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BUREAU OF ENERGY EFFICIENCY
Government of India, Ministry of Power

ASPIRE Programme
Accelerating Smart Power & Renewable Energy in India

SUMMARY REPORT

SECTORAL WORKSHOP ON
BEST PRACTICES IN ENERGY EFFICIENCY IN CHLOR-ALKALI SECTOR
A PATH FOR DECARBONISATION

HOSTED BY:
Gujarat Alkalies And Chemicals Limited,
Dahej (Bharuch), Gujarat, India

27TH FEBRUARY 2024

iDeeksha

Industrial Decarbonisation and Energy Efficiency
Knowledge Sharing Platform

Contents

Abbreviations

ASPIRE	Accelerating Smart Power and Renewable Energy in India
AHU	Air Handling Unit
BEE	Bureau of Energy Efficiency
CPP	Captive Power Plant
CCUS	Carbon Capture Utilisation and Storage
CCTS	Carbon Credit Trading Scheme
Cl_2	Chlorine
CHP	Combined Heat and Power
CAGR	Compound Annual Growth Rate
COP	Conference of the Parties
DCs	Designated Consumers
ERDA	Electrical Research and Development Association
EC	Energy Conservation
EESL	Energy Efficiency Services Limited
FCDO	Foreign, Commonwealth and Development Office, Government of UK
GESI	Gender Equality Social Inclusion
GHG	Greenhouse gases
GACL	Gujarat Alkalies and Chemicals Limited
HVAC	Heating, Ventilation, and Air Conditioning
HCl	Hydrochloric Acid
H_2	Hydrogen
IDEEKSHA Platform	Industrial Decarbonisation and Energy Efficiency Knowledge Sharing Platform
IEED	Industrial Energy Efficiency and Decarbonisation
KPI	Key Performance Indicators
KLD	Kilo Litres per Day
LED	Light Emitting Diode
MOC	Material of Construction
MMT	Million Metric Tonne
MToE	Million Tonnes of Oil Equivalent
$MtCO_2$	Million Tonnes of Carbon dioxide
MoP	Ministry of Power
MW	Mega Watt

NMEEE	National Mission on Enhanced Energy Efficiency
OPEX	Operational Expenses
PFC	Perfluorocarbons
PAT	Perform Achieve and Trade
POSH	Prevention of Sexual Harassment Committee
RFID	Radio Frequency Identification
RRC	Radio Remote Units
RO	Reverse Osmosis
SRCS	Sulphate Removal & Concentration System
SOP	Standard Operating Procedure
TPD	Tonnes per Day
VFD	Variable Frequency Drive

BACKGROUND

The chlor-alkali industry constitutes approximately **1%** of the global chemical industry, with a turnover of ~INR **5,700** billion (~**GBP 55 billion**). The Indian chlor-alkali industry commands a **~6%** share of the global market and has made significant advancements in the last three years[1]. In India, this sector contributes ~**70%** of basic chemicals, encompassing caustic soda, chlorine, soda ash, and essential elements such as hydrogen, hydrochloric acid etc. within the broader chemical industry landscape. The caustic soda/ chlorine segment features a diverse array of **~30** companies, experiencing substantial investments in recent years. Installed capacity for caustic soda (and concomitantly that for chlorine, which is co-produced in an unalterable ratio) has grown with a compound annual growth rate (CAGR) of ~**8%** from **3.37** million tonnes per annum in FY 2016 to **4.54** million tonnes per annum in FY 2020[2].

Chlor-alkali sector is categorised as one of most energy intensive industries in India. Energy consumption of the sector is expected to increase by **~45%** to **5 million tonnes** of oil equivalent (MTOE) resulting in ~**16** million tonnes of CO_2 emissions by FY 2030-31. The process for conversion of common salt into caustic soda lye, chlorine, and hydrogen gas involves utilisation of electric energy, while thermal energy is employed in brine preparation and the transformation of lye into flakes. In many units, the hydrogen produced serves as fuel for lye concentration and caustic flake production. This energy-intensive process incurs substantial costs, with energy accounting for **50-60%** of the total production cost, contingent on power expenses. The sector is bifurcated into captive power plant (CPP)-based facilities and non-CPP based facilities (grid-connected plants).

Approximately **40%** of the hydrogen produced in chlor-alkali industry serves as captive fuel for boilers or in caustic soda fusion plants, while ~**28%** is transformed into Hydrochloric Acid (HCl)[3]. The remaining **30%** yields a higher 'chemical value' either through captive consumption or by selling to third parties[4]. In India, major applications of caustic soda include textiles (21% share), alumina (12%), inorganic chemicals manufacturing (13%), pulp & paper production (8%), and the production of soaps and detergents (7%)[2].

Given that the chlor-alkali sector holds substantial energy efficiency potential, it is under the ambit of the Bureau of Energy Efficiency's (BEE), a central government agency, flagship Perform Achieve and Trade (PAT) scheme. The threshold limit for any chlor-alkali unit to be notified as a designated consumer (DC) under the PAT scheme is **12,000** MToE[5]. Currently, **29** industries are notified as DCs under the PAT scheme. The specific energy consumption, as reported under the PAT scheme of BEE, varies between **0.262** and **0.997** ToE/T of Sodium Hydroxide (NaOH).

1 https://www.indianchemicalnews.com/chemical/nextgen-summit-2023-chlor-alkali-to-dominate-investments-within-chemical-industry-18438
2 https://ama-india.org/wp-content/uploads/2020/10/Chlor-alkali-industry-in-India-status.pdf
3 https://beeindia.gov.in/sites/default/files/Chlor-Alkali-1-44.pdf
4 https://www.businesstoday.in/opinion/columns/story/what-role-can-chemicals-play-in-indias-decarbonisation-journey-310138-2021-10-22
5 https://beeindia.gov.in/sites/default/files/Chlor-Alkali-1-44.pdf

The chlor-alkali industry in the United Kingdom (UK) is a pivotal sector specialising in the production of chlorine and caustic soda, essential chemicals with diverse applications spanning industries such as chemicals, pharmaceuticals, textiles, and water treatment. Environmental sustainability and safety are paramount, with stringent regulations in place to minimise environmental and health risks. To remain competitive globally, the UK chlor-alkali industry relies on cost-effective production methods and maintaining high-quality standards in its products. UK's Chlor-Alkali sector offers some key industrial energy efficiency and decarbonisation (IEED) technologies, solutions, and best practices in the areas of:

- **Advanced process control systems**
- **Catalyst technologies**
- **Advancements in electrode and cell component materials**
- **Carbon capture, Utilisation and Storage (CCUS) technologies**
- **Combined heat and power (CHP) systems**
- **Waste heat recovery systems**
- **Equipment Upgrade**
- **Process optimisation studies and simulation tools**

The strengths and capabilities of UK's chlor-alkali sector can be leveraged to facilitate rapid transition of Indian Chlor-Alkali sectors' journey to net-zero.

In view of this, a one-day **sectoral workshop** was organised at Gujarat Alkalies and Chemicals Limited (GACL) Auditorium, Dahej on 27th February 2024 under the Accelerating Smart Power and Renewable Energy in India (ASPIRE) programme[6]. The sectoral workshop was jointly organised by Foreign, Commonwealth and Development Office (FCDO) and the BEE, with support from GACL. During the workshop, the stakeholders deliberated on best practices, technologies and policy interventions required to accelerate the decarbonisation of the chlor-alkali sector. In the workshop, some key organisations from the UK chlor-alkali sector presented the various leading best practices and technologies adopted in the UK.

Objective of the Workshop

Apprise stakeholders about Industrial Decarbonisation and Energy Efficiency Knowledge Sharing (IDEEKSHA) platform and its key functionalities

Provide an overview of impact of the PAT scheme and IEED measures implemented in the chlor-alkali sector

Share best practices/ technologies for enhancing IEED and identify learnings from the UK experience

Disseminate knowledge and information on new and emerging IEED technologies available globally (including from the UK).

6 Accelerating Smart Power and Renewable Energy (ASPIRE) is a bilateral programme being implemented by the UK Government Foreign Commonwealth and Development Office (FCDO), in association with the Ministry of Power and Ministry of New and Renewable Energy, Government of India. KPMG is the implementation advisor to FCDO in relation to the ASPIRE programme.

Highlights

70+ participants from India and UK

4 interactive technical sessions

Dedicated session on “importance of Gender Equality and Social Inclusion (GESI) within Indian Industries”.

Active participation from the government agencies, Industry associations, leading chlor – alkali manufacturers and technology providers from India and UK

INAUGURAL SESSION

(L – R) Mr. K. K. Chakarvarti, Mr. D.B. Jain, Mr. Pankaj Pujara, Mr. Sunil K. Khandare, Mr. Balawant Joshi & Mr. Anurag Singh Sirola

Speakers

Mr. Swaroop P
IAS, Managing Director, GACL

Mr. Sunil. K. Khandare
Director, BEE

Ms. Sanyukta Das Gupta
Senior Advisor, Smart Power, Climate and Energy Team, British High Commission

Mr. K. K. Chakarvarti
Senior Advisor, IDEEKSHA Platform, ASPIRE Programme

Mr. Anurag Singh Sirola
Manager, KPMG India, ASPIRE Programme

Mr. Balawant Joshi
Managing Director, Idam Infra, ASPIRE Programme

Key Takeaways

- The Chlor-Alkali sector is a critical sector with applications in various end use industries, such as chemicals, aluminium, pharmaceuticals, textiles, pulp & paper, etc.

- In 2023, the global chlor-alkali market stood at ~INR **6** trillion (~GBP **57** billion) and is further expected to grow to ~INR **8** trillion (GBP **75** billion) by 2030 at a steady growth rate of **~4.5%**. Indian chlor-alkali sector accounts for **~6%** of the global market share.

- The Indian Chlor-Alkali sector is as one of the energy-intensive industrial sectors and has been focus sector on BEE's PAT scheme since its inception in 2012. Energy consumption of the sector is expected to increase by **~45%** to **5** MTOE resulting in **~16** million tonnes of CO2 emissions by FY 2030-31.

- Critical enablers for enhancing energy efficiency (EE) and for enabling decarbonisation of the chlor-alkali sector include:

    - Adoption of advanced electrode coatings
    - Improvements in electrolyser technology and membranes
    - Transition to greener fuel supply options such as renewable energy, hydrogen, etc.
    - Integration of AI and IoT-based platforms in decarbonisation strategies
    - Implementation of recycling and circular economy principles such as membrane recycling and waste reduction
    - Integration of waste heat recovery systems
    - Addressing mercury pollution through its conversion into simpler compounds

TECHNICAL SESSION I

PERFORM, ACHIEVE AND TRADE SCHEME FOR CHLOR-ALKALI SECTOR

Speakers

Mr. Sunil. K. Khandare
Director, BEE

Mr. Ajitesh Upadhyay
Sector Expert – Chlor Alkali, BEE

Key Takeaways

- The PAT scheme stands as a flagship initiative of the BEE under the National Mission on Enhanced Energy Efficiency (NMEEE). As a regulatory tool, PAT scheme aims to curtail specific energy consumption within energy-intensive industries through a market-based mechanism that certifies excess energy savings, allowing them to be traded, thereby enhancing cost-effectiveness in the pursuit of energy efficiency.
- The chlor-alkali sector is an energy intensive industrial sector, with its energy requirements and overall energy emissions expected to reach 5 MTOE and 16 $MtCO_2$, respectively by 2030-31, under a business-as-usual scenario.
- In PAT Cycle VIII, the chlor-alkali sector comprises a total of **29** designated consumers (DCs).
- The threshold limit for any chlor-alkali unit to be notified as a DC under the PAT scheme is 12,000 MToE[4].
- The Chlor-Alkali industry is primarily characterised by the production of several key products, including caustic soda, chlorine, hydrogen, and soda ash, alongside various value-added derivatives. The following four products are considered in PAT scheme:
    - Caustic soda lye
    - Liquefied chlorine
    - Bottled hydrogen
    - Caustic soda flakes

- The Carbon Credit Trading Scheme (CCTS), recently announced by the Ministry of Power (MoP), includes greenhouse gas emissions (GHG) such as carbon dioxide (CO2) and perfluorocarbons (PFC). The CCTS encompasses the following emissions:

    - **Direct GHG emissions:** These stem from sources owned or controlled by the obligated entity, comprising emissions from the combustion of fossil fuels in stationary equipment like boilers, gas turbines, kilns, or furnaces for heat, mechanical work, and steam generation.

    - **Direct process emissions from industrial processes:** These refer to emissions apart from combustion emissions, resulting from chemical reactions between substances or their transformation.

    - **Indirect GHG emissions:** These arise because of the obligated entity's activities but occur at sources external to its establishment. They include indirect emissions from purchased electricity from the grid, as well as emissions from electricity and heat imported beyond the plant boundary.

TECHNICAL SESSION II

SHARING OF BEST PRACTICES BY INDIAN CHLOR-ALKALI SECTOR

Speakers

Mr. Rajesh Patil
Complex Head, GACL

Mr. Mayank Shukla
Deputy General Manager,
Grasim Industries

Mr. R. S. Chakravorty
Assistant General Manager
(Electrical), Orient Paper Mills

Key Takeaways

- **GACL** has established a **90** MW combined cycle captive power plant (CPP) within its Dahej complex. Additionally, the company has implemented **171.45** MW of wind farms and **36** MW of solar power plants. GACL has also commissioned a **0.7 MW** floating solar project on its raw water reservoir.

- GACL operates a **700** tonnes per day (TPD) caustic evaporation unit featuring state-of-the-art plate type heat exchangers, energy-efficient steam consumption methods, and holds the title of the nation's largest capacity. This advancement has significantly lowered operating costs, reduced energy consumption, and optimised space usage.

- GACL has implemented following IEED best practices:

    - **Individual cell voltage monitoring** enables real-time voltage monitoring, immediate problem detection, optimisation of cell performance, data logging and analysis, and seamless integration with control systems

    - **Chlorine (Cl_2) tonner temperature monitoring & tracking** ensures safe handling during filling with radio frequency identification (RFID) tracking

    - **Hydrogen (H2) pipeline supply** enables direct supply at 50 bar (G) reducing logistics and enhancing reliability

- **Flameproof IIC static earthing relay:** enhances H2 bottling safety with modern earthing systems
- **Radio remote units (RRC) for crane safety:** improves equipment reliability and worker safety
- Heating, ventilation, and air conditioning (HVAC) air handling unit (AHU) System upgrade
- **Energy saving equipment installations:** light emitting diode (LED) lights, efficient motors, variable frequency drive (VFD) drives, and relays enables energy savings and reduces carbon emissions
- **Standard operating procedure (SOP):** provides criteria for energy-efficient cell systems and membranes
- **Installation of wastewater treatment plant:** installed **3,300** kilo litres per day (KLD) wastewater treatment plant to ensure environmental preservation

- **Grasim Industries** has implemented digitalisation and benching tools to enhance energy efficiency and enable decarbonisation in the operations, some of the key technologies include the following:
  - **Specific energy consumption reduction system:** real-time monitoring and continuous benchmarking provides insights on potential energy saving areas, resulting in a **4%** reduction in auxiliary power consumption.
  - **Process key performance indicators (KPI) control:** real-time landscape of factors impacting KPIs, facilitates immediate action, thereby enhancing operational excellence and better asset utilisation planning.
  - **Hydrogen management:** real-time monitoring of hydrogen usage reduces venting by **4%**, leading to significant cost savings.
  - **Process analytics & control:** long-term data analytics identifies process drifts and root causes, enhancing operational efficiency.
- **Orient Paper Mill's** caustic soda unit has adopted various IEED best practices to enhance operational efficiency, including:
  - Implemented ISO standards (50001:2018, 9001:2015, 14001:2015, 45001:2018, RC 14001:2015) for efficient operations and compliance.
  - Installed energy products based on BEE's Star Ratings to optimise energy usage.
  - Collaborated with Energy Efficiency Services Limited (EESL) to **replace old motors with energy efficient IE3 motors**.
  - Reduced radiation heat losses by applying **altic nano insulation paint** on equipment and lines.
  - Planning to implement a **0.2** MW power generation system using a **micro turbine**.

TECHNICAL SESSION III

CASE STUDIES AND LOW CARBON & DIGITAL TECHNOLOGIES FOR CHLOR - ALKALI SECTOR – BY ACCREDITED ENERGY AUDITORS AND INDIAN TECHNOLOGY SUPPLIERS

Speakers

Mr. Som Derashri
Managing Director, SyGuru Innovators Pvt. Ltd.

Mr. Kuldeep Ruparelia
Energy Auditor & Engineer, Electrical Research and Development Association

Mr. Dev Krishna
Bertrams India Private Limited

Mr. Nitin Jose
Executive Director, SepraTECH Solutions Pvt. Ltd.

Key Takeaways

- Electrical Research and Development Association (ERDA) discussed its case study on **strategies for improving energy efficiency** in the chlor-alkali sector, including the following:
    - Regular maintenance, including cleaning the condenser during shutdown periods
    - Conducting thorough inspections and overhauling of pump impellers to ensure optimal performance
    - Installing VFD for blowers to regulate energy consumption

  - Installing flue gas analysers and controlling combustion air blower dampers based on feedback from oxygen readings, supporting in efficient combustion processes

- Bertrams India Pvt. Ltd. has achieved **~40% reduction in fuel consumption** (from **1** million kcal/ton to **0.6 million** kCal/ton) through **integration** of **high concentration** section with the **caustic evaporation plant**

- Syguru' **sandwiched flat belt with crowned pulleys drive system** outperforms traditional V Belts and offers several advantages, including the following:
  - Grips crowned pulley for enhanced traction
  - Thinner cross-section, reducing bending loss
  - Consistent speed with no differential speed as only one belt runs
  - Special material of construction (MOC) ensures constant speed and minimal slip
  - Guaranteed higher lifespan compared to V belts, offering maintenance-free operation
  - Eliminates black or foreign particle generation, minimising contamination risks
  - Energy-efficient, providing a 5% (+/- 2%) improvement in efficiency

- SepraTECH Solutions has developed some **innovative waste water treatment technologies** to enable sustainability in the chlor-alkali sector. These technologies include:
  - **Sulphate removal & concentration membrane system (SRCS)** is designed to efficiently remove high sulphate levels from the brine effluent, offering greater flexibility in operating pressure and significantly reducing operating expenses
  - **New generation reverse osmosis (RO) and nanofiltration (NF) membranes** in zero liquid discharge (ZLD) system improves overall cleaning efficiency of the system

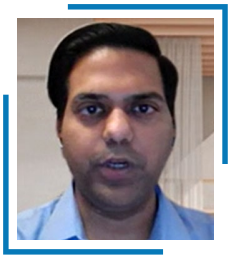
TECHNICAL SESSION IV

STANDARDS & DECARBONISATION TECHNOLOGIES FOR CHLOR-ALKALI SECTOR – BY INTERNATIONAL (INCLUDING FROM THE UK) TECHNOLOGY & SOLUTIONS PROVIDERS

Speakers

Mr. Robert Craig
IES Technology Manager,
INEOS, UK

Mr. Anand Vardhan
Director, HTFE
(India Partner of
Centrica PLC, UK)



Mr. Niraj Singh
Senior Project
Development Manager,
Carbon Clean, UK

Key Takeaways

- The Indian Chlor-Alkali industry can significantly benefit from **INEOS, UK's** advanced IEED technologies, including:
    - **BICHLOR™ Electrolysers:** an innovative zero-gap "modular" bipolar design optimises membrane area utilisation, leading to substantial energy savings and prolonged membrane lifespan.
    - **CHLORCOAT™ Coatings:** facilitates chlorine and hydrogen evolution at low voltage, enhancing resistance to alkali wear, reverse currents, and impurities.
- **Carbon Clean,** UK's patented carbon capture technology using **CDRMax™** process allows capturing more carbon at the lowest cost, all while meeting strict environmental criteria. The CDRMax™ process captures carbon dioxide from the industrial flue gases or off-gases emitted from power plants, boilers, kilns, and chemical facilities. CDRMax™ can be used with source gases that contain CO_2 concentration between **3%** to **25%** by volume. The process produces carbon dioxide with purities ranging from **95%** to **99%**, which can then be sold, reused, or sequestered.
- **Centrica's** patented technology driven by wireless sensors and advanced analytics from power radar software enables machine-level energy management systems for enhancing operating margins, reducing energy consumption, predict breakdowns and driving sustainability across the organisation.

UK's Chlor-Alkali sector offers some key industrial energy efficiency and decarbonisation (IEED) technologies, solutions, and best practices in the areas of:

- **Advanced process control systems** to optimise production parameters in real-time, improving energy efficiency in chlor-alkali plants.
- Extensive research in **catalyst technologies** which boost efficiency in key chlor-alkali processes, aiding in energy conservation.
- **Advancements in electrode and cell component materials** to enhance efficiency and durability in chlor-alkali production.
- **Carbon capture, Utilisation and Storage (CCUS) technologies** to mitigate carbon emissions, reducing the carbon footprint while optimising energy usage.
- **Combined heat and power (CHP) systems** to capture excess heat for reuse, enhancing overall energy efficiency.
- **Waste heat recovery systems** to repurpose heat generated during chlor-alkali production, contributing to energy savings.
- **Upgrading equipment** to energy-efficient models, such as pumps and compressors, leads to significant energy savings.
- **Process optimisation studies and simulation tools** to identify opportunities for energy efficiency improvements.

GENDER EQUALITY AND SOCIAL INCLUSION (GESI)

Mr. Anurag Singh Sirola
Manager, KPMG India

Promoting Gender Equality and Social Inclusion (GESI) is crucial for Indian industries to foster an equitable and inclusive workplace culture. Despite challenges, integrating GESI initiatives offers several advantages:

- **Value creation:** Ensuring full and productive employment, decent work for all, and equal pay for equal work, including for persons with disabilities
- **Innovation:** Studies reveal a strong link between diversity in management and increased innovation, especially in an evolving industrial sector
- **Customer Service:** GESI initiatives enhance customer outcomes by fostering interactions between employees and customers who better represent the customer base.
- **Profitability:** Companies prioritising gender diversity in executive teams tend to have 25% higher profitability compared to those with less diverse teams

To ensure GESI, industries can implement the following measures:

- Foster an inclusive approach to hiring, developing, and retaining diverse talent, creating a culture where minority groups feel empowered to voice their opinions.
- Identify local champions across government, private sector, and civil society to collaborate on addressing inequality and exclusion.
- Implement participation quotas to increase the involvement of excluded groups.
- Fulfill the company's social mission by uniting communities and embracing diversity.

- Establish and transparently measure predetermined GESI metrics, monitoring inclusion in meetings, events, and decision-making processes.

Several Indian industries have already embraced GESI considerations:

- **J K Paper Limited** promotes women empowerment through inter-group savings, credit facilitation, and capacity-building programs.
- **Vardhman Fabrics** ensures equitable work and remuneration regardless of gender, offering social skill development programs for women workers.
- **Vedanta Limited** focuses on hiring LGBTQ personnel and providing sensitisation training, along with initiatives like "Sakhi" to empower women.
- **Hindalco's** "Women at Hindalco (WAH)" initiative offers equal opportunities for women employees and establishes a dedicated committee to prevent sexual harassment.
- **Trident** Group's initiatives include "Saksham" for employing differently abled individuals, "Hastkala" for crafts training, and "Sreeiana" for menstrual and reproductive health awareness among adolescent girls.

CONCLUDING SESSION

- Enhancing energy efficiency and enabling decarbonisation of industries, particularly the chlor-alkali sector, is crucial to achieving sustainability & India's energy transition to net-zero.

- ASPIRE programme intends to support large energy-intensive industries in the adoption of low-carbon technologies and solutions through collaboration with global technology suppliers including from the UK.

- INEOS's advanced BICHLOR™ Electrolyser technology and CHLORCOATTM coatings aids industries in reaching their net zero goals. Alongside, Carbon Clean's CCUS technology and Centrica's wireless sensors, presents significant opportunities for enhancing energy efficiency and cutting carbon emissions in the Chlor-Alkali industry. Stakeholders in the Indian chlor-alkali sector have already shown keen interest in these technologies. However, expediting the deployment of these innovative and low-carbon technologies requires systematic interventions that support technology transfer.

- The workshop successfully deliberated on innovative measures adopted by Indian chlor-alkali manufacturers and new-age technologies and solutions required to accelerate decarbonisation of the chlor-alkali sector.

FEEDBACK FROM THE PARTICIPANTS

- More than **96%** of the participants responded that they were more than satisfied with the outcomes of the workshop (*provided a 7+ rating on a scale of 10*).
- More than **96%** of the participants rated the quality and content of the delivery as more than satisfactory (*provided a 7+ rating on a scale of 10*).
- All technical sessions were highly appreciated by the participants.
- Participants expressed their interest in exploring following IEED technologies from UK:
    - Waste heat recovery and utilisation output
    - Energy, data management, and reporting
    - Recycling technologies and processes
    - Advanced electrolysis technologies and processes
- Women accounted for ~**20%** of total employee strength in most of the participating organisations.
- Participating organisations have undertaken various initiatives to promote Gender Equality and Social Inclusion (GESI), including:
    - Undertaking Corporate Social Responsibility (CSR) activities to improve the education levels of marginalised communities, particularly girls and women.
    - Implemented Prevention of Sexual Harassment Committee (POSH) in the organisation.
    - Ensuring safe working environment as per POSH act.
    - Ensuring equal opportunities for both genders in terms of tasks and support to achieve set targets. This includes addressing any gender biases in recruitment, performance evaluations, and promotions.

"Great workshop! Extremely informative and well organised. Kudos to the organisers for their excellent scheduling and management of the session."

- Mr. Vinayak Srivastava, Assistant Engineer (Mechanical)
GACL

"Excellent Workshop. Looking forward to attending more in the future"

- Mr. K V Suresh, Head - Energy Cell
UPL Limited

WAY AHEAD

Group photograph of Participants

The sectoral workshop has garnered a positive response with substantial participation from esteemed officials from BEE, executive leaders from prominent Indian chlor-alkali industries, and technology and solutions providers from India and the UK. This workshop has served as a platform for national and international organisations to exchange knowledge on best practices and technologies aimed at enhancing industrial energy efficiency and decarbonisation measures within the Indian chlor-alkali sector. This workshop is expected to have a demonstrable and long-lasting on-field impact in due course of time. The upcoming tasks to ensure the momentum include:

Guidance and support to large energy-intensive industries, including those in the pulp & paper sector, to identify technologies, solutions, technology suppliers, and financing options for increased adoption of IEED interventions.

- Plan and organise online seminar / B2B meetings with pulp & paper industry stakeholders in close collaboration with UK technology suppliers such as CoolPlant, Carbon Clean, Centrica, LAT water, etc.
- Create more discussion forums to facilitate the exchange of knowledge and information that will aid in the formulation of policies.

GALLERY


BEST PRACTICES IN
ENERGY EFFICIENCY
IN CHLOR - ALKALI SECTOR:

Annexure
AGENDA

Time (IST)	Name of Session	Presenter
Inaugural Session		
09:00 – 09:30	Registration	
09:30 – 09:35	Lighting of Lamp	
09:35 – 09:40	Welcome Address	Mr. Anurag Singh Sirola, Manager, KPMG India, ASPIRE Programme Team
09:40 – 09:50	Introduction to the ASPIRE Programme*	Ms. Sanyukta Das Gupta, Senior Advisor, Smart Power, Climate and Energy Team, British High Commission*
09:50 – 10:00	Brief overview of industrial energy efficiency (IEE) theme of the ASPIRE Programme	Mr. Balawant Joshi, Managing Director, Idam Infra (ASPIRE Programme Team)
10:00 – 10:10	Keynote Address by Bureau of Energy Efficiency (BEE)	Mr. Sunil K. Khandare, Director, BEE
10:10 – 10:15	Vote of Thanks	Mr. K. K. Chakarvarti, Senior Advisor, IDEEKSHA Platform (ASPIRE Programme Team)
10:15 – 10:20	Group Photograph	
10:20 – 10:35	**Tea Break and Networking**	
Technical Session I: Perform Achieve and Trade Scheme for Chlor - Alkali Sector		
10:35 – 10:40	Moderator	Mr. Sunil K. Khandare, Director, BEE
10:40 – 11:00	Perform Achieve and Trade (PAT) Scheme for the Chlor - Alkali Sector	Mr. Ajitesh Upadhyay, Sector Expert-Chlor-Alkali, BEE
11:00 – 11:10	Q&A	
Special Address by Managing Director, GACL		
11:10 – 11: 20	Special Address by Gujarat Alkalies and Chemicals Ltd. (GACL)	Mr. Swaroop P, IAS, Managing Director, GACL
Technical Session II: Sharing of best practices by Indian Chlor - Alkali Industries		
11:20 – 11:25	Moderator	Mr. K. K. Chakarvarti, Senior Advisor, IDEEKSHA Platform (ASPIRE Programme Team)
11:25 – 11:45	Best Practices and Energy Efficiency measures undertaken by GACL	Representative from GACL
11:45 – 12:05	Chlor-Alkali Digitisation: Sustainable approach to enhance energy efficiency	Mr. Mayank Shukla, Deputy General Manager, Grasim Industries
12:05 – 12:25	Major Energy Saving Projects and Process Optimization -Orient Paper Mills-Caustic Soda Unit	Mr. R.S. Chakravorty, Assistant General Manager (Electrical), Orient Paper Mills Limited
12:25 – 12:35	Importance of Gender Equality and Social Inclusion (GESI) measures in Indian Industries	Mr. Anurag Singh Sirola, Manager, KPMG India, ASPIRE Programme Team
12:35 – 12:45	Q&A	
12:45 – 13:45	**Lunch Break and Networking**	

Time (IST)	Name of Session	Presenter
Technical Session III: Case Studies and Low Carbon & Digital Technologies for Chlor - Alkali Sector – by Accredited Energy Auditors and Indian Technology Suppliers		
13:45 – 13:50	Moderator	Mr. Dipak Khandare & Ms. Dhaarna Rawat, Moderator (ASPIRE Programme Team)
13:50 – 14:10	Successful energy-saving case studies in the Chlor-Alkali sector	Mr. Som Derashri, Managing Director, SyGuru Innovators Pvt. Ltd.
14:10 – 14:30	Energy Efficiency Case Studies in Chlor-Alkali Sector	Mr. Kuldeep Ruparelia & Bhavesh Vasiyani, Electrical Research and Development Association (ERDA)
14:30 – 14:50	Energy Saving in Evaporation & High Concentration Section of Caustic Plants	Mr. Vikram Bhatt, Director, Bertrams India Private Limited.
14:50 – 15:10	Custom design turbines and micro turbines for power generation out of process steam from PRVS and PRDS	Mr Dilip Kumar Shaw/ Mr. Vinay Annappa, Chola Turbo Machinery International Private Limited
15:10 – 15:30	New developments in Sulphate Removal & Concentration (SRCS) Membrane System & RO and NF Membranes for Zero Liquid Discharge (ZLD)	Mr. Nithin Jose, Executive Director, SepraTECH Solutions Pvt. Ltd.
15:30 – 15:40	Q&A	
Technical Session IV: Low Carbon & Digital Technologies for Chlor - Alkali Sector – by UK Technology Suppliers		
15:40 – 15:45 ***(10:10 – 10:15 GMT)***	Moderator	Mr. Anurag Singh Sirola, Manager, KPMG India, ASPIRE Programme Team
15:45 – 16:05 ***(10:15 – 10:35 GMT)***	Presentation by INEOS Group* on *'Technology Sustainability in Chlor-Alkali Sector'* • *Sustainable Chlor-Alkali industry in the UK* • *INEOS' BICHLOR™ Electrolyser* • *INEOS' CHLORCOAT™ Coating*	Mr. Robert Craig, IES Technology Manager, INEOS Group
16:05 – 16:10 ***(10:35 – 10:40 GMT)***	Q&A	
16:10 – 16:25 **(10:40 – 10:55 GMT)**	Presentation by Centrica PLC* *'Improve efficiency, reduce energy, & predict breakdowns with Centrica's wireless, real-time technology'*	Mr. Anand, Director, HTFE (India Partner of Centrica PLC, UK)
16:25 – 16:30 ***(10:55 – 11:00 GMT)***	Q&A	
16:30 – 16:45 **(11:00 – 11:15 GMT)**	Presentation by LAT Water, UK* *'Offering waste heat-powered treatment of industrial wastewaters'*	Mr. Mark Hardiman, Chief Operating Officer, LAT Water Limited, UK
16:45 – 16:50 ***(11:15 – 11:20 GMT)***	Q&A	
16:50 – 17:05 ***(11:20 – 11:35 GMT)***	Presentation by Carbon Clean, UK* *'Offering carbon capture, utilisation and storage technology to help achieve net-zero'*	Mr. Niraj Singh, Senior Project Development Manager, Carbon Clean, UK
17:05 – 17:10 ***(11:35 – 11:40 GMT)***	Q&A	
Discussions, Feedback and Concluding Remarks		
17:10 – 17:30	Mr. Sunil K. Khandare, Director, BEE Ms. Sanyukta Das Gupta, Senior Advisor, Smart Power, Climate and Energy Team, British High Commission* Mr. Anurag Singh Sirola, Manager, KPMG India, ASPIRE Programme Team Mr. Balawant Joshi, MD, Idam Infra, ASPIRE Programme Team Mr. K. K. Chakarvarti, Senior Advisor, Idam Infra, ASPIRE Programme Team	
17:30 onwards	**Tea Break and Networking**	

**Virtual participation*

Attendance Sheet

S. No	Name	Designation	Organisation
1	Mr. Mayank Shukla	Deputy General Manager	Grasim Industries – Aditya Birla Chemicals
2	Mr. R C Patel	Assistant General Manager-Mechanical	DCM Shriram Alkali & Chemicals
3	Mr. Sheshanshu Pandey	HOD – Caustic Plant	UPL Limited
4	Mr. K V Suresh	Head – Energy Cell	UPL Limited
5	Mr. Amit Dutta	Manager	Grasim, Karwar
6	Ms. Herambha Gayathri	Dy. Manager - Electrical	Grasim, Karwar
7	Mr. Som Derashri	MD	SyGuru Innovators Pvt. Ltd.
8	Mr. Rajeev Kumar Ranjan	Dy. General Manager, CTS	Grasim Industries Limited, Chemical Division, Vilayat, Gujarat
9	Mr. Abhijit Shukla	Manager, CTS	Grasim Industries Limited, Chemical Division, Vilayat, Gujarat
10	Mr. Pallab Das	Manager, CTS	Grasim Industries Limited, Chemical Division, Vilayat, Gujarat
11	Mr. Santhosh Kumar G	GM - Electrical	Grasim Industries Limited, Chemical Division, Vilayat, Gujarat
12	Mr. Hardik Jasani	General Manager	Reliance Industries Limited, Dahej
13	Mr. Piyush Borad	Sr Manager	Reliance Industries Limited, Dahej
14	Mr. Hanif Manknojiya	Sr Manager	Reliance Industries Limited, Dahej
15	Mr. Piyush Patel	Chief Mgr (P & Energy)	GACL, Vadodara
16	Mr. Pranav Gandhi	Sr. Mgr (E)	GACL, Vadodara
17	Mr. A R Sahoo	Mgr (P)	GACL, Vadodara
18	Mr. Ashok Gangani	DGM (Electrical)	Kutch Chemical Industries Ltd.
19	Mr. Subhamoy Biswas	Shift In- charge	Kutch Chemical Industries Ltd.
20	Mr. R S Patil	GM - Complex Head	GACL, Dahej
21	Mr. Anjan Kundu	AGM - Operation	GACL, Dahej

S. No	Name	Designation	Organisation
22	Mr. R R Bora	AGM - ES	GACL, Dahej
23	Mr. D K Hingrajia	AGM – Power Plant	GACL, Dahej
24	Mr. M J Patel	AGM - Inst	GACL, Dahej
25	Mr. Amit Mehta	DGM - Mech/ Energy Manager	GACL, Dahej
26	Mr. N C Jethwa	CS & Power Plant - Operations	GACL, Dahej
27	Mr. H J Mistry	CS & Power Plant - Operations	GACL, Dahej
28	Mr. M Y Patel	CS & Power Plant - Operations	GACL, Dahej
29	Mr. Akash Singh	CS & Power Plant - Operations	GACL, Dahej
30	Mr. K V Patel	CS & Power Plant - Operations	GACL, Dahej
31	Mr. Rupen Radia	CS & Power Plant - Operations	GACL, Dahej
32	Mr. Nishant Patel	CS & Power Plant - Operations	GACL, Dahej
33	Mr. Ashwin Prajapati	CS & Power Plant - Operations	GACL, Dahej
34	Mr. Nirmal Jain	CS & Power Plant - Mechanical	GACL, Dahej
35	Mr. H G Patel	CS & Power Plant - Mechanical	GACL, Dahej
36	Mr. Sagar Patil	CS & Power Plant - Mechanical	GACL, Dahej
37	Mr. Vinayak Shrivastav	CS & Power Plant - Mechanical	GACL, Dahej
38	Mr. D P Tiwari	CS & Power Plant – Electrical	GACL, Dahej
39	Mr. Biren Shah	CS & Power Plant – Electrical	GACL, Dahej
40	Mr. P V Patel	CS & Power Plant – Electrical	GACL, Dahej
41	Mr. Jigar Gandhi	CS & Power Plant – Electrical	GACL, Dahej
42	Mr. D B Jain		GACL, Vadodara
43	Mr. P G Pujara		GACL, Vadodara
44	Mr. Nikhil Bhargava		GACL, Vadodara
45	Mr. Dev Krishna	Director	Bertrams India Private Ltd.

S. No	Name	Designation	Organisation
46	Mr. M. Naveen Kumar	Assistant Manager - Production	Tamilnadu Petroproducts limited
47	Mr. Bhavesh Vasiyani	Manager and Accredited EA	Electrical Research & Development Association (ERDA)
48	Mr. R.S. Chakravorty	AGM(Electrical) Energy Manager (EM-9204)	Orient Paper & Industries Ltd (Caustic Soda Unit).
49	Mr. Sunil K. Khandare	Director	Bureau of Energy Efficiency
50	Mr. Ajitesh Upadhyay	Sector Expert	Bureau of Energy Efficiency
51	Mr. Aditya Moghe	Project Engineer	Bureau of Energy Efficiency
52	Ms. Sanyukta Das Gupta*	Sr. Advisor, Smart Power	British High Commission (ASPIRE Team)
53	Mr. K. K. Chakarvarti	Sr. Advisor, IDEEKSHA	Idam Infra (ASPIRE Team)
54	Mr. Anurag Sirola	Manager	KPMG India (ASPIRE Team)
55	Mr. Ashish Sharma	Senior Consultant	KPMG India (ASPIRE Team)
56	Mr. Balawant Joshi	Managing Director	Idam Infra (ASPIRE Team)
55	Mr. Dipak Khandare	Associate Director – Industrial Decarbonisation	Idam Infra (ASPIRE Team)
58	Ms. Dhaarna Rawat	Consultant	Idam Infra (ASPIRE Team)
59	Dr. Asmita Marathe	Manager	Idam Infra (ASPIRE Team)
60	Mr. Vivek Sharma	AGM (power plant and utility)	Epigral Ltd.
61	Mr. Nitin Jose	Executive Director	SepraTECH Solutions Pvt. Ltd.
62	Mr. K R Vaidya	CEO	GNAL
63	Mr. Sudhir Bhargav		GNAL
64	Ms. Krusha Dave		GACL Baroda
65	Mr. J. J. Patel		GACL Baroda
66	Ms. Bansari Purohit		GACL Baroda
67	Ms. Ritu Shah		GACL Baroda
68	Mr. Chintan Patel		GACL Baroda
69	Mr. Ketan Vadgama		GACL Dahej
70	Mr. Munish Raval		GACL Dahej
71	Mr. Rakesh Sharma		Nirma Limited

S. No	Name	Designation	Organisation
72	Mr. Niraj Pandya		GACL Dahej
73	Mr. Rahul Sharma		GACL
74	Mr. Sandeep Virani		GACL
75	Mr. Ankit Soni		GACL
76	Mr. S. J. Saiyed		GACL
77	Mr. Kuldeep Ruparelia		ERDA
78	Mr. Niraj Singh*	Senior Project Development Manager	Carbon Clean
79	Mr. Anand*	Director	HTFE (India Partner of Centrica PLC)
80	Mr. Robert Craig*	IES Technology Manager	INEOS

*Attended Virtually

FOR MORE INFORMATION PLEASE CONTACT

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Partner and National Lead Power & Utilities
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