the producer countries. Further, continuous fluctuations in prices as well as increase in other costs (e.g., transportation) make the fossil fuels more unreliable [1]. On the other hand, environmental, technological, and political dangers of nuclear energy make the utilization of other reliable energy resources a necessity.

To respond to the challenges and achieve the security of energy supply, diversification and utilization of renewable energy resources (RER) are two of the important debates among policy makers and researchers. Free and local availability, cleanliness, eco-friendliness, and sustainability of RERs caused some economists and policy makers to admit that the only way to reach sustainable development is the maximal consumption of RERs.

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For instance, about 100% and 96.6% of the demanded electricity in Norway and Iceland were supplied by sustainable resources in 2010 [2]. There are also noticeable efforts and long-term plans in other countries in Europe, Asia, and North America for utilization of RERs. According to former future energy policies, development strategies of renewable energy (RE) are an important part of the US energy security action plan.

On the other hand, statistics show that about 56% of rural households and 400 million people are without electricity access in the world [3]. While rural areas have challenges such as low per capita consumption and inadequate power supply, RE utilization provides social welfare equity among local people.

However, despite successful efforts in diffusion of RE utilization, there are remarkable gaps between achievements and plans. Beyond the technological issues, RE industry needs strong capital and investment with core role of private sector. In other words, to use RERs economically, they should be diffused pervasively by the contribution and support of the private sector. As an example, the share of private sector in electricity generation and distribution in the US is approximately 80% and nearly 75% of the electricity sale [4]. This percentage is very low in developing countries. For instance, less than 3% of the investment and operation in energy industry is performed by the private sector in the Middle East [5].

Since RE industry offers a profitable future from both security and rural area development aspects, sufficient possibility and potential exist for private sector investments. However, investors are not assured about participation and investment in this industry [35]. From a private investor's viewpoint, the RE industry is an entrepreneurial industry along with technological, political and market uncertainties in which traditional evaluation of investment and market analysis are difficult [1]. This means that there are important points that an investor wants to consider before investing in the RE industry. To understand the different dimensions of decision making among private investors, researchers have investigated on investor's criteria in this industry [1,6,7]. Fig. 1 shows some important factors of investment from an investor's viewpoint in developing countries. These criteria are classified into three main dimensions: politics and business, engineering, and environment [1].

Investigations show that major concerns of investors to start RE investment are market and business aspects [8]. In other words, profit in short-term and market-based orientation are dominant factors for the private sector to start an investment. Therefore, study of dominant business structure in the RE industry and evaluation of potentials of related innovative technologies are two of the important research scopes for diffusion of RE development [9,10]. Understanding factors leads to successful introduction of new businesses in the RE industry which can help investors to establish and implement plans effectively, minimize risks, and avoid mistakes. In other words, analyzing the business structure of the RE industry can act as a mediating construct between RE technology innovation and economic value via superior value creation as compared to competitors (both in the level of companies and replacement products such as fossil fuels).

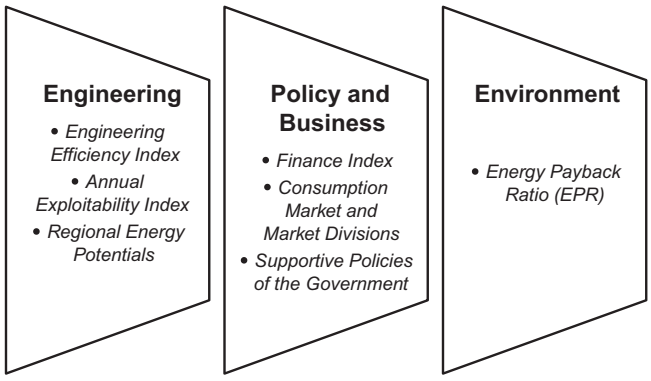

Fig. 1. Investment dimensions and criteria in the RE industry [1].

The overall objective of this article is to identify key elements of RE business. The defined areas of business structure can promote commercialization and diffusion of related technologies in this industry. The work helps mangers, investors, and policy makers to study different aspects of business in the RE industry.

The article is started by a brief definition of the business model and structures in the RE industry (Section 2). Important barriers to have a successful RE business is also introduced in that section. Section 3 presents and describes definition areas of business structure of RE with an innovative framework based on a wide qualitative research.

2. Initial definition of business model

Circumstances of doing a successful business have changed in recent decades because of factors such as competition, faster innovation cycles, and increasing globalization [11]. These factors have made the markets more dynamic, competitive, and complex [12]. For survival, managers and entrepreneurs should produce new business ideas or plans, examining business activities and modifying existing structures and strategies [11]. The business models and structures help managers and firms to identify, analyze, and manage the areas and ideas of successful business activities systematically. In other words, a business model learns how to make money out of a technology or an idea [13].

According to Feldman, the approach of the business model is to unify the resource-based and market-based views of a company or technology [31]. Although development and design of business models and structures have become increasingly important in different industries, there are gaps in the development of RE business in both developed and developing countries [8]. Table 1 summarizes the most important barriers and limitations.

Although studies show that there is no universal or best business structure in energy/RE industry and market, several studies have tried to cover a part of the research gap that exists in the related literature [14]. Some studies address the RE business

Table 1
Important barriers of successful RE businesses.

	Barrier or limitation
1	Budgetary limitations
2	Lack of information on RE market, demand, and potentials
3	Inadequate coordination among the various stakeholders
4	Ambiguous policies and regulations
5	Cost of RE utilization for end-user
6	Conversion efficiency of RERs
7	Operation and maintenance costs
8	Lack of mechanisms to provide modern and efficient energy services in rural areas
9	Inadequate incentive for RERs utilization compared to fossil fuels (e.g., taxation, tariffs, substitutes, and feed in)
10	Absence of policies related to promotion RE energy
11	Low public awareness on RERs
12	Lack of familiarity with green certificates and standards
13	Lack of a robust planning to RE development in the strategic and practical levels
14	Low storage capacity of RE technologies compared to fossil fuels
15	Gaps between research projects and market's needs
16	Poor quality of some RE technologies and utilization
17	Lack of specialized and skilled manpower in RE industry
18	Dominance of old carbon-based energy-inefficient technologies
19	Social and environmental barriers via beneficiary groups
20	Location selection