Research Article
Research on New Energy Industry Development in Shandong Province with Financial Support

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Abstract: Shangdong Province is a major energy exporter as well as a green city of economic development. However, amid the rapid development of economy, Shandong province has witnessed the development of some non-economic and green industries, therefore, to fulfill the government's obligation and to make the industry planning better and to create green environmental industry, it is necessary to study the development function of new energy industry in Shandong under the support of government finance. Energy plays an important role in developing economy and sustaining human life, without which human cannot survive. Nowadays, due to the mass consumptions of energy on earth by humankind, it is urgent for humankind to seek new alternative energy sources and develop environmental protection industry. As one of the key industries supported by the state in recent years, new energy industry, including industries supported by hydropower, wind power, tidal energy and luminous energy, is under rapid development and has become the main driving force to change the enterprise structure and promote the development in Shandong Province. Based on the data of energy developmental level within 20 years from 1993 to 2012 in Shandong Province, this thesis is to build a financial support model suitable for new energy development in Shandong Province by using the basic principle of factor analysis. After unit root test, co-integration test and causality test on the data and analysis, a conclusion that the measurement index between financial efficiency, scale and results are indeed co-integrate and moreover, it gives a major push to the development of new energy industry. Therefore, the major drivers of the development of new energy in China with the financial support can be summarized. This research can provide theoretical basis for the structure of new energy industry in Shandong Province.

Keywords: Development, energy finance, financial support, new energy industry

INTRODUCTION

With the continuous development of social economy, people are consuming energy sources in large quantities while enjoying the benefits, which greatly threaten the harmonious development between humankind and nature. Nowadays in China, because of the highly centralized credit funds, if the supply-demand relationships of the products change, or economic operation experiences cyclical adjustment, the credit funds of the enterprises will be at high risks (Wen, 2012). Therefore, this thesis focuses on the study and analysis of the relation between energy and finance so as to push the development of new energy industry.

Data sources: Among all the new energy industries, the financial indices data of each subsidiary industry (concerned solar energy, wind energy source, biomass energy, etc.) are provided by China Stock Market Accounting Research (CSMAR) and annual financial report of each listed company. In addition, in this thesis, relevant data measured on the index including financial efficiency, scale and structured data are from Shandong Statistical Yearbook in 2012.

Based on the developmental level and measurement criteria of the energy industry, output ratio between renewable energy sources and non-renewable energy sources, output ratio between renewable energy and indexes such as energy-processing efficiency are selected and analyzed. In Statistical Yearbook in 2012, energy output can be reflected in total energy production, while renewable energy sources can be calculated by using the proportion of wind power, hydropower and nuclear energy as well as the proportion of coal, oil and natural gases in the total energy production. To ensure the continuity of the data, the twenty years data from 1993 to 2012 are calculated and selected as research sample, which can be seen in Table 1 in detail.

DEVELOPMENT MODEL FOR NEW ENERGY INDUSTRY WITH FINANCIAL SUPPORT

- **Index selection of evaluation system for new energy industry development:** Since early 1990s, scholars in our country set out to study the index measurement of financial development on the basis of some mature financial index abroad. However,

Table 1: Data of energy development level from 1990 to 2009

Year	Output ratio between renewable energy and non-renewable energy	Output ratio between different renewable energy	Energy-processing efficiency	Financial interrelation ratio	Energy industry development index
1993	14.99	5.85	8.92	5.03	12.05
1994	15.38	4.98	5.2	7.94	11.11
1995	16.43	5.85	5.73	11.13	12
1996	18.18	12.15	17.37	14.35	17.14
1997	22.04	24.75	2.47	13.32	16.91
1998	27.91	33.09	80.6	16.45	43.41
1999	30.38	30.18	67.28	22.84	40.71
2000	30.65	42.43	59.47	31.8	40.33
2001	28.4	52.29	50.31	43.58	37.77
2002	29.69	36.12	49.73	56.42	36.18
2003	31.65	55.58	45.69	58.85	38.83
2004	37.5	83.67	51.47	70.18	47.65
2005	42.2	81.49	45.69	79.58	48.48
2006	57.35	58.85	52.62	86.55	56.22
2007	73.56	68.24	78.69	83.07	74.29
2008	83.69	71.17	86.54	85.85	82.8
2009	89.77	73.98	83.03	83.78	85.74
2010	93.82	81.49	76.67	75.67	87.34
2011	96.24	94.49	86.54	74.9	93.28
2012	97.89	95.22	90.78	94.2	95.53

as we are still in a developing stage and our financial development is not as mature as foreign countries, we need to produce our own measurement index on the financial development according to our own practical conditions:

o **Financial scale index:** Index for financial scale measurement = (Total deposits- Total loans)/GDP
o **Financial structure index:** Index for financial structure measurement = Domestic equity financing balance/Bank loan balance
o **Financial efficiency index:** Index for financial efficiency measurement = Generalized total saving deposits/Fixed investments in society at large

• **Facility status recognition based monitoring:** The idea of factor analysis appeared at the beginning of 20th century at the earliest, which was discovered and put forward by scholars including Karl Pearson during the statistical analysis of intelligence test. Factor analysis, by definition, is the common cause for variable changes or the special cause inducing the variable changes (Gao, 2012). Factor analysis divides the variables into two factors, one is the common factor each variable have in small number, the other is individual factor broken by special factor in the variables. It can be shown in mathematical model as the following:

$$\begin{cases} x1 = a11\,f1 + a12\,f2 + \ldots\ldots + a1mfm + \varepsilon1 \\ x2 = a21\,f1 + a22\,f2 + \ldots\ldots + a2mfm + \varepsilon2 \\ \\ xp = ap1\,f1 + ap2\,f2 + \ldots\ldots + apmfm + \varepsilon p \end{cases}$$

In the above model, the mean value and standard deviation of X are zero and one, respectively, both of which are standardized variables. A, the factor load matrix of variable a_{jj}, is the coefficient of No.$_i$ and No.$_j$

factors. F refers to the variable of factors or the common factors in different variables. In the mathematical model, variables are represented by linear combination.

• **Suitability test on factor analysis:** KMO is usually used to conduct suitability test on factors. KMO test compares the variables during the test. The formula is that the square summation of original variation coefficient plus the square summation of deviation coefficients and finally dividing the former by the latter (Li, 2010). The lager the result is, the more suitable it is for factor analysis. The criteria are as follows:

• 0.9<KMO: very suitable
• 0.8<KMO<0.9: suitable
• 0.7<KMO<0.8, general
• 0.6<KMO<0.7, relatively less suitable
• KOM<0.6, not suitable

It can be seen from Table 2, Bartlett's sphere city test results is 148.9, with the p-value approximate to zero, indicating that the relation between these variables are close since KMO is greater than 0.5, therefore, factor analysis can be conducted.

• **Integrate score of listed enterprises in new energy industry in Shandong Province:** The function results of factors can be calculated on the basis of the factor analysis results, while the integrate score of listed enterprises in new energy industry in Shandong Province in each year can be calculated according to the specific value between variance contribution of primary factor and

Table 2: KMO and Bartlett's test

Extracting enough Kaiser-Meyer-Olkin		0.793
	Chi-squared approximation	148.9
Bartlett's sphericity test	Df	28
	Sig	0.000

Table 3: Integrate score of new energy industry in Shandong Province from 2001 to 2010

Year	F1	F2	F3	Integrate scores
2001	-0.16802	2.804787	-0.25262	1.134518696
2002	-1.12958	-0.50502	-0.52505	-0.841304814
2003	-0.39736	-0.2866	1.04121	-0.096776743
2004	-0.52117	-0.32307	1.11876	-0.153149946
2005	-1.38829	-0.38492	-0.56778	-0.912282418
2006	-0.31087	-0.21828	0.23090	-0.191197061
2007	1.102276	-0.15049	1.67582	0.767221308
2008	0.263926	-0.09513	-0.63065	-0.051761794
2009	0.679277	-0.65541	-1.57332	0.652501493
2010	1.869817	-0.18585	-0.51729	-0.841304814

accumulating contribution rate, which can be seen in Table 3.

- **Construction of the model:** $NE_1 = B_0 + B_1 InFSC_1 + B_2 InFE_1 + B_3 InFST_1 + B_4 InR\&D_1 + B_5 InK_1 + \epsilon_1$

In the above, NE_t is the index that measures the development of new energy industry, FSC_t, the index that measures financial scale, refers to the ratio between the balance of total deposit and total loan in Shandong and the local GDP in a given year (Yang, 2010). FST_t, the index that measures financial structure, refers to the ratio between equity financing amount and bank loan amounts in a given year. FE_t, the index that measures financial efficiency, refers to the local saving-investment transformation rate (Wen *et al.*, 2009).

EMPIRICAL STUDY ON THE DEVELOPMENT OF NEW ENERGY INDUSTRY WITH FINANCIAL SUPPORT

- **Data processing:** The data sources are lack of legal veracity and the time of each data entry is rather long so that the data may not be so accurate. As a result, it is needed to analyze the original data first and remove those inauthentic data before the use of data.

- **Data processing:** The application of non-stationary time series in building regression model may lead to spurious regression, according to the knowledge of time series in econometrics. Therefore, stationarity test need to be conduct first before building regression model, with the test results listing as Table 4.

As it can be seen from Table 4, only the development index of new energy industry and the index of financial structure is stable, with all the others unstable.

- **Co-integration test:** In co-integration test, the results are non-stationary when testing on single time series, however, when integrated, it becomes stationary. Due to the lasting linear relation among them, it is feasible to study the equilibrium relations among them. So far, there are many methods to conduct co-integration test on time variables, in which the co-integration relationship among different variables can be determined to illustrate the equilibrium relations between financial efficiency, financial structure and technical progress (Chen and Li, 2010).

Table 4: Test results on the stationary of each variable

Null hypothesis	t-statistics	p-valve	Results
There is roots of unity for Net	-4.267891244	0.0123	Rejected
There is roots of unity for D (Net)	-4.957802351	0.0064	Rejected
There is roots of unity for FSCt	-2.564995340	0.1334	Rejected
D (FSCt)	-2.390967271	0.1687	Rejected
Fet	-1.89213057	0.3221	Accepted
D (Fet)	-2.50369243	0.1454	Rejected
FSTt	-2.19993128	0.2169	Accepted
D (FSTt)	-4.49414277	0.0111	Rejected
There is roots of unity for R & Dt	-0.86122277	0.7553	Accepted
There is roots of unity for D (R & Dt)	-4.11253824	0.0152	Rejected
There is roots of unity for Kt	-0.704616289	0.8014	Accepted
There is roots of unity for D (Kt)	-3.52176877	0.0346	Rejected

Table 5: Granger causality test result

Null hypothesis	F-statistics	p-value	Result
FSCt is not the granger cause of Net	33.74042	0.008782	Rejected
Net is not the granger cause of FSCt	22.35801	0.012538	Rejected
FEt is not the granger cause of Net	27.42961	0.08538	Rejected
Net is not the granger cause of FEt	18.47908	0.09851	Rejected
FSTt is not the granger cause of Net	19.12381	0.18785	Accepted
Net is not the granger cause of FSTt	1.76367	0.81159	Accepted
RDt is not the granger cause of Net	11.60599	0.03561	Rejected
Net is not the granger cause of RDt	22.12383	0.09997	Rejected
Kt is not the granger cause of Net	0.68188	0.57002	Accepted
Net is not the granger cause of Kt	1.34249	0.38334	Accepted

- **Causality test:** We can only get the equilibrium relations between variables from co-integration test, without knowing the causal relationship between them (Gao, 2010). Combining relevant data, causality test on the development index of new energy industry has been conducted, with the results listing as Table 5. All the above indicates that, for the new energy industries in Shandong Province, such factors as financial efficiency, financial scale and technical advance are boosting the development of the new energy industry, with financial structure having no apparent effect on it (Jiang *et al.*, 2010). Thus, it follows that, to develop new energy industry, it is not only needed to keep on developing financial efficiency, financial scale and technology on the present basis, but also to lay emphasis on the optimization of financial structure (Chen, 2011).

As it can be seen from the above, the measurement index between financial efficiency, scale and results are indeed co-integrate and moreover, it gives a major push to the development of new energy industry (Yang, 2010).

CONCLUSION

Energy is the important material to develop economy and to maintain human survival movement. It is impossible for human being to live if there is no energy. More and more energy in our planet is used by the human; therefore, it is urgent for the human being to look for new alternative energy sources and to develop energy saving industry and environmental protection industry. New energy industry is one of the major industries supported by our country. Industries based on hydroelectric energy, wind power, tidal energy and optical energy are booming now, which have become the main force to change the industrial structure and to make it develop in Shandong. In recent years, the new energy industry in Shandong Province has been developing rapidly and gained great achievements within the overall context of vigorously developing emerging environmental protection and green industries by the government. Meanwhile, we must realize that the new energy industry is taking off and still in the initial

stage. Therefore, it is necessary to provide more financial support, improve financial management system, speed up financial institution establishment and innovate financing pattern. In the mean time, the development of new energy industry and the establishment of financial industry are mutual impetus to their development, since the development of financial industry in Shandong will provide financial support and development capital for the development of new energy industry, while in return, the development of the latter is conducive to the development of the former as well as technology innovation. Therefore, it is essential to have both of them in hand, developing new energy industry in the process of establishing financial industry. Only in this way can the new energy industry in Shandong keep in advance and make innovations.

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