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Detailed Project Report
On
VSD Screw air compressor

Synnova Ceramic Pvt. Ltd.
Thangadh (Gujarat)

Prepared for

Bureau of Energy Efficiency
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Disclaimer

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List of abbreviations

BEE	:	Bureau of Energy Efficiency
CO_2	:	Carbon Dioxide
D/E	:	Debt /Equity
DPR	:	Detailed Project Report
DSCR	:	Debt Service Coverage Ratio
EE	:	Energy Efficient
GEF	:	Global Environmental Facility
GHG	:	Green House Gas
HSD	:	High Speed Diesel
IGDPR	:	Investment Grade Detailed Project Report
IRR	:	Internal Rate of Return
kW	:	Kilo Watt
kWh	:	Kilo Watt Hour
LSPs	:	Local Service Providers
MSME	:	Micro, Small and Medium Enterprises
MT	:	Metric Tonne
NG	:	Natural Gas
NPV	:	Net Present Value
O&M	:	Operation and Maintenance
PCB	:	Pollution control board
RE	:	Renewable Energy
ROI	:	Return On Investment
SCM		Standard Cubic Meter
SME	:	Small and Medium Enterprises
SPP	:	Simple Payback Period
TERI	:	The Energy and Resources Institute
Toe	:	Tonnes of oil equivalent
UNIDO	:	United Nations Industrial Development Organization
VSD	:	Variable Speed Drive
WACC	:	Weighted Average Cost of Capital

Executive summary

The overall aim of the GEF-UNIDO-BEE project 'Promoting Energy Efficiency (EE) and Renewable Energy (RE) in selected MSME clusters in India' is to develop and promote a market environment for introducing energy efficiency and enhancing the use of renewable energy technologies in process applications in selected energy-intensive MSME clusters in India. This would help in improving the productivity and competitiveness of the MSME units, as well as in reducing the overall carbon emissions and improving the local environment.

Under the GEF-UNIDO-BEE Project, TERI has been entrusted to undertake Capacity building of Local Service Providers (LSPs) to BEE. The Scope of Work under the project,

- Organizing 4 one-day training/ capacity building workshops for LSPs in each cluster.
- Development of 10 bankable DPRs for each cluster, based on mapping technology needs with capacities of local technology suppliers/service providers, and also replication potential and applications to banks in each cluster.

Brief introduction of the MSME unit

Name of the unit	M/s Synnova Ceramic Pvt. Ltd.
Constitution	Private limited
MSME Classification	Small
No. of years in operation	2
Address: Registered Office:	Abhepar Road At. Abhepar P.B. No.9 Thanghar-363 530
Industry-sector	Sanitary ware (Ceramic)
Products manufactured	Manufacturer, exporter and supplier of designer wash basin, wash basin, ceramic wash basin, Indian toilet seats, urinal, antique wash basin, sanitary ware
Name(s) of the promoters/ directors	Mr. Dilip Petel
Existing banking arrangements along with the details of facilities availed	State Bank of India (CC)

Brief highlights of the past financial position of the MSME unit

(Rs lakh)

S. No	Particulars	FY 2018 (Audited)
1	Total income	618
2	Net profit	49

A detailed assessment study was undertaken in the identified area with the use of the sophisticated handheld instruments. Energy consumption pattern and production data were collected to estimate the specific energy consumption of the unit. The unit level baseline of the unit was also estimated using the historical data. The plant is consuming about 680,214 kWh of electricity per year. The annual consumption of the HSD is 1,200 litres and NG is

760,620 SCM. The total energy consumption of the unit during last 12 months is estimated to be 740 toe which is equivalent to 250 lakh rupees. The total CO_2 emission during this period is estimated to be 1,892 tonnes. Electricity, HSD and NG were considered for CO_2 emission estimation.

The unit manufactures the ceramic sanitary ware. The total annual production of the unit during 2017-18 is estimated to be about 3,900 tonnes.

Accepted/ recommended technology implementation

The recommended technology considered after discussion with the plant personnel for implementation in the unit is given below.

Technology	Annual energy saving	Investment[1] (Rs lakh)	Monetary savings	Simple payback period (Years)	Emission reduction (tonnes of CO_2)
	Electricity (kWh)		(Rs lakh/ year)		
Replacement of existing reciprocating air compressors with variable speed (VSD) screw air compressor	61,254	9.8	4.01	2.4	50.3

Other benefits

- The proposed project is not expected to bring in any change in process step or operating practices therefore no change expected in the product quality.
- Implementation of the selected technology in the unit may result in reduction in CO_2 emissions.

Cost of project & means of finance

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	9.80	10.16	10.06
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	17.53	11.73	13.36
4	NPV	Rs. In Lakh	1.93	0.38	0.82
5	DSCR	-	-	1.95	2.69

[1] Investment including air compressed– Rs. 8.4 lakh, and (ii) taxes and miscellaneous – Rs. 1.4 lakh

1.0 Details of the unit

1.1 Particulars of unit

Table 1.1: Particulars of the unit

1	Name of the unit	M/s Synnova Ceramic Private Limited	
2	Constitution	Private Limited	
3	DIC Number	EM22400812001976	
4	PCB consent No.	PCB ID: 44793	
5	Date of incorporation / commencement of business	2015	
6	Name of the Contact Person	Mr. Dipli Patel	
7	Mobile / Ph. No		
8	Email	info@synnovaceramic.com	
9	Address: Registered Office	Abhepar Road At. Abhepar P.B. No.9 Thanghar-363530	Owned
10	Factory	Abhepar Road At. Abhepar P.B. No.9 Thanghar-363530	Owned
11	Industry / Sector	MSME/Manufacturing	
12	Products Manufactured	Manufacturer, exporter and supplier of designer wash basin, wash basin, ceramic wash basin, Indian toilet seats, urinal, antique wash basin, sanitary	
13	No of hours of operation/shift	8	
14	No of shifts/ day	3	
15	No of days/year	350	
16	Installed Capacity	15 tonnes per day	
17	Whether the unit is exporting its products (Yes/ No)	Yes	
18	Quality Certification, if any	ISO 9001 : 2015	

2.0 Energy profile

2.1 Process flow diagram

Manufacturing of ceramic item uses wide range of raw material combination to produce different shape, size and colour. It requires both electrical and thermal energy at different stages of the process to operate the ball mill, casting/moulding, kilns, cutting & finishing machines and utilities such as motors, pumps air compressor etc. Ceramic manufacturing process primarily consists of mould preparation, body material preparation, shaping, drying and firing. Typical process flow chart is shown with figure 2.1.

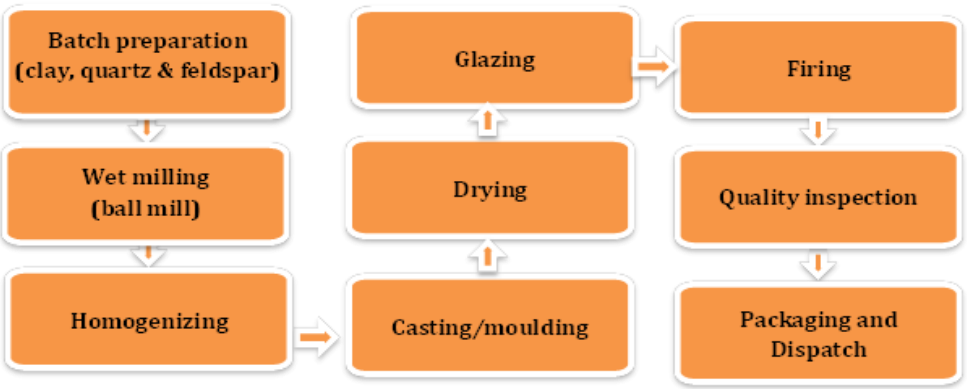


Figure 2.1: Process flow chart

2.2 Details of technology identified

The details of the existing air compressor unit are given in Table 2.2.

Table 2.2: Details of existing air compressor

Particulars	Unit	Compressor - 1
Make	-	IR
Type	-	Receiver
Model No.	-	NA
Year of Installation	-	2007
Purpose	-	Process air
Capacity of receiver	M^3	1
Rated Capacity	M^3/Min	4.25

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Paschim Gujarat Vij Company Ltd under the tariff category HTP-I. Table 2.3 provides the details of energy uses.

Table 2.3: Energy used and description of use

S No	Energy source	Description of use
1	Electricity	Motive power for different drives in different process sections and utilities
2	NG	Kiln
3	HSD	For diesel generator (backup power during power cuts)

2.4 Energy sources, availability & tariff details

Different energy sources, availability of listed energy types and their respective tariffs are given in table 2.4.

Table 2.4: Energy sources, availability and tariffs

Particular	HTP-1
Supplied by PGVCL Connection category: HTP – 1	Demand charges: ▪ For first 500 kVA of billing demand: Rs. 150/- per kVA per month ▪ For next 500 kVA of billing demand: Rs. 260/- per kVA per month Energy charges: 420 paise per unit **Penalty:** ▪ 1% of energy charges for every point drop in PF between 0.85 to 0.90 ▪ 2% of energy charges for every point drop in PF below 0.85 **Rebate** 0.5% of energy charges for every point increase in PF over 0.95 TOU Pricing: For energy consumption during the two peak periods, viz., 0700 Hrs to 1100 Hrs and 1800 Hrs to 2200 Hrs ▪ For Billing Demand up to 500kVA: 35 Paise per unit ▪ For Billing Demand above 500kVA: 75 Paise per unit.

2.5 Analysis of electricity consumption

Table 2.5: Electricity consumption profile

Month & Year	Total electricity consumption (kWh)	Sanctioned load/demand (kVA)	Power factor	Recorded demand, kVA	Demand charges (Rs)	Energy charges (Rs)	Monthly bill (Rs)
Aug-17	38,025	225	0.91	176	28,650	1,52,100	2,51,254
Sep-17	56,004	225	0.97	191	28,650	2,24,016	3,56,428
Nov-17	61,839	225	0.97	216	32,400	2,47,356	3,93,485
Dec-17	58,680	225	0.97	203	30,450	2,34,720	3,72,433
Jan-18	59,334	225	0.98	203	30,450	2,37,336	3,68,828
Feb-18	66,225	225	0.98	193	28,650	2,64,900	4,00,101
Total	**6,80,214**	**-**	**-**	**-**	**3,58,500**	**27,20,856**	**42,85,057**

Figure 2.5 presents contract demand, recorded maximum demand and the energy consumption of the unit.

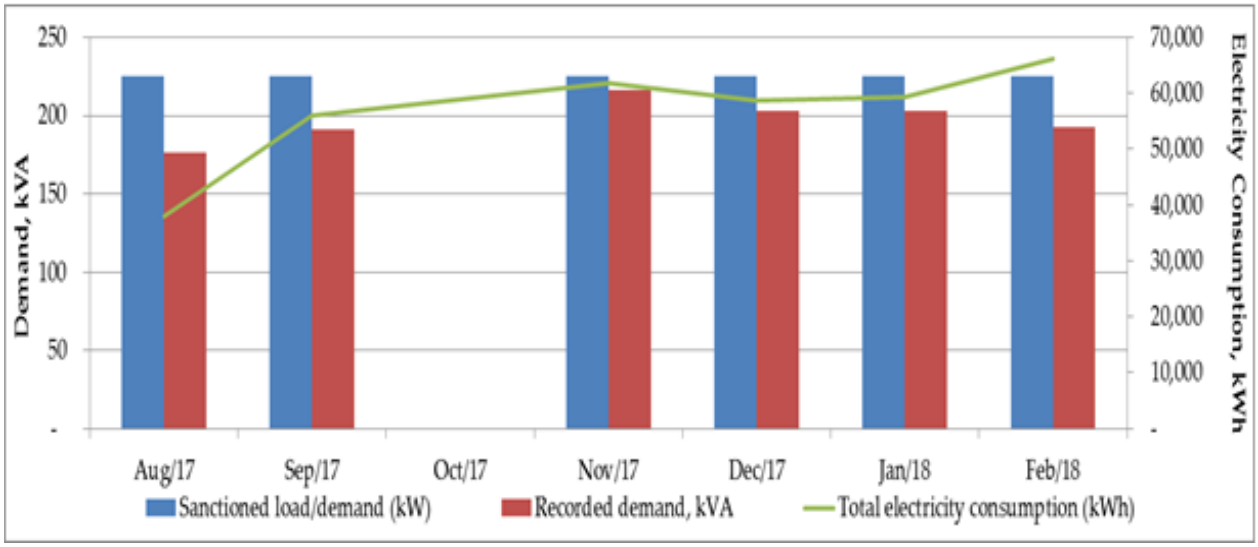


Figure 2.5: Demand pattern and energy consumption profile

2.6 Analysis of other energy forms/ fuels

The analysis of the other fuels/forms of energy used in the unit is given in table 2.6.

Table 2.6: Analysis of other energy/ fuel consumption

Parameters	NG (SCM)	HSD (Litres)
Consumption unit/year	760,620	1,200
Calorific value per unit	8,935	9,202
Equivalent toe per year	679.6	1.1
Price (Rs per unit)	26.9	60.0
Total price per year	20,494,906	72,000

The share of various energy forms used in the unit is given in figure 2.6.

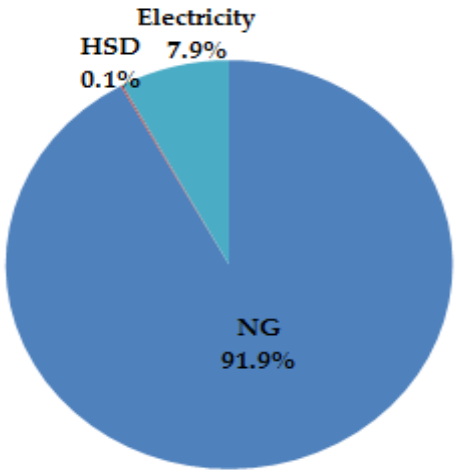


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 680,214 kWh of electricity per year. The annual consumption of the HSD is 1,200 litres and NG is 760,620 SCM. The total energy consumption of the unit during last 12 months is estimated to be 740 toe which is equivalent to 250 lakh rupees. The total CO_2 emission during this period is estimated to be 1,892 tonnes. Electricity, HSD and NG were considered for CO_2 emission estimation.

3.0 Proposed technology for energy efficiency

Based on the measurements, observations/ findings during detailed assessment study conducted in the unit, the following technology has been identified for energy efficiency improvement. The detail is given below.

3.1 Replacement of existing reciprocating air compressors with variable speed (VSD) screw air compressor

3.1.1 Background

The Synnova Ceramic Pvt. Ltd. is manufacturing designer ceramic wash basin, Indian as well as western toilet seats, urinal etc. To cater the compressed air requirement of process and instrumentation, unit has two compressed air networks. The compressed air system used for the glazing process is rotary screw type with one standby and for the rest of the plant; vertical piston type compressor is in used. The operational parameters of the air compressor system were measured during the detailed assessment study.

3.1.2 Observations and analysis

During the study free air delivery (FAD) test of the compressed air system was conducted for evaluating the performance. The outcome of the analysis is shown in table 3.1.2.

Table 3.1.2: Performance analysis of compressed air system

Particulars	Unit	Value
Design details		
Make	-	IR
Type	-	Reciprocating
Model No.	-	
Year of Installation	-	2007
Purpose	-	Process air
Capacity of receiver	M^3	1
Rated Capacity	M^3/Min	4.25
Operational parameters		
Operating Pressure	kg/cm^2	5
Initial Pressure	kg/cm^2	0
Atmospheric pressure	kg/cm^2	1.013
Capacity of Receiver	M^3	0.75
Additional holdup volume	M^3	0.01
Pump-up time	Seconds	74
Inlet air temperature	^oC	37.6
Calculated/Analyzed parameters		
Actual FAD	M^3/Min	3.05
Volumetric Efficiency	%	72
Isothermal Power	kW	8.1
Motor input power	kW	28
Efficiency of Motor	%	0.92
Shaft input power	kW	25.8
Isothermal Efficiency	%	31.3
Specific Power Consumption	kW/m^3/min	9.19

Air compressors were operated using load/unload control load/ unload control also known as constant speed control, which allows the motor to run continuously, but unloads the compressor when the discharge pressure is adequate. The volumetric efficiency of the compressor is 72% of the design capacity which is lower than the recommended value. It is to be noted that the FAD of any compressor should not be less than 80% of their rated capacity in order to achieve optimum operational efficiency.

The specific power consumption (SPC) in compressors is generally in the range of 5.5 – 6.0 kW/M^3/min. The estimated SPC in the air compressors is about 9.2 kW per cubic meter per minute, which is higher than the recommended range.

3.1.3 Recommendation

It is recommended to replace existing inefficient reciprocating air compressors with a single variable speed (VSD) screw air compressor of capacity about 4.25 m^3 per min. VSD operated screw compressor has two functions; one it varies rpm of compressor based on pressure variation at the load or perform end and it also reduces no load power consumption during unloading condition by bringing the motor to halt. Such operation prevents consumption of power during unload condition.

The other advantages of installation of VSD based screw compressor are as follows:

- By using VSD in screw air compressors, the operating pressure of air compressor can be precisely controlled and there is no need to maintain a range of pressure as required in the existing system. This leads to reduction in average operating pressure of the compressor hence reduction in power consumption.
- The leakage in the compressed air system is proportional to the operating pressure. Since there is a significant reduction in operating pressure, volume of air leakage would also reduce.

3.2 Cost benefit analysis

The estimated saving in annual operation cost by replacement of existing air compressors with variable speed (VSD) screw air compressors is Rs. 4.01 lakhs. The investment requirement[2] is Rs 9.8 lakh with a simple payback period of 2.4 years. The detailed calculations of the recommended energy conservation measures for DPR are provided in table 3.2.

Table 3.2: Cost benefit analysis for recommended energy savings measures

Particulars	Unit	Values
Total installed capacity	m^3/min	4.25
Actual air delivery	m^3/min	3.05
Volumetric Efficiency	%	71.66
Input motor power	kW	28
Specific Power Consumption	kW/m^3/min	9.19
Proposed power consumption	kW/m^3/min	6
Reduction of power consumption	kW	18
Reduction in annual energy consumption	kWh/annum	61,285

[2] Quotation – 1 has been considered for estimation of investments

Particulars	Unit	Values
Monitory savings	Rs	4.01
Cost of maintenance inclusive of taxes	Rs	9.8
Simple payback period	Years	2.4

3.3 Pre-training requirements

The training would be required on best operating and maintenance practices for new air compressor.

3.4 Process down time for implementation

The estimated process down time required for implementation of recommended measure is estimated to be 2 days.

3.5 Environmental benefits

3.5.1 CO_2 reduction[3]

Implementation of the selected energy conservation measures in the unit may result in reduction in CO_2 emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 50.3 tonne of CO_2 per year.

3.5.2 Reduction in other pollution parameters (gas, liquid and solid)

There is not significant impact on the reduction in other pollution parameters including gas, liquid and solid.

[3] Source for emission factor: 2006 IPCC Guidelines for National Greenhouse Gas Inventories & electricity: CO_2 Baseline Database for the Indian Power Sector, user guide version 12.0, May 2017 (CEA)

4.0 Project financials

4.1 Cost of project and means of finance

4.1.1 Particulars of machinery proposed for the project

The particulars of machinery proposed for the project is given in table 4.1.1.

Table 4.1.1: Particulars of machinery proposed for the project

S. No.	Name of machinery (Model/ specification)	Name of manufacturer, contact person	Advantage	Disadvantage
1	Air Compressor : UP5-22-7VSD • Suitable Ingersoll-Rand make • Single – Stage Screw Air Compressor Model: UP5-22-7 VSD complete with 22 Kw motor • Capacity - 63-125 CFM, Air-cooled air and oil coolers, star delta starter, microprocessor based Intellisys Control Panel mounted on a common skid.	P. Prabhudas Eng. Pvt Ltd. Mr. Jimmy J Daxini (9824210451)	Reputed manufacturer	High cost
2	30 HP Direct Driven Screw Air Compressor • Lubricated, electric rotary type screw compressor • Permanent magnet motor & VSD drive	Venus Corporation 60/3, Diamond Industrial Estate Naroda G.I.D.C. Ahmedabad	PM Motor	New supplier

4.1.2 Means of finance

The means of finance for the project is shown in table 4.1.2.

Table 5.1.4: Means of finance

S. No.	Details	100% equity	D/E- 70:30	D/E- 50:50
1	Additional (Share) Capital	9.80	2.94	4.90
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	6.86	4.90
5	Others	-	-	-
	Total	**9.80**	**9.80**	**9.80**

4.2 Financial statement (project)

4.2.1 Assumptions

The assumptions made are provided in table 4.2.1.

Table 4.2.1: Assumptions made

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
General about unit				
No of working days	Days		350	
No of shifts per day	Shifts		3	

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Annual operating hours	hrs/year		8,400	
Installed production capacity	tonnes/year		5.250	
Production in last financial years	tonnes/year		3.900	
Capacity utilization factor	%		74	
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	9.80	9.80	9.80
Investment without interest defer credit (IDC)	Rs. (in Lakh)	9.80	9.80	9.80
Implementation time	Months	6.00	6.00	6.00
Interest during the implementation phase	Rs. in lakhs	-	0.36	0.26
Total investment	Rs. in lakhs	9.80	10.16	10.06
Financing pattern				
Own funds	Rs. in lakhs	9.80	3.30	5.16
Loan funds (term loan)	Rs. in lakhs	-	6.86	4.90
Loan tenure	Years	-	5.0	5.0
Moratorium period (No EMI (interest and principal amount))	Months	-	6.0	6.0
Total repayment period	Months	-	66.0	66.0
Interest rate	%	-	10.5	10.5
Estimation of costs				
Operation & maintenance costs	%		5.0	
Annual escalation rate of O&M	%		5.0	
Estimation of revenue				
Reduction in energy cost	Rs Lakh/year		4.01	
Total saving	Rs Lakh/year		4.01	
Straight line depreciation	%		16.21	
IT depreciation	%		80.0	
Income tax	%		33.99	
Period of cash flow analysis	Years		5.0	

4.2.2 Payback

The simple payback period on the investments made are shown in table 4.2.2.

Table 4.2.2: Payback

Details	100% equity	D/E- 70:30	D/E- 50:50
Total project cost (Rs. In lakh)	9.80	10.16	10.06
Cash flow as annual saving (Rs. In lakh/year)	4.01	4.01	4.01
O&M Expenses for first year (Rs. In lakh/year)	0.49	0.51	0.50
Net Cash flow (Rs. In lakh/year)	3.52	3.50	3.51
SPP (months)	33.41	34.81	34.41
Considered (month)	33.40	34.80	34.40

4.2.3 NPV and IRR

The NPV and IRR calculations are shown in table 4.2.3.

Table 4.2.3a: NPV and IRR (100% equity)

Particulars / years	0	1	2	3	4	5
			(Rs. in lakhs)			
Profit after tax	-	1.93	2.72	0.81	0.71	0.67
Depreciation	-	1.59	1.59	1.59	1.59	1.59
Cash outflow	9.80	-	-	-	-	-
Net cash flow	-9.80	3.52	4.31	2.40	2.29	2.26
Discount rate % @ WACC	9.25	9.25	9.25	9.25	9.25	9.25
Discount factor	1.00	0.92	0.84	0.77	0.70	0.64
Present value	-9.80	3.22	3.61	1.84	1.61	1.45
Net present value	**1.93**					
Simple IRR considering regular cash flow	**17.53%**					

Table 4.2.3b: NPV and IRR (D/E- 70:30)

Particulars / years	0	1	2	3	4	5
			(Rs. in lakhs)			
Profit after tax	-	1.51	2.49	0.42	0.41	0.48
Depreciation	-	1.65	1.65	1.65	1.65	1.65
Cash outflow	10.16	-	-	-	-	-
Net cash flow	-10.16	3.15	4.14	2.07	2.06	2.12
Discount rate % @ WACC	10.09	10.09	10.09	10.09	10.09	10.09
Discount factor	1.00	0.91	0.83	0.75	0.68	0.62
Present value	-10.16	2.86	3.41	1.55	1.40	1.31
Net present value	**0.38**					
Simple IRR considering regular cash flow	**11.73%**					

Table 4.2.3c: NPV and IRR (D/E- 50:50)

Particulars / years	0	1	2	3	4	5
			(Rs. in lakhs)			
Profit after tax	-	1.63	2.56	0.53	0.49	0.53
Depreciation	-	1.63	1.63	1.63	1.63	1.63
Cash outflow	10.06	-	-	-	-	-
Net cash flow	-10.06	3.26	4.19	2.16	2.12	2.16
Discount rate % @ WACC	9.86	9.86	9.86	9.86	9.86	9.86
Discount factor	1.00	0.91	0.83	0.75	0.69	0.62
Present value	-10.06	2.97	3.47	1.63	1.46	1.35
Net present value	**0.82**					
Simple IRR considering regular cash flow	**13.36%**					

4.3 Marketing & selling arrangement

The marketing and selling arrangements of the unit are given in table 4.3.

Table 4.3: Marketing & selling arrangements

Items	Remarks
Main Markets (locations)	Pan India
Locational advantages	-
Indicate competitors	Other units
Any USP or specific market strength	-
Whether product has multiple applications	NA
Distribution channels (e.g. direct sales, retail network, distribution network)	Direct sales
Marketing team details, if any.	NA

4.4 Risk analysis and mitigation

The risk analysis and mitigation for the proposed options are given in table 4.4.

Table 4.4: Risk analysis and mitigation

Type of risk	Description	Mitigation
Technology	The equipment/technology provided by the supplier may not be of high quality which may result in underperformance.	The equipment/technology should be procured from standard/reputed vendors only.
Market /Product	Demand of the product manufactured by the unit may change resulting in lower capacity utilization.	Regular vigilance/tab on the market scenario by the SME will help in better understanding of new substitute product. The unit may modify the product line based on the emerging market trend.
Policy/ Regulatory	Changes in government regulation/policy related to pollution and taxes & duties can affect the viability of the unit.	Local industrial association may play a role in discussing these issues with the relevant governmental bodies on a regular basis, so that any concerns of the unit are brought to their notice.

4.4 Sensitivity analysis

A sensitivity analysis for various scenarios which may affect the return on investment is given in table 4.4.

Table 4.4: Sensitivity analysis

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
1	10% increase in estimated savings	100% equity	30.00	2.96	21.73	-	14.59
		70:30	31.20	1.39	15.95	2.11	22.26
		50:50	30.90	1.84	17.57	2.92	18.93
2	10% reduction in estimated savings	100% equity	37.70	0.90	13.18	-	10.57
		70:30	39.30	-0.63	7.33	1.78	15.54
		50:50	38.90	-0.20	8.98	2.46	13.24
3	10% rise in interest rates	70:30	35.00	0.08	11.12	1.91	18.77
		50:50	34.50	0.59	12.93	2.63	16.04

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
4	10% reduction in interest rates	70:30	34.70	0.69	12.32	1.98	19.77
		50:50	34.30	1.05	13.79	2.75	16.62

5.0 Conclusions & recommendations

The IGDPR prepared for the replacement of existing reciprocating air compressors with variable speed (VSD) screw air compressor based on the performance assessment study conducted at unit and the acceptance of the unit management. The brief of selected energy conservation measures is given below.

5.1 List of energy conservation measures

The brief summary of the energy conservation measures are given in table 5.1.

Table 5.1: Summary of the energy conservation measures

Technology	Annual energy saving Electricity (kWh)	Investment (Rs lakh)	Monetary savings (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO_2)
Replacement of existing reciprocating air compressors with variable speed (VSD) screw air compressor	61,285	9.8	4.01	2.4	50.3

These measures have an estimated investment of 9.8 lakh rupees and can yield a savings of 4.01 lakh rupees per year. The total annual reduction in emission by implementation of recommended measures is estimated to be 50.3 tonnes of CO_2. The financial indicators provided above in the table shows the project is financially viable and technically feasible.

5.2 Summary of the project

The summary of the project is given in table 5.2.

Table 5.2: Summary of the project

S. No.	Particulars	Unit	100% equity	D/E- 70:30	D/E- 50:50
1	Cost of Project	Rs. In Lakh	9.80	10.16	10.06
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	17.53	11.73	13.36
4	NPV	Rs. In Lakh	1.93	0.38	0.82
5	DSCR	-	-	1.95	2.69

5.3 Recommendations

The financial indicators provided above show the project is financially viable and technically feasible. It is recommended that the implementation of the identified the energy conservation measures may be undertaken by the unit.

6.0 Financing schemes for EE investments for MSME sector

Government of India has many schemes to provide concessional finance for EE technologies among MSMEs. Some major government schemes are summarised in table 6.1.

Table 6.1: Major government schemes

Name of the scheme	Brief Description and key benefits
ZED assessment and certification	Assessment process, fee and subsidy are as follows: Online (e-Platform) self-assessment: Nil fee Desk Top assessment : Rs 10,000 per SME Complete assessment : Rs 80,000 ZED rating per SME; Rs 40,000 for additional ZED defence rating; Rs 40,000 for re-rating The rating costs will include cost of Rs 10,000/- as certification cost by QCI. Subsidy for Micro, Small and Medium Enterprises are 80%, 60% and 50% respectively.
Credit Linked Capital Subsidy Scheme (CLCSS) (2000-ongoing)	15% capital subsidy of cost of eligible plant and machinery / equipment for adoption of proven technologies for approved products / sub-sectors for MSE units subject to ceiling of INR 15 lakhs
Credit Guarantee Fund Scheme for Micro and small Enterprises (in partnership with SIDBI) (2000-ongoing)	This scheme was launched by MoMSME and SIDBI to alleviate the problem of collateral security and enable micro and small scale units to easily adopt new technologies. Under the scheme, collateral free loans up to Rs 1 crore can be provided to micro and small scale units. Additionally, in the event of a failure of the SME unit which availed collateral free credit facilities to discharge its liabilities to the lender, the Guarantee Trust would guarantee the loss incurred by the lender up to 75 / 80/ 85 per cent of the credit facility.
Technology and Quality Up gradation Support to MSMEs (TEQUP) (2010-ongoing)	The benefits available to SMEs under TEQUP include—technical assistance for energy audits, preparation of DPRs and significant capital subsidy on technologies yielding an energy savings of over 15%. The scheme offers a subsidy of 25% of the project cost, subject to a maximum of Rs. 10 lakhs. TEQUP, a scheme under NMCP, focuses on the two important issues in enhancing competitiveness of the SME sector, through EE and Product Quality Certification.
Technology Upgradation Fund Scheme (TUFS) (1999-ongoing)	Interest subsidy and /or capital subsidy for Textile and Jute Industry only. 1. To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being: • Promoter's margin -15%; • Subsidy – 15% available on investment in TUF compatible machinery subject to ceiling of Rs 45 lakh; • Loan amount – 70% of the cost of the machinery by way of Term Loan

Name of the scheme	Brief Description and key benefits
	• Interest rate: Reimbursement of 5% on the interest charged by the lending agency on a project of technology upgradation in conformity with the Scheme • Cover under Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGMSE) available 2. To enable technology upgradation in micro and small power looms to improve their productivity, quality of products and/ or environmental conditions • 20% margin subsidy on investment in TUF compatible specified machinery subject to a ceiling of Rs 60 lakhs or Rs 1crore (whichever is applicable) on subsidy amount to each unit – released directly to the machinery manufacturer.
Tax incentives	• Accelerated depreciation is provided to the customers / users of the energy saving or renewable energy devises under the direct tax laws. • Under indirect taxes, specific concessional rates of duty are only available to CFLs and not to all energy efficient products • A further waiver of import tariffs and taxes for EE technology imports are dealt on a case to case basis, meaning higher costs for those imported technologies that are not available in the domestic markets at present.

Two financing schemes have been created by Bureau of Energy Efficiency (BEE) under The National Mission for Enhanced Energy Efficiency (NMEEE) for financing of energy efficiency projects - Venture Capital for Energy Efficiency (VCFEE) and Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE). These funds seek to provide appropriate fiscal instruments to supplement the efforts of the government for creation of energy efficiency market. Highlights of these two schemes are provided in the table 6.2.

Table 6.2: BEE's VCFEE and PRGFEE scheme

Venture Capital for Energy Efficiency (VCFEE)	• This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. • A single investment by the fund shall not exceed Rs 2 crore • Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	• A PRGF is a risk sharing mechanism lowering the risk to the lender by substituting part of the risk of the borrower by granting guarantees ensuring repayment of part of the loan upon a default event. • Guarantees a maximum 50% of the loan (only principal). In case of default, the fund will: o Cover the first loss subject to maximum of 10% of the total guaranteed amount o Cover the remaining default (outstanding principal) amount on

Venture Capital for Energy Efficiency (VCFEE)	• This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase. • A single investment by the fund shall not exceed Rs 2 crore • Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less
	partial basis upto the maximum guaranteed amount • PFI shall take guarantee from the PRGFEE before disbursement of loan to the borrower. • The Guarantee will not exceed Rs 300 lakh per project or 50% of loan amount, whichever is less. • Maximum tenure of the guarantee will be 5 years from the date of issue of the guarantee

Indian Renewable Energy Development Agency (IREDA), a non-banking financial institution established by the government also extends financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation. The detailed financing guidelines for energy efficiency projects are provided in table 6.3.

Table 6.3: IREDA's financing guidelines

Eligible companies who can apply	Private Sector Companies/ firms, Central Public Sector Undertaking (CPSU), State Utilities/ Discoms/ Transcos/ Gencos/ Corporations, Joint Sector Companies which are not loss making.
Minimum loan amount	• Rs. 50 lakh
Type of projects considered for term loans	• Replacement / retrofit of selected equipment with energy efficient equipment • Modification of entire manufacturing processing • Recovery of waste heat for power generation
Incentive available	• Rebate in central excise duty • Rebate in interest rate on term loan • Rebate in prompt payment of loan instalment
Interest rate	• 10.60% to 11.90% depending upon the grading of the applicant with prompt payment rebate of 15 bps if payment is made on / before due dates • Interest rates are floating and would be reset on commissioning of the project or two years from the date of first disbursement. Thereafter, the rates will be reset after every two years. • Rebate of 0.5% in interest rates are available for projects set up in North Eastern States, Sikkim, J&K, Islands, Estuaries. Rebates of 0.5% in interest rates are also available for projects being set up by SC/ST, Women, Ex Servicemen and Handicapped categories involving project cost of upto Rs. 75.00 lakh.
Loan	Upto 70% of the total project cost. Promoter's contribution should be Minimum 30% of the total project cost
Maximum debt	3:1

equity ratio	The project cash flow should have a minimum average Debt Service Coverage Ratio of 1.3
Maximum repayment period	12 years with moratorium of maximum 12 months
Procurement procedures	The borrower is required to follow the established market practices for procurement and shall demonstrate that the quality goods and services are being purchased at reasonable and competitive prices. Wherever the loan is sanctioned against international lines of credit such as the World Bank, Asian Development Bank, kfW, etc., the relevant procedures will have to be followed and requisite documents will have to be submitted by the borrower

Small Industries Development Bank of India (SIDBI) has several schemes and focused lines of credit for providing financial assistance for energy efficiency and cleaner production projects for SMEs. Highlights of some of the major financial assistance schemes/projects managed by SIDBI are given in table 6.4.

Table 6.4: Major EE financing schemes/initiatives of SIDBI

End to End Energy Efficiency (4E) Program	Support for technical /advisory services such as: • Detailed Energy Audit • Support for implementation • Measurement & Verification Financing terms: • Terms loans upto 90% • Interest rate upto 3% below normal lending rate.
TIFAC-SIDBI Revolving Fund for Technology Innovation (Srijan Scheme)	To support SMEs for up-scaling and commercialization of innovative technology based project at flexible terms and interest rate. Preference accorded to sustainable technologies / products. Soft term loan with an interest of not more than 5%.
Partial Risk Sharing Facility for Energy Efficiency (PRSF) Project (supported by World Bank)	Sectors covered: • Large industries (excluding thermal power plants) • SMEs • Municipalities (including street lighting) • Buildings Coverage: • The minimum loan amount Rs 10 lakh and maximum loan amount of Rs 15 crore per project. • The extent of guarantee is 75% of the loan amount
JICA-SIDBI Financing Scheme	• The loan is used to provide SMEs with funds necessary to invest in energy-saving equipment (and some medical equipment) in the form of two-step loans through SIDBI or three-step loans through intermediary financial institutions.

	• Project uses an Energy Saving Equipment List approach • Equipment/machinery with energy saving potential less than 10% is not eligible. • Interest rate: As per credit rating and 1% below the normal lending rate • Separate technical assistance component which is used for wetting of loan applications, holding seminars to raise awareness of energy saving among SMEs and to improve the ability of financial institutions to screen loan applications for energy-saving efforts
KfW-SIDBI Financing Scheme	Coverage a) SMEs for energy efficiency projects b) SMEs and clusters for cleaner production and emission reduction measures, waste management and Common Effluent Treatment Plant (CETP) facilities Interest rate As per credit rating and 1% below the normal lending rate Eligible criteria 3 t CO_2 emission reduction per year per lakh invested List of eligible equipment/technology and potential suppliers developed for guidance

State Bank of India (SBI) has been provided a green line of credit by Japan Bank for International Cooperation (JBIC) for financing of energy efficiency investments. Highlights of the line of credit are given in table 6.5.

Table 6.5: JBIC-SBI Green Line

Key Features

- Amount : USD 90 million
- Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment)

Eligibility Criteria

- Projects contributing to preservation of global environment, i.e. significant reduction of GHG emissions
- Acceptance of JBIC-MRV ('J-MRV") by the project proponent in terms of the numerical effect of the environment preservation. To ensure effective GHG reduction emissions in Green financed projects, JBIC reviews such effects through simple and practical Measurement Reporting Verification (MRV) process both in (a) prior estimation and (b) ex-post monitoring.
- Procurement in line with the "Guidelines for Procurement under Untied Loans by Japan Bank for International Cooperation"

Canara bank has a dedicated scheme for financing EE investment among SME sector as mentioned in table 6.6.

Table 6.6: Canara bank scheme of EE SME loans

Purpose	**For acquiring/adopting energy conservation/savings equipment/ measures by SMEs**
Eligibility	Units under Small and Medium Enterprises Cost of energy for the unit should constitute not less than 20% of the total cost of production Unit should possess energy audit report issued by an approved energy Consultant/Auditor. Borrowal a/cs-ASCC code S1 or S2 during previous review. Current account holders having dealings exclusively with us satisfactorily for a period of last one year
Maximum loan	Maximum Rs 100 lakhs in the form of term loan
Security	Prime: Assets created out of loan Collateral: Upto Rs.5 lakhs – NIL Above Rs.5 lakhs, as determined by the bank
Repayment	Maximum 5-7 years including moratorium of 6 months
Guarantee cover	Cover available under CGMSE of CGTMSE available for eligible loans
Margin	10% of the project cost
Rate of interest	1% less than the applicable rate
Upfront fee	1% of the loan
Insurance cover	Assets acquired and charged as security to Bank to be insured
Special offer, if any	**Grants :** Bank provides 25% of the cost of Energy Audit / Consultancy charges with a maximum of Rs 25000/- to the first 100 units on a first come first served basis which is in addition to the grant of Rs 25000/- being provided by IREDA(First 100 units)

Among the private sector banks in India, Yes Bank is also active in financing of renewable energy and energy efficiency projects. The bank has an MOU with SIDBI for providing funding for EE through PRSF.

Most commercial banks charge interest rate between from 11% to 13% from MSMEs depending upon general criteria such as credit ratings, references, past lending record, balance sheet for last 3 years and so on. Interest rebate is offered for a few customers whose collateral value is around 125% of the loan amount. Further 0.5% concession in interest rate was offered to women entrepreneurs.

Annexures

Annexure 1: Budgetary offers / quotations

Quotation 1 : P. Prabhudas Eng. Pvt. Ltd

P. PRABHUDAS
Engineering Pvt. Ltd.

'Power House',
3/12, Bhaktinagar Station Plot,
Rajkot-360 002.
Tel. : 0281-2461130, 2461131
E-mail : irrajkot@gmail.com

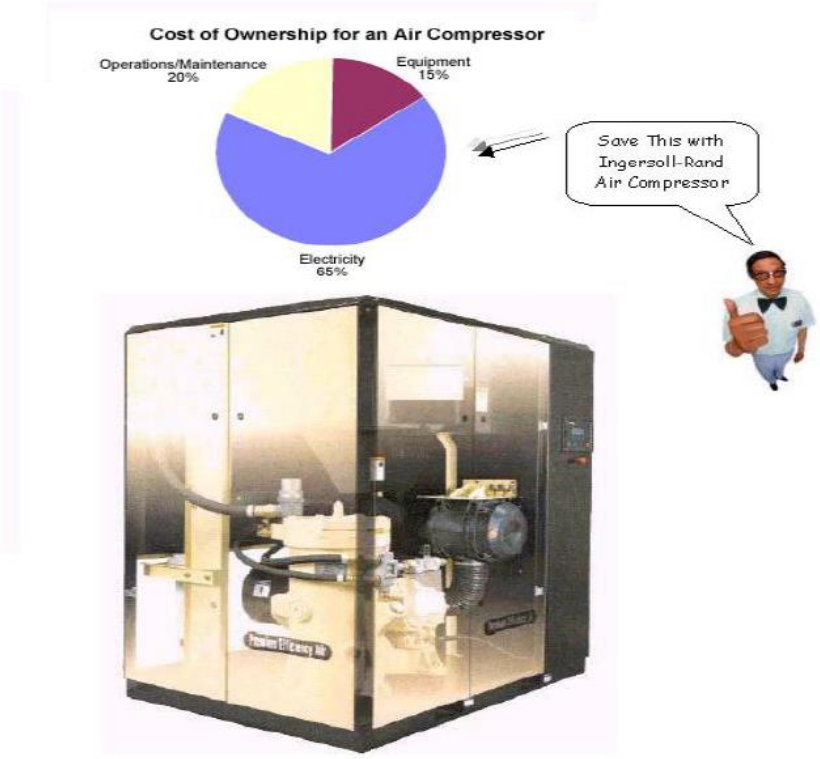
P.Prabhudas Eng.Pvt.Ltd Offer For Compressed Air System.

In favor of : M/s . Vivek Sharma (Teri)
Date : 01-05-2018
Your Ref : DIRECT
Our Ref : 153
Model : UP5-22-7VFD, RS30i-7.5VFD, RS37i-7.5VFD

1

P. PRABHUDAS
Engineering Pvt. Ltd.

'Power House',
3/12, Bhaktinagar Station Plot,
Rajkot-360 002.
Tel. : 0281-2461130, 2461131
E-mail : irrajkot@gmail.com



Compressor Technical Details

Model	UP5-22-7VFD
Motor Power (Kw)	22
Maximum Working Pressure (Bar)	7.5
C F M	63-125

2

P. PRABHUDAS
Engineering Pvt. Ltd.

'Power House',
3/12, Bhaktinagar Station Plot,
Rajkot-360 002.
Tel. : 0281-2461130, 2461131
E-mail : irrajkot@gmail.com

INGERSOLL-RAND Model: UP5-22-7VFD Single Stage Contact Cooled Rotary Screw Air Compressor Package Complete with the following.

STANDARD SCOPE OF SUPPLY

- Oil flooded asymmetrical screw compressor
- Bio-Degradable synthetic Coolant (ultra Coolant)
- Pilot Valve
- Thermal valve
- Closely coupled Air-End Separator Module
- Spin on Separator element
- Integrated MPCV
- Low Sound enclosure 68Db(A)Centrifugal Cooling fan
- Pressure relief Valve
- Integrated Air/Oil cooler
- Poly-V belt drive with easy to adjust belt tension control
- **Intellisys Controller with Dew point indicator on color code basis**
- High Temperature trip switch
- Motor over load relay
- Blow down valve
- Load/Unload valve
- Pressure switch
- Auto start/stop feature
- Emergency stop switch Reset button

- **Power on indication**
  →Green Auto restart indication
  →Amber On/Off selector switch

- **Trip Indication**
  →High Air Temperature trip
  →Motor over load trip

- **Electricals**
  →Dual Shaft motor with Cooling Blower mounted on main Shaft
  →400V,50Hz,3Phase,TEFC,Squirrel cage induction motor
  →IP55 motor protection with Class 'F'insulation with Class B temp rise

P. PRABHUDAS
Engineering Pvt. Ltd.

'Power House',
3/12, Bhaktinagar Station Plot,
Rajkot-360 002.
Tel. : 0281-2461130, 2461131
E-mail : irrajkot@gmail.com

Commercial Offer

Sr. No.	Description	Qty	Price (Each)
1	**Air Compressor : UP5-22-7VFD** Suitable Ingersoll-Rand make, Single – Stage Screw Air Compressor Model: UP5-22-7VFD complete with 22 Kw motor CFM: 63-125 , Air-cooled air and oil coolers, star delta starter, microprocessor based Intellisys Control Panel mounted on a common skid. **Cfm : 63-125, Pressure : 7.5**	1	8,37,000/-

Piping Between Air compressor to Air Dryer to Air Filter to Air Receiver will be your scope.

TERMS & CONDITION

Taxes: GST Extra 18%

Freight: Extra, at Actual Ex- Ahmedabad.

Validity: Validity till 30days from the date of dispatch.

Delivery: Delivery shall be 4-5 Weeks from the date of receipt of your firm purchase order.

Payment Terms: 30% Advance Remaining against PI before dispatch.

Transit Insurance: This would be in purchaser's/buyer's scope.

Warranty: 18 months from the date of dispatch or 12 months from the date of commissioning, whichever occurs earlier However the warranty terminates if the unit/system is exported from India.

P.Prabhudas Eng.Pvt Ltd.
Jimmy J Daxini
(9824210451)

4

SALES - SERVICE - PARTS & RENTAL BOSCH fischer CROMWELL Authorised Distributors of Ingersoll Rand

Quotation 2 : Venus Corporation

VENUS®
COMPRESSORS

VENUS CORPORATION

Office.: 60/3, Diamond Industrial Estate, Nr. Unnati Pump, Opp. Toyota Show Room, N.H.No.8, Nana Chiloda, Naroda G.I.D.C., Ahmedabad, Gujarat. TEL. (079) 22821999
E-Mail: prakash@venuscompressor.com, inquiry@venuscompressor.com Mob: +91 9925968840, +91 9825200073

REF.:- VENUS/SONEX-01/18-19

May 19, 2018

To,
M/s SONEX PLUS
MORBI
GUJARAT

Email:

SUB.:- PROPOSAL FOR ROTAY TYPE SCREW COMPRESSOR AONG WITH PM MOTOR AND VFD DRIVE

Dear Sir,

We thank you very much for your valuable enquiry given to us for AIR Compressor. We take pleasure to introduce ourselves as a one of the leading manufacturer Of RECIPROCATIING COMPRESSOR LOW, MEDIUM, HIGH PRESSURE AIR COMPRESSSOR, 100% OIL FREE AIR COMPRESSORS, VACCUM COMPRESSORS, RECIEVERS, AIR DRYERS and ALL AIR COMPRESSOR ACCESSOREIS. For SCREW COMPRESSORS we are authorized dealer of "LOFFTOL", U.S. based firm for Screw Compressor.

WE HEREBY GIVE YOU OUR TECHNO-COMMERCIAL PROPOSAL FOR YOUR KIND CONSIDERATION.

WORKS.: 60/3 Diamond Industrial Estate, Nr. Unnati Pump, Opp. Toyota Show Room, N.H.No.8, Nana Chiloda, Naroda G.I.D.C., Ahmedabad.

VENUS COMPRESSORS

VENUS CORPORATION

Office.: 60/3, Diamond Industrial Estate, Nr. Unnati Pump, Opp. Toyota Show Room, N.H.No.8, Nana Chiloda, Naroda G.I.D.C., Ahmedabad, Gujarat. TEL. (079) 22821999

E-Mail: prakash@venuscompressor.com, inquiry@venuscompressor.com Mob: +91 9925968840, +91 9825200073

LUBRICATED, ELECTRIC ROTARY TYPE SCREW COMPRESSOR WITH PERMANENT MAGNET MOTOR & VFD DRIVE

Model			TSC-30PMV
Description			30 HP Direct Driven Screw Air Compressor
Air Flow/ Air Discharge Pressure		(CFM)/	134.21 cfm
			8 kg/cm2
Ambient Temperature		°C	-5~+45
Cooling Method			Air Cooling
Lubricant Oil Volume		Ltr	10 Ltrs
Transmission Mode			Direct Drive (Coupling)
Electrical Drive		22 kw	Variable Frequency Drive
Air Quantity Adjusting Method			ON-OFF Auto Adjusting
Oil Content of the Discharged Air		Ppm	≤3
Noise		dB(A)	68±2
Setting Pressure of Safety Valve		MPa	Rated Working Pressure x1.2
Motor	Power	KW	22
	Rotation Speed	RPM	3000
	Type of Motor		Permanent Magnet Motor
	Starting Method Class		VFD Drive
	Protection/ Insulation		IP54/F
	Motor Efficiency		98.3%
Fan	Power	KW	0.55
	Rotation Speed	RPM	1440
	Air Quantity	M^3/Min	75
Airend			DEUTSCH
External Dimension		Mm	1490X950x1210
Weight		Kg	530
Outlet Diameter		Inch	1"
Special Discounted Price / Each			Rs.3,75,000/-

WORKS.: 60/3 Diamond Industrial Estate, Nr. Unnati Pump, Opp. Toyota Show Room, N.H.No.8, Nana Chiloda, Naroda G.I.D.C., Ahmedabad.

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E-Mail: prakash@venuscompressor.com, inquiry@venuscompressor.com Mob: +91 9925968840, +91 9825200073

COMPETITIVE FEATURES OF COMPRESSOR

- Generation III Screw Element with 5:6 Ratio.
- Direct Driven, zero (0) transmission losses. (Motor & Screw RPM Equal)
- Single Control System.
- Oil & After Cooler designed at 45°C ambient temperature.
- No hose pipes, All S.S. Pipes.
- PLC Controller with Volt/Amp, Logbook Reverse Rotation, Single Phase Preventer, fault Indicator with Flow Diagram and much more.
- P.M. give high motor efficiency and reduces the power consumption.
- Motor and Screw Shaft is Common, which make sure that transmission loss become zero and work efficiency of machine increases.
- Compressors functions with A/C drives ensures the output of machines as per the demand of plant.
- Reduces Maintenance Cost, by high performance Screw Air end and direct motor connection.
- 100% synthetic Oil reduces the possibility of Carbon Depositions in system.

TERMS & CONDITIONS:		
Prices	:	FOR Ahmedabad
Packing & Forwarding	:	As Actual, Wood Box Packing If Required.
GST	:	Exclusive; GST would be extra as application @ 18%
Freight	:	Extra as Actual.
Delivery	:	4-6 week after receipt of Purchase Order
Payment	:	50% advance with Purchase Order balance against delivery Receipt.
Warranty	:	12 Months from the date of Purchase. (Against Manufacturing Defect) 2years of Warranty for Screw Element.
Validity	:	15 Days
Jurisdiction	:	Ahmedabad

WORKS.: 60/3 Diamond Industrial Estate, Nr. Unnati Pump, Opp. Toyota Show Room, N.H.No.8, Nana Chiloda, Naroda G.I.D.C., Ahmedabad.

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E-Mail: prakash@venuscompressor.com, inquiry@venuscompressor.com Mob: +91 9925968840, +91 9825200073

We hope that you will find our proposal quite in line with your requirement, if you want any clarification feel free to contact us.

We look forward receiving from you in this matter.

Best regards,
FOR VENUS CORPORATION

PRAKASH NARSINGHANI | 9825200073
(This is a computer generated document; hence the signature does not appear)

WORKS.: 60/3 Diamond Industrial Estate, Nr. Unnati Pump, Opp. Toyota Show Room, N.H.No.8, Nana Chiloda, Naroda G.I.D.C., Ahmedabad.

Annexure 2: Instruments used

Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Fluke: 43B,	Electrical Parameters Harmonics analysis, power logging	± 0.5%
Thermal imager	875-2/Testo	Surface Temperature & Image	± 2%
Anemometer	Testo: 425, Airflow: TA45	Air Velocity	±(0.03 m/s +5% of mv)