Project code: 2017IE08
Cluster: Morbi
Report ID: MB/01/DPR

Detailed Project Report
On
PMSM VSD Air compressor

Sonex Tiles Private Limited

Morbi (Gujarat)

Prepared for

Bureau of Energy Efficiency

(13/GEF-UNIDO-BEE/LSP/14/4562)

Suggested Format for Citation

This document may be reproduced in whole or in part and in any form for educational and non-profit purposes without special permission, provided acknowledgement of the source is made. BEE and TERI would appreciate receiving a copy of any publication that uses this document as a source. A suggested format for citation may be as below:

GEF-UNIDO-BEE Project, Bureau of Energy Efficiency, 2018

"Capacity Building of Local Service Providers"

For more information

GEF-UNIDO-BEE PMU
Bureau of Energy Efficiency
4th Floor, Sewa Bhawan, Sector-1,
R.K. Puram, New Delhi-110066

Email: gubpmu@beenet.in
pmc@teri.res.in
Website: www.beeindia.gov.in
www.teriin.org

Disclaimer

This document is an output of an exercise undertaken by TERI under the GEF-UNIDO-BEE project's initiative for the benefit of MSME units and is primarily intended to assist the decision making by the management of the intended unit for the proposed technology. While every effort has been made to avoid any mistakes or omissions, GEF, UNIDO, BEE or TERI would not be in any way liable to any person or unit or other entity by reason of any mistake/omission in the document or any decision made upon relying on this document.

Acknowledgement

The Energy and Resources Institute (TERI) places on record its sincere thanks to Global Environment Facility (GEF), United Nations Industrial Development Organization (UNIDO) and Bureau of Energy Efficiency (BEE) for giving opportunity to partner in this prestigious assignment on Capacity Building of Local Service Providers (LSPs) under the GEF-UNIDO-BEE project 'Promoting energy efficiency and renewable energy in selected MSME clusters in India'.

TERI is particularly grateful to Mr Milind Deore, Director, Bureau of Energy Efficiency, Mr Sanjay Shrestha, Industrial Development Officer, Industrial Energy Efficiency Unit, Energy and Climate Branch, UNIDO , Mr Niranjan Rao Deevela, National Technology Coordinator, UNIDO, Mr Vijay Mishra, Cluster Leader, Morbi Ceramic Cluster, UNIDO, Mr. Bhudarbhai G Jetparia, M/s Sonex Tiles private limited and Morbi Ceramics Association for their support and guidance during the project.

Last but not least, the interactions and deliberations with numerous ceramic units, Industry Associations, technology providers and who were directly or indirectly involved throughout the study were exemplary and the whole exercise was thoroughly a rewarding experience for TERI.

The Energy and Resources Institute (TERI)
New Delhi

Table of contents

Acknowledgement **1**

List of tables 1

List of figures 1

List of abbreviations **1**

Executive summary ..... **i**

1.0 Details of the unit **1**

1.1 Particulars of unit 1

2.0 Energy profile **3**

2.1 Process flow diagram 3

2.2 Details of technology identified 3

2.3 Energy used and brief description of their usage pattern 3

2.4 Energy sources, availability & tariff details 4

2.5 Analysis of electricity consumption 4

2.6 Analysis of other energy forms/ fuels 4

3.0 Proposed technology for energy efficiency **7**

3.1 Installation of PMSM VSD Air Compressor 7

3.1.1 Background 7

3.1.2 Observations and analysis 7

3.1.3 Recommendation 8

3.2 Cost benefit analysis 8

3.3 Pre-training requirements 9

3.4 Process down time for implementation 9

3.5 Environmental benefits 9

3.5.1 CO_2 reduction 9

3.5.2 Reduction in other pollution parameters (gas, liquid and solid) 9

4.0 Project financials **11**

4.1 Cost of project and means of finance 11

4.1.1 Particulars of machinery proposed for the project 11

4.1.2 Means of finance 11

4.2 Financial statement (project) 11

4.2.1 Assumptions 11

4.2.2 Payback 12

4.2.3 NPV and IRR 13

4.3 Marketing & selling arrangement 14

4.4 Risk analysis and mitigation 14

4.5 Sensitivity analysis 14

5.0 Conclusions & recommendations 17

5.1 List of energy conservation measures 17

5.2 Summary of the project 17

5.3 Recommendations 17

6.0 Financing schemes for EE investments for MSME sector 19

Annexures 25

Annexure 1: Budgetary offers / quotations 27

Quotation 1: Landsky Engineers Pvt Ltd 27

Quotation 2: Venus Corporation 30

Annexure 2: Instruments used 33

List of tables

Table 1.1: Particulars of the unit....1
Table 2.2: Details of Air compressor....3
Table 2.3: Energy used and description of use....3
Table 2.4: Energy sources, availability and tariffs....4
Table 2.5: Electricity consumption profile....4
Table 2.6: Analysis of other energy/ fuel consumption....4
Table 3.1.1: Details of Air compressor....7
Table 3.2: Cost benefit analysis for recommended energy savings measures....8
Table 4.1.1: Particulars of machinery proposed for the project....11
Table 4.1.2: Means of finance....11
Table 4.2.1: Assumptions made....11
Table 4.2.2: Payback....12
Table 4.2.3a: NPV and IRR (100% equity)....13
Table 4.2.3b: NPV and IRR (D/E- 70:30)....13
Table 4.2.3c: NPV and IRR (D/E- 50:50)....13
Table 4.3: Marketing & selling arrangements....14
Table 4.4: Risk analysis and mitigation....14
Table 4.5: Sensitivity analysis....14
Table 5.1: Summary of the energy conservation measures....17
Table 5.2: Summary of the project....17
Table 6.1: Major government schemes....19
Table 6.2: BEE's VCFEE and PRGFEE scheme....20
Table 6.3: IREDA's financing guidelines....21
Table 6.4: Major EE financing schemes/initiatives of SIDBI....22
Table 6.5: JBIC-SBI Green Line....23
Table 6.6: Canara bank scheme of EE SME loans....24

List of figures

Figure 2.1: Process flow chart....3
Figure 2.6: Percentage share of various fuel types in the unit....5
Figure 3.1.2: Power consumption pattern of air compressor....7

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
IDC	:	Investment without interest defer credit
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
SPC	:	Specific Power Consumption
SPP	:	Simple Payback Period
TERI	:	The Energy and Resources Institute
Toe	:	Tonnes of oil equivalent
UNIDO	:	United Nations Industrial Development Organization
VFD	:	Variable Frequency 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 Sonex Tiles Private Limited
Constitution	Private Limited
MSME Classification	Medium
No. of years in operation	23
Address: Registered Office:	8-A National Highway, Lalpar, Morbi, Gujarat 363642 (Gujarat) India.
Industry-sector	Ceramic
Products manufactured	Vitrified tile
Name(s) of the promoters/ directors	Mr. Bhudarbhai G Jetparia Mr. Ravjibhai K Patel Mr. Ketan P Shah Mr. Hasmukh N Jetpariya Mr. Ravikumar J Amrutiya
Existing banking arrangements along with the details of facilities availed	NA

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 2,927,520 kWh of electricity per year. The annual consumption of the diesel is 15,600 litres and coal is about 5,688 MT. The total energy consumption of the unit during last 12 months is estimated to be 2,825 toe which is equivalent to 563 lakh rupees. The total CO_2 emission during this period is estimated to be 12,770 tonnes. Electricity, diesel and coal were considered for CO_2 emission estimation.

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 Electricity (kWh)	Investment[1] (Rs lakh)	Monetary savings (Rs lakh/ year)	Simple payback period (Years)	Emission reduction (tonnes of CO_2)
Installation of PMSM VSD Air Compressor	54,009	7.9	3.9	2.0	44.3

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	7.9	7.9	7.9
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	25.94	21.58	22.83
4	NPV	Rs. In Lakh	3.25	2.18	2.48
5	DSCR	-	-	2.1	0.92

[1] Investment including the one units of air compressors – Rs. 7.9 lakh (inclusive all)

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 Sonex Tiles Private Limited	
2	Constitution	Private Limited	
3	MSME Registration No/UAN	-	
4	PCB consent No.	-	
5	Date of incorporation / commencement of business	2008	
6	Name of the Contact Person	Mr Manoj Bhai Patel	
7	Mobile / Ph. No	+91-9712976776	
8	Email	info@sonextiles.com	
9	Address: Registered Office	8-A, National Highway, At. Lalpur, Morbi-363 642.(Guj.) INDIA.	Owned
10	Factory	8-A, National Highway, At. Lalpur, Morbi-363 642.(Guj.) India.	Owned
11	Industry / Sector	MSME/Manufacturing	
12	Products Manufactured	Digital flooring tiles	
13	No of hours of operation/shift	12	
14	No of shifts/ day	02	
15	No of days/year	350	
16	Installed Capacity	96,000 boxes per month	
17	Whether the unit is exporting its products (Yes/ No)	No	
18	Quality Certification, if any	NA	

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.

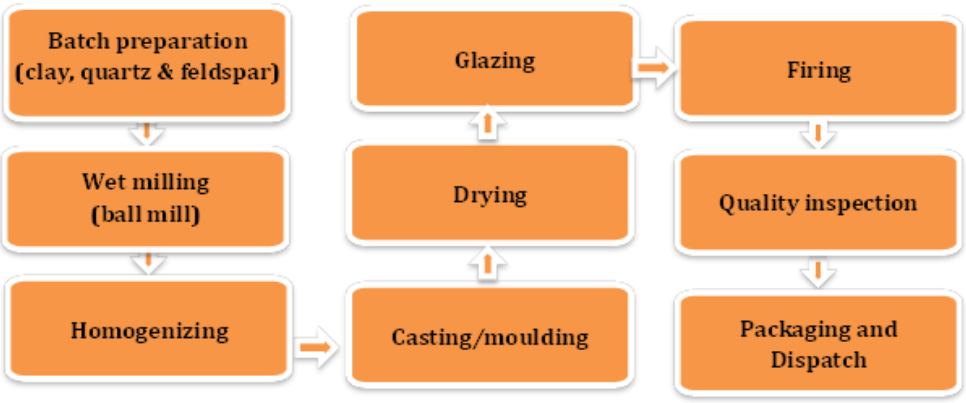

Figure 2.1: Process flow chart

2.2 Details of technology identified

The details of the compressed air installed in the unit are given in table 2.2.

Table 2.2: Details of Air compressor

Parameters/ Equipment ID	Value
Equipment	Air compressor
Type	Reciprocating
Make	IR
Model	ESV-1-LUB
Year of installation	1998
Capacity	100 CFM
Fuel Details	Electricity

2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Paschim Gujarat Vij Company Limited under the tariff category of HTP-1. 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

S No	Energy source	Description of use
		different process sections and utilities
2	Coal	Kiln
3	Diesel	Power generator

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

Source	Remarks	Price
Electricity (PGVCL)	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: @ Rs. 4.20/kWh Power factor 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 Power factor rebate: • 0.5% of energy charges for every point increase in PF over 0.95.
Natural gas	Gujarat Gas Ltd.	• Minimum Guaranteed Offtake (MGO): Rs. 32.70/SCM • Non - Minimum Guaranteed Offtake (Non-MGO): Rs. 35.97/SCM

2.5 Analysis of electricity consumption

Table 2.5: Electricity consumption profile

Month & Year	Total electricity consumption (kWh)	Sanctioned load/demand (kW)	Power factor	Recorded demand, kVA	Demand charges (Rs)	Energy charges (Rs)	Monthly bill (Rs)
Mar-18	243,960	700	0.99	524	99,700	1,024,632	1,538,943
Yearly	**2,927,520**	**-**	**-**	**-**	**1,196,400**	**12,295,584**	**18,467,311**

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	Coal (MT)	HSD (Litre)
Consumption unit/year	5,688	15,600
Calorific value per unit	4,500	9,202
Equivalent toe per year	2,559.4	14.4
Price (Rs per unit)	6.5	60.0
Total price per year	3,69,68,750	9,36,000

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

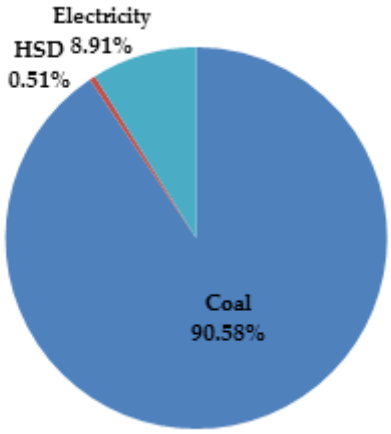

Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 2,927,520 kWh of electricity per year. The annual consumption of the diesel is 15,600 litres and coal is about 5,688 MT. The total energy consumption of the unit during last 12 months is estimated to be 2,825 toe which is equivalent to 563 lakh rupees. The total CO_2 emission during this period is estimated to be 12,770 tonnes. Electricity, diesel and coal 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 Installation of PMSM VSD Air Compressor

3.1.1 Background

To cater to compressed air requirement of the ceramic manufacturing process, Unit has installed vertical piston type air compressor. The capacity of the air is about 100 cubic feet per minute (CFM) and installed motor capacity is 22 kW. The details of the compressed air installed in the unit are given in table 3.1.1.

Table 3.1.1: Details of Air compressor

Parameters/ Equipment ID	Value
Equipment	Air compressor
Type	Reciprocating
Make	IR
Model	ESV-1-LUB
Year of installation	1998
Capacity	100 CFM
Fuel Details	Electricity

The operational parameters of the air compressor system were measured during the detailed assessment study.

3.1.2 Observations and analysis

During the detailed assessment study of the compressed air system, free air delivery test of the compressed air system was conducted for evaluating the existing performance. 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 loading of the air compressor is estimated to be 80.37% of the rated capacity. The power consumption pattern of the air compressor during the normal plant operation is shown in figure 3.1.2.

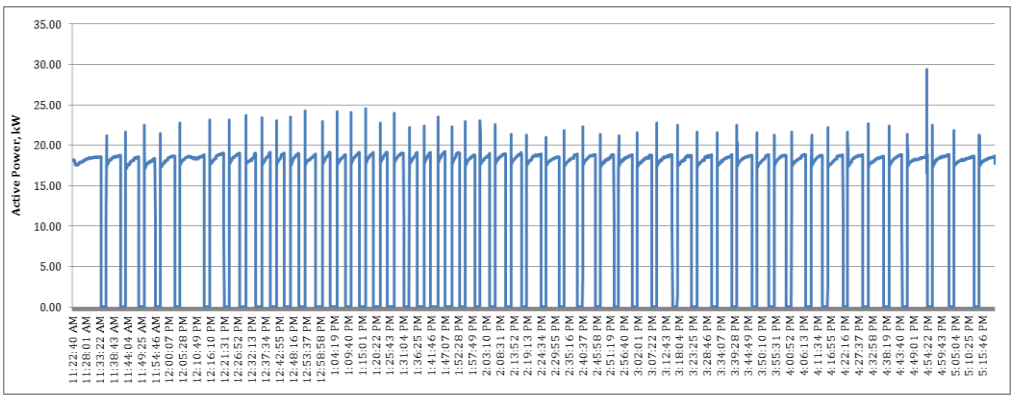

Figure 3.1.2: Power consumption pattern of air compressor

The specific power consumption (SPC) of non PMSM based compressors are generally in the range of 0.18 – 0.19 kW/CFM, however the estimated SPC is about 0.22-0.23 kW/CFM, which is higher than the recommended range.

3.1.3 Recommendation

It is recommended to replace existing inefficient compressed air system with a single VFD based screw compressor of capacity about 141 CFM. VFD operated screw compress 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 VFD based screw compressor are as follows:

- By using VFD 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 annual energy saving by replacing of existing air compressor system with VFD enable compressed air system is 54,009 kWh which is equivalent to about Rs. 3.9 lakhs. The investment requirement is Rs 6.6 lakh with a simple payback period of 1.7 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

Parameter	Unit	Existing	Proposed
Make of the compressor	-	IR	Hitachi make
Compressor rating	-	ESV-1	VFD-PM motor
Type of compressor	-	Reciprocating	Screw
Rated capacity	kW	22	22
Rated CFM	CFM	100	141
Specific power consumption	kW/CFM	0.22	0.14
Operating hours	Hours	-	8,400
Average compressed air demand	CFM	-	80.37
Reduction in energy consumption	kWh/year	-	54,009
Unit rate	Rs/kWh	-	7.2
Annual monetary benefits	Rs	-	3.88
Total investment[2]	Rs	-	7.9
Simple payback period	Years	-	2.0

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

3.3 Pre-training requirements

The training would be required on preventive maintenance of new compressor. Best practices to be adopted for housekeeping near the location of the machine.

3.4 Process down time for implementation

The estimated process down time required for implementation of recommended measure is estimated to be 1 days after commissioning and testing.

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 44.3 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	HITACHI - Oil Flooded Model OSP 22VANA Motor Nominal output 22 kw Driving system DCBL Direct Driving Discharge pressure 141 CFM 7.0 Kg/cm²	Landsky Engineers Pvt Ltd., 35-69,GK Colony Sainikpuri, Secunderabad-94,	Reputed manufacturer	Not based in cluster
2	30 HP Direct Driven Screw Air Compressor • Lubricated, electric rotary type screw compressor • Permanent magnet motor & VFD 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 4.1.2: Means of finance

S. No.	Details	100% equity	D/E- 70:30	D/E- 50:50
1	Additional (Share) Capital	7.90	2.37	3.95
2	Internal Accruals	-	-	-
3	Interest free unsecured loans	-	-	-
4	Term loan proposed (Banks/FIs)	-	5.53	3.95
5	Others	-	-	-
	Total	**7.90**	**7.90**	**7.90**

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		2	

Details	Unit	100% equity	D/E- 70:30	D/E- 50:50
Annual operating hours	Hrs/year		8,400	
Installed production capacity	tonnes/year		-	
Production in last financial years	tonnes/year		-	
Capacity utilization factor	%		-	
Proposed investment (Project)				
Total cost of the project	Rs. (in Lakh)	7.90	7.90	7.90
Investment without interest defer credit (IDC)	Rs. (in Lakh)	7.90	7.90	7.90
Implementation time	Months	3.0	3.0	3.0
Interest during the implementation phase	Rs. in lakhs	-	0.03	0.02
Total investment	Rs. in lakhs	7.9	7.9	7.9
Financing pattern				
Own funds	Rs. in lakhs	7.90	2.40	4.0
Loan funds (term loan)	Rs. in lakhs	-	5.53	3.9
Loan tenure	Years	-	5.0	5.0
Moratorium period (No EMI (interest and principal amount))	Months	-	3.0	3.0
Total repayment period	Months	-	60.0	60.0
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		3.9	
Total saving	Rs lakh/year		3.9	
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)	7.90	7.93	7.92
Cash flow as annual saving (Rs. In lakh/year)	3.89	3.89	3.89
O&M Expenses for first year (Rs. In lakh/year)	0.39	0.40	0.40
Net Cash flow (Rs. In lakh/year)	3.49	3.49	3.49
SPP (months)	27.13	27.26	27.22
Considered (month)	27.10	27.30	27.20

4.2.3 NPV and IRR

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

Particulars / years	0	1	2	3	4	5
			(Rs. in lakhs)			
Profit after tax	-	2.21	2.40	1.09	1.00	0.97
Depreciation	-	1.28	1.28	1.28	1.28	1.28
Cash outflow	7.90	-	-	-	-	-
Net cash flow	-7.90	3.49	3.68	2.37	2.28	2.25
Discount rate % @ WACC	9.30	9.30	9.30	9.30	9.30	9.30
Discount factor	1.00	0.92	0.84	0.77	0.70	0.64
Present value	-7.90	3.20	3.09	1.81	1.60	1.45
Net present value	**3.25**					
Simple IRR considering regular cash flow	**25.94%**					

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	-	1.93	2.18	0.82	0.81	0.87
Depreciation	-	1.29	1.29	1.29	1.29	1.29
Cash outflow	7.93	-	-	-	-	-
Net cash flow	-7.93	3.21	3.46	2.11	2.10	2.16
Discount rate % @ WACC	10.10	10.10	10.10	10.10	10.10	10.10
Discount factor	1.00	0.91	0.83	0.75	0.68	0.62
Present value	-7.93	2.92	2.86	1.58	1.43	1.33
Net present value	**2.18**					
Simple IRR considering regular cash flow	**21.58%**					

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	-	2.01	2.24	0.90	0.87	0.90
Depreciation	-	1.28	1.28	1.28	1.28	1.28
Cash outflow	7.92	-	-	-	-	-
Net cash flow	-7.92	3.29	3.53	2.18	2.15	2.18
Discount rate % @ WACC	9.90	9.90	9.90	9.90	9.90	9.90
Discount factor	1.0	0.91	0.83	0.75	0.69	0.63
Present value	-7.92	3.00	2.92	1.64	1.48	1.36
Net present value	**2.48**					
Simple IRR considering regular cash flow	**22.83%**					

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)	All over India
Locational advantages	-
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.

4.5 Sensitivity analysis

A sensitivity analysis for various scenarios which may affect the return on investment is given in table 4.5.

Table 4.5: 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	24.40	4.25	30.73	-	18.19
		70:30	24.50	3.16	26.44	2.12	28.46
		50:50	24.50	3.47	27.66	0.92	24.18
2	10% reduction in estimated savings	100% equity	30.50	2.25	21.02	-	14.28
		70:30	30.70	1.20	16.55	2.12	23.29

S. No.	Scenario	D/E ratio	Payback period (months)	NPV (Rs lakh)	IRR (%)	DSCR	ROI (%)
		50:50	30.60	1.49	17.84	0.92	19.30
3	10% rise in interest rates	70:30	27.30	1.92	21.11	2.12	25.94
		50:50	27.20	2.29	22.49	0.92	21.80
4	10% reduction in interest rates	70:30	27.20	2.44	22.04	2.12	26.39
		50:50	27.20	2.67	23.16	0.91	22.11

5.0 Conclusions & recommendations

The DPR prepared for the replacement of existing under reciprocating compressed air system with VFD enable energy efficient compressed air system based on the performance assessment study conducted at unit and the acceptance of the unit management. The brief of selected energy conservation measure 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)
Installation of PMSM VSD Air Compressor	54,009	7.9	3.9	2.0	44.3

The measure has an estimated investment of 7.9 lakh rupees and can yield a savings of 3.89 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 44.3 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	7.90	7.90	7.90
2	D/E Ratio	-	-	7:3	1:1
3	Project IRR	%	25.94	21.58	22.83
4	NPV	Rs. In Lakh	3.25	2.18	2.48
5	DSCR	-	-	2.1	0.92

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: Landsky Engineers Pvt Ltd

LANDSKY ENGINEERS PVT LTD.,
(A Division of Landsky Group)
35-69,GK Colony,Sainikpuri,Secunderabad-94,
Tel:91-40-27115231,65217355,27110207, Fax: 040-27110278
E-mail: info@landskyindia.com, URL: www.landskyindia.com

QUOTATION

Ref: LEPL/CAV-ACA/

M/s. THE ENERGY AND RESOURCES INSTITUTE (TERI)	Kind Attn : Mr. Chetan Kumar
Industrial Energy Efficiency Division	Ph: +91 11 2468 2100 or 2111
Darbari Seth Block, IHC Complex, Lodhi Road	Email: Chetankumar.Sangole@teri.res.in
New Delhi 110003	

REF : Your Requirement For Compressed Air System

SUB : Your Enquiry Through Mail Dt: 23.09.2015

Hitachi -Techno-Commercial PROPOSAL for Compressed Air System

SNO	DESCRIPTION	MODEL	MAKE	TYPE	CAPACITY	WORKING PRESSURE	UNIT	QTY	PRICE EACH IN RS	AMOUNT IN RS
PROPOSAL - I	HITACHI - Oil Flooded Screw Compressor	OSP-22VANA	HITACHI	IMPORTED	141 CFM	7.0 Kg/cm^2	No	1	789,809.00	789,809.00

COMMERCIAL TERMS & CONDITIONS

PRICE	CIF, Chennai
PACKING	NIL
IMPORT DUTIES	All Import Duties are Extra to your account
SALES TAX	Sales Tax @ 14.5% VAT or NIL against HIGH SEA SALES AGREEMENT in the event of an Order to us , otherwise not applicable
COMMISSIONING	Included
DELIVERY	Within 10-12 weeks from the date of receipt of your confirmed Order.
PAYMENT	100% TT in advance or LC at site in favour of our Principals
VALIDITY	Within 30 days only.
WARRANTY	12 months from the date of Commissioning against any manufacturing defects.

for LANDSKY ENGINEERS PVT. LTD.

D.Shiva Reddy
Sales Co-ordinator
9948269977

Technical Specifications for Oil Flooded Screw Compressor	
TechnicalSpecification for OSP 22	
Type of Compressor	Oil Flooded Screw Compressor
Model	OSP 22VANA
Motor Nominal out put	22 kw
Driving system	DCBL Direct Driving
Discharge pressure	141 CFM 7.0 Kg/cm^2
Suction pressure/Temperature	Atmospheric Pressure / 0-40 deg C
Discharge Temperature Air	Ambient Temperature + 15 or below
Starter Type	Soft Start
Lubricating oil	New Hiscrew oil 2000
Lubricating oil filling Amount	10 Ltrs
Discharge Air pipe Diameter	Rc 1-1/2
Dimensions	1,000 x 1,000 x 1,500 mm
Weight	460 Kg
Noise level	65 dB(A)

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.

Annexure 2: Instruments used

Instruments	Model/ Make	Application	Accuracy
Power analysers	Fluke: 435, Fluke: 43B,	Electrical Parameters Harmonics analysis, power logging	± 0.5%
Infrared thermometer	Testo: 845	Surface Temperature	± 0.75% of mv
Anemometer	Testo: 425, Airflow: TA45	Air Velocity	± (0.03 m/s +5% of mv)