

## GUJARAT ALKALIES AND CHEMICALS LIMITED, VADODARA

### 20(i). Unit Profile

**Gujarat Alkalies and Chemicals Limited (GACL)** is the **single largest flag bearer company** in chlor-alkali industry having installed capacity of **4,12,550** 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 **1,85,167 TPA** of Caustic Soda and Caustic Potash with unique product integration manufacturing more than **25** chemicals at Vadodara & Dahej complexes. This is a **pioneer unit** in the country to introduce **energy-efficient and eco-friendly Membrane Cell Technology** by converting its mercury cell plant in 1989 and completely changed over in 1994 itself. This unit has always been **proactive in adapting world-class state-of-the-art technology**.

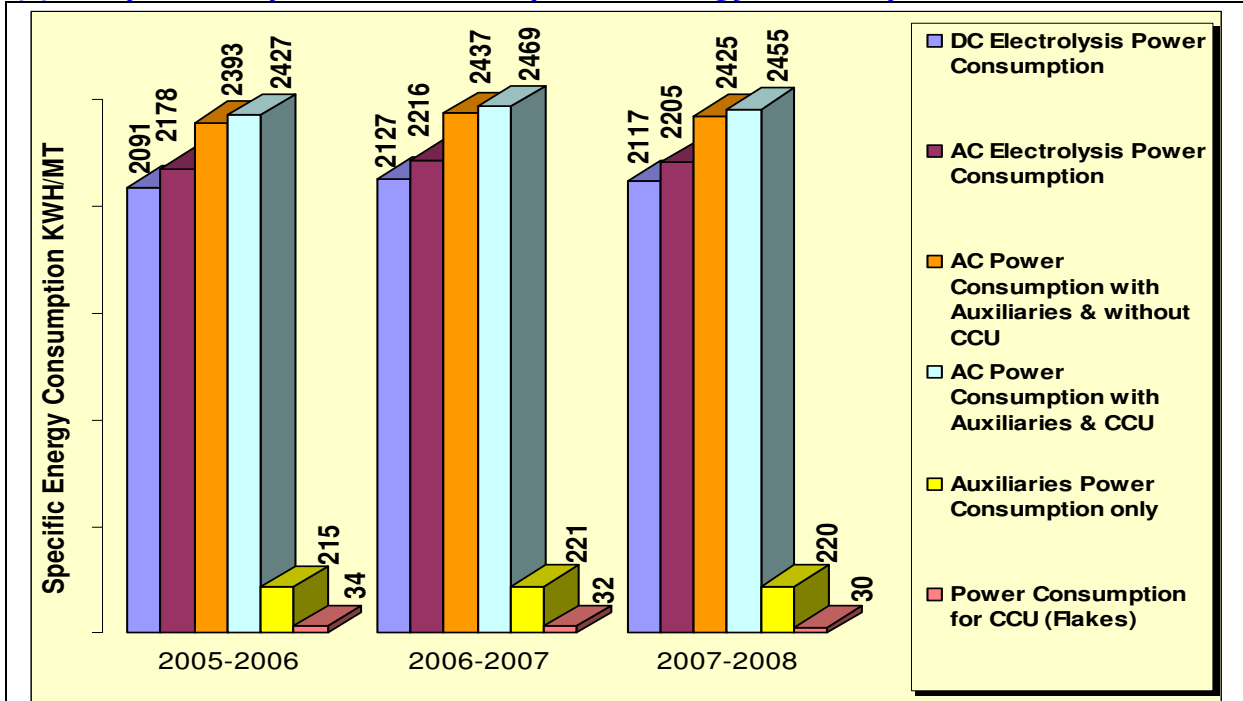
Company has following distinctions to differentiate it from its competitors for maintaining its leadership with market share of **18%** and capacity utilization of **108.92%** (AMAI Report) during 2007-08.

- **First PSU**, who laid foundation of **23.75 MW Windmill Power Generation** – Unit in Kutch.
- **95.21%** utilization of **Hydrogen** – which is a co-product in chlor-alkali process. It is used to produce eco-friendly chemical of Hydrogen Peroxide and also it is used as fuel in concentrating Caustic Soda/Potash.
- Complete changeover to clean energy source of Natural Gas from Furnace Oil since 2006, which resulted in increased energy efficiency and lower CO<sub>2</sub> generation.
- Capacity utilization at Vadodara unit is **108.92%** as against industry average of **83.1%**.
- We introduced **DCS** (Distributed Control System) in **Chlor-Alkali Industry in 1994** in the country while converting its mercury plant to membrane plant in second phase. The “trend” continued for all other UHDE – plants thereafter. In the year 2007-08 we have changed over to DCS System from panel based instrumentation system in our pioneer caustic plant commissioned in 1976. This has improved our operating efficiency and reduced energy consumption evident in the data.
- Company is ISO 9001:2000, ISO 14001:2004 and IS 18001:2000 certified for its commitment to Quality system, 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).
- GACL Vadodara changed over to Natural Gas from Furnace-oil completely for its boiler at Vadodara adopting a Clean Technology Philosophy as committed in its “**Energy Management Policy**” since 2006.

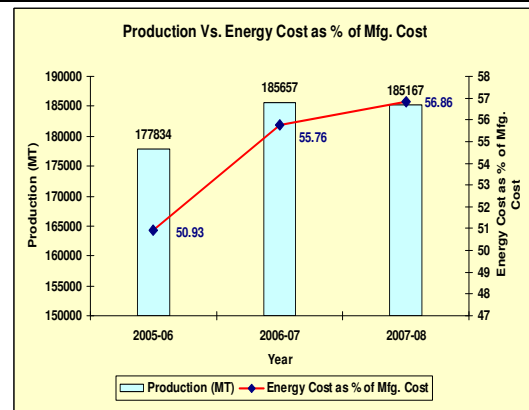
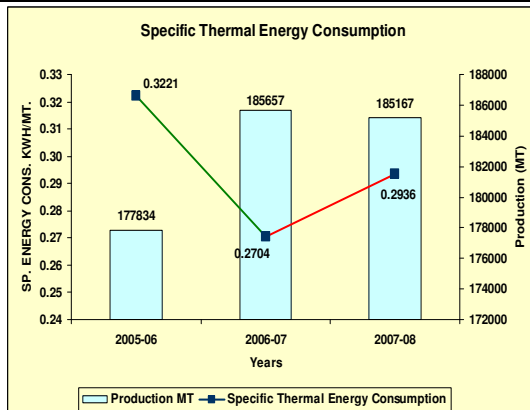
### Energy Consumption

<b>Specific Power Consumption Details</b>	<b>Unit</b>	<b>2005-2006</b>	<b>2006-2007</b>	<b>2007-2008</b>
Annual Production (Caustic Soda & Potash)	MT	<b>177834</b>	<b>185657</b>	<b>185167</b>
Total energy consumption per annum	Lacs KWH	4255.7	4524.37	4490.29
Total thermal energy consumption	MKacl	<b>57293.71</b>	<b>50207.8</b>	<b>54358.18</b>
Total Manufacturing Cost	Rs. Lacs	22925.42	28539.95	31850.78
Total Energy Cost	Rs. Lacs	11676.19	15913.89	18112.08
Energy Cost as % of Manufacturing Cost	%	50.93	55.76	56.86
DC Electrolysis Power Consumption	KWH/MT	<b>2091</b>	<b>2127</b>	<b>2117</b>
AC Electrolysis Power Consumption	KWH/MT	2178	2216	2205
AC Power Consumption with Auxiliaries & without CCU	KWH/MT	<b>2393</b>	<b>2437</b>	<b>2425</b>
AC Power Consumption with Auxiliaries & CCU	KWH/MT	2427	2469	2455
Auxiliaries Power Consumption only	KWH/MT	215	221	220
Power Consumption for CCU (Flakes)	KWH/MT	<b>34</b>	<b>32</b>	<b>30</b>
Thermal Energy Consumption	Mkcal/MT	<b>0.3221</b>	<b>0.2704</b>	<b>0.2936</b>
Hydrogen gas utilization as Fuel in CCU Furnace	NM3 lacs	<b>223.41</b>	<b>211.68</b>	<b>249.22</b>

## 20(ii). Graphical Representation of Specific Energy Consumption:

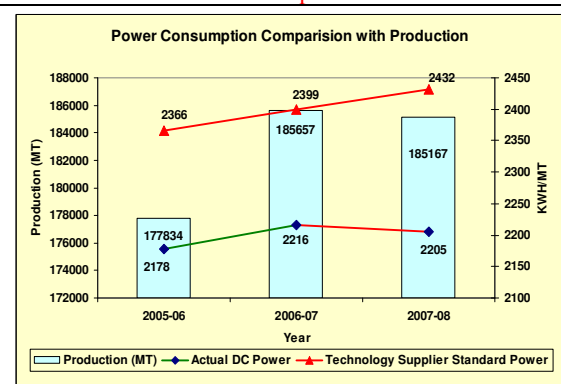
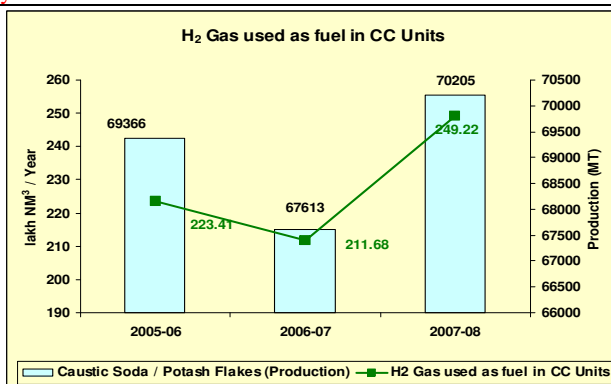


\*The production rate improvement has been contributing for high electrical consumption due to typical process characteristics of design even though by adopting EC measures reduction in specific power consumption is achieved in current year.



\*Thermal Energy is increased as we have received NG containing Methane % of above 90% against 76% during last year.

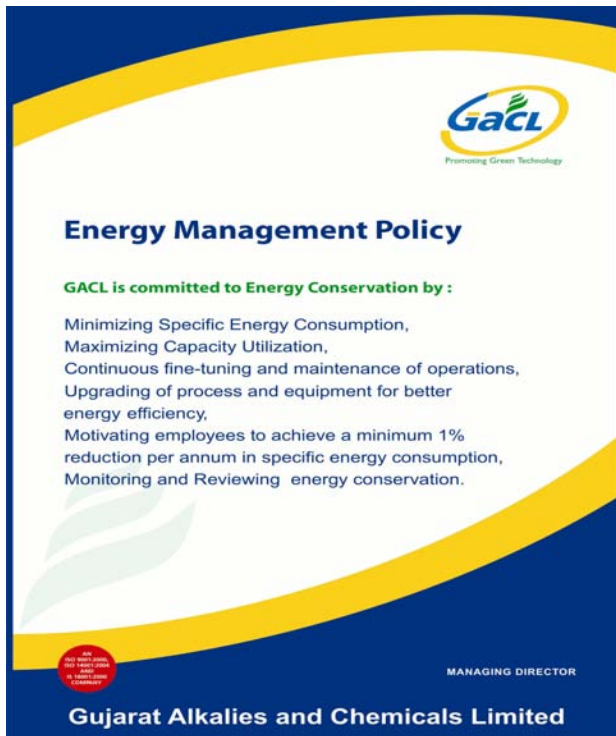
\*Though Power consumption is less, cost of energy has increased due to new imposed regulatory tariff on electrical transmission & Gas price.



\*H<sub>2</sub> Gas is used as fuel in place of Natural Gas in Caustic Concentration unit (CCU) for making Caustic Soda/Caustic Potash Flakes.

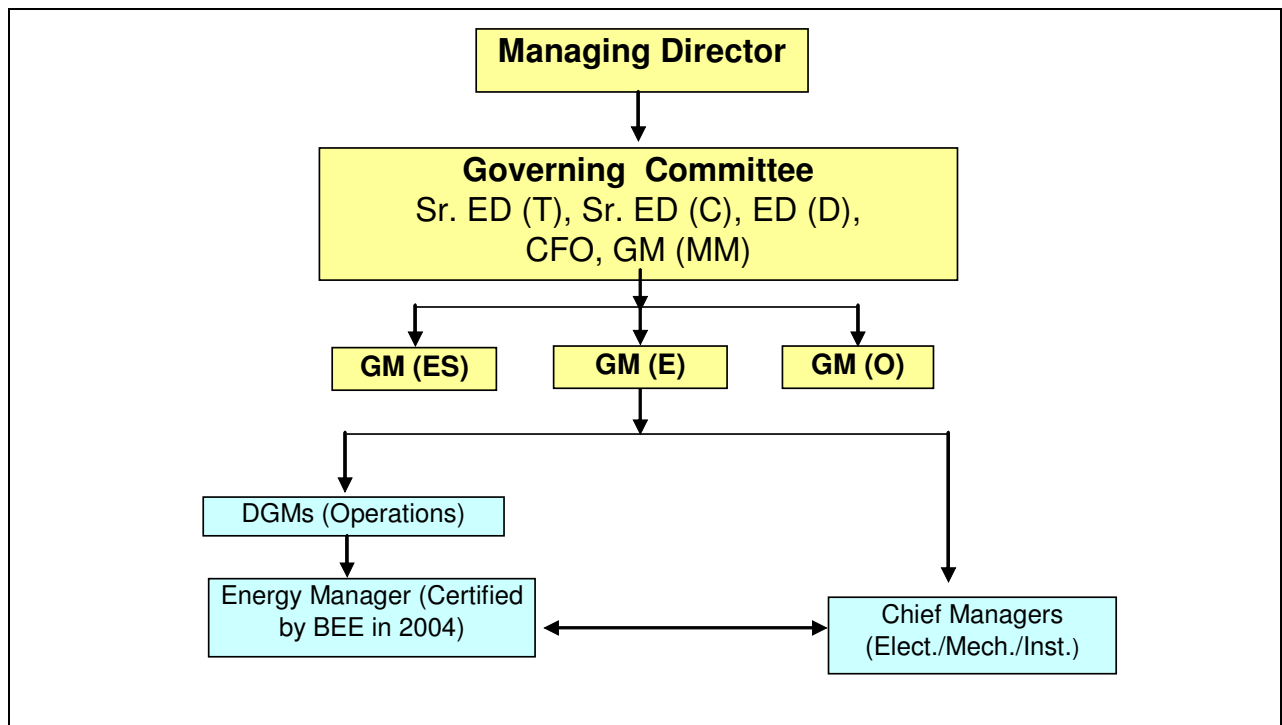
\*By taking all energy conservation measures, we are able to reduce specific power consumption against norm.

**20(iii). Energy Conservation Commitment, Policy & Organisational Set-up:**



GACL has a Energy Conservation Cell at Vadodara Complex, headed by Managing Director assisted by Sr. Executives and BEE certified Energy Manager, who is supported by Chief Managers from each department forming a team. This team finds various energy saving potential in their working areas, brings the proposals to Energy Cell for elaborated discussions and brain storming to finalize and implement the projects. Regular audits are conducted by external certified auditors. Annual budgetary provisions are made for energy conservation activities. As top management is committed to implement the energy saving measures, GACL always fine-tunes operations & maintenance continuously to achieve the continual improvement, technology up-gradations with energy efficient processes and equipments. Company's top management is motivating & giving training & encouraging our employees to achieve a target of reducing specific energy consumption by minimizing 1% every year evident in the results reported in this application.

**ENERGY CONSERVATION CELL STRUCTURE:**



**20(iv). Achievements: 2007-2008**

Unit has implemented **22 nos.** of major EC projects during the year 2007-2008 at total investment of **Rs. 13160.95 lacs** saving worth **Rs 3396.57 lacs**. Major projects are mentioned here below:

We have installed 23.75 MW Wind Farm at Kutch to cater power requirement of Vadodara unit and utilization of “Green Power” to reduce CO2 generation which will reduce “Global Warming” to some extent and our commitment shown in our “Logo”



**Saving in Cost** during 2007-08 .....**2467.20 Rs.lakhs**  
**Total Investment** ..... **12263 Rs.lakhs**

Power factor was improved from 0.972 to 0.983 resulted into additional rebates of Rs. 5.24 Lacs / month from MGVCL. Also net power saving of 1.63 Lacs units per month achieved. Earlier one of the capacitor bank was not having series reactor. Subsequently, series reactor was connected in the circuit and 6 nos. of capacitors were added at 33KV bus. Capacitors in LT network was also added to reduce voltage drop in the cable which resulted in improvement in quality of power by reducing harmonics.



**Saving in Cost**.....**109.6 Rs. lakhs**  
**Total Investment**.....**50.0 Rs.lakhs**

**Revamping of Cooling Tower hardwares** inclusive of using **Aero Dynamic** blades in place of normal metallic blades as a result of reduction in **Drift losses & improvement in Air circulations**. **Motor of 22 KW was replaced by energy efficient motor of 15 KW**. The following data shows the energy saving and investment during the year 2007-08.



**Saving in cost**.....**10.87 Rs.lakhs**  
**Total Investment**.....**12.2 Rs.lakhs**

Existing Freon refrigeration system for chilled water having very old reciprocating compressors which consumed more power & also more maintenance. So, these old compressors were replaced by energy efficient screw compressors in phases.



**Saving in cost**.....**89.08 Rs.lakhs**  
**Total Investment**.....**275 Rs.lakhs**

The company is 30 years old, We plan regular replacement of Hot & Cold Insulations of Pipe lines and Equipments and we have a budget provision and annual maintenance contract for replacement of Hot & Cold Insulation as required. The following data shows the energy saving and investment during the year 2007-08.

**Steam Header from Boiler to Plants** →

**Saving in cost.....14.88 Rs.lakhs**  
**Total Investment.....78 Rs. lakhs**



Process parameters like cell temperature, brine gpl, Caustic Concentration, Pressure across membrane are controlled by DCS instead of conventional panel based instrumentation system. This resulted into saving in power consumption due to continuous monitoring of key parameters contributing to energy consumption. It is very easy to analyse all these data on DCS and process parameters are optimized on regular basis.

**Replaced Panel Instruments by DCS control** →

**Saving in cost.....68.37 Rs.lakhs**  
**Total Investment.....0.0 Rs. lakhs**



We are converting Caustic Soda Lye into Caustic Soda Flakes in CCU Plant where we use NG as fuel in Furnace. By providing additional hydrogen gas line along with cooler, NG is replaced by hydrogen gas which will reduce CO2 generation and help in reduction in “Global Warming”.

**Hydrogen gas pipe line to CCU** →

**Saving in cost..... 161.97 Rs.lakhs**  
**Total Investment.....25.5 Rs. lakhs**



Alkaline water generated by cooling of H2 gas and CCU plant was earlier going to drain, which has been now used for HCl fume neutralization in HCl absorption tower of HCl plant and storage tank farm. Thus, process water was used in tower is saved and performance of tower is improved because of alkalinity.

**Recycling of Alkaline Water** →

**Saving in cost.....3.15 Rs.lakhs**  
**Total Investment.....3.5 Rs. lakhs**



### Other Energy Conservation Projects implemented during 2007-08.

- 1) Replacement of conventional chokes by electronics chokes (1000 nos.)
- 2) Utilization of existing spare capacity of caustic feed pump of CEU-II for CEU-I also.
- 3) Replaced old Motors by **high efficiency motors** of 10 nos. of equipments.
- 4) Replaced existing old 250W/160W MLL lamps/light fittings by 101W/80W light fittings.
- 5) Installation of **higher size Cl2 evaporator** to recover energy and more cl2 supply to CLM.
- 6) Installation of high performance membranes F8020 & N2030.
- 7) Minimization of steam leakages by pipe replacement and online leak protection.
- 8) Installation of recovery system of steam condensate of concentration unit.
- 9) Optimized operation of chilled water pumps system to save power by stopping one pump.
- 10) Ensured discipline among all for Switching off lights, fans, ACs, whenever offices are not occupied.

### 20 (v). Energy Conservation Plans and Targets:

Energy Conservation Measures (Planned)	Anticipated savings in		Approx. investment (Rs.lakhs)	Project Commencement & Completion year
	Energy Value (specify units)	Rs. Lakhs		
Replacement of 20 yr old elements by <b>energy efficient latest version-5</b> of UHDE electrolyzers	32.26	161.3	2400	2008-09
Remembraning of MC-II cell house after achieving life of 5 years	158.75	731.14	1000	2008-09
Replacement of existing chilled water compressor by energy efficient screw compressors	7.548	37.14	162	2009-10
Replacing old rectifier transformer by high efficient transformer	47.69	238.45	1200	2008-09
Replacing two reciprocating air compressor by energy efficient centrifugal air compressors	14.9	74.5	250	2008-09
Replacing old rectifier transformer by high efficient transformer	47.69	238.45	1200	2009-10
Installation of waste heat recovery boilers	0	112	135	2009-10
<b>Utilization of renewable Energy by installing Wind Mill of 39 MW for catering power requirement</b>	632	3160	23700	2008-09
Other small projects like replacement of chokes, reflectors, energy efficient motors etc.	23.5	115.62	200	2008-09
Sub Total:	<b>964.338</b>	<b>4868.6</b>	<b>30247</b>	

## 20 (vi). Environment and Safety :

Our unit has been accredited for ISO 14001:2004 and IS 18001 by Bureau of Indian Standards (BIS) valid till 2009 indicating managements commitments of environment and health of its employees and community as per 'SHE' policy as under. This unit has completed **1905 Accident Free Days** as on 10-10-2008 with around 1600 employees and associates working at site.

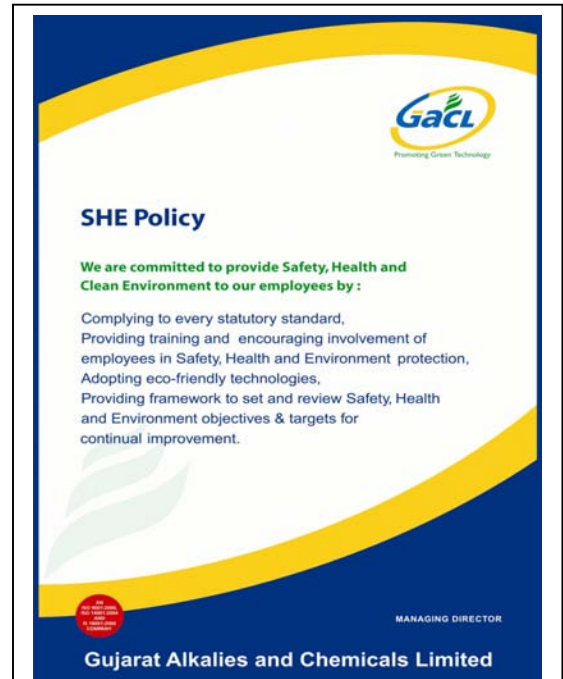
GACL's Vadodara unit has been winner of Safety **Silver Award of Greentech Foundation** for the year 2007 for outstanding achievement in Safety Management.



This unit also has implemented **Vermi-Composting** plant from canteen and garden wastes since 5 years.

- Company has also made recharging bore-well from the **harvested rain water** at various sites.

- Planted about **29,000 green trees** since last **12 years**. And every year we plant about **3,500 trees** at our **Green belt area** & thus justifying **Promoting Green Technology** shown in our logo.



**Vermicomposting - a**



**Vermicomposting - b**



**Green House Activity**