Baseline Audit Report

Baby Marine International

Thoppumpady, Cochin-682005, Kerala, India

BEE's National Program on Energy Efficiency in SMEs Kochi (Sea Food) cluster in XII plan

TÜV SÜD South Asia Pvt. Ltd.

May, 2016

Acknowledgement

TUV SUD South Asia Pvt. Ltd. is thankful to **Bureau of Energy Efficiency (BEE), Ministry Of Powe**r for providing us an opportunity to conduct Baselineaudit in five units of Kochi Seafood Processing Cluster under the BEE SME Programme. We express our sincere Gratitude to the following officials of BEE

Shri Dr. Ajay Mathur –Director General

Shri Sanjay Seth– Secretary

Shri Milind Deore – Energy Economist

Shri Tarun Dixit – Project Engineer

We are extremely grateful to the officials of the **Seafood Exporters Association of India (SEAI)** for their support and cooperation. We extend

Our special thanks to **Mr. S. Ramakrishnan, Secretary of the SEAI** and **Mr. Alex Ninan, Vice President of the SEAI**.

We thank the **Baby Marine International** owner and their staffs for their support and cooperation during the baseline audit study.

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Executive Summary

1. Unit Details

Unit Name	**Baby Marine International**
Address	Thoppumpady, Cochin-682005, Kerala, India
Contact Person	Alex K. Ninan/Mr. Surendran
	Phone:0484-2231251/54
Products	Sea Food processing
Production	8 MT (average) Per Day
DIC Number	320081206079
Bank Details	Current Account No. 519201010012001 Union Bank of India, Overseas Branch, M. G. Road, Ernakulam - 682035 KERALA IFSC : UBIN0551929 MICR : 682026023
TIN / PAN No.	TIN: 32020808264
	PAN: AAAFB9937F
Contract demand	450 KVA

2. Existing Major Energy Consuming Technology

The major equipments in a typical seafood processing unit are compressors, condensers, cooling towers, freezers, ice making units, and the motors connected to these equipment . Compressors are the major energy consuming equipment in these seafood processing units.

Cold storage :

After packing frozen material product will keep in cold storages at -18deg C temperature. Baby marine is having total 2 cold storages to keep products in required temperatures they installed 5 FCU 's . R22 which is the commonly used as coolant in the FCU's .

3. Proposed Energy Saving Technologies with Cost Economics

Identified technology up gradation proposals

- Replacement of reciprocating compressor with Screw compressor with VFD
- Replacement of water cooled condenser with Evaporative condenser

- Installation of variable frequency drive for condenser water pumps
- Installation of THERMOSHIPON SYSTEM (GAS COOLING) for Compressor.
- Automation of refrigeration plant by using PLC controller

Cost Economic Analysis :

S No	Recommendation	Annual Savings in kWh	Savings in Rs	Investment in Rs	Payback in Years
1	Replacement of reciprocating compressor with Screw compressor with VFD	232578	1448961	2360000	1.63
2	Replacement of water cooled condenser with Evaporative condenser	170820	1195740	2500000	2.09
3	Installation of variable frequency drive for condenser water pumps	15768	99338.4	125000	1.26
4	Installation of THERMOSHIPON SYSTEM (GAS COOLING) for Compressor.	50589	315169	700000	2.22
5	Automation of refrigeration plant by using PLC controller	126472.5	787924	1400000	1.78
	Total	596228	3847132	7085000	1.8

Identified Energy Saving Proposals:

- Proper maintenance of condenser coil
- Proper insulation of identified insulation damaged areas.

Cost Economic Analysis :

S No	Recommendation	Annual Savings in kWh	Savings in Rs
1	Proper maintenance of condenser coil	3-5% savings	
2	Proper insulation of identified insulation damaged areas.	1-2 % savings	

OBJECTIVE OF BEE SME PROGRAM

The BEE SME Program aims to improve Energy Efficiency (EE) in SME sector by technological interventions in the various industrial clusters in India. The EE in SMEs is intended to be enhanced by helping the industries in the 25 energy intensive SME clusters by:

- Technology interventions
- Implementation of EE measures and projects in clusters, and
- Capacity building for improved financial planning for SME entrepreneurs

The program also aims at creating a platform for dissemination of the appropriate practices and the appropriate technologies available in the market for energy efficiency and conservation, to create awareness in the clusters, and to demonstrate the new technology interventions/ projects to stimulate adoption of similar technology/projects in the clusters. The BE E SME program has been designed in such a way that it addresses the specific needs of the industries in the SME sector for EE improvement and to overcome the common barriers in the implementation of EE technologies in cluster through knowledge sharing, capacity building, and development of innovative financing mechanisms.

The major activities for which we need to give support to BEE's National Program on Energy Efficiency in SMEs Kochi (Sea Food) cluster in XII plan are:

- Conducting pre-activity cluster workshop.
- Conducting initial Baseline audits to get an overview of the technology presently existing in the Seafood processing units in Kochi.
- Identify areas of energy saving, both without & with investment and propose to BEE two energy efficient process technologies.
- Identify at least 5 Local technology/ service providers for the above technologies in the cluster
- Identify 20 SME units willing to implement and demonstrate the above two technologies
- Assist BEE to enter into a contract with each of the 20 shortlisted SME units
- Conduct comprehensive Baseline Energy Audits in 20 SME units
- Development of technology specific case studies for each technology
- Preparing Best Operating Practices(BOP) document for the top 5 energy using equipment/ process
- Carry out post implementation energy audit in each of the above 20 units
- Verify and submit to BEE all the relevant documents of each participating unit
- Assist BEE in conducting five post energy audit training workshops

Brief about Unit

Baby Marine Group is sprinkled in the South Eastern and Western coasts of India, in the picturesque locations of the states of Kerala, Karnataka and Goa with its Head Office at Cochin, the commercial capital of God's own country. This Seafood Processing industry establishment is the creation of Mr. K.C. Ninan, the founder of Baby Marine Group since its inception in 1977. Now the Group has grown from strength to strength and made its mark in the Seafood business worldwide.

The management is headed by Mr. K.C. Ninan and his two sons, Alex and George who walk in stride with the changing world scenario and feel that the Seafood Industry in India is yet to unravel its best. The people at Baby Marine are proud to be the first to introduce the Organic Fresh Water Shrimp (Scampi) to the world.

Technology overview of typical sea food processing unit

1. Compressors :

It was noticed that reciprocating compressors are being used in the chilling unit. Reciprocating compressors consists of a piston moving back and forth in cylinder, with suction and discharge valves to achieve suction and compression of the refrigerant vapor. The suction side of the compressor is connected to the exit of the evaporator, while discharge side of the compressor is connected to condenser inlet. The performance evaluation of the compressors (KW/TR) should be done regularly in order to monitor the performance of the same.

2. Condenser :

It was observed at the time of audit the following type of condenser is being used in the plant:

1. Direct contact Water Cooled Condenser

The above mentioned condenser is being used in the HVAC system to the cool ammonia which is the commonly used coolant in the plant for freezers. The detailed analysis and performance evaluation of condenser will be discussed in refrigeration system chapter.

3. Freezers

It was noticed at the time of baseline audit that the following type of freezers are being used in the Baby Marine food processing unit.

i) Plate freezer
ii) Blast freezer
iii) Spiral Freezer

Plate freezer:

Plate freezer are commonly used for freezing brick shaped packaged products. In plate freezers, the refrigerant is allowed to circulate inside the thin channels within the plates. The packaged products are firmly pressed between the plates. High rates of heat transfer can be obtained between the packed product and the refrigerant plates

Blast Freezer:

Blast freezer is commonly used freezer in sea food processing unit in which blower is being used to supply the cold air over the product in order freeze the product. The temperature range are maintaining in the range of -40 deg C and the air speed over the product will be high, to get good heat transfer.

Spiral Freezer:

Spiral freezers operate using a mechanical conveyor system to pass food through a continuous freezing

process. Spiral freezers will allow food producers to;

- Freeze food products individually, or in set batches
- Adjust airflow and belt / conveyor speeds to allow increased freezing speeds depending on the production/cost requirements.
- Ensure the product is frozen quickly
- Ensure the product is frozen consistently
- Ensure the quality of the product is not impaired during the freezing process.

4. Other equipments:

In addition to the above processing equipment, ice making unit and chilled water base cooling systems are also being used in the plant for processing area cooling purpose.

Energy & Production Situation in the Unit

Energy scenario:

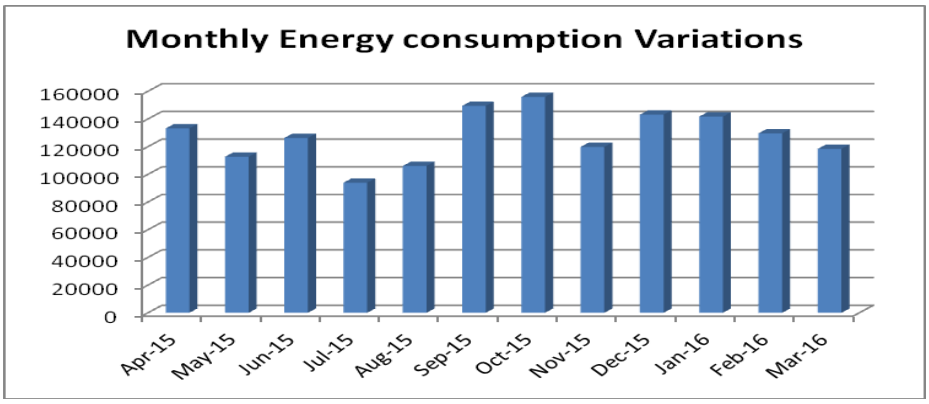
It was noticed during the course of audit, the electricity is drawn from the Kerala state electricity board (KSEB) and Diesel generators are being used in the plant as a back system to meet the demand in case of grid supply failure or scheduled power cut from the grid

Energy consumption of the plant

The primary source of energy is electricity and that is imported from the KSEB and diesel generators are being used as a back system during power failure. Month wise electricity consumption of the plant details are as follows:

S. No	Month & Year	CMD (KVA)	RMD (KVA)	KWh	KVAh	P.F	Total Bill(Rs)	P.F incentives/ penalty	Unit cost (Rs/KWh)
1	Apr-15	450	443	133194	142896	0.93	842019	-5230	6.32
2	May-15	450	344	112716	116916	0.96	696626	-8822	6.18
3	Jun-15	450	367	126294	132252	0.95	775685	-8225	6.14
4	Jul-15	450	393	93996	98088	0.95	549237	-7422	5.84
5	Aug-15	450	338	106074	111414	0.95	655698	-6848	6.18
6	Sep-15	450	449	149460	159060	0.93	925698	-7801	6.19
7	Oct-15	450	500	155940	167046	0.93	981977	-6083	6.30
8	Nov-15	450	433	119856	125910	0.95	763801	-7834	6.37
9	Dec-15	450	403	143106	151476	0.94	877328	-7460	6.13
10	Jan-16	450	488	141720	155946	0.90	917480	-1865	6.47
11	Feb-16	450	361	129642	132660	0.97	792907	-13640	6.12
12	Mar-16	450	468	118440	124848	0.94	775236	-7808	6.55
	Total			**1530438**	**1618512**		**9553692**	-89038	
	Avg			**127536.5**	**134876**	**0.94**	**796141**		**6.23**

The electricity consumption of the plant is varying from 0.93 lakh kWh/month to 1.55 Lakh kWh/month and average electrical energy cost for the plant is 6.23 Rs/kWh



Diesel Generators :

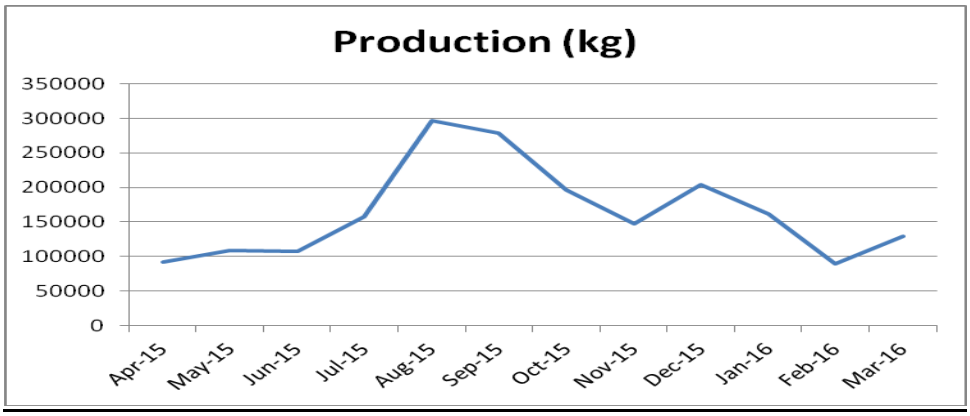
Diesel generators are being used in the plant as a back system to meet the demand in case of grid supply failure or scheduled power cut from the grid. Around 4320 liters diesel utilized in FY-2015-16. It is seems to be diesel consumption of plant is nominal only . as plant people are not maintaining any log book for diesel usage , so exact monthly consumptions details are not available at site.

Production scenario:

The following table shows the monthly wise production details of **Baby Marine International** for FY-2015-16.

S.No	Month & Year	Production (kg)
1	Apr-15	92117
2	May-15	108686
3	Jun-15	107390
4	Jul-15	157328
5	Aug-15	296471
6	Sep-15	279024
7	Oct-15	196683
8	Nov-15	147832
9	Dec-15	204588
10	Jan-16	161010
11	Feb-16	89824
12	Mar-16	128969
		1969922

Graphical representation of Production

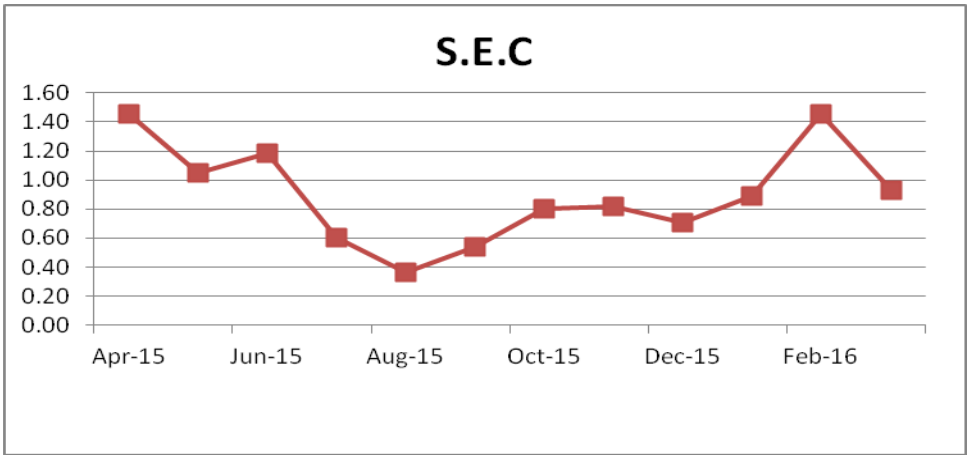


Specific Energy Consumption (SEC):

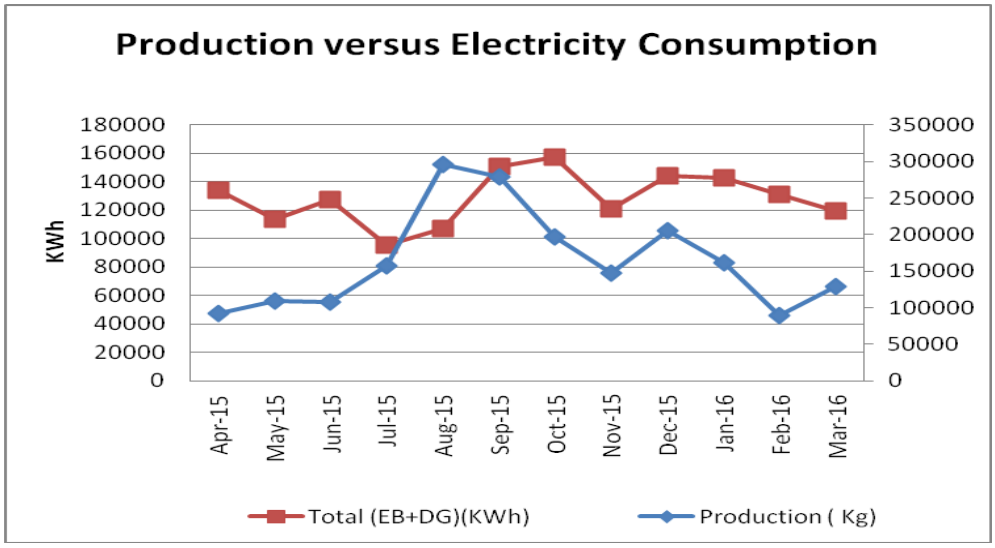
The specific energy consumption unit range from 0.36 kWh/kg of the product to 1.46 kWh/kg of the product

S. No	Month & Year	Production (Kg)	Total (EB+DG)(KWh)	S.E.C(KWh/Kg)
1	Apr-15	92117	134274	1.46
2	May-15	108686	113796	1.05
3	Jun-15	107390	127374	1.19
4	Jul-15	157328	95076	0.60
5	Aug-15	296471	107154	0.36
6	Sep-15	279024	150540	0.54
7	Oct-15	196683	157020	0.80
8	Nov-15	147832	120936	0.82
9	Dec-15	204588	144186	0.70
10	Jan-16	161010	142800	0.89
11	Feb-16	89824	130722	1.46
12	Mar-16	128969	119520	0.93
		1969921.5		**0.90**

Monthly Specific Energy consumption Variation for the year 2015-16



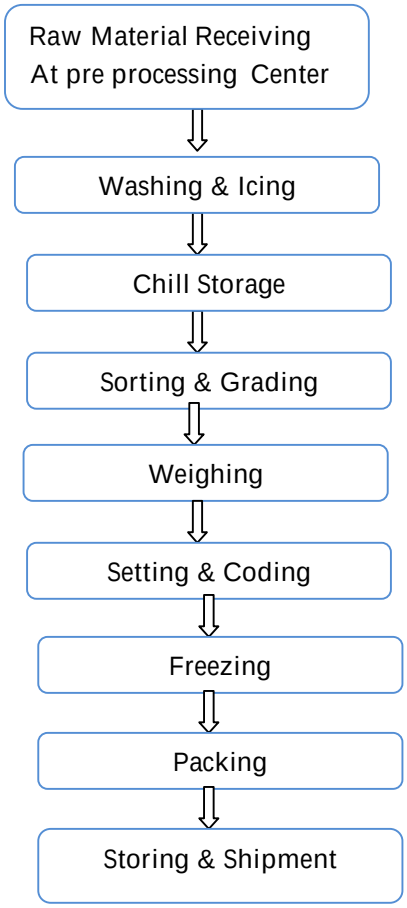
Monthly Variation in Production versus Electricity Consumption for the year 2015-16



Process flow diagram

For all of the units surveyed, the preprocessing of fish was done outside the units and the operations in the units started with the cleaning of preprocessed/ cleaned fish. While most of the units follow the general process of cutting, cleaning, grading, weighing, freezing, packing, and storing; the difference arise in the way fish is frozen and the freezers used for the purpose.

The typical process followed in the seafood processing industry is shown in the flowchart below.



From the flowchart, it can be inferred that the energy intensive steps in the process are the freezing and the storage. Freezing alone accounts for nearly 75% of all the electricity consumed in the unit.

Condenser Analysis

The major equipments in a typical seafood processing unit are compressors, condensers, cooling towers, freezers, ice making units, and the motors connected to these equipment . Compressors are the major energy consuming equipment in these seafood processing units.

Baby Marine have installed direct contact water cooled condenser in their HVAC system to cool the ammonia which is the commonly used coolant in the unit.

As a part of audit we conducted performance evolution of refrigeration system , there are 7 compressors installed in baby marine to meet the cooling load requirements.

		Design	Measured				
S.No	**Description**	**Rating(KW)**	**V**	**A**	**KW**	**P.F**	**KVA**
1	Compressor-1	45	Not working				
2	Compressor-2	45	Not working				
3	Compressor-3	45	420	85.5	59	0.92	64
4	Compressor-4	45	420	84	58	0.92	63
5	Compressor-5	55	Not working				
6	Compressor-6	75	Not working				
7	Compressor-7	75	Not working				

By the time of audit only one plate freezer is working, to estimate cooling load of freezer can be calculated using the formula given below:

Heat rejected at condenser = Cooling load + Work done by compressor

$$\text{Heat Rejected (TR)} = (\text{Evaporator TR}) + \frac{\text{kW}}{3.516}$$

$$\text{Heat rejected (TR)} = \frac{\text{Mc x } C_p \times (t_{wo} - t_{wi})}{3024}$$

Performance comparison of HVAC System

Condenser-Heat Rejected (TR)-Measured	65
Compressor (KW)-measured	89.76
Evaporator (TR)-Measured	40

Condenser water pumps :

		Design	Measured				
S.No	**Description**	**Rating(KW)**	**V**	**A**	**KW**	**P.F**	**KVA**
1	Condensor pump-1	5.6	391	8.5	5.03	0.87	5.78
2	Condensor pump-2	5.6	393	11	6.36	0.85	7.48
3	Condensor pump-3	5.6	395	10.5	6.17	0.86	7.18
4	Condensor pump-4	5.6	Not working				

Cold storage :

After packing frozen material product will keep in cold storages at -18deg C temperature. Baby marine is having total 2 cold storages to keep products in required temperatures they installed 5 FCU 's . R22 which is the commonly used as coolant in the FCU's .

Detailed analyses of units are given below:

S.No.	DESCRIPTION	Cold storage-1			Cold storage-2		Ante room
		Unit-1	Unit-2	Unit-3	Unit-1	Unit-2	Unit-1
1	Air density(Kg/m3)	1.29	1.29	1.29	1.29	1.29	1.29
2	Air flow(m3/h)	2258	1957	1686	1430	1851	1645
3	Supply air temp deg C	-13	-16	-14	-16	-15	4
4	Return air temp deg C	-7	-9	-7	-9	-8	6
5	TR	5.78	5.84	5.03	4.27	5.53	1.68
6	KW	6.45	6.70	6.13	5.90	6.20	2.10
7	KW/TR	1.12	1.15	1.22	1.38	1.12	1.25
8	COP	3.14	3.06	2.88	2.54	3.13	2.82

From the above table we can observe that Net refrigeration capacity of the HVAC system varies from 4.27 to -5.84 TR and 1.68 TR for ante room . Also the range in kW/ TR is observed to be little bit high . But the CoP varies from 2.8 to 3.14 .

Identified technology up gradation proposals

1. Replacement of reciprocating compressor with screw compressor with VFD

Present status:

Ammonia based reciprocating compressor is being used in plant for cooling purpose. Compressors are coupled with motor through V belt drive. There are total 7 compressors with different ratings details are given below:
1.60HP*4
2.100HP*2
3.75HP*1

Observation

- The specific energy consumption of reciprocating compressor is varying from 1.5 kW/TR to 2 kW/TR
- The specific energy consumption of screw compressor will vary from 0.85 kW/TR to 1 kW/TR
- Compressors are not operated to their full capacity due to less capacity utilization of the plant.

Recommendation:

It is recommended to replace the reciprocating compressor with screw compressor in order to reduce the specific energy consumption to certain level and that will result in considerable amount of energy savings.

Saving percentage:

Saving percentage will be 10-20%

Investment:

Investment amount will be in the range of 20 to 30 Lakhs.

Payback:

Payback period will be in between 1.5 to 2 years.

In general 4 to 5 compressors are running to meet cooling requirement , it is suggested to replace 4*45 KW reciprocating compressor with screw compressors, calculation has been mentioned below:

S. No.	Particulars	Units	Value
1	Capacity of the reciprocating compressor	kW	45
2	Number of compressors	no's	4
3	Actual power consumption of 4 compressors	kW	236
4	Expected power consumption by screw compressor with VFD(@15% saving)	KW	200.6
5	Savings in kW	kW	35.4
6	Operating hours	hours	18
7	Savings in kWh per annum	kWh/Annum	232578
8	Savings in Rs	Rs	1448961
9	Investment	Rs	2360000
10	Payback	Years	1.63

2. Replacement of water cooled condenser with Evaporative condensers

Present status:

At the time of audit, it is observed that unit is using water cooled condenser. Cooling water is spraying on condenser tubes to cool down hot gas .

Observation:

- Cooling towers are filled with algae formation and that will affect the effectiveness of the cooling towers.
- Evaporative condenser is a single unit which reject the heat more efficiency when compared to other condensers

Recommendation:

It is recommended to replace the old & inefficient water cooled condenser with energy efficient evaporative condenser in order to save substantial amount of energy savings.

Percentage Saving :

Saving percentage will be at least 20-30%.

Investment:

Investment amount will be in the range of 20 -30 Lakhs.

Payback:

Payback period will be in between 2 years.

The energy saving calculation for condensers has been mentioned below :

S. No.	Particulars	Units	Value
1	Capacity of the open coil atmospheric condenser	Ton	250
2	Present Energy Consumption Condenser Pumps	kW	28
3	Power Consumption after installation of Evaporative condenser	kW	8.5
4	Savings in kW	kW	19.5
5	Savings in kWh/Annum	kWh/Annum	170820
6	Saving in Rs/Annum	Rs	1195740
7	Investment	Rs	2500000
8	Payback	Years	2.09

3. Installation of Variable frequency drive (VFD) for condenser water Pumps

Present status:

It is noticed that the conensor pumps are being used in the plant to supply the cooling water to condenser for cooling application

Observation:

At the time of audit, it was observed that pumps are running continuously irrespective on the load in the secondary side and throttle valves are being used in the pipe lines to control the flow of pump. This will only reduce the flow and would not reduce the energy consumption of the pump.

Recommendation:

Variable frequency drive can installed in the pump and which will vary the speed of the motor with respect to loading on secondary side and this will result in substantial energy savings.It is recommend installing variable frequency drive in the pumps in order to save substantial amount of energy savings and sample calculation for the same has been tabulated as below:

S.NO	Particulars	Units	Value
1	Rated capacity of the pump	HP	7.5
2	Actual power consumption of the pump	kW	6
3	No. of pumps	No	4
4	Total power consumption	kW	24
5	Savings with VFD %	%	10
6	Projected Energy Consumption	kW	21.6
7	Savings in kW	kW	2.4
8	Savings in kWh/Day	kWh/day	43.2
9	Savings in kWh/Annum	kWh/Annum	15768
10	Savings in Rs	Rs/Annum	99338.4
11	Investment	Rs	125000
12	Payback	Years	1.26

4. Installation of THERMOSHIPON SYSTEM (GAS COOLING) for Compressor.

Present status:

At the time of audit, it is observed that unit is using water cooled Cooling system for compressor. Cooling water is circulating on compressor head to cool down compressor temperature . Separate Pump installed and running continuously for circulating cooling water for compressor cooling.

Observation:

- Cooling towers are filled with algae formation and that will affect the effectiveness of the cooling towers.
- Thermoshipon system is a new technology developed for compressor cooling. It will improve the work done compressor and efficiency .

Recommendation:

It is recommended to install Thermoshipon system for compressor cooling in order to save substantial amount of energy savings.

Percentage Saving :

Saving percentage will be at least 1-2 %.

Investment:

Investment amount will be in the range of 3 Lakhs.

Payback:

Payback period will be in around 1.5 year.

S. No.	Particulars	Units	Value
1	Capacity of the Present reciprocating compressors	kW	242
2	Number of compressors	no's	3
3	Expected power consumption by installation of Thermoshipon system (@2% saving)	KW	4.84
4	Operating hours	hours	18
5	Savings in kWh per annum	kWh/Annum	31798.8
6	Savings in Rs	Rs	200332
7	Investment	Rs	300000
8	Payback	Years	1.50

5.AUTOMATION of refrigeration plant by using PLC controller:

Present status:

At Present Refrigeration system is controlling in manual mode only. Based on temperature requirements refrigerate flow controlling with the help of opening and closing values manually by operators.

Observation:

- while operating manually error may occur, it will cause power loss.
- We can program When to stat and when to stop in Automatic system .
- PLC will control Loading and unloading of compressors automatically.

Recommendation:

It is recommended to install PLC based automatic system to save substantial amount of energy .

Percentage Saving :

Saving percentage will be at least 5 %.

Investment:

Investment amount will be in the range of 6 Lakhs.

Payback:

Payback period will be in around 1.5 year.

S. No.	Particulars	Units	Value
1	Capacity of the Present reciprocating compressors	kW	242
2	Number of compressors	no's	3
3	Expected power consumption by installation of PLC based automatic system (@5% saving)	KW	12.1
4	Operating hours	hours	18
5	Savings in kWh per annum	kWh/Annum	79497
6	Savings in Rs	Rs	500831
7	Investment	Rs	600000
8	Payback	Years	1.20

Identified Energy Saving Proposals:

1. Proper maintenance of condenser coil

Present status:

- Condensing units are one of the main equipment of sea food processing unit.
- Heat rejection to the atmosphere takes place through condenser coil only.
- Circulating water is being used to cool the condenser coil

Observation:

It is understood from the plant people that the condensing coils are being cleaned once in a 6 months .

Recommendation:

It is recommended to clean the condenser tube three month once so that it will prevent the algae formation as well as scale formation inside the tube.

Algae growth or scale formation will act as an insulator and that will impede the transfer between refrigerant and water. It increases the condenser temperature and head pressure.

Increasing head pressure, will increase the compressor energy use, hence the energy consumption of the system will increase.

Fouling can increase the temperature difference needed between the leaving condenser water temperature and the refrigerate condensing temperature to maintain the same cooling load.

Savings percentage:

Approximately 3-5% of energy can be achieved.

Investment:

No investment

2.Proper insulation of identified insulation damaged areas.

Present status:

• Most of the units have poor insulation for the ammonia lines leading to large exposed areas and ice accumulation.

• Exposed ammonia lines absorb significant amount of thermal energy thereby reducing the evaporative capacity within the freezer.

Observation:

- The average surface temperature were 4-5 ^{o}C higher than the insulated area of the ammonia lines

Recommendation:

- By providing complete and proper insulation, thermal energy transgression across exposed surface can be cut off.
- Need to Survey entire refrigeration line frequently for identification of any exposed areas or Insulation damage areas

Savings percentage:

Approximately 1-2% of energy can be achieved.

Investment:

Nominal amount

Conclusion

Based on our audit in the Baby Marine processing unit and above given energy saving opportunities in detail we are recommending the below given energy efficient technology up gradation in the Baby Marine International

1. Replacement of reciprocating compressor with screw compressor with VFD
2. Replacement of water cooled condenser with Evaporative condensers
3. Installation of Variable frequency drive (VFD) for condenser water Pumps
4. Installation of THERMOSHIPON SYSTEM (GAS COOLING) for Compressor.
5. Automation of refrigeration plant by using PLC controller

The total investment cost is 20 Lacs, After successful implementation of any project, the plant will get the subsidiary amount of Rs. 10 Lac from BEE

The summary of the savings plans are are below:

S.No	Recommendation	Investment in Rs	Eligible Subsidiary amount in Rs
1	Replacement of reciprocating compressor with Screw compressor with VFD	2360000	1000000
2	Replacement of water cooled condenser with Evaporative condenser	2500000	
3	Installation of variable frequency drive for condenser water pumps	125000	
4	Installation of THERMOSHIPON SYSTEM (GAS COOLING) for Compressor.	700000	
5	Automation of refrigeration plant by using PLC controller	1400000	

The BEE will provide subsidiary amount of Rs.10 Lacs per plant and will not provide more than ceiling amount of Rs.10 Lac

Equipments Suppliers Contact Details

Compressors & Condensers	
Kirloskar Pneumatic Co Ltd. 1st Floor, Elcanso Building, 10, Casa Major Road, Egmore, Chennai-600 008 Phone: 044-28193066, 2890436, 2892092 Fax: 044-28194397 E-mail: kpclchnacd@kpcl.net	**Elgi Equipment Limited** #39/3973, Pallimukku, M.G.Road, Kochi – 682016. Tel (0484) 2360155 Fax (0484) 2351904 E-mail : enquiry@elgi.com
Frick India Limited 41/3273-D, Golden Castle Bldg. Old Railway Rd., Cochin - 682018. Phone: 0484-2394173 E-mail: cochin@frick.co.in	**Johnson Controls (India) Pvt. Ltd.** C/ o. York India Limited, Delphina Building 2nd floor CMH Road, Indiranagar Stage 1 Bangalore, Karnataka 560 038 India Ph: +91 (80) 3057 5730 Fax: +91 (80) 3057 5729
Evapco Condensor ACS Consultancy Pvt . Ltd 276/ 5, Sangam Apartments Belly Area, Anna Nagar West Chennai-40, India Ph: (91) 9840818637 / 9444048480 Fax: (91) 44-42026477 Email: evapco-india@airtelmail.in	**Lloyd Insulations (India) Limited,** 38/ 449, Panampilly Nagar Manorama Junction, Ernakulam, Kerala 680036 Ph: +91 (484) 2324472
Bombay Ammonia Sales Corporation B-17, Rishabh Shri House, Ranjeet Nagar Commercial Complex, New Delhi – 110 008	**Vision Engineering Madras Pvt. Ltd.** No 6/1, Shanthi Nagar Main Road, Ramapuram, Chennai - 600089, Opposite Dlf & Moonlight Phone: +(91)-44-22492800, 22490801, Mobile: +(91)-9444040948, 9444040946, 9444040950
Baltimore Aircoil Condensor Densol Engineering Pvt . Ltd. #43/ C, 9th Main, R P C Layout Vijayanagar 2nd Stage Bangalore 560040	
Belts **Beblec (India) Private Limited** Plot No. 126, Sipcot Indlustrial Complex Hosur - 635 126	**Belts** **Anjanaa Belting** 3857, TNHB, Ayapakkam, Chennai – 600077

Tamil Nadu, India	Ph: +91-44 – 64991300/ 9840186799
Sagar Electric Power Services #70, K. Kamaraj Road, Bangalore, India—560042 Ph: +91 9060133874; 9448073258	**Vijay Energy Products Pvt.Ltd.** SP – 75, Ambattur Indl. Estate Chennai – 600 058 044 – 625 4326
Pumps **BI Marketing & Services Pvt Ltd** Dealer: Grundfos Pumps No.50, 3rd street, East Abhiramapuram, Chennai – 60004 Ph: +91-44-24671267	**VFD's** **Enpro Industrial Automation Pvt Ltd.** Dealer: Danfoss VFD F18 Ambattur Industrial estate, Ambattur Chennai – 600058 Ph: +91-44-26244583; 26244865;26359850 email: projects@enproautomation.com
Motors **Project & Supply** A – 605, Sunswept Lokhandawala Complex Swami Samarth Nagar,4, Bungalow, Andheri (West) Mumbai 400 050,Ph: 022 – 626 6584	**Motors** **Kirloskar Electric Co. Ltd** 294 – 295, Lloyd's Road, Royapettah. Chennai –14. Ph: 044 – 28133176
Motors **Siemens Ltd** 3rd Floor, Jyoti Mahal, No. 49, St . Marks Road, Bangalore 560 001 +91 80 5119 1500 Ph: +91-4344-276358 / 278658 / 400688 /400687	**Capacitors** **Momaya Capacitors** 401, Madhav Apartments Jawahar Road, Opp.Rly.Stn. Ghatkopar (East) Mumbai – 400 077,Ph: 022 – 516 2899 / 1005 / 0745
Insulation	
India Insulations NH Bypass, Vytilla, Kochi – 682 019, Kerala Ph: +91 (484) 2304465	**Thermax Limited,** RNG Pallazzo, No. 1, 1st Floor South End Street Kumarapark East Bangalore 560 001 Ph: +91 (80) 22371721,Fax: +91 (80) 22371726
For Ice Storage System:	
Balamurugan Refrigeration Engineers, Liveiro building, Thoppumpady Kochi 5	**GEA Refrigeration India Pvt. Ltd.** Branch Office- 5th Floor, Lohia Jain Business Centre, Friends' Park Society, Senapati Bapat Road ,Pune –

Ph: +91 (484) 2231844	411016 India
ACS Refrigeration 272/5, Sangam Apartments, Belly Area, Anna Nagar west., Chennai – 600040. Tamil Nadu, India. Mob No:- 09840818637, Tele Fax:: 044-42026477 Email : sales@acsref.com	

The service providers were selected considering the technology recommended and their ability to service the sea food processing units located in Kochi. Since not all service providers have dealership network in Kochi, hence dealers have been selected from Chennai & Bangalore.