A RESEARCH ON VALUE EVALUATION OF GARBAGE INCINERATION POWER GENERATION PROJECT BASED ON B-S MODEL

Uma pesquisa sobre avaliação de valor do projeto de geração de energia de incineração de lixo com base no modelo b-s

Ye Jinling, Ye Houyuan
School of Management, Wuhan University of Technology, Wuhan, P.R.China, 430070
(E-mail: 523159386@qq.com, yehy@whut.edu.cn)

Abstract: With the development of the economy and the accelerated process of urbanization, the amount of waste, such as domestic waste and industrial waste, is increasing rapidly, and the municipal solid waste is becoming a huge problem that hinders the development of the city. However, in the academia, there is no systematic evaluation method for the garbage incineration power generation project. So if we just simply apply the traditional evaluation method to the project, we would ignore the strategic value and ecological value of the project investment. Therefore, it is an urgent problem to find a new method of project valuation. In this paper, the B-S model of the option pricing model is selected, and on this basis, the market and policy factors that affect the model results are proposed. It is considered that the waste incineration power has the value of evaluation and the possibility of evaluating the results.

Key words: Garbage incineration power generation project; Real option; B-S model; Project evaluation

UMA PESQUISA SOBRE AVALIAÇÃO DE VALOR DO PROJETO DE GERAÇÃO DE ENERGIA DE INCINERAÇÃO DE LIXO COM BASE NO MODELO B-S

A research on value evaluation of garbage incineration power generation project based on b-s model

Ye Jinling, Ye Houyuan
School of Management, Wuhan University of Technology, Wuhan, P.R.China, 430070
(E-mail: 523159386@qq.com, yehy@whut.edu.cn)

Resumo: Com o desenvolvimento da economia e o processo acelerado de urbanização, a quantidade de resíduos, como resíduos domésticos e industriais, está aumentando rapidamente, e os resíduos sólidos municipais estão se tornando um enorme problema que dificulta o desenvolvimento da cidade. Entretanto, no meio acadêmico, não existe um método sistemático de avaliação para o projeto de geração de energia para incineração de lixo. Portanto, se simplesmente aplicássemos o método de avaliação tradicional ao projeto, ignoraríamos o valor estratégico e o valor ecológico do investimento no projeto. Portanto, é um problema urgente encontrar um novo método de avaliação de projeto. Neste artigo, o modelo B-S do modelo de precificação de opções é selecionado e, com base nisso, são propostos os fatores de mercado e de política que afetam os resultados do modelo. Considera-se que o poder de incineração de resíduos tem o valor da avaliação e a possibilidade de avaliar os resultados.

Palavras-chave: Projeto de geração de energia para incineração de lixo; Opção real; Modelo B-S; Avaliação do projeto

ACEITO EM: 10/11/2019

1 Introduction

Since nineteenth Century, industrial development has caused rapid population concentration in the world and the rapid development of urbanization. Because of this, garbage disposal has been becoming a worldwide problem. In China, the average daily garbage output per person is about 1 kilograms, and is increasing rapidly at the rate of 8%~10% per year, while the rate of innocuous treatment for domestic waste is only 51.7%. Garbage siege has become a huge obstacle to the development of contemporary cities.

So, with the development of the economy, the progress of technology and the spread of the concept of environmental protection, people began to seek a more sustainable way of garbage disposal. In this environment, garbage incineration power generation came into being. It is of great significance to explore a set of methods suitable for the evaluation of the investment value of the garbage incineration power generation project, because of the great market prospect, the large independent expansion space and the high esteem between the government and the people.

Foreign scholars have made some achievements in the study of this issue. For example, in 1987, Trigeorgis and Mason believed that the real value of the project could be evaluated with the value of the basic NPV plus real options[1]; the results of Hantzis and Tanguturi thought that real options theory could be used in some project investment decisions[2]; Schuhmacher considered the risk management of waste incineration projects, The Monte Carlo method can be used to understand what effect the incineration of garbage can have on the human body; in its study, Hertzman believes that enterprises should open garbage incineration technology and improve public acceptance of garbage incineration projects; Corjan B has established a dynamic and computable general equilibrium model to analyze the cost benefit analysis of the carbon emission allowance price adjustment in the EU carbon emission trading system[3]

In recent two years, scholars in China have begun to pay attention to this issue. Kang Zhentong uses the cost - benefit method to analyze the problems that need to be paid attention to in the calculation of the cost, cost and income in the economic evaluation of the BOT project of domestic garbage incineration. Zhu Feng used traditional cost-benefit analysis and sensitivity analysis to conduct an economic evaluation and analysis of a garbage incineration power generation project. Song Jinbo and some one else used the system dynamics model to evaluate the revenue of the BOT project of garbage incineration power generation, constructed the system dynamics model of the revenue of the BOT project of the waste incineration power generation, and simulated the situation with the actual case[4].

2 Analysis of the Characteristics

We generally think that the garbage incineration project is a kind of environmentally friendly, renewable energy generation project, and has been encouraged by the government and the strong support of public opinion[5]. Therefore, the following characteristics can be summed up through the analysis.

(1) The irreversibility of investment. The development and construction of garbage incineration power generation projects requires specialized equipment such as incinerators, and the amount of investment is huge. Once capital is invested, it will be difficult to recover. And the equipment's specificity is very high. If the decision is to withdraw from the midway, the equipment can not be transferred to other usage. Therefore, once the initial investment is invested, it will become sunk cost and has strong irreversibility.

(2) the uncertainty of the return on investment. First of all, due to the large investment in the construction period of the garbage incineration generation and the imperfect income system of domestic waste, the return on investment of government subsidies is not definite. On the other hand, the electricity price income is also influenced by the state policy, the substitutes of complementary products, and the development of technology, and the return on investment is relatively strong. So, it may have some risks.

(3) the future growth space. In recent years, the shortage of energy resources, the problem of garbage besieging is the focus of attention at home and abroad. Garbage incineration power generation

project has great strategic value for enterprises. With the intensification of global climate problems, China must shoulder the responsibility for reducing emission in the future, and the government's policy support for waste incineration will be further strengthened.

To sum up, the garbage incineration power generation project has the irreversibility of investment, the uncertainty of income and the growth of investment, which makes the future cash flow of the project face great uncertainty. The traditional discounted cash flow method (DCF) does not consider such uncertainty and is not applicable to the investment price evaluation of such projects. The real option evaluation method is to use the thinking of financial options to solve the problems existing in the real investment. In the project decision, the option analysis technology is adopted to conceptualize, quantify or model the problem of investment flexibility that the traditional DCF can't deal with[6].

3 The Construction of the Model
3.1 Applicability analysis of model

In the general research, there are three kinds of options pricing methods: B-S pricing model, two fork tree model and Monte Carlo simulation. The most widely used is the B-S model, which has several application preconditions. The price changes of the subject matter are in accordance with the random Brown movement, the subject matter is in a free trading market, the price changes into a continuous state, the price change rate can be measured and kept constant[7]. Next, the rationality of the B-S model applied to garbage incineration power generation project is analyzed first.

Without the influence of external policy or other contingency, the price of the garbage incineration power generation project usually changes in a continuous way, and does not take a large jump, which is in line with the random Brown movement. In addition, it is difficult to meet the requirements of the complete market in the B-S model, and China's carbon market is not perfect. However, this year, the continuous transaction, especially the CCER project of waste incineration, has been developing continuously, and the reasonable market transaction price is gradually forming, so it is now possible to assume the premise of satisfying the B-S model. Therefore, we can think that the B-S model can be used to calculate the theoretical price of options, but our assessors can also improve the adjustment according to the current market conditions.

3.2 Model construction

The classic B-S model is generally:

$$C = S*N(d_1) - L * e^{-rT}N(d_2) \tag{1}$$

$$\text{And,} d_1 = \frac{ln\frac{S}{L} + (r+0.5*\sigma^2)*T}{\sigma*\sqrt{T}}, \qquad d_2 = d_1 - \sigma * \sqrt{T} \tag{2}$$

C—the initial reasonable price of the project,

L—option delivery price

S—the present price of the waste incineration project

T—validity period

R—continuous compound interest rate free interest rate σ—the volatility of future revenue from waste incineration

This formula can be used as the pricing basis of our project value assessment, that is, the formula for calculating the real option value of garbage incineration power generation. On this basis, because of the consideration of the enterprises, there are other factors that affect the value of the project, such as the changes in environmental related policies, the development of the related industries, the progress of environmental protection technology and so on. If the above formula is used to evaluate, it will bring value to be overestimated or underestimated. From this point of view, this paper will amend the above models in combination with

environmental protection policy and technology development, in order to improve the accuracy of project value assessment.

The return value S of the expected cash flow of a project obeys the stochastic Brown motion law due to the influence of market uncertainties.

$$dS = \mu * S d_t + \sigma * \quad S dz \qquad (3)$$

Among them, μ is the expected growth rate of S return, and σ is the volatility of future earnings growth.

In addition, considering the influence of technological progress and policy factors, the future expected earnings will change under the influence of these factors. It is foreseeable that the progress of garbage disposal technology will reduce the expected growth rate of future revenue .And its possible to change from μ to $\mu(-a)$. In addition, changes in the relevant policies will lead to a larger fluctuation of future earnings growth and a change from $\mu(-a)$ to $(\mu-a+b)$, so the expected return S will change to:

$$dS = (\mu-a+b) * S d_t + \sigma * S dz \qquad (4)$$

According to Ito lemma, the revised B-S pricing model is:

$$C = S * e^{(b-\mu)T} * N(d_1) - L * e^{-rT} N(d_2) \qquad (5)$$

And, $d_1 = \dfrac{\ln\frac{S}{L} + (r+b-a+0.5*\sigma^2)*T}{\sigma*\sqrt{T}}$,

$$d_2 = d_1 - \sigma * \sqrt{T} \qquad (6)$$

3.3 The determination of wave rate σ

Commonly, the methods used to determine the wave rate are the approximation method of historical return volatility and the iterative method. However, because the garbage incineration power generation project is still in the emerging stage, and the historical data are limited, and the future development is also faced with many uncertainties, so it is difficult to predict the volatility of future income accurately with the limited historical data. The iterative method is used to measure and calculate the variable speed iteration.

The so-called variable speed iterative method is that each iteration is not an increasing number of Q elements, but the expert determines how many elements each time according to their own decision. Each increment may be certain, perhaps not necessarily, the result of this iteration is more in line with the actual situation, and can also better express the expert opinion.

$$m(u_i) \triangleq \dfrac{\sum_{r=1}^{s} \sum_{s=1}^{c_i} U_S^{(j)}(u_i)}{\sum_{r=1}^{s} t_j} \qquad (7)$$

In order to be more precise, each expert should memorizing m times without memory. After the iteration process is terminated, we also calculate the coverage frequency of u_i, $i = 1,2,... k;$

Among them, t_j is the termination step of the iteration process of the j evaluator, and the result is that the arithmetic mean of the m result is obtained.

$$w_A(u_i) = m(u_i)/\sum_{i=1}^{k} m(u_i), \qquad (8)$$

and then, the σ obtained.

4 Conclusion

With the development of economy and the increasing number of garbage, the garbage incineration power generation project has become a hot issue in the society. Since the traditional net cash flow method is unable to meet the needs of the project asset evaluation, we combine the other methods of intangible assets assessment, such as real option method, to explore a new way ,using for this kind of value assessment. However, this paper only discusses the factors that affect the results from the market impact and policy impact, but does not pay attention to the social and environmental impacts of such projects, which is still not perfect and needs further research and discussion.

Acknowledgement

The authors would like to thank the Mr Ye for his selfless support, and the Waste Incineration Research Center (WIRC), as well as the National Bureau of Statistics of the People's Republic of China, for their kind cooperation. Finally, thanks to ICIM for giving me this opportunity.

References

[1] Trigeorigis L,Mason S P. Valuing managerial flexibility and strategy in resource [J]. Midland Corporate Finance Journal, 1987(1):14-21

[2]Harmantzis F C，Tanguturi V P.Investment decisions in the wireless industry applying real options [J]. Telecommunications Policy, 2007,31(6):107-123

[3] Andrey K，Nikolay Khabarov. Michael Obersteiner. Fair Pricing of REDD－based Emission Offsets under Risk Preferences and Benefit－sharing [J]. Energy Policy, 2016,96(9):193-205

[4] Gan Jie. Evasion avoidance in MSW incineration power plant-Taking the nine peak project in Hangzhou as an example [J]. Environmental sanitation engineering., 2016(04):87-88 (In Chinese)

[5] Song Jinbo.System dynamics model of BOT project income from MSW Incineration [J].2015(3):67-74 (In Chinese)

[6] Zheng Shiwei, Bao Jianzhen, Zhang mao.Present situation and Prospect of municipal solid waste incineration power generation market in China [J]. Renewable resources and circular economy, 2017(4):19- 22 (In Chinese)

[7] Gao Yabing.Research on the application of real options in the valuation of intangible assets [D]. Liaoning University, 2014 (In Chinese)

[8] Zao Peipei. The application of real option in the value analysis of China's CDM project [D]. Jiangnan University, 2012 (In Chinese)

[9] Qin Zhengbiao. Investment decision analysis of domestic funded BOT Expressway Based on real option theory [D]. Doctoral dissertations of Southwest Jiao Tong University, 2011 (In Chinese)

[10] Zhao Wenhui, Li Ruan, Li Xiaonan. Research on emission trading mode based on real options [J]. soft science, 2018,32(03):89-92 (In Chinese)