August 2018

DETAILED PROJECT REPORT ON BIO GAS REACTOR

M/s Amul Fed Dairy, Gandhi Nagar – 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

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List of Abbreviations

AFDG	Amul Fed Dairy Gandhinagar
BEE	Bureau of Energy Efficiency
CS	Capital Structure
°C	°Celsius
CO_2	Carbon dioxide
DPR	Detailed Project Report
EE	Energy Efficiency
FI	Financial Institution
GCMMF	Gujarat Cooperative Milk Marketing Federation
GEF	Global Environmental Facility
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
RE	Renewable Energy
SBI	State Bank of India
SIDBI	Small Industrial Development Bank of India
TOE	Tonnes of Oil Equivalent
UNIDO	United Nations Industrial Development Organisation
WACC	Weighted Average Cost of Capital

ACKNOWLEDGEMENT

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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	Amul Fed Dairy , Gandhinagar
Name(s) of the Plant Head	Mr. R S Sodhi, Managing Director
Contact person	Mr. Prashant Seth
Constitution	Cooperative Society
MSME Classification	Large Scale
Address:	Plot No 35, Gandhinagar- Ahmedabad Road ,Bhat , Gujarat
Industry-sector	Dairy

1.2 Proposed EE Measure

After the discussion with the plant team, it has been decided to install bio gas reactor to process the canteen food waste and generate energy. 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
		kg LPG	TOE				
1	Installation of Bio Gas Reactor	9,000	10.65	4.79	11.12	28	26.82

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	**11.12**
ii	Means of Finance	Self / Bank Finance	**Self**
Iii	IRR	%	**62.31**
Iv	NPV at 70 % Debt	Rs. Lakh	**19.19**

2. INTRODUCTION ABOUT AFDG

2.1 Unit Profile

Amul is the apex organisation of the Dairy Cooperatives of Gujarat which aims to provide remunerative returns to the farmers and also serve the interest of consumers by providing quality products which are good value for money. AFDG was established with the objective of receiving of "Surplus Milk" from the Member Unions Cooperative Dairies of Gujarat State and convert it to milk products and also to supply milk round the year to meet liquid milk market demand of Ahmedabad and Saurashtra.

Table 4: Unit Profile

Particulars	Details
Name of Plant	Amul Fed Dairy , Gandhinagar
Name(s) of the Plant Head	Mr. R S Sodhi, Managing Director
Contact person	Mr. Prashant Seth
Contact Mail Id	prashant.sheth@amul.coop
Contact No	07574802084
Constitution	Cooperative Society
MSME Classification	SME
No. of years in operation	72
No of operating hrs/day	24
No of operating days/year	360
Address:	Plot No 35, Gandhinagar- Ahmedabad Road ,Bhat , Gujarat
Industry-sector	Dairy
Type of Products manufactured	Milk ,Ghee, Dahi, Butter milk, Powder

2.2 Production Details

The various products manufactured in AFDG dairy are liquid milk, butter milk, flavoured milk, lassi, ghee and ice cream. The graph below shows the milk processed during last one year

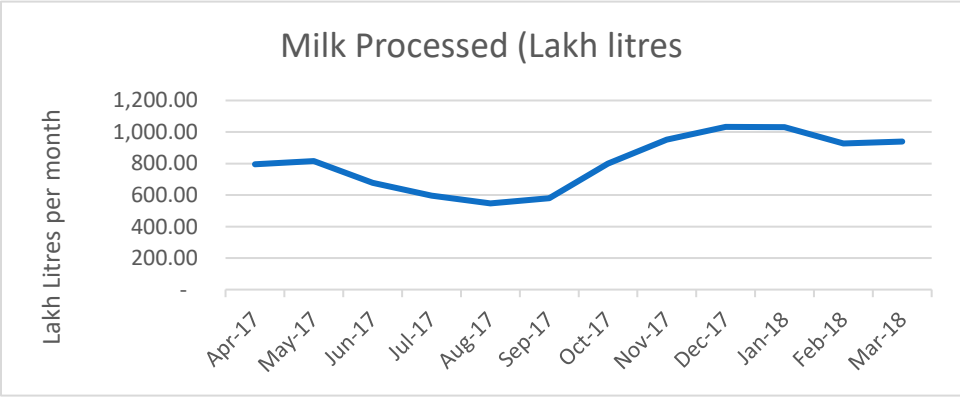

Figure 1: Milk Processed

2.3 Typical Dairy Process Flow Diagram

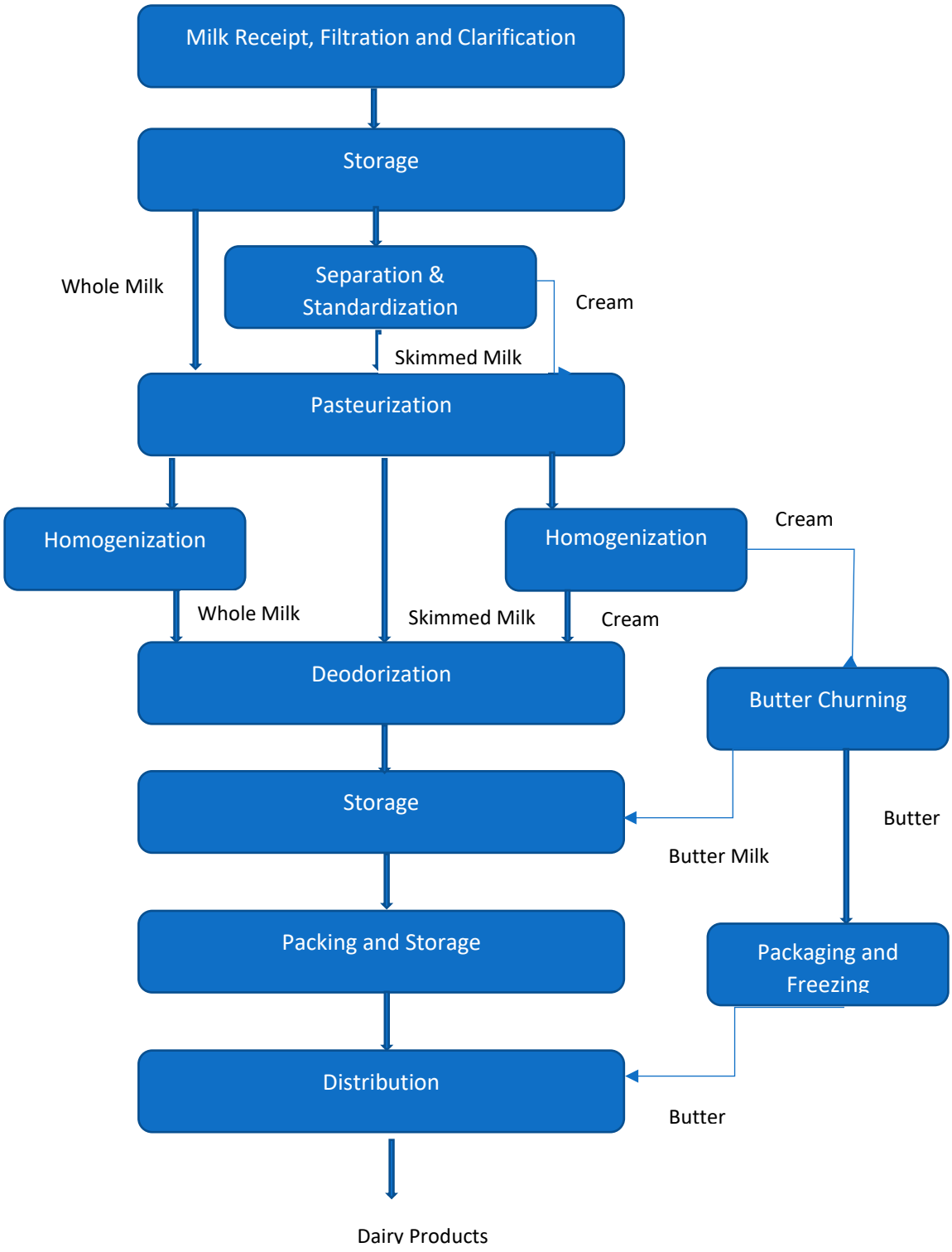

Figure 2: Typical process flow of Milk manufacturing

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.

The table below shows the production capacity of various section in plant.

Table 5: Production Capacity

Sl No	Product	UOM	Quantity
1	Milk Processing	Lakh Litres per Day	32
2	Milk Packaging in Poly Pouches	Lakh Litres per Day	12
3	Ghee Manufacturing and Packaging	MT/day	60
4	Milk Powder Manufacture and Packaging	MT/day	160
5	Ice Cream Manufacture and Packaging	KL/day	150
6	UHT Processing and Expecting Packaging in Tetra Pack	KL/day	600
7	Frozen Pizza Manufacturing and Packaging	Pieces/day	15000
8	Cultured Milk Product	Tons/day	4

9	UHT Processing and Aseptic Packaging in Pet Bottle	KL/day	100
10	Butter Plant	Tons/day	40

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
1	Electricity	Rs./kWh	7.90	
2	Natural Gas	Rs/SCM	27	8750
3	Bio gas			

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	Electricity Consumption (kWh)	Fuel Consumption – NG (SCM)	Bio Gas from ETP (SCM)
Apr-17	54,19,313	9,96,870	1,25,200
May-17	58,06,800	10,33,427	1,33,200
Jun-17	49,87,540	7,38,025	1,27,700
Jul-17	41,65,900	6,76,852	1,17,960
Aug-17	42,33,800	5,47,415	1,26,000
Sep-17	42,58,080	6,20,058	1,21,500
Oct-17	49,06,300	10,05,865	1,30,000
Nov-17	49,75,852	13,03,072	1,32,680
Dec-17	49,07,600	14,46,200	1,13,750
Jan-18	52,30,000	14,92,005	1,09,200
Feb-18	50,98,700	13,24,665	1,25,200
Mar-18	58,35,200	14,03,537	1,27,000
Total	**5,98,25,085**	**1,25,87,990**	**14,89,390**

The major form of energy used in the plant is electricity which is from UGVCL grid. For thermal plant is using NG as the major fuel and also Bio gas from ETP. The percentage share of fuel cost is shown below:

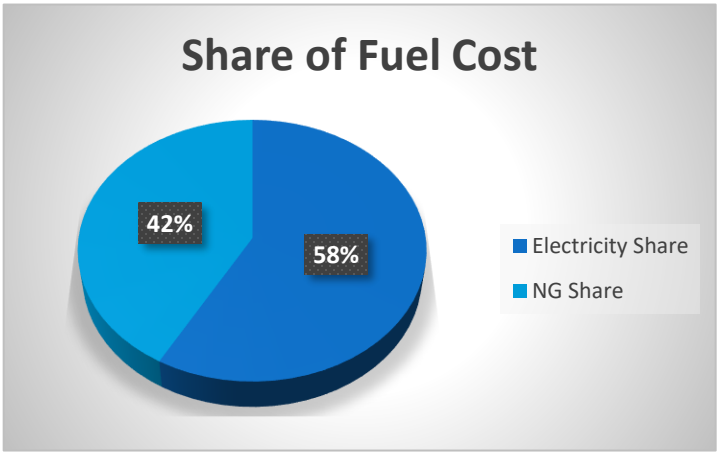

Figure 3: Share of fuel cost

Based on the data collected from the plant, the graph above shows the variation of fuel cost over the last one year. Average electricity cost is Rs 3.93 Crore/month whereas the average thermal energy cost is Rs 2.83 Crore/month.

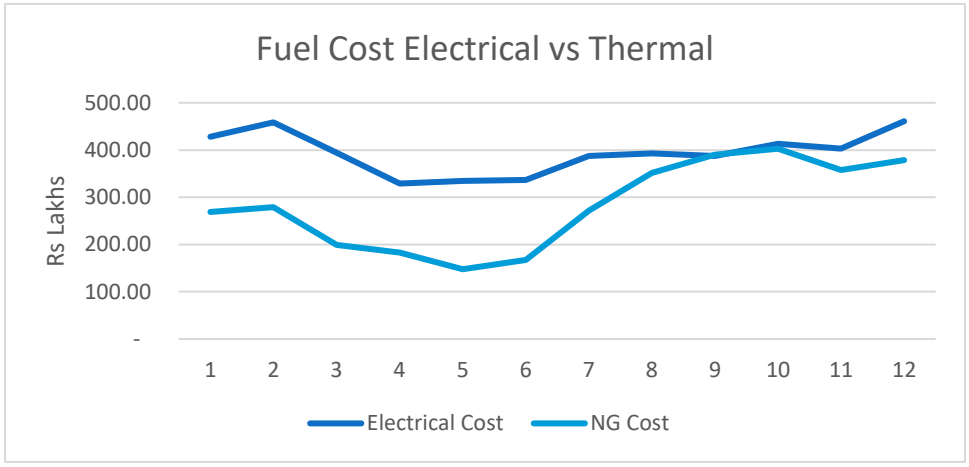

Figure 4: Fuel Cost Electrical vs Thermal

3. PROPOSED EE MEASURE – BIO GAS REACTOR

3.1 Present System

The plant is having a canteen which is catering food to around 600 employees in the plant. Currently for all the cooking purposes bio gas from the ETP and LPG is used as fuel for cooking. The average amount of food waste generated per day from the canteen is 500 kg. The food waste generated from the canteen is disposed outside.

However, the canteen waste been organic in nature and high in organic content it can be converted into biogas and manure using an anaerobic digestion process. The anaerobic digestion process would address two aspects – generation of Non-fossil fuel-based energy and the avoidance of waste going to landfill. The biogas generated can be further purified and can substitute the use of LPG in the canteen and the manure generated from the process can be used for gardening process. Recently there have been many developments in Biogas digestion technologies and the economics have also improved substantially. With rising fossil fuel price and especially LPG, the installation of Bio-digesters to generate biogas can be good substitute of conventional source of energy and would result in both environment and economic benefits to the company.

3.2 Recommendation

Most commonly used models are fixed dome reactors, floating drum reactors and off late there has development of few mild steel-based digesters. There has not been much innovation in the design during the past several years. With the older designs usage of mild steel and concrete also adds up to cost of the digester. One of the main challenges has been the developing digesters with simplicity in operation and maintenance. Mild steel digesters have major challenges such as rusting due to H2S content in the biogas and exposure to wet weather conditions among other problems.

It is recommended to install Bio gas plant which is a fabric-based bio gas technology for processing 500 kg food waste daily. This technology would process all the canteen waste that is generated inside the plant rather than disposing it outside.

Figure 5: Fabric used for biogas

The schematic layout of the proposed system is given below.

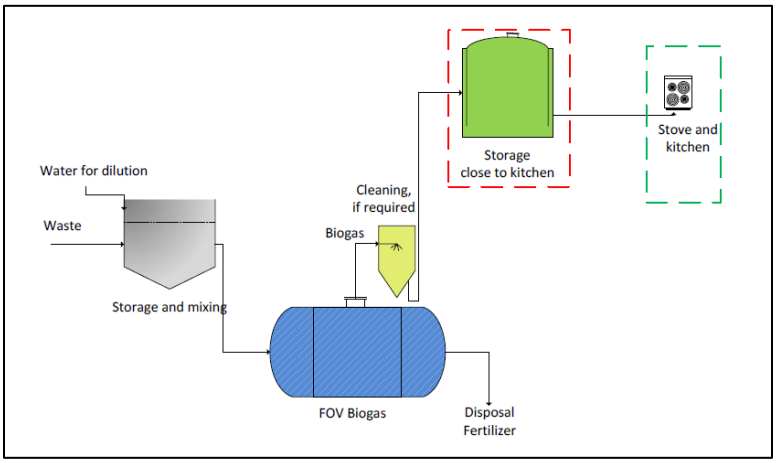

Figure 6: Layout of FOV Bio Gas Technology

Biogas plant will be initially loaded with active inoculum to start the process. After the initial loading is complete, 500kgs of food waste is mixed with 500 litres of water to reach slurry form by feeding in a crusher. The slurry will be fed in to a feeding tank. The organic waste from feeding tank will be fed in to a 50 m^3 biogas reactor. The reactor will have 30 m^3 liquid space and rest 20 m^3 gas storage space. The additional gas generated can be stored in a gas holder. 1 m^3 of diluted organic waste in a slurry form will be fed in to the reactor every day. The excess liquid slurry coming out of the digester can be re-circulated back as a replacement for fresh water.

On an average, the reactor will have a 30 days retention time. Under optimized running conditions the biogas plant will generate about 50$m^{3[1]}$ of biogas per day. The feeding and digestate collection is a continuous process. The biogas generated will be piped to the kitchen and used for cooking by using biogas burners. The total area required for the biogas plant is about 80 m^2 space. The design of the biogas plant can be adjusted according to the space availability.

Benefits of new system

- Plug and flow digester (no settlement of sludge, natural mixing of organic waste)
- Low operations and maintenance costs
- No rusting unlike other designs which are made of mild steel for digester tanks and for gas collection

[1] Guaranteed by supplier

- No moving parts used for feeding, mixing and sludge outflow as all the operations are based on natural gravity-based process. Very low captive power consumption for operating the digester
- In built gas space at the top of digester which can hold up to 50% of total gas generated.
- Highest material quality

3.3 Supplier Details

Table 8: Supplier Detail

Equipment Detail	500 kg Processing Bio Gas Plant
Supplier Name[2]	FOV Bio Gas India
Address	FOV Bio Gas India 420 CDS Apartment, Tansi Nagar Velachery , Chennai Pin 600042
Contact Person	Mr. Jospeh Arulappan
Mail Id	joseph@nordcleantech.com

3.4 Savings

The expected energy savings by installation of Bio Gas technology is 9000 kg of LPG annually with energy reduction of 10.65 TOE/year. The annual monetary saving for this project is ***Rs 4.79 Lakhs with an investment of Rs 11.12 lakhs and payback for the project is 27 months.***

Detailed savings calculations are given in below table

Table 9: Savings Calculation

Parameters	UOM	Existing System	Proposed System
Canteen waste generated per day	kg	500	500
LPG used per day	kg	25	NIL
Gas Potential from 500 kg waste	m^3/day	50	50
Operating days/annum		360	360
Annual Energy Savings	kg LPG	-	9000
LPG Cost	Rs/kg	53.23	53.23
Annual Cost Savings	Rs/lakh	-	4.79
Investment	Rs/lakh	-	11.12
Payback	Months	-	27

[2] Bio Gas reactor is a unique technology supplied by FOV Bio Gas India only

4. FINANCIAL ANALYSIS

4.1 Project Cost

Table 10: Project Cost

Parameter	Amount in Rs Lakhs
Bio Gas Plant Cost	9.42
GST @18%	1.69
Total Project Cost	**11.12**

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 11: 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	11.12							
Energy Savings		4.79	4.89	4.98	5.08	5.19	5.29	5.40
O&M Cost		-0.56	-0.56	-0.56	-0.56	-0.56	-0.56	-0.56
Depreciation		4.4	2.7	1.60	1.0	0.6	0.3	0.2
Net Cash Flow	-11.12	8.68	7.00	6.03	5.49	5.21	5.08	5.05

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

Table 12: 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 13: 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)	-11.12	7.9	5.7	4.5	3.7	3.2	2.8	2.5	19.2
NPV at CS 2 (50:50)	-11.12	7.8	5.6	4.3	3.5	3.0	2.6	2.3	18.1
NPV at CS 3 (100% Equity)	-11.12	7.5	5.3	4.0	3.1	2.6	2.2	1.9	15.5

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 14: Sensitivity analysis: based on energy savings

Based on Savings	at 100% Savings	at 75% Savings	at 50% Savings
NPV at CS 1 (D70:E30)	19.2	13.1	7.1
NPV at CS2 (D50:E50)	18.1	11.1	5.6
NPV at CS3 (D0:E100)	15.5	10.3	5.0
IRR	62%	48%	33%

Table 15: 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)	19.2	16.8	14.3
NPV at CS2 (D50:E50)	18.1	15.7	13.4
NPV at CS3 (D0:E100)	15.5	13.4	11.3
IRR	62%	57%	51%

Table 16: 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)	20.3	19.9	19.6	19.19	18.97	18.76

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 17: 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 schemes from various banks (SBI, Bank of Baroda, and 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 installing Bio Gas Plant for processing food waste would result in annual LPG savings of 9,000 kg which is equivalent to 10.65 TOE per annum. The proposed EE measure will result in decrease of CO_2 emissions by 26.82 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 unit 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 on for installation of Bio Gas Plant has been prepared after the OEM came to the dairy and done a detailed feasibility study. This measure will result in an annual LPG savings of 9,000 kg of LPG which is equivalent to 10.65 TOE/year with 26.82 TCO_2 reduction. The following table gives the overall summary of the savings achieved:

Table 18: Proposed EE Measure

Sl No	EE Measure	Annual Energy Savings		Monetary Savings (Rs. Lakhs)	Investment (Rs. Lakhs)	Payback (Months)	AnnualTCO_2 reduction
		Kg LPG	TOE				
1	Installation of Bio Gas Reactor	9,000	10.656	4.79	11.12	28	26.82

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 install bio gas reactor to process canteen waste.

Table 19: Financial Analysis

Sl. No.	Particulars	Unit	Value
i	Total Investment (Incl of Tax)	Rs. Lakh	**11.12**
ii	Means of Finance	Self / Bank Finance	**Self**
Iii	IRR	%	**19.19**
Iv	NPV at 70 % Debt	Rs. Lakh	**62.31**

7.1 Replication Potential

Most of the units in Gujarat Dairy cluster have big canteens for their employees, so the concept of Bio gas reactor has a huge replication potential in the cluster. Also the bio gas technology can be also installed in all ETPs of dairy plant to capture the methane and thereby producing energy. 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

FOV Biogas
Swedish cleantech
rethinking biogas technology

PROJECT PROPOSAL FOR SETTING UP BIOGAS REACTOR USING

500 KGS OF FOOD WASTE PER DAY

2018-01-22

Submitted by

FOV BIOGAS INDIA PVT.LTD

Chennai

3. Scope of supplies and pricing

Nos.	Scope of Supplies and services
1	FOV Biogas Digester 50 m^3 (30 m3 liquid space and 20 m3 gas space)
2	Crusher for the food waste
3	Electrical cables and panel for food waste crusher
4	Moisture trap for gas pipe line connecting the digester
5	Biogas blower for pressurizing the gas
6	Piping works (inlet and outlet connections) 4 meters in total
7	FOV will provide gas piping connections to kitchen up to 10m distance from biogas plant. (If longer than 10m customer shall bear the cost for extra distance of piping works)
8	1 Unit of canteen type biogas burner

Project costs

Total project cost (excluding applicable taxes) - Rs. 9.42 lakhs (Nine lakhs and forty two thousand only)

4. Project timeline, terms and conditions

Activity	No. of working days
Ground works (Client scope) under FOV Supervision	2
Digester installation (FOV Scope)	1
Digester loading (FOV Scope)	1
Commissioning (FOV Scope)	1
Total	5

Payment Terms:

1. 55 % advance along with order
2. 45 % before dispatch
3. Validity: This quotation is valid for a period of 30 days.
4. Delivery: 4 to 5 Weeks from date of your order & advance received.
5. Taxes and duties as per government rules

6. Scope of Customers

1. Level and clear site for executing the works including pit formation for placing the digesters
2. Plant and area lighting with approach road.
3. Necessary 3 phase power connection for erection and installation of plant at actual work location.
4. Required water supply during construction and testing
5. Safe & secure facility for storing material and equipment.
6. Continuous availability organic segregated feedstock during testing and commissioning
7. Non-availability of feedstock due to any reason shall not be a limiting factor for payment to FOV and/or its partners and no payment shall be stopped on this account.
8. Drilling works for piping or electrical works on restricted area within the customer premises shall be carried out by the customer under supervision of FOV engineers.
9. Any civil works will come under customer scope
10. Cow dung for initial loading to be arranged by customer. Labor for feeding the initial cow dung will come under customers' scope.
11. Accommodation and travel costs for 2 Engineers

If you have questions, please don't hesitate to contact us

Yours sincerely
Joseph Arulappan
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