

## PRELIMINARY ECONOMIC CONSIDERATION FOR METAL EVALUATION FROM OLD FLOTATION TAILING DUMP LOCATION BOR, SERBIA

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### ABSTRACT

*The last decade is characterized by the trend of higher prices of non ferrous and precious metals on world markets. Copper, gold and silver are centuries old knows products of mining in Bor . By long years of copper production and procesing have been created flotation tailing dumps. Tailing dumps contain a significant share of metals and can be exploited to evaluate the useful materials. Economic consideration are based on projection the annual evaluation of copper Ostrelj waste dumps and the old flotation tailing dumps for the next ten years in consideration of cost-effectiveness framework to the total production capacity of about 3040 t of cathode copper on the basis of technical and technological research. Preliminary economic consideration showed highly positive results of the success and profitability through profit or loss account, economic cash flow, cost price and so on. Economic analysis and possibility of investment return basis on data for technical possibility to production annual sum of 3040 tone copper cathode. Cumulative evaluation of economic analysis shows: period of project: 10 years, investments in fixed assets 13.495.000USD, average net profit 4.000.000 USD, average product price 2884,2 USD per tone copper cathode, Payable of Investments: Internal rate of return 53,7%, Pay back period 2 years, Net present value (10%) 24.670.000 USD. Specify data according to technical elements, shows that starting economic analysis gives very good results.*

**Key words:** economic consideration , copper , flotation tailing dumps,

### 1. INTRODUCTION

Expert analyzes show that the exploitation of flotation tailings, or obtaining metals from the waste raw material, far cheaper than the standard procedure of mining that involves blasting, excavating, drilling them in this case no. If the flotation tailings does not contain a significant share of copper and precious metals reclamation process is carried out. Trend increase in metal prices has intensified further geological studies as well as professional and scientific advanced training technologies of production and processing of copper.

On the basis of technical-technological parameters for copper valorisation from Ostrelj waste dumps initial parameters are:

1. Financial parameters are in US Dollars
2. Selling prices for copper cathode 4200 USD/t
3. Calculations of material and other costs are from technical part and planing prices.

4. Costs of maintenance are: 15% on value of investments for equipment and 5% on value of other investments, and insurance are 2% on value of investments.
  5. Amortization of fixed assets has been determined according to the current regulations for new investments in Serbia.
  6. Employers salaries have been calculated at the level of USD 1000 per month and per one worker over the entire period.
  7. Other costs are computed according to revenue.
  8. Profit tax is determined according to the current regulations at the rate in Serbia.
  9. Current assets are computed about ¼ average revenue.
  10. Evaluation period is 10 years.
- Total investments and financial construction  
Total investments for fixed assets are: Total loan is 12.500.000 USD, repayment period 8 years, interest rate is 10% ,equal annual instalments.

## 2. CALCULATE OF REVENUE

Revenue calculated on basis copper cathode quantity and selling prices .

Table 1.\* Calculate of revenue

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Product	price	revenue	revenue
* year : 1-10			
1 Cu	1500.0000	4.2000	6,300.00
1 Cu	1540.0000	4.2000	6,468.00
** years revenue		12,768.00	12,768.00
* total revenue		127,680.00	127,680.00

## 3. DINAMIC EVULATION -ECONOMIC CASH FLOW

Table 2.\*Economic Cach Flow

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Years	1	2	3	4	5	6
<b>I. CACH INFLOW</b>						
1. CASH FROM SALES	12768	12768	12768	12768	12768	12768
<b>2. Residual</b>						
-Fixed assets						
-Current assets						
TOTAL	12768	12768	12768	12768	12768	12768
<b>II. CASH OUTFLOWS</b>						
4. Investments	16695					
6. Operational costs	6142	6142	6142	6142	6142	6141
7. Salaries	420	420	420	420	420	420
8. Taxes	345	357	369	383	398	415
TOTAL	23603	6919	6931	6945	6960	6976
Net cash flow	-10835	5849	5837	5823	5808	5792
Cumulative	-10835	-4986	851	6674	12481	18274
<b>DISCOUNTED VALUE</b>						
- 8.00 %	-10835	5416	5004	4622	4269	3942
-10.00 %	-10835	5317	4824	4375	3967	3597
-12.00 %	-10835	5222	4653	4145	3691	3287
-53.17 % (IRR)	-10835	3819	2488	1620	1055	687

-YEAR	7	8	9	10	TOTAL	AVERAGE
<b>I. . CACH INFLOW</b>						
1. CASH FROM SALES	12768	12768	12768	12768	127680	12768
<b>2. Residual</b>						
- Fixed assets						
- Current assets				3200		
TOTAL	12768	12768	12768	15968	130880	13088
<b>II. CASH OUTFLOWS</b>						
4. Investments					16695	1670
6. Operational costs	6141	6141	5127	5127	59387	5939
7. Salaries	420	420	420	420	4200	420
8. Taxes	432	451	647	647	4444	444

TOTAL	6993	7011	6194	6194	84726	8473
Net cash flow	5775	5757	6574	9774	46154	4615
Cumulative	24049	29806	36380	46154		
DISCOUNTED VALUE						
-8.00 %	3639	3359	3552	4889	27858	2786
-10.00 %	3260	2954	3067	4145	24670	2467
-12.00 %	2926	2604	2655	3525	21872	2187
-53.17 % (IRR)	447	291	217	211	0	

Dynamical evaluation is very good by all methods:

- Internal rate of return is 53,17%
- Payback period is 2 year
- Net present value ( 10%) is: 24.670.000 USD

#### 4.STATICAL EVALUATION IN 5. YEAR

**-Koefficient of economic:**

Revenue/total costs=12.768.000/8.788.000=1,45

**-Rate of accumulation:** Gross profit/total investments=3.980.000/16.695.000=23,8%

**-Simple rate of return:**Net profit/total investments= 3.582.000/16.695.000=21,46%

**-Reproduction:**Net profit+Amortization/ total investments =5.083.000/16.695.000= 30,44%

**- Rate of profit:**Gross profit/revenue=3.980.000/12.768.000=31%

#### 5. DINAMICAL SENSIBILITY ANALYSIS

Table 3. Table of sensibility with changes

%chang.	-30%	-25%	-20%	-15%	-10%	- 5%	IRR%	+ 5%	+10%	+15%	+20%	+25%	+30%
REVENUE													
-E :	12	18	24	31	38	45	53	62	72	83	95	>	100
COSTS													
-E :	85	79	73	68	63	58	53	49	45	41	37	33	30
INVESTMENTS													
-E :	0	88	78	70	63	58	53	49	46	43	40	37	35
SALARIES													
-E :	55	55	54	54	54	53	53	53	53	52	52	52	52
TAXES													
-E :	55	55	54	54	54	53	53	53	53	52	52	52	52

Legend: E = Ekonomik IRR

From present table follows that project iz very sensitive on revenue changing.If revenue alls 30% - IRR is 12% and that is equivalet to interest rate.

Sensibility analysis **with raise investments** ,trough softer „REMIP“\*\*\*computers ,economic model of investments planning , shows :

+60%

IRR-19,7%

NPV(12%) -6.633.000 USD

Pay back period -5years

+50%

IRR-23,77%

NPV(12%)-9.490.000 USD

Pay back period -4 years

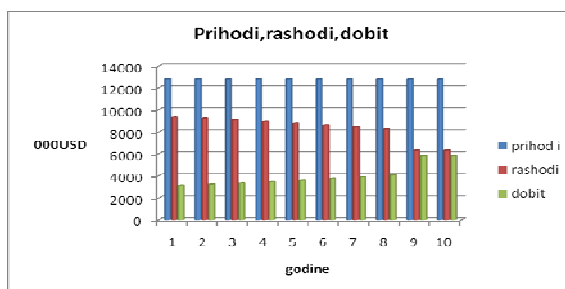


Figure 1. Revenues, costs, profit

## 6. TOTAL EVALUATION

DESCRIPTION	VALUE	U.M.
<b>1. Period of project</b>	<b>10</b>	<b>year</b>
<b>2.Total investments:</b>	<b>16.695.000</b>	
Fixed assets	13.495.000	USD
Current assets	3.200.000	
<b>3. REVENUE</b>		
- Total revenue	127.680.000	USD
- Average revenue	12.768.000	USD
<b>4. COSTS</b>		
- Total costs	83.236.000	USD
- Average costs	8.324.000	USD
<b>5. Profit</b>		
-Total gross profit	44.444.000	USD
-Average gross profit	4.444.000	USD
-Ukupna neto dobit	39.999.000	USD
-Prosečna god.neto dobit	4.000.000	USD
<b>6. Average product cathode price per tone</b>	<b>2884,2</b>	<b>USD</b>
<b>7. Total rate of profit</b>	<b>34,8</b>	<b>%</b>
<b>8.BEP</b>	<b>56,2</b>	<b>%</b>
<b>9.PAYABLE OF INVESTMENTS:</b>		
<b>IRR - Internal rate of return</b>	<b>53,7</b>	<b>%</b>
<b>PP - Payback period</b>	<b>2</b>	<b>year</b>
<b>NPV – Net present value (10%)</b>	<b>24.670.000</b>	<b>USD</b>

According to technical elements economic analysis shows very good results.

## 7. CONCLUSION

Economic analysis and possibility of investment return basis on data for technical possibility to production annual sum of 3040 tone copper cathode. Cumulative evaluation of economic analysis shows: PERIOD OF PROJECT: 10 years, INVESTMENTS IN FIXED ASSETS 13.495.000 USD, REVENUE: Total revenue 127.680.000 USD, Average revenue 12.768.000 USD, COSTS: Total costs 83.236.000 USD, Average costs 8.324.000 USD, PROFIT: Total gross profit 44.444.000 USD, Average gross profit 4.444.000 USD, Total net profit 39.999.000 USD, Average net profit 4.000.000 USD; Average product price 2884,2 USD per tone copper cathode, Total rate of profit 34,8%, Break even point 56,2%; PAYABLE OF INVESTMENTS: Internal rate of return 53,7%, Pay back period 2 years, Net present value (10%) 24.670.000 USD. Specify data according to technical elements, shows that prime analysis gives very good results.

## 8. REFERENCES

- [1] B. Cavender, Mineral Production Costs - Analysis and Management, SME, (1999).
- [2] N. Dondur, Economic analysis of projects, Mechanical Engineering, Belgrade (2002).
- [3] G. Mankju, Principles of Economics, Faculty of Economics, Belgrade, (2005).
- [4] M. Bugarin, G. Slavkovic "Techno-economic evaluation" Copper Institute, Bor, (2006).
- [5] T. Kuronen: Capital Budgeting In A Capital-Intensive Industry, Helsinki University of Technology, 2108 Mat-Independent Research projects in applied mathematics, (2007).

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*\*Table are from softver REMIP\*\*-own software  
Computational model of economic investment planning of Mining and Metallurgy Institute Bor, Serbia*