

## GUJARAT ALKALIES AND CHEMICALS LIMITED, VADODARA

### 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.

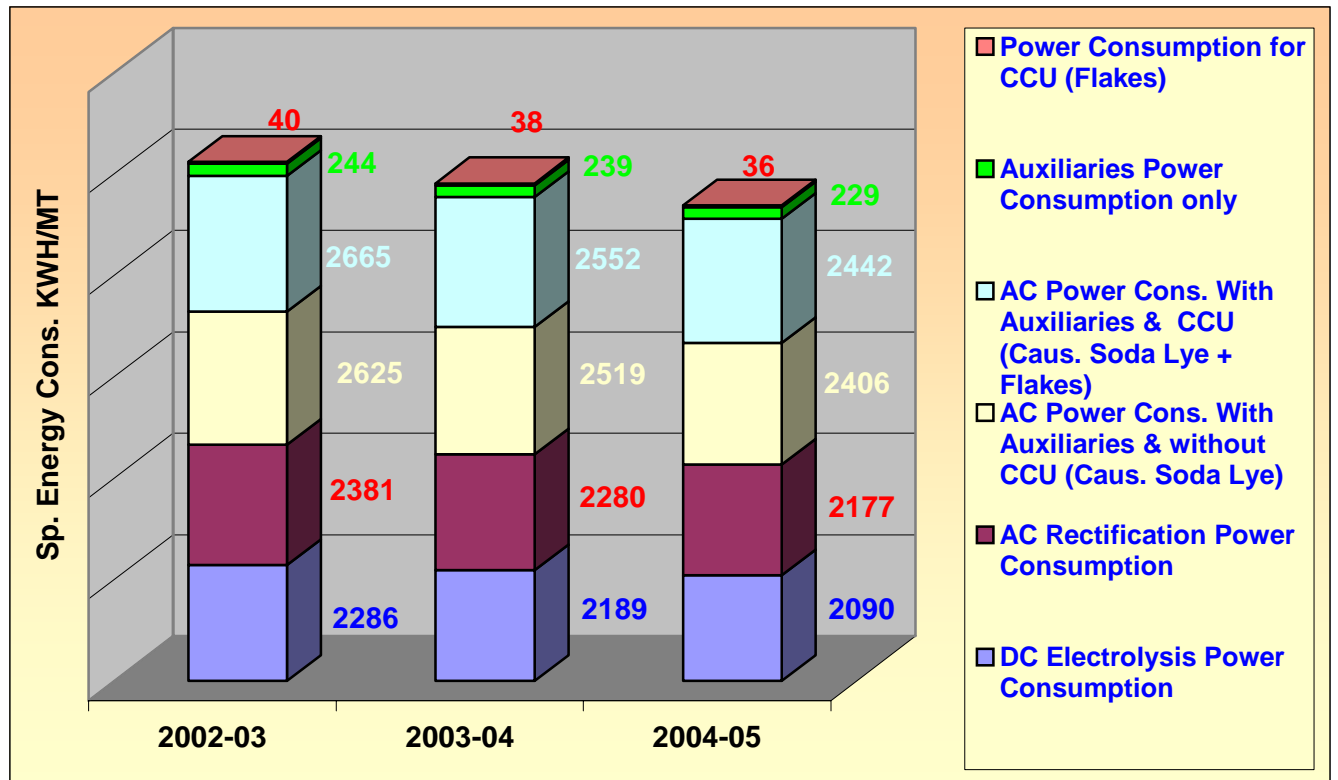
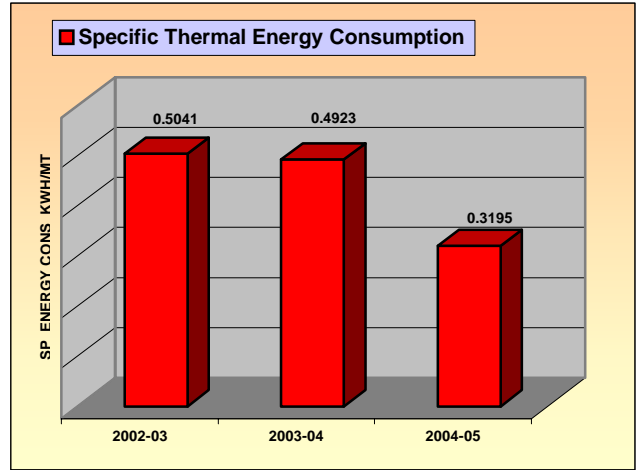
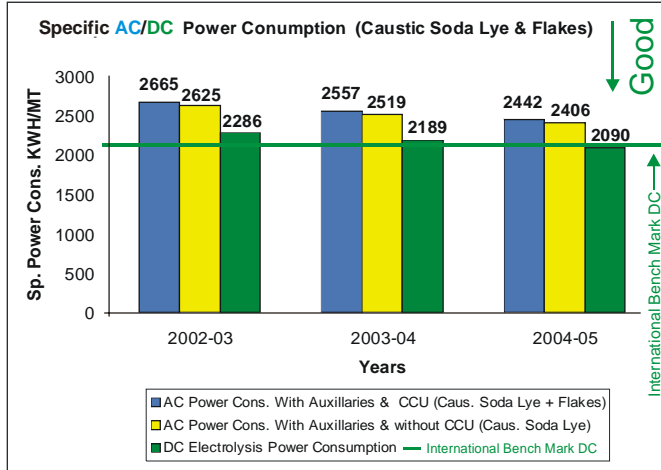
Company has following distinctions to differentiate it from its others in the industry for maintaining its leadership with market share of **16.19%** and **111.15%** capacity utilization. (AMAI Report).

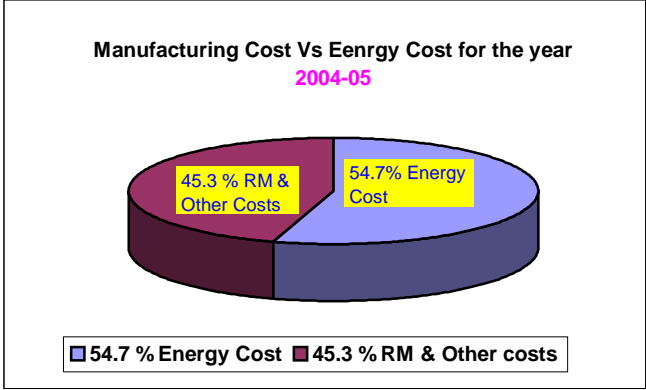
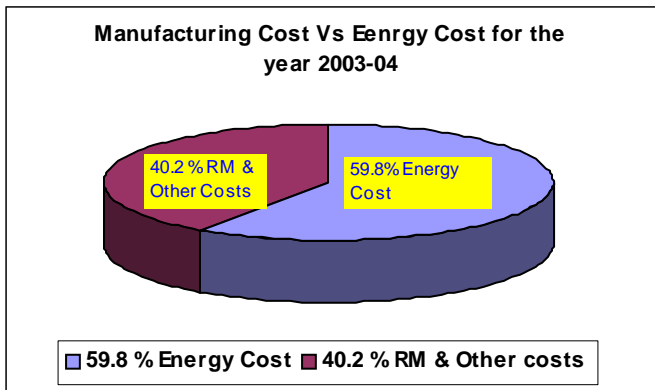
- **98.27%** utilization of **Hydrogen** – which is a co-product in chlor-alkali process. It produces eco-friendly chemical of Hydrogen Peroxide and uses it as fuel in concentrating Caustic Soda/Potash.
- Capacity utilization at Vadodara unit is **111.15 %** against industry average of **70%** (AMAI 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	<b>170620</b>
Total energy consumption per annum	Lacs KWH	4008.60	3957.85	4105.12
Total thermal energy consumption	MKacl	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	<b>2286</b>	<b>2189</b>	<b>2090</b>
AC Electrolysis Power Consumption	KWH/MT	2381	2280	2177
AC Power Consumption with Auxiliaries & without CCU	KWH/MT	<b>2625</b>	<b>2519</b>	<b>2406</b>
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	<b>0.5040</b>	<b>0.4923</b>	<b>0.3195</b>


**Graphical Representation of Specific Energy Consumption:**





**Energy Conservation Commitment, Policy & Organisational Set-up:**

# ENERGY MANAGEMENT POLICY



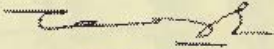
**GUJARAT ALKALIES  
AND CHEMICALS LTD.**

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

**Through**

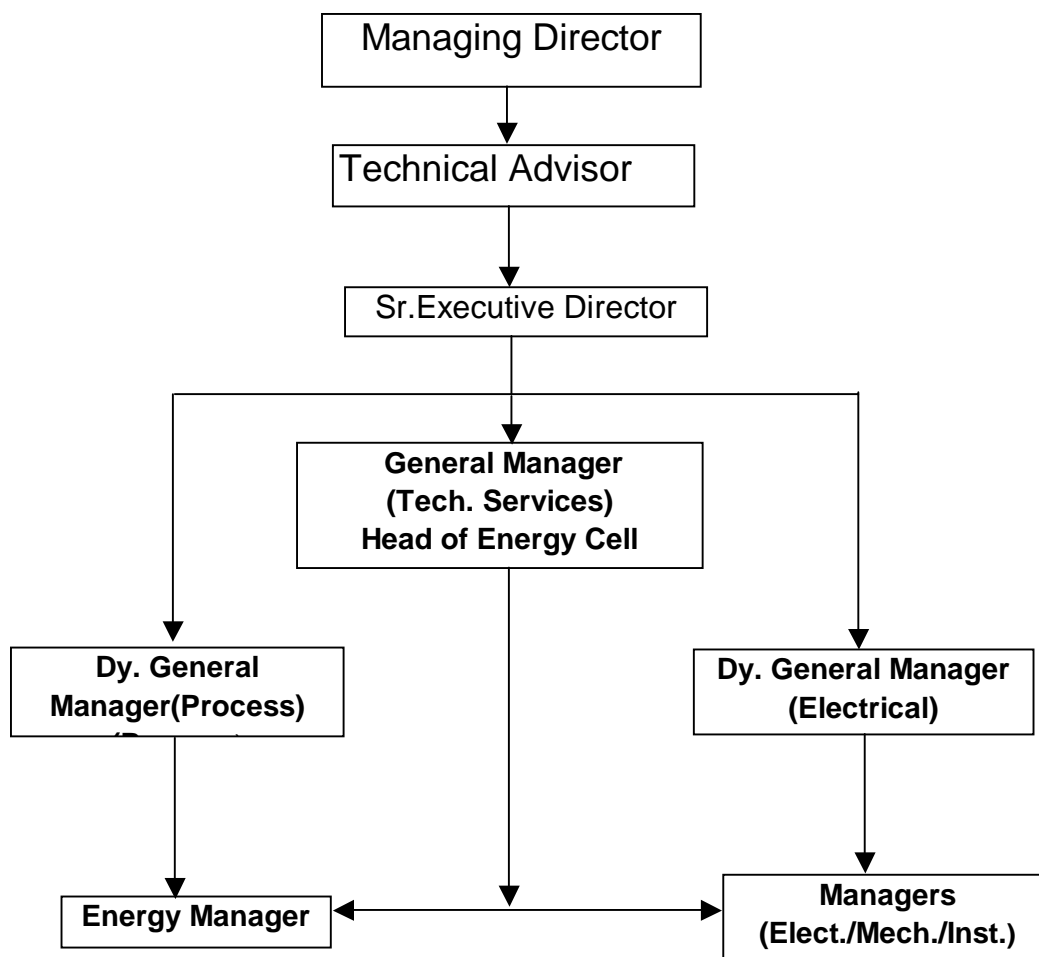
1. Maximising the Capacity Utilisation.
2. Fine tuning our Operations and Maintenance continuously to achieve the above Goal.
3. Technology Upgradation with energy efficient processes and equipments.
4. Motivating, Training and Encouraging our employees to achieve a target of reducing specific energy 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.

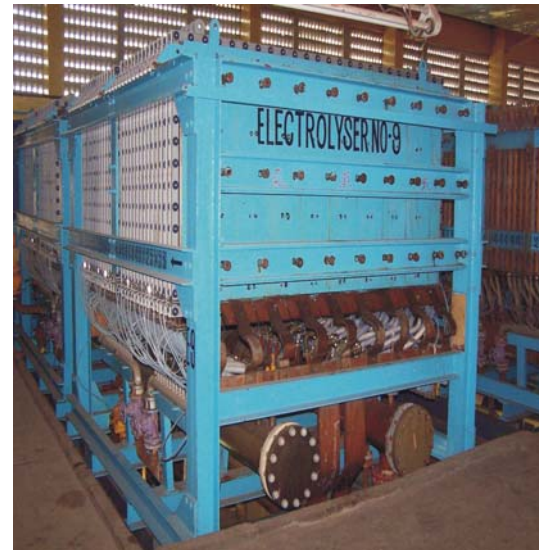
Unit has been sanctioned to implement a unique project using renewable energy resource (Solar-Photovoltaic) for industrial DC load of its instrumentation system at the cost of Rs. 40 lacs with 6 years pay-back period. This unit is facilitating for international trials of new technology from Japan, Germany & 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 lacs**. 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 electrolysers (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/m<sup>2</sup> current density.



Reduction in Specific Energy Consumption.....**13.66kWh/Tonne**  
**Saving in Power:** 2004-05 part operation.....**23.3 lacs 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 electrolysers 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:**

We already had installed **dual fuel** burners in our 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, We plan regular replacement of Hot & Cold Insulations of Pipe lines and Equipments and we have 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:**

We are out sourcing process water supply from Mahi River through GSFC & IPCL pipelines. Earlier we used to put this water in our water reservoir and then pumping it to chloromethane plant. Our water management study revealed that we 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 :**

We have up-graded Hardware & Software of our 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. We are able to maintain the brine temperature, quality of brine ensuring minimum calcium and magnesium content in brine which leads to saving in power consumption across the electrolyzers.



**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 <b>energy efficient new version-4</b> 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
<b>Sub total :</b>	<b>805.2</b>	<b>1778.4</b>	<b>9507</b>	<b>-</b>