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Research on Chinese graphite storage

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ABSTRACT

In traditional economics,value refers to indifference human labor in commodity and acts as commodity price. This paper firstly introduced the theory of user cost. With the use of user cost approach,this paper calculates the value depreciation of chinese graphite during 2001-2011 who distributes as yearly increasing,accounts for most part of gross value of nonmetal industrial output and overpass the global balanced supply and demand in unit price. Then,based on profit maximum theory,this paper analyzed the theory of value-cost approach. This paper use cost-profit approach to calculate the reasonable quantity of graphite storage. After compound analysis,it is concluded that our country should enhance government supervision and management with strict examination and issuing of exploration and concession to maintain a balanced intergeneration graphite condition.

KEYWORDS

Natural graphite; Storage quantity; Exhausted resources; User cost approach; Value-benefit approach.

INTRODUCTION

In traditional economics,value refers to indifference human labor in commodity and acts as commodity price[1]. In other words,only the commodity who is created by human has value. So,in traditional economy,the value of natural mining was usually ignored,which leads to human uncontrolled exploitation. However,with increasing exploitation,some mining recourse,especially non-renewable recourse is draining away[2]. Intergeneration externalities harm sustainable development of economy[3]. All of the above phenomenon aroused human's consideration on mineral recourse value. In modern economics,recourse value refers to abstract human labor in underdevelopment recourse.

In view of "Green GDP",mineral value is usually calculated from externalities,and intergeneration sustainable development to estimate the renewable value depreciation[4]. TABLE 1 shows that user cost approach is the most widely used method. In this paper,graphite value will be primarily calculated by this method.

TABLE 1 : Methods to estimate natural mineral value in different green GDP

	ISEW	SEEA	ENRAP
Proposer	Herman E. Daly and JihnB. Cobb(1989)	United Nations (1993)	Henry M. Peskin (1998)
Methods	1. Renewable Recourse: User Cost Approach 2.Non-renewable Recourse: User Cost Approach	1.Renewable Recourse: Net Price Approach 2.Non-renewable Recourse: User Cost Approach	1. Renewable Recourse: Asset Value Approach 2.Non-renewable Recourse: User Cost Approach

Materials the theory of user cost approach

User cost,initially advanced by Marshell,was defined as a kind of opportunity cost due to the current use of non-renewable recourse other than used in the future[5]. Then Keynes defined it as a decrease of equipment value,which realized the idea that theory in non-reality can be measured by real economic data[6].

The User Cost Approach was initially advanced by EL Serafy in 1981 and firstly used to measure real income then turn to non-renewable recourse depreciation. According to EI Serafy,the User Cost Approach focuses on the current depreciation of mineral recourse future value which is the mineral recourse variation between different periods[7]. It is regarded that like common recourse,gross income of mineral recourse is consist of real income (real income without recourse depreciation) and opportunity cost[8,9]. It can be interpreted as follows in math:

We assume that part of the non-renewable recourse rent is used to investigate in order to maintain a specific consume level. This part of rent is the user cost of recourse,i.e.,

$$D_t = \frac{R}{(1+r)^T} \quad (1)$$

Where,

D_t : User cost,

R : expected annual rent income by recourse exploitation,usually valued by annual gross income (profit without intermediate cost),

r : annual depreciation rate,

T : recourse expected exploitation period.

Li Guoping and Wu Di (2004) rewrite R and T as $R = P_t Q_t$ and n_t respectively,so,

$$D_t = \frac{P_t Q_t}{(1+r)^{n_t}} \quad (2)$$

Where,

D_t : User cost,

$R = P_t Q_t$, P_t : expected rent per unit, Q_t : expected exploitation quantity,

r : annual depreciation rate,

T : recourse expected exploitation period.

When r is positive,the current value of capital is higher than the future value. In terms of the user cost of recourse,the user cost is comparatively lower with a positive r,which

makes unequal to next generation. So in consider of inter-general equal,r is usually evaluated lowly.

Assume $r = 0$,EQ (2) can be rewrite as follows:

$$D_t = P_t Q_t = TR_t - NR_t \quad \textbf{(3)}$$

Where,

TR_t : total profit of recourse exploitation,

NR_t : normal return on capital of recourse exploitation,the product of net value of fixed capital and the rate of normal return on capital.

In national income statistics,

$$NGP_t = GOP_t - CMC_t \quad \textbf{(4)}$$

$$NGP_t = W_t + SF_t + TR_t \quad \textbf{(5)}$$

Where,

NGP_t : net value of recourse exploitation,

GOP_t : total value of recourse exploitation,

CMC_t : intermediate cost of recourse exploitation without normal capital return,wage or social welfare,counted as total output of recourse exploitation miners added value,

W_t : wage,

SF_t : expenditure for social welfare,

TR_t : total profit of recourse exploitation.

Based on EQ.(4)and EQ.(5),we get

$$TR_t = GOP_t - CMC_t - W_t - SF_t \quad \textbf{(6)}$$

Substitute EQ. (6) into EQ. (3),we get

$$D_t = GOP_t - CMC_t - W_t - SF_t - NR_t \quad \textbf{(7)}$$

Because social welfare is usually calculated in intermediate cost,so EQ(7) can be simplified as

$$D_t = GOP_t - CMC_t - W_t - NR_t \quad \textbf{(8)}$$

EQ. (8) is the basic equation to calculate value depreciation of graphite exploitation in China.

Estimation of chinese graphite value depreciation

This paper calculated the graphite value depreciation during 2001-2011. Based on the above analysis,data including price,production quantity of graphite and intermediate cost of graphite exploitation together with total wage and normal capital return of graphite industry are need.

After considering the assuming premise,graphite price is the price in perfectly competitive market. Because of strict chinese management on graphite,we choose USA import price (import price divide by import quantity) as the price in perfectly competitive market which should be conversed by exchange rate between RMB and USD.

Graphite production,the gross industrial output value of graphite mining and dressing and the number of employees are got from China Statistical Yearbook of Minerals (2002-2012). Exchange rate of RMB and USD,deposit rate,CPI index,RPI index and average wage (take wage of mining industry for reference) are got from China Statistical Yearbook (2002-2012).

Being lack of separated statistics on mining and dressing of graphite industry (which are lined with nonmetal industry),both the industrial added value of graphite and net value of fixed capital are calculated with the share of graphite industrial added value and nonmetal industrial added value. Statistics are got from China Statistical Yearbook of Minerals (2002-2012).

Specific statistics needed are shown in TABLE 2.Now,let's try to get how long the chinese graphite can be mined and the depreciation rate. Based on statistics of China Statistical Yearbook of Minerals,our chinese exploited graphite keeps about 200 billion ton and can be mined for more than 50 years according to exploitation plans of the year,even some years exceeding 80 years. Take year 2010 for example,China has explored graphite reverse of 1849.02 thousand tons,enough to last up to more than 30years.

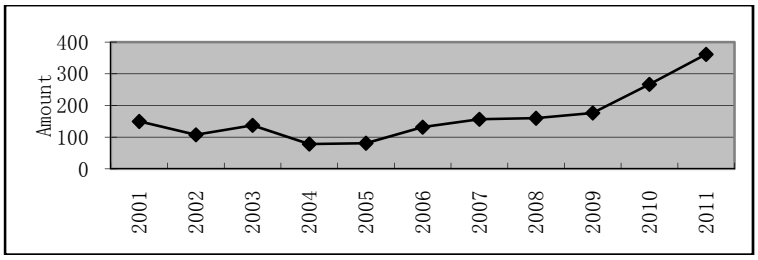

Figure 1 : Result of Chinese graphite resources evaluation depreciation (2001-2011)

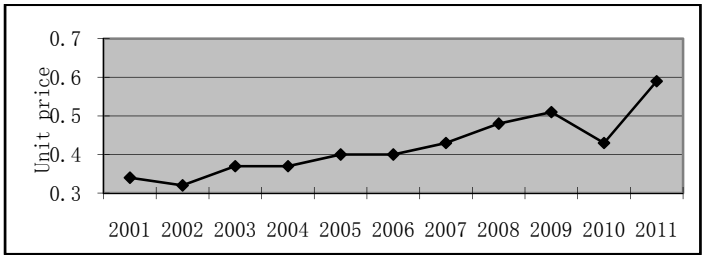

Figure 2 : Result of Chinese graphite user cost (2001-2011)

TABLE 2 : Basic data in calculation of Chinese graphite resources evaluation depreciation

Year	Graphite Production (ten thousand ton)	Graphite Price (USD/ton)	Exchange Rate (RMB/USD)	Gross Output Value of Mining and Dressing (ten billon yuan)	Industrial Added Value of Mining and Dressing (ten billon yuan)	Number of Employees (person)
2001	433.89	447.22	8.28	2.93	0.99	16410.00
2002	338.19	412.20	8.28	2.09	0.71	9464.00
2003	371.01	466.54	8.28	2.55	0.85	11321.00
2004	211.54	469.39	8.28	2.70	1.02	10394.00
2005	203.34	537.98	8.19	3.74	1.39	8764.00
2006	326.03	553.23	7.97	3.68	1.35	9442.00
2007	364.28	636.52	7.61	3.89	1.47	7343.00
2008	331.05	825.04	6.95	4.02	1.82	7539.00
2009	347.27	897.28	6.83	4.06	1.52	7337.00
2010	615.66	796.64	6.77	9.31	3.42	7995.00
2011	610.31	1132.31	6.46	10.42	4.06	8193.00

Year	Average Wage (yuan)	Net Value of Fixed Capital (ten billon yuan)	Deposit Rate (%)	CPI	Rate of Normal Return on Capital(%)	RPI②
2001	9586.00	2.58	2.25	0.80	1.45	102.54
2002	11017.00	1.71	1.98	-0.70	2.68	101.01
2003	13627.00	1.72	1.98	0.90	1.08	100.70
2004	16774.00	1.37	2.25	3.80	-1.55	103.52
2005	20449.00	1.28	2.25	1.20	1.05	103.94
2006	24125.00	1.27	2.25	1.90	0.35	105.49
2007	28185.00	1.22	3.60	5.40	-1.80	111.40
2008	34233.00	1.60	3.60	5.60	-2.00	117.86
2009	38038.00	1.02	2.25	0.20	2.05	116.57
2010	44196.00	2.03	2.54	3.30	-0.76	121.64

2011	52230.00	3.52	2.54	5.40	-2.86	123.41

Note: ①CPI_{t-1}=100 ②RPI_{2000}=100

According to EI Serafy,when the recourse can be exploited for a long period,depreciation rate r is positive and (1+r) n is too big that the current user cost will be very low[10]. So the result is out of practical significance. Judging from this,we set r=0 in this paper. Results are shown in Figure 3 and TABLE 2&3.

TABLE 3 : Result of Chinese graphite resources evaluation depreciation (2001-2011)

Year	Adjusted Graphite Industrial Value (ten billon yuan)	Intermediate Cost (ten billon yuan)	Total Wage (ten billon yuan)	Normal Return on Capital (ten billon yuan)	Value Depreciation (ten billon yuan)	User Cost (ten thousand yuan/ ton)
2001	156.69	1.90	1.53	3.65	149.60	0.34
2002	114.27	1.37	1.03	4.53	107.35	0.32
2003	142.32	1.68	1.53	1.85	137.26	0.37
2004	79.42	1.62	1.68	-2.05	78.16	0.37
2005	86.20	2.26	1.72	1.29	80.92	0.40
2006	136.27	2.21	2.16	0.42	131.49	0.40
2007	158.40	2.17	1.86	-1.97	156.34	0.43
2008	161.06	1.87	2.19	-2.72	159.72	0.48
2009	182.57	2.18	2.39	1.79	176.21	0.51
2010	272.99	4.85	2.90	-1.27	266.51	0.43
2011	361.74	5.15	3.47	-8.16	361.28	0.59

Theory of value-benefit pproach

In western economics,people are assumed as reasonable who go for the maximized profit for himself[11,12]. Mineral recourse is endowed diversified among different countries and has its own value which will be converted into economic cost[13]. When the recourse keeps under ground,the value turns to be the opportunity cost who equals to the max economics revenue in the future exploitation. So,it is necessary for a country to keep part of recourse as reverse to reduce current exploitation loss and further to protect recourse value[14,15].

In our country,mineral recourse storages system needs perfecting. Storage quantity is determined according to guarantee usage and through some methods in foreign countries with affected by recourse exploitation,global demand and some other factors. Such method ignores recourse value. Based on profit maximum theory and Cost-benefit Approach by J·Agaraual,value-profit approach is used in this paper to calculate the reasonable quantity of graphite storage.

Being rich in mineral recourses,many developing countries export most part of the mineral recourse as raw material or primary product for exchange or trade balance after domestic usage[16]. But,some strategic mineral recourses are sold at a low unit price while bought at a high price,which leads to the threat to trade balance and recourse safety. Considering specific characters for each recourse,it is believed that mineral recourse value equals to unit value multiply by storage quantity,in other words,it is the opportunity cost of mineral recourse[17],i.e.,

$$V = D_t \cdot Q_t^* \tag{9}$$

Where,

V : mineral recourse value,

D_t : mineral recourse value per unit,

Q_t^* : storage quantity.

Mineral recourse benefit equals to the sum of net export quantity multiply by graphite price and net import quantity. It is the compensation for economics loss because of insufficient recourse deep processing technology,i.e.,

$$R = Q_t^e \cdot P_t - M_t^e + M_t^i \tag{10}$$

Where,

R: mineral recourse benefit,

Q_t^e: export quantity,

P_t: mineral recourse price,

M_t^e: export volume;

M_t^i:import volume.

Let mineral recourse value equal to benefit,i.e.,

$$D_t \cdot Q_t^* = Q_t^e \cdot P_t - M_t^e + M_t^i \quad (11)$$

Then,

$$Q_t^* = \frac{Q_t^e \cdot P_t - M_t^e + M_t^i}{D_t} \quad (12)$$

This is the equation used to calculate graphite storage.

Storage quantity of Chinese graphite

China owns the advantage on graphite with more than 70% all around the world but technology for further development still needs upgrading. Now,chinese graphite industries mainly focus on mining and dressing. Most export products are primary with low added-value,while products used in national defense and hi-tech rely on import. Only in such national trade,China suffered great economic loss and threaten to our advantages on graphite.

According to benefit–value approach,the unit price of chinese graphite Dt is shown by user cost meaning opportunity cost. Graphite export quantity Q_t^e and volume M_t^e and import volume M_t^i are got from China Statistical Yearbook of Minerals (2002-2012). Graphite price P_t is the higher one of current world price P_t^w and China import unit price P_t^i.

TABLE 4 : The quantity of Chinese graphite storage based on value-benefit approach (2001-2011)

Year	Unit Value (ten thousand yuan/ton)	Export Quantity (ten thousand ton)	Unit Price (ten thousand yuan/ton)	Export Volume (hundred million yuan)	Import Volume (hundred million yuan)	Current Storage Quantity (hundred million yuan)	Accumulative Storage Quantity (hundred million yuan)
2001	0.34	37.24	0.68	3.91	0.20	62.96	62.96
2002	0.32	32.18	4.44	3.78	0.33	438.76	501.72
2003	0.37	33.96	2.84	4.40	0.46	250.05	751.77
2004	0.37	45.17	1.10	5.36	0.51	121.51	873.28
2005	0.40	49.37	0.24	6.73	0.54	14.27	887.55
2006	0.40	46.56	0.14	5.91	0.69	3.49	891.04
2007	0.43	67.06	0.13	7.05	0.87	5.25	896.29
2008	0.48	59.73	0.11	9.66	0.68	-4.97	891.32
2009	0.51	40.61	0.13	6.45	0.09	-2.25	889.07
2010	0.43	51.07	0.17	8.95	0.12	-0.28	888.79
2011	0.59	34.39	0.19	13.25	0.32	-11.05	877.74

CONCLUSION

From the above results,when r=0,our chinese graphite depreciation is very big and keeps going up,especially with recourse scarifying and price increasing. As shown in Figure 2,since 2005 graphite depreciation keeps going up and after 2009 it goes faster. In our country,graphite depreciation adds up to 180.482 billion yuan taking up 11.49% of national non-metal industry gross output value (1570.741 billion yuan). It means that graphite exploitation at current phase is harmful to non-metal industry. We can learn from Figure 3 that value depreciation equals to gross industry output which means that with each unit graphite exploited the same value depreciation comes into being. Graphite value is not only be guaranteed,but also be wasted.

In the view of user cost,user cost of our graphite increased from 3400 yuan per ton to 5900 yuan/ton,much higher than global price and export price of our country. It reveals that we will pay much to make up for graphite exploitation. The products for export didn't reserve any trade earnings,on the contrary,harm future generations. In recent years,graphite taking more and more important place in atomic energy technology and national safety defense,some countries set about to store graphite. In America,Japan and Koran graphite mines have been sealed up and turn to import to meet chinese demand. At the same time,they make full use of low price to start chinese storage confidentially. It is urgent for our country to start our chinese storage to protect mineral recourse. Now,some documents such as Entire Program on National Mineral Recourses (2008-2015) and Outlines of Strategic Actions on Miner Recourse Hunting (2011-2020) have been published saying that we will strengthen the supervision of the graphite,get strict command of examination and approval rights of exploration and mining,together with issuing qualification of mining enterprises.

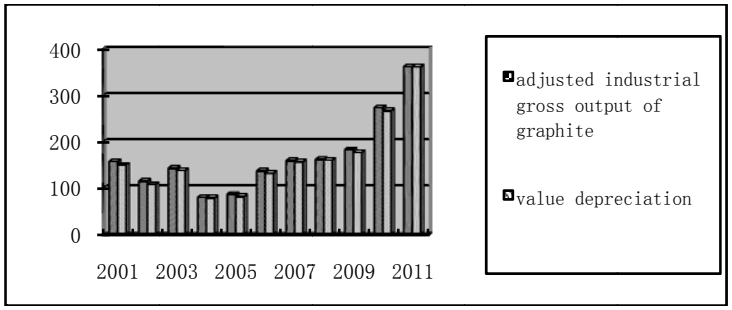

Figure : 3 Chinese graphite resources evaluation depreciation and total industrial output value

In the view of storage,during 2001-2005,because of insufficient emphasis on natural graphite and substandard mining process,chinese graphite suffered huge value losses and should be reserved much. After 2005,especially with issuing of Outlines of Strategic Actions on Miner Recourse Hunting in 2008,Graphite was enrolled of one kind of strategic mineral resources,with great investment in research and development of mining in order to make the graphite industry go into hi-tech industry and raise unit export price. Since 2008,the storage quantity turning to negative shows that thanks for improvement of graphite deep processing technology,manufactured products start to be exported and make profits. So,more graphite could be exploited for trade balance and international balance of payments. But it does not mean that our country can intensify development of graphite. After 2010,graphite is increasingly important in hi-tech and several industrial powers in the world strengthen the management,research and development of the graphite,all of which leads price to rise again. However,the related technology in China is not yet mature; therefore,reserves needs to continue.

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