August 2018

DETAILED PROJECT REPORT ON STEAM TRAPS & CONDENSATE RECOVERY SYSTEM

M/s Sarvottam Milk Chilling Center – Gujarat Dairy Cluster

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

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

Prepared by

Confederation of Indian Industry
CII – Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post, Near HITEC City
Hyderabad 500064

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BEE	Bureau of Energy Efficiency
CIP	Cleaning in Process
CS	Capital Structure
°C	°Celsius
CO_2	Carbon dioxide
DPR	Detailed Project Report
EE	Energy Efficiency
FI	Financial Institution
FO	Furnace Oil
GCMMF	Gujarat Cooperative Milk Marketing Federation
GEF	Global Environmental Facility
IRR	Internal Rate of Return
kJ	Kilo Joule
kW	Kilo Watt
LSP	Local Service Provider
MSME	Micro and Medium Scale Industries
NPV	Net Present Value
OEM	Original Equipment Manufacturer
RE	Renewable Energy
SBI	State Bank of India
SIDBI	Small Industrial Development Bank of India
TOE	Tonnes of Oil Equivalent
SOPT	Steam Operated Pumping Trap
UNIDO	United Nations Industrial Development Organisation
WACC	Weighted Average Cost of Capital

ACKNOWLEDGEMENT

Confederation of Indian Industry (CII) would like to express its sincere thanks to United Nations Industrial Development Organization (UNIDO), Global Environment Facility (GEF) and Bureau of Energy Efficiency (BEE) for the role played by them in guiding and steering this prominent assignment - "Capacity Building of Local Service Providers in Gujarat Dairy Cluster".

CII is 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. Suresh Kennit, National Project Manager, UNIDO and Mr. Niranjan Rao Deevela, National Technology Coordinator, Energy Efficiency & Renewable Energy in MSMEs, UNIDO for their support and guidance during the project.

CII would also like to give special gratitude to Gujarat Cooperative Milk Marketing Federation (GCMMF) for supporting CII for carrying out this project at Gujarat Dairy Cluster and for their constant support and coordination throughout the activity. CII team is also grateful to the M/s Sarvottam Dairy especially Mr. H R Joshi, Managing Director, Mr. H B Pandya and Mr. Gopal Dave, Manager, Engineering for showing keen interest in the this implementation of this technology and providing their wholehearted support and cooperation for the preparation of this Detailed Project Report.

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	Sarvottam Milk Chilling Center
Name(s) of the Plant Head	Mr. H R Joshi
Contact person	Mr. H B Pandya
Constitution	Cooperative Society
MSME Classification	Medium Scale
Address:	Shree Bhavngar D.C.M.P.U.LTD, Sarvottamdairy, Bhavnagar Rajkot Highway, Sihor PIN:-364240
Industry-sector	Dairy – Milk Chilling Center

1.2 Proposed EE Measure

After the discussion with the plant team, it has been decided to replace the existing traps and to modify the existing condensate recovery system. 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
		FO (kg)	TOE				
1	Installation of Steam Traps and Condensate Recovery system	29,077	28.50	10.76	11.35	13	89.33

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	**11.35**
ii	Means of Finance	Self / Bank Finance	**Self**
Iii	IRR	%	**121.07**
Iv	NPV at 70 % Debt	Rs. Lakh	**49.32**

2. INTRODUCTION ABOUT SARVOTTAM DAIRY CHILLING CENTER

2.1 Unit Profile

Sarvottam Dairy Chilling Center was established in 2017 with the aim of chilling the milk that is obtained from cooperative societies before transferring to dairy. The chilling center is able to chill 1.6 Lakhs litres of milk to 4^{o}C before sending to Sarvottam Dairy.

Table 4: Unit Profile

Particulars	Details
Name of Plant	Sarvottam Milk Chilling Center
Name(s) of the Plant Head	Mr. H R Joshi
Contact person	Mr. H B Pandya
Contact Mail Id	hbpandya@sarvottamdairy.com
Contact No	9374221604
Constitution	Cooperative Society
MSME Classification	Medium Scale
No. of years in operation	< 1 year
No of operating hrs/day	24
No of operating days/year	365
Address:	Shree Bhavngar D.C.M.P.U.LTD, Sarvottamdairy, Bhavnagar Rajkot Highway, Sihor PIN:-364240
Industry-sector	Dairy – Milk Chilling Center

2.2 Milk Chilling Center Details

Sarvotttam chilling center is one of the recent chilling center for Sarovttam Dairy where it is able to chill average of 1.60 lakh litres per day.

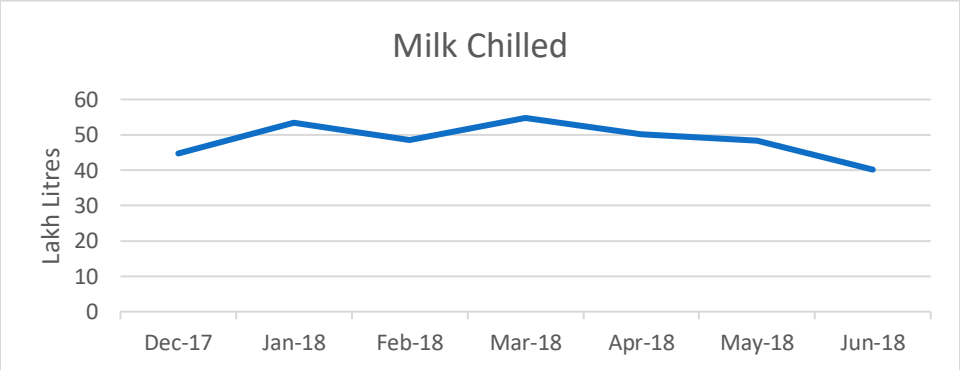

Figure 1: Milk Chilling Capacity

2.3 Typical Dairy Process Flow Diagram

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

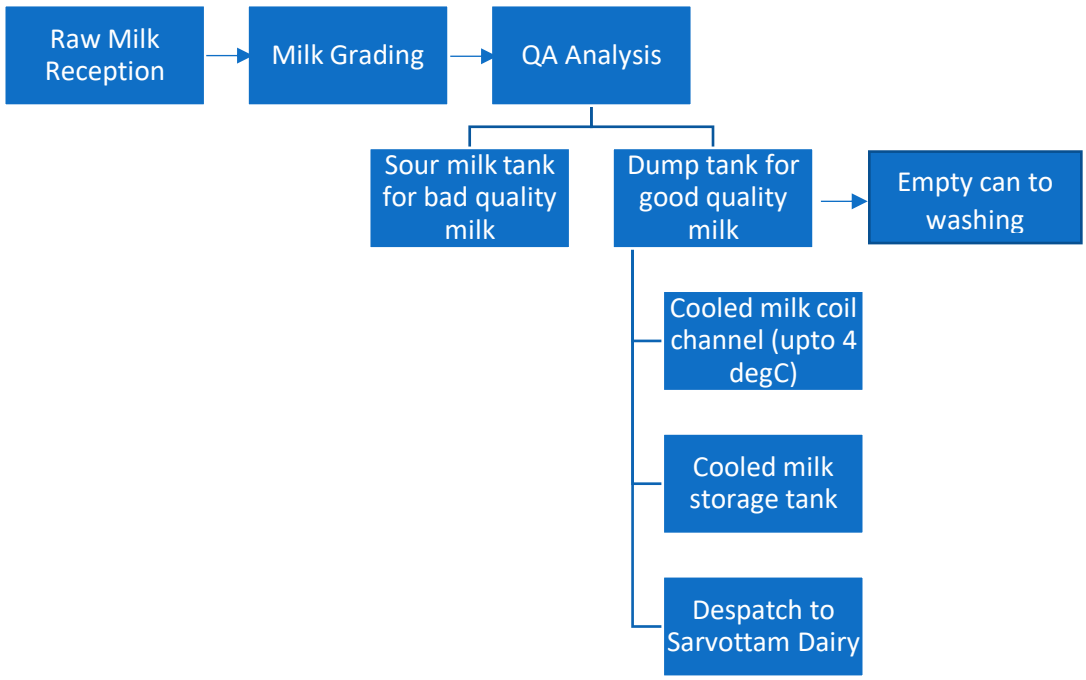

Figure 2: Sarvottam MCC Process Flow

The milk is received in societies through cans and its first graded and analyzed for separating good and bad quality milk. Bad quality milk is dumped into a sour tank which is drained out. Good quality milk is then cooled in bulk milk coolers upto 4 ^{o}C. Then it is stored in Silo and dispatched to Sarvottam dairy for processing. Electrical Chillers are used for chilling the milk and for can washing purpose hot water is generated using a FO fired boiler.

Table 5: Production Capacity

Sl No	Product	UOM	Quantity
1	Milk Cooling Capacity	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	6.87	
2	FO	Rs/kg	37	9800
3	Diesel	Rs/Litre	70	10800

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

Table 7: Fuel Consumption Details

Month	Fuel Consumption – FO (kG)	Fuel Consumption – Diesel (Litre)	Electricity Consumption (kWh)
Jan-18	9450	430	105840
Feb-18	8460	400	119705
Mar-18	8960	200	128378
Apr-18	8490	800	123275
May-18	8980	1400	130540
Jun-18	9000	1900	142220
Total	**53,340**	**5,130**	**7,49,958**

The major form of energy used in the plant is electricity and for thermal, plant is using FO as the major fuel. The percentage share of fuel cost is shown. Based on the data collected from the plant, the graph below shows the variation of fuel cost over the last 6 months. Average electricity cost is Rs 9.38 lakhs/month whereas the average thermal energy cost is Rs 3.91 Lakhs/month

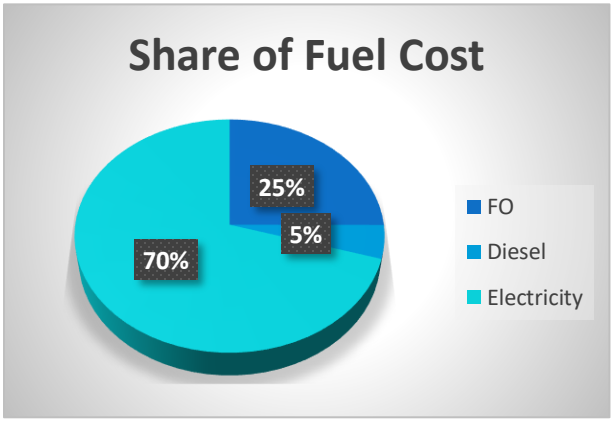

Figure 3: Share of fuel cost

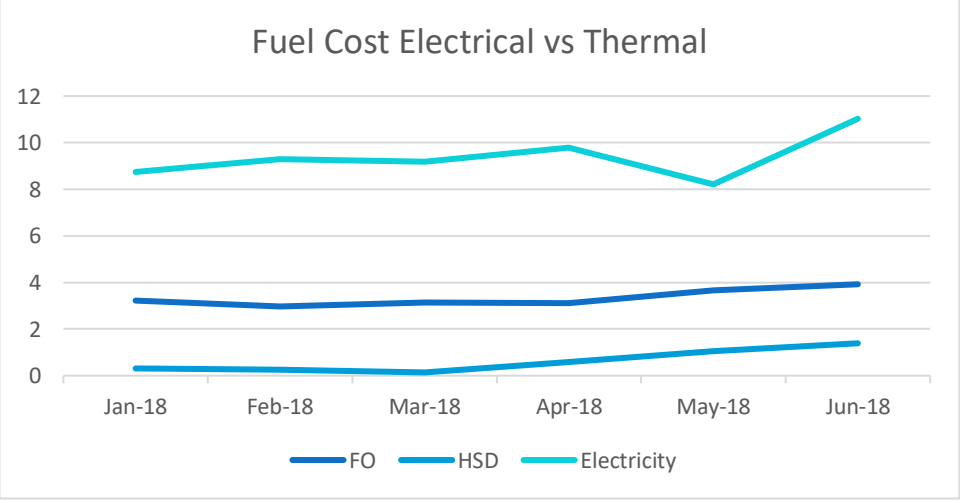

Figure 4: Fuel Cost Electrical vs Thermal

3. PROPOSED EE MEASURE – STEAM TRAPS AND CONDENSATE RECOVERY SYSTEM

3.1 Present System and Recommendations

Sarvottam Chilling Center has two FO fired boilers of 2 TPH capacity for the hot water requirement of the plant.

Table 8: Boiler Details

Boiler	Fuel Type	Design Capacity (TPH)	Make of the company	Operating pressure (bar)	Design pressure (bar)
Boiler 1	FO - Running	2 TPH	Thermax	8	10
Boiler 2	FO - Standby	2 TPH	Thermax	-	10

The FO used for boiler is preheated using an electric heater in a heating tank and then it is used for firing. The following are the steam consuming equipment's of the chilling centre:

- 1 No. of 5KL Heat Exchanger at CIP section
  - Operating pressure - 3.5 kg/cm2 g
- 2 Nos of Crate Washers
  - Operating Pressure - 3.5 kg/cm2 g
- 4 N.s of CIP Tanks
  - Operating pressure - 3.5 kg/cm2 g

Figure 5: CIP Tanks

Figure 6: Can Washing

- **5 kL Heat Exchanger for CIP Section**

Observation

The steam flow to the Heat Exchanger is regulated by a PID based Temperature Control Valve (TCV) which is taking feedback from the temperature sensor (RTD) at the outlet hot water line. Now, as the set temperature of hot water is attained, the TCV tends to close position. This in turn causes the steam flow rate, and thus steam pressure be reduced, which in turn causes water logging at the steam trap due to the lack of required differential pressure across the trap.

A steam trap will be operational only above the rated minimum differential pressure. Normally, operation of a steam trap requires a minimum differential pressure of 0.1 kg/cm2, however, this may vary with manufacturers. If the condensate flow pressure is lesser than the minimum required differential pressure, water logging happens which is also called stalling. This leads to problems of hammering, reduction of thermal performance of heat exchanger, corrosion of heating surfaces, inevitably reducing the service life of exchanger.

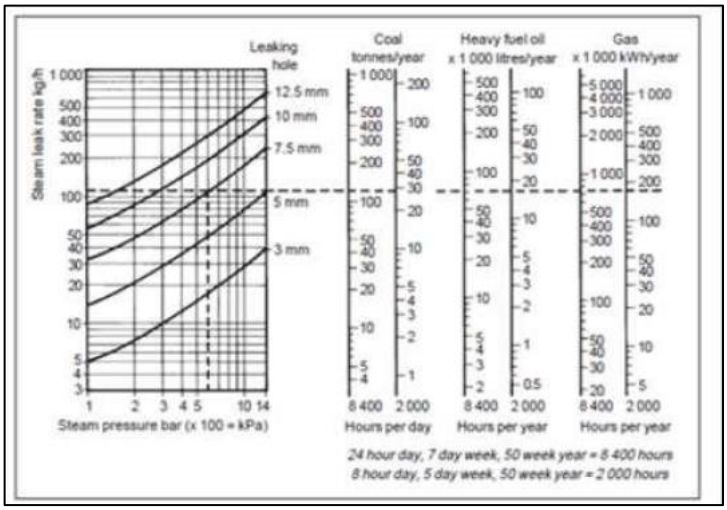

Figure 7: Steam Loss Chart

Now, to avoid this stall condition of steam traps, equipment operator normally operate the by-pass valve, either keeping bypass line partially open full time or intermittently opening and closing of bypass line. In both the cases, live steam loss occurs, thereby increasing the energy consumption. The orifice size of 15NB bypass valve open is 5 mm at 3.5 barg operating pressure. Through this orifice size steam loss is 30kg/hr from the steam loss chart.

Recommendation

It is recommended to replace the ball float steam trap with Steam Operated Pumping Trap (SOPT). With this system in place, whenever the condensate pressure is low, motive steam / air shall provide the additional thrust to make the condensate flow, and avoid any stalling.

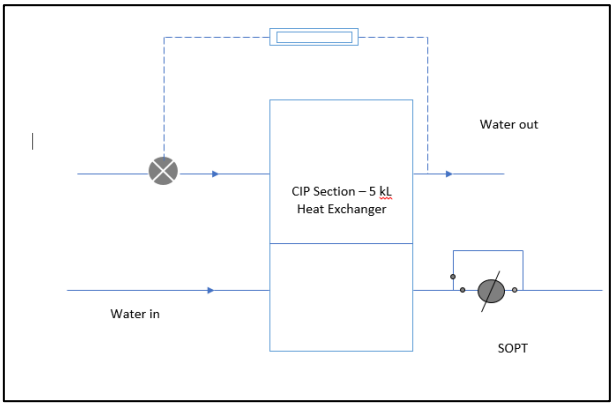

Figure 8: Existing system with SOPT

Crate Washers, CIP Tanks and FO Tanks

Observation

There are two numbers of crate washers being used for bottle cleaning. The equipment requires steam for heating cleaning water and drying air.

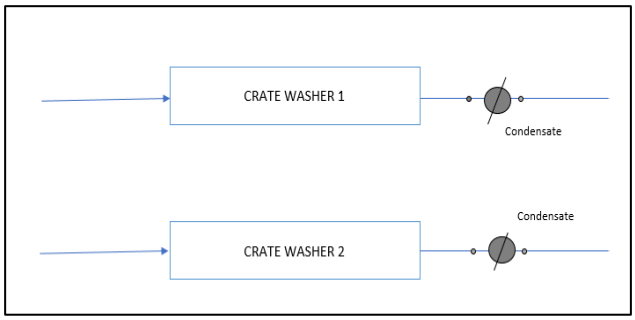

Figure 9: Crate washing with float trap

There are four numbers of CIP tanks which has a capacity of 10 kL each. The equipment requires steam for maintaining the chemicals at specific temperature. Normal traps are installed for the CIP tanks and these traps at the outlet were found leaking. The orifice size of 15NB local trap is 3mm at 3.5barg operating pressure. The steam loss through this orifice is 12kg/hr.

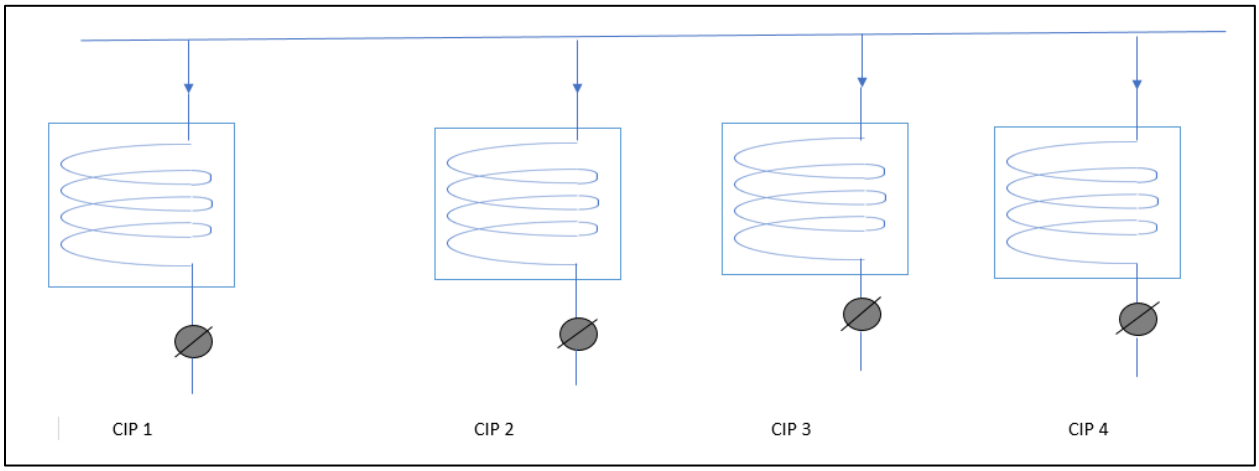

Figure 10: CIP tanks with regular traps

FO is heated which is required to maintain the pour point of Furnace Oil for ease of pumping. It is observed that TD trap is installed in the condensate line which is wrong selection for the application. Also, TD traps causes improper utilisation of heat and thus overall steam consumption increases.

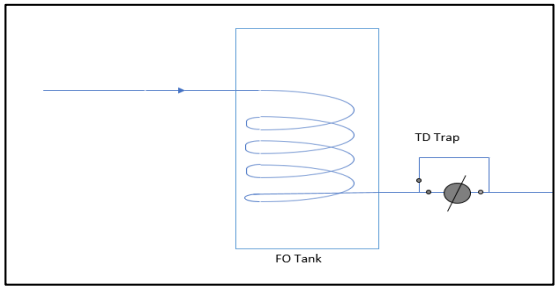

Figure 11: FO tank with TD Trap

Currently from all the systems mentioned above condensate is recovered and put into a recovery tank and from there it is pumped using an electrical pump. The condensate is recovered at 55 ^{o}C using the existing system.

Recommendation:

- It is recommended to replace the existing steam traps for CIP tanks and FO tanks with better efficient ball float traps to avoid any further passing of steam and avoid steam leakages. The orifice float trap can recover the complete condensate at temperature above 90°C.

Figure 12: Compact Module Trap

- It is recommended to collect the condensate from the Crate Washers and FO Tank and feed to the boiler feed water tank by installing a proper condensate recovery system at temperature above 90°C. It is recommended to install Pressure Powered Pump Packaged Unit (PPPPU) for efficient condensate recovery. Condensate recovery thro' Pressure Powered Pump Package Unit (PPPPU) Pressure Powered Pump Package Unit is recommended for efficient collection and easy handling to lift the condensate without the use of electricity. The Pressure Powered Pump operates on motive steam pressure. The steam consumption is approx. 3kg per 1000 kg of condensate pumped. Every 1 bar (g) of inlet pressure can lift the condensate to a height of +approximately 9m. The Pressure Powered Pump can operate with a minimum pressure of 0.35 bar (g) to a maximum of 8.7 bar (g), without any adjustment. Condensate can be pumped at 95 deg c to the boiler feed water tank which will increase the feed water temperature and result in monetary savings Recovery of flash steam – 10% Flash steam contains almost equal amount of energy as there in 90% of the condensate. recovery & Flash vessel for flash steam recovery before the PPPPU. Advantages will be avoiding the loss of pure water and avoiding the heat loss in the condensate, thereby raising the feed water temperature and quality.

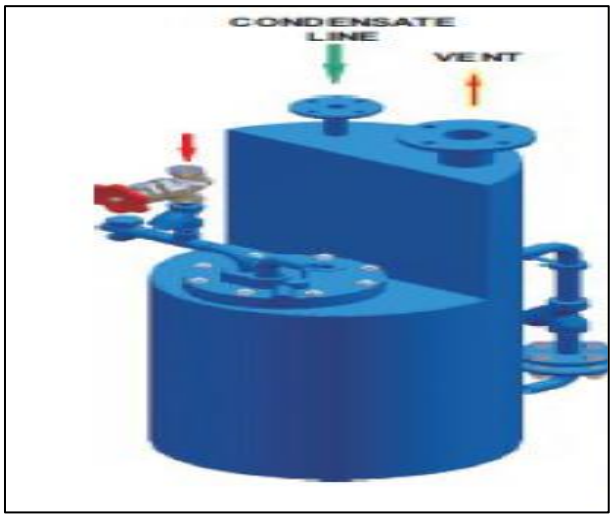

Figure 13: Compact Condensate Pump

3.3 Supplier Details

Table 9: Supplier Detail

Equipment Detail	Steam Trap and Condensate Recovery System
Supplier Name – Quotation attached in annexure	Forbes Marshall
Address	Forbes Marshall Pvt Ltd Pune – 411 034
Contact Person	Mr. Rupesh Bhawsar
Mail Id	rbhawsar@forbesmarshall.com
Phone No	+91 8980024819

Supplier Name	Thermax Pvt Ltd
Address	Thermax Pvt Ltd 410, Mahakant Complex Mavlankar Marg, Ahmedabad - 380006
Contact Person	Mr. Jainak Patel
Phone No	+91 9426464977

3.4 Savings

The expected fuel savings by modification of steam system 29,077 kg of FO anually. The annual monetary saving for this project is ***Rs 10.76 Lakhs with an investment of Rs 11.35 lakhs and payback for the project is 13 months.***

Detailed savings calculations is given in below table

Table 10: Savings Calculation Condensate Recovery from CIP and FO tanks and Crate Washer

Parameters	UOM	
Feed Water Temperature	°C	55
Condensate Available	kg/hr	300[1]
GCV of fuel	kCal/kg	9800
Fuel Cost	Rs/kg	37
Condensate Pressure at trap inlet	kg/cm2 (guage)	1
Condensate Temperature before trap	°C	119.62
Enthalpy of Condensate @ 1kg/cm2g	kCal/kg	119.87
Existing Feed Water Temperature	°C	55
Total heat available for recovery	kCal/hr	19461.00
Boiler Efficiency	%	79[2]
Fuel Savings	kg/hr	2.51
Operating hrs	hrs/day	20
Operating days	days	330.00
Annual Fuel Savings	Kg of FO	16590.36
Annual Monetary Savings	**Rs Lakhs**	**6.00**
Investment	**Rs Lakhs**	**7.13**
Pay Back	**Months**	**14**

Table 11: Savings Calculation for SOPT Trap - CIP Heat Exchanger

Parameters	UOM	
Orifize Size	mm	5
Operating Pressure	bar	3.5

[1] Estimated figure
[2] Measured Boiler Efficiency

Steam loss through orifice	kg/hr	30
Considering 50% live steam leakage	kg/hr	15
Enthalpy of steam at 3.5 bar	kCal/kg	651
Total heat loss	kCal/hr	9765
GCV of Fuel	kCal/kg	9800
Boiler Efficiency	%	79
Fuel Loss	kg/hr	1.26
Operating hrs	hrs	3300
Annual Fuel Savings	kg	4162.297
Fuel Cost	Rs/kg	37
Monetary Savings	**Rs Lakhs**	**1.54**
Investment	**Rs Lakhs**	**1.51**
Pay Back	**Months**	**12**

Table 12: Savings calculation of trap leak at 4 CIP Tanks and FO tank

Parameters	UOM	
Orifize Size	mm	3
Operating Pressure	bar	3.5
Steam loss through orifice	kg/hr	12
Considering 50% live steam leakage	kg/hr	6
Enthalpy of steam at 3.5 bar	kCal/kg	651
Total heat loss through one trap	kCal/hr	3906
Total heat loss through five trap	kCal/hr	19530
GCV of Fuel	kCal/kg	9800
Boiler Efficiency	%	79
Total Fuel loss	kg/hr	2.52
Operating hrs	hrs	3300
Savings	kg	8324.593
Fuel Cost	Rs/kg	37
Monetary Savings	**Rs Lakhs**	**3.08**
Investment	**Rs Lakhs**	**2.71**
Pay Back	**Months**	**11**

4. FINANCIAL ANALYSIS

4.1 Project Cost

Table 13: Project Cost

Parameter	Amount in Rs Lakhs
Forbes Marshall make Steam operated Pumping Trap – 5 kL CIP Heat Exchanger	1.257
Forbes Marshall make Two orifice Float Trap – 4 Nos CIP & 1 FO Tank	2.255
Condensate Recovery System – 2 Nos Crate Washer and 1 No FO tank	4.564
Other Accessories – Deaerator Head and DCV	1.356
GST @18%	1.69
Packing and Transportation @ 2.5%	0.23
Total Project Cost	**11.35**

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 14: 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	11.35							
Energy Savings		10.76	10.97	11.19	11.42	11.65	11.88	12.12
O&M Cost		-0.57	-0.57	-0.57	-0.57	-0.57	-0.57	-0.57

Depreciation		4.5	2.7	1.63	1.0	0.6	0.4	0.2
Net Cash Flow	-11.35	14.73	13.13	12.26	11.83	11.67	11.66	11.76

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

Table 15: 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 16: 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)	-11.34	13.3	10.8	9.1	8.0	7.1	6.4	5.9	49.3
NPV at CS 2 (50:50)	-11.34	13.2	10.5	8.8	7.6	6.7	6.0	5.4	46.9
NPV at CS 3 (100% Equity)	-11.34	12.8	9.9	8.1	6.8	5.8	5.0	4.4	41.5

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 17: Sensitivity analysis: based on energy savings

Based on Savings	at 100% Savings	at 75% Savings	at 50% Savings
NPV at CS 1 (D70:E30)	49.3	35.7	22.1
NPV at CS2 (D50:E50)	46.9	31.5	19.2
NPV at CS3 (D0:E100)	41.5	29.7	18.0
IRR	121%	95%	68%

Table 18: 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)	49.3	43.9	38.4

NPV at CS2 (D50:E50)	46.9	41.7	36.5
NPV at CS3 (D0:E100)	41.5	36.8	32.1
IRR	121%	111%	100%

Table 19: 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)	51.7	50.7	50.3	49.32	48.86	48.40

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

5.2 FI Schemes in Gujarat

Table 20: 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 EESL	Mr Chandan SIDBI, Bhavan, Ist Floor, P.B.No. 10, Navjivan P.O., Ahmedabad. Ph No : 0562-2521023 Mail Id: ahmedabad@sidbi.co.in

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 accessed for single or aggregated investments.	• 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 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 modifying steam system would result in annual fuel savings of 29,077 kg of FO which is equivalent to 28.50 TOE per annum. The proposed EE measure will result in decrease of CO_2 emissions by 89.33 TCO_2 annually, thus resulting in reduced GHG effect.

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 upskilling 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 traps and condensate recovery system has been prepared after the OEM came to the dairy and done a detailed feasibility study. The implementation of this measure will significantly will result in an annual fuel savings of 29,077 kg of FO with 89.33 TCO_2 reduction. The following table gives the overall summary of the savings achieved:

Table 21: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings		Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	Annual TCO_2 reduction
		FO (kg)	TOE				
1	Modification in Steam System	29,077	28.50	10.76	11.35	13	89.33

The summary of financial analysis given in the below table clearly indicates that implementation of this project is economically and financially viable with an attractive payback period. So it is recommended to modify the steam system by replacing old traps and installing condensate recovery system.

Table 22: Financial Analysis

Sl. No.	Particulars	Unit	Value
i	Total Investment (Incl of Tax)	Rs. Lakh	**11.35**
ii	Means of Finance	Self / Bank Finance	**Self**
Iii	IRR	%	**121.07**
Iv	NPV at 70 % Debt	Rs. Lakh	**49.32**

7.1 Replication Potential

Trap modification and condensate recovery has a huge potential in dairy industry. If the trap is not selected properly it can lead to steam leakage and thereby it result in huge amount of boiler fuel loss. Similarly it is always recommended to recover all the condensate from the process and use this condensate for several hot water applications within the plant itself. The implementation of this project will inspire other units 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

FORBES MARSHALL

Steam Survey Report

Date: 17th April 2018

Customer:
Sarvottam Chilling Center (Bhavnagar)

FORBES MARSHALL

FORBES MARSHALL PVT. LTD.
PUNE 411 034
INDIA
Tel: +91-8980024819
Email: rbhawsar@forbesmarshall.com

FORBES MARSHALL

Sr. No.	Description	Location	QTY	Unit Price (Rs.)	TOTAL Price (Rs.)
1.	**Forbes Marshall make Steam operated Pumping Trap** with accessories TD Trap, 15&40 NB Strainers, DCV, Air Vent Size – 40NB X 25NB	For 5KL CIP Pasteurizer	1 Nos	1,25,750/-	1,25,750/-
2	**Forbes Marshall make Two orifice Float Trap** Size – 20 NB, NIBR Built in Zero leakage Piston Inlet valve, bypass valve, outlet valve, strainer and non-return valve End Connection – Flanged End	For 4 nos CIP tank & 1 Nos FO Heating tank	5 Nos	45,100/-	2,25,500/-
3	**Forbes make condensate recovery Pump** Size – 25 NB with Receiver Isolation Valve, Strainer, Inlet Disc Check valve Outlet Disc Check Valve Motive Steam / Air Isolation valve with Strainer	For CIP Pasteurizer, 2nos Crate Washer & 1 No FO Heating tank	3 Nos	1,52,150/-	4,56,450/-
4	**Forbes Marshall make Deaerator Head** Size – 150 NB For Feed water Tank With – Vacuum Berker, Air Vent MOC- SS 316	For the Feed water Tank	1 Nos	95,650/-	95,650/-
5	**Forbes Marshall make DCV** Size – 25 NB End Connection – Sandwich type	For the Condensate Line hook up	5 Nos	8,000/-	40,000/-
	Grand Total				**9,43,350/-**

Terms and Condition

Prices	:	Ex. Pune Exclusive of Taxes & duties
P & F	:	Extra @ 2.5%
Terms of Payment	:	30% Advance and balance against Proforma Invoice prior to dispatch.
GST	:	Extra @18 %
Freight	:	Extra At actual.
Delivery	:	6-8 Weeks after the receipt of PO
Ordering Information	:	Please raise your Purchase Order in the name of "Forbes Marshall Private Limited, Chakan , Pune"