Carbon Performance Evaluation Standard from the Perspective of Carbon Emission Right Trading

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Abstract. Carbon performance evaluation standard is an important system to help the enterprise realize low carbon transformation. However, although many organizations and scholars do researches in this field, it still lacks a generally accepted carbon performance evaluation standard. The paper finds that emission difference between actual emission and allowance and carbon price are the key factors to affect carbon performance from the perspective of carbon emission rights trading. The results show that over emission or below emission not only affects economic benefit or loss but also affect environmental benefit or loss. Therefore, the paper puts forward a two dimensional carbon performance evaluation standard of “inner economic benefit-outer environmental benefit”. This standard is helpful to strengthen carbon emission reduction of the enterprise and also helpful to anticipate carbon trading and develop carbon emission rights market.

Introduction

The enterprise’s active participation in dealing with climate change and developing low-carbon economy is the key factor to reduce emissions. However, as for business, low carbon transformation requires not only policy, technical systems and other aspects of the support, but also the material, energy, time, space, capital and other elements of a comprehensive economic integration. Improving efficiency of comprehensive economic problems cannot be separated from the effective performance evaluation criteria. As an important part of the incentive and restraint of enterprise low carbon transition, carbon performance evaluation is to evaluate the economic benefits and environmental benefits of carbon emission reduction by analyzing the allocation efficiency of carbon resources and the output efficiency of carbon emissions. In view of the close relationship between carbon emission and energy input, this paper intends to build a new carbon performance evaluation standard from the perspective of energy flow based on existing research results of carbon performance. The study is to construct a carbon performance evaluation standard definition from the perspective of carbon emission rights trading. This paper is organized as follows: first, literature review is presented. Second, the basic principle of carbon emissions trading is developed. Third, Excessive carbon emission or emission reduction and the carbon price are the key factors that influence carbon performance. Forth, two dimensional evaluation model of “internal economic benefits-external environment benefit” evaluation criteria of carbon performance is constructed, which is followed by conclusion and implications.

Literature Review

As early as the beginning of twenty-first Century, international organizations have begun to explore carbon performance. The most representative organization is Carbon Disclosure Project (CDP). CDP was established in 2000, which mainly sent carbon emissions information of questionnaire to top 500 enterprises in the world, which can set up a improve trust between companies and stakeholders on carbon emissions information communication channel. Starting from the first portion of the carbon disclosure report released in 2003, after more than 10 years of development, CDP has developed from a single disclosure of carbon emissions in the beginning (CDP, 2003) to
disclosure of corporate carbon development strategy, governance, stakeholder communication and performance information, such as the composition of the carbon Performance Leadership Index (CDPL) (CDP, 2011). CDPL is an evaluation method to evaluate the emission reduction performance based on the score of each company’s carbon emissions and the performance level. World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) is also released in 2004 -- ”greenhouse gas protocol corporate accounting and reporting standards” (WBCSD, 2004). The aim of protocol is to develop the international recognition of greenhouse gas accounting and reporting standards and to promote their adoption.

However, compared with abroad increasingly valued carbon performance information disclosure and performance management, domestic enterprises are obviously lagging behind. According to the questionnaire survey of China’s top 100 enterprises in CDP in 2011, the disclosure of carbon information of enterprises is less than 10%, to some extent, which shows that the carbon disclosure and management awareness of China’s enterprises is still very weak. In recent years, research of carbon disclosure and performance management gradually attracted the attention of scholars, such as Deming Tan, Shuliang Zou, Caiping Zhang, Xiaoxu, Aiguo Wang trying to construct China’s carbon disclosure framework by summing up the international carbon information disclosure experience.

To sum up, domestic and foreign organizations and scholars have paid attention to the disclosure of carbon performance information and the management of performance, these research results laid the foundation for the future research of carbon performance evaluation standards. Of course, there still have following defects in current study: (1) Carbon performance evaluation criterion is not clear. Corporate carbon emissions and emission reduction is not only an economic problem, but also an environmental issue. Therefore, according to the evaluation criterion, we should reflect the key factors of economic benefits and environmental benefits; (2) how to build carbon performance evaluation standards lacks a clear idea. To solve these problems, this paper attempts to from carbon emissions trading right perspectives.

The Basic Principle of Carbon Emissions Trading

Carbon emissions trading mainly refers to the transaction behavior of enterprises with different marginal abatement costs, so as to achieve the purpose of low cost reduction. Emissions trading encourages low cost reduction of enterprises difference reduction, and will receive a quota or carbon credits through the transaction to sell to high abatement costs of enterprises, to help high abatement costs of enterprises to achieve emission reduction targets, in order to reduce enterprise performance cost.

Under the Kyoto mechanism, European Union Emission Trading Scheme (EU ETS) under the voluntary mechanism are all based on the quota control and transaction system. Cap and Trading Scheme (CTS) is one of forms of EU ETS. Fig. 1 shows that in the beginning of the year to get a free quota of 12000 tons, the annual quota of 6000 tons, if the actual carbon emissions at the end of the year is 11500 tons, 500 tons of emission reduction; If the actual emissions of 12500 tons, 500 tons of excess emissions.

Figure 1. Cap and Trading Scheme (CTS).
Two-Dimension Carbon Performance Evaluation Standard Construction

Excessive carbon emission or emission reduction and the carbon price are the key factors that influence carbon performance.

As shown in Fig. 1, at the beginning of the year, the government allocated 12,000 tons of quotas to enterprise for free, and then the carbon price was 10 yuan per ton. On June 30, enterprise sales quota of 6000 tons, and the carbon price was 12 yuan per ton. At the end of the year, the actual emissions of carbon dioxide were 11,500 tons, so enterprises must buy 5,500 units quota from the carbon market, and the carbon price was 11 yuan per ton. The enterprise gains 11,500 yuan (6000 × 12 - 5500 × 11 = 11500) after 500 tons of emission reduction. Of course, if the enterprises actual emissions throughout the year were 12,500 tons, the enterprise must buy 6,500 units quota from the market. However, enterprises still get carbon income of 500 yuan (6000 × 12 - 6500 × 11 = 500). This fully reflects that the carbon trading system is designed to reduce the cost of carbon emission reduction. Thus, excessive carbon emission or emission reduction and the carbon price are the key factors that affect performance of carbon enterprise. The carbon cost or carbon gain should be the basis of performance evaluation, because it can constrain and motivate excessive carbon emission or emission reduction, improving the enterprise’s carbon benefits (see Fig. 2).

Figure 2. Excess or below emission’s influence and carbon price on carbon performance.

The Impact of the External Environment Generated from the Carbon Excessive Emission or Emission Reduction on Carbon Performance

Compared with the traditional performance evaluation, a significant feature of carbon performance evaluation is that it is not only concerned about the carbon economic benefits of the enterprise, but also must consider the environmental impact of carbon emissions. Obviously, carbon excessive emissions will strengthen the greenhouse effect and air pollution, resulting in the value of environmental damage, while carbon emission reduction can reduce the adverse impact of climate change.

Although at present China is still lack of scientific methods to account the cost of the external environment generated by excessive emission, the Japanese comprehensive industrial technology research institute of life cycle assessment research center and the joint development of LCA Project Life Cycle Environmental Impact Assessment Method based on Endpoint Model (Life cycle Impact assessment Method based on the Endpoint Modeling, LIME) provides a method of model for calculating the cost of environmental damage. In this method, the amount of human health damage caused by different kinds of environment loads is gathered together in a common endpoint, and the importance of considering the endpoint number when index merger is transformed into the evaluation of monetary value. LIME takes into account the global warming, ozone layer destruction and urban air pollution and other eleven environmental areas, and the 1000 kinds of environmental load material were estimated. As the model in the process of environmental damage assessment of waste resources, the technology and methods of environmental engineering, epidemiology, ecology, sociology and economics are integrated.

Therefore, it has a good comprehensive integration and assessment accuracy. The single currency index can be obtained by the following formula:
\[ \sum_{j=1}^{J} \sum_{i=1}^{I} S_i \times DF_{ij} \times WTP_j = \sum_{i=1}^{I} S_i \times \left[ \sum_{j=1}^{J} DF_{ij} \times WTP_j \right] \]

\( S_i \) = the life cycle listing of material \( i \);
\( DF_{ij} \) = damage coefficient of material \( i \) to protect the object \( j \);
\( WTP_j \) = protection object index of one unit of harm avoidance intention payments.


The fundamental purpose of carbon performance evaluation is to establish evaluation criteria, motivate and constraint carbon emissions of enterprises, achieve the win-win situation of economic and environmental benefits, which is the ultimate goal of developing low-carbon economy for the enterprises and achieving low carbon transformation. Therefore, this article attempts to construct an “internal economic benefits - external environment benefit” two - dimensional evaluation model as the standard of carbon performance evaluation. The following cases reflect the characteristics and advantages of these evaluation criteria.

Coal-fired power generation enterprise is typical of high fossil energy investment and high carbon dioxide emissions. It is the first batch of enterprises on the carbon emissions control in our country. In 2014, the National Development and Reform Commission, the Ministry of Environmental Protection, the National Energy Bureau jointly issued the plan of transformation and upgraded of the coal and electricity energy conservation and emission reduction (2014-2020), and also proposed ultra low emission transformation plan. Forced in rigid index reversed transmission and self-pressurized process, many coal-fired power plants began to improve the efficiency of transformation and construction. \( A_1, A_2, A_3 \), three scale of coal power generation enterprises’ carbon emissions data in 2014 are as follows: \( A_1, A_2, A_3 \), three companies have free access to the same quota, that is, 500 thousand tons, but the actual emissions are different. \( A_1 \) enterprise’ real carbon emissions is 720 thousand tons, 800 thousand tons of \( A_2 \), enterprises \( A_3 \) enterprises 860 thousand tons. The transaction price of carbon is 20 yuan per ton at the end of the year. According to the value of LIME, the conversion of the environmental damage per ton \( \text{CO}_2 \) monetary value of 0.45 yuan, the total value of environmental damage by 0.45yuan ultra displacement.

(1) The analysis of the internal economic efficiency and the external environment of the three enterprises in the same situation of carbon price is as follows (Table 1, Fig. 1):

<table>
<thead>
<tr>
<th></th>
<th>( A_1 )</th>
<th>( A_2 )</th>
<th>( A_3 )</th>
</tr>
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<tbody>
<tr>
<td>Actual emission(Kt.)</td>
<td>720</td>
<td>800</td>
<td>860</td>
</tr>
<tr>
<td>Allowance (Kt.)</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Difference(Kt.)</td>
<td>220</td>
<td>300</td>
<td>360</td>
</tr>
<tr>
<td>Carbon price(yuan)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Economic benefit(Kilo-yuan)</td>
<td>4400</td>
<td>6000</td>
<td>7200</td>
</tr>
<tr>
<td>LIME(yuan)</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Environment benefit(Kilo-yuan)</td>
<td>99</td>
<td>135</td>
<td>162</td>
</tr>
</tbody>
</table>
From the above Table 1 and Fig. 3, we can see that the $A_1$ enterprise has the smallest displacement, and the carbon cost and environmental cost is the lowest, therefore, the economic benefit and environmental benefit is the best, $A_2$ secondly, $A_3$ is the worst. Thus, the evaluation criteria are very intuitive to reflect the negative impact of carbon excessive emissions on enterprise economic benefits and environmental benefits, thereby encouraging enterprises to implement emission reduction measures actively and to reduce carbon emissions, carbon costs and environmental costs are also effective constraints on the excessive emission of enterprises.

The analysis of the internal economic efficiency and the external environment of the three enterprises in different circumstances of the carbon price is as follows. However, the excessive emission is not the only determinant of carbon performance. The carbon prices will also affect carbon performance. If $A_2$ and $A_3$ enterprise can purchase quotas at a low carbon price in usual times rather than be forced to purchase quotas at a high carbon price at the end of the final period, the carbon costs of the two companies will be completely different. Specific data are as follows (Table 2). The environmental benefits and economic benefits of the three enterprises under different carbon price conditions are shown in Fig. 4.

Table 2. $A_1$, $A_2$, $A_3$’s economic benefit and environment benefit based on the different price.

<table>
<thead>
<tr>
<th>Actual emission (Kt.)</th>
<th>$A_1$</th>
<th>$A_2$</th>
<th>$A_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allowance (Kt.)</td>
<td>500</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>Difference (Kt.)</td>
<td>220</td>
<td>300</td>
<td>360</td>
</tr>
<tr>
<td>Carbon price (yuan)</td>
<td>15</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Economic benefit (K. yuan)</td>
<td>3300</td>
<td>3000</td>
<td>2520</td>
</tr>
<tr>
<td>LIME (yuan)</td>
<td>0.45</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>Environment benefit (K. yuan)</td>
<td>99</td>
<td>135</td>
<td>162</td>
</tr>
</tbody>
</table>

From the above Table 2 and Fig. 4, because $A_2$ and $A_3$ enterprise buy the quota at a lower carbon price, the carbon cost is lower than the original, $A_2$ from the original 6 million yuan to 3million
thousand yuan, lower the amount of 3 million yuan, down to 50%; A3 decreased from the original 7 million 200 thousand yuan to 2 million 520 thousand yuan, reduced by 65%, thus reducing the impact of excessive emission on the carbon economy benefit greatly. From this we can know the importance of using carbon price fluctuations to reduce carbon costs. If the emission reduction, in order to achieve the maximization of carbon gain must participate in the carbon market. Obviously, the evaluation criteria can effectively encourage enterprises to actively participate in the carbon emissions market, thus promoting the development of carbon trading market.

Conclusions and Implications
In this article, we explore the key factors that affect carbon performance from the perspective of carbon emission rights trading. The study shows that the emission of carbon emissions generated from the difference between the actual amount of carbon emissions and the quota and the fluctuation of carbon price are the key factors that affect the carbon performance. Based on these results, this article constructs “internal economic benefits - external environmental benefits” two dimensional carbon performance evaluation criteria. The criteria have some implications:

**Enterprises should Develop Long-Term Emission Reduction Strategy and Continue to Promote the Enterprise’s Reduction Behavior of Carbon Emission**

“Internal economic benefits - external environment benefit” two dimensional carbon performance evaluation standard fully reflects the adverse effect of the excessive emission on the economic and environmental benefits of enterprises. Obviously, in the context of sustained economic development in the country, long-term excessive emission will weaken the low carbon competitiveness of enterprises. Strict emission standards should not become a stumbling block to the development of enterprises, but should be forced enterprises to forge ahead, pursuing new and change, through technological innovation and realize low carbon transition. Therefore, the enterprise should set up the carbon emission reduction strategy under the guidance of the low carbon concept and the specific carbon budget runs through every aspect of the enterprise.

**Enterprises should Take the Initiative to Participate in Carbon Trading**

Carbon trading is a kind of institutional arrangement for the government to use market means to promote enterprises to realize low cost reduction. Whether it is a excessive emission or emission reduction, using the fluctuations in the price of carbon market can achieve the improvement of carbon. Such as the European Union’s carbon trading system, the excess emissions will face a double penalty: the purchase and the excess emissions quota and the extra fine is up to 100 euros per ton. At present, China has no obligation of mandatory international emission reduction, but the pressure of carbon emission reduction is huge. Therefore, enterprises should be familiar with carbon trading rules as soon as possible for the purpose of laying the foundation for carbon trading in the future.

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