Field survey analysis of the public’s cognition on the new energy industry in China

Q F Guo1 and Y Song

School of business administration, China University of Petroleum (Beijing)
No. 18 Fuxue Road Changping District, Beijing 102249, China

E-mail: guo18901106799@163.com

Abstract. The public enjoy an important role in the development of China’s new energy industry. However, the role has not attracted sufficient attention. By the way of field investigation, the paper acquired the first hand data of the public cognition on the China’s new energy industry. Survey data showed that the public enjoyed awareness of China’s new energy industry to some extent. And the public had optimistic expectations on the future development of new energy industry. Moreover, there were obvious differences in the degree of public’s familiarity with different new energy varieties. The education level and age of the individual public had a significant impact on his awareness of China’s new energy industry. To raise public participation in China’s new energy industry, it entailed highlighting the status of the public in China’s new energy industry, increasing the publicity of the new energy industry with different measures for different types of public group.

1. Introduction

With the increasing depletion of traditional fossil fuels, unstable energy supply, serious pollution, countries all over the world began to attach importance to the development of new energy sources. In order to ensure the energy security, promote the adjustment of economic development mode, China also vigorously developed new energy sources. A variety of subsidy policies continued to be introduced, so that all kinds of enterprises flooded into the new energy industry. In 2014, China’s clean energy investment reached $767 million, increasing by 20%, and more than the United States to become the world’s largest clean energy investment nation. The hydropower, wind power and nuclear power construction scale ranks the first in the world. Along with the rapid development of China's new energy industry,
problems were constantly emerging, such as irrational industrial structure, the imperfect industry chain, the lack of core technology, institutional obstacles and heavy market hindering.

New energy development cannot be separated from the behavior of economic agents. With respect to the governments (including the central government and local governments), enterprises and other economic entities, the status and role of the public had not caused full attention in the China’s new energy industry development. In fact, the role of the public in the development of China’s new energy industry is still very important. First of all, the public is an important part of the end product consumption in the new energy industry. Secondly, the public also effects on the supply side activities (investment, R&D and production, etc) in new energy industry by influencing related policies such as tax, price, environment and so on. Therefore, to realize the sound and rapid development of China's new energy industry, it is required to understand the relevant behaviors of the public in the new energy industry.

There were a few related literatures on the public's behavior in the new energy industry. Sovacool et al. listed thirteen myths that the American public misunderstood the energy fields including new energy industry. Schmid showed that the extensive participation of the private sector played a more and more important role in the development of the new energy industry through empirical studies. Kitzing et al. showed that the new energy policy in Europe was moving towards an integration trend of top-down. Pfeiffer indicated that economic development and effective management, higher level of education, stable democratic system had contributed to the development of non-hydro renewable energy power generation technology through the study of 108 developing countries from 1998 to 2010. Mallon took public participation as one of the ten major factors in the success of the new energy market Li Meng et al. gave the power mechanism of the development of new energy industry, and thought that the important role of social factors in the development of new energy industry had not been fully played out. Gehrke analyzed how to use renewable energy in the family. As a whole, the researches of new energy industry development of public behaviors are still preliminary, fragmented and lack of systematic. This paper attempts to make a systematic study on the public behaviors of the new energy industry in China. However, because the public are complex and diverse groups, it is difficult to understand the behaviors of the public to the new energy industry. On the other hand, as China's new energy industry was still in the primary stage, and there was a certain gap between most of the public and new energy industry. Knowledge precedes action, and through field investigation and data analysis on the public perception of China’s new energy industry, the paper attempts to understand a clue of public behaviors to China's new energy industry. Finally, the paper hoped to contribute to the draw up of policies concerned with China's new energy industry, especially those bottom-up policies.

2. The acquisition of field survey data

Field research or field investigation is the practice and application of the direct observation method. And it is also a pre-step for the acquisition of the original data. The good design of the questionnaire is the basis of the ideal field survey. China's new energy industry was still in its initial stage of development, and enjoyed low public participation. On the contrary, the composition of the public was more complex and diversified. Therefore, The design of the questionnaire in the paper not only took into account the key contents of public awareness of
China’s new energy industry, but also the requirements of the respondents’ cooperation. Finally, the questionnaire was revised and determined by a small scope pre-survey.

In 2015, a total of 300 people were interviewed on the spot, and the geographical distribution of respondents included Beijing, Xinjiang, Henan, Heilongjiang, Shandong and other provinces. The identity of sample public was very rich: Ages ranged from 20 to 75, and occupations included all walks of life such as students and teachers. The survey data would basically reflect the situation of public cognitive on China’s new energy industry. Based on the brief records of interviewing process, 236 valid questionnaires were selected, and the rate of the valid questionnaire was 78.7%. Although the contents of the questionnaire was simple and clear, but there were still more than 20% of the respondents refused to fill in the questionnaire with no understanding or no interest in the new energy industry as excuses, which showed the public were indifference to China’s new energy industry in a certain extent. Therefore, it is very urgent to strengthen the public awareness of new energy industry in China.

3. The frequency statistics analysis of the public’s cognition on the China’s new energy industry

3.1 Methodology
Frequency statistical analysis can reflect the public’s cognition on new energy industry from the angle of probability as a whole. The frequency statistics are calculated by the following formula:

$$f_i = \frac{\sum_{i=1}^{N} \alpha_i}{N}$$  \hspace{1cm} (1)

In terms (1): $f_i$ denotes the probability of occurrence of a situation (e.g. the public knows very well about new energy industry); $\alpha_i$ denotes whether the respondents selected the option of $i$; if selected, $\alpha_i=1$, otherwise, $\alpha_i=0$. $N$ denotes the scale of total samples, and the total valid sample scale in the paper was 236. $\sum_{i=1}^{N} f_i = 1$.

3.2 The public overall understanding of China’s new energy industry
In order to understand the situation of the public awareness of China's new energy industry, 4 individual options were designed in the questionnaire including “very understanding”, “understand some”, “heard” and “not clear”. The results of frequency statistical showed that: 8.9% of the respondents were very understanding of new energy; 61.9% of the respondents said they understand some of the new energy; 28% of respondents said they only heard of new energy; and 1.3% of respondents said they did not know the new energy. More than 70% of the respondents had an understanding of new energy, which showed that the public’s cognition on the new energy industry was relatively high, which meant the long-term sound
development of China's new energy industry would have a good public foundation. However, it would not be very optimistic. Only 8.9% of the respondents were very understanding of new energy industry; on the contrary, nearly 30% of the respondents only heard or were not clear of it. Considering that there were more than 20% of the invalid questionnaires, the gap between China's new energy industry and the public was still very large.

China's great efforts to develop new energy industry had been over 10 years, and a good many national level policies had also been introduced to strongly encourage and support the new energy industry. However, there were still a considerable parts of the public said they did not quite understand the new energy. Therefore, how to make the new energy into the tens of thousands of China’s households, accepted by the broad masses of the people, the promotion of the public in China’s new energy industry would still need a lot of work.

3.3 The comparison of the public cognition on different varieties of new energy sources

In order to examine the situation of the public familiar with each new energy varieties, for the respondents who choose “very well”, “understanding” of the new energy industry, five single options were designed in questionnaire to judge which was the most familiar one of new energy varieties, including “solar energy”, “wind power” and “biomass”, “new energy vehicles”, “don't know”. Survey data showed that solar energy was the best known to the general public with accounting for 51.47%; wind power followed with accounting for about 30.15%; the third was the new energy vehicles with accounting for about 13.97%; biomass was at least with accounting for only 2.94%; and another 1.47% of the respondents said they did not understand any kind of the four given new energy sources. The difference of public awareness of new energy sources was basically consistent with the development of new energy products in China. Solar energy in China enjoyed rapid development in recent years, and solar water heaters and other thermal products had been more popular in particular. Wind power also acquired rapid development in recent years, and the wind power was more popular in the area of advantageous natural conditions particularly. Biomass energy is an “old” energy. However, the modernization of China's biomass energy was very slow because of the constraints such as transformation of technology.

3.4 Public optimism about the future of the new energy industry

In order to examine the situation of public optimism about the future of the new energy industry, for the respondents who choose “very well”, “understanding” of the new energy industry, three single options were designed in questionnaire including “Promising”, “no future” and “not clear”. Survey data showed that “Promising” accounted for 85.63%; “no future” accounted for 6.59%; and “not clear” accounted for 7.78%. The price of fossil energy and China's increasingly severe environmental problems in recent years made the public keep overall optimistic outlook on China's new energy industry. However, there were still some doubts, which also reflected many problems and difficulties in the development of China's new energy industry in this stage. For example, photovoltaic and wind power was difficult to enter the existing power grid; it was difficult to collect biomass materials; and the new energy vehicles existed technical bottlenecks; etc.

3.5 The public's perception of how long China's new energy turning into conventional energy

In order to examine the situation of the public's perception of how long China's new energy
turning into conventional energy, for the respondents who choose “very well”, “understanding” of the new energy industry, four single options were designed in questionnaire including “five years”, “ten years”, “twenty years” and “not clear”. Survey data showed that “five years” accounted for 12.57%; “ten years” accounted for 44.31%; “twenty years” accounted for 125.15%; and “not clear” accounted for 17.96%. There was considerable disagreement in the public’s perception of how long China’s new energy turning into conventional energy, which also indicated that the conventional time of the new energy industry had a lot of uncertainty. However, most of the public thought that the conventional time of the new energy industry would be relatively long, and this perception may be objective and fair.

3.6 The most important measure to develop new energy resources
In order to examine the situation of the public’s perception of the most important measure to develop new energy resources, for the respondents who choose “very well”, “understanding” of the new energy industry, four single options were designed in questionnaire including “technical innovation”, “supporting enterprises”, “expanding the market”, and “natural development”. Statistics show that 52.14% of respondents believed that technological innovation was the most important measure of the development of new energy industry in China, which indicated that the public believes that technological innovation is the biggest driving force for the development of new energy sources. 24.29% of respondents believed that supporting enterprises was the most important measure of the development of new energy industry in China. Because enterprises are the most direct agents of new energy commercialization, the status of enterprises in China’s new energy industry had also been highly valued by the public. However, Only 20% of respondents attached great importance of the market in China’s new energy industry, which might reflect the current embarrassing situation with low degree of commercialization in China’s new energy industry. Only 3.57% of respondents believed that the new energy industry should be allowed to develop naturally, which showed that the public had a high degree of awareness of the need for policy support for the new energy industry.

4. The interactive analysis between the subject characteristics of respondents and their familiarities with new energy industry in China

4.1 Methodology
Respondents’ age, educational background and other main characteristics will affect their cognitive status of the new energy industry in China. In order to further analyze the relationship between personality characteristics of respondents and their cognitive status of China’s new energy industry, the paper introduced the interactive analysis between the subject characteristics of respondents and their familiarities with new energy industry in China. The aim of interactive analysis was to provide some kind of behavioral cues that taking different measures for different types of the public groups in China’s new energy industry. The formula of interactive analysis is as follows:

\[ p_{ij} = \frac{\sum \alpha_i \beta_j}{\sum \beta_j} \]  \hspace{1cm} (2)
In terms (1): $p_{ji}$ denotes the probability for the specific respondent with $j$ subject characteristic to choose the $i$ option. $\beta_j$ denotes whether the specific respondent was in line with the $j$ subject characteristic; if satisfied, $\beta_j = 1$, otherwise, $\beta_j = 0$. $\alpha_i$ denotes whether the respondents selected the option of $i$; if selected, $\alpha_i = 1$, otherwise, $\alpha_i = 0$. $\sum \beta_j$ is in fact the sum of the samples of respondents who satisfy $j$ subject characteristic.

Because the terms that relating to the subject characteristics of respondents and their perception options of new energy in China were very complicated, there would be great number of combinations between subject characteristics of respondents and their perception options of new energy in China. Due to space limitations, the paper just conducted the interactive analysis between the age, educational background of respondents and their familiarities with new energy industry in China. The age of respondents was divided into four types including “less than 25”, “25-35”, “36-50” and “more than 50”. The educational background of respondents was divided into four types including “junior high school and below”, “high school”, “junior college or bachelor degree”, “master degree and above”.

4.2 The interactive analysis between the age of respondents and their familiar situations of new energy industry in China

The results of interactive analysis between the age of respondents and their familiarities with new energy industry in China were shown in table 1.

**Table 1. The relationship between the age of respondents and their familiarities with new energy industry in China**

| Types of ages    | Number of samples | Very understanding | Understand some | Heard | Not clear |
|------------------|-------------------|--------------------|-----------------|-------|-----------|
| less than 25     | 126               | 9.5%               | 67.5%           | 22.2% | 0.8%      |
| 25-35            | 33                | 3.0%               | 63.6%           | 30.3% | 3.0%      |
| 36-50            | 56                | 10.7%              | 51.8%           | 37.5% | 0.0%      |
| more than 50     | 14                | 0.0%               | 50.0%           | 42.9% | 7.1%      |

**Note:** In the process of interactive analysis, the samples without the age information of respondents were excluded.

It would be seen from table 1 that the age of respondents enjoyed significant effect on their familiarities of new energy industry in China. As a whole, the lower the respondents’ age, the higher degree of his familiarity with new energy industry in China they kept, and the age group with the highest degree of familiarity with new energy industry in China was 36-50. The relationship between the ages of respondents and their familiarities with new energy industry in China had double meanings: The public with their ages at 36-50 would be the backbone of China’s new energy industry. On the other hand, the younger public enjoying good familiarities with new energy industry in China would help the future development of this industry have a robust public basis.
4.3 The interactive analysis between the educational backgrounds of respondents and their familiarities with new energy industry in China

The results of interactive analysis between the educational background of respondents and their familiarities with new energy industry in China are shown in table 2.

**Table 2.** The relationship between the educational backgrounds of respondents and their familiarities with new energy industry in China

| Types of educational backgrounds | Number of samples | Familiarities with new energy industry in China |
|---------------------------------|-------------------|-----------------------------------------------|
|                                 |                   | very understanding | understand some | heard | not clear |
| junior high school and below    | 13                | 0.0%               | 23.1%            | 76.9% | 0.0%      |
| high school                     | 48                | 6.5%               | 60.4%            | 31.0% | 2.1%      |
| junior college or bachelor degree | 143              | 7.7%               | 65.0%            | 25.9% | 1.4%      |
| master degree and above         | 15                | 13.3%              | 66.7%            | 20.0% | 0.0%      |

**Note:** In the process of interactive analysis, the samples without the educational background information of respondents were excluded.

It would be seen from table 1 that none of respondents with the educational background of junior high school and below was “not clear” in the China’s new energy industry, and there were somehow discrepancies between the results above mentioned and actual situation. However, the educational backgrounds of respondents enjoyed a positive relationship with their familiarities with new energy industry in China as a whole. The respondents with higher educational background were more likely to be familiar with the new energy industry in China.

5. Conclusions and policy recommendations

In addition to the government policy support, the perfect market mechanism and the enterprise's initiative, it also requires the public recognition and acceptance in the development of new energy industry. The paper examined the public awareness of the development of new energy in china. Those findings suggested that most of the public understood and were hopeful about the new energy industry in China, but it still needed to be enhanced. China’s public awareness of solar energy, wind power was relatively large, but their understanding of new energy vehicles, biomass was relatively inadequate. The subject characteristics of respondents could significantly influence on their familiarities with new energy industry in China.

Compared to conventional fossil fuels, the new energy industry is more closely linked with the public, especially the distributed new energy sources. The development of new energy needs the public's positive reaction in China, and the public awareness and behavior of the new energy industry will affect the development of China's new energy industry. To raise the public rational awareness of the new energy industry and the level of participation will be conducive to the marketing and the implementation of relevant policies in China’s new energy industry.

First of all, it should be attached great importance to the public's position in the development of new energy industry. Especially, the status and role of the public should be
paid attention during the governments’ introducing the relevant policies and the enterprises’
promoting their market in the new energy industry. Meanwhile, it is indispensable to establish
effective public contact mechanisms, such as feedback, public surveys, etc.

Secondly, it is urgent to strengthen propaganda to the public in China’s new energy
industry. The Governments and related enterprises should vigorously promote the new energy
industry so that the new energy industry can establish a close relationship with the public.
Further, it should be strived to make the new energy industry become a part of the public’s
daily life. In the aspects of publicity of new energy industry, it should not favor one more than
another for different varieties of new energy. Each variety of new energy sources has its own
characteristics and advantages. All varieties of new energy should acquire importance to
better play their own value with enlarging growth space.

Last but not least, it is to take different measures for different public groups. For example,
young public's current position on the new energy industry is relatively low, but their
optimism of the new energy industry is very high. Therefore, based on the characteristics of
young public, the governments and enterprises should increase awareness and experience of
the new technology and new consumption styles for the young public in China’s new energy
industry.

References:
[1] Sovacool B K and Brown M A 2007 Energy and American society: thirteen myths (New
York: Springer Science + Business Media BV)
[2] Schmid G 2012 The development of renewable energy power in India: which policies
have been effective Energy Policy 45 317–26
[3] Kitzing L, Mitchell C and Morthorst P E 2012 Renewable energy policies in Europe:
Converging or diverging Energy Policy 51 192–201
[4] Pfeiffer B and Mulder P 2013 Explaining the diffusion of renewable energy technology
in developing countries Energy Economics 40 285–96
[5] Li M and Deng X D 2014 China's new energy industry development: factor analysis of
the impacts Innovation 2 17-20
[6] Mallon K 2014 Renewable energy policy and politics: A handbook for decision-making
(Beijing: Economy & Management Publishing House)
[7] Gehrke R 2015 Renewable energies for your home (Beijing: China Machine Press)