Research on the Development Quality Evaluation of energy enterprises from the perspective of low-carbon

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Abstract. National strategic transformation puts forward higher requirements for energy conservation and emission reduction in energy enterprises. Under the low-carbon perspective, energy enterprises should seize the opportunity and combine their own conditions to realize energy conservation and emission reduction while ensuring the development quality of enterprises. This paper constructs a development quality evaluation system for energy enterprises, which includes four first-level indicators including customer dimension, environmental protection dimension, social responsibility dimension and financial dimension, and 18 second-level indicators, providing reliable basis for high-quality development of energy enterprises.

Keywords: Energy Enterprise, AHP, Development Quality Evaluation.

1. Introduction

Energy is an important material basis for the survival and development of human society and has a particularly important strategic position in the national economy. The development quality of energy enterprises is particularly important in today's increasingly prominent energy pressure. Accurate and scientific evaluation of the development quality of energy enterprises is of great significance for promoting the development of national energy industry and realizing healthy economic development.

2. Design principles of the index system

2.1. Combine comprehensiveness with scientificity
Comprehensiveness means that the evaluation index system should be able to evaluate the overall situation of the development of energy enterprises without losing some important attributes. The selection of evaluation indexes should cover all links of enterprise development quality. Scientificity means that the evaluators should evaluate the actual situation and characteristics of energy enterprises in a rigorous manner when conducting research.

2.2. Combine short-term and long-term goals
When designing the evaluation research of energy enterprise development quality under the low-carbon vision, we should not only consider the short-term goal of the enterprise, but also pay attention to the long-term goal of the enterprise. We should not only consider the short-term economic performance of enterprises, but also pay attention to the long-term social responsibility dimension of enterprises. Only
comprehensive consideration of the two can ensure that enterprises do not seek growth at the cost of the environment and achieve sustainable development.

2.3. Combination of qualitative indicators and directional indicators
Qualitative index is to make subjective judgment based on the rich practical experience of experts, and generally to speculate from the nature of the research object. Quantitative research is based on a large amount of data to describe the research objects and explore the relationship between the data. The organic combination of the two can fully and objectively reflect the real conditions of the research objects.

3. The determination of the index system
Based on the above principles and referring to the previous research results, the development quality evaluation system of energy enterprises under the low-carbon vision is designed. Specifically, it includes four first-level indicators including customer dimension, environmental protection dimension, social responsibility dimension and financial dimension, and eighteen second-level indicators.

3.1. Customer dimension
Customers are the service objects of enterprises, and customer satisfaction and loyalty directly affect the benefits of enterprises. Therefore, the customer dimension should be considered first when measuring the quality of enterprise development. This first-level index is mainly composed of three second-level indexes, namely, customer repeat purchase times, market share and customer satisfaction. The number of repeated purchases by a customer refers to the number of repeated purchases by the same customer within a rated time. This data reflects customer loyalty, and with the development of big data technology, it is possible to capture this data. Market share refers to the market share of the product in the sales of similar products. The higher the market share, the more popular the product is. Customer satisfaction refers to the satisfaction degree of customer perception compared with customer expectation. This data can be obtained through the corresponding questionnaire.

3.2. Environmental protection dimension
In order to achieve sustainable and healthy development, energy enterprises should not only pursue economic interests, but also pay attention to environmental protection. The healthy development of enterprises can be realized only when economic benefits are obtained and environmental behaviors of energy conservation and emission reduction are taken into account, and economic and environmental interests are well coordinated. The first-level index is mainly represented by four second-level indexes, namely, energy decline, pollution control investment rate, environmental protection investment rate and r&d expense ratio. The calculation formula of the above data is shown in Table 6, which can be obtained by processing the report data released by enterprises.

3.3. Social responsibility dimension
With the development of society, the social responsibility of enterprises has been paid more and more attention. The fulfillment of social responsibility has been concerned by all sectors of society, and the fulfillment of social responsibility has become an important indicator of the development quality of enterprises. In addition to avoiding its own harm, enterprises should expand their positive influence while achieving economic benefits. Social responsibility includes responsibility to society, responsibility to employees and responsibility to consumers. Specifically, the social responsibility is reflected by the administrative penalty rate, public welfare donation rate and tax rate. The employee's responsibility is expressed by two secondary indexes, employee's earning rate and safety cost rate. The responsibility to consumers is reflected by the second-level index of consumer interest rate.
3.4. Financial dimension
Financial dimension is an important part of the whole evaluation system. The financial indicators of enterprises should be integrated into the whole, and the financial status of energy enterprises under the low-carbon vision should be comprehensively displayed. If energy companies want high-quality development, they should at least be able to make profits, operate and grow. Specifically, profitability is the foundation for the survival and development of enterprises. In this paper, the return on equity and the rate of return on total assets are chosen to represent the two secondary indicators. Operating capacity reflects the ability of an enterprise to repay its debts with its own assets and is an important symbol of whether an enterprise can survive healthily. In this paper, asset-liability ratio and total asset turnover are selected to reflect the two secondary indicators. Growth ability is the ability of the enterprise to expand its business, which reflects the development trend of the enterprise in the future. In this paper, the second-level index of total asset growth rate is chosen to represent the growth ability of enterprises.

4. Construct judgment matrix and determine the weight
In this paper, M1, M2, M3 and M4 are used to represent the customer dimension, environmental protection dimension, social responsibility dimension and financial dimension respectively. N1-n3 is used to represent the three secondary indicators in the customer dimension, N4-N7 is used to represent the four secondary indicators in the environmental protection dimension, N8-N13 is used to represent the six secondary indicators in the social responsibility dimension, and N14-N18 is used to represent the five secondary indicators in the financial dimension.

First, the elements of the target layer are constructed in Yaahp software, and then the index elements of the criterion layer are constructed. Table 1 is the judgment matrix between the first-level index elements M1, M2, M3 and M4:

| A   | M1  | M2  | M3  | M4  | W_i | Consistency check               |
|-----|-----|-----|-----|-----|-----|---------------------------------|
| M1  | 1   | 1/2 | 1/3 | 1/5 | 0.0917 | λmax=4.1080 CR=0.0404<0.1 |
| M2  | 2   | 1   | 2   | 1/2 | 0.2484 |
| M3  | 3   | 1/2 | 1   | 1/3 | 0.1799 |
| M4  | 5   | 2   | 3   | 1   | 0.4800 |

As shown in Table 1, the consistency ratio is 0.0404. The judgment matrix passes the consistency test and the result is acceptable. Its maximum eigenvalue is 4.1080, and four-dimensional weight vector WI (0.0917, 0.2484, 0.1799, and 0.4800).

Table 2 shows the judgment matrix between customer dimension indexes N1-N3:

|       | M1 | N1 | N2 | N3 | W_i | Consistency check               |
|-------|----|----|----|----|-----|---------------------------------|
| N1    | 1  | 1  | 1/2| 0.2611 | λmax=3.0537 CR=0.0516<0.1 |
| N2    | 1  | 1  | 1  | 0.3278 |
| N3    | 2  | 1  | 1  | 0.4111 |

As shown in Table 2, the consistency ratio is 0.0516. The judgment matrix passes the consistency test, and the result is acceptable. Its maximum eigenvalue is 3.0537, and three-dimensional weight vector WI (0.2611, 0.3278, and 0.4111). The judgment matrix between environmental protection dimension indexes N4-N7 is shown in Table 3:
Table 3. Judgment matrix of environmental protection dimensions

| M2 | N4 | N5 | N6 | N7 | Wi   | Consistency check |
|----|----|----|----|----|------|-------------------|
| N4 | 1  | 5  | 4  | 3  | 0.5529 | λ_max=4.0918, CR=0.0344<0.1 |
| N5 | 1/5| 1  | 1/2| 1  | 0.1124 |
| N6 | 1/4| 2  | 1  | 2  | 0.2037 |
| N7 | 1/3| 1  | 1/2| 1  | 0.1311 |

As shown in Table 3, the consistency ratio is 0.0344. The judgment matrix passes the consistency test and the result is acceptable. Its maximum eigenvalue is 4.0918, and four-dimensional weight vector Wi (0.5529, 0.1124, 0.2037, and 0.1311).

The judgment matrix between social responsibility dimension indexes N8-N13 is shown in Table 4:

Table 4. Judgment matrix of social responsibility dimensions

| M3 | N8  | N9  | N10 | N11 | N12 | N13 | Wi   | Consistency check |
|----|-----|-----|-----|-----|-----|-----|------|-------------------|
| N8 | 1   | 1/2 | 1/2 | 1/2 | 1   | 1/2 | 0.1015 | λ_max=6.4442, CR=0.0705<0.1 |
| N9 | 2   | 1   | 1   | 1   | 1/2 | 1   | 0.1176 |
| N10| 2   | 3   | 1   | 1   | 1/2 | 1   | 0.2039 |
| N11| 2   | 3   | 1   | 1   | 1/2 | 1   | 0.1888 |
| N12| 1   | 2   | 1   | 1   | 1   | 1   | 0.1719 |
| N13| 2   | 3   | 1/2 | 2   | 1   | 1   | 0.2163 |

As shown in Table 4, the consistency ratio is 0.0705. The judgment matrix passes the consistency test, and the result is acceptable. Its maximum eigenvalue is 6.4442, and six-dimensional weight vector Wi (0.1015, 0.1176, 0.2039, 0.1888, 0.1719, and 0.2163).

The judgment matrix between financial dimension indicators N14-N18 is shown in Table 5:

Table 5. Financial dimension judgment matrix

| M4 | N14 | N15 | N16 | N17 | N18 | Wi   | Consistency check |
|----|-----|-----|-----|-----|-----|------|-------------------|
| N14| 1   | 1   | 1/2 | 2   | 1   | 0.2009 | λ_max=5.4477, CR=0.0999<0.1 |
| N15| 1   | 1   | 1/2 | 1/5 | 1/2 | 0.1095 |
| N16| 2   | 2   | 1   | 1   | 1   | 0.2420 |
| N17| 1/2 | 5   | 1   | 1   | 1   | 0.2420 |
| N18| 1   | 2   | 1   | 1   | 1   | 0.2056 |

As shown in Table 5, the consistency ratio is 0.0999. The judgment matrix passes the consistency test and the result is acceptable. The maximum eigenvalue is 5.4477, and the five-dimensional weight vector Wi (0.2009, 0.1095, 0.2420, 0.2420, and 0.2056). All the matrices passed the one-time test, which showed that the evaluation system of development quality of energy enterprises under the low-carbon vision constructed in this paper was objective and effective. Then, the weight value of each second-level index can be obtained as shown in Table 6.
### Table 6. Evaluation index system of energy enterprise development from the perspective of low-carbon

| Dimension       | Name                                      | Meaning                                                        | Weight  |
|-----------------|-------------------------------------------|----------------------------------------------------------------|---------|
| Customer        | Times of repeated consumption by customers | The number of times the customer makes a repeat purchase within the rated time | 0.0240  |
|                 | Market share                              | Enterprise product sales/Market sales                          | 0.0301  |
|                 | Customer satisfaction                      | Customer perception/Customer expectation                       | 0.0377  |
| Environmental    | Energy decline                            | Current year energy consumption - Last year energy consumption  | 0.1373  |
| Protection      | Rate of investment in pollution control    | Administrative expenses/Operating income                       | 0.0279  |
|                 | Environmental investment rate              | Environmental investment/Revenue                                | 0.0506  |
|                 | R&D expense ratio                          | R & D expenses/Operating income                                | 0.0326  |
| Social Responsibility | Administrative penalty rate               | Administrative penalty expenditure/Revenue                      | 0.0183  |
|                 | Charitable donation rate                   | Public welfare donation expenditure/Operating income           | 0.0212  |
|                 | Tax rate                                  | (Taxes+Income tax)/Number of employees                          | 0.0367  |
|                 | Employee earning rate                      | Employee remuneration/Operating income payable                  | 0.0340  |
|                 | Safety cost ratio                          | Safety expenditure/Operating income                             | 0.0309  |
|                 | Consumer interest rate                     | (Current operating income - previous operating income)/Previous operating income | 0.0389  |
| Financial       | Return on equity                          | Net profit/Average balance of shareholders' equity             | 0.0964  |
|                 | Rate of return on total assets             | (Gross profits + interest expenses)/Average total assets       | 0.0525  |
|                 | Asset-liability ratio                      | Total liabilities/Total assets                                  | 0.1162  |
|                 | Total asset turnover                       | Revenue/Average total assets                                    | 0.1162  |
|                 | Growth rate of total assets                | (Total assets of the current period - Total assets of the previous period)/Total assets of the previous period | 0.0987  |

### 5. Conclusion

High-quality development of energy enterprises will have a positive impact on the national economy. From the perspective of low-carbon, energy enterprises should seize the development opportunities of low-carbon economy and combine their own situations to realize energy conservation and emission reduction while ensuring the development quality of enterprises. Based on the low-carbon perspective, this paper constructs the enterprise development quality evaluation system of energy enterprises in four dimensions: customer, environmental protection, social responsibility and finance. The research results of this paper have certain reference value for guiding the high-quality development of energy enterprises.

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