

PROJECT REPORT OF ACETYLENE GAS MANUFACTURING UNIT

PURPOSE OF THE DOCUMENT

This particular pre-feasibility is regarding Acetylene Gas Manufacturing Unit.

The objective of the pre-feasibility report is primarily to facilitate potential entrepreneurs in project identification for investment and in order to serve his objective; the document covers various aspects of the project concept development, start-up, marketing, finance and management.

[We can modify the project capacity and project cost as per your requirement. We can also prepare project report on any subject as per your requirement.]



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PROJECT AT GLANCE

1 Name of Proprietor/Director	XXXXXXXXXX
2 Firm Name	XXXXXXXXXX
3 Registered Address	XXXXXXXXXX
4 Nature of Activity	XXXXXXXXXX
5 Category of Applicant	XXXXXXXXXX
6 Location of Unit	XXXXXXXXXX
7 Cost of Project	20.94 Rs. In Lakhs
8 Means of Finance	
i) Own Contribution	2.09 Rs. In Lakhs
ii) Term Loan	14.85 Rs. In Lakhs
iii) Working Capital	4.00 Rs. In Lakhs
9 Debt Service Coverage Ratio	2.96
10 Break Even Point	0.25
11 Power Requirement	15 KW
12 Employment	9 Persons

13 Major Raw Materials

Calcium Carbide,
Lime and Coke,
Some natural
Gases, Acetone &
Chilled Methanol

14 Details of Cost of Project & Means of Finance

<u>Cost of Project</u>	<u>Amount in Lacs</u>
Particulars	Amount
Land	Owned/Leased
Building & Civil Work	Owned/Leased
Plant & Machinery	15.50
Other Misc Assets	1.00
Working Capital Requirement	4.44
Total	20.94

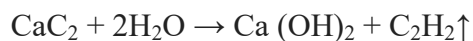
<u>Means of Finance</u>	<u>Amount</u>
Particulars	Amount
Own Contribution	2.09
Term Loan	14.85
Working capital Loan	4.00
Total	20.94

1. INTRODUCTION



Acetylene is an organic compound that belongs to the category called “Hydrocarbons” and has the chemical formula C_2H_2 . It is gaseous in nature, is colourless, odorless, and is the simplest “Alkene”. It is widely used as a fuel as also used as the starting material for the preparation of a number of other compounds. It is highly unstable in the natural form as is thus handled in the form of solution. Since the gas is odorless, the commercial grade have odor due to the presence of impurities such as phosphine and divinyl sulfide.

This gas was initially prepared in the year 1836 by Edmund Davy and this was an accidental discovery while attempting to isolate the Potassium metal. Since the 1950s, this gas is being prepared by the Partial Combustion of the methane. It is recovered as a Side Product in the production of Ethylene by Cracking of Hydrocarbons. Its presence in ethylene is usually undesirable because of its explosive character and its ability to poison the Ziegler-Natta Catalysts. For this reason, it is selectively hydrogenated to ethylene using Palladium-Silver catalysts. It was prepared by the hydrolysis of calcium carbide, a reaction discovered by Friedrich Wöhler in 1862 and still familiar to students:



Calcium carbide production requires extremely high temperatures, ~2000 °C, necessitating the use of an electric arc furnace.

At atmospheric pressure, acetylene cannot exist as a liquid and does not have a melting point. At room temperature, the solubility of acetylene in acetone is 27.9 g per kg. For the same amount of dimethylformamide (DMF), the solubility is 51 g. At 20.26 bar, the solubility increases to 689.0 and 628.0 g for acetone and DMF, respectively. These solvents are used in pressurized gas cylinders.

Acetylene is the most efficient of all fuel gases and provides high levels of productivity due to the fact that it requires the least amount of oxygen to ensure complete combustion. A low flame moisture content makes this a good choice for many critical industrial heating processes such as flame heating, flame gouging, welding, flame hardening, flame cleaning, flame straightening, thermal spraying, spot heating, brazing, texturing, profile-cutting, branding wooden pallets, wood aging, and carbon coating. It is the only fuel gas that is recommended for underground working conditions as it is lighter than air. It is also the only fuel gas, for instance, that can weld steel. In cutting, Oxy-acetylene flame gives the fastest pre-heating piercing times than any other fuel gas combination. Some of the major benefits of using the Oxy-Acetylene flame are:

- Improved Cut Quality
- Higher cutting speeds
- Fastest cut initiation time
- Reduced oxygen use.

Acetylene being a Flammable gas, there are certain safety requirements associated with it. It is for this reason that the regulator for this gas is different from the regulators used for other gases. It is due to this reason that the gas is dissolved in liquid acetone. The liquid acetone is then stored in the acetylene cylinder, which in turn, is filled with a porous (sponge-like) cementitious material. Copper metal catalyzes the decomposition of acetylene and as a result acetylene is not to be transported in copper pipes. Brass pipe fittings are also to be avoided.

2. PRODUCT DESCRIPTION

2.1 PRODUCT USES

Some of the common uses of the Acetylene gases can be listed as below:

1. Acetylene is the “Only” fuel gas that is used for welding purpose.
2. It is also used for brazing, cutting, flame gouging, spot heating, hardening, texturing, cleaning, and thermal spraying many materials.
3. The glass and the materials processing industries often use acetylene gas for carbon coating as it provides a lubricated surface between two materials.
4. Acetylene is mixed with oxygen or air to produce a graphitic and amorphous carbon coating that loosely adheres to the surface.
5. It is used in the laboratories as fuel gas in different instruments like Atomic Absorption Spectrophotometer.
6. It is used for the manufacture of different other chemicals in the industries.
7. In the late 1800s, acetylene was for the first time used to light a portable lamp known as a carbide or acetylene gas lamp. These lamps were installed on cars, in homes, on bicycles, etc. They were also used extensively by miners. In some cases, acetylene was used to light some cities and towns. In the lamps, calcium carbide and water are used to produce acetylene. The flow of the acetylene is carefully monitored to control the amount of acetylene used.
8. It is useful in the production of polyethylene plastics, PVC, and PVDF. These chemicals are produced from ethylene, which in turn is derived from acetylene.

2.2 MANUFACTURING PROCESS

The manufacturing process for Acetylene gas by the Calcium Carbide Process is as given below:

1. The process begins with the procuring of Calcium Carbide for the process. Calcium carbide vigorously reacts with water to form the Acetylene gas. So the removal of the excess amount of heat from the reaction chamber is very important. There are several variations of

this process in which either calcium carbide is added to water or the water is added to the calcium carbide. There is a third process in which a limited amount of water is added and is called the Dry Process which is mentioned here.

2. A high capacity Acetylene Generator is used for this purpose. The generator uses a rotating screw to feed calcium carbide granules into the reaction chamber which has been filled upto a certain level with water. The granules measure about 2mm x 8mm, providing the right amounts of exposure to allow for a complete reaction. The feed rate is determined by the desired rate of gas flow and is controlled by a pressure switch in the chamber. If too much gas is being produced at one time, the pressure switch opens and cuts back the feed rate.
3. To ensure that complete reaction takes place, the reaction chamber is agitated by a set of rotating paddles inside the reaction chamber. These paddles also prevent any granule from floating on the top of the water surface that may overheat and cause explosion.
4. The acetylene gas, bubbles to the top of the surface and is removed and is drawn off under low pressure. As it leaves the reaction chamber, the gas is cooled by a spray of water. This water spray also adds water to the reaction chamber to keep the reaction going as new calcium carbide is added. After the gas is cooled, it passes through a flash arrester, which prevents any accidental ignition from equipment downstream of the chamber.
5. As the calcium carbide reacts with the water, it forms a slurry of calcium carbonate, which sinks to the bottom of the chamber. Periodically the reaction must be stopped to remove the built-up slurry. The slurry is drained from the chamber and pumped into a holding pond, where the calcium carbonate settles out and the water is drawn off.
6. There is an ammonia scrubber that uses water in removing any ammonia that might be present in the acetylene system. This is done to make the Acetylene purification system last longer.
7. The acetylene gas is dried by passing it through a calcium carbide chamber at medium pressure. The dried acetylene gas is then passed through acetylene purifier which removes any kind of impurities such as phosphine, arsine, and hydrogen sulphide, etc. This step can be bypassed for industrial grade acetylene.
8. Finally the purified acetylene gas passes through purification scrubbers to remove any traces of the purification material.
9. The acetylene then enters the compressor and is raised from the inlet pressure to desired final cylinder pressure through 3-stages of compression

10. The acetylene stream passes through a set of high-pressure driers that remove any traces of oil and perform moisture removal. Without this final moisture removal, water would be transferred to the cylinders.
11. As the acetylene travels at high pressure to the manifolds it passes through flame arresters on each side of every shutoff valve. In high pressure, acetylene valves are the cause of most ignitions and the flame arresters are positioned to stop the flame as quick as possible therefore limiting the potential for damage to the system.
12. The acetylene is compressed into a cylinder at a pressure of about 300 psi (2,070 kPa) that has liquid acetone and porous monolithic mass filler. This acetone in the filler allows there to be 25 times more acetylene in the cylinder than if there was no acetone.
Once dissolved, it loses its explosive capability, making it safe to transport. When the cylinder valve is opened, the pressure drop causes some of the acetylene to vaporize into gas again and flow through the connecting hose to the welding or cutting torch.
13. The ratio of acetone and acetylene will always be constant, but the total amount of acetone will vary due to cylinder size.
14. The air compressor supplies compressed air to operate the acetone pump, lime slurry pump and the actuated ball valves in the acetylene plant.
15. The thickened calcium carbonate is then dried and sold for use as an industrial waste water treatment agent, acid neutralizer, or soil conditioner for road construction.
16. Acetylene gas being a highly explosive gas, it must be handled with great safety. When it is transported through pipelines, the pressure is kept very low any the length of the pipelines is kept very short.

3. PROJECT COMPONENTS

3.1 Land & Building

The land required for this manufacturing unit will be approx. around 2500-3000 square feet. Land Purchase and Building Civil Work Cost have not been considered as part of the cost of project. It is expected that the premises will be on rental and approximate rentals assumed of the same will be Rs.25000 to 30000 per month.

3.2 Plant & Machinery

- **Carbide Hopper Filling Cart:** It is cart that is “Custom-built” with spark resistant features and the capacity to match the generator’s hopper size. It is used to move the Carbide to the generator hoppers for filling. The sizes can be 200 – 1200 Kg.



- **Pneumatic Hoists:** These are also known as “Air operated hoists” and are reliable to lift heavy weights without the use of electricity.



- **Acetylene Generator:** This is the main area for the production of the acetylene gas. The machine is configured with intrinsically safe pressure controls to maintain the system operating pressure. The safety relief valves are capable of relieving up to relieving 638 Kg/hour and 807 kg/hour (25,800 scfh/hour), depending on the plant model. Two water filled flashback arresters with check valves are provided to protect the generator from flashes up stream.



- **Acetylene Condenser:** To cool the acetylene gas generator which is hot and laden with moisture. The condenser is used for cooling the gas and condenses the excessive moisture in preparation for its subsequent elimination. The capacity of the condenser is decided according to the local conditions and ensures total cooling, provided that sufficient water supply is maintained.



- **Ammonia Scrubber unit:** Ammonia Scrubber unit for the purification or deammonization of the acetylene gas.



- **Low pressure dryer:** Low pressure Dryer is a pressure vessel charged with solid anhydrous carbide that sucks up the moisture in the gas. It improves the overall performance of the acetylene plant.



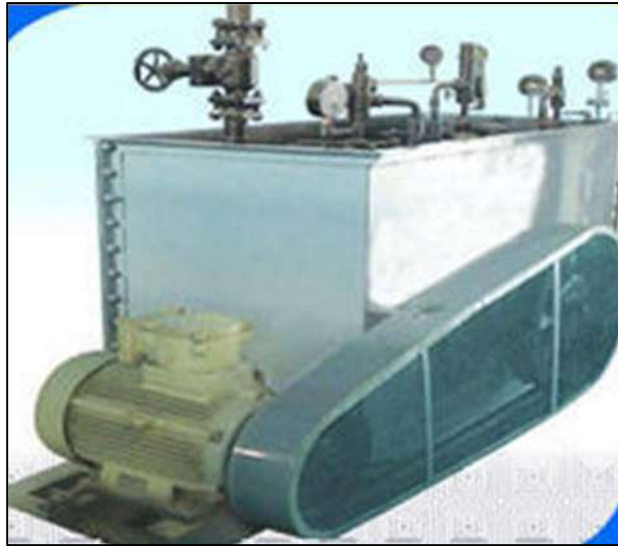
- **High pressure dryers:** These consists of three columns. The first column is filled with packing to avoid any void and for proper mixing and the second and third are filled with anhydrous calcium chloride. It is solid and improves performance. It is very imperative that the high-pressure drier is fully filled up with Calcium Chloride, as any void in high-pressure area is against the required safety. It must be ensured that acetylene high pressure drier is of high quality and meets the international quality standards.



- **Acetylene Purifier:** The purifying chamber is filled with chemicals which removes phosphorus and Sulphur compounds and any acidic fumes. Thereafter the gas passes through a water scrubber so that the particles of the purifying chemicals which may have been carried over with the gas from the purifying chamber are removed. The wet gas then enters the acetylene compressor where it is compressed and passed to the high pressure dryer where mechanical devices and chemicals remove moisture and any lube oil vapor from the gas.



- **Acetylene Air Compressor:** Acetylene Air Compressor for the compression of the manufactured acetylene before sending it to the filling manifolds.



- **Pneumatic Pumps:** For the filling of the acetone and the acetylene gas in the cylinders and also for the control of the transfer of the gas among the different units in the industry. There are different types of pneumatic pumps and among them, the one used to transfer liquid and the one used to move a media through a cylinder would be required here.



- **Water Demineralization Plant:** To get pure water for the synthesis of Acetylene ensuring higher purity.



- **Acetylene gas filling manifold:** It consists of a battery of filling connections, which is employed to connect the gas cylinders. Non-return valves are employed to adjoin various sections of the pipelines to the filling manifold.



4 LICENSE & APPROVALS

Basic registration required in this project:

- MSME Udyam registration
- GST registration
- NOC for fire safety board
- NOC from Pollution Control Board
- Trade License
- Factory License (Optional)
- Import/Export License (Optional)
- License to store Gas Cylinders, Gas Cylinders Rules, 2004, Chapter VI - Filling and Possession.
- Choice of a Brand Name of the product and secure the name with Trademark if required.

PROJECTED BALANCE SHEET						(in Lacs)
PARTICULARS	1st year	2nd year	3rd year	4th year	5th year	
<u>Liabilities</u>						
Capital						
Opening balance		4.19	6.50	8.58	11.88	
Add:- Own Capital	2.09					
Add:- Retained Profit	4.99	6.81	8.38	10.80	12.45	
Less:- Drawings	2.90	4.50	6.30	7.50	9.60	
Closing Balance	4.19	6.50	8.58	11.88	14.73	
Term Loan	13.20	9.90	6.60	3.30	-	
Working Capital Limit	4.00	4.00	4.00	4.00	4.00	
Sundry Creditors	0.74	0.90	1.06	1.23	1.42	
Provisions & Other Liability	0.40	0.48	0.58	0.80	0.96	
TOTAL :	22.53	21.77	20.81	21.21	21.10	
<u>Assets</u>						
Fixed Assets (Gross)						
Gross Dep.	2.48	4.58	6.37	7.89	9.18	
Net Fixed Assets	14.03	11.92	10.13	8.61	7.32	
Current Assets						
Sundry Debtors	1.40	1.76	2.08	2.42	2.81	
Stock in Hand	3.95	4.71	5.54	6.41	7.38	
Cash and Bank	0.66	1.28	0.86	1.47	1.20	
Loans & Advances /Other Current Assets	2.50	2.10	2.20	2.30	2.40	
TOTAL :	22.53	21.77	20.81	21.21	21.10	

PROJECTED PROFITABILITY STATEMENT						(in Lacs)
PARTICULARS	1st year	2nd year	3rd year	4th year	5th year	
Capacity Utilisation %	35%	40%	45%	50%	55%	
<u>SALES</u>						
Gross Sale						
Acetylene Gas	59.85	75.37	89.14	103.88	120.23	
Total	59.85	75.37	89.14	103.88	120.23	
<u>COST OF SALES</u>						
Raw Material Consumed	31.92	38.40	45.36	52.80	60.72	
Electricity Expenses	1.01	1.21	1.36	1.51	1.66	
Depreciation	2.48	2.10	1.79	1.52	1.29	
Wages & labour	8.04	8.84	9.73	10.70	12.31	
Repair & maintenance	1.20	1.51	1.78	2.08	2.40	
Packaging & Cosumables	2.39	3.77	5.35	6.75	8.42	
Cost of Production	47.03	55.83	65.37	75.36	86.80	
Add: Opening Stock	-	2.35	2.79	3.27	3.77	
Less: Closing Stock	2.35	2.79	3.27	3.77	4.34	
Cost of Sales	44.68	55.39	64.89	74.86	86.23	
GROSS PROFIT	15.17	19.97	24.25	29.01	34.00	
	25.34%	26.50%	27.20%	27.93%	28.28%	
Salary to Staff	2.88	3.74	4.31	5.08	5.69	
Interest on Term Loan	1.46	1.29	0.92	0.56	0.20	
Interest on working Capital	0.44	0.44	0.44	0.44	0.44	
Rent	3.00	3.45	3.97	4.56	5.25	
Selling & Administrative Exp.	2.39	3.77	5.35	6.75	8.42	
TOTAL	10.17	12.69	14.98	17.39	19.99	
NET PROFIT	4.99	7.29	9.27	11.62	14.01	
	8.34%	9.67%	10.39%	11.19%	11.65%	
Taxation	-	0.48	0.89	0.82	1.56	
PROFIT (After Tax)	4.99	6.81	8.38	10.80	12.45	

PROJECTED CASH FLOW STATEMENT						(in Lacs)
PARTICULARS	1st year	2nd year	3rd year	4th year	5th year	
<u>SOURCES OF FUND</u>						
Own Margin	2.09					
Net Profit	4.99	7.29	9.27	11.62	14.01	
Depreciation & Exp. W/off	2.48	2.10	1.79	1.52	1.29	
Increase in Cash Credit	4.00	-	-	-	-	
Increase In Term Loan	14.85	-	-	-	-	
Increase in Creditors	0.74	0.15	0.16	0.17	0.18	
Increase in Provisions & Oth labilities	0.40	0.08	0.10	0.22	0.16	
	-					
TOTAL :	29.56	9.62	11.31	13.54	15.65	
<u>APPLICATION OF FUND</u>						
Increase in Fixed Assets	16.50					
Increase in Stock	3.95	0.76	0.82	0.87	0.97	
Increase in Debtors	1.40	0.36	0.32	0.34	0.38	
Repayment of Term Loan	1.65	3.30	3.30	3.30	3.30	
Loans & Advances /Other Current Assets	2.50	- 0.40	0.10	0.10	0.10	
Drawings	2.90	4.50	6.30	7.50	9.60	
Taxation	-	0.48	0.89	0.82	1.56	
TOTAL :	28.89	9.00	11.73	12.93	15.91	
Opening Cash & Bank Balance	-	0.66	1.28	0.86	1.47	
Add : Surplus	0.66	0.62	-0.42	0.60	-0.27	
Closing Cash & Bank Balance	0.66	1.28	0.86	1.47	1.20	

CALCULATION OF D.S.C.R					
PARTICULARS	1st year	2nd year	3rd year	4th year	5th year
CASH ACCRUALS	7.47	8.91	10.17	12.32	13.74
Interest on Term Loan	1.46	1.29	0.92	0.56	0.20
Total	8.93	10.20	11.09	12.88	13.94
<u>REPAYMENT</u>					
Instalment of Term Loan	1.65	3.30	3.30	3.30	3.30
Interest on Term Loan	1.46	1.29	0.92	0.56	0.20
Total	3.11	4.59	4.22	3.86	3.50
DEBT SERVICE COVERAGE RATIO	2.87	2.22	2.63	3.34	3.99
AVERAGE D.S.C.R.	2.96				

REPAYMENT SCHEDULE OF TERM LOAN

Interest 11.00%

Year	Particulars	Amount	Addition	Total	Interest	Repayment	Closing Balance
1st	Opening Balance						
	1st month	-	14.85	14.85	-	-	14.85
	2nd month	14.85	-	14.85	0.14	-	14.85
	3rd month	14.85	-	14.85	0.14	-	14.85
	4th month	14.85	-	14.85	0.14	-	14.85
	5th month	14.85	-	14.85	0.14	-	14.85
	6th month	14.85	-	14.85	0.14	-	14.85
	7th month	14.85	-	14.85	0.14	0.28	14.58
	8th month	14.58	-	14.58	0.13	0.28	14.30
	9th month	14.30	-	14.30	0.13	0.28	14.03
	10th month	14.03	-	14.03	0.13	0.28	13.75
	11th month	13.75	-	13.75	0.13	0.28	13.48
	12th month	13.48	-	13.48	0.12	0.28	13.20
					1.46	1.65	
2nd	Opening Balance						
	1st month	13.20	-	13.20	0.12	0.28	12.93
	2nd month	12.93	-	12.93	0.12	0.28	12.65
	3rd month	12.65	-	12.65	0.12	0.28	12.38
	4th month	12.38	-	12.38	0.11	0.28	12.10
	5th month	12.10	-	12.10	0.11	0.28	11.83
	6th month	11.83	-	11.83	0.11	0.28	11.55
	7th month	11.55	-	11.55	0.11	0.28	11.28
	8th month	11.28	-	11.28	0.10	0.28	11.00
	9th month	11.00	-	11.00	0.10	0.28	10.73
	10th month	10.73	-	10.73	0.10	0.28	10.45
	11th month	10.45	-	10.45	0.10	0.28	10.18
	12th month	10.18	-	10.18	0.09	0.28	9.90
					1.29	3.30	
3rd	Opening Balance						
	1st month	9.90	-	9.90	0.09	0.28	9.62
	2nd month	9.62	-	9.62	0.09	0.28	9.35
	3rd month	9.35	-	9.35	0.09	0.28	9.07
	4th month	9.07	-	9.07	0.08	0.28	8.80
	5th month	8.80	-	8.80	0.08	0.28	8.52
	6th month	8.52	-	8.52	0.08	0.28	8.25
	7th month	8.25	-	8.25	0.08	0.28	7.97
	8th month	7.97	-	7.97	0.07	0.28	7.70
	9th month	7.70	-	7.70	0.07	0.28	7.42
	10th month	7.42	-	7.42	0.07	0.28	7.15
	11th month	7.15	-	7.15	0.07	0.28	6.87
	12th month	6.87	-	6.87	0.06	0.28	6.60
					0.92	3.30	

4th	Opening Balance						
	1st month	6.60	-	6.60	0.06	0.28	6.32
	2nd month	6.32	-	6.32	0.06	0.28	6.05
	3rd month	6.05	-	6.05	0.06	0.28	5.77
	4th month	5.77	-	5.77	0.05	0.28	5.50
	5th month	5.50	-	5.50	0.05	0.28	5.22
	6th month	5.22	-	5.22	0.05	0.28	4.95
	7th month	4.95	-	4.95	0.05	0.28	4.67
	8th month	4.67	-	4.67	0.04	0.28	4.40
	9th month	4.40	-	4.40	0.04	0.28	4.12
	10th month	4.12	-	4.12	0.04	0.28	3.85
	11th month	3.85	-	3.85	0.04	0.28	3.57
	12th month	3.57	-	3.57	0.03	0.28	3.30
					0.56	3.30	
5th	Opening Balance						
	1st month	3.30	-	3.30	0.03	0.28	3.02
	2nd month	3.02	-	3.02	0.03	0.28	2.75
	3rd month	2.75	-	2.75	0.03	0.28	2.47
	4th month	2.47	-	2.47	0.02	0.28	2.20
	5th month	2.20	-	2.20	0.02	0.28	1.92
	6th month	1.92	-	1.92	0.02	0.28	1.65
	7th month	1.65	-	1.65	0.02	0.28	1.37
	8th month	1.37	-	1.37	0.01	0.28	1.10
	9th month	1.10	-	1.10	0.01	0.28	0.82
	10th month	0.82	-	0.82	0.01	0.28	0.55
	11th month	0.55	-	0.55	0.01	0.28	0.27
	12th month	0.27	-	0.27	0.00	0.27	-
					0.20	3.30	
	DOOR TO DOOR	60	MONTHS				
	MORATORIUM PERIOD	6	MONTHS				
	REPAYMENT PERIOD	54	MONTHS				

DISCLAIMER

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