



**Welcome**

# A to Z EC steps in GACL

by

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# OUR VISION

**To continue to be identified and recognized as a dynamic, modern and eco-friendly chemical company with enduring ethics and values.**

# ABOUT OUR COMPANY

1. Gujarat Alkalies and Chemicals Limited (GACL) is a Company promoted by Government of Gujarat in 1973.
2. The company is the leading producer of Caustic Soda in the country with market share of @ 18 %.
3. The first Chlor-alkali Plant was commissioned in 1976 at Baroda with Mercury Cell Technology.
4. The company is the first in the country to convert Mercury Cells into the Membrane Cells in 1989.
5. Presently Company is producing Caustic Soda and Chlorine at two Complexes of Baroda and Dahej. Both the plants are operating on Membrane Cell Technology.
6. The company has also installed a plant for Caustic Potash (KOH) production of 50 TPD parallel to Caustic Soda.

# ABOUT GACL

7. In addition, the company is producing other allied chemicals also like Hydrochloric Acid, Potassium Carbonate, Sodium Hypo Chlorite, Mixed Chloromethanes, Hydrogen Peroxide, Sodium Cyanide, Sodium Ferro Cyanide, Phosphoric Acid, Calcium Chloride, Poly Aluminum Chloride (PAC), Anhydrous Aluminum Chloride, Chlorinated Paraffin Wax (CPW), Benzyl Chloride, Benzyldehyde etc. The company has a basket of 27 products. **More Products are also in pipe line.**
8. The company had installed a **90 MW Combined Cycle Gas Based Power Plant** in 1998 at Dahej. Three Wind Farms ( **23.75, 39 & 21 MW** ) were installed at Kutch in the year 2008, 2009 & 2010 to meet its Power Demand of Baroda plant.

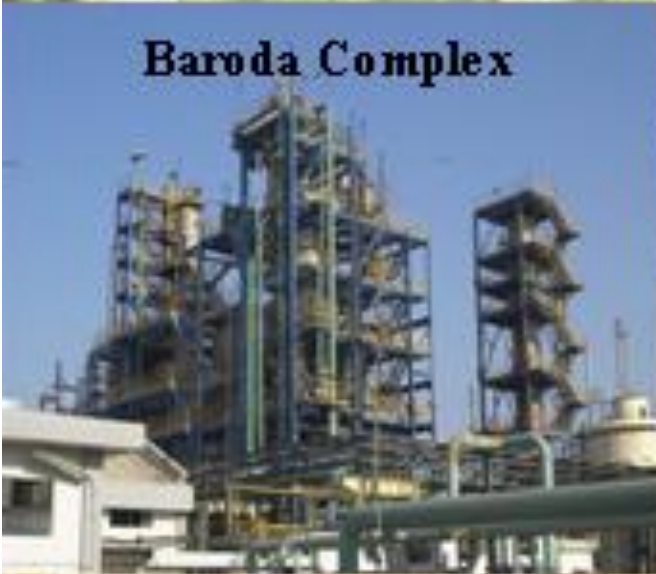
# ABOUT GACL

- 9 The company has a certified system Standard and has obtained following Certifications.
  - (A) ISO-9001:2000, version 2008 is under certification
  - (B) ISO-14001:2004 and
  - (C) IS-18001:2007
- 10 The company was recipient of the National Energy Conservation Award for 5 consecutive years since 2004. The company was recipient of the ICC Award for Excellence in Energy Conservation & Management-2008
- 11 The company has achieved largest producer status in the country for production of Caustic Soda. Presently we are producing 1245 TPD Caustic Soda & 63 TPD Caustic Potash. Total Alkali production – 1308 TPD.

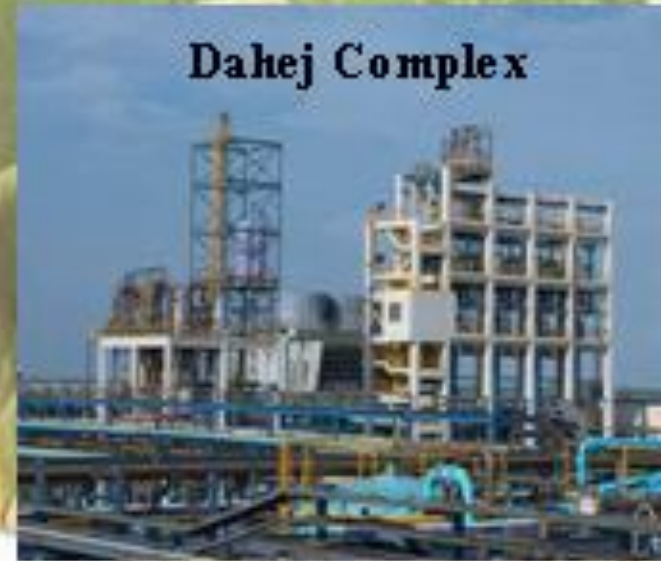
# Company – An Overview

With a handful of Salt **Gandhiji** led the nation to freedom...

**Baroda Complex**



**Dahej Complex**



...Today **GACL** transforms this common mineral into **27** valuable multifarious products

# **GACL BARODA COMPLEX**

Company has following plants at Baroda Complex.

- 1. Chlor-Alkali Plant ( NaOH & KOH)**
- 2. Chloromethanes Plant**
- 3. Hydrogen Peroxide Plant**
- 4. Caustic Soda Flaking Plant**
- 5. Potassium Carbonate Plant**
- 6. Caustic Potash Flaking Plant**
- 7. Sod. Cyanide & Sod. Ferro Cyanide Plant**

# **GACL DAHEJ COMPLEX**

Company has following plants at Dahej Complex.

- 1. Chlor-Alkali Plant (NaOH)**
- 2. Caustic Flaking and Prilling Plant**
- 3. Phosphoric Acid Plant**
- 4. Calcium Chloride Plant**
- 5. Captive Co-generation Power Plant (NG)**
- 6. Poly Aluminum Chloride (PAC)**
- 7. Anhydrous Aluminum Chloride (AlCl<sub>3</sub>)**
- 8. Hydrogen Peroxide Plant**
- 9. Gypsum from Sulphate Removal System (SRS)**

## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

- A) Adopting latest design of Elements(5<sup>th</sup> generation).**
- B) By modifying existing cell rack to increase present elements 52/41 to 64/48 respectively in MC-I / MC-II Electrolysers to reduce operating current density.**
- C) Control of impurities in Feed Brine like Ca,Mg,**Ba**,Sr ,I.**
- D) Dedicated Human Resources who have suggested to minimizing gap between Anode & Cathode looking to planarity and by providing 0.8/0.9 mm distance strips.**
- E) Economizer installation in Boiler to increase boiler feed temperature by using hot flue gas stream.**
- F) Fuel change over in Boiler from furnace Oil to Natural Gas to get better efficiency.**

## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

- G) Gas which is generated in Boiler and containing CO<sub>2</sub>, is utilized to produce potassium Carbonate from KOH which reduces green house gas in the atmosphere.**
- H) Hydrogen Gas which is a by-product of Chlor-Alkali, is utilized in CCU furnaces in place of Natural Gas as fuel.**
- I) Increase capacity utilization to utilize maximum level of available resource & facilities in the plant.**
- J) Joint efforts and study of potentiality for energy conservation and installed VFD at various equipments.**
- K) KAIZEN-Continuous improvement by giving awareness programme on EC and brain storming amongst working group which resulted in best suggestion to implement.**

## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

- L) Liquid chlorine pumping to supply chlorine to RIL & CLM plant thro. evaporators which reduces Dry Air for handling liquid chlorine and recover energy from chlorine/ Direct Cl<sub>2</sub> supply(10% mixing) to RIL to reduce refrigeration load.**
- M) Modification in H/E of 8 pass by 4 pass to reduce pressure drop which resulted in higher chilled water flow and recover all most double energy then previous.**
- N) New Nitrogen plant which is energy efficient and integrated with latest energy efficient common instrument air system which reduce power consumption.**
- O) Optimizing process parameters to achieve lowest power consumption & highest cell efficiency in the country.**
- P) Proper modulating Air/fuel ratio to achieve highest boiler efficiency and continuous monitoring of CO/O<sub>2</sub> % in flue gas.**

## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

- Q) Quantity analysis of all energy data and study for its system efficiency which gives idea for corrective action to achieve maximum efficiency and reduction in energy consumption.**
- R) Remembraning with latest high performance membranes and Recoating of anodes & cathodes on regular basis so that plant performance always remains steady and giving best quality result with respect to power consumption per tonne of NaOH.**
- S) Selecting latest control systems to closely monitor all process parameters to reduce power consumption and achieve highest cell efficiency. Selection of energy efficient pumps along with motors.**
- T) Training to all operating staff on regular basis to achieve best result for plant performances.**

## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

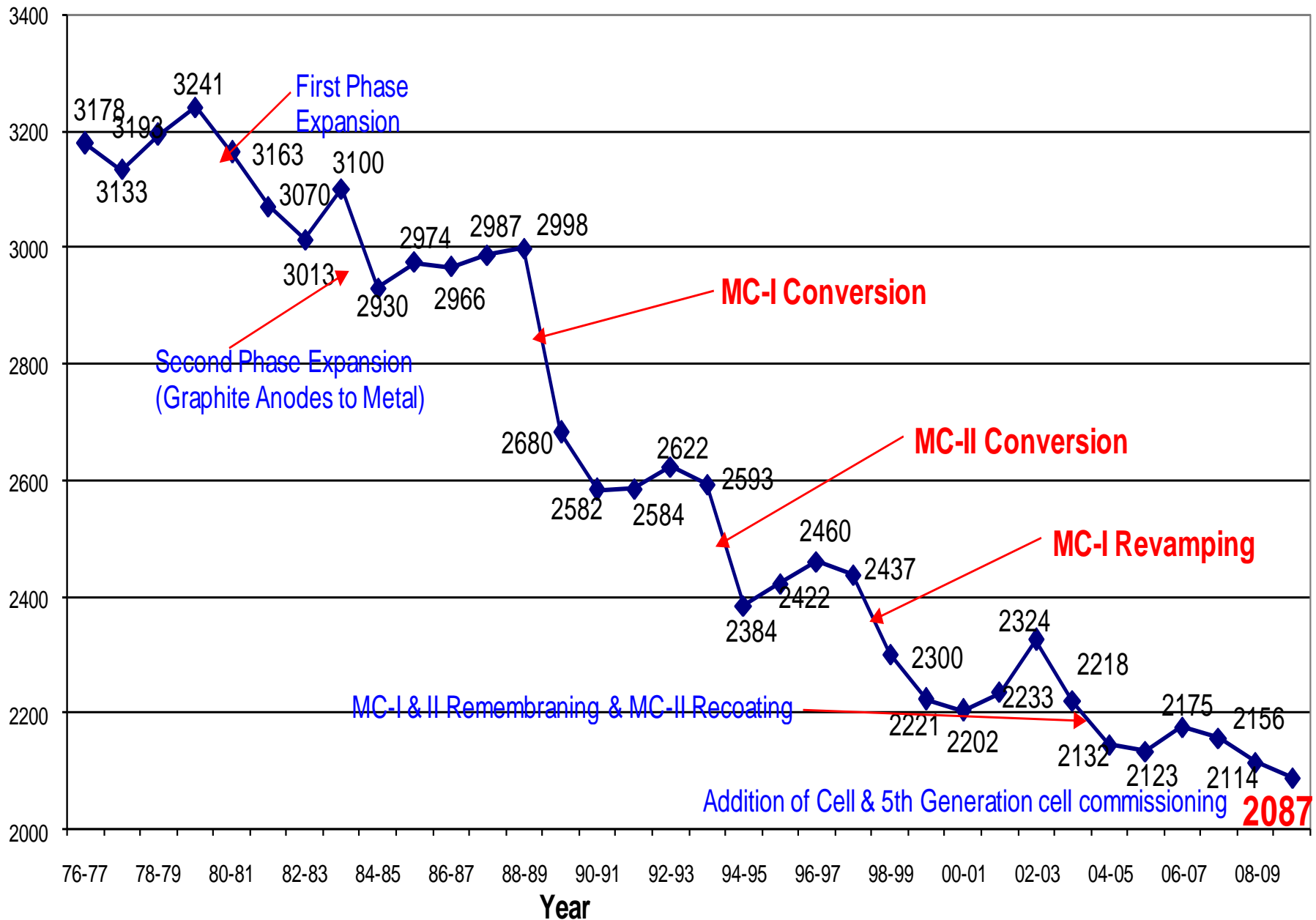
- U) Utility reduction by selecting Triple effect evaporators to concentrate 32% to 48% NaOH to achieve maximum steam economy.**
- V) Various studies to reduce power consumption suggested to add one more electrolyser in MC-II to reduce operating current density which result in large amount of power saving.**
- W) Waste heat recovery where ever possible in the plant.**  
**Wind energy- To generate green energy (Renewable energy which is today's need) by installing Wind Farms of 23.75, 39 & 21 MW capacity to cater Baroda plant power demand.**
- X) Continuous interaction on New Technology Development/up gradation in Cells and implement accordingly to sustain growth in this competitive global market.**

## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

**Y) Yearly/monthly data analysis and discussion amongst operating staff /EC Cell group to reduce further power consumption as this is continuous on going efficiency improvement process.**

**This can be seen in next slide of per tonne power consumption for Caustic Soda since 1976 i.e. inception of GACL**

# Yearwise DC Power Consumption in KWH/MT for Caustic Soda Production

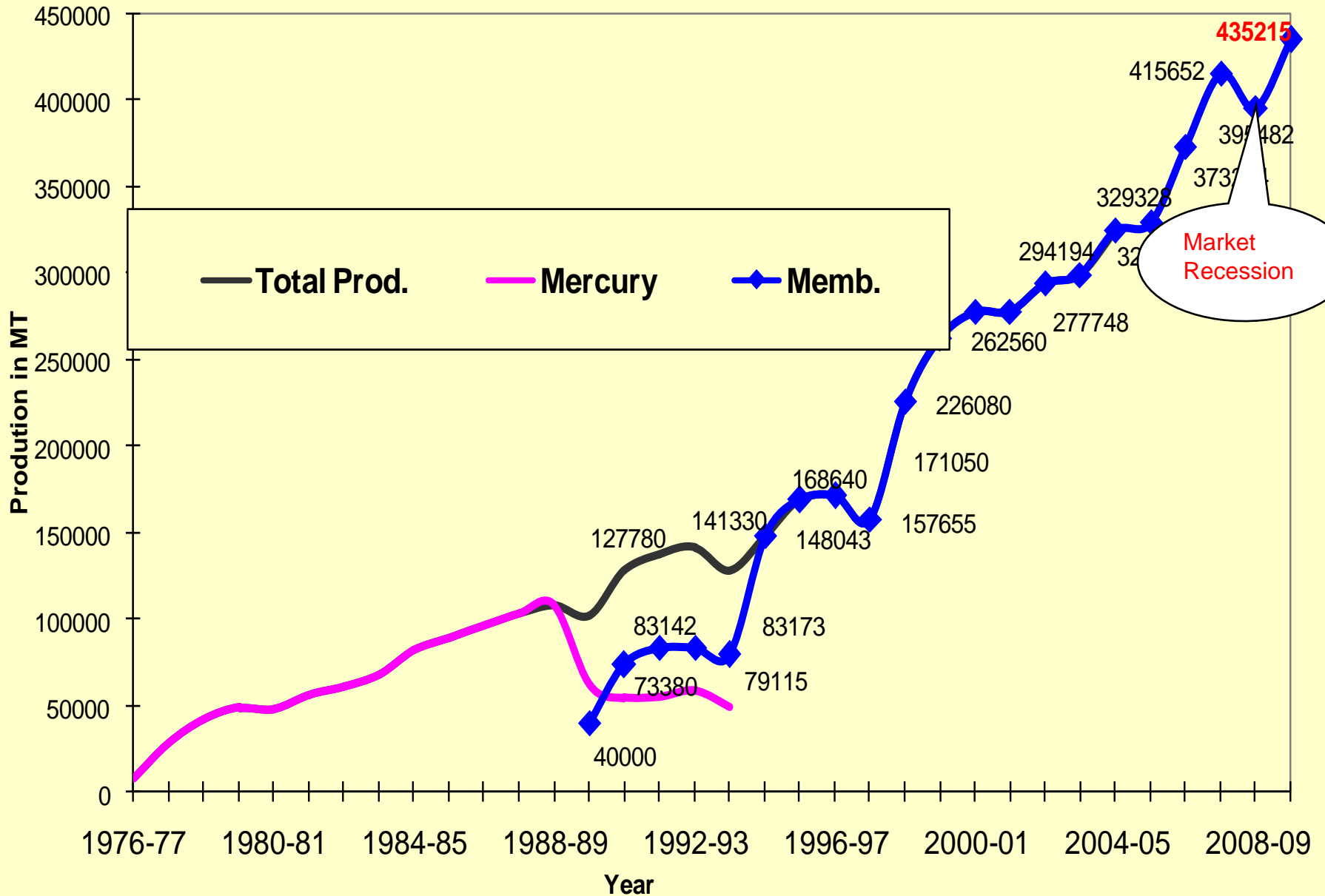


## **A to Z EC steps in Chlor- Alkali plant of GACL, BARODA**

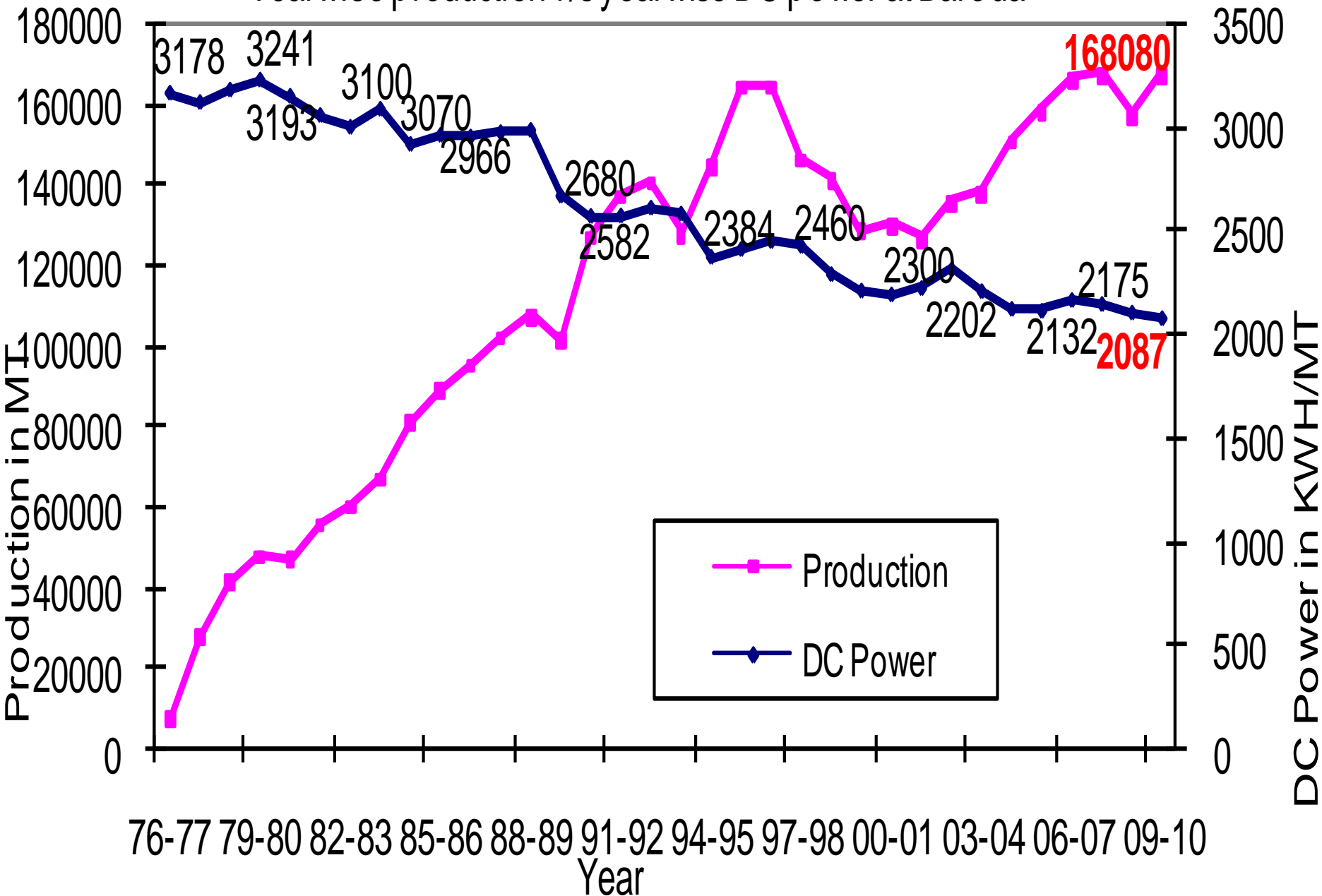
- Z) - Zero break down and increase availability of critical equipments which result in continuous running of plant and achieve lowest energy consumption.**
- Replacement of metallic blades of cooling towers by aerodynamic FRP blades which reduces power rating of I D Fan motor from 22 Kw to 15 Kw.**
  - Replacement of 70 TPD capacity Cl<sub>2</sub> compressor by 100 TPD capacity Cl<sub>2</sub> compressor with same motor rating(200Kw).**
  - Installation of Chlorine recuperator to recover heat from hot chlorine which is to be cooled and brine which is to be heated.**

**Thus GACL remains committed to Energy Conservation and effective Energy Management**

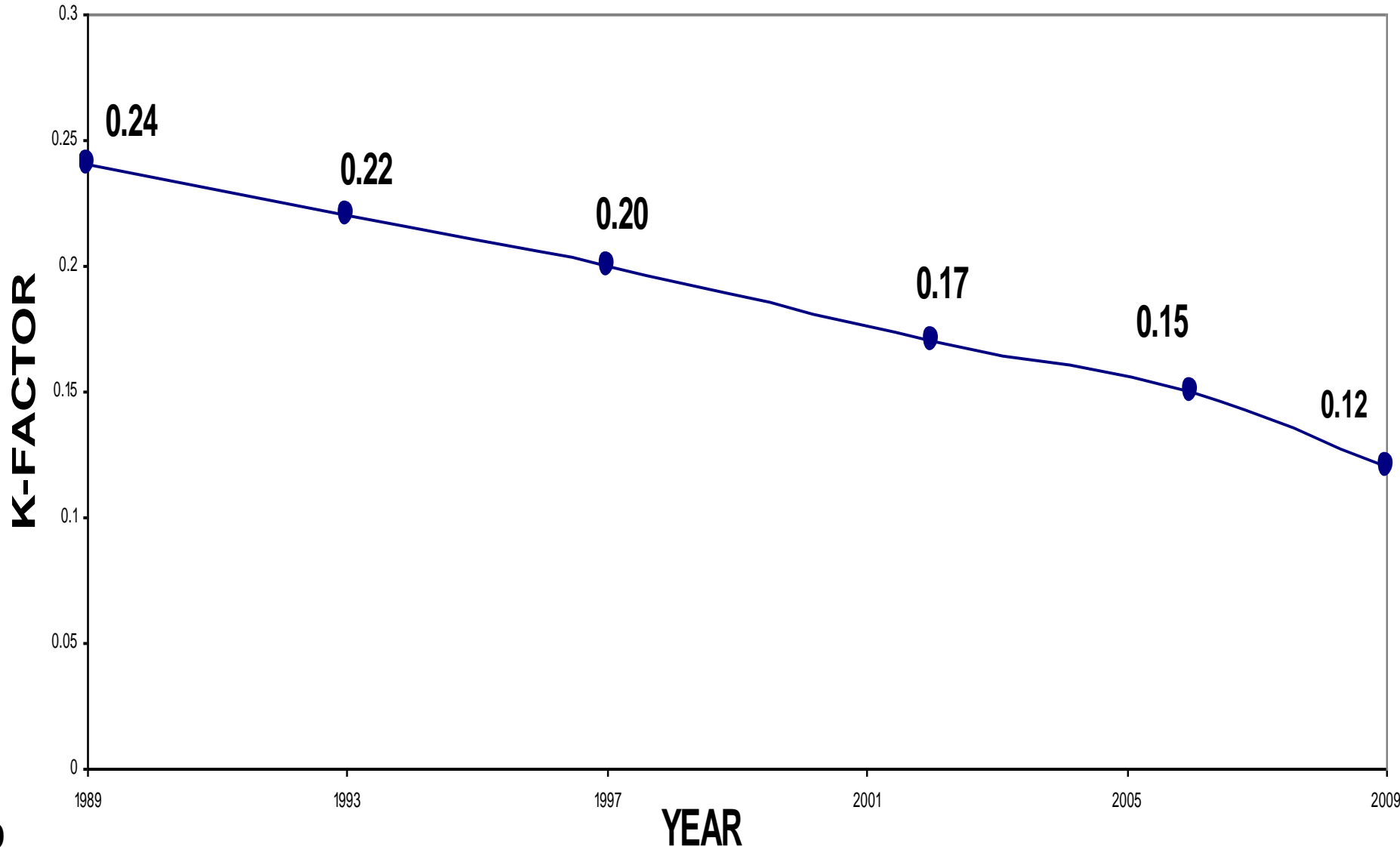
# Alkali Production since inception of GACL(1976)



Yearwise production v/s yearwise DC power at Baroda

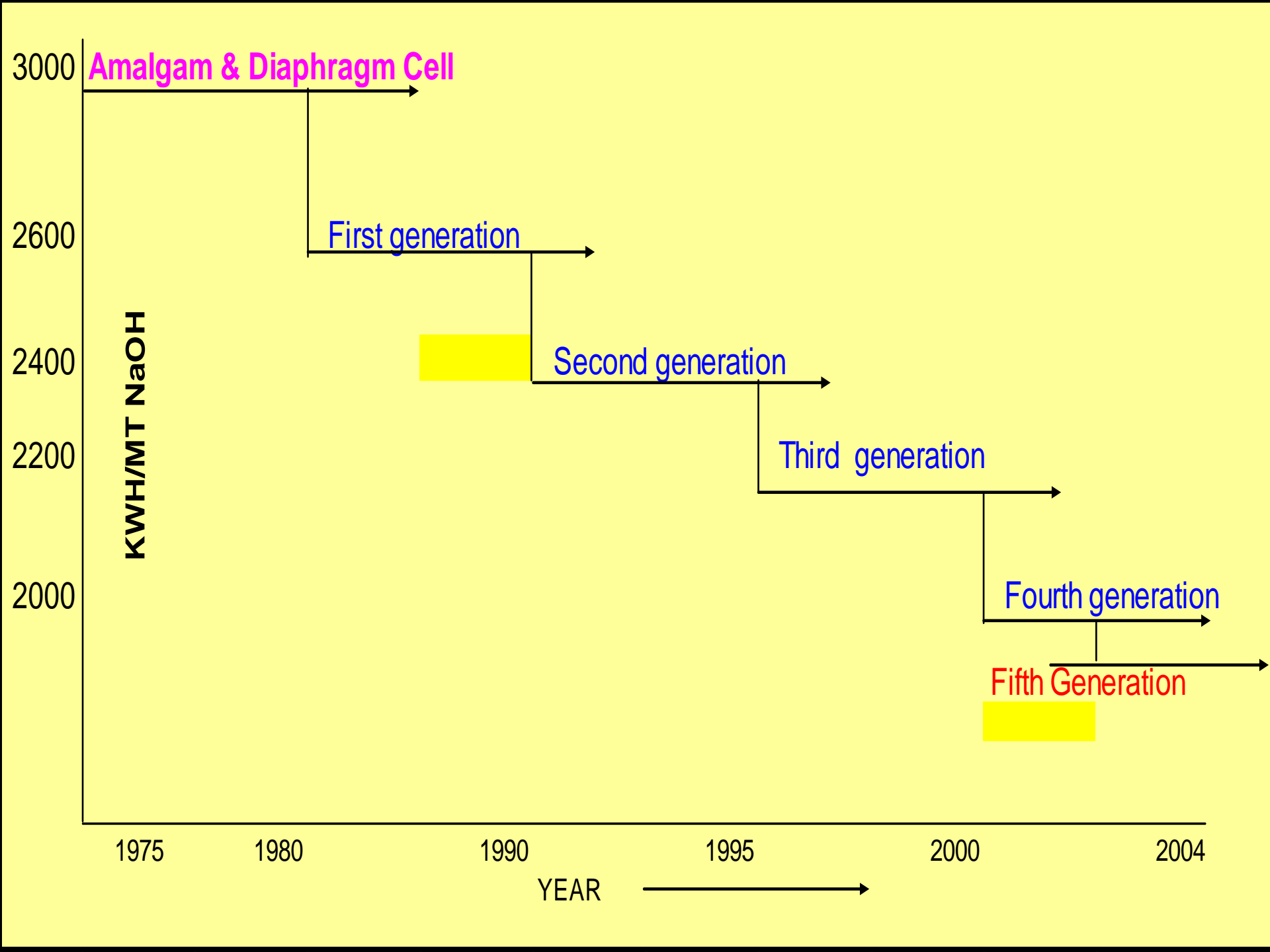


# k- Factor improvement achieved in GACL



# A comparison of Cell Voltage at 3 CD

		Voltage		
		Finite Gap	Narrow Gap	Zero Gap
1	Membrane IR	0.5	0.5	0.5
2	Electrolyte IR	0.23	0.12	0.07
3	Current collector	0.0	0.0	0.01
4	Structural IR	0.05	0.04	0.05
5	Electrode over voltage	0.12	0.12	0.12
6	Decomposition voltage	2.20	2.20	2.20
<b>Total Voltage</b>		<b>3.10</b>	<b>2.98</b>	<b>2.95</b>



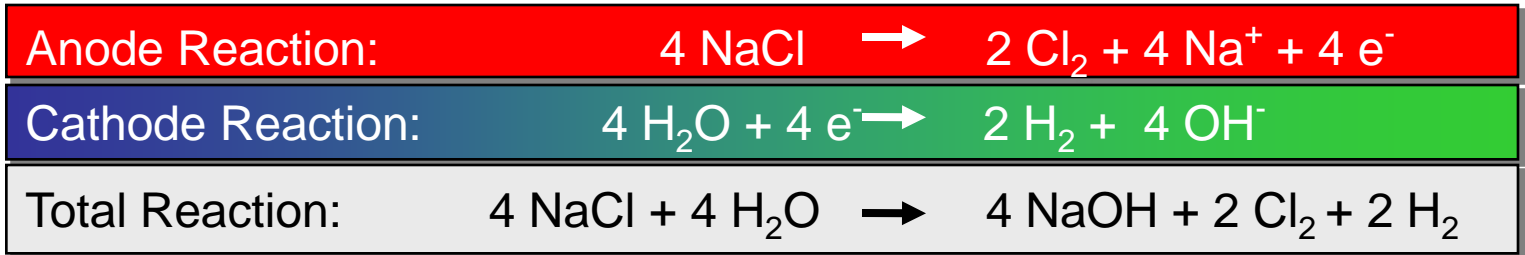
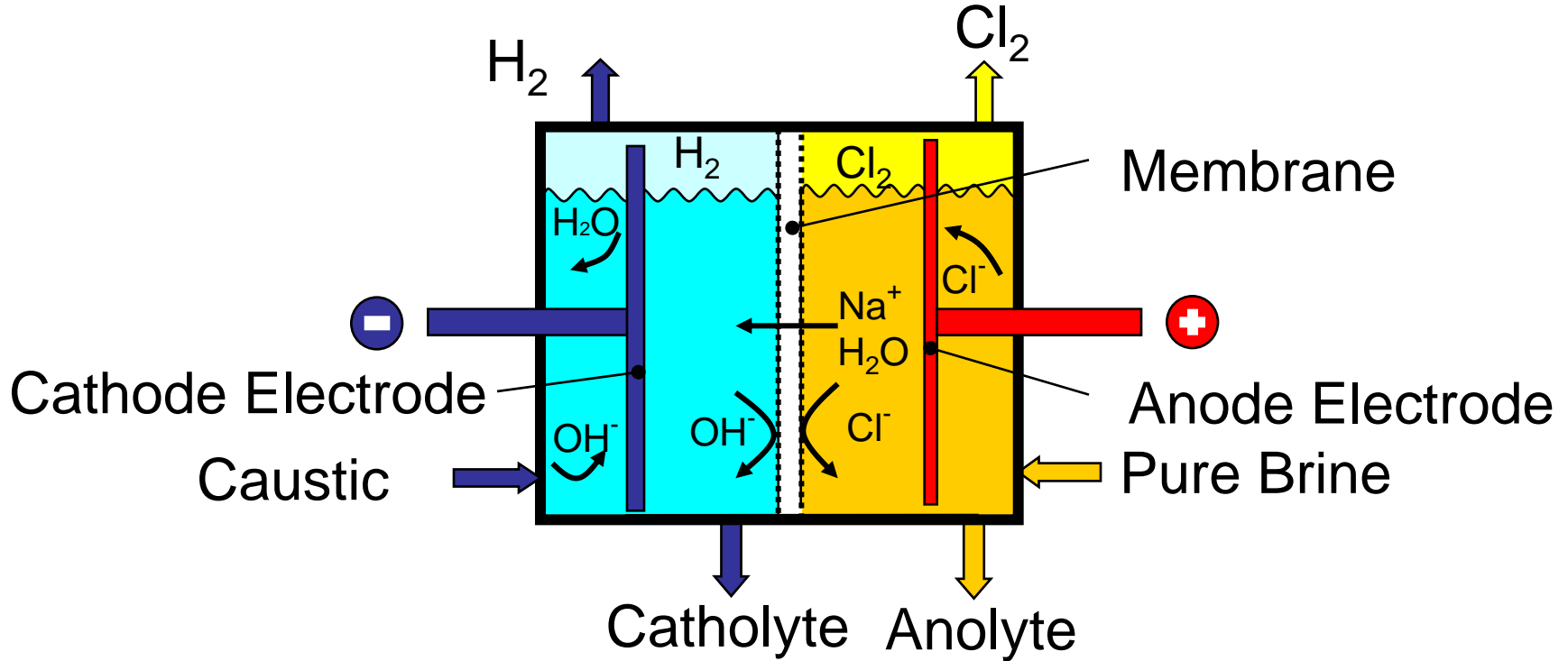
# 10 Tips for better operation of C/Soda Plant

1. Operating CD at 3.0 for Old Gen. & 4.0 New Gen.
2. Sulphate level at 10 gpl to minimize Barium level in brine to achieve better cell effi. & stable voltage
3. Minimize  $Mg^{++}$  content in brine for lower voltage
4. Optimize ABR gpl & Temp. for better cell voltage
5. Optimize Caustic Conc. for better eff. & low voltage
6. Maximize elements in Electrolyser to reduce mv/CD
7. Optimize Diff. Pressure to achieve max. cell effi.
8. Use of Thick Teflon Strips for cell rack to lower mv
9. Regular analysis for early detection to get longer life
10. Consistent operation of electrolysers at same load

# Conventional Chlor-alkali Electrolysis

Cathode Semi-Shell

Anode Semi-Shell



## Replacement of metallic blades by aerodynamic FRP blades



**Modification in EG Brine/Chilled water HE Nos. of pass increased from 4 to 8 to recover heat**



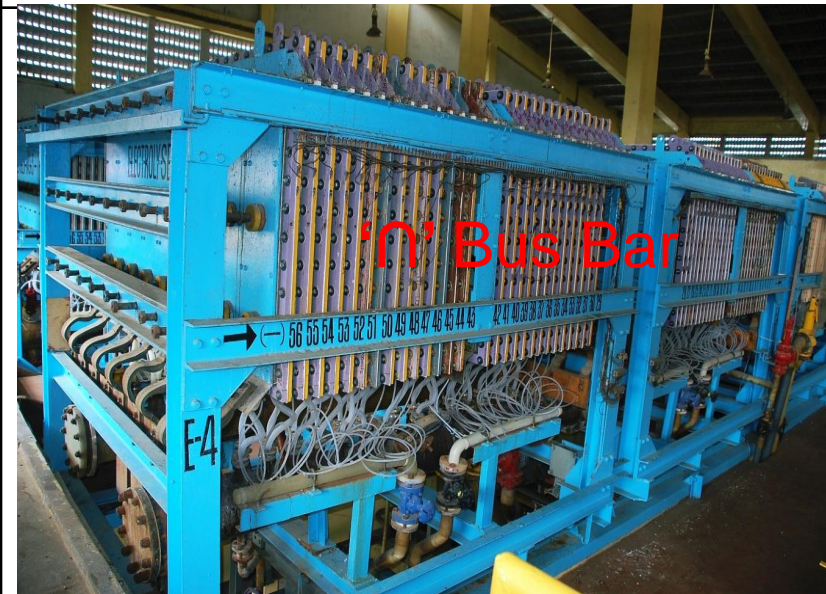
**Clarifier with insulation and water seal.**



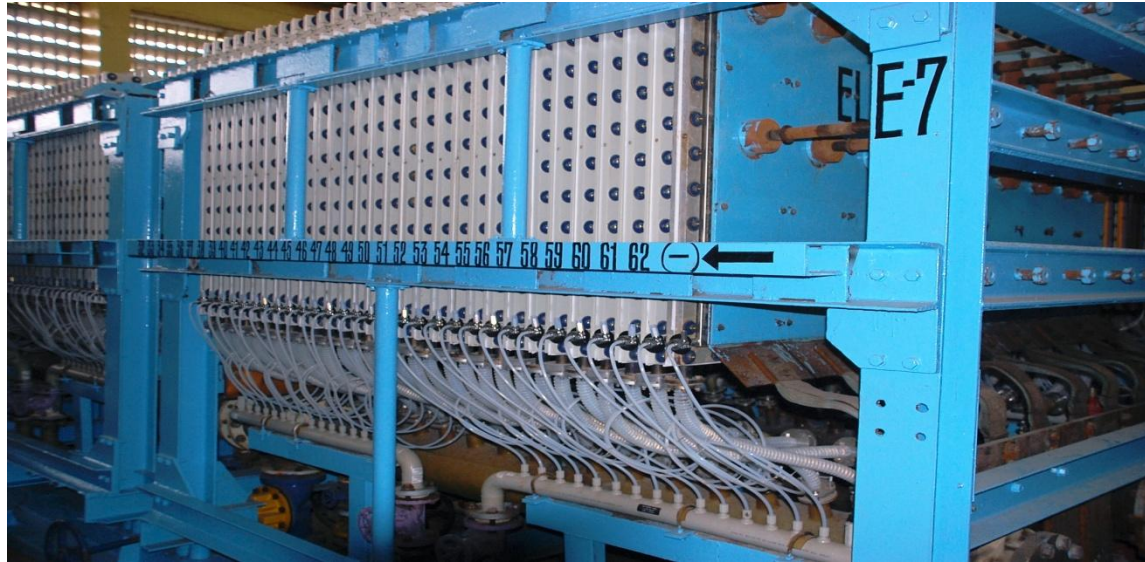
**Clarifier without insulation**



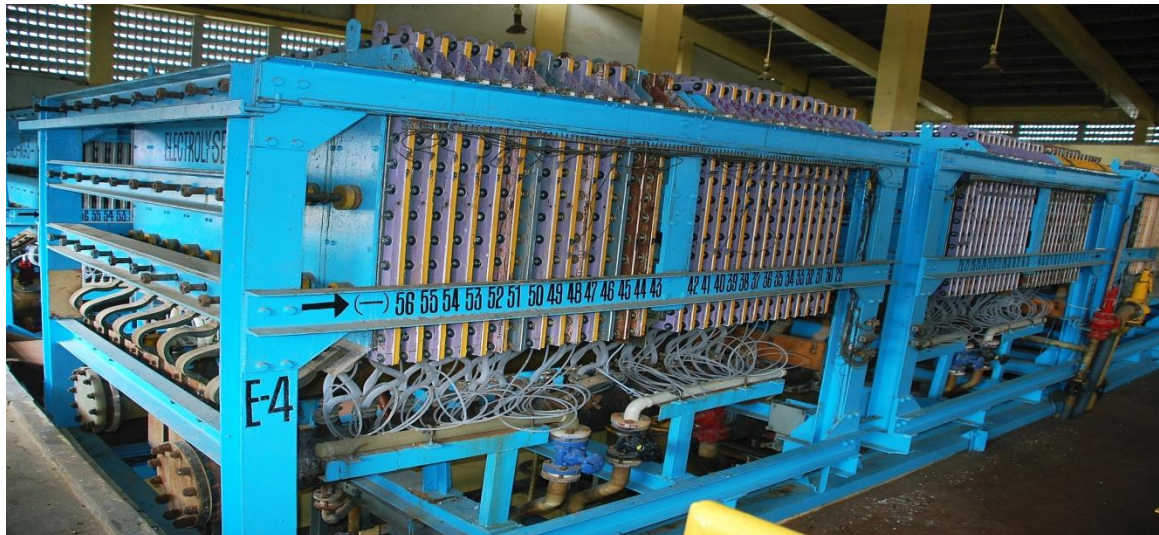
**Removal of 'n' bus bar and addition of five more elements**



# 5th Generation element installed in four electrolysers No. Elect. 1, Elect. 2, Elect. 7 & Elect. 8 in MC-I Cell House



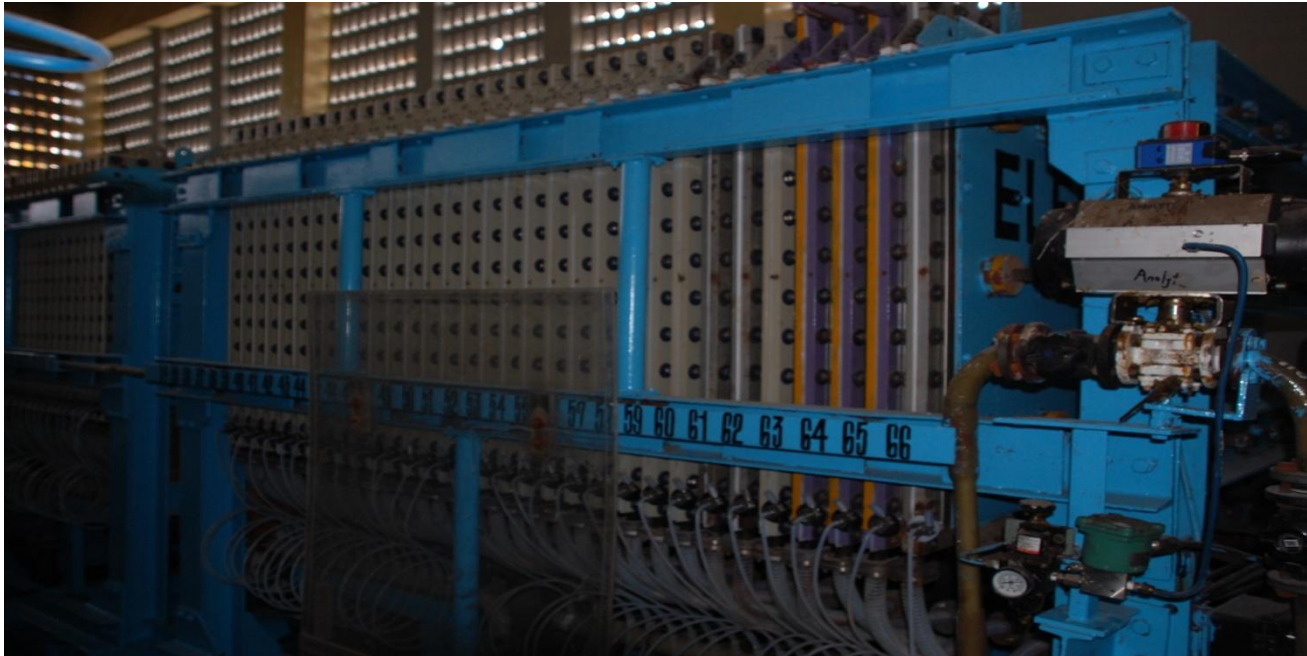
## Elements with old generation



# Cell Voltage Monitoring System(CVMS) for individual Elements



## Addition of elements in electrolysers of MC-I & II Cell Houses



## Replacement of Cl<sub>2</sub> Compressor with 100 TPD capacity



## Direct Cl<sub>2</sub> Control Loop to control ratio(Max 15%) to RIL



## Cl<sub>2</sub> mixer for Evap.Cl<sub>2</sub> with direct Cl<sub>2</sub>



**Wind Farm 1 of 23.75 MW having 19 Nos. of Wind Mills each of 1.25 MW at Kuchchh commissioned in Jan-2008, Wind Farm 2 of 39 MW having 26 Nos. of Wind Mills each of 1.5 MW at Kuchchh commissioned in Jan-2009 & Wind Farm 3 of 21 MW having 14 Nos. of Wind Mills each of 1.5 MW at Malia-Miyana commissioned in Jan-2010. Total units generated during year 2009-10 = **1234.7 Lacs****



# Thank you all

