Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2014, 6(5): 527-535

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Study on the evaluation of strategic alliance partners among iron and steel enterprises in the perspective of energy-saving services

Dajun Ye

Sichuan College of Architectural Technology

ABSTRACT

To help steel companies get rid of slump and achieve low-carbon development, this essay integrate energy-saving concept into iron and steel enterprise of strategic alliance partners, and adopts the methods such as surveys and interviews to look for and filter out the impact indicator for it to select from the perspective of energy conservation service, and make arrangement and categorization. The importance of indicators are analyzed by analytic hierarchy process (AHP), so as to determine the weight of each indicator to discuss the impact of important index on the alliance development of iron and steel enterprises.

Key words: Analytic hierarchy process; Partner selection; Iron and steel enterprise; Energy-saving services

INTRODUCTION

Iron and steel enterprises are of huge potentiality for energy saving and emission reduction, but face a series problems like the choice of development path to the low carbon economy and the implementation of a breakthrough [1-4]. In order to help these enterprises out of their slump to achieve sustainable development, many scholars have study on strategic alliance partners among iron and steel enterprises to achieve low carbon in the whole steel industry[5-9]. Starting from the perspective of energy-saving services, cooperation has been strengthened between steel enterprises and energy service companies with means and methods of cooperation being improved.

Energy-saving services are provided by the professional third-party technology agencies to help enterprises address the process and the implementation of energy conservation with technologies. In recent years, the growth of the energy-saving industry is speeding astonishing as well as the scale of enterprises engaged in and number of projects implemented, which results substantial benefits [10].Today, the contracting energy management is the primary means of implementing energy-saving services [11-14], which is developing amazingly and mature in the Western developed countries, and whose energy conservation and emission reduction is of significance. In the United States, the management model trends to be perfect [15], which is mainly due to the new continuous improvement of energy-saving technologies, the governmental focus and offset, and a wide range of sources or channels of funding [16]. In the mid and late of 1990s, energy management contracting was introduced in China [17-21], establishing specialized energy management companies (EMCos) [22-24], opening up a new chapter in China's energy-saving and emission reduction. Now, with its rapid development in China, EMCos have made significant contribution to the realization of China's energy-saving and emission reduction, bringing substantial economic benefits [25-26].Shanghai Bao steel is the first in China to implement one of the major iron and steel enterprises on contracting energy management. Because of the relying on support of Baosteel's own capital and National Special Fund, Bao steel energy management company, to a large extent, solves the bottlenecks in financing difficulties faced by peer companies in China[27]. Though energy management contracting would not only help improve economic benefit of enterprise, also helps to improve the business environment and fulfill their social responsibilities, for most of energy services companies, they have to face common problems of small scale, long revenue cycle, high moral hazard, financing difficulties and technical issues[28]. Even supported by governmental policies, most these companies are of technical advantages but small in scale. Scholars have discovered through investigation that it could not exceed the size of a traditional industry enterprise taking all the energy service companies together[10][29]. Therefore, steel enterprises and energy service companies form strategic alliance to consolidate resources more effectively to get targets. Geng Xianfeng and Jin Zhang have put forward that it need to take into account the strategic objectives, resources, organizational culture, and the match total of overall strength in partners selection, and application of analytic hierarchy process[30-32], a qualitative analysis method of partner selection[33]. Yang Dongqi and Xu Ying, from task, relationship and performance-oriented three factors affecting the alliance partner selection, have analyzed the relationship between the performance of three factors and the alliance, and the construction of theoretical model of influential factors[34]. Based on Energy performance contracting (EPC), Chen Yuanzhi considers that by changing the business model and operating mechanism of the energy service enterprises[35], to offer new ideas for low carbon development of iron and steel enterprise strategic alliance. By investigation of large iron and steel enterprises in China, specific analysis is made in this paper on indicators effecting of iron and steel enterprise strategic alliance partners selection.

COMPONENTS OF IRON AND STEEL ENTERPRISE STRATEGIC ALLIANCE PARTNERS SELECTION

According to field research, questionnaire, interview and so forth in major steel enterprises as Panchangcheng Steel, Pancheng Steel, Shanghai Bao steel and Wuhan steel, combining with measures and methods enterprise implement in energy-saving and emission reducing, we systematically put out elements effecting strategic alliance partners among iron and steel enterprises in the perspective of energy-saving services and by analytic hierarchy process to resort all targets and elements at all levels based on importance. We will categorize the level one indicator effecting strategic alliance partner selection into the following 6 ones: scientific ability of energy-saving service enterprises, transformation of energy-saving results, benefit transformation ability, resource status of the energy-saving service enterprises, cooperation model and trust degree, shown in Fig. 1.

EXPERIMENTAL STUDY ON THE DESIGN METHODS AND RESULTS

Analysis of reliability and validity

We have get a large number first-hand information from steel enterprise by intensive investigation, field research, and depth interview in Bao steel, Wu steel, Ma steel, Desheng steel, Pancheng steel and so on. At the same time, questionnaire copy issued more than 180 for steel enterprise management staff, reclaimed 134 with 116 effective in questionnaire reliability selection, whose quantity ratio of questionnaire of enterprises' management from high to low is about 1.1:1.0:0.9.

In order to ensure reliability and authenticity of the survey, we conduct research on reliability and validity of the questionnaire's results. Analysis of questionnaires is applied with Cronbach α coefficient reliability tests. After analysis and calculation, all indicators Alpha reliability coefficients are between 0.78-0.82, qualifying reliability testing standards with high internal consistency. In addition, the validity of reclaimed questionnaire shows its KMO value is greater than 0.6, which means that the construct validity of the questionnaire is reliable.

Specified analysis with analytic hierarchy process on partner selection

a. Experiential methods

Based on the composition of the indicators system, the analytic hierarchy process is applied in this paper, in which the overall objective is A the alliance, which is divided into indicator level one Ai, further into level two Aij(i=1,2,3,…,j=1,2,3…), using Peng Guofu's methods to calculate[36-38].

(1)Making use of research data and interviews to construct a hierarchical relationship, and to calculate the Judgment Matrix with sum-product algorithm

(2)Constructing comparison matrix

(3)With sum-product algorithm, calculating the indicator weight and vectors

(4)the largest eigenvalue λ_{max} of the Judgment Matrix

$$\lambda_{max} = \frac{1}{n}\sum_{i=1}^{n}\frac{(AW)_i}{W_i} \text{......................} (i=1,2,....,n) \quad (1)$$

In above formula, $(AW)_i$ stands for the ith component of AW; A stands for comparison matrix.

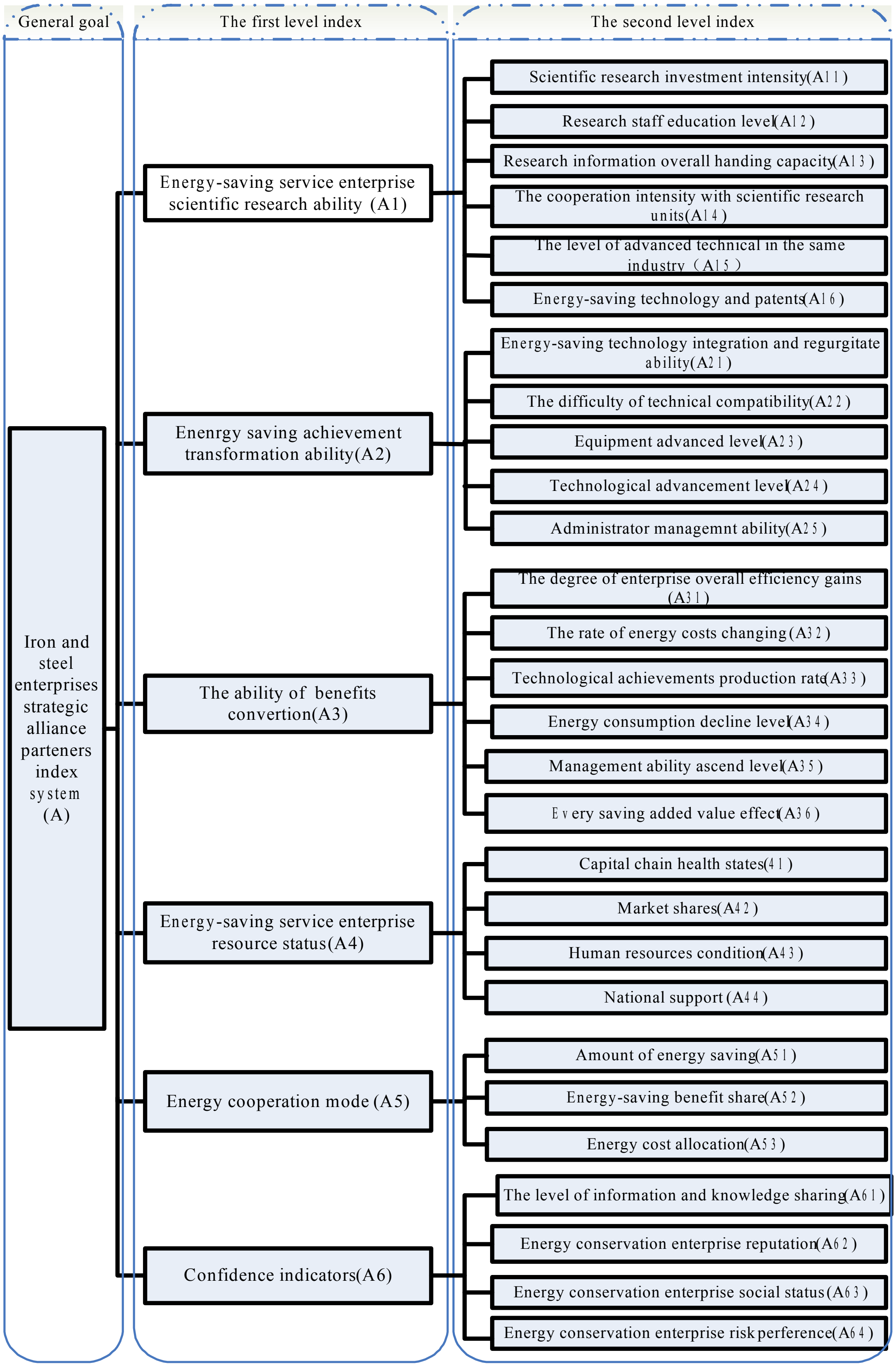

Fig. 1: Indicators system based on strategic alliance partners among iron and steel enterprises in the perspective of energy-saving services

(5)Consistency test Consistency indicator:

$$CI = (\lambda_{max} - n) / (n-1) \quad (2)$$

Consistency testing coefficient:

$$CR = CI / RI \quad (3)$$

there RI represents the average random consistency indicators , its value can be checked in the average random matrix consistency indicators table; if CR minor than 0.1, then the matrix passes the test, on the contrary, fails.

b. Calculating the judgment matrix composed with indicators, its results show:
(1)To the overall objective, the importance of comparison among level one indicators to construct the following judgment matrix

Table 1 level one indicators judgment matrix

	A1	A2	A3	A4	A5	A6
A1	1	1/2	3	1/3	4	1
A2	2	1	4	1/2	5	2
A3	1/3	1/4	1	1/6	2	1/3
A4	3	2	6	1	7	3
A5	1/4	1/5	1/2	1/7	1	1/4
A6	1	1/2	3	1/3	4	1

Table 2 level one characteristic matrix of weight coefficient

	A1	A2	A3	A4	A5	A6
A1	0.1319	0.1124	0.1714	0.1346	0.1739	0.1319
A2	0.2637	0.2247	0.2286	0.2019	0.2174	0.2637
A3	0.0440	0.0562	0.0571	0.0673	0.0870	0.0440
A4	0.3956	0.4494	0.3429	0.4038	0.3043	0.3956
A5	0.0330	0.0449	0.0286	0.0577	0.0435	0.0330
A6	0.1319	0.1124	0.1714	0.1346	0.1739	0.1319

W=[0.1427 0.2333 0.0592 0.3819 0.0401 0.1427]T, λ_{max}=6.0814,CI=0.0163,CR= 0.0131.The analysis of table 1 and 2 shows that from the sort of feature vectors, level one indicator weights from largest to smallest sort : A4>A2>A1=A6>A3>A5, in which A4 weight coefficient is 0.3819, the largest proportion of level one six indicators. Judgment matrix maximum eigenvalue, λ_{max} =6.0814; Consistency testing with the use of consistency indicators, random indicators, consistency ratio, we could get CR=0.0131<0.1. Test passed, the eigenvector is the weight vector.

(2)To level one indicators, the importance of comparison among level two indicators to construct the following judgment matrix

Table 3 Judgment matrix of weight coefficient of components effecting level one indicator A1

	A11	A12	A13	A14	A15	A16
A11	1	4	5	7	3	6
A12	1/4	1	2	4	1/2	3
A13	1/5	1/2	1	3	1/3	2
A14	1/7	1/4	1/3	1	1/5	1/2
A15	1/3	2	3	5	1	4
A16	1/6	1/3	1/2	2	1/4	1

W=[0.4408 0.1451 0.0938 0.0402 0.2199 0.0603]T, λ_{max}=6.1633,CI=0.0327,CR =0.0263.

Table 4 Judgment matrix of weight coefficient of components effecting level one indicator A2

	A21	A22	A23	A24	A25
A21	1	4	5	3	7
A22	1/4	1	2	1/2	4
A23	1/5	1/2	1	1/3	3
A24	1/3	2	3	1	5
A25	1/7	1/4	1/3	1/5	1

W=[0.4845 0.1469 0.0946 0.2289 0.0451]T, λ_{max} =5.1385,CI=0.0346,CR= 0.0309.

Table 5 Judgment matrix of weight coefficient of components effecting level one indicator A3

	A31	A32	A33	A34	A35	A36
A31	1	2	4	6	5	7
A32	1/2	1	3	5	4	6
A33	1/4	1/3	1	3	2	4
A34	1/6	1/5	1/3	1	1/2	2
A35	1/5	1/4	1/2	2	1	2
A36	1/7	1/6	1/4	1/2	1/2	1

W=[0.4058 0.2785 0.1354 0.0579 0.0815 0.0409]T, λ_{max} =6.1495,CI=0.0299,CR= 0.0241.

Table 6 Judgment matrix of weight coefficient of components effecting level one indicator A4

	A41	A42	A43	A44
A41	1	6	5	4
A42	1/6	1	1/2	1/3
A43	1/5	2	1	1/2
A44	1/4	3	2	1

W=[0.5981 0.0756 0.1234 0.2028]T, λ_{max} = 4.0660,CI= 0.0220,CR = 0.0245.

Table 7 Judgment matrix of weight coefficient of components effecting level one indicator A5

	A51	A52	A53
A51	1	6	3
A52	1/6	1	1/3
A53	1/3	3	1

W=[0.6530 0.0960 0.2510]T, λ_{max}=3.0183,CI=0.0092,CR= 0.0158.

Table 8 Judgment matrix of weight coefficient of components effecting level one indicator A6

	A61	A62	A63	A64
A61	1	2	2	1/2
A62	1/2	1	1	1/3
A63	1/2	1	1	1/3
A64	2	3	3	1

W=[0.2630 0.1411 0.1411 0.4547]T, λ_{max}=4.0104,CI=0.0035,CR= 0.0038.

Through calculation and analysis, table 3 to 8 pass test, whose indicators rank is of consistency.

(3)Rank of indicator weight

After above analysis, all tests pass, indicators rank is of consistency. This shows the importance rank of strategic alliance partners among iron and steel enterprises in the perspective of energy-saving services is : resource status of the energy-saving service enterprises > transformation of energy-saving results > scientific ability of energy-saving service enterprises = trust degree > benefit transformation ability> cooperation model. Amongst level two indicators, healthy status of the fund chain and integration of energy-saving technology digestion are two indicators of high attention by steel enterprise strategic alliance partner selection, especially the former one, which is considered the most important indicator of the iron and steel enterprises. In the energy services industry, funding sources and stability plague its development most.

Table 9 the index weight of the iron and steel enterprise strategic alliance partner selection system

	Standard hierarchy	A1 0.1427	A2 0.2333	A3 0.0592	A4 0.3819	A5 0.0401	A6 0.1427	The weight of indicators relative to the overall objective
index hierarchy	A11	0.4408						0.0629
	A12	0.1451						0.0207
	A13	0.0938						0.0134
	A14	0.0402						0.0057
	A15	0.2199						0.0314
	A16	0.0603						0.0086
	A21		0.4845					0.1130
	A22		0.1469					0.0343
	A23		0.0946					0.0221
	A24		0.2289					0.0534
	A25		0.0451					0.0105
	A31			0.4058				0.0240
	A32			0.2785				0.0165
	A33			0.1354				0.0080
	A34			0.0579				0.0034

A35	0.0815				0.0048
A36	0.0409				0.0024
A41		0.5981			0.2284
A42		0.0756			0.0289
A43		0.1234			0.0471
A44		0.2028			0.0774
A51			0.6530		0.0262
A52			0.0960		0.0038
A53			0.2510		0.0101
A61				0.2630	0.0375
A62				0.1411	0.0201
A63				0.1411	0.0201
A64				0.4547	0.0649

CONCLUSION

Analytic hierarchy process can not only transform a large number of survey data into simple matrix to reduce the workload but also improve the indicators' scientific nature and reliability through analysis. After that, during the formation process of strategic alliance of the iron and steel enterprises, resource status of the energy-saving service enterprises is the most important indicator in the iron and steel enterprises 'eyes, and transformation of energy-saving results is a important indicator of iron and steel enterprises to achieve energy-saving emission reduction and low carbon development. Resource is the material basis for the survival of enterprises. Without enough resource, work of energy-saving emission reduction cannot be guaranteed for fully promotion. Healthy financial system and stable funding chain have an extremely important position in the resource of the enterprise. If the source of funds cannot be guaranteed, the normal running of the enterprise will not be maintained, and the requirements of energy-saving service cannot be achieved, and even the goals of energy-saving emission reduction become an illusion. Compared with scientific ability of energy-saving service enterprises, iron and steel enterprises pay more energy on transformation of energy-saving results, which means iron and steel enterprises face extremely heavy energy-saving emission reduction burdens. Therefore, how to find a low-carbon development path based on the energy-saving service is an ineluctable problem for iron and steel enterprises.

From the perspective of energy saving services, those who can help iron and steel enterprises achieve the goals of energy-saving emission reduction are easy to be partners. From the primary index level, iron and steel enterprises attach great importance to resource of energy-saving service enterprises taking advantages of and ability of transformation from energy-saving technologies to energy-saving results. From the secondary index level, health condition of capital chain, digestive ability of energy-saving technology integration and research funding have very important influences on the iron and steel enterprises partner selection. Benefit transformation ability and trust degree don't seem to be the iron and steel enterprises' focus issue, but the iron and steel enterprise alliance partner choice must pay attention to the influence of these two indicators. Therefore, further exploration and research on the effect of iron and steel enterprises partner selection index are still needed.

Question and discussion

This research selects the main indicators of influencing iron and steel enterprises to choose alliance partners without considering the influence of iron and steel enterprises itself for partner selection of energy-saving service companies. In this paper, although the data derived from the questionnaire of representative of the iron and steel enterprises, the data does not include all the domestic large-scale iron and steel enterprises, and actual data from the energy-saving service companies are few.

Iron and steel enterprises can explore new methods of energy-saving emission reduction from professional energy-saving service enterprises. Nowadays, contracting energy management develops gradually in China. More and more enterprises prefer to cooperate with professional energy-saving service enterprises to explore new methods of energy-saving emission reduction. However, since development of professional energy-saving service enterprises hasn't been mature in China, many large enterprises don't dare to cooperate further with them. How to regulate the development of professional energy-saving service enterprises and make them become ideal partners for large enterprises are questions which worth further research.

In addition, iron and steel enterprises are well-funded with large scale and strong technical force. As the key enterprises of "three pollution", while promoting the rapid development of economy, they have inescapable responsibility on the destruction of the environment, depletion of resources. The ideal mode of iron and steel enterprises in the development of low carbon economy is: (1) from the perspective of industry chain, iron and steel enterprises cooperate upstream and downstream and the surrounding supporting enterprises, forming alliances, sharing of results, and hold high level of industrialization. (2) From the angle of the enterprises, iron and steel enterprises have many technologies and results; the effect is good, lower cost, good environmental benefit.

However, there is a lot of problems to be faced with to achieve low carbon development: (1) the alliance operation process is not standardized, and the University, Research Institute and other units of the strategic cooperation system has not been fully established; (2) sharing of the development of new technology and the development achievements of new energy is difficult to be realized. In the process of enterprise alone development to industry, many problems such as intellectual property protection and huge expense have to be faced with. (3) Enterprises who carry out full cooperation with the iron and steel enterprises must have super strength, and general enterprise cannot meet the requirement, thus leads to lack of a lot of potential partners.

Possibility of saving energy consumption, reducing pollution, saving cost and obtaining energy-saving benefit exists in any process of iron and steel enterprises running. We should not only strengthen transverse alliance with the cooperation of the iron and steel industry, but also research from the aspect of the industry chain of iron and steel enterprises with raw material suppliers, retailers, pin vertical alliance between logistics enterprises and other related industries. From a micro perspective, strengthen the iron and steel enterprises and other enterprises (especially small and medium-sized enterprises engaged in the energy-saving service) cooperation to achieve enterprise energy-saving emission reduction, internal coordination development situation. From a macro perspective, we can use the ecological point of view to establish enterprise ecological system. In the enterprise ecosystem, carrying out cooperative competition and the survival of the fittest between the enterprises, and gradually establishing a stable ecological system for collaborative development and innovation. And finally change the condition of ideal mode with bad result to achieve the enterprise ecosystem sustainable low carbon development.

REFERENCES

[1] Du T,Cai J J ,Lu Z W. *Journal of Iron and Steel Research*,v.11,n.2, pp.38-41, **2004**.
[2] Karen R P,Francis C M. *Energy Policy*, v.30,n.10,pp.865-883,**2002**.
[3] Jan P A,Barry H. *Energy*, v.6,n.2,pp.137-159, **2012**.
[4] Ayres R U. *Resources Conservation and Recycling*, v.21,n.3,pp.145-173, **1997.**
[5] Das T K,Teng B S. *Organization Science*,v. 4,n.3,pp.245-267, **2000**.
[6] Gulati R,Nohria N,Zaheer A. *Strategic Management Journal,v.* 7,pp.67-78, **2000**.
[7] Geringer J M,Hebert C A. *Journal of International Business Studies*,v.10,pp.456-467, **2001**.
[8] Aulak H,Preet S,Masaaki K,Arrind S. *Journal of International Business studies*, *Special Issue*,v. 12,pp.12-15, **2006**.
[9] Dyer J H,Singh H. *Academy of Management Review*,v. 6,pp.235-278, **2008**.
[10] Liu Q Z, Zhang W Y. *industry economy,v.* 3,pp. 63-64, **2011**.
[11] Nicole H,Charles G. *A Survey of the U.S.ESCO Industry:Market Growth and Development from 2000 to 2006.Environmental Energy Technologies Division.v.* 5,pp.25-40, **2007**.
[12] *The Canadian Energy Performance Contracting Experience.Presented to the International Seminar on Energy Service Companies.The International Energy Agency*, pp.27-28, Oct.,**1997.**
[13] *Marsha H,Smith U.S. National Action Plan for Energy Efficiency.*July,**2007**.
[14] Energy and Power Generation Group.*North American Energy Management Services Market.***2003**.
[15] *Charles G.. Review of U.S.ESCO Industry Market Trends:An Empirical Analysis of Project Data*,**2005**.
[16] Wu G. *Market development status of The United States' contracting energy management (EPC) . Energy conservation in Shanghai,v.*4,pp.96-99,110, **2005**.
[17] Albert K. *China Economic Review.* v.12,pp.355-367, **2001**.
[18] John A. *Energy Economics*,v. 22,pp.615-625, **2000**.
[19] Wankeun O H,Kihoon L. *Journal of Policy Modeling, v.*26,pp.973-981, **2004**.
[20] Erolu Y. *Journal of Electricity and Employment.* v.13,pp.113-122, **1987**.
[21]James E.Richardson. *The Business Model: An Integrative Framework for Strategy Execution. working paper, www.ssrn.com* ,September 1**, 2005**.
[22] Vine E. *An international survey of the energy service company industry.Energy Policy*, v.33,pp.691-704, **2005**.
[23] Evan M,Steve K,Gary Weissc,Paul A. *Energy Policy*,v.34,pp.188-199, **2006**.
[24]Konstantinos D P,Anna P,John P. *Renewable and Sustainable Energy Reviews*, v.12,pp.790-806, **2008**.

[25] Milou B,Niels B. *Energy Policy*,v.35,pp.4812-4825, **2007**.
[26] Steve S. *Energy Policy,v.*35,pp.507-521, **2007**.
[27] Li D, Li Y, Wang X M. *Metallurgical Energy,* v.30,n.6,pp.6-8,15, **2011**.
[28] Chen G J. *Energy-saving,*v.8pp.4-7, **2010**.
[29] Lv R S, Wang J. *Journal of north China electric power university (social science edition),*v.3,pp.1-5, **2011**.
[30]Epstein S,Rauzy A. *Reliability Engineering and system Safety*,v.88,n.3,pp.195, **2005**.
[31]Kim D J. *Decision Support Systems,* v.8,pp.143-166, **2005**.
[32] Chen H H, Lee H, Tong Y H. *Expert Systems with Applications*,v. 33,n.2,pp.337, **2007**.
[33] Di X F, Zhang J. *Contemporary economic management,*v.30,n.3,pp.31-33, **2008**.
[34] Yang D Q, Xu Y. *Science, technology and industry, v.*9,n.6,pp.71-75, **2009**.
[35] Cheng Y Z. *Reform and strategy,* v.28,n.3,pp.51-53,165, **2009**.
[36] Peng G F, Li S C, Sheng M K. *China soft science*,v.6,pp.136-139, **2004**.
[37] T.L.Saaty. *The Analytic Hierarchy Process.New York,McGraw-Hill Inc*,**1980**.
[38] Partovi F Y. *Int.J.Oper.Prod.Mgmt*, v.14,n.6,pp.25-39, **1994**.