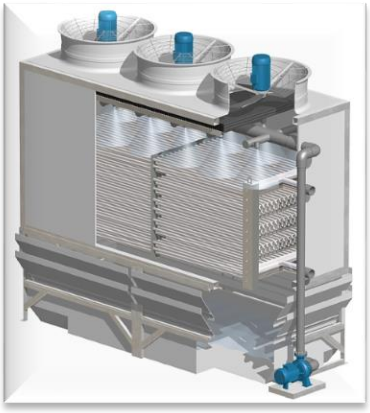
August 2018

DETAILED PROJECT REPORT ON EVAPORATIVE CONDENSER

M/s Sursagar Dairy – Gujarat Dairy Cluster



Submitted To
(Prepared under GEF-UNIDO-BEE Project)

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List of Abbreviations

BEE	Bureau of Energy Efficiency
CS	Capital Structure
°C	°Celsius
CO_2	Carbon dioxide
COP	Coefficient of Performance
CT	Cooling Tower
DPR	Detailed Project Report
EE	Energy Efficiency
FI	Financial Institution
GEF	Global Environmental Facility
HSD	High Speed Diesel
IRR	Internal Rate of Return
kW	Kilo Watt
LSP	Local Service Provider
MSME	Micro and Medium Scale Industries
NPV	Net Present Value
OEM	Original Equipment Manufacturer
PHE	Plant Heat Exchanger
RE	Renewable Energy
SBI	State Bank of India
SIDBI	Small Industrial Development Bank of India
TOE	Tonnes of Oil Equivalent
TR	Tonnes of Refrigeration
UNIDO	United Nations Industrial Development Organisation
WACC	Weighted Average Cost of Capital

ACKNOWLEDGEMENT

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CII also thanks Mr. Falgun Pandya, Cluster leader for Gujarat Dairy cluster for the continuous support extended all throughout this activity.

We also take this opportunity to express our appreciation to the Original Equipment Suppliers and Local Service Providers for their support in giving valuable inputs and ideas for the completion of the Detailed Project Report.

We would also like to mention that the valuable efforts being taken and the enthusiasm displayed towards energy conservation by the Gujarat Dairy Cluster is appreciable and admirable.

1. EXECUTIVE SUMMARY

Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, in collaboration with United Nations Industrial Development Organization (UNIDO) is executing a Global Environment Facility (GEF) funded national project "Promoting energy efficiency and renewable energy in selected MSME clusters in India".

The overall aim of the project is to develop and promote a market environment for introducing energy efficiency and enhanced use of renewable energy technologies in process applications in 12 selected energy-intensive MSME clusters across 5 sectors in India (with expansion to more clusters later). This will enable improvement in the productivity and competitiveness of units, as well as reduce overall carbon emissions and improve the local environment.

Key activities involved in the project are shown below

- **LSP MAPPING:** Detailed Mapping of LSPs in the cluster.
- **TECHNOLOGY FEASIBILITY STUDIES:** Preparation of 10 bankable DPRs.
- **TRAINING MATERIALS:** Development of 5 customized training material based on mapping
- **TRAINING PROGRAM:** Conduct 4 training programs in the cluster for the capacity building of local service providers.
- **LSP's AS LOCAL DISTRIBUTORS:** Mapping of LSPs and OEMs so that LSPs can be local dealers for major OEMs.

1.1 Brief Unit Profile

Table 1: Unit Details

Particulars	Details
Name of Plant	Sursagar Dairy
Name(s) of the Plant Head	Mr. Gurdeet Singh , MD
Contact person	Mr. H.P.Mathuriya
Constitution	Cooperative Society
MSME Classification	Medium Scale
Address:	Plot 249, Phase 2, GIDC Wadhan, Ambawadi, Surendranagar.
Industry-sector	Dairy

1.2 Proposed EE Measure

After the discussion with the plant team, it has been decided to replace the existing shell and tube condenser with evaporative condenser unit. The details of the proposed EE measure is given in below table:

Table 2: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings		Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual TCO_2 reduction
		kWh	TOE				
1	Installation of Evaporative condenser	1,98,129	17.04	13.08	29.52	27	162.47

1.3 Means of Finance

The details of means of finance for the proposed EE measure is as under:

Table 3; Project Finance

Sl. No.	Particulars	Unit	Value
i	Total Investment (Incl of Tax)	Rs. Lakh	**30.27**
ii	Means of Finance	Self / Bank Finance	**Self**
Iii	IRR	%	**63.79**
Iv	NPV at 70 % Debt	Rs. Lakh	**52.75**

2. INTRODUCTION ABOUT SURSAGAR DAIRY

2.1 Unit Profile

Surendranagar District Co-operative Milk Producers' Union Ltd, popularly known as "SURSAGAR DAIRY" - a district level milk union came into being in the year 1975 under the operation flood program. Sursagar dairy is collecting milk from more than 750 village level co-operative societies located in Surendranagar district which is supplying milk to dairy's chilling centers and dairy is collecting milk from dairy's own chilling centers located in Surendranagar district. The dairy processes about 1.6 lakh litres of milk per day.

Table 4: Unit Profile

Particulars	Details
Name of Plant	Sursagar Dairy
Name(s) of the Plant Head	Mr. Gurdeet Singh, MD
Contact person	Mr. H.P.Mathuriya
Contact Mail Id	engghead@sursagardairy.coop
Contact No	7069012276
Constitution	Cooperative Society
MSME Classification	Small Scale
No. of years in operation	< 1 year
No of operating hrs/day	24
No of operating days/year	365
Address:	Plot 249, Phase 2, GIDC Wadhan, Ambawadi, Surendranagar.
Industry-sector	Dairy

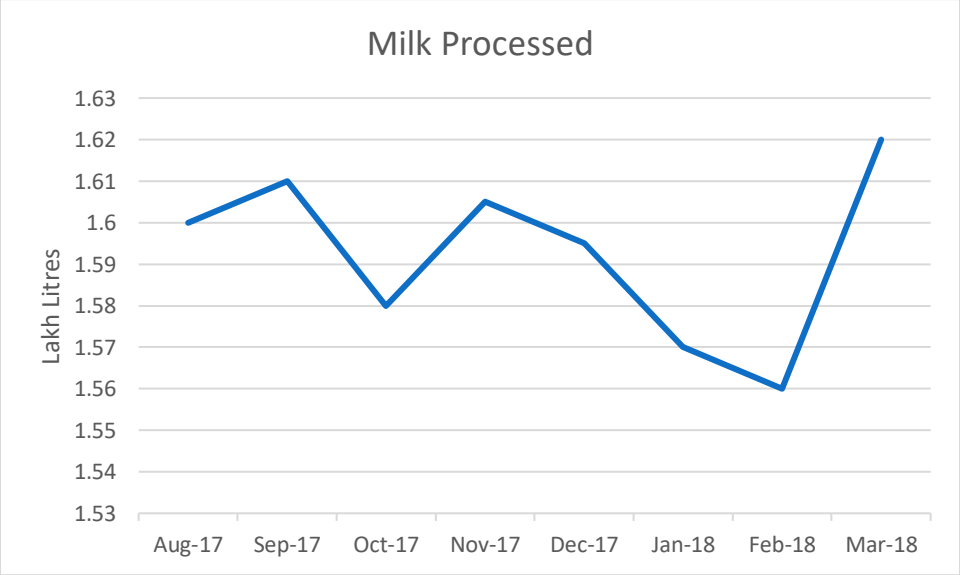

Figure 1: Milk Processed

2.3 Typical Dairy Process Flow Diagram

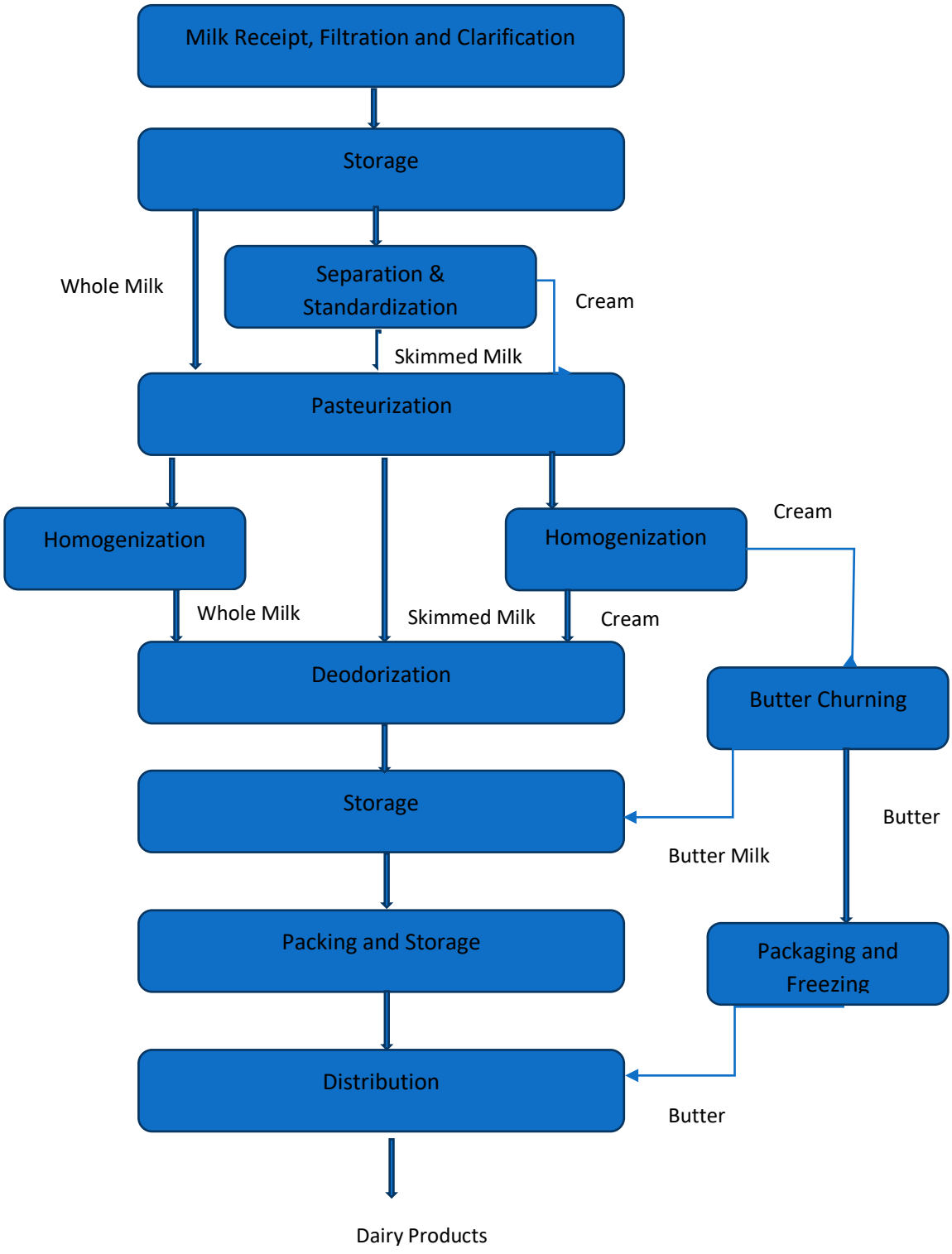

Figure 2: Typical process flow of Milk manufacturing

The processes taking place at a typical milk plant after receiving and filtration of milk from the chilling units includes:

Separation: After being held in storage tanks at the processing site, raw milk is heated to separation temperature in the regeneration zone of the pasteurizer. The milk (now hot) is standardized and homogenized by sending it to a centrifugal separator where the cream fraction is removed. The skim is then usually blended back together with the cream at predefined ratios so that the end product has the desired fat content. Surplus hot cream is cooled and usually processed in a separate pasteurizer ready for bulk storage and transportation to a cream packing plant.

Pasteurization is a process of heating milk to 72°C for 16 seconds then quickly cooling it to 4°. This process slows spoilage caused by microbial growth in the food. Unlike sterilization, pasteurization is not intended to kill all micro-organisms in the food. Instead, it aims to reduce the number of viable pathogens so they are unlikely to cause disease.

Homogenization (if required): Milk must then be homogenized. Without homogenization, the milk fat would separate from the milk and rise to the top. Milk fat is what gives milk its rich and creamy taste. Homogenization makes sure that the fat is spread out evenly in the milk so that every sip of milk has the same delicious flavor and creamy texture. Milk is transferred to a piece of equipment called a homogenizer. In this machine the milk fat is forced, under high pressure, through tiny holes that break the fat cells up in to tiny particles, 1/8 their original size. Protein, contained in the milk, quickly forms around each particle and this prevents the fat from rejoining. The milk fat cells then stay suspended evenly throughout the milk

Packaging and storage: Milk is pumped through automatic filling machines direct into bags, cartons and jugs. The machines are carefully sanitized and packages are filled and sealed without human hands. This keeps outside bacteria out of the milk which helps keep the milk stay fresh. During the entire time that milk is at the dairy, it is kept at 1°-2°C. This prevents the development of extra bacteria and keeps the milk fresh.

Table 5: Production Capacity

Sl No	Product	UOM	Quantity
1	Milk Processing	Lakh Litres per Day	1.60
2	Milk Packaging in Poly Pouches	Lakh Litres per Day	1.60

2.3 Energy Profile

Both electricity and thermal energy are used for carrying out various dairy processing activities. The following fuels are used in the plant:

Table 6: Type of fuel used

Sl. No.	Type of fuel/Energy used	Unit	Tariff	GCV (kCal/m^3)
1	Electricity	Rs./kWh	6.60	-
2	Natural gas	Rs/SCM	35	8500

The table below shows the monthly consumption of various fuels used in the plant during the last one year.

Table 7: Fuel Consumption Details

Month	Electricity Consumption (kWh)	Fuel Consumption Natural gas (SCM)
Aug-17	178746	36746
Sep-17	165810	35768
Oct-17	177078	35528
Nov-17	177672	43811
Dec-17	190758	59574
Jan-18	187392	65108
Feb-18	173856	53004
Mar-18	208254	49455
Total	**1459566**	**378994**

The major form of energy used in the plant is electricity which is supplied from the grid. For thermal energy, plant is using NG as the main fuel. The percentage share of fuel cost is shown. Based on the data collected from the plant, the graph above below the variation of fuel cost over the last one year. Average electricity cost is Rs 12.04 Lakhs/month whereas the average thermal energy cost is Rs 16.58 lakhs/month.

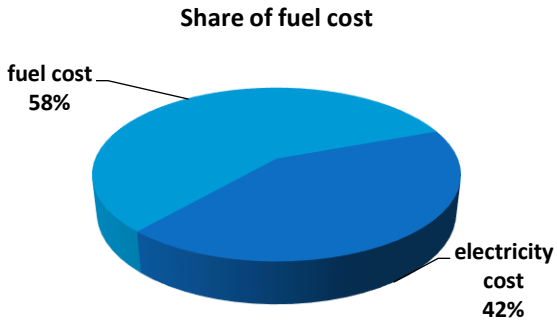

Figure 3: Share of fuel cost

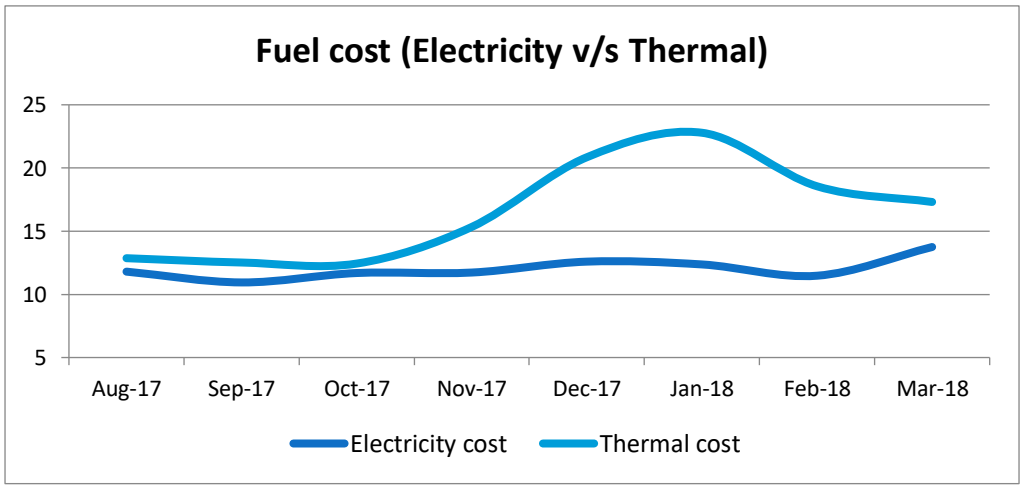

Figure 4: Fuel Cost Electrical v/s Thermal

3. PROPOSED EE MEASURE – EVAPORATIVE CONDENSER

3.1 Present System

Sursagar Dairy has installed 2 reciprocating chiller compressors of 180 Hp and 150 Hp with 100 TR capacity each for the chilled water requirement in the plant. For the refrigeration purpose, vapor compression based ammonia cycle is used.

In a refrigeration cycle, when the compressor is run, the refrigerant starts flowing through the system i.e., the system starts it's working. The compressor continuously sucks low pressure, low temperature refrigerant vapors from the evaporator and pump these to condenser at high pressure and high temperature condition. While flowing through the condenser, the high temperature vapors release their heat to atmosphere and condense to high pressure liquid state. After condenser this high-pressure liquid enters the expansion valve where it is throttled to low pressure. It is so constructed that a control quality of refrigerant flows (due to expansion valve) from one necessary steps to another at definite and predetermined pressure. On throttling the pressure and temperature of refrigerant decreases and when this low pressure, low temperature throttled liquid flows through evaporator, it sucks heat and produce cooling. On absorbing heat in evaporator all the low-pressure liquid evaporates to low-pressure, low-temperature vapors, which are again sucked by compressor. In this way all these processes go on continuously and as long as the compressor runs, the system produces cooling around the evaporator. A block diagram of a vapor compression refrigeration system is shown below[1] :

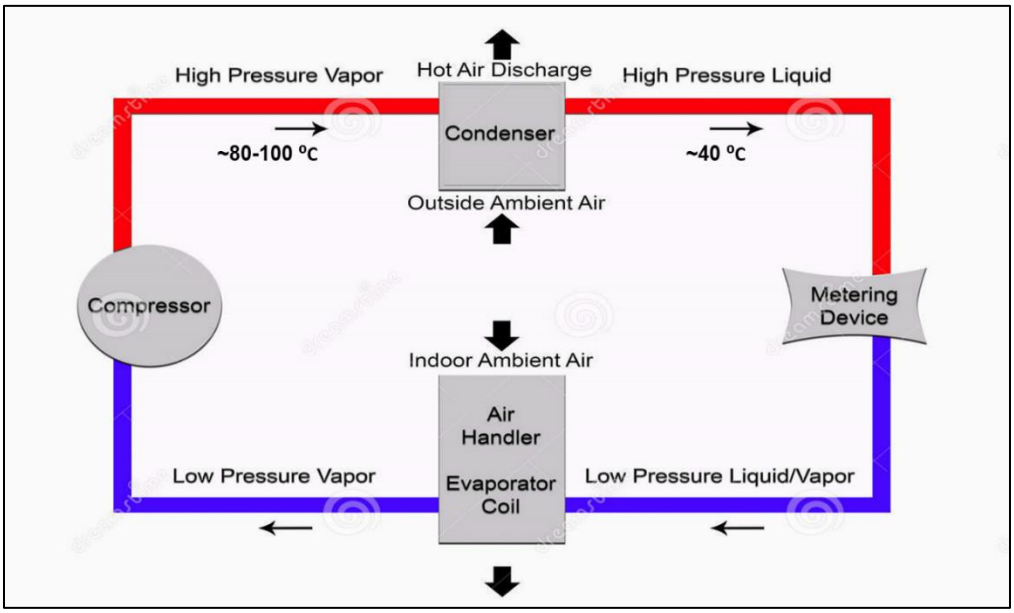

Figure 5: Vapor Compression Cycle

[1] http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1728

Sursagar dairy has installed one PHE condenser for 180Hp Mycom Chiller and shell & tube condenser for J&E Hall 150 Hp Chiller with both open cooling tower for the refrigeration system.

The detailed project report is made for the replacement of a PHE condenser for the Mycom Chiller with evaporative condenser.

Existing Condenser System

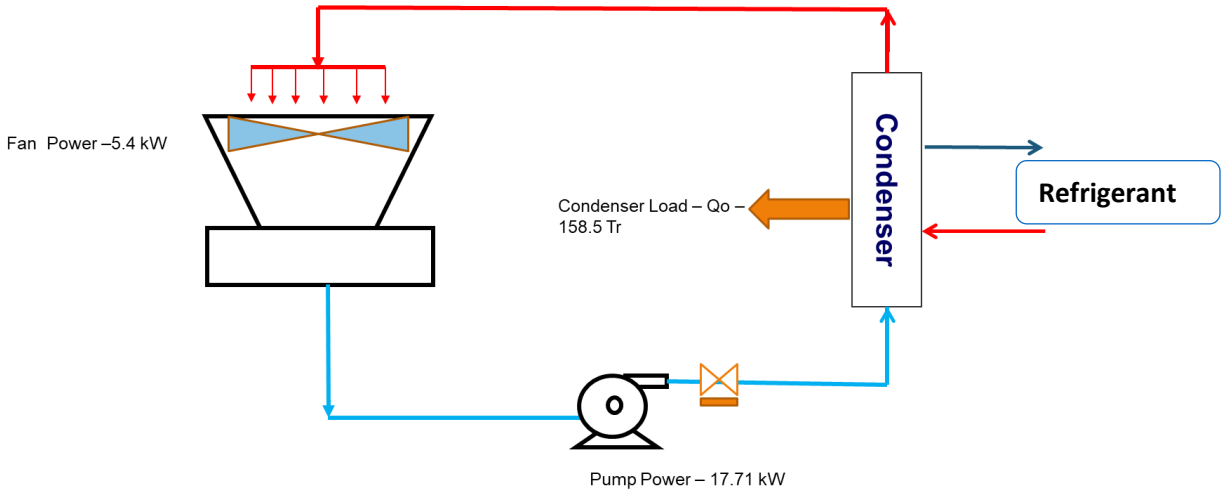

Figure 6: Existing Condenser System

Currently plant is having a normal PHE condenser with CT arrangement for the Mycom chiller. The compressor is running at 40°C condensing temperature and -2°C evaporation temperature. As the current system has separate condenser an CT, the auxiliary load are on the higher side and also the water quality can affect the condenser performance due to scaling and fouling. This can result in increased power consumption of chiller compressor. Also during the study it was found that condensing temperature was on the higher side. Lower the condensing temperature better the performance of chiller compressor. For the existing system following table shows the power consumption of refrigeration system:

Table 8: Existing System Power Consumption

Sl No	Parameter	UOM	
1	Chiller Compressor	kW	103
2	Condenser Pump	kW	17.71
3	Cooling Tower Fan Power	kW	5.4

3.2 Recommendation

It has been decided to replace the existing PHE Condenser with CT with an evaporative condenser. Evaporative condensers combine the features of a cooling tower and water-cooled condenser in a single unit. In these condensers, the water is sprayed from top part on a bank of tubes carrying the refrigerant and air is induced upwards. There is a thin water film around the condenser tubes from which evaporative cooling takes place. In evaporative condenser the

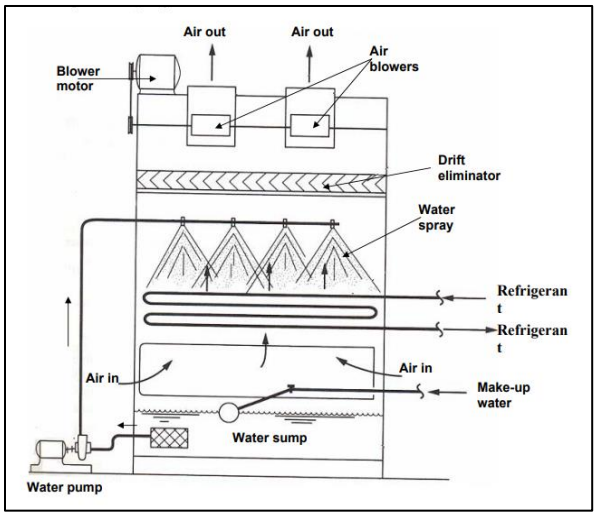

Figure 7: Evaporative Condenser

vapor to be condensed is circulated through a condensing coil, which is continually wetted on the outside by a recirculating water system. Air is pulled over the coil, causing a small portion of the recirculating water to evaporate. The evaporation removes heat from the vapor in the coil, causing it to condense. The heat transfer coefficient for evaporative cooling is very large. Hence, the refrigeration system can be operated at low condensing temperatures (about 11 to 13 K above the wet bulb temperature of air). The water spray countercurrent to the airflow acts as cooling tower. The role of air is primarily to increase the rate of evaporation of water. The required air flow rates are in the range of 350 to 500 m^3 /h per TR of refrigeration capacity.

With the installation of evaporative condenser, condensing temperature of 36°C can be achieved for the same cooling capacity. As a result the compressor power will come down drastically at 4°C lower condensing temperature compared to existing condensing tempreature of 40°C.

Benefits

- Reduces Fouling Tendency - Advanced coil technology, applied on Evaporative Condensers, is used to reduce the tendency to accumulate fouling and scale on the coil's exterior surface. Four facets of the unique product design contribute to the reduced tendency for fouling.
- The Air and Water Flow in a Parallel Path - Better water coverage over the coil is maintained because the air and spray water flow in a smooth, parallel, downward path over the coil. With this parallel flow, the spray water is not stripped from the underside of the tubes by the upward air flow, as on other, conventional designs. This eliminates scale-producing dry spots on the coil.
- Increased Water Flow Over the Coil - The spray water flow rate over the coil plan area is more than twice that of conventional units. This heavy coverage provides continuous flooding of the primary heat transfer surface for decreased fouling potential. Improved spray water coverage is provided at no increase in pumping horsepower due to the unique heat transfer system of the design.
- Evaporative Cooling in the fill- They incorporate combined flow technology, using both primary and secondary heat transfer surfaces. The primary heat transfer surface is the serpentine coil, which is the most important and expensive component in the unit. More than 80% of the latent heat transfer occurs in the secondary surface, PVC cooling tower fill, effectively moving the evaporation process away from coil. The coil is protected from detrimental fouling and scale since it relies primarily on sensible conduction/convection

heat transfer and, therefore, is less susceptible to scale formation than are other condensers that rely primarily on latent (evaporative) heat transfer.

- Colder Spray Water - Spray water at a colder temperature has a lower propensity to form scale because scale-forming compounds remain in solution, rather than deposit as solids on the coil exterior surface. Spray water flowing over the coil is commonly 6°F to 8°F colder than on other designs due to the addition of the secondary heat transfer surface. Colder spray water alone typically reduces the scaling potential by 25% compared to other designs. This is over and above the fouling reductions achieved by the first three factors described above.

Technical Specification of the new evaporative condenser is shown below

S/N	Parameter	Value
1	Project Name	**Sursagar Dairy, Surendranagar**
2	Model No	**CXVB-221-0812-7.5 - Qty – 1 Nos.**
3	Total Heat Rejection Capacity Required	704 kW (200 TR)
4	No of Unit required	1 Nos.
5	Condensing Temp	36 °C
6	Design Wet Bulb Temperature	29 °C
7	Total Fan Motor KW per Unit	5.5 kW
8	Total Spray Water Pump KW per Unit	4 kW
9	Airflow Rate per Unit	24.12 m3/s
10	Spray Flow Rate per Unit	45.36 lps
11	MOC of Structure	Hot Dipped Galvanized
12	MOC Of Basin	Hot Dipped Galvanized
13	MOC Of Coil	Hot Dipped Galvanized **(Continuous Pipe Coil)**
14	Evaporative coil inlet/outlet connections (mm)	1 X DN 100mm
15	Shipping Weight per Unit	5,357 kgs Approx
16	Operating Weight per Unit	7,852 kgs Approx.
17	Dimensions in L x W x H per Unit	(4260 x 2584 x 5526) mm
18	No of Fan Motor per Unit	1 No.
19	No. of Fans per Unit	2 Nos.
20	No. of Spray Pump per Unit	1 No.
21	Refrigerant	Ammonia

Figure 8: Technical specification of Evaporative Condenser

3.3 Supplier Details

Table 9: Supplier Detail

Equipment Detail	Evaporative Condenser
Supplier Name – Quotation attached in annexure	VINI Enterprise
Address	13, Nutan Patidar Society, Vallabhwadi, Maninagar, Ahmedabad-380008.
Contact Person	Mr. Saurin Dave
Mail Id	saurin@vinienterprise.com
Phone No	+91 97270 12111
Supplier Name	Frick India Ltd
Address	3rd Floor, Tiecicon House, Dr. E Moses Road, Jacob Circle, Dr E Moses Rd, Lower Parel, Mumbai
Contact Person	Mr Mohan Garud
Mail Id	mumbai@frickmail.com
Phone No	+91 9833994591

3.4 Savings

The expected savings by installation of evaporative condenser is 1,98,129 units annually. The annual monetary saving for this project is ***Rs 13.07 Lakhs with an investment of Rs 29.52 lakhs and payback for the project is 27 months.***

Detailed savings calculations is given in below table

Table 10: Savings Calculation

Parameters	UOM	
Existing System - Measured		
Chiller Compressor Rating	kW	132.3
Power Consumption	kW	103
Evaporator Temperature	°C	-2
Condensing Temperature	°C	40
Condenser Heat Load Qo	TR	158.5
Condenser Pump Power	kW	17.71
Cooling Tower Fan Power	kW	5.4
Proposed System		
Design of new condenser with 25 % safety margin	TR	198.12
Evaporative Condenser Model available	TR	200
Evaporative Condenser Fan Power	kW	5.5
Evaporative Condenser Pump Power	kW	4
Energy Savings		
Total Auxiliary Power of Existing Condenser	kW	23.11
Total Auxiliary Power of Evaporative Condenser	kW	9.5

Savings in Auxiliary Power	kW	13.61
Current Compressor Power @ 40°C condenser temperature	kW	103
Compressor Power @ 36°C condenser temperature (with installation of Evaporative Condenser)	kW	94
Savings in Compressor Power due to reduction in condenser temperature	kW	9
Total Savings	kW	22.61
Power Cost	Rs/kWh	6.6
Operating Hours	hrs/day	24
No of Days	Days/year	365
Annual Energy Savings	kWh	198129
Annual Cost Savings	Rs lakhs	13.07
Investment for 200 TR evaporative condenser	Rs lakhs	29.52
Payback	Months	27

4. FINANCIAL ANALYSIS

4.1 Project Cost

Table 11: Project Cost

Parameter	Amount in Rs Lakhs
Evaporative Condenser Cost	24.38
Assembly and Installation Charges	0.75
GST Charges @ 18%	4.38
Total Project Cost	**29.52**

4.2 Assumptions for Financial Analysis

- Interest rate taken as 12 %
- Yearly increase in electricity cost by 2% for cash flow analysis
- Life cycle of the project is taken as 7 years
- Three different Capital Structure considered
    - CS1 – 70:30 Debt Equity Ratio
    - CS2 – 50:50 Debt Equity Ratio
    - CS3 – 100 % Equity
- Return on equity is taken as 15 %
- Depreciation – 40%
- Operation and Maintenance Cost taken as 5% of Initial investment
- For calculating weighted average cost of capital, tax rate is assumed as 30 %

4.3 Cash Flow Analysis

Table 12: Cash flow of the project

Cash flow for the project		1	2	3	4	5	6	7
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Required Investment	29.52							
Energy Savings		13.08	13.34	13.60	13.88	14.15	14.44	14.73
O&M Cost		-1.48	-1.48	-1.48	-1.48	-1.48	-1.48	-1.48
Depreciation		11.8	7.1	4.25	2.6	1.5	0.9	0.6
Net Cash Flow	-29.52	23.41	18.95	16.38	14.95	14.21	13.88	13.80

The table below shows the various capital structure assumed for the project finance

Table 13: Capital Structure

Capital Structure			
Particulars	CS 1	CS 2	CS 3
Debt	70	50	0
Cost of Debt	0.12	0.12	0.12
Equity	30	50	100
Cost of Equity	0.15	0.15	0.15
WACC	10.38	11.7	15

Table 14: NPV Calculation

NPV Calculation	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	NPV
NPV at CS 1 (70:30)	-29.52	21.2	15.6	12.2	10.1	8.7	7.7	6.9	52.7
NPV at CS 2 (50:50)	-29.52	21.0	15.2	11.8	9.6	8.2	7.1	6.4	49.7
NPV at CS 3 (100% Equity)	-29.52	20.4	14.3	10.8	8.5	7.1	6.0	5.2	42.7

4.3 Sensitivity Analysis

A sensitivity analysis has been carried out to ascertain how the project financials would behave In different situations such as

- Change in energy savings
- Change in operating hours
- Change in interest rate

A good sensitivity analysis will help to estimate the behavioral nature thereby helping to understand the financial viability over a long period of time.

Table 15: Sensitivity analysis: based on energy savings

Based on Savings	at 100% Savings	at 75% Savings	at 50% Savings
NPV at CS 1 (D70:E30)	52.7	36.2	19.6
NPV at CS2 (D50:E50)	49.7	30.8	15.8
NPV at CS3 (D0:E100)	42.7	28.4	14.2
IRR	64%	50%	34%

Table 16: Sensitivity analysis: change in operating hrs

Based on Operating Hours	at 100% operating hours	at 90% Operating hours	at 80% Operating hours
NPV at CS 1 (D70:E30)	52.7	46.1	39.5
NPV at CS2 (D50:E50)	49.7	43.3	37.0
NPV at CS3 (D0:E100)	42.7	37.0	31.3
IRR	64%	58%	53%

Table 17: Sensitivity analysis: change in interest rate

Based on Interest Rate	at 9.5% interest rate	at 10.05% interest rate	at 11% interest rate	at 12% Interest Rate	at 12.5% Interest Rate	at 13% Interest Rate
NPV (70:30)	55.8	54.6	53.9	52.75	52.16	51.58

5. ENERGY EFFICIENCY FINANCING IN MSMEs

Financing plays a key role in facilitating procurement and implementation of energy efficient technologies and products in any industry. Government has given EE financing in MSMEs top priority since the sector contributes significantly towards India's economic growth. However, existing financing options are not sufficient to meet the financing requirement in the sector due to the large size of the sector. MSMEs using various financing schemes for technological up-gradation are still very less, as most of them use their own capital fund rather than making use of external financing models. Although financing models were very successful in some clusters, the scale-up of such activities is rather slow. This slow pace in implementation of energy efficiency financing in MSMEs is due to the various sector specific challenges in the sector.

Some of the key barriers to finance EE projects in the sector are:-

- Lack of available capital for investment as EE interventions being small may not get financed through FIs as they do not qualify as term loans
- Lack of clarity on financing schemes- repayment mechanism and complex procedural requirements
- Lack of availability of financing model that cater to the particular requirement of the MSME
- Lack of awareness among MSMEs with respect to benefits of implementing EE technologies
- FIs consider MSMEs as a high risk category due to low credit flow to this sector. This is due to several factors such as poor book-keeping practices, weak balance sheets, poor credit history and smaller sizes of MSME loans.
- Collateral based lending, advocated by FIs, restricts MSMEs from availing loans
- No formal M&V procedure available to estimate the savings achieved by implementing EE measure
- Risks associated with repayment of loans which include technical, commercial and performance risks

5.1 FI Schemes in Gujarat

Table 18: FI schemes in Gujarat

Sl.No	Name of Scheme	Purpose	Financial Details	Contact Address
1	SIDBI Make in India Soft Loan Fund for Micro, Small & Medium Enterprises (SMILE)	• The focus of the scheme is on technology upgradation which helps in reducing the impacts from process and operations as the reduction in resource consumption and productivity improvements are major outcome of technology upgradation • The program aims to bridge the gap by providing financial support to the companies.	• Rate of interest is according to credit rating • Interest rates for soft loans are from (8.90 % to 8.95 % pa) and term loans are in the range of (9.45% to 9.60% pa) • Min loan amount: Rs 25 Lakhs • Term Loan: 75% of the project cost as debt	Mr Chandan SIDBI, Bhavan, Ist Floor, P.B.No. 10, Navjivan P.O., Ahmedabad Ph No : : 8769436639 Mail Id: ahmedabad@sidbi.co.in
2	4E scheme (End to End Energy Efficiency Financing scheme)	• The 4E scheme promoted by SIDBI aims to assist the industries in implementation of energy efficiency and renewable energy projects. • The scheme addresses all aspects of energy efficiency in a company from assessment and identification of energy efficiency interventions to facilitating implementation by providing technical and financial support	• Interest rate - 2.5% below market interest rate • Min loan amount: Rs 10 Lakhs • Max loan amount: Rs 150 Lakhs • 90% of the project cost as debt	Mr Chandan SIDBI, Bhavan, Ist Floor, P.B.No. 10, Navjivan P.O., Ahmedabad. Ph No : 8769436639 Mail Id: ahmedabad@sidbi.co.in
3	Partial Risk Sharing Facility for Energy Efficiency project (PRSF)	• The partial risk sharing facility aims at transforming the energy efficiency market in India and promotion of Energy Service Contracting Model for the Energy Efficiency. • The scheme address barrier related to the financing aspects for energy efficiency	• Term Loan: 12%-15% • Min loan amount: Rs 10 Lakhs • Max loan amount: Rs 15 Cr • Total Project funding of – USD 43 million • Risk Sharing facility component of USD 37 million to be managed by SIDBI • Technical assistance component of USD 6 billion to be managed by SIDBI and	Mr Chandan SIDBI, Bhavan, Ist Floor, P.B.No. 10, Navjivan P.O., Ahmedabad. Ph No : 0562-2521023 Mail Id: ahmedabad@sidbi.co.in

			EESL	
4	Bank of Baroda's Scheme for Financing Energy Efficiency Projects	All these these Schemes from various banks (SBI, Bank of Baroda, Canara Bank) have their focus towards technology upgradation. Technology upgradation can lead to improvement in energy, productivity, and lower emission from the MSME company. As technology upgradation could be capital intensive most of the schemes from banking institutions aim at bridging the gaps for access to finance for MSME sector	• Loans of up to 75% of the total project cost, subject to maximum of Rs. 1 crore, will be provided. (Minimum amount of loan Rs. 5 Lakhs • Collateral will be required for all loans. An interest rate of bank base rate + 4% will be applicable, to be paid back over a period of 5 years.	Bank of Baroda SME Loan Factory 2nd Floor Baroda Towers, Ellisbridge, Ahmedabad Ph No : 9979867501 Mail Id : cpc.sme.ahmedabad@bankofbaroda.com
5	Canara Bank's Loan scheme for Energy Savings for SMEs		• The scheme covers up to 90% of project costs of up to INR 1 million (EUR 13,000). • Max. loan: INR 10 million (EUR 130,000) • Security: collateral free up to INR 5 million (EUR 65,000), beyond INR 5 million collateral required as determined by the bank • Margin: 10% of project costs	Swaraj Arcade, Kumudvadi Opp.Lal Tanki, Chitra Road,Bhavnagar-364002 Ph No : 0751-2233141/ 2431541 Email Id : cb4831@canarabank.com
6	SBI's Project Uptake for Energy Efficiency		• SBI identifies industrial clusters with potential for quick technology upgradation and a supporting environment. Based on studies in interested units, technology upgradation is undertaken if the same in viable. • With a ceiling of INR 1 lakh, an amount equal to that invested by the unit is provided under this loan. There is a start-up period of 3 years, with a repayment period of 5-7 years, at zero interest.	SBI SMECC Ground Floor, Zodiac Avenue, Opp Commisionar Bunglow, Navrangpura, Ahmedabad, Gujarat Ph No : 022 22029456 Email Id : sbi.60438@sbi.co.in
7	Solar Roof Top Financing Scheme IREDA	The loan scheme is applicable to grid interactive, rooftop solar PV plants for industries, institutions and commercial establishments. Financing can be	• Interest rate: 9.9% - 10.75% • Max. repayment time: 9 years • Minimum promoter's contribution: 30% • The applicant's minimum capacity needs to be 1MW	IREDA Camp Office 603, Atlanta Towers Near Panchvati Circle, Gulabi Tekra Ahmedabad

		accessed for single or aggregated investments.		Ph No : 9811889805 Email Id : ashokyadav@ireda.in
8	SBI - World Bank: Grid Connected Rooftop Solar PV Program	Loans for financing grid connected rooftop solar photovoltaic (GS- RSPV)	• Loan amount is 75% of the project cost • Fixed Asset coverage ratio: >1.25 • Moratorium period: upto 12 months from date of commencement of commercial operations • Guarantee: in case of sole proprietorship/partnership firm/personal guarantee of partners	SBI SMECC Ground Floor, Zodiac Avenue, Opp Commisionar Bunglow, Navrangpura, Ahmedabad, Gujarat Ph No : 022 22029456 Email Id : sbi.60438@sbi.co.in

6. ENVIRONMENTAL AND SOCIAL BENEFIT

6.1 Environmental Benefit

A resource-efficient business demonstrates a responsibility towards the environment. Energy and the environment are so closely linked, that, in addition to saving energy and reducing utility expenses, there are additional and often unreported benefits from conserving energy, saving natural resources being an important benefit.

Energy efficiency plays a major role, even where company output is increased, energy efficiency improvements can contribute significantly in most cases to reducing the negative impact of energy consumption per unit of output. Any increase in pollutant emissions will thus be minimized. Significant environmental benefits gained by adopting energy efficient technologies and processes may include lowering the demand for natural resources, reducing the emission of air pollutants, improving water quality, reducing the accumulation of solid waste and also reducing climate change impacts. Improving energy conservation at the facility can improve the facility's overall efficiency, which leads to a cleaner environment.

Reduction in Pollution Parameters

The proposed EE measure of installing evaporative condenser would result in annual electricity savings of 1,98,129 units which is equivalent to 17.04 TOE per annum. The proposed EE measure will result in decrease of 162.47 TCO_2 emissions.

6.2 Social Benefit

Work Environment

The Factories Act, 1948 covers various aspects relating to working environment maintenance and improvement. The good maintenance practices, technology up gradation, efficient use of energy and resource conservation not only contribute to energy and pollutant reduction but also contributes in ensuring safe and clean working environment to the employees of the organization. Many units have also been doing review of safety process and have provided access to safe working environment to the workers. Basic facilities such as first aid kit, PPE gears and many others have been made available

Skill Improvement

Implementing energy efficiency measures requires mix of people and skills. It involves up skilling workers at all levels from the shop floor to the board room to understand how companies manage their energy use—and to identify, evaluate and implement opportunities to improve energy performance. As the project involved identifying energy saving projects, implementing and verifying the savings, the unit have understood how to estimate energy savings with respect to energy saving proposals and also energy wastage have been identified. The activity has been successful in bringing the awareness among workers on energy wastage reduction, technology up

gradation possible, etc. Each new technology implemented in a dairy plant will create an impact on the entire Gujarat Dairy cluster as each dairy units can replicate the new technology and promote the concept of energy efficiency in entire Gujarat Dairy Cluster and thus reduce the overall energy consumption of the cluster as a whole.

Technical skills of persons will be definitely improved. As the training provided by the OEMS' on latest technology will create awareness among the employees on new trends happening in market. The training also helps in improving the operational and maintenance skills of manpower required for efficient operation of the equipment.

7. CONCLUSION

Energy efficiency is an instrument to address the issue of energy crisis and also be employed as a cost effective means to attain sustainability and business. Cost of energy is considered as a vital component for industries and warrant judicious use of energy. Amid spiraling power cost energy efficiency assumes at most importance for the sector to remain competitive.

The GEF, UNIDO and BEE project through its various engagements is able to demonstrate energy efficiency potential in Gujarat Dairy cluster. The project is able to promote the concept of energy efficiency and renewable energy in dairy cluster through various capacity building programs for local service providers, technology feasibility studies in dairy units, training programs on EE/RE technologies and also helped in penetrating new /latest technologies into the cluster.

The DPR for installation of evaporative condenser has been prepared after the discussion with the OEM. The implementation of this measure significantly will result in an annual electricity savings of 1,98,129 units with an annual 162.47 TCO_2 reduction. The following table gives the overall summary of the savings achieved:

Table 19: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings		Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	AnnualTCO_2 reduction
		kWh	TOE				
1	Installation of Evaporative Condenser	1,98,129	17.04	13.08	29.52	27	162.47

The summary of financial analysis given in the below table clearly indicates that implementation of this project is economically and financially viable. So it is recommended to install evaporative condenser for the existing refrigeration system.

Table 20: Financial Analysis

Sl. No.	Particulars	Unit	Value
i	Total Investment (Incl of Tax)	Rs. Lakh	**29.52**
ii	Means of Finance	Self / Bank Finance	**Self**
Iii	IRR	%	**52.75**
Iv	NPV at 70 % Debt	Rs. Lakh	**63.79**

7.1 Replication Potential

Evaporative condenser has a good potential in Gujarat Dairy Cluster. The system can be easily replicated in all the dairy plants which are using conventional type of condensers. Also in the implementation of this project will inspire other units in Gujarat to take up similar energy efficiency initiatives which eventually will lower the bottom line and increase the top line therefore the margin increases. Secondly, the very clear specifications on vendor and the cost base is already available which makes it easy for other units in the Gujarat Dairy cluster to access the technology and gives them a very good idea about the cost and benefits associated with the projects. Overall, the holistic approach adopted by the project will be extremely useful in achieving the goal of improving EE in the cluster.

8. ANNEXURE

8.1 Financial Quotation

VINI ENTERPRISE

13, NUTAN PATIDAR SOCIETY, VALLABHWADI, MANINAGAR, AHMEDABAD-380008.
PHONE: +91 97270 12111, +91 98240 49546. Email: saurin@vinienterprise.com

REF NO: VINI/BAC/18-19/0135 DATE: 31.07.2018

TO,

M/s. Sursagar Dairy
Plot no.249, Phase-2, Ambawadi G.I.D.C
Wadhwan, Surendranagar,
Gujarat – 363035

Kind Attn.: Shri H M Mathuriya,

Subject : Offer for BAC Make Evaporative Condenser

Dear Sir,

We thank you for the subject enquiry for BAC Evaporative Condenser. We are pleased to submit our Techno-

Commercial Offer for BAC make Evaporative Condensers as per below.

- Option-1 - 1 Nos. of Model: CXVB-221-0812-7.5, Each Capacity: 722.2 kW (205.4 TR) @ 36 C / 29 C.

All the parts like Coil, Basin & Panels are Hot Dipped Galvanized.

We trust this offer is in line with your requirements and will be looking forward to your valued reply.

Thanks & Regards,

FOR VINI ENTERPRISE

Saurin Dave

M : + 91 97270 12111

E-mail: saurin@vinienterprise.com

VINI ENTERPRISE

13, NUTAN PATIDAR SOCIETY, VALLABHWADI, MANINAGAR, AHMEDABAD-380008.
PHONE: +91 97270 12111, +91 98240 49546. Email: saurin@vinienterprise.com

Price Sheet for Supply

Sr. No.	Option	Description	Unit Price (USD)	Qty	Total Price (USD)
1	Option - 1	Unit Price of Model: CXVB-221-0812-7.5 @ CIF, Nava Sheva Sea Port, Mumbai. Each Capacity: 722.2 kW @ 36 C / 29 C *Scope Of Supply: Std. HDG Unit*	$ 34,888	1 Nos.	$ 34,888

Price Sheet for Assembly & Installation

(GST Tax Extra as applicable)

Sr. No.	Description	Qty	Unit Price (INR)	Total Price (INR)
1	Assembly & Installation Charges for Evaporative Condenser @ Dairy Site 1. CXVB-221-0812-7.5 Order should be place in the name of M/s. VINI ENTERPRISE. Crane/Hydra, I Beam, Utility Power & Water, etc. in the client scope. Payment Terms: 1. 80% of the Basic Amount + 100% GST Amount will be released within 10 Days from the date of Installation (Installation Report will be submitted along with Invoice) 2. 20% of the Basic Amount will be released within 10 Days from the date of Commissioning or 60 Days; whichever is earlier (Commissioning Report will be submitted for release this remaining payment)	1 Nos.	Rs. 75,000/-	Rs. 75,000/-

VINI ENTERPRISE

13, NUTAN PATIDAR SOCIETY, VALLABHWADI, MANINAGAR, AHMEDABAD-380008.
PHONE: +91 97270 12111, +91 98240 49546. Email: saurin@vinienterprise.com

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Terms and Conditions

1. **Price Basis:** CIF, Nhava Sheva Sea Port, Mumbai, India.
2. The order will be placed to

   M/s, BAC MALAYSIA SDN BHD

   628,6th Flr.Block A, Damansara Intan,

   No.1 JalanSS20/27, 47400 Petaling Jaya,

   Selangor Darul Ehsan, Malaysia.

   With a copy to M/s. VINI ENTERPRISE
3. The all statutory clearances will be customer's responsibility.
4. **Freight & Clearances:** The expenses for transportation / freight, clearing the consignment, Custom duties and related charges and transportation from inland port will be arranged by customer.
5. **Payment Terms:** Thru 100 % Confirmed & Irrevocable Letter of Credit payable at sight or 100 % cash in Advance.
6. **Delivery:** Within 16 weeks at Nhava Sheva Port, Mumbai from the date of receipt and acceptance of Letter of Credit or Cash-in-Advance.
7. **Warranty:** 12 months from the date of commissioning OR 18 months from the date of Bill Of Lading (BL), whichever is earlier.
8. **Delivery Terms:** Units will be delivered in CKD condition and will require assembly by others at site.
9. **Country of Origin:** China.
10. **Validity of offer:** 60 Days
11. **Installation:** M/s. VINI ENTERPRISE shall provide supervision services & assembly work (With Manpower/Supervision) of Evaporative Condensers at site with Extra Cost.
12. **Exclusions:** Customer is responsible for maintaining water quality. Any equipment damages or parts required for change on account of quality of water shall be to customer scope eg. Fills etc.
13. **Warranty:** BAC's liability in respect of any defect in or failure of product supplied to site, or any loss, injury or damage attributable thereto, is limited to making good by replacement or repairs, defects, which appear therein, provided the product is stored and installed in accordance with GMP, and arise totally from proved fault in manufacturing, materials or workmanship, within a period of 12 months from the date of Commissioning or 18 months from date of bill of lading whichever is earlier.
14. **The warranty period does not cover the following:**
    - Normal wear and tear
    - Damages/defects arising out of wrong installation of the equipment by the Purchaser and/or arising out of accidents, riots, fire, etc.