

# Case Study: Equipment Decision

You are working as a mining engineer for an operating mine in its final state. The existing equipment (excavator and the haul truck fleet) is getting older and should be replaced in two years.

Management asks you if the system should be maintained, or if the operation should go *immediately* for a band conveyor system.

So Option A would be to replace the excavator and the haul truck fleet in two years from now.

Option B would be to invest in a band conveyor system with a mobile crusher and three wheel loader right now.

Use dynamic investment calculation methods (NPV; EAC; ROI) to find the most profitable equipment combination.

Option A: Excavator and haul trucks

Option B: Loader and band conveyor

Assumptions: 84 kt ore reserves (left) with 14kt/a capacity

Op. Costs: 28 k€/a Processing

3 €/t Transport

Labour and Means of Production see table

Revenues: 185 €/t

12% p.a. interest rate, No residual values

Costs: (in €)

Option A				Option B			
Labour	500,000	p.a.	Year 1+2	Labour	415,000	p.a.	
	450,000	p.a.	Year 3-6				
MoP	34	p.t.	Year 1+2	MoP	25	p.t.	
	25	p.t.	Year 3-6				
Invest				Invest			
Excavator	6,130,000	5a	Life time	3 wheel loader	2,295,000	4a	Life time
3 Haul trucks	2,430,000	5a	Life time	Crusher (mobile)	800,000	10a	Life time
				Band conveyor system	1,100,000	8a	Life time

Approach: LOM, NPV, EAC, ROI

**Solution:**

First step: Calculate **LOM**.

$$LOM = \frac{84 \cdot 10^3 \text{ t ore}}{14 \text{ kt/a}} = 6 \text{ a}$$

Second step: **NPV**.

Option A

The operating surplus (OS) amounts to:

Revenues:  $185 \text{ €/t} \cdot 14 \cdot 10^3 \text{ t/a} = 2,590,000 \text{ €/a}$

Costs:

Year 1 and 2 [in €/a]:

- Processing 28,000
- Transport 42,000
- Labour 500,000
- MoP 476,000
- **TOTAL 1,046,000**

Year 3 to 6 [in €/a]

- Processing 28,000
- Transport 42,000
- Labour 450,000
- MoP 350,000
- **TOTAL 870,000**

**OS = Revenues - Costs → 1544k€ for year 0-2 and 1720k€ for year 3-6**

**Invest for year 2: 8560k€**

[10 <sup>3</sup> ]	0	1	2	3	4	5	6
<b>OS</b>	1544	1544	1544	1720	1720	1720	1720
<b>(1+i)</b>	1.0000	1.1200	1.2544	1.4049	1.5735	1.7623	1.9738
<b>A</b>			8560				
<b>PV</b>	1544	1378.57		1224.26	1093.09	975.974	871.405
		1	-5593.11	2	1	2	5
<b>NPV</b>	<b>1494.19</b>						
	<b>2</b>						

Option B

OS:

Revenues:  $185 \text{ €/t} \cdot 14 \cdot 10^3 \text{ t/a} = 2,590,000 \text{ €/a}$

Costs:

- Processing 28,000
- Transport 42,000
- Labour 415,000
- MoP 350,000
- **TOTAL 835,000**

→ OS 1,755k€.

Invest for year 0: 4,195k€

Re-Invest: 2,295 in year 4

[10 <sup>3</sup> ]	0	1	2	3	4	5	6
<b>OS</b>		1755	1755	1755	1755	1755	1755
<b>(1+i)</b>	1.0000	1.1200	1.2544	1.4049	1.5735	1.7623	1.9738
<b>A</b>	4195				2295		
<b>PV</b>	-4195	1566.96 4	1399.07 5	1249.17 4	- 343.18	995.834 1	889.137 6
<b>NPV</b>	<b>1562.00 6</b>						

→ NPV would prefer Option B

Third step: **EAC**.

$$\omega_n = \frac{(1+i)^n \cdot i}{(1+i)^n - 1} = \frac{(1.12)^6 \cdot 0.12}{1.12^6 - 1} = 0.2432$$

Option A: PA=1494\*0.2432=363k€ and 25€/t

Option B: PA=1562\*0.2432=380k€ and 27€/t

→ EAC would prefer Option B

Fourth step: **ROI**

ROI = PA/SUM(A)

Option A: 363/(8560/1.2544)=5.3%

Option B: 380/(4195+2295/1.5735)=6.7%

→ ROI would prefer Option B

**Remarks:**

Only if we had a significant difference (of invested capital) with more than (12+6,2%) interest rate, a supplement investment would be necessary.

Be aware that the change in labour costs could be interpreted been caused by firing some truck drivers, which may cause additional costs. This can be neglected, if the people are re-distributed within the company.

We need to invest to continue the operation, so the focus is on what option is to prefer, not if it is economic at all. Not continuing is not an option.

Transport and processing costs in this case are assumed to be the same for both.

There are no residual values considered.

Maintenance costs are assumed to be included in operation costs.

The replacement for option B is done right away, as there is some transition time to the new system assumed.

Although it is a running operation, there is no CF in in year 0, as there is no CF from THIS investment.