



MANDYA DAIRY, A UNIT OF MANDYA DISTRICT CO-OPERATIVE MILK PRODUCERS' SOCIETIES' UNION LTD., BM ROAD, GEJJALAGERE, MADDUR TALUK MANDYA DISTRICT – 571 428. KARNATKA

UNIT PROFILE:

MANDYA DAIRY, A UNIT OF Mandya District Co-Operative Milk producers' Societies' Union Limited registered under the Karnataka co-operative act has been commissioned in the year 1983. The dairy was a Product Dairy commissioned by the then Karnataka Dairy development Corporation (KDDC) which was expected to serve as a feeder balancing dairy. The dairy possessed a processing capacity of 100 TKPD (Thousand Kgs per day) and a powder plant with a capacity of manufacturing 10 MT of Skim Milk Powder per day. The dairy had no facilities for receiving milk in cans or milk packing facilities. The dairy was receiving milk in tankers from various dairies in Karnataka for conversion of milk to Skim Milk Powder & Butter. Later on the milk production in the district increased considerably and Mandya District Co-Operative Milk producers' Societies' Union Limited was registered under the Karnataka co-operative act in the year 1987. In the year 1988 the Product dairy was handed over to Mandya District Co-Operative Milk producers' Societies' Union Limited with inclusion of minimum facilities for receiving milk in cans & milk packing facilities. Subsequently the dairy was expanded to 200 TKPD in the year 2005-06 & to 250 TKPD during the year 2006-07 by NDDB under the turn key project.

The dairy receives milk in cans with temperature of 27^o C to 30^o C from village co-operatives located in the Mandya district, and in tankers with temperature of 5^oC to 6^oC from the two chilling centers located at KR Pet & Nagamangala towns. Also the dairy receives milk with temperature of 5^oC to 6^oC in tankers from 23 Bulk Milk Coolers. These bulk milk coolers have been installed to maintain the initial quality of raw milk and also to reduce the intake of energy intensive raw materials. As on date the per day quantity of milk received through cans directly from dairy co-operatives, tankers from chilling centers and tankers from bulk milk coolers is as follows:

❖ In cans from village dairy co-operatives	159063 Kgs
❖ In tankers from chilling centers	139727 Kgs
❖ In tankers from bulk milk coolers	51046 Kgs

The dairy processes the milk and packs the following qualities of milk:

1. **Toned milk** with 3.1% Fat & 8.5% Solids not fat
2. **Homogenised Toned milk** with 3.1% Fat & 8.5% Solids not fat
3. **Homogenised Cow Milk** with 3.6% Fat & 8.5% Solids not fat
4. **Double toned milk** with 1.6% Fat & 9% Solids not fat
5. **Full cream milk** with 6.1% Fat & 9% Solids not fat

The dairy also caters to the need of bulk milk in tankers to the dairies of Kerala, Andhra Pradesh & Maharashtra.

During flush season for a period of around 100 to 150 days the Powder plant will be in operation and conversion of available surplus milk to skim milk powder & Butter takes place. The Skim Milk Powder & Butter manufactured during the last three years is as follows:

YEAR	SKIM MILK POWDER (Tonnes)	BUTTER (Tonnes)
2004-05	1735.959	2118.297
2005-06	1678.956	1665.926
2006-07	1346.213	1439.682

In addition, the following milk products are manufactured. The products manufactured during 2006-07 are as follows:

- Ghee 1300.275 Metric Tonnes
- Curd 3962.509 Metric Tonnes
- Peda 23.673 Metric Tonnes
- Butter milk 182.432 Metric Tonnes
- Badam Burfi 2.153 Metric Tonnes

The dairy markets milk and milk products under the trade name “NANDINI” a registered trade name of “Karnataka Milk Federation”, the apex institution at the state level.

The technical and financial assistance comes from National Dairy Development Board, Anand, Gujarath under operation flood and vision schemes.

The one of the market developing activities taken up by the dairy is Creating awareness about milk in public especially among the women folk and school children through programs conducted in the training hall of the dairy by trained employees and the dairy has conducted programs wherein 23466 women folk too part and also under the consumers and school children awareness programs 2070 members participated during 2005-06 & 2006-07.



One of the agenda in all the above programs was educating the participants on energy conservation. The cartoon film on “Save Energy” was screened at the school children programs.

The dairy has secured the **ISO-9001 : 2000** certificate for the years 2007-2010.

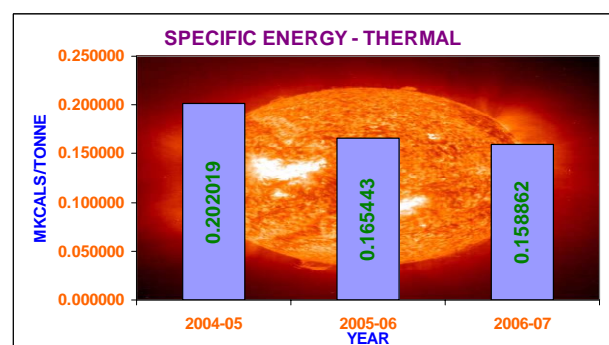
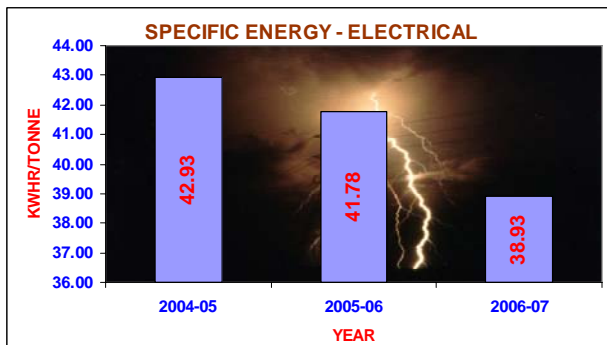
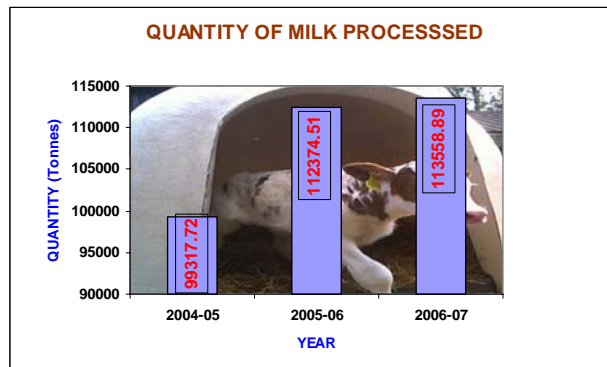
ENERGY CONSUMPTION:

The energy consumption and milk handled at the dairy in the years 2004-2005, 2005-2006 & 2006-07 is as follows:

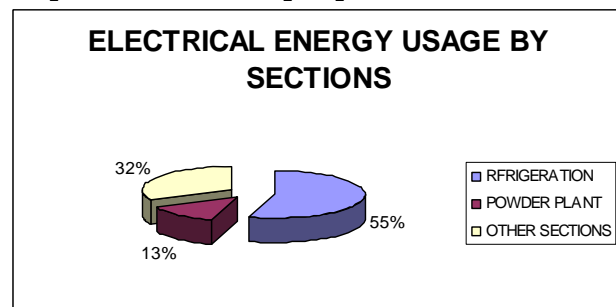
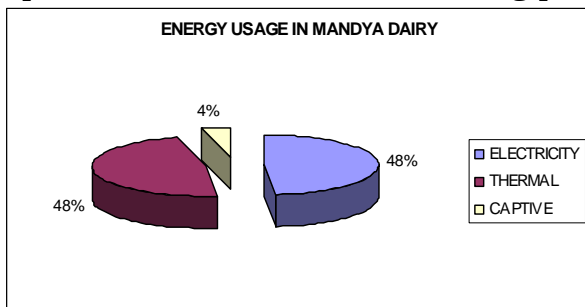
DESCRIPTION	UNIT	2003-2004	2004-2005	2005-2006
Milk Handled	Metric Tonnes	99317.718	112374.509	113558.893
Total energy cost	Rs in Lakhs	421.70150	448.56887	417.07234
Energy cost v/s Manufacturing expenses	Percent	56.72	71.17	67.20
Total energy consumption – Electrical	Lakhs kWh	42.64191	46.95563	44.20728
Specific energy consumption – Electrical	KWh/Tonne	42.935	41.784	38.929
Total energy consumption – Thermal	Million Kcals	20064.07	18591.61	18040.18
Specific energy consumption – Thermal	Million Kcals	0.20202	0.16544	0.15886

The sources of energy in the dairy are Electrical and Thermal. The energy cost is 56 to 71 % of the total manufacturing cost of the dairy.

The total connected load is 1714 Hp or 2142 KVA and maximum demand is 750 KVA.



The dairy has been expanded & renovated under Vision 2001-2005 plan by NDDB. The infrastructures such as New 20 KLPH Milk Pasteuriser, Curd Pasteuriser, New mechanical milk packing machines, construction of new packing block along with milk & curd cold store are provided. This addition of new equipment has commanded additional electrical load of 700 Hp or 875 KVA. Hence, an application for sanction of additional load has been made to KPTCL authorities. Under Vision 2005-2010 infrastructures such as Expansion & renovation of Effluent Treatment Plant with latest technology, Cleaning in place system, Addition of reception & processing equipment, Expansion of refrigeration section with introduction of less energy consuming condensers & interposing of desuper-heaters for heat recovery from discharge gas in refrigeration section, Expansion & renovation of existing powder plant Etc., are proposed.



Electrical energy along with captive power generation & Thermal energy occupy 52% & 48% respectively in the energy profile. The refrigeration section is the major user of this source of energy, wherein 55% of the total electrical energy is used by this section. Hence, major thrust was given in conserving energy in this section.

This section has 4 ammonia compressors each driven by 125 Hp motors. In addition the dairy has 2 booster compressors driven by 2 Nos. 20 Hp motors. Also there are 5 Nos. chilled water pumps driven by 5 Nos. 10 Hp motors. The section has five evaporative condensers. Each condenser had blower driven by 12.5 Hp motor and water pump energised by 7.5 Hp motors. At any point of time three compressor, one booster compressor, 3 or 4 evaporative condensers & 3 or 4 chilled water pumps will be in operation to cater the refrigeration load in the dairy. The average running hours of motors in this section ranges between 22 hours per day.

Electrical section had 2 Nos. 500 KVA transformers. These transformers have been replaced by 1500 KVA transformer consequent to the expansion of the processing capacity of the dairy during 2007-08. In addition, for the purpose of captive power generation in the event of power breakdown the dairy has one 625 KVA, Three 250 KVA diesel generators which would be used depending on the electrical load in the dairy. Furnace oil and Coal are sources of thermal energy. The dairy has one 5 MT capacity oil fired boiler, one 5 MT capacity coal fired boiler & two 2 MT capacity oil fired boilers. Among the two sources coal is the cheapest source of thermal energy, hence much thrust was put in the area of coal boilers under the energy conservation program. Of course the oil fired boilers

were never neglected since the use of these boilers is inevitable in the event of non supply of coal from coaleries. This constitutes 48 % of the total energy. The major user of this energy is the milk processing section and powder plant wherein more than 75% of the thermal energy is utilised. Thus this was the major section wherein the thermal energy saving efforts were put forth.

ENERGY CONSERVATION COMMITMENT:

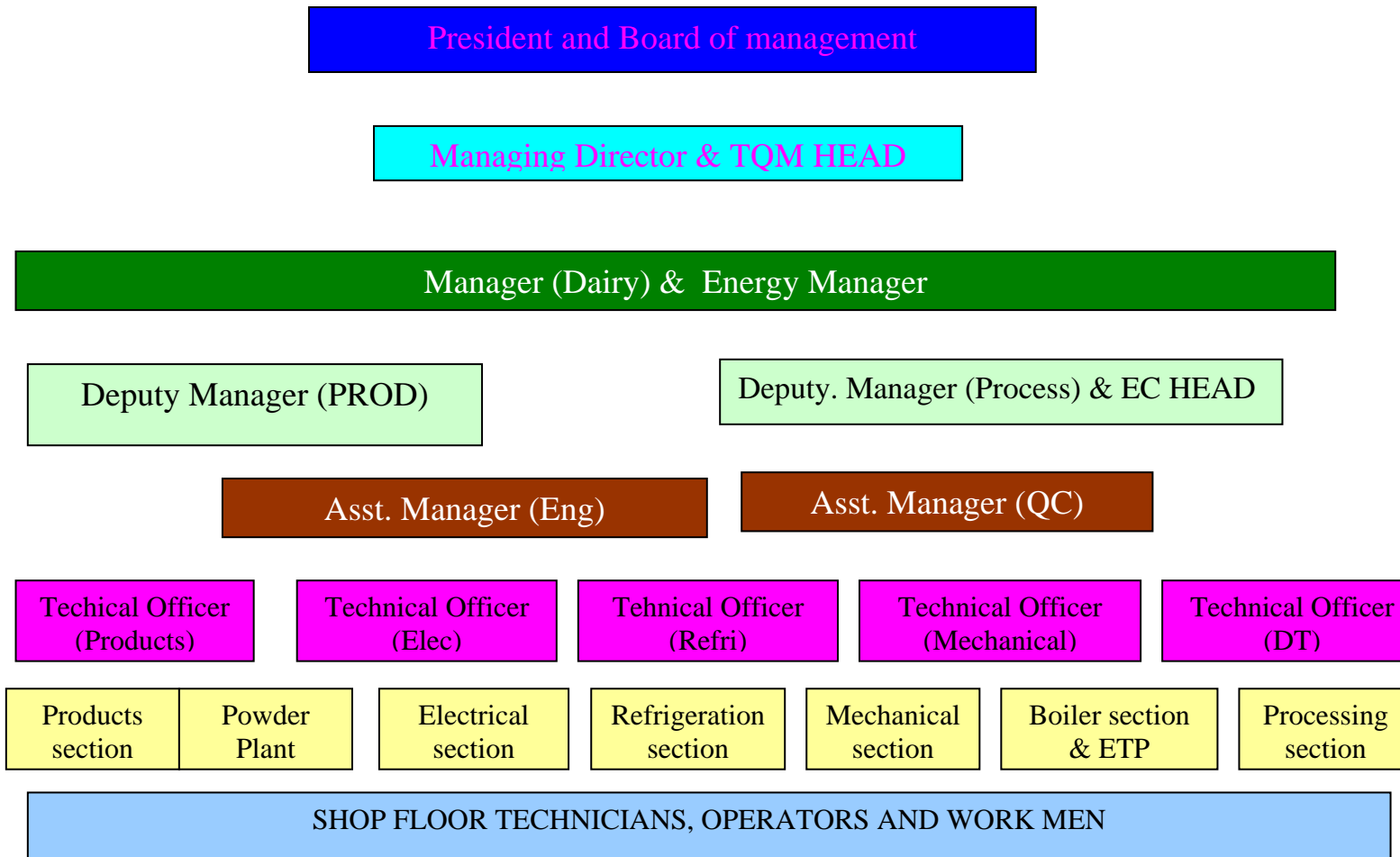
National Dairy Development Board (NDDB), Institute Of Rural Management, Anand (IRMA) & Karnataka Milk Federation (KMF) facilitated all the milk unions in Karnataka in launching the Energy Conservation Program during the year 2001-02. This program helped the milk unions including Mandya Milk Union to gear up the employees towards saving of energy. The energy team was setup and this team was responsible in conducting Awareness and orientation programs to all the employees. The members of this team were trained by the IRMA Faculty , leading HRD personnel & eminent energy auditors. The energy team initially conducted an in-house energy audit and was able to identify few energy saving opportunities. During the year 2004-05 M/S Electrical Research & Development Association were invited to conduct an “Energy Audit” of Mandya dairy.

The Energy Team has been at present entrusted the responsibility of “TOTAL QUALITY MANAGEMENT” which encompasses the Energy & Quality Management which is leading in the emergence of quality raw materials & quality products in addition to savings in Energy expenditures. This team is putting forth a continuous approach to sustain the achievements made on energy conservation with due stress on improvement of product quality. Hence, the product quality was not sacrificed while saving energy. Cross functional teams were formed and the philosophy of energy conservation and quality improvement and sustainability were inculcated among all the employees by way of lectures and discussions. The dairy follows the 5 “S” house keeping principles with due stress on kaizen-a continual improvement, Good manufacturing and hygienic practices. The ideas from the employees contributed to a greater extent in achieving cost reduction and quality improvement.

ENERGY CONSERVATION POLICY:

MANDYA DISTRICT CO-OPERATIVE MILK PRODUCERS’ SOCIETIES’ UNION LIMITED IS COMMITED TO PROCURE GOOD QUALITY MILK FROM THE PRODUCERS IN THE DISTRICT BY PERCOLATING CLEAN MILK PRODUCTION PROGRAM & TO EDUCATE & MOTIVATE THE EMPLOYEES TO ADOPT MODERN, ECO FRIENDLY, CONSISTENT ENERGY EFFICIENT TECHNOLOGIES, GOOD MANUFACTURING PRACTICES & GOOD HYGIENIC PRACTICES TO MANUFACTURE MILK & MILK PRODUCTS TO THE DELIGHTMENT OF CONSUMERS AT AFFORDABLE PRICE WHILE OFFERING REMUNERATIVE PRICE TO THE PRODUCERS.

ORGANISATIONAL SETUP:



ENERGY CONSERVATION ACHIEVEMENTS:

During 2004-05 initially energy audit was conducted by in house team and few energy saving potentials were identified. Later in the same year with a view of identifying major energy saving potentials and to have an idea of the efficiency of major equipment (in particular ammonia compressors & boilers) & major motors energy audit was conducted by M\ S ERDA, Vadodara. During 2004-2007, Mandya dairy has implemented 15 energy saving projects through engineers initiatives, sub section team suggestions and innovative ideas by officers and have achieved savings of Rs. 65.07 Lakhs with an investment of Rs. 44.70 Lakhs resulting in 9.33% reduction in specific electrical energy consumption and 21.36% in specific thermal energy consumption.

The energy saving projects implemented during 2006-07:

- 1. Installation Of New Mechanical Milk Packing Machines :-** The conventional milk packing machines are pneumatic type. The air to these was being catered from air compressors. One double head pneumatic type packing

machine require 53 M³ of air per hour. On the contrary the newly emerged mechanical type packing machines do not require air for their operations. The dairy had 10 double head pneumatic packing machines. As a trial basis in the year 2005-06 one pneumatic machine was replaced with one new mechanical machine. Since the performance of the machines was satisfactory and proved that without requirement of air the efficiency is equal to that of the conventional pneumatic machine in the year 2006-07 three more were replaced by mechanical ones since they were old. In total the dairy has four mechanical machines. Since, these machines did not require air there was considerable reduction in running hours of air compressors and substantial electrical energy was saved.

CONVENTIONAL PNEUMATIC MACHINES



NEW MECHANICAL PACKING MACHINES



□ Air requirement by one double head pneumatic machine	53 M ³ /hour
□ Air requirement by three machines	159 M ³ /hour
□ Running hours of these machines for packing milk	12 hours/day
□ Air requirement per day	1908 M ³
□ Air displacement by air compressor with 37 KW motor	414 M ³ /hour
□ Running hours of air compressor to displace 1908 M ³	4.61hours
□ Energy consumed by air compressor for 4.61 hours	170.52KWh

By replacing the old pneumatic packing machines with new mechanical type machines 170.52 KWh was saved by reduction in running of air compressor

□ Energy saved for one year @ 170.52 KWh per day	62240 KWh
□ Savings per annum	Rs. 2.71 Lakhs

2. Replacement of higher capacity blower motors with lower capacity blower motors in the evaporative condensers:- The dairy has 5 evaporative condensers with blower motors each put to operation with the help of one 12.5 Hp motors. At any given point of time 4 condensers will be in operation. The study revealed that these motors are under loaded. Hence these 12.5 Hp blower motors were replaced with 7.5 Hp motors and the performance was closely observed for decrease in the efficiency and the level of load on the motors. The performance was as good as was with 12.5 Hp motors and the motors were operating at optimum load.

7.5 Hp Blower motor



5 Hp Blower motor



The savings achieved is as follows:-

- ❖ The energy consumed by one 12.5 Hp blower motor 9.375 KWh
- ❖ The energy consumed by one 7.5 Hp blower motor 5.625 KWh
- ❖ Running hours of evaporative condensers 21 Hours per day
- ❖ Energy saved per hour by replacement of 4 motors 15.00 Kwh
- ❖ Energy saved per day 315.00 Kwh

By replacement of high capacity motors with lower capacity motors 315.00 KWh was saved per day.

- ❖ Energy saved per annum 114975.00 KWh
- ❖ Total savings per annum @ 315.00 KWh per day Rs. 5.00 Lakhs

3. Improvement of Co-Efficient of Performance (COP) of refrigeration system:-

The refrigeration section has 4 Ammonia compressors each driven by 125 Hp motors & there are 5 evaporative condensers each energized by one 12.5 Hp (blower) & one 7.5 Hp (Water pump) motors. As stated in energy savings project 2 the 12.5 Hp motor at blower was replaced by 7.5 Hp motor. There was scale formation on the coils in the evaporative condensers by which the heat transfer efficiency was reduced resulting in lower COP as low as 2.5 against the standard 5.0. Thus in order to acquire required cooling all the 5 condensers were put in operation. The descaling of all the 5 condenser coils was done & this resulted in improvement of COP from 2.5 to 4.0 & also resulted in efficient heat transfer. Since the heat transfer was improved we were able to put off one evaporative condenser. The improvement of COP resulted in reduction of running hour of one ammonia compressor by 1 hour.



SCALE FORMATION



DESCALED COILS



- ❖ Energy saved by putting off 1 evaporative condenser for
22 Hours 247.5 KWh
- ❖ Energy saved by reduction of running hour of compressor
By 1 hour 93.75 KWh
- ❖ Total energy saved per day 341.25 KWh

By improvement of COP & heat transfer efficiency 341.25 KWh was saved per day.

- ❖ Total energy saved per annum 124556.00 KWh
- ❖ Total savings per annum @ 341.25 KWh per day Rs. 5.42 Lakhs

4. Installation of energy efficient 20 KL milk Pasteuriser:- The dairy had one old 10 KL milk pasturiser. The energy audit revealed that the pasteurizer had less regeneration efficiency (82.5 %) and the milk to chilled water & milk to hot water ratio were 1:3. The supply of hot water was through hot water battery wherein considerable amount of steam was being consumed. This pasteuriser was in operation with two numbers 5 Hp Milk & hot water pumps and the throughput was only 7500 Kgs per hour. Thus this was replaced new 20 KL milk pasteurizer which had regeneration efficiency of 90% and milk to chilled water & milk to hot water ratio were 1:2. The supply of hot water was through Plate Heat Exchanger wherein there is no wastage of steam. This pasteurizer had two Nos. 7.5 Hp milk & hot water pumps & the throughput was 20 KL per hour.

OLD 10 KL MILK PASTEURISER



HOT WATER BATTERY SYSTEM
IN OLD MILK PASTEURISER



NEW 20 KL MILK PASTEURISER



PHE SYSTEM IN NEW MILK
PASTEURISER



A. Reduced power consumption for processing 16 KL milk:

- Time required for processing by 10 KL pasteurizer 21.3 Hours
- Power consumption for 21.33 hours 159.98 KWh
- Time required for processing by 20 KL pasteurizer 10 Hours
- Power consumption for 10.00 hours 112.50 KWh
- Power saved per day 47.48 KWh

B. Reduced chilled water ratio:

- Chilled water used by 10 KL pasteurizer 639.90 KL
- Chilled water used by 20 KL pasteurizer 200.00 KL
- Reduction in chilled water circulation 439.90 KL
- Power saved per day 54.99 KWh

C. Improved regeneration efficiency (from 82.5% to 90%):

- Regeneration efficiency of old pasteuriser 82.5 %
- Regeneration efficiency of new pasteurizer 90%
- Rise in milk temperature by improved regeneration Efficiency 6.4 °C
- Milk flow rate in pasteurizer 20000 litres/Hour
- Reduction in heat content of the milk 1,28,000 Kcals/hour
- Equivalent reduction in thermal energy 1,28,000 Kcals/hour
- Fuel (Coal) saved considering GCV of coal 33.77 Kgs Coal
- Fuel (Coal) saved per day (10 Hours) 337.70 Kgs Coal

D. Reduction in Milk pasteurization temperature from 81 ° C to 76 ° C due to auto controls:

- Delta "T" heating 5 ° C
- Thermal energy saved per day for 16 KL milk 0.800 MKcals
- Equivalent Coal saved per day 211.08 Kgs

By installation of new 20KL pasteurizer due to increased throughput, reduced chilled water circulation, increased regeneration efficiency & reduction in milk pasteurization temperature there was a savings of 102.47 KWh of electrical energy & 548.78 Kgs of Coal per day.

❖ Total electrical energy saved per annum	37401.55 KWh
❖ Total coal saved per annum	200.304 Tonnes
❖ Total savings per annum	Rs. 8.56 Lakhs

Under Vision 2005-2010 expansion of dairy from 250 KL capacity to 400 KL capacity has been envisaged along with renovation & expansion of the powder plant, provision of new fat handling equipment and expansion of the refrigeration section. The total estimated cost for the project is Rs. 11.03 Crores with NDDDB technical and financial assistance.

ENERGY CONSERVATION PLANS AND TARGETS:

- 1) Installation of butter pre-stratification tank :- The dairy is manufacturing Ghee from butter by using butter melting vat & ghee vat. By the introduction of pre-stratification tank prior to ghee vat more than 50% of the moisture would be removed just by gravitational force which would result in saving of thermal energy. The approximate savings expected is Rs. 3.30 lakhs and the proposed investment is Rs. 9 lakhs. The target year is 2007-2008.
- 2) Installation of Auto Controls for Milk Pasteuriser:- The dairy has three pasteurisers. During 2006-07 One pasteuriser which very old was replaced with new energy efficient pasteuriser along with auto controls. This replacement attracts an investment of Rs. 20.00 lakhs with an annual savings of Rs. 8.56 Lakhs. Also, it is proposed to equip the one pasteuriser with auto controls with an investment of Rs. 1.75 Lakhs. The proposed annual savings is Rs. 0.95 Lakhs. The target year is 2007-2008.
- 3) Replacement of two Nos. Pneumatic packing machines with Mechanical packing machines:- As on date 4 pneumatic machines have been replaced with mechanical ones. These have been proved to be energy efficient and working of these machines is satisfactory. Hence, it is decided to replace 2 more out of 6 pneumatic machines in the year 2007-08. the expected savings per annum is Rs. 2.71 Lakhs.
- 4) Replacement of less efficient ammonia compressor with new ammonia compressor:- M\S ERDA have analysed the efficiency of the existing ammonia compressors and had indicated that the performance of ammonia compressor No. 4 has deteriorated by 25 % & the said compressor should be overhauled or replaced. A decision has been taken to replace this compressor with new compressor during 2007-2008. The expected annual savings is Rs. 5.98 Lakhs and investment is Rs. 8.5 Lakhs. The target year is 2007-2008.

- 5) Construction of new milk cold store to avoid heat loss, to improve the efficiency & to reduce the packing hours:- The old cold store was of the conventional type and the insulation at this cold store was very old and resulted in higher temperature losses. Added to this the packing section in the dairy was squeezed in in the available free space. Thus the packing section was very congested and was exhibiting operational problems and delays. Hence, it was decided to construct modern new milk packing block along with new milk & curd cold store using energy efficient equipment & gadgets with an estimated outlay of Rs. 5.75 Crores. This new project has been handed over to NDDB on turn key basis and is expected to be completed in 2007-08. On completion of this project the radiation heat loss & higher energy consumption by old inefficient blowers would be avoided. The expected energy savings by this project is around 600 KWHR/day resulting in annual savings of around Rs. 9.53 lakhs. This project not only saves energy but also improves the quality of milk & curd since the expected temperature is attained before the milk is dispatched to the market. The investment is 565 Lakhs.
- 6) Renovation & Expansion of existing effluent treatment plant:- The existing effluent treatment plant is of the conventional aerator technology and requires expansion as a sequelae to the dairy processing expansion. Hence it is decided to renovate by introducing latest technology which would yield raw material for generation of thermal energy in terms of Methane gas & expand the same with an estimated outlay of Rs. 80 Lakhs. This project would result in utilization of methane gas to run a 30 KVA diesel generator by using the methane:diesel mixture. The project has been targeted for 2007-2008. The savings that could be turned out of this is estimated to be Rs. 2.26 Lakhs per annum. The target year is 2007-2008.
- 7) Installation of pre chiller for return chilled water:- Chilled water is being used as cooling medium for milk, Cream in various process activities in closed circuit between the equipments and ice bank tank (IBT). The chilled water when it flows back to IBT will have attained a temperature of 8 ° C. The temperature of ammonia gas at the inlet of the compressors will be between -4 ° C to -8 ° C. This gas when compressed attains a temperature of 110 ° C to 130 ° C. The gas that goes at the inlet can be used to chill the return chilled water from 8 ° C to 4 ° C where the gas at return -4 ° C to -8 ° C will attain a temperature of -1 ° C to -4 ° C. This process will reduce the load on IBT which in turn results in reduction in operating hours of ammonia compressors. The expected annual savings by reduced operational hours is Rs. 2.39 Lakhs & investment is Rs. 6 Lakhs. The target year is 2008-2009.
- 8) Desuperheaters (Heat Recovery Units):- Heat recovery units are proposed to be introduced in the exhaust line of ammonia. This would reduce the load on ammonia condensers and improves cooling efficiency (Co-efficient of performance) in addition to yielding considerable quantity of hot water at

around 70 – 75 ° C. The expected savings per annum is Rs. 1.25 lakhs. Proposed investment is Rs. 7.0 Lakhs. The target year is 2008-2009.

- 9) Replacement of evaporative condensers:-The existing 5 Nos. evaporative condensers are consuming 1235 KWh per day. This could be replaced by atmospheric condensers which consumes 600 Kwh per day. The expected annual savings is Rs. 10.09 Lakhs and investment is Rs. 25 Lakhs. The target year is 2008-2009.

ENVIRONMENT AND SAFETY:

Actions have been initiated to get the HACCP & EMS 14000 certification. The target date is by the end of year 2008.

All the safety measures suggested by the statutory authorities have been implemented. There has been no incidence of accidents from past 3 years. The treated water from the Effluent treatment plant is being used efficiently for raising fodder demonstration plots & for gardening purpose. The dairy premises has sufficient greenery to achieve the eco-balance. Added to this with the help of consultant the On-sight emergency plan is in place. There are plans to implement environmental management plan with the help of consultants. The expansion of the dairy capacity has been done in the years 2005-06 & 2006-07. The Effluent

GREENARY IN DAIRY PREMISES



FODDER PLOT & GARDEN



Treatment Plant (ETP) needs to be expanded. The ETP is intended to be constructed during 2007-08. The plan of ETP has already been approved by Karnataka State Pollution Control Board (KSPCB). There is a condition by KSPCB that the consent for 2006-07 would be accorded after the completion of the ETP. Hence, the consent for 2006-07 is awaited and construction of ETP is in progress.