UK Government

iDeeksha

Bureau of Energy Efficiency
Ministry of Power, Government of India

ASPIRE Programme

Accelerating Smart Power & Renewable Energy in India

Sectoral Workshop & Study Trip

BEST PRACTICES IN ENERGY EFFICIENCY IN CHLOR-ALKALI SECTOR: A PATH FOR DECARBONISATION

HOSTED BY:

GACL
Promoting Green Technology

Gujarat Alkalies and Chemical Limited, Dahej (Bharuch), Gujarat

WORKSHOP:
Date: *27th February 2024*
Time: *09:00 – 17:30 IST / 03:30 – 12:00 GMT*
Venue: *GACL Auditorium, Dahej Complex-1, Gujarat*

STUDY TRIP:
Date: *28th February 2024*
Time: *09:30 – 13:00 IST / 04:00 – 07:30 GMT*
Venue: *GACL plant, Bharuch, Dahej, Gujarat*

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1. About ASPIRE Programme

Accelerating Smart Power and Renewable Energy (ASPIRE) is a bilateral programme being implemented by the Foreign Commonwealth and Development Office (FCDO), Government of UK in association with the Ministry of Power and Ministry of New and Renewable Energy (MNRE), Government of India (GoI). Key objective of the ASPIRE Programme is to facilitate India's transition towards a sustainable, low carbon energy ecosystem to fulfill its net-zero commitments. KPMG is the implementation advisor to FCDO in relation to the ASPIRE programme and Idam Infrastructure Advisory Private Limited (India) is a key consortium member.

Industrial Energy Efficiency and Decarbonisation (IEED) is a key thematic area of support under the ASPIRE programme which is being implemented in association with Bureau of Energy Efficiency (BEE), GoI.

2. About IDEEKSHA Platform

The Industrial Decarbonisation and Energy Efficiency Knowledge Sharing (IDEEKSHA) Platform has been developed under the ASPIRE Programme in collaboration with the BEE to promote and share best practices and energy-efficient technologies among large-scale industries. The IDEEKSHA platform was launched by Mr. R.K. Singh, Hon'ble Cabinet Minister for Power and New and Renewable Energy, Government of India during the 21st Foundation Day Event of BEE on 1st March 2023, in Delhi.

Snapshots from IDEEKSHA Platform and Newsletter launch during BEE's Foundation Day Event

The IDEEKSHA platform is a one-stop shop for all energy efficiency/ decarbonisation needs of large industries covered/ expected to be covered under BEE's PAT Scheme. The IDEEKSHA platform would thus facilitate:

- Exchange of knowledge and information to enhance peer to peer learning.
- Designated Consumers (DCs) in adoption of new and emerging IEED tools & technologies by facilitating access to Indian and global (including from the UK) technology suppliers.
- Access to a database of financial institutions.
- Access to IEED tools, technologies & technology providers available in India and globally.
- Access to data sources and knowledge repositories to support knowledge translation.
- Sector/ industry specific workshops/ seminars to enhance EE measures.
- Knowledge and commercial partnerships.

The IDEEKSHA platform facilitates knowledge exchange and partnerships among industry and technology suppliers for 8 hard-to-abate industrial sectors (Cement, Aluminium, Iron & Steel and Textile, Fertiliser, Chlor-Alkali, Pulp & Paper, and Refinery) which are also covered under BEE's Perform Achieve and Trade (PAT) scheme. Under the IDEEKSHA Platform, support was extended to four (4) energy-intensive industrial sectors (Cement, Aluminium, Iron & Steel and Textile) in terms of providing access to database of global industrial energy efficiency & decarbonisation (IEED) technologies, organising capacity building workshops and study trips, etc. Four sectoral workshops and study trips were organised in 2022 and 2023, each focusing on key industries: Aluminium, Textile, Cement, and Iron & Steel. These events are aimed at understanding industry-specific challenges, opportunities, and identifying strategies for sustainable development. The details of the events, including background notes, presentations, event summary reports, etc., can be accessed through the IDEEKSHA Platform under 'Past Events' tab. Below are the direct links to access the resources:

S.No.	Past Events	Sector	Reference Links
1	Sectoral Workshop on Best Practices in Energy Efficiency in Aluminium Sector: A Path for Decarbonisation	Aluminium	https://www.ideeksha.in/pages/Sectoral Workshop on Best Practices in Energy Efficiency in Aluminium Sector
2	Study Tour/ Visit of Aditya Aluminium Plant, Lapanga, Odisha		https://www.ideeksha.in/pages/A Study Tour Visit of Aditya Aluminium Plant
3	Sectoral Workshop on Best Practices in Energy Efficiency in Textile Sector: A Path for Decarbonization	Textile	https://www.ideeksha.in/pages/Sectoral Workshop on Best Practices in Energy Efficiency in Textile Sector
4	Study Tour/ Visit of Raymond Textile Plant, Chhindwara, Madhya Pradesh		https://www.ideeksha.in/pages/A Study Tour Visit of Raymond Textile Plant
5	Sectoral Workshop on Best Practices in Energy Efficiency in Cement Sector: A Path for Decarbonisation	Cement	https://www.ideeksha.in/pages/Sectoral Workshop on Best Practices in Energy Efficiency in Cement Sector: A Path for Decarbonisation
6	Study Tour/ Visit of Udaipur Cement Works Limited (UCWL)		https://www.ideeksha.in/pages/A Domestic Study Tour-Visit of Cement Plant
7	Sectoral Workshop on Best Practices in Energy Efficiency in Iron & Steel Sector: A Path for Decarbonisation	Iron & Steel	https://www.ideeksha.in/pages/Sectoral Workshop on Best Practices in Energy Efficiency in Iron & Steel Sector: A Path for Decarbonisation
8	Study Tour/ Visit of Godawari Power & Ispat Limited (GPIL)		https://www.ideeksha.in/pages/A Domestic Study Tour-Visit of Iron & Steel Plant
9	Sectoral Workshop on Best Practices in Energy Efficiency in Pulp & Paper Sector: A Path for Decarbonisation	Pulp & Paper	The report is under development and would be soon uploaded on IDEEKSHA platform.
10	Study Tour/ Visit of Khanna Paper Mills, Amritsar		

Now, it is proposed to extend the technical assistance support through IDEEKSHA platform to four (4) new industrial sectors namely, **Pulp & Paper**, **Chlor-Alkali**, **Tyre manufacturing** and **Sugar**.

As part of the support, ASPIRE Programme team will organise workshops and plant study trips for the above 4 new focus sectors to enhance energy efficiency measures and enable decarbonisation in the industrial sectors. Further, the IDEEKSHA Platform would also host a technology compendium and newsletters showcasing leading industrial energy efficiency and decarbonisation (IEED) practices, along with innovative technologies/ solutions and their suppliers tailored for the above sectors.

3. Overview of Chlor - Alkali Sector in India

The Chlor-Alkali industry constitutes approximately **1%** of the global chemical industry, with a turnover of ~ **INR 57 lakh crores** (**£54.8 billion)**. The Indian chlor-alkali industry commands a **~6%** share of the global market (~INR 3.4 lakh crores) 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 **33.7** lakhs tonnes per annum in FY 2016 to **45.4** lakhs tonnes per annum in FY 2020[2].

Chlor-Alkali sector is one of the highest energy intensive industries in India, having a total energy consumption of ~**0.88** MToE per annum. 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].

BEE has been at the forefront in promoting EE in various demand sectors, with a special focus on the industrial sector, as it is one of the major contributors to total GHG emissions in India and holds immense energy-saving potential. The PAT scheme, now in its eighth cycle, has been instrumental in orchestrating the adoption of various low-hanging energy efficiency measures by large energy-intensive industries. Given that the Chlor- Alkali sector holds substantial Energy Efficiency potential, it has rightfully emerged as a primary focus area for the BEE in its pursuit of EE enhancement. 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)[5]. The threshold limit for any unit to be notified as a Designated Consumer (DC) under the PAT Scheme has been marked at **12,000** MToE[3]. Currently, **29** DCs have been notified under the PAT scheme.

Industrial Energy Efficiency (IEE) and Decarbonisation achievement in Chlor-Alkali Sector under PAT Cycle I & PAT Cycle II are presented below in Table 1

Table 1: Energy efficiency & Decarbonisation - achievement under PAT Cycle I & II in Chlor Alkali sector

Total Number of DCs Notified in PAT Cycle I to VII	Energy Savings Achievement (MToE)	Decarbonisation Achievement ($MTCO_2$)
29	**0.223**	**0.62**

[1] [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://www.npcindia.gov.in/NPC/Uploads/Competencies/Manual%20Chlor-alkali%20Sector.pdf

4. Decarbonisation of Indian Chlor - Alkali Industry

India's ambitious target of achieving Net Zero emissions by 2070 reflects a significant commitment to addressing the climate crisis. The designated consumers (DCS) within the chlor-alkali sector have committed to achieving energy efficiency targets through systematic planning, and many of these entities have shown significant progress. Some of the energy efficient measures adopted by chlor-alkali plants are mentioned below:

- **Gujarat Alkalies and Chemicals Limited (GACL):** GACL has implemented 171.45 MW of Wind Power and 36.4 MW of solar installations for captive use, contributing to approximately 25% of its total electrical energy requirements.
- **Tata Chemicals Limited (TCL):** Tata Chemicals employs energy efficiency solutions such as waste heat recovery, the adoption of energy-efficient equipment and motors, and digital interventions like automation and IoT across all manufacturing facilities. Some of the specific initiatives include:
  - 100% Fly Ash consumption Recycling solid waste > 5 Lakh MT
  - Optimised the specific energy consumption of vacuum salt (one of the key products) by ~33% from 6.44 GJ/ tonne in 2014 to 4.29 GJ/ tonne
  - Installation of high efficiency 132/ 22 kV power transformer with harmonic filter bank of 4.09 MVAR capacity at its Nagda facility that resulted in power savings of 12,250 kWh/ day[7].
- **Aditya Birla Chemicals Limited:** Aditya Birla Chemicals focuses on utilising available heat through process heat integration, employing digitalisation programs for data-driven decision-making. Recoating of 15 electrolysers across sites resulted in overall power saving of ~126,000 kWh/ day[6].
- **DCM Shriram Limited:** DCM Shriram has taken a pioneering step by producing blue hydrogen as a by-product of Chlor-Alkali plant processes. This hydrogen is then utilised as fuel in the plant's furnaces, serving as a substitute for fossil fuels. The utilisation of 30,165,290 Nm^3 of hydrogen as an alternative fuel resulted in an abatement of ~80 tCO_2e[7].

Chlor-Alkali industries have adopted the following leading industrial energy efficiency & decarbonisation (IEED) practices and technologies in their operations:

- Upgrading technology to Zero-gap technology: Minimises the gap between the anode and cathode in the electrolysis process, reducing energy consumption and emissions.
- Installation of micro-turbine: Micro-turbines generate electricity from waste gases or low-pressure gas streams, improving energy efficiency and reducing emissions.
- Feeding of 48% hot caustic soda lye directly to flaker plant: Reduces energy consumption associated with heating, enhancing process efficiency.
- Utlilising Hydrogen as a fuel in place of Furnace Oil (FO) in process heating/steam requirement: substituting fossil fuels with hydrogen decreases carbon emissions and enhances the sustainability of process heating and steam generation.
- Utilising hydrogen as a fuel in captive power plant: Reduces reliance on fossil fuels, leading to lower GHG emissions.
- PEM Fuel Cell Technology using Hydrogen: Convert hydrogen into electricity with high efficiency and low emissions, contributing to decarbonization efforts.
- Hydrogen Compressed Natural Gas (HCNG) (Hydrogen blending with CNG): Reduces the carbon intensity of the fuel and lowers emissions from transportation or industrial processes.
- Operational Changes: Implementing changes in operating schedules or production sequences to optimise energy use during periods of lower demand or when energy costs are lower.
- Zero Effluent Discharge: Zero effluent discharge practices aim to minimize or eliminate the release of wastewater or effluents into the environment, reducing pollution and resource consumption.

[6] https://www.adityabirlachemicals.com/pdf/grasim-integrated-annual-report-2021-22.pdf#toolbar=0
[7] https://www.dcmshriram.com/docs/sustainability-report/Sustainability-Report-2022-23.pdf

- Re-use of fly ash and brine sludge: Reusing fly ash and brine sludge from industrial processes as raw materials or in other applications reduces waste generation and promotes resource efficiency.
- Employee Training: Providing training programs for employees to raise awareness about energy conservation and encourage a culture of energy efficiency within the organisation.
- Lighting and HVAC Efficiency: Upgrading lighting systems to energy-efficient LED technologies and optimising heating, ventilation, and air conditioning (HVAC) systems for improved efficiency.
- Collaboration and Benchmarking: Collaborating with industry associations, participating in benchmarking initiatives, and learning from best practices in the sector to continuously improve energy efficiency.

5. Potential Technology Interventions for Enhancing IEED in Indian Chlor - Alkali Sector

Some of the potential areas for technology intervention in the Indian Chlor - Alkali sector to reduce carbon intensity & facilitate a rapid transition to net-zero have been identified below:

- Adoption of Zero Gap Membrane Cell Technology- Zero-gap technology
- Bichlor™ Electrolyser (Zero gap Electrolyser)
- SMART (Sustainable Modularly Arranged Pressure Reducing Turbines)
- Oxygen Depolarised Cathode (Membrane Process for Energy Savings Chlorine Production)
- Supplying Certified Green Hydrogen from Chlor-Alkali Electrolysis
- Industry 4.0 Wireless Energy Solutions
- Sustainable Wastewater Treatment Technology
- Carbon Capture Technology
- Bipolar Membrane (BM) Single Element Technology
- Renewable Energy Integration in a Chlor-Alkali Facility
- Energy-Efficient Equipment: Investing in energy-efficient machinery and equipment, such as pumps, compressors, and motors.
- Process Optimisation: Conducting thorough energy audits and process optimisation studies to identify areas where energy efficiency can be improved without compromising product quality.
- Waste Heat Recovery: Implementing systems to capture and reuse waste heat generated during the production process.
- Energy Management Systems (EMS): Implementing advanced energy management systems to monitor, control, and optimise energy usage throughout the manufacturing facility.

Chlor- Alkali Industry in the UK

The chlor-alkali industry in the United Kingdom specialises in the production of chlorine and caustic soda, essential chemicals with diverse applications spanning industries such as chemicals, pharmaceuticals, textiles, and water treatment. These critical chemicals are manufactured through an electrolysis process involving salt, generating chlorine gas and caustic soda simultaneously. Chlorine is utilised in the production of materials like Polyvinyl chloride (PVC) for plastics and plays a vital role in water disinfection. Meanwhile, caustic soda is a fundamental ingredient in the creation of soaps, detergents, pulp and paper, and aluminium. This industry significantly contributes to the UK's chemical manufacturing sector, serving both domestic needs and international markets. Environmental sustainability and safety are paramount, with stringent regulations in place to minimize 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.

Indian Chlor-Alkali industries can leverage strengths and capabilities of UK Chlor-Alkali sector to accelerate their journey towards achieving net-zero emissions. This can be facilitated by adopting following best practices, technologies, and solutions offered by the UK technology providers:

- **Membrane Cell Technology**: Transitioning from mercury cell technology to membrane cell technology is a significant step toward energy efficiency in chlor-alkali production. Membrane cells operate at lower energy consumption levels and have environmental advantages over mercury cells.
- **Advanced Process Control**: Implementing advanced process control systems that use real-time data and analytics to optimise production parameters can enhance energy efficiency in chlor-alkali plants.
- **Catalyst Development**: Research and development in catalyst technologies can lead to improved efficiency in key processes within the chlor-alkali production chain, contributing to energy savings.
- **Combined Heat and Power (CHP)**: Utilising combined heat and power systems within chlor-alkali facilities can capture and reuse excess heat, improving overall energy efficiency.
- **Waste Heat Recovery**: Implementing waste heat recovery systems to capture and repurpose heat generated during the chlor-alkali production process can contribute to energy savings.
- **Energy-Efficient Equipment**: Upgrading equipment, including pumps, compressors, and motors, to energy-efficient models can result in substantial energy savings.
- **Process Optimisation and Simulation**: Conducting detailed process optimisation studies and utilising simulation tools can identify opportunities for energy efficiency improvements in chlor-alkali production.
- **Advanced Materials**: Research into advanced materials for electrodes and cell components can lead to more efficient and durable chlor-alkali production processes.
- **Carbon Capture Storage and Utilisation**: Enables industries to capture carbon dioxide emissions produced during their processes and either store them underground or utilise them in various applications. By implementing CCUS technologies, industries can reduce their carbon footprint while also optimising their energy usage.

6. IDEEKSHA Sectoral Workshop for Chlor-Alkali Sector

A one-day workshop on **"*Best Practices in Energy Efficiency in Chlor-Alkali Sector: A Path for Decarbonisation*"** is being organised under the ASPIRE Programme in collaboration with BEE, with the support of Gujarat Alkalies and Chemicals Limited (GACL), on **27th February 2024** at **GACL Auditorium, Dahej Complex – 1, Gujarat, India**. The workshop will cover various aspects of the Chlor - Alkali sector such as the PAT scheme, best practices and new & emerging low-carbon technologies to enhance industrial energy efficiency and decarbonisation (IEED) measures. The workshop is designed to provide national and international organisations with a platform to present their best practices and technologies in the above areas. The workshop would provide an opportunity for stakeholders to understand the Chlor-Alkali sector in India and connect with key stakeholders for potential partnerships. The workshop would thus enable in capacity building of Chlor-Alkali sector stakeholders.

ASPIRE Programme promotes gender equality, and the sectoral workshop is expected to deliver GESI (Gender Equality and Social Inclusion) through the participation of women and stakeholders from marginalised groups from large energy-intensive industries.

The detailed agenda for the Chlor-Alkali sectoral workshop has been provided in Annexure.

7. Study Trip of Gujarat Alkalies and Chemicals Limited (GACL), Dahej Complex, Gujarat

A study trip/ plant visit to Gujarat Alkalies and Chemical Limited (GACL) in Dahej, Gujarat, is scheduled on **February 28th, 2024**. GACL, a forward-looking company promoted by the Government of Gujarat, has evolved into one of India's largest producers in the Chlor-Alkali sector, operating across two complexes in Dahej and Vadodara. GACL is strategically diversifying and expanding its infrastructure beyond caustic soda, to strengthen its leadership in the Chlor-Alkali sector and other integrated downstream products, including Chlorine and Hydrogen derivatives, employing world-class technologies.

As a company with high energy intensity striving for self-reliance, GACL has established a **90 MW** combined cycle captive power plant at its Dahej complex. Additionally, it boasts renewable power assets, including **171.45 MW** wind farms and **36 MW** solar power plants. GACL places unwavering emphasis on environmental commitment, embodying a strong “Green Attitude”.

Dedicated to customer satisfaction and international standards, GACL holds management system certifications under ISO 9001:2015, ISO 14001:2015, ISO 45001:2018, and ISO 50001:2018. The company has earned accolades across various divisions, notably recognised as a “**Top Performer Designated Consumer for Chlor-Alkali sector of PAT Cycle II under NMEEE**”.

Driven by a vision to be acknowledged as a dynamic, modern, and eco-friendly chemical company with enduring ethics and values, GACL is on a mission to manage its business responsibly and sensitively. The company continuously strives for improved performance and a significant contribution to CSR activities at large.

The study trip/ plant visit to GACL Dahej Complex aims to facilitate dialogue and knowledge exchange among industry stakeholders, fostering a deeper understanding of the integration of renewable energy in Chlor-Alkali plants. Participants will have the opportunity to gain insights into cutting-edge sustainable development initiatives implemented by GACL and learn about the latest Industrial Energy Efficiency and Decarbonisation (IEED) technologies and procedures adopted by the plant. This visit is designed to encourage the sharing of best practices and technologies between industries, promoting an ambitious, mutually beneficial, and outcome-focused relationship.

8. Annexure: Agenda for IDEEKSHA Sectoral Workshop – Chlor-Alkali Sector

Theme: Best Practices in Energy Efficiency in Chlor-Alkali Sector: A Path for Decarbonisation
Date: 27th February 2024
Time: 09:00 – 17:30 IST / 03:30 – 12:00 GMT
Venue: GACL Auditorium, Dahej Complex, Gujarat

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	Representative from FCDO, 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 – 10:20	Inaugural Address by Gujarat Alkalies and Chemicals Ltd. (GACL)	Representative from GACL
10:20 – 10:25	Vote of Thanks	Mr. K. K. Chakarvarti, Senior Advisor, IDEEKSHA Platform (ASPIRE Programme Team)
10:25 – 10:30	Group Photograph	
10:30 – 10:45	**Tea Break and Networking**	
Technical Session I: Perform Achieve and Trade Scheme for Chlor - Alkali Sector		
10:45 – 10:50	Moderator	Mr. Sunil K. Khandare, Director, BEE
10:50 – 11:10	Perform Achieve and Trade (PAT) Scheme for the Chlor - Alkali Sector	Mr. Ajitesh Upadhyay, Sector Expert, BEE
11:10 – 11:20	Q&A	
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 - 12:45	Importance of Gender Equality and Social Inclusion (GESI) measures in Indian Industries	Mr. Anurag Singh Sirola, Manager, KPMG India, ASPIRE Programme Team
12:45 – 13:00	Q&A	
13:00 – 14:00	**Lunch Break and Networking**	

Technical Session III: Case Studies and Low Carbon & Digital Technologies for Chlor - Alkali Sector – by Accredited Energy Auditors and Indian Technology Suppliers		
14:00 – 14:05	Moderator	Mr. Dipak Khandare, Associate Director, Idam Infra (ASPIRE Programme Team)
14:05 – 14:25	Successful energy-saving case studies in the Chlor-Alkali sector	Mr. Som Derashri, MD, SyGuru Innovators Pvt. Ltd.
14:25 – 14:45	Energy Efficiency Case Studies in Chlor-Alkali Sector	Mr. Kuldeep Ruparelia & Bhavesh Vasiyani, Electrical Research and Development Association (ERDA)
14:45 – 15:05	Energy Saving in Evaporation & High Concentration Section of Caustic Plants	Mr. Vikram Bhatt, Director, Bertrams India Private Limited.
15:05 – 15:25	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
15:25 - 15:45	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.
15:45 – 15:55	Q&A	
Technical Session IV: Low Carbon & Digital Technologies for Chlor - Alkali Sector – by UK Technology Suppliers		
15:55 – 16:00	Moderator	Mr. Anurag Singh Sirola, Manager, KPMG India, ASPIRE Programme Team
16:00 – 16:15	Technology Sustainability in Chlor-Alkali*	Mr. Robert Craig, IES Technology Manager, INEOS Group
16:15 – 16:20	Q&A	
16:20 – 16:35	Presentation by Centrica PLC *'Improve OEE, Reduce Energy, & Predict Breakdowns with Centrica's Wireless, Real-time Technology'* (TBC)	Mr. Anand, Director, HTFE (India Partner of Centrica PLC, UK)
16:35 – 16:40	Q&A	
16:40 – 16:55	Presentation by IEED Technology Provider, UK (TBC)	Representative from IEED Technology Provider, UK
16:55 – 17:00	Q&A	
17:00 – 17:15	Presentation by Carbon Clean, UK (TBC) *'Carbon Capture, Utilisation and Storage technology to help achieve net-zero'*	Mr. Niraj Singh, Senior Project Development Manager, Carbon Clean, UK
17:15 – 17:20	Q&A	
Discussions, Feedback and Concluding Remarks		
17:20 – 17:30	Mr. Sunil K. Khandare, Director, BEE Representative from GACL Representative from FCDO, 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 presentation*