



OXYGEN AND NITROGEN GAS PLANTS

Introduction

Gases have numerous applications in industries, like oxygen is very important for medical institutions and nitrogen for preservation of numerous food items. These gases have an enormous demand in infrastructure projects. Oxygen is commonly used for cutting and welding. Liquid nitrogen is vital for recycling plastics, packaging and retreading tyres. These gases are primarily available in their liquefied form. These industrial gases belong to a group of gases that are commercially manufactured and used for numerous functions.

Market Potential

Both Nitrogen and Oxygen have an enormous demand in industrial market as a result of their unlimited advantages. Oxygen has wide scope in glass industry, coal gasification, municipal solid waste gasification, gas to liquid systems and metals oxidation. It is also used in high altitude flying, deep sea diving, etc. Likewise Nitrogen also has numerous uses in industry. It is important to provide an unreactive atmosphere. It is used in the electronics industry during the production of transistors and diodes and to preserve foods. Large quantity of nitrogen is also helpful in annealing stainless steel and other steel mill products.

Product Uses

It can be used for everything from testing pipeline pressure to purging air to managing temperature to lightening liquids for better flow. Nitrogen is used to pressurize pipelines in order to help propel liquids and to help purge piping and equipment to prevent contamination.

USES OF OXYGEN

Medical facilities and medical breathing at home.

Breathing at high altitudes, in the event of a decompression emergency or continuing (as in an unrefined aircraft).

Oxygen first aid kits.

Oxygen therapy.

Gas mixing to create diving breath compounds such as Nitrox, Trimix and Heliox.

Open-Round Scuba Set - Mainly used for accelerated decompression in technical diving.

For use in climbing, "bottle oxygen" refers to oxygen tanks for trekking.

Industrial processes, including steel and monolithic production.

Oxyacetylene welding equipment, glass lamp working flames and some gas cutting flames.

Use as liquid rocket drivers for rocket engines.

Manufacturing Process

The two products Oxygen and Nitrogen are all produced from air within the same plant. Air, the raw material is liquefied cryogenically and the separation of the two components liquid oxygen and liquid nitrogen takes place in a fractional distillation column. Compressed nitrogen oxygen and gases are bottled into cylinders by compressors or pumps after vaporization of the respective liquid fractions.

Step 1: The air is compressed in three stages to a pressure of 30kg/cm².

Step 2: Thereafter the removal of water vapour and carbon dioxide takes place in a battery of molecular sieves.

Step 3: After which, the out-going carbon dioxide and water vapour free air is further compressed to a pressure of 100 kg/cm² and cooled well by external refrigeration.

Step 4: This high-pressure air is cooled in heat exchangers by the outgoing product gases. Bulk of this cold air is then passed to expand through an expansion engine and the remaining air is routed through an expansion valve.

Step 5: The downstream air of the expansion engine attains a pressure of 5 kg/cm² and a considerably reduced temperature.

Step 6: The opposite stream of air going through the expansion valve is expanded to attain a pressure of 5kg/cm², whereby partial liquefaction of air takes place.

Step 7: Both the streams of air are mixed and introduced as a liquid vapour mixture to the bottom column of the double rectification column i.e. fractional Distillation Column.

Step 8: Due to heat and mass transfer at every perforated tray in the column the nitrogen-rich liquid vapour accumulate at the upper trays and an oxygen-rich liquid-vapour mixture collects at the sump of the column.

Step 9: The liquid nitrogen accumulating at the top portion of the bottom column is drawn out as product for storage in Vacuum insulated cryogenic tanks.

Step 10: For nitrogen gas production, this liquid nitrogen is pumped from the storage tank through vaporizers for gasification and bottled into cylinders.

Step 11: The oxygen rich liquid-vapour mixture at the sump of the bottom column is routed to the top column of the distillation column, which is at a lower pressure of 0.5kg/cm².

Step 12: In this low pressure column further separation of oxygen and nitrogen vapour, take place through a mass and heat transfer method at the various trays within the column.

Step 13: The oxygen vapours which are separated, settle at the bottom of the column and condense to form liquid oxygen due to exchange of heat with the colder liquid nitrogen which is formed at the top of the bottom column.

Step 14: This liquid oxygen accumulating at the bottom portion of the highest column is drawn out as product for storage in Vacuum insulated cryogenic tanks.

Step 15: For the production of compressed oxygen, this liquid oxygen can be vaporized by the heat exchange between the incoming process airs and compressed by oxygen compressors for bottling into cylinders or the stored liquid oxygen can be pumped through vaporizers for gasification and bottling into cylinders.

Cost of Project

Particulars	Amount (Rs. In Lakhs)
Land (Owned)	-
Civil works and Buildings (50,000sqft @1000/sqft)	500.00
Fixed Asset	2,567.50
Misc. Fixed Assets	521.10
D G Set 50 KV	4.40
Escalation & Contingencies	179.65
Preliminary & Preoperative Expenses	68.37
Sub-total (A)	3,841.02
Working Capital Margin @40% of Total WC Requirement	20.00
Total Project Cost	3,861.02
Total Working Capital Requirement (25% of 1st Year Project Turnover) (B)	50.00
MEANS OF FINANCE	
Total Funds Required(A+B)	3,891.02
Loan Component	-
TERM LOAN(60% of A)	2,304.61
WORKING CAPITAL(60% of B)	30.00
Total	2,334.61
Equity	1,556.41
Total	3,891.02

Detailed Cost Element

SL	Particulars	Qty.	Amt. (Rs. In Lakhs)
1	Recycle Compressor, PHE & Liquefier Exchanger, Cold Box Assembly, Upper & Lower	1	1000.00
2	Main Air Compressors, Air Filter, Warm end skid, PP Vessel, DCA, N2/Water Tower, Drain	1	400.00
3	Storage Tank: 77 KL Capacity	2	100.00
4	Overhead Crane	1	10.00
5	Inter Connecting Pipe line Flange nut-bolt, gasket, drain pipe for complete plant	1	8.00
6	Product Pipe Line (2 Sets)	1	6.00
7	Cryogenics Liquid transfer pump	2	12.00
8	Cylinder filling pump with vaporizer manifold etc.	2	1000.00
9	Insulation	-	5.00
10	Cylinder Testing Station	-	6.50
11	Installation & Erection	-	20.00
	Total		2567.50

Contingencies and Escalations

It has been assumed at approximately 5% at cost of project.

Preliminary Expenses

Particulars	Amt. (Rs. In Lakhs)
Incorporation Expenses	0.20
Project Report Preparation and Consultation	0.35
Feasibility and Engineer's/Architect's Report and Plans	12.50
Legal Charges - Drafting for agreements, contracts, stamp paper, notary and affidavit cost	0.15
Other recurring expenses of revenue nature up to start of	5.85
Interest Cost for period before commercial operations	49.32
Total	68.37

Salary

Designation	Manpower	Amt. (Rs. In Lakhs)
General Manager	1	3.60
Skilled	6	14.40
Unskilled	4	4.80
Security Guard	1	1.80

Profitability Statement

	Amount (Rs. In Lakhs)				
Particulars	Year- 1	Year- 2	Year- 3	Year- 4	Year- 5
A. INCOME					
Production Capacity (Cum/annum)-					
Nitrogen	32,16,000	32,16,000	32,16,000	32,16,000	32,16,000
Oxygen	21,12,000	21,12,000	21,12,000	21,12,000	21,12,000
Capacity utilization	50%	55%	60%	65%	70%
Production per annum at capacity utilization (Cum/annum)-					
Nitrogen	16,08,000	17,68,800	19,29,600	20,90,400	22,51,200
Oxygen	10,56,000	11,61,600	12,67,200	13,72,800	14,78,400
Annual Sales-					
Nitrogen	643.20	707.52	771.84	836.16	900.48
Oxygen	528.00	580.80	633.60	686.40	739.20
Total Income/ annum	1,171.20	1,288.32	1,405.44	1,522.56	1,639.68
B. OPERATING EXPENSES					
Raw Materials					
Salary- Skilled	14.40	15.84	17.42	19.17	21.08
- Unskilled	7.20	7.92	8.71	9.58	10.54
-General Manager	3.60	3.96	4.36	4.79	5.27
-Security Guard	1.80	1.98	2.18	2.40	2.64
Repair & Maintenance	51.35	53.40	55.54	57.76	60.07
Power & utilities	1.28	1.40	1.54	1.70	1.87
Depreciation and Amortization	527.04	527.04	526.83	526.62	526.62
Total Operating Expenses	606.67	611.55	616.58	622.02	628.09
Operating Profit (A-B)	564.53	676.77	788.86	900.54	1,011.59
C.FINANCIAL					
Interest on loan	207.65	191.32	165.70	140.07	112.31
D. Other Expenses					
Administrative & General Expenses	35.14	38.65	42.16	45.68	49.19
Total Expenses	242.79	229.97	207.86	185.75	161.50
Profit before Tax	321.75	446.80	581.00	714.79	850.09
Provision for Tax	80.44	111.70	145.25	178.70	212.52
Profit After Tax	241.31	335.10	435.75	536.10	637.56
Dividend	-	-	-	-	-
Retained Profits	241.31	335.10	435.75	536.10	637.56

Breakeven Point

Break Even Point (BEP)		Amount (Rs. In Lakhs)				
SL	Particulars	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5
A.	Net Sales	1,171.20	1,288.32	1,405.44	1,522.56	1,639.68
B.	Variable Cost					
	Raw Material	-				
	Other Expenses	35.14	38.65	42.16	45.68	49.19
	Power and Utility	1.28	1.40	1.54	1.70	1.87
	Total Variable Cost	36.41	40.05	43.71	47.37	51.06
C.	Contribution (A-B)	1,134.79	1,248.27	1,361.73	1,475.19	1,588.62
D.	Fixed and Semi-Fixed					
	labour Charges	27.00	27.00	29.70	32.67	35.94
	Repair & Maintenance	51.35	53.40	55.54	57.76	60.07
	Interest on term Loan	207.65	191.32	165.70	140.07	112.31
	Depreciation	527.04	527.04	526.83	526.62	526.62
	Total Fixed Cost	813.04	798.77	777.77	757.13	734.94
E.	Breakeven Point	72%	64%	57%	51%	46%
F.	Cash BEP	25%	22%	18%	16%	13%

Debt-Service Coverage Ratio

		Amount (Rs. In Lakhs)				
SL	Particulars	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5
i	Profit	241.31	335.10	435.75	536.10	637.56
ii	Depreciation	527.04	527.04	526.83	526.62	526.62
iv	Interest	207.65	191.32	165.70	140.07	112.31
A	Total (i + ii + iii)	976.00	1,053.46	1,128.27	1,202.79	1,276.50
i	Interest	207.65	191.32	165.70	140.07	112.31
ii	Principal repayment	150.73	301.46	301.46	301.46	301.46
B	Total (i + ii)	358.38	492.78	467.16	441.54	413.78
	DSCR (A / B)	2.72	2.14	2.42	2.72	3.08

Interest on Term Loan and Principal Repayment

Refer Annexure I.

We have assumed the repayment tenure of term loan for a period of 7 years, Rate of interest being 8.5% p.a. with the moratorium period of 9 months.

Address of Vendors

Name Of the Vendor	Address and Contact Number
Aarya Engineering	Address – Nutan Mill Compound, Saraspur, Ahmedabad Contact Number – <u>08048764518</u>
Pee Kay Enterprises	Address – Dahisar, East Mumbai Contact Number - <u>08048993670</u>
Ambica Engineering Works	Address - Vatwa Phase 3, Ahmedabad, Gujarat Contact Number - <u>08047020290</u>

ANNEXURE- I

Principal													
Opening	2,304.57	2,320.89	2,337.33										
Repaid													-
Closing	2,320.89	2,337.33	2,353.89										
Interest	16.32	16.44	16.56										49.32
I													
Principal													
Opening	2,383.89	2,400.78	2,417.78	2,434.91	2,452.15	2,469.52	2,487.02	2,471.47	2,455.82	2,440.05	2,406.89	2,373.73	
Repaid	-	-	-	-	-	-	33.16	33.16	33.16	33.16	33.16	33.16	198.96
Closing	2,400.78	2,417.78	2,434.91	2,452.15	2,469.52	2,487.02	2,471.47	2,455.82	2,440.05	2,406.89	2,373.73	2,340.57	
Interest	16.89	17.01	17.13	17.25	17.37	17.49	17.62	17.51	17.40	17.28	17.05	16.81	206.79
II													
Principal													
Opening	2,340.57	2,307.41	2,274.25	2,241.09	2,207.93	2,174.77	2,141.61	2,108.45	2,075.29	2,042.13	2,008.97	1,975.81	
Repaid	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	397.92
Closing	2,307.41	2,274.25	2,241.09	2,207.93	2,174.77	2,141.61	2,108.45	2,075.29	2,042.13	2,008.97	1,975.81	1,942.65	
Interest	16.58	16.34	16.11	15.87	15.64	15.40	15.17	14.93	14.70	14.47	14.23	14.00	183.45
III													
Principal													
Opening	1,942.65	1,909.49	1,876.33	1,843.17	1,810.01	1,776.85	1,743.69	1,710.53	1,677.37	1,644.21	1,611.05	1,577.89	
Repaid	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	397.92
Closing	1,909.49	1,876.33	1,843.17	1,810.01	1,776.85	1,743.69	1,710.53	1,677.37	1,644.21	1,611.05	1,577.89	1,544.73	
Interest	13.76	13.53	13.29	13.06	12.82	12.59	12.35	12.12	11.88	11.65	11.41	11.18	149.62
IV													
Principal													
Opening	1,544.73	1,511.57	1,478.41	1,445.25	1,412.09	1,378.93	1,345.77	1,312.61	1,279.45	1,246.29	1,213.13	1,179.97	
Repaid	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	397.92
Closing	1,511.57	1,478.41	1,445.25	1,412.09	1,378.93	1,345.77	1,312.61	1,279.45	1,246.29	1,213.13	1,179.97	1,146.80	
Interest	10.94	10.71	10.47	10.24	10.00	9.77	9.53	9.30	9.06	8.83	8.59	8.36	115.80
V													
Principal													
Opening	1,146.80	1,113.64	1,080.48	1,047.32	1,014.16	981.00	947.84	914.68	881.52	848.36	815.20	782.04	
Repaid	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	397.92
Closing	1,113.64	1,080.48	1,047.32	1,014.16	981.00	947.84	914.68	881.52	848.36	815.20	782.04	748.88	
Interest	7.89	7.65	7.42	7.18	6.95	6.71	6.48	6.24	6.01	5.77	5.54	5.30	79.16
VI													
Principal													
Opening	748.88	715.72	682.56	649.40	616.24	583.08	549.92	516.76	483.60	450.44	417.28	384.12	
Repaid	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	397.92
Closing	715.72	682.56	649.40	616.24	583.08	549.92	516.76	483.60	450.44	417.28	384.12	350.96	
Interest	5.30	5.07	4.83	4.60	4.37	4.13	3.90	3.66	3.43	3.19	2.96	2.72	48.15
VII													
Principal													
Opening	350.96	317.80	284.64	251.48	218.32	185.16	152.00	118.84	85.68	52.52	19.36	-	
Repaid	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	33.16	19.36	-	350.96
Closing	317.80	284.64	251.48	218.32	185.16	152.00	118.84	85.68	52.52	19.36	-	-	
Interest	2.49	2.25	2.02	1.78	1.55	1.31	1.08	0.84	0.61	0.37	0.14	0.00	14.43