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Process & Operation Management

Professor Ciocan

Pumping Iron at Cliffs & Associate:

The Circored Iron Ore Reduction Plant in Trinidad

Group Assignment 1.

Home Group

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Question 2:

We divided the operational process into the steps shown in Exhibit 8 and decided to calculate the cost taking into account each step of the process.

First, for each step we took into account the mass reduction and the yield loss (**Tab 1**). With this data we find the total resulting loss at the end of each process step and second we determined the amount of tons per hour at the end of each step, finding our total Final Output.

We then start calculating the total variable costs. Based on hint C we know that in each step the plant uses different materials. We sum the variable cost per ton for every step. Based on hint C we also know that the cost is proportional to the actual output (taken into account the loss reduction). Thus, we multiply the variable cost of each step times the tons/hour ratio of Final Output / Inflow (per step).

Next, we find the total number of tons produced in one year, by considering the actual hours the plant is working (we have to take into account the downtime of each process step).

To find the fixed cost, we divide the total amount of fixed costs (from exhibits) by the total number of tons produced in one year and so we find the total fixed cost per ton.

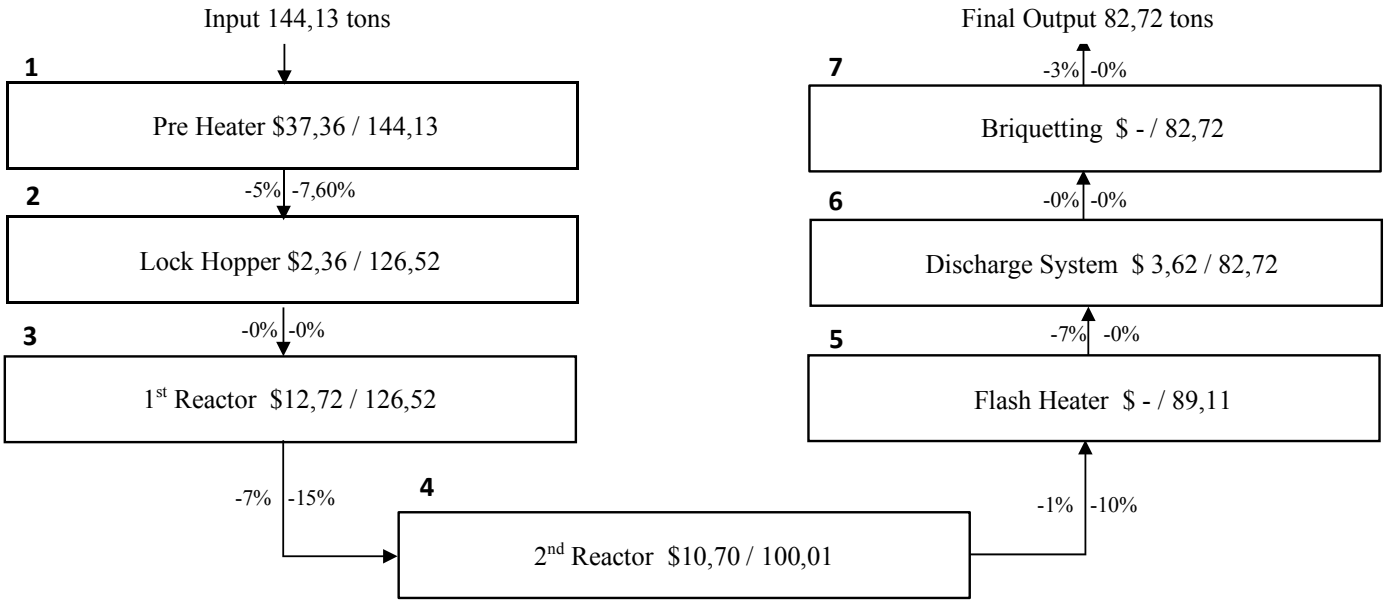
To find the total production cost per ton, we sum variable and fixed costs.

Tab 1: Yield Loss, Mass Reduction and Downtime in Production Line

	Pre Heater	Lock Hopper	1st Reactor	2nd Reactor	Flash Heater	Discharge system	Briquetting	Total
Yield Loss [%]	5,00%	0,00%	7,00%	1,00%	7,00%	0,00%	3,00%	23,00%
Mass Reduction [%]	7,60%	0,00%	15,00%	10,00%	0,00%	0,00%	0,00%	32,60%
Downtime [%]	10,00%	0,00%	1,00%	1,00%	0,00%	3,00%	1,00%	16,00%

Tab 2: Variable Cost Per Steps

	1	2	3	4	5	6	7	
Yield loss [%]	**5,00%**	**0,00%**	**7,00%**	**1,00%**	**7,00%**	**0,00%**	**3,00%**	-
Mass reduction [%]	7,60%	0,00%	15,00%	10,00%	0,00%	0,00%	0,00%	-
Proportion Inflow/Outflow [%]	87,40%	100,00%	78,00%	89,00%	93,00%	100,00%	97,00%	-
Tons/hour [Input*Outflow/Inflow ratio]	**144,13**	**126,52**	**126,52**	**100,01**	**89,11**	**82,87**	**82,87**	**80,39**
Proportion to output [Inflow per step/Final Output]	1,79	1,57	1,57	1,24	1,11	1,03	1,03	59,05
Ore Fines [$/tons]	$26,5	-	-	-	-	-	-	-
Natural gas [$/tons]	$10,86	-	-	-	-	-	-	-
Magnesium Oxide [$/tons]	-	$1,5	-	-	-	-	-	-
Hydrogen [$/tons]	-	-	$8,08	-	-	-	-	-
Electricity [$/tons]	-	-	-	$4,25	-	-	-	-
Water/Sewer [$/tons]	-	-	-	$2,52	-	-	-	-
Operating Costs [$/tons]	-	-	-	$1,83	-	-	-	-
Nitrogen [$/tons]	-	-	-		-	$3,51	-	-
Variable Cost [$ per tons/hour]	$37,36	$1,5	$8,08	$8,6	-	$3,51	-	$59,05
Total Variable Cost per Unit (Proportion to output)	**$66,98**	**$2,36**	**$12,72**	**$10,70**	**-**	**$3,62**	**-**	**$96,38**



Tab 3: Actual Production of HBI (tons)

Tons produced per hour	**80,39**
Hours operated per day	24
Hours after downtime	20,16
Days per year	365
Total operating hours	7358,4
Actual production of tons of HBI	**591 541,78**

Tab 4: Fixed Cost per tons

	CURRENT SCENARIO	PERFECT SCENARIO
Tons produced per hour	80,39	100,00
Hours operated per day	24	24
Actual hours after downtime	20,16	24
Days per year	365	365
Total operating hours	7358,4	8760
Annual production of tons of HBI	591 541,78	876 000,00
Fixed cost (from Exhibit)	20 790 000,00	20 790 000,00
FIXED COST / TON	**$35,15**	**$23,73**

Tab 5: Total Production Cost

	CURRENT SCENARIO	PERFECT SCENARIO
TOTAL VARIABLE COST	$96,38	$59,05
TOTAL FIXED COST	$35,15	$23,73
TOTAL COST OF PRODUCTION PER TON	**$131,53**	**$ 82,78**

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QUESTION3:

To find the total valuation of the company we first start by calculating revenues, expenses, EBIT, NOPLAT, and free cash flows. To find the revenues we used Exhibit 13 and the estimated probabilities of different prices to calculate the expected value of each price. We then summed them together to find the expected price the company will charge for 1 ton of HBI.

To find the expenses we multiplied the total number of tons per year times the total cost

We used the 30% tax rate as given in the case to find NOPLAT

Depreciation is given in the case, and we take the common assumption that the CAPEX amount equals Depreciation since there is no information on the case indicating otherwise

The WACC of similar industries during the same time of the case was between 5 to 15%, so we assume a median WACC of 10%.

Tab 6: Expected Selling Price

From [$/ton]	To [$/ton]	Probability	Average	Expected Value
70	80	7,100%	75	$5,33
80	90	7,100%	85	$6,04
90	100	0,000%	95	-
100	110	21,400%	105	$22,47
110	120	7,100%	115	$8,17
120	130	7,100%	125	$8,88
130	140	0,000%	135	-
140	150	21,400%	145	$31,03
150	160	28,600%	155	$44,33
				$126,23

Tab 7: FCF based on 3% revenue growth and a 3% decrease in fixed and variable costs

		1	2	3	4
Oprev (+)	74 670 318,89	74 670 318,89	74 670 318,89	76 910 428,46	79 217 741,31
Opex (-)	77 805 490,32	77 805 490,32	77 805 490,32	80 139 655,03	80 067 529,34
=					
EBIT	-3 135 171,43	-3 135 171,43	-3 135 171,43	-3 229 226,58	-849 788,03
TAX (-)	-940 551,43	-940 551,43	-940 551,43	-968 767,97	-254 936,41
=					
NOPLAT	-2 194 620,00	-2 194 620,00	-2 194 620,00	-2 260 458,60	-594 851,62
Depreciation (+)	7 000 000,00	7 000 000,00	7 000 000,00	7 000 000,00	7 000 000,00
Capital Expenditure (-)	-7 000 000,00	-7 000 000,00	-7 000 000,00	-7 000 000,00	-7 000 000,00
=	0				
Free Cash Flows	-2 194 620,00	-2 194 620,00	-2 194 620,00	-2 260 458,60	-594 851,62

	5	6	7	8	9
Oprev (+)	81 594 273,55	84 042 101,76	86 563 364,81	89 160 265,75	91 835 073,73
Opex (-)	79 995 468,57	79 923 472,65	79 851 541,52	79 779 675,13	79 707 873,43
=					
EBIT	1 598 804,98	4 118 629,11	6 711 823,29	9 380 590,62	12 127 200,30
TAX (-)	479 641,49	1 235 588,73	2 013 546,99	2 814 177,19	3 638 160,09
=					
NOPLAT	1 119 163,49	2 883 040,38	4 698 276,30	6 566 413,43	8 489 040,21
Depreciation (+)	7 000 000,00	7 000 000,00	7 000 000,00	7 000 000,00	7 000 000,00
Capital Expenditure (-)	-7 000 000,00	-7 000 000,00	-7 000 000,00	-7 000 000,00	-7 000 000,00
=	0				
Free Cash Flows	1 119 163,49	2 883 040,38	4 698 276,30	6 566 413,13	8 489 040,21

Hypothetical Scenario

The plant has a net loss of 2,19 million. If no improvements are made, the company should be liquidated. Today, the company is producing at a variable cost of $96,38 due to yield losses and mass reduction, and the fixed cost per ton is $35,15 due to downtime. If there were none of these downtime and the company's production line was not affected, the company would be producing at a fixed cost of $23,73 and a variable cost of $59,05, for a total of $82,78, which is about what the company is estimated at the beginning of the case. So we decide to create a scenario in which the company tries to achieve the perfect cost scenario.

So over the next 10 years, production costs will slowly move from the current situation to something close to the perfect scenario.

We assume that:

- Production will increase by 3%.
- Fixed costs and variable costs will decrease by 3%.
- The price remains the same
- Capex = depreciation.