

GUJARAT ALKALIES AND CHEMICALS LIMITED **Vadodara (Gujarat)**

Unit Profile

Gujarat Alkalies and Chemicals Limited (GACL) is the **single largest flag bearer company** in chlor-alkali industry having installed capacity of **2,70,000 tons per annum (TPA)** of Caustic Soda/Potash with state-of-the-art technology at locations of Vadodara and Dahej. This unit of Vadodara commenced Caustic Soda production in 1976 with production of **37,425 TPA** and expanded it to current capacity of **1,70,620 TPA** of Caustic Soda and Caustic Potash with unique product integration manufacturing **21** chemicals at Vadodara. This is a **pioneer unit** in the country to introduce **energy-efficient and eco-friendly membrane cell technology** converting its mercury cell plant in 1989. This unit has always been proactive in adapting modern-technologies of the time.

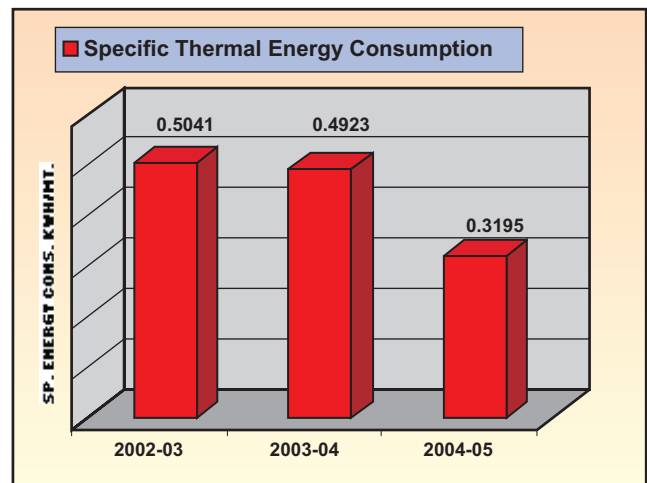
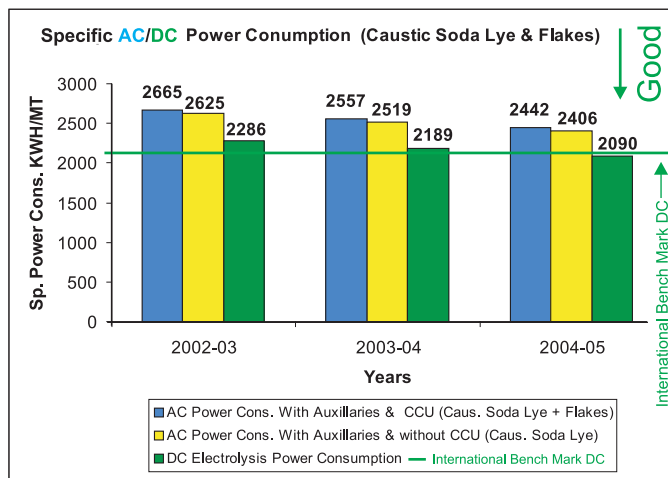
Company has following distinctions to differentiate it from its others in the industry for maintaining its leadership with market share of **16.19%** and **111.15%** capacity utilization. (AMAI Report).

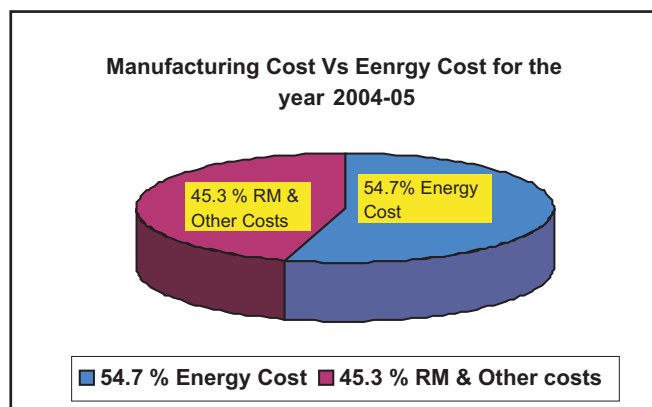
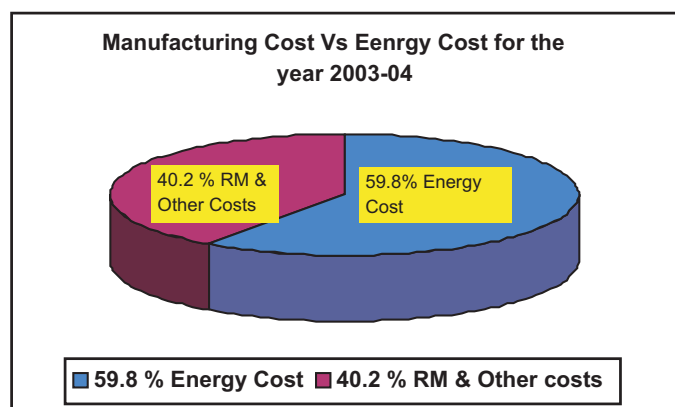
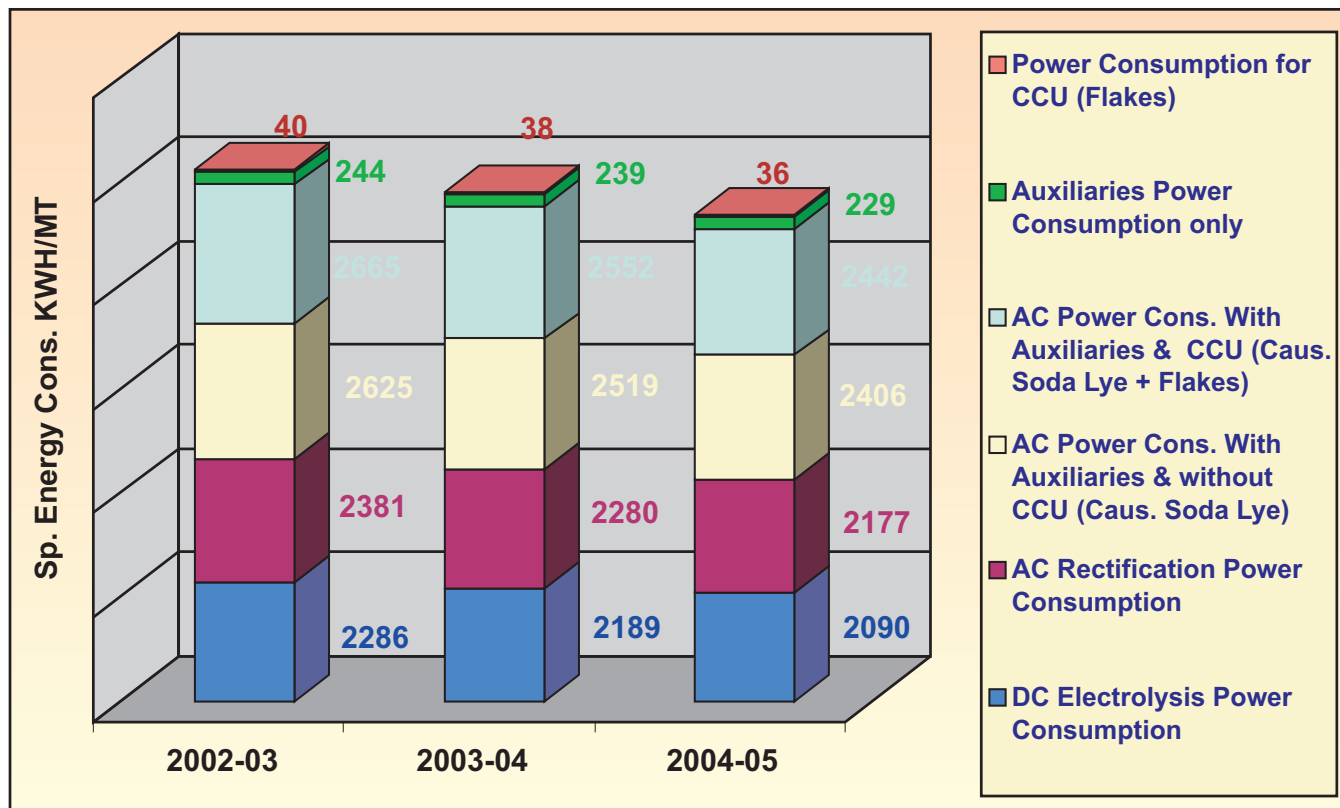
- **98.27%** utilization of **Hydrogen** – which is a co-product in chlor-alkali process. It produces eco-friendly chemical of Hydrogen Peroxide and uses it as fuel in concentrating Caustic Soda/Potash.
- Capacity utilization at Vadodara unit is **111.15 %** against industry average of **70%** (AMAI Report).
- It introduced **DCS** (Distributed Control System) in **chlor-alkali industry in 1994 first-time** in the country converting its mercury plant to membrane plant in second phase. The “trend” continued for all other UHDE – plants thereafter.
- Company is ISO 9001:2000, ISO 14001:1996 and IS 18001:2000 certified for its commitment to Safety, Environment and Health of its associates in particular and community in general.
- GACL Vadodara unit has a unique Potassium Carbonate Plant using Carbon Dioxide from flue-gas of its boiler/furnace reducing Green House Gases (GHG).
- It changed over to Natural Gas from Furnace-oil for its boiler at Vadodara adopting a Clean Technology Philosophy as committed in its “**Energy Management Policy**”.

Energy Consumption

Specific Power Consumption Details	Unit	2002-2003	2003-2004	2004-2005
Annual Production (Caustic Soda & Potash)	MT	152690	157120	170620
Total energy consumption per annum	Lacs KWH	4008.60	3957.85	4105.12
Total thermal energy consumption	MKacI	76972.44	77366.3	54513.09
Total Manufacturing Cost	Rs. Lacs	22237.62	22903.27	21420.69
Total Energy Cost	Rs. Lacs	12198.62	13645.38	11719.92
Energy Cost as % of Raw Material cost	%	54.6	59.8	54.7
DC Electrolysis Power Consumption	KWH/MT	2286	2189	2090
AC Electrolysis Power Consumption	KWH/MT	2381	2280	2177
AC Power Consumption with Auxiliaries & without CCU	KWH/MT	2625	2519	2406
AC Power Consumption with Auxiliaries & CCU	KWH/MT	2665	2557	2442
Auxiliaries Power Consumption only	KWH/MT	244	239	229
Power Consumption for CCU (Flakes)	KWH/MT	40	38	36
Thermal Energy Consumption	Mkcal/MT	0.5040	0.4923	0.3195

Graphical Representation of Specific Energy Consumption:





ENERGY MANAGEMENT POLICY



**GUJARAT ALKALIES
AND CHEMICALS LTD.**

At GACL, We are committed to minimize the Specific Energy Consumptions for our products to International Standards

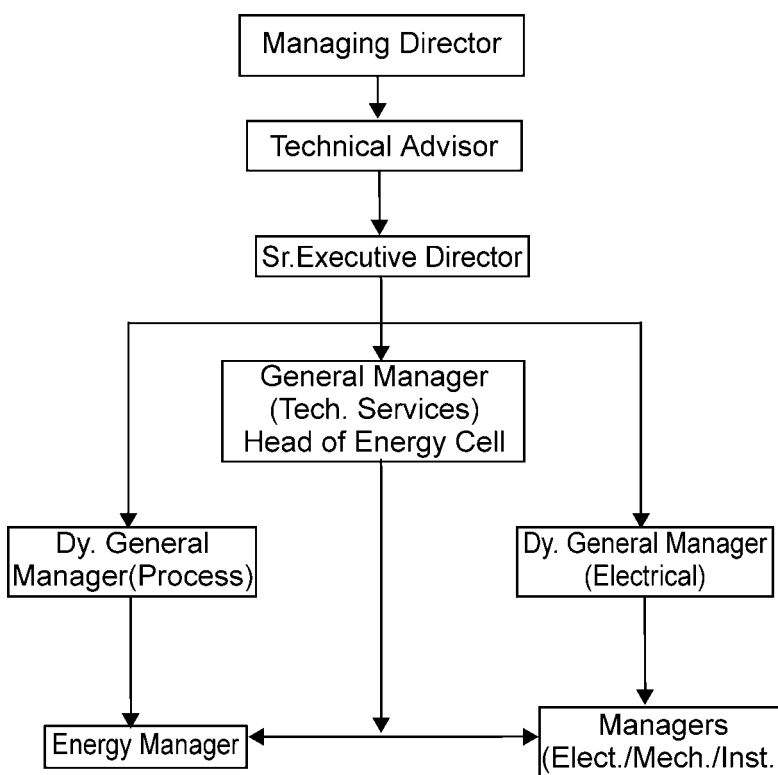
Through

1. Maximising the Capacity Utilisation.
2. Fine tuning our Operations and Maintenance continuously to achieve the above Goal.
3. Technology Upgradation with energy efficient processes and equipments.
4. Motivating, Training and Encouraging our employees to achieve a target of reducing specific energy consumption by minimum 1% every year till 2010 by Employee Awareness & Incentive Programmes.
5. Promoting the use of renewable natural resources for sustainable development, safeguarding the society & protecting the Environment.
6. Setting up a system to continuously monitor the progress.

VADODARA
DATE : 03/12/2002

P. K. TANEJA
MANAGING DIRECTOR

Organisational Set-up:



GACL, Vadodara unit has commitment from top management as shown above in the organizational Set-up. Energy management policy for the corporate is monitored for implementation in monthly Extended Executive Committee meetings regularly. The Energy Conservation Cell motivates and promotes employees/associates to suggest energy saving projects. The suggested projects are evaluated by a committee headed by Advisor Technical and the winners are rewarded suitably in EEC by Managing Director.

GACL, Vadodara unit takes commitment of management for National Campaign for Energy Conservation 2005 very sincerely and this unit has conducted 10 awareness programs in Schools, Engg. Colleges/ Universities, Residential Colonies and for Small Scale Industry in the year 2004-2005 as per commitment.

Unit has been sanctioned to implement a unique project using renewable energy resource (Solar-Photovoltaic) for industrial DC load of its instrumentation system at the cost of Rs. 40 lacs with 6 years pay-back period. This unit is facilitating for international trials of new technology from Japan, Germany & U.S.A. for new membrane evaluation and new generation of electrolyzers from UHDE, Germany. Unit has very well experienced expertise of 40 years of experience in operation of the Caustic Soda plants with various technologies.

There is an adequate budget provision for Energy Conservation projects & a special budget is provided for non-plan projects. Company has certified Energy Manager for this unit.

Achievements: 2004-2005

Unit has implemented 13 no. of EC projects during the year 2004-2005 at total investment of **Rs. 1755.2 lacs** saving worth **Rs. 1210.03 lakhs**. Major projects are mentioned here below:

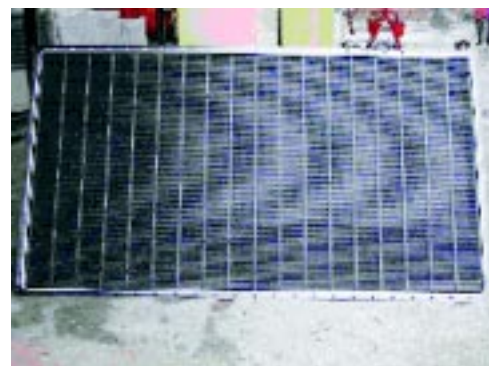
Technology Up gradation: GACL-Vadodara has initiated changeover to **energy efficient design** of Electrolyser version-4 of UHDE for its Electrolysers of version-1 installed in 1989 in phases (changed two electrolysers out of 33 electrolysers) This is the **first time trial in India** for conversion of old electrolysers (1989) to new elctrolysers (2004) of UHDE Germany, even though pay back period is high. It saves power due to narrow gap; laser welded ribs, down comers; flooded element operation at reduced and stable differential pressure of 20 mbar. Guaranteed Power consumption of less than **2100 kWh/t NaOH** at 6-kA/m² current density.

Reduction in Specific Energy Consumption.....**13.66kWh/Tonne**
Saving in Power: 2004-05 part operation.....**23.3 lakhs kWh**
Saving in Cost during 2004-05.....**64.56 Rs.lakhs**
 Total Investment.....**784 Rs.lakhs**
 Pay back period.....**6 years**
Remarks: Cost of investment is high due to innovative technology.



Re-membraning of balance Electrolysers (16 nos.) : GACL had commenced re-membraning of elctrolysers in 2003-04 which completed this year in 2004-05 saving electrical energy and cost as below:

Reduction in Sp.Energy Consumption.....**139 kWh/tonne**
 Production per year from 16 electrolysers.....**82725 Tonnes**
Saving in Power.....**115 lakhs kWh**
Saving in Cost.....**319 Rs. lakhs**
 Total Investment.....**800 Rs.lakhs**
 Payback period.....**2.5 years**



Revamping of Cooling Towers hardware inclusive of using FRP blades in place of metallic blades as a result of which Drift losses reduced; Air circulation improved; Pumping cost reduced

Saving in Energy.....**4.84 lakhs kWh**
Saving in cost.....**13.42 Rs.lakhs**
 Total Investment.....**49 Rs.lakhs**
 Pay back period.....**3.65 years**





Change-over of Boiler fuel (3 nos.) from Furnace oil to Natural Gas:

Plant already had installed **dual fuel** burners in boilers since its commissioning. So, this change over to better energy efficient fuel was implemented at negligible cost. This reduced SOx emission & suspended solid particulates in the flue gases.

Saving in Energy.....10248 Mkal.
Saving in cost.....348 Rs.lakhs
Total Investment.....1.0 Rs.lakhs
Pay back period.....Negligible



Replacement of Damaged Hot & Cold Insulations and Minimizing Steam Leakages :

The unit being 30 years old, Plant plan regular replacement of Hot & Cold Insulations of Pipe lines and Equipments and has a planned budget provision and annual maintenance contract for replacement of Hot & Cold Insulation as required.

Saving in Energy.....3428 Mkal.
Saving in cost.....42 Rs.lakhs
Total Investment.....50 Rs. lakhs



Water supply line from GSFC extended directly to process unit saving additional pumping power, which was in use earlier:

Plant is out sourcing process water supply from Mahi River through GSFC & IPCL pipelines. Earlier it has put in water reservoir and then pumped it to chloromethane plant. Water management study revealed that plant could directly pump from GSFC itself to the user plant saving pumping cost in caustic plant.

Saving in Energy..... 4.84 lakhs kWh.
Saving in cost.....12 Rs.lakhs
Total Investment.....3 Rs. lakhs

Up-gradation of DCS Software & Hardware for precise monitoring and control of chemical processes & Electrolysis :

Plant has up-graded Hardware & Software of Tata-Honeywell DCS for additional facilities of alarms and trend monitoring for accurate control of process parameters and energy consumptions. This DCS was **first in the country** in 1994 in caustic soda industry which paved the way for others to go for DCS based control instead of panel based control.



Saving in Energy.....87.27 lakhs kWh.
Saving in cost.....237.4 Rs.lakhs
Total Investment.....35 Rs. lakhs

Replacement of 10 years old equipments like chlorine evaporator, brine recuperator and caustic evaporators:

Two no. of Caustic evaporators were replaced with new one, which save good amount of steam. Brine recuperator was replaced with new one, which helps to recover heat from high temperature chlorine. Chlorine evaporator was also replaced which helps to recover heat from liquid chlorine and save refrigeration energy.



Saving in Energy..... 6.57 lakhs kWh.
Saving in Energy.....9141 Mkal.
Saving in cost.....96.2 Rs.lakhs
Total Investment.....23.5 Rs. lakhs

Other Energy Conservation Projects implemented during 2004-05.

- 1) Installed of **98 nos. Ecoventilators** facilitating natural light and Air ventilation without use of electricity.
- 2) Installed of **water separators in Hydrogen Gas** line to furnace of Caustic concentration units (CCU) to save heat of evaporation of water contained in Hydrogen Gas.
- 3) **Replacement of 75kW Motors** (2 nos.) of pure brine pumps by 45kW Motors.
- 4) **Direct Caustic Pumping to Caustic evaporation** by using existing catholyte circulation pump.
- 5) Continuous operational mode of Hydrogen condensate pump changed to **on-off mode**.
- 6) Installed Heat Exchanger to **recover Heat Energy** in Solvent Recovery Unit in the down stream of C/S plant.
- 7) Replaced old Motors (1976), by **high efficiency motors** of cold-well pumps and chlorine compressors.
- 8) Replaced 60 ordinary tube lights by energy efficient tube lights.
- 9) Ensured discipline among all for Switching off lights, fans, ACs, whenever offices are not occupied.

Energy Conservation Plans and Targets

Energy Conservation Plans	Anticipated Saving in		Approx. investment (Rs.lakhs)	Projects Commencement & Completion Year
	Energy (lakhs kWh)	Cost Rs. Lakhs		
Conversion of old electrolyzers to energy efficient new version-4 of UHDE electrolyzers	466	233	1568	2005-06
Replacing air line of 2" by 4" & Reduction in loading/unloading pressure of air compressors	0.5	2	4	2005-06
Installing VFD in boiler feed water	1.26	6.3	5	2005-06
Replacing rectifier transformer to improve efficiency	64.8	174	863	2006-07
Replacing two reciprocating air compressor by one centrifugal air compressor	5.04	25	22	2006-07
Installing heat exchanger to recover heat from HOT gases off the CAUSTIC Concentration unit.	3.5	17.5	5	2005-06
Installing a photovoltaic renewable energy system for DC load of Instrumentation	1.3	6.6	40	2005-06
20 MW Cogen. Captive Power Plant using natural gas	262.8	1314	7000	2006-07
Sub total :	805.2	1778.4	9507	-

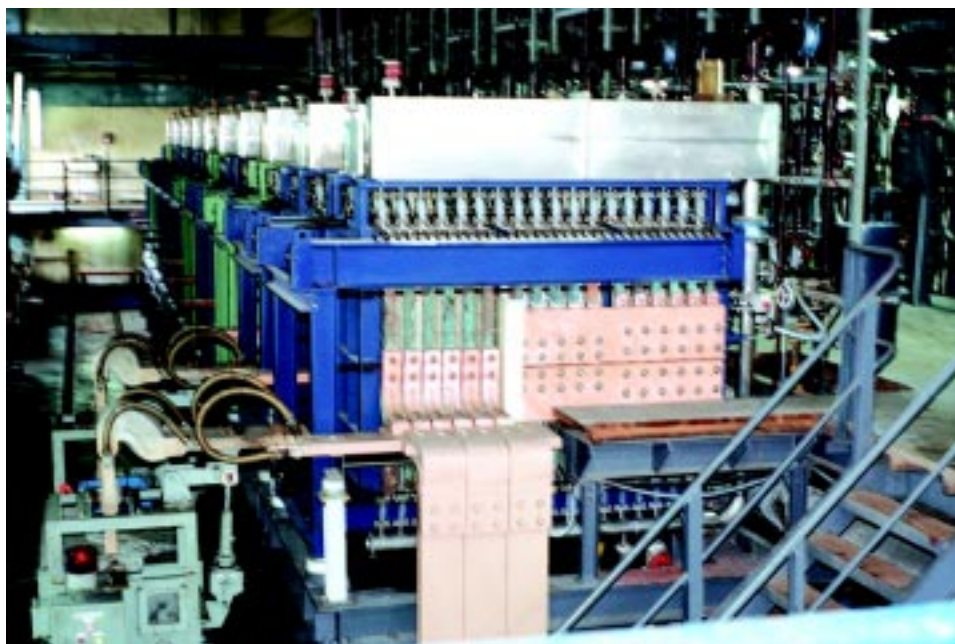
Environment and Safety

The unit has been accredited for ISO 14001:1996 and IS 18001 by Bureau of Indian Standards (BIS) valid till 2007 indicating managements commitments of environment and health of its employees and community as per 'SHE' policy attach here under : This unit has completed **777** accident free days as on 09-09-2005. With about 1500 employees and associates working at site breaking the previous record of 234 days.

THE TRAVANCORE-COCHIN CHEMICALS LIMITED
Udyogamandal, Kochi (Kerala)

Unit Profile

The Travancore-Cochin Chemicals Limited, TCC, as it is popularly known situated at Udyogamandal, Kochi, 20 Km away from the Kochin International Airport and 15 Km away from the Ernakulam Railway Station, is a Kerala State Public Sector Undertaking incorporated in the year 1952. Presently the daily production capacity is 150 TPD. The company supports a large number of industrial units of strategic importance like pulp and paper, aluminium, soaps and detergents, textiles, rayon, drugs and pharmaceuticals, rare-earths, fertilizers, PVC and plastics, insecticides, agrochemicals etc. The unit is a main supplier of chlorine to the Kerala Water Authority. With continuous efforts of upgradation of technology and professional management the company has been maintaining a good track record of profitable operation & healthy industrial relations. TCC has been a very environmental-friendly. Energy conservation has been continuing activity in TCC. TCC was bestowed with various awards for excellence performance with regard to productivity, energy conservation, pollution control and safety.

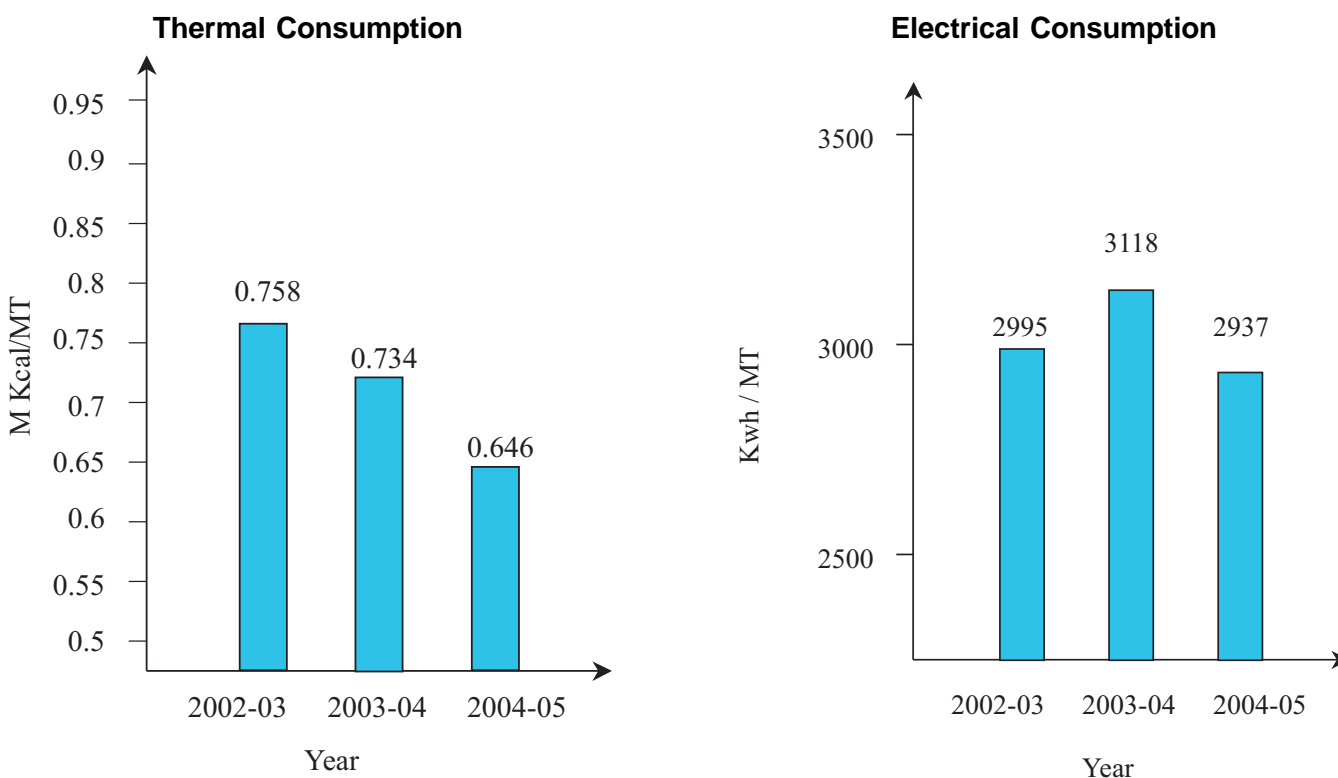


Energy Consumption

Details of energy consumption, production etc., for the past 3 years are shown below :

Description	Unit	2002-03	2003-04	2004-05
Annual Production	MT	47263.169	55285.202	47201.081
Installed Capacity	MT	68595	74250	52250
% Capacity Utilisation	%	68.90	74.46	90.34
Annual Sales Turnover	Rs. lakhs	8499	10441	10202
Total electrical energy consumption/ Annum	Lakhs KWH	1415.73	1723.73	1386.80
Specific energy consumption - Electrical	KWH/MT	2995	3118	2937
Total thermal (fuel) consumption/ Annum	MKcal	35825.43	40593.76	30483.94
Specific energy consumption – Thermal (Fuel)	MKcal/MT	0.758	0.734	0.646

Computer Graphics Presentation related to Specific Energy Consumption



In fact the above figures and graph pertaining to the preceding 3 years do not depict the real situation of energy saving due to the conversion of mercury cell process to membrane cell process because the

mercury cell plant was operated at reduced load after 2001. At reduced load the energy consumption in the Mercury Cells will be less.

Month	Production in MT	Energy Consumption Kwh	Specific Energy Consumption KWh/MT (Monthly)
January	2371	9251900	3902
February	1905	7471900	3922
March	2029	7866450	3877
April	2158	8374700	3881
May	2189	8542650	3903
June	2489	9588295	3852
July	2278	8674850	3808
August	2401	9094750	3785
September	2095	7956250	3797
October	2400	9139815	3808
November	1871	7406450	3958
December	1674	6333350	3782
Total	25860	99701410	

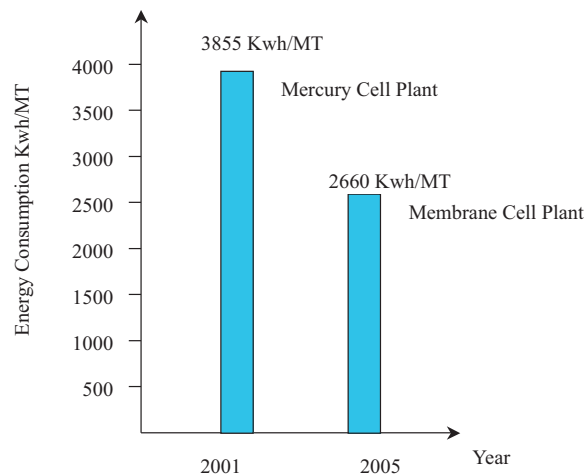
The average specific energy consumption for the year 2001 = 3855 Kwh.

Specific energy consumption in the membrane cell plant after the second stage of conversion is 2660 KWh/MT in September 2005. Therefore the saving in specific energy consumption due to the conversion process = 3855 – 2660 = 1195 Kwh/MT.

HENCE THE SAVINGS AS A PERCENTAGE WHICH IS THE EFFECT OF THE CONVERSION OF MERCURY CELL PLANT TO MEMBRANE CELL PLANT

$$= \frac{1195}{3855} \times 100 = 31\%$$

A graphical representation of the saving in the Membrane Cell Plant compared to the Mercury Cell Plant is given below :-



Energy Conservation Commitment Policy and Organisational Set up

The company is always committed to energy conservation. It is given very high priority. Every possible effort is done for energy conservation.

The Energy Policy has been declared by the Company as stated under:

**THE TRAVANCORE-COCHIN CHEMICALS LTD.
UDYOGAMANDAL**

ENERGY POLICY

WE, AT THE TRAVANCORE-COCHIN CHEMICALS UDYOGAMANDAL, ARE ALWAYS COMMITTED TO CONSERVATION OF ENERGY BY ALL POSSIBLE MEANS.

- TO ACCOMPLISH OUR MISSION, WE STRIVE FOR;
- * TECHNOLOGICAL UPGRADATION TO REDUCE SPECIFIC ENERGY CONSUMPTION
 - * CONDUCTING ENERGY CONSERVATION STUDIES INCLUDING ENERGY AUDIT AND ADOPTING THE APT MEASURES FOR CONSERVING ENERGY
 - * CONTACTING OTHER ORGANISATIONS AND ENRICHING OUR EXPERIENCES ON ENERGY CONSERVATION
 - * USING RENEWABLE ENERGY SOURCES TO THE EXTEND POSSIBLE
 - * DISSEMINATING KNOWLEDGE AND INFORMATION ON ENERGY CONSERVATION TO OUR EMPLOYEES
 - * LOW ENERGY FUELS ALSO TO BE TRIED DEPENDING UPON FEASIBILITY

sd/-
MANAGING DIRECTOR

Energy Conservation Achievements

ELECTRODES RE-COATING & MEMBRANES REPLACEMENT WITH HIGH EFFICIENCY MEMBRANES

The membrane cell hardware consists of anodes, cathodes and membranes. The anode mesh is Titanium made up of expanded metal with R_uO_2 Catalyst coating having an effective area of 1.71 m². The cathode mesh is copper made of punched metal with nickel plating. The normal life of the anode and cathode is 72 months; where as the normal life of the membrane is 36 months.

The factors determining the cell voltage are the cell hardware, electrolytic conditions and the conditions of the membrane.

At 3KA/M² current density, the cell voltage is as under :

Reaction voltage	:	2.25 V
Structural IR drop	:	0.20 V
Membrane IR drop	:	0.35 V
Electrolyte IR drop	:	0.08 V
Anodic over Voltage	:	0.05 V
Cathodic over Voltage	:	0.10 V
<hr/>		
Total Cell Voltage	=	3.03 V

At the fag end of the periods stated above, the cell voltage starts increasing to 3.6 V. At this stage the electrodes need to be re-coated and the Membranes need to be changed.

In 2004-05 the unit has replaced the Membranes and re-coated the electrodes at an expense of Rs. 832 lakhs. The unit has saved electrical energy to the extent of 85.43 lakh kWh with an equivalent monetary saving of Rs. 228.11 lakhs.

PROCESS RE-ENGINEERING – PART CONVERSION OF THE MERCURY CELL PRODUCTION CAPACITY TO MEMBRANE TECHNOLOGY – SECOND STAGE

The purpose of this project was to reduce the energy consumption as well as to eradicate mercury pollution since no mercury is used in Membrane Cells. There is enormous gain in electrical energy while using membrane cells. To illustrate these, the average specific energy consumption in the Uhde Mercury Cell Plant during January 2001 to December 2001 was 3855 Kwh/MT. After the installation of the Membrane Cell Plants in lieu of the Mercury Cell Plant the energy consumption per MT has come down to as low as 2660 Kwh, (in September 2005), ie., again of 1195 kWh/MT. In percentage this works out to 31%. It is a tremendous gain. The expense for the project was Rs.2200 lakhs.

We have already taken up the project work for the third stage conversion of the 100 TPD Uhde Mercury Cell Plant which is expected to be commissioned by next year at a project cost of around Rs.2200 lakhs.

Energy Conservation Plans and Targets

The unit has commissioned in July 2005, 25 TPD Membrane Cell Plant (UHDE make) as the second part conversion fo the Uhde Mercury Cell Plant, at an expense of Rs.2200 lakhs. The specific energy consumption has come down as low as 2660 kWh per MT by September 2005. We hope to achieve a figure of 2650 shortly.

The project work for the next part of conversion (25 TPD) has already begun. The plant will be commissioned in 2006. The estimated cost is slightly above Rs.2200 lakhs. By the end of 2006, the unit expects to bring down the specific energy consumption figure to 2600 kWh/MT.

The reaction of hydrogen and chlorine in the HCl Oven is exothermic. Till now this heat was wasted because no oven were available from which the above waste heat could be extracted. Now the plant has located a party who can supply HCl ovens with waste heat recovery system.

Plant is also indenting a new energy efficiency boiler with multiple fuel facility (Hydrogen + Furnace Oil) so that it can utilize byproduct Hydrogen in the boiler also.

Specific Energy Consumption Targets

Year	Electrical Energy kWh/MT (over all)	Thermal Energy MKcal/MT	Reduction over the year 2004-05	
			Electrical %	Thermal %
2004-05 (base year)	2937	0.647	NA	NA
2005-06	2650	0.625	9.77	3.4
2006-07	2600	0.600	11.47	7.26

The target for 2005-06 has almost been achieved by September 2005.

Environment and Safety

TCC is very much environmental – friendly. The Plant strictly adhere to the pollution standards.

Plant trains the truck drivers who take out the hazardous chemicals like chlorine, on how to handle adverse situations on road. Accidents are very least in this company and all are safety – conscious.

GUJARAT ALKALIES AND CHEMICALS LIMITED
Dahej, Bharuch (Gujarat)

Unit Profile

GUJARAT ALKALIES AND CHEMICALS LIMITED (GACL), DAHEJ UNIT commercial production commenced in August, 1998, with and installed capacity 100000 MTA. As a whole, GACL (RANOLI) installed capacity of 153500 MTA & (DAHEJ) installed capacity of 116500 MTA is largest Caustic Soda manufacturer in INDIA. GACL (Dahej Unit) production capacity utilization is 122.06%.

GACL (DAHEJ) is an integrated complex of Caustic Soda – 300 TPD, Captive Power Plant (Combined Cycle Co-generation Power Plant) having and installed capacity of 90 MW and Phosphoric Acid Plant (Technical Grade) with and installed capacity of 80 TPD. GACL markets it's products all over Gujarat and its exports many products.

GACL has it's own Energy Management Policy in addition to various other policies like quality policy, SHE Policy (Safety, Health & Environment Policy), Policy for Training & Development, Personnel Policy and Information Technology Policy. All these policies are in place which are declared by company Managing Director.

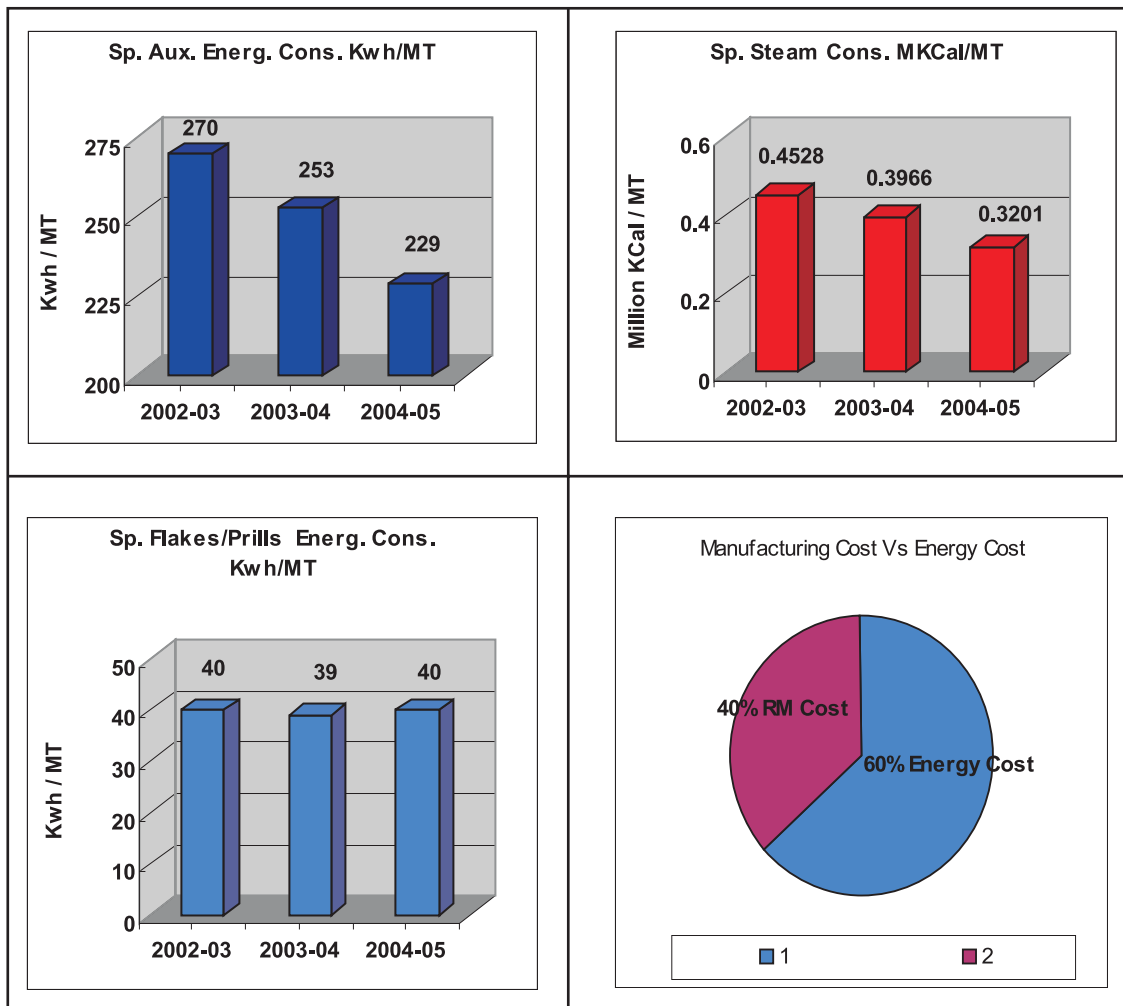
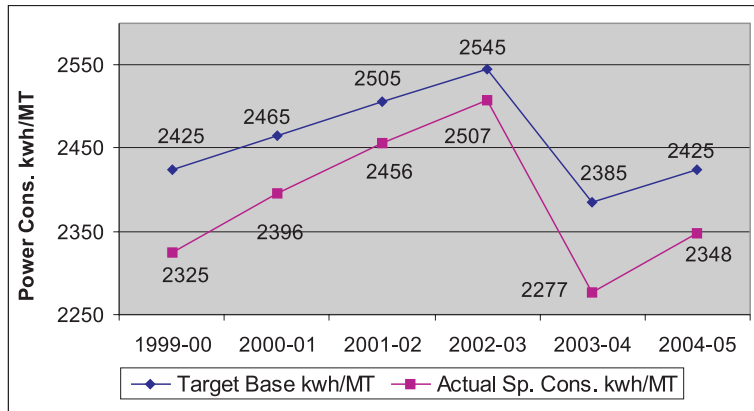
All policies are functioning well with participation of all employees up to their maximum capacity and continuous efforts are on in implementation of all the policies. GACL, Dahej unit is a ISO 9001-2000, ISO14001-1996 and ISO 18001-2000 certified company. **GACL has received the prestigious Green Tech Award Silver Medal for Safety for the year 2004 and for the year 2005 Green Tech Award Silver Medal for Environment for the year 2004 and National Energy Conservation Award – 2004 awarded by Ministry of Power, Government of India.**

Energy Consumption

SPECIFIC POWER CONSUMPTION DETAILS	UNIT	2002-03	2003-04	2004-05
Annual Production	MT	141504	142205	154310
Total Energy consumption per annum	KWH (Lakhs)	3931	3598	3963
Total Thermal Energy Consumption	Million Kcal	64070	56403	49397
Total Manufacturing Cost in Rs. (lakhs)	Rs. Lakhs	20166	19591	18190
Total Energy Cost in Rs. (lakhs)	Rs. Lakhs	11891	11891	10704
Energy Cost as % of Raw-Material cost	%	59	60	59
DC Electrolysis Power Consumption	KWH/MT	2447	2220	2289
AC Power Consumption without Auxiliaries & CCU	KWH/MT	2510	2277	2348
AC Power Consumption with Auxiliaries & without CCU	KWH/MT	2780	2530	2577
Auxiliary Power Consumption only	KWH/MT	270	253	229
Power Consumption for CCU flakes & prills	KWH/MT	40	39	40
Steam Consumption	MKcal/MT	0.4528	0.3966	0.3201

Year	Target based on base figure of 2385 kwh/MT in 1998-99 (Without Auxiliries)	Actual kwh/MT	Savings kwh/MT
1999-00	2425	2325	100
2000-01	2465	2396	69
2001-02	2505	2456	49
2002-03	2545	2507	38
2003-04	2385	2277	108
2004-05	2425	2348	77

Specific Energy Rectifier AC Power Consumption kwh / MT

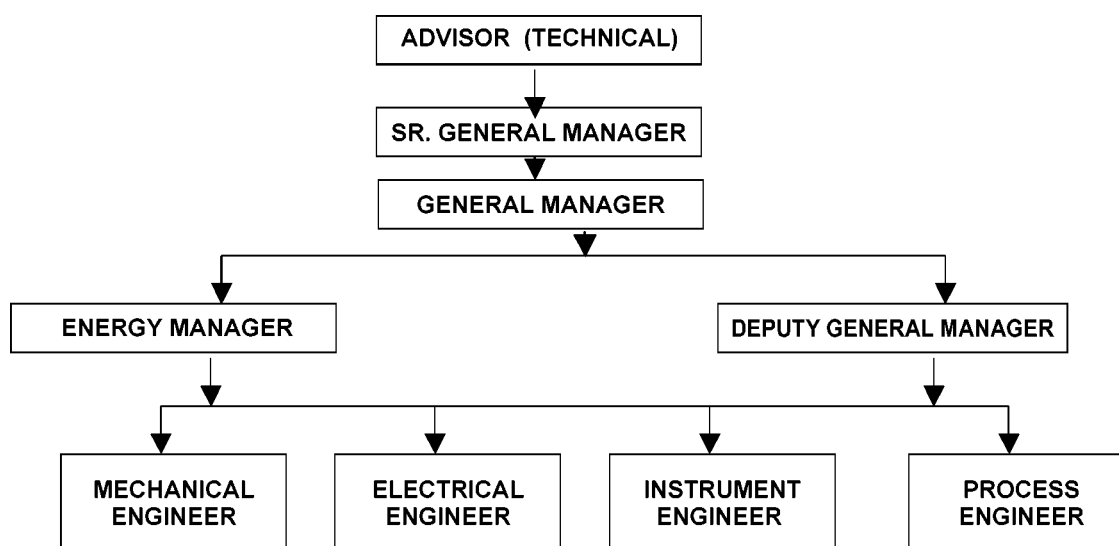


Energy Conservation Policy and Set Up

SALIENT FEATURES OF ENERGY CONSERVATION CELL:

GACL has its own Energy Conservation Cell at Dahej Complex, headed by General Manager (D) assisted by Energy Manager is supported by at least two Engineers from each department forming a team. This team finds various energy saving potential in their working areas, brings the proposal to Energy Cell for elaborate discussions and brain storming sessions for finalization and implementation. GACL committed to fine tuning operations & maintenance continuously to achieve the goal. Technology up gradation with energy efficient process and equipments. Motivating, Training & encouraging our employees to achieve a target of reducing specific energy consumption by minimizing 1% every year. Promoting the use of renewable natural resources for sustainable development, safeguarding the society and protecting the environment. Setting up a system to continuously monitor the progress.

ENERGY CONSERVATION CELL STRUCTURE



Energy Conservation Achievements

GACL has implemented many energy saving proposals of small, medium & large. We have Replaced defective Evaporator tube bundles with new tube bundle in CEU to save thermal energy. Retrofitting of luminaries, Preheating of Natural Gas to improve Heat Rate of Power Plant. Maintaining brine temperatures as per the norms, DC power consumption of Cell Power within limits. Many other under efficiency Equipments stopped / replaced to conserve the energy. During 2004-05 with energy conservation measures, unit has saved an amount to the tune of **Rs. 327.14 Lakhs**.

MAJOR ENERGY CONSERVATION PROJECTS IMPLEMENTED DURING THE YEAR 04-05.

A) Energy saved in Cell House

As per Industries norms, the cell element voltage increases with the aging of membrane and hence power losses increases to the tune of 40 kwh/MT. By maintaining brine temperature and quality of brine and ensuring minimum deposition calcium and magnesium salts and hence less power consumption. The energy saved by above activities is as below:

TARGET	2004-05
1) Based on base figure of 2385 kwh / MT for the year 2003-04 and industry norms 40 kwh / Ton / year increases due to aging of cell membranes.	2425
2) Specific power consumption kwh / MT.	2348
3) Caustic Production (MT).	154310
4) Saving in Power (Lakh kwh/year)	118.82
5) Power cost (Rs./kwh)	1.71
6) Amount saved per year (Rs. In Lakh).	203.18



B) Thermal Energy Saving by Replacement of Heat Exchanger tube bundles with new ones.

Two no. of Heat Exchangers EV-11 and EV-13 tube bundles were developed leakages in CEU. These tube bundles were replaced with new tube bundles, which saved quite good amount of thermal (Steam) energy. The saving of thermal energy is as below:

1) Before replacement of the tube bundles specific thermal energy consumption was	- 0.3966 Mkal/MT.
2) After replacement of the tube bundles specific thermal energy consumption was	- 0.3201 Mkal/MT.
3) Annual production	- 154310 MT.
4) Thermal energy saving	- 11805 Mkal
5) Amount saved (Rs. Lakh).	- 94.00



C) Improvement in Heat Rate of Power Plant.

Preheating of Natural Gas from 5degC to 40degC, to improve the net heat rate gain in power plant (GTG- 2 nos. and STG – 1 nos.). Natural Gas is fed 5 Lakh SM3/ day at 5degC to both GTGs. Natural Gas Temperature raised to 40deg C through IP saturated steam heat exchanger at 1.2bar pressure (steam consumption was 0.5T/Hr.)

1) Thermal energy saved by preheating the N.Gas	210 Mkal/Yr.
2) Thermal energy saved through mini STG turbine	313 Mkal/year
3) Total Heat saved	523 Mkal/year
4) Natural Gas saved (1 SM3 = 8787 Kcal)	59520 SM3/year
5) Amount saved (Rs. In Lakh)	4.17



D) Auxiliary consumption reduced by replacing FRP Fan in place of Metallic Fan in Cooling Tower 3 nos. The power saving details are as below.

1) With metallic blades power cos.(kwh lakhs)	9.59
2) With FRP blades power cons.(kwh lakhs)	5.96
3) Power saved (kwh lakhs)	3.63
4) Investment made (Rs. Lakhs)	1.50
5) Amount saved (Rs. Lakhs) @Rs. 1.71	6.20



E) Switching off of 2.2 MVA idle charged transformer power saved.

Switching off of 2.2 MVA Transformer, which was in ideal charged condition. This transformer put off through out the year except charging the transformer 2 days in a month for keeping in healthy condition.

Before Switch off of transformer	
Power consumption (kwh lakhs)	5.05
After Switch off of transformer	
Power consumption (kwh lakhs)	0.46
Power saved (kwh lakhs)	4.59
Investment made (Rs. Lakhs)	Nil
Amount saved (Rs. Lakhs) @Rs. 1.71	7.85



F) One no. 45 kw pump Switched off instead of running two nos. by incorporating bigger size impeller :

Instead of running 2 nos. of 45 kw pure brine pumps only 1 nos. 55 kw with bigger size impeller to meet the process requirement.

Before implementation of above measure	5.84
Power consumption. (kwh lakhs)	
After implementation of above measure	
Power consumption. (kwh lakhs)	4.77
Power saved (kwh lakhs)	1.07
Investment made (Rs. Lakhs)	0.20
Amount saved (Rs. Lakhs) @Rs. 1.71	1.83



G) One 18.5 kw ETP pump replaced with 9.3 kw pump to save the power and meet the same process requirement:

One nos. 18.5 kw ETP pump, Suction starving which was having lower size suction pipe and hence delivery was not proper. This pump was replaced with 9.3 kw Rating Pump.



With 18.5 kw motor power consumed (kwh lakhs)	1.30
With 9.30 kw motor power consumed (kwh lakhs)	0.51
Power saved (kwh lakhs)	0.79
Investment made (Rs. Lakhs)	Nil
Amount saved (Rs. Lakhs) @Rs. 1.71	1. 35

H) Out of three running pumps one pump was stopped to cater the flow requirement with two pumps only in CCP :

There are three pumps namely clarified water pump to PA Plant. Clarified water pump to CSPlant and C.T. makeup pump were running continuously. By piping interconnections clarified water pump and C.T. make up pump both together catering the flow to all the three location and the PAPlant pump totally stopped. The saving is as below:



When three pump in operation the power was (kw)	64.80
After modification only two pumps are in Operation the power was (kw)	42.40
Total energy saving per year (kwh Lakhs)	1.94
Energy cost (Rs. / kwh)	1.71
Investment made (Rs. Lakhs)	1.00
Total amount saved for the year (Rs. In Lakh)	3.32

I) By maintaining the power factor above 0.95 lag amount saved:

By maintaining the power factor of the complete electrical system of the complex more than 0.95 lag. Rebate in the form of revenue obtained from Gujarat Electricity Board. For complete year of 2004-05 is



Investment made (Rs. Lakhs)	Nil
Rs. In lakh	4.91

J) By stoppage of drinking water pump energy is saved:

Previously 2.2 kw pump was catering the drinking water pump in CCP plant. At present the same is met by inter connecting pipeline to existing over head tank.



With this the power saved is (kwh/year)	0.19
Investment made (Rs. Lakhs)	0.20
Amount saved per year (Rs. Lakhs) @ Rs. 1.71	0.33

Other projects implemented during 2003-04.

1) Timers installed for control of lighting. 2) Stoppage of idle running of motors. 3) Electronic chokes in place of conventional chokes. 4) Thermal insulations provided wherever damaged. 5) L.T. capacitors installed to improve the Power Factor. 6) Switching off lights, fans, ACs, by individuals whenever offices are not occupied. 7) Lighting transformers installed to maintain the normal voltage level of 230V. We have implemented the 5s' system (short, set in order, shine, standardize & sustain) for good & clean environment. Kaizens system has been implemented for improvement.

National campaign on Energy Conservation 2005:

As committed in the manifesto of Energizing India, plant has organized energy campaign in surrounding schools of the villages at Dahej and Bharuch district of Gujarat. Rest of the program as committed in the manifesto will be complied in true spirit. A book was printed containing domestic appliances on energy conservation and distributed the same in nearby schools and the villagers who attended the program. In the year 2004, the company celebrated Energy Conservation Week in December 2004 and organized energy slogan competition for all employees.

Energy Conservation Plans and Targets

Energy Saving Measure	Amt.saved (Rs.Lakhs)	Investemen (Rs. Lakhs)	Project*
Vent out Hydrogen will be utilized instead of Natural Gas in New CCU (100 MT per day Caustic Flakes)	60.24	16.00	2005-2006
Vent out Hydrogen will be utilized instead of Natural Gas in Old CCU (200 MT per day Caustic Flakes)	121.21	18.00	2005-2006
Cooling Tower Performance improvement in CCP	12.82	10.00	2005-2006
Rectifier Electrical A.C. replacement by spare chiller cooling coil	1.71	2.00	2005-2006
In place of existing 10 nos. of air compressors, two nos. of screw compressors installation to cater total air requirement	34.20	120.00	2005-2006
Replacement of 250watt HPMV lamps with 150watt HPSV lamps	1.37	0.60	2005-2006
Replacement of lower size motor of 30 kw in place of existing 37 kw motor (3 nos.)	1.15	1.20	2005-2006

* Project commencement and completion year.

ENERGY CONSERVATION CAMPAIGN BY GACL



◀ ENERGY CONSERVATION CAMPAIGN FOR SCHOOL CHILDREN AT VILL. JOLWA.

▶ ENERGY CONSERVATION CAMPAIGN AT GACL COLONY – BHARUCH (GUJ.)



▶ ENERGY CONSERVATION CAMPAIGN FOR SCHOOL CHILDREN AT VILL. DAHEJ.

▶ ENERGY CONSERVATION CAMPAIGN AT SVMIT BHARUCH FOR ENGG. STUDENTS.



Environment and Safety

Safety

GACL has a Safety Department and maintains regular safety stringent checks all over the plant surprisingly and will see the safety measures are being followed very strictly.

We have a Central Control Room which functions round the clock where an Engineer/Officer will be the in-charge who will co-ordinate and organize necessary help required from outside agencies as well as In-house in case of emergency.

Emergency response plans are drawn and made known to every employee. Surprise Mock-Drills are conducted regularly to know the employees response. As GACL produces chlorine and stocks some extent, it regularly conducts Safety Awareness Programs in nearby villages and will made them understand what pre-cautions are to be taken in case of Chlorine Leakage. GACL maintains all statutory regulations and Acts and review in time without fail.

GACL has a First-Aid Centre in Complex managed by Doctor round the clock. An Ambulance is also readily available to shift the patients in case of emergency.

Environment

As a part of GACL culture we have maintained complete plant leakage free and good house keeping. Some of the salient points are as below:

i) Vermicomposting of canteen waste:

Unit started vermicomposting of all our canteen waste. From this canteen waste, we are, generating valuable vermicompost for us in our green belt / garden.

ii) Recovery of CaCl_2 from effluent:

Unit's effluent from Phosphoric Acid Plant contains 18% CaCl_2 . Last year we have installed the plant to recover that CaCl_2 to produce 50 TPD CaCl_2 (100% basis). This has reduced effluent load of approximately 200 M³/Day and in form of condensate recovery, conservation of water is achieved by approximately 140 M³/day.

iii) Water harvesting:

Unit has made 10 nos. of earthen ponds in last two years with total water storage capacity of 35,750 M³ in complex to fulfill our water requirement for large scale plantation activity.