

AN EVALUATION OF TONNAGE OXYGEN PLANTS

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SUMMARY

Tonnage oxygen plants have increased in size and are available today in the 100- to 1,400-ton-per-day range. The capital investment requirements and estimated selling price are investigated in this study.

INTRODUCTION

Interest in the production of synthetic liquid and gaseous fuels has intensified so that several systems have reached the point where prototype plants are being installed or are being considered for installation. In many of these systems high-purity oxygen is a requirement, whether it be in the direct gasification of coal, oil, or shale, or for the production of hydrogen for the hydrogasification or hydrogenation of such raw materials.

DISCUSSION

A previous paper explored the subject of oxygen plant costs;¹ however, a major change has occurred since then--the size of the oxygen plant that can be built today is much larger. The present study takes into account the capital investment requirements and the production costs of these larger units and updates the data contained in the earlier study.

The parameters of the present study are as follows:

1. Location of plant: Ohio Valley.
2. Size of plant: 100 to 1,400 tons per day.
3. Purity: 99.5 percent.
4. Pressure specification: atmospheric and 450 psig.
5. Process employed: low pressure cycle.
6. Type of compressors: electric drive.
7. Cost of available power: \$0.00675 per kilowatt-hour.

Figure 1 shows the relationship between power requirements and plant capacity for the two pressures set up as a parameter. Since the production process is the same, the difference in the two curves is the power required to compress the oxygen to 450 psig discharge pressure.

Figure 2 presents the capital investment requirements for the plants ranging in size from 100 to 1,400 tons per day.

¹/ Katell, Sidney, and John H. Faber. Cost of Tonnage Oxygen. BuMines Inf. Circ. 7939, 1960, 6 pp.

Table 1 presents the method used in determining the cost of operation on an annual basis for a 500-ton-per-day plant with the oxygen produced at a discharge pressure of 450 psig. The calculation is typical of the several made to establish the curves shown in figure 3. As noted direct labor costs are assumed at \$4 per hour, annual onstream time as 350 days per year, and depreciation at 15 years on a straight-line basis.

Using the discounted cash flow rate of return of 12 percent as a criterion for return on investment, the typical calculation is shown in table 2 and the values obtained are plotted in figure 4.

TABLE 1

Oxygen Plant
500 Tons Per Day
Oxygen Compressed to 450 PSIG

Operating Cost

	<u>Annual cost,</u> <u>dollars</u>
Direct costs:	
Power.....8,670 kwhr/hr x 8,400 hr/yr x \$0.00675/kwhr	491,600
Cooling water....135 M gal/hr x 8,400 hr/yr x \$0.020/M gal.....	22,700
Direct labor: 60 hr/day at \$4 per hour.....	87,600
Supervision @ 15 percent.....	13,100
Plant maintenance @ 2 percent of investment.....	88,000
Payroll overhead @ 25 percent of payroll.....	38,200
Operating supplies @ 20 percent of plant maintenance....	<u>17,600</u>
Total direct cost.....	758,800
Indirect costs:	
40 percent of labor, maintenance, and supplies.....	82,500
Fixed costs:	
Taxes and insurance @ 2 percent of investment.....	88,000
Depreciation @ 6.66 percent of investment.....	<u>293,300</u>
Total annual operating cost.....	1,222,600

Annual production = 500 x 350 = 175,000 tons

Cost, dollars per ton of oxygen = 1,222,600 ÷ 175,000 = \$6.99

TABLE 2

Oxygen Plant
500 Tons Per Day
Oxygen Compressed to 450 PSIG

Financial Analysis, DCF at 12 Percent

Discounted cash flow, n = 15 years (life of plant)
i = 12 percent per year

$$P = R \frac{(1+i)^n - 1}{i(1+i)^n}$$

$$P/R = 4.47335/0.656826 = 6.81086$$

$$R = \$4,400,000/6.81086 = \$646,000$$

Net profit = R - Depreciation = \$352,700

With Federal Income Tax @ 50 percent,

Gross profit = 2 x \$352,700 = \$705,400

Sales = Gross profit + operating cost = \$1,928,000

Selling price, dollars per ton oxygen = \$1,928,000/175,000 = \$11.02

Capital investment = P = \$4,400,000

Sales - 175,000 tpy x \$11.02 per ton = \$1,928,000

Operating cost = 1,222,600

Gross profit = 705,400

Federal Income Tax at 50 percent = 352,700

Net profit = 352,700

Cash flow:

Depreciation = 293,300

Net profit = 352,700

Total positive cash flow = R = 646,000

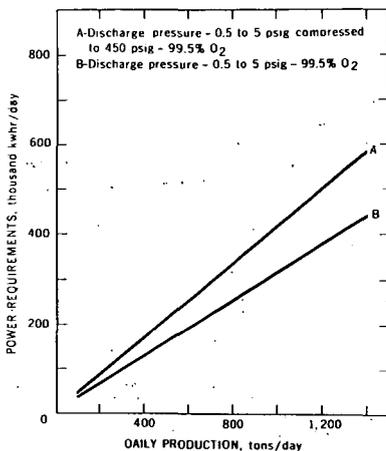


FIGURE 1. - Power Requirements for Tonnage Oxygen Plants.
Daily Production vs. Power Requirements.

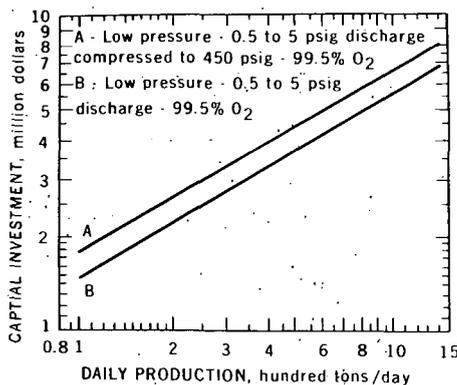


FIGURE 2. - Oxygen Plant. Capital Investment vs.
Daily Production.

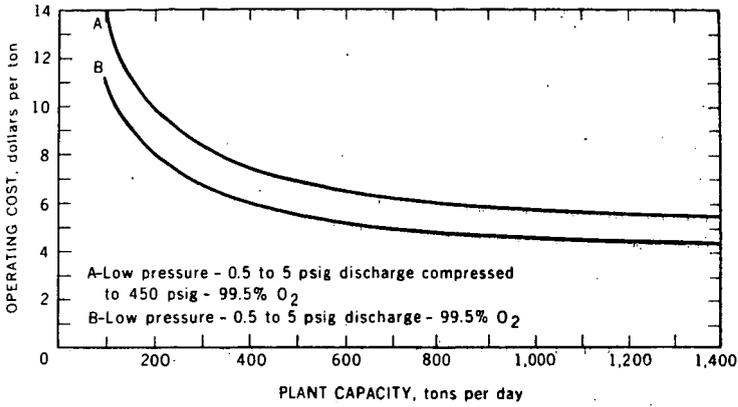


FIGURE 3. - Oxygen Plant. Operating Cost vs. Daily Production.

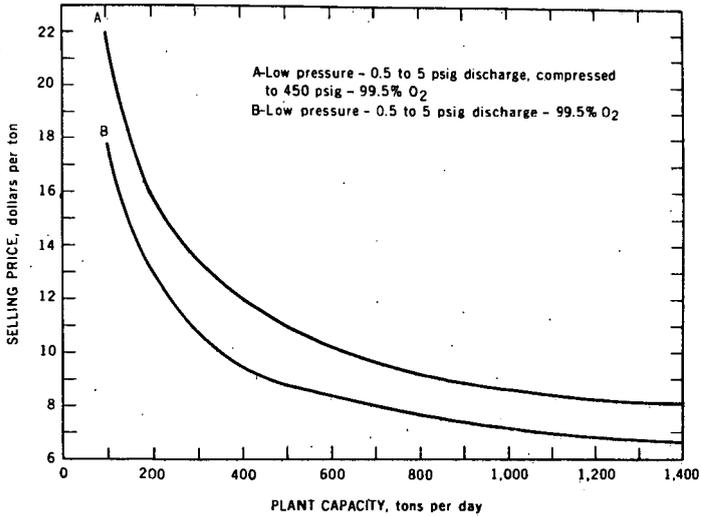


FIGURE 4. - Oxygen Plant. Selling Price vs. Daily Production.