Survey of Developing Factors for Wind Power Industrial Policy Making Framework Using ANP and FGI

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Abstract

The purpose of this study is to develop factors for policy framework for the Korean wind power industry. Policy decision-making process needs to be comprehensive and concise. However, it is difficult to predict the impact of strategic decision, because of expanding of business area, change of value chain in IT technology and globalization. This study purposes to develop factors for framework of strategic decision-making in case of tariffs in wind power industry. The methodology of the study is ANP (Analytic Network Process) and FGI (Focus Group Interview) based on S-C-P (Structure-conduct-performance) model. In this study, Tariffs affect market structure and conduct factors like technology level, technology localization ratio, business strategy and so on. To minimize the policy failure, an analysis of factors is clearly needed before application. This study expects to be useful in making policy decisions in middle and long term perspective.

Keywords: *Wind Power, renewable energy, Tariff, S-C-P model, ANP, FGI*

1. Introduction

Wind power is being magnified as a means of being able to substitute fossil fuel as its economic efficiency is the highest among that of the new renewable energies and in case of onshore wind power, its power cost reaches within grid parity as well. Due to this reason, global wind power industry sustains its growth trend in spite of global economic crisis in 2008. By the end of 2010, global installation capacity is estimated to be total 199.5GW including 44.7GW of China, 20.2GW of the U.S.A., 13.7GW of Germany, 10.2GW of Spain and 6.5GW of India, respectively. In particular, growth rate for the recent past 6 years reaches 27.8% based on new installation capacity and 27.4% based on accumulated installation capacity. Though this growth rate has been decreased to some degree due to recent global financial crisis but it is expected that this growth trend would sustain again from 2013 onwards [1]. In order to respond to expanding trend of offshore wind power market and to create national new growth engine industry by concentrating the capabilities of the enterprises relevant to offshore wind power, Korea is also scheduled to develop offshore wind power farm of 2.5GW class at southwestern sea by 2019 through establishment of offshore wind power promotion program on nationwide scale[2]. The objective of the government is to pursue environmental conservation, sound and sustained development of national economy and enhancement of national welfare by diversifying energy source, converting energy structure to eco-friendly structure and promoting stabilized energy supply and reduction of greenhouse gas emission through an industrial policy of new renewable energy. In order to achieve this objective, the government is making and

supporting a policy relevant to industrial promotion and infrastructure creation through the laws of development, utilization, distribution and promotion of new renewable energy.

In this study, complicated policy making framework was suggested by deducing influencing factors to be considered at the time of policy making and analyzing its correlation based on decision process of price system applied for power supply of new renewable energy. Structure-Conduct-Performance Model (SCP), a framework of analysis for the study, is based on a theory of industrial structure. To draw candidate factors for market structure and behavior in deciding price system, a method of in-depth interview with experts (Focus Group Interview, FGI) was applied. Explored priority and significance were deduced through ANP(Analytic Network Process) analysis and feasibility of such factors was secured. Finally, this study suggested factors to utilize policy making framework.

2. Related Research

Price system is an access barrier to new entrants and also has a direct impact on earnings rate to existing enterprises. Especially in industrial structure, it acts as regulatory actions for enterprises[3, 4]. Related research of renewable energy, including wind power industry, mostly are about advantages and disadvantages of price system and considered main factors in the process of introducing the system. Byun et al. (2009) examines two types of price FIT(Feed-in Tariff) and RPS(Renewable Portfolio Standards), and proved that FIT is more fit for growing markets in their initial stages, and RPS is more effective once the market gains some measure of maturity in that it induces competition [5]. Berry et al.(2001) examines consider factors of policy making process and Wiser et al.(2003) analyzed renewable energy policy by electricity restructuring[6, 7]. Based on the studies, Jang et al.(2005) divided policy factors into selection of target, applicability, flexible mechanism, administrative responsibility and etc. [8]. Various studies are focused on renewable energy price system, but very few studies include critic characteristic of energy industry. In particular, policy of renewable energy, including wind power, requires researching the industrial structure, not only to disseminate renewable energy, but also to achieve the goal of industrial growth. Therefore, this study presents factors which should be considered in the process of determine the price system, focused on renewable energy(including wind power) industry.

3. Status of Wind Power Industry

Global onshore wind power market in 2011 was grown by 18% compared with that of the previous year with its installation record of 42.2GW and in 2012 also, it was learned to have grown by 13% compared with that of 2011 with its installation record of 47.7GW. In particular, wind power market of China is expected to keep leading, front runner position by 2020 in terms of its scale and global market mainly based on Canada, Brazil and India is also forecasted to be grown rapidly. On the other hand, turbine supply capacity may be reduced in the future due to increased advancement of new enterprises into wind power industry targeting its high market growth rate but market competition is expected to be intensified within 3 years from now on due to an occurrence of excessive supply situation [9]. When observing global wind power market structure, market share of existing enterprise such as Vestas of Denmark is still dominantly high in reality except market share based on domestic demand market of China. Market share of Vestas was lowered from 19.8% at the end of 2008 to 14.8% in 2010 but their market share of 1st position remains unchanged while market competition is seen to be accelerated. In particular, market share of 10 largest enterprises was reduced from 95.7% in 2006 to 79.8% in 2010 and it is expected that in the future,

competition would be more intensified due to expansion of offshore wind power. Korea is scheduled to strengthen industrial competitiveness by expanding industrial supply network and promoting technical innovation based on development program of 2.5GW class at the Southwestern sea. In order to achieve this objective, Korea has announced development program of 3 stages and test bed (100MW) of 1st stage is to be developed at the area between Jeonbuk Wido-Jeonam Anmado by the end of 2014 and test bed (400MW) of 2nd stage is to be created by 2016 by selecting turbine type to be installed through performance assessment. In addition, extended farm (2 GW class) of 3rd stage is scheduled to be created by 2019 [10].

4. FGI Analysis

It will be feasible to select the subjects of focus group interview among the circles of industry, academia and institute involved in the field of wind power on the premise that they understand the traits of the relevant industry.

- *Industry: large enterprises/system: 2 people, SMEs/system: 1 person, SMEs/components: 1 person, power distribution service: 1 person*
- *University: aerospace, mechanical engineering: each 1 person*
- *Research Institute: system design, wind power industrial policy: each 1 person*

Interview was performed by explaining about future trend of wind power industry and its competitiveness strengthening method linked with distribution expansion policy of new renewable energy in advance and in establishing price regulation system based on SCP approach, it was explained by dividing it into market structure and market behavior. First of all, in order to help understand price system in advance, SCP model was explained.

A process of deducing candidate factors through FGI was performed in 2 stages. First stage is to start preceding survey and to select experts. Through preceding survey, number of enterprises, economy of scale, product differentiation, condition of market access were deduced as market structure, price differentiation, advertising, strategic response, collusion(price rigging), advertising, R&D as market behavior and technical advancement, public policy as achievement factors and finally technical level was deduced as basic condition. In 2nd stage, through focus group interview based on this, result of preceding study and objective of interview were explained and influencing factors were deduced through this interview.

Table 1. Project Outline of Offshore Wind Power Farm of 2.5GW Class at Southwestern Sea

	Step 1: Proof	Step 2: Demonstration	Step 3: Expansion
Purpose	Test Bed and Develop Core Technology	Track Record and Biz Model	Commercial operation
Capacity	100MW	400MW	2,000MW
Period	’11-’14 (4 years)	’15-’16 (2 years)	’17-’19 (3 years)

(Source: Ministry of Knowledge Economics, Korea 2011[2])

Table 2. Influencing Factors Deduced from FGI

Division	Items
Technical competitiveness	Technology level
	Localization rate
Market competitiveness	Economy of scale
	Market scale
Industrial competitiveness	Establishment degree of supply chain
	Numbers. of enterprises
	Target market for access
Technology acquisition strategy	Technology acquisition strategy
Government policy	Government support
	Government regulation
Management strategy	Business strategy

5. ANP Analysis

In this study, in order to analyze price determinants of new renewable energy, "Super Decision [11]", an analysis tool exclusive for ANP, was utilized. ANP comprised objective (price regulation), cluster (technical competitiveness, market competitiveness, industrial competitiveness, management strategy, technology acquisition strategy, government policy) and factors (12 items including technical level) [12]. Table 3 is the result of ANP performed based on the result of questionnaire. Figure 1 is a network model analyzing ANP based on the result of questionnaire. It could be realized that technical competitiveness, market competitiveness and industrial competitiveness are exerting their influence interactively among factors within cluster. For example, market competitiveness, industrial competitiveness, government policy and management strategy are exerting their influence interactively but technical competitiveness and technology acquisition strategy are exerting their influence unilaterally. Table 3 shows the level of mutual influence among cluster and shows the priority of influencing factors in price regulation system of new renewable energy. At this time, total sum of matrix row is regularized as Technical competitiveness (0.30351) exerts most significant influence over internal factors followed by in the order of industrial competitiveness (0.24814) and management strategy (0.19792). Table 4 shows priority of factors by generalized weight in clusters. The result of analysis shows that technical level and location rate are the highest (0.18). It presents that in the process of determining the policy in price system, the current status and long-term impact analysis of technical level and location rate needs to be proceeding.

Table 3. Cluster Matrix

Cluster Node Labels	Technical competitiveness	Market competitiveness	Industrial competitiveness	Management strategy	Technology acquisition strategy	Government policy
Technical competitiveness	0.30351	0.21664	0.25116	0.32758	1.00000	0.23046
Market competitiveness	0.00000	0.24019	0.18875	0.25778	0.00000	0.25395
Industrial competitiveness	0.24814	0.17806	0.23035	0.22625	0.00000	0.21579
Management strategy	0.19792	0.13317	0.13202	0.00000	0.00000	0.18198
Technology acquisition strategy	0.12664	0.09929	0.19772	0.18839	0.00000	0.11784
Government policy	0.12379	0.13264	0.00000	0.00000	0.00000	0.00000

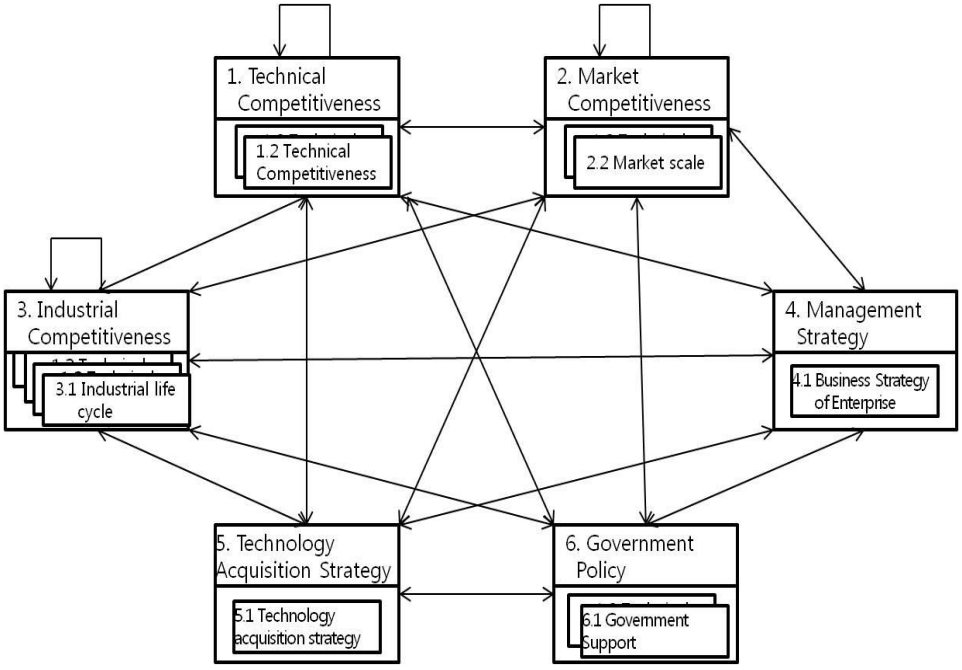

Figure 1. Network Model through ANP Analysis

Table 4. Priority of Influencing Factors in Price Regulation System of New Renewable Energy

Factors	Generalized weight in cluster	Priority and weight
1.1 Technical level	0.50645	0.181375
1.2 Localization rate	0.49355	0.176752
2.1 Economy of scale	0.32435	0.043917
2.2 Market scale	0.67565	0.091483
3.1 Industrial life cycle	0.13470	0.024041
3.2 Establishment level of supply chain	0.48414	0.086408
3.3 Number of enterprise	0.23150	0.041317
3.4 Target market for access	0.14967	0.026713
4.1 Business strategy of enterprise	1.00000	0.155678
5.1 Technology acquisition strategy	1.00000	0.115848
6.1 Government support	0.78510	0.044334
6.2 Government regulation	0.21490	0.012135

6. Conclusion and Implications

Government intervene production, investment, and trading activities of market to reinforce economy growth or global competitiveness through controlling the industry. However, recent globalization and convergence of industries makes the policy making process more complicated. Wind power industry fulfills an agenda of green growth and it is the most realistic alternative source for fossil fuel. Especially, because the direct costumer of the industry is a government, its policy has a huge ripple effect on the industry. It is hard to consider both impact and effect of policy, so policy-makers purpose to achieve existing policy. The establishment of shortsighted policy could take inefficiency and consistency problems. The study analyzed essential factors in making price system policy, especially in new renewable energy industry. The result shows that technical level, localization rate, business strategy of enterprise, and technology acquisition strategy should be considerate preferentially. Renewable energy industry's factors, such as socio-environmental, political and industrial, involves complicated. Previous studies are mostly about socio-environment and political aspects; however the price system affects market's structure and performance. Especially lately, industrial factor such as growth engine has emerged in renewable energy industry. This study suggests industrial factors, which should be considered in the process of making policy decisions in price system, that wasn't presented in previews studies. Further, the study is going to be expanding in using drawn factors in system dynamics framework to analyze Korean wind power industry. Also, it is expected to be useful in making policy decisions in middle and long term perspective.

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