

Group Discussion II, Monday, May 29, 2017

Øyeal Aluminium 2017 (Tabereaux) (The problem stresses the need to understand the impact of the economics of the process on the process parameters)

The president of the Øyeal Aluminium smelter in Trondheim has decided to increase aluminium production. The two choices at Øyeal Aluminium are; 1) increase amperage or, 2) increase CE% by increasing the % AlF_3 target in cells.

- Calculate the increased costs as well as the "profit margins" for both options and make a recommendation to the company president.

Plant Operational Parameters

Amperage = 300 kA, Volts/pot = 4.2, % CE = 94.0%

Total # Cells = 285, (# out cells = 5), # Days/y = 365. (# out days = 5)

Al Sale Price = USD \$1900/mt Al, Plant Cost = USD \$1600/mt Al

Elec Power Costs = USD \$30/MWh, (\$0.030/kWh)

Aluminium Production Calculations:

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| Al Production (mt/y) = 8.054 kg Al/kA x Potline Amperage (kA) x Current Efficiency x # operating pots x # operating days |
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Al (mt/y) = (8.054 kg Al/kA) x (300 kA) x (0.94 CE) x (280 cells) x (360 days)/1000
kg/mt = 228,940 mt Al/y

Plant Profit Margin = (Sale Price USD \$/mt Al – Cost USD/mt Al) x mt Al/yr
Profit Margin (\$/y) = ((\$1900 – \$1600) x (228,940 mt Al/y)) = \$68,682,000

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| Plant Elec. Costs/yr = (kA x Volts/pot x 24 h) / mt Al/yr x (\$ MWh/kA Al) |
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MWh/day = (300 kA x 4.2 V x 24 h) = 30,240 kWh/1000 kW/MW = 30.24

MWh/yr = 30.24 MWh/day x 360 days = 3,048,192

Elec. Costs (\$/y) = 3,048,192 MWh x \$30/MWh = \$91,445,760

Total Costs = \$1600/mt Al x 228,940 mt Al/y = \$ 366,304,000

% = (\$91,445,760 / \$366,304,000)/100 = 25%

CLASS PROBLEM

Calculate the \$ margin value and additional costs for the two options:

Option 1.

Increase the potline amperage by 2,000 amps.

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Option 2.

Increase the current efficiency in the potline to 94.5% (+0.5) by increasing the AlF_3 % target in bath from 10.5% to 11.5%. The AlF_3 consumption is expected to increase from 0.018 to 0.020 mt AlF_3 /mt Al. The purchase price for AlF_3 is USD \$1,200 / mt AlF_3 .