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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 SUGAR SECTOR

A PATH FOR DECARBONISATION

LUCKNOW, UTTAR PRADESH, INDIA
MARCH 21, 2024

iDeeksha

Industrial Decarbonisation and Energy Efficiency
Knowledge Sharing Platform

Contents

Abbreviations

ASPIRE	Accelerating Smart Power and Renewable Energy in India
APH	Air Preheaters
AHU	Air Handling Unit
ACFCS	Automatic Cane Feed Control System
ACW	Auxiliary Cooling Water
BCML	Balrampur Chini Mills Limited
BFP	Boiler Feed Pump
BEE	Bureau of Energy Efficiency
CCS	Carbon Capture and Storage
CO	Carbon Monoxide
CCUS	Carbon Capture Utilisation and Storage
CDM	Clean Development Mechanism
CHP	Combined Heat and Power
CEP	Condensate Extraction Pump
CSR	Corporate Social Responsibility
DVVNL	Dakshinanchal Vidyut Vitran Nigam Limited
DSM	Demand Side Management
DCs	Designated Consumers
DCH	Direct Contact Heater
DISCOMs	Distribution Companies
DCS	Distributed Control System
ETP	Effluent Treatment Plant
ESP	Electrostatic Precipitator
FFE	Falling Film Evaporator
FCDO	Foreign, Commonwealth and Development Office
GESI	Gender Equality & Social Inclusion
GHG	Greenhouse Gases
HVAC	Heating, Ventilation, and Air Conditioning
HPH	High-Pressure Heater
HT	High-Tension
H^2	Hydrogen
ISMA	Indian Sugar Mills Association

IDEEKSHA Platform	Industrial Decarbonisation and Energy Efficiency Knowledge Sharing Platform
IEED	Industrial Energy Efficiency and Decarbonisation
KEP	Knowledge Exchange Platform
KPLD	Kilo Liters Per Day
LPH	Low-Pressure Heater
LT	Low-Tension
MMT	Million Metric Tons
MVVNL	Madhyanchal Vidyut Vitaran Nigam Limited
MTOE	Metric Tonnes of Oil Equivalent
$MtCO_2$	Million Tonnes of Carbon dioxide
MoP	Ministry of Power
MW	Mega Watt
MWh	Mega Watt-Hour
NIBE	National Institute of Bioenergy
NMEEE	National Mission on Enhanced Energy Efficiency
NSI	National Sugar Institute
PAT	Perform Achieve and Trade
PVVNL	Purvanchal Vidyut Vitaran Nigam Limited
STP	Sewage Treatment Plant
SJ	Sulphited Juice
TPP	Thermal Power Plant
TCD	Tonnes of Cane Per Day
UPSDA	Uttar Pradesh State Designated Agency
VFD	Variable Frequency Drive

BACKGROUND

India is the largest producer of sugar in the world, having an annual output value of ~**INR 800 billion** (~**GBP 7.6 billion**)[1]. The sugarcane and sugar sector are the country's second-largest agro-based industry, after cotton. The industry is witnessing significant expansion, with ~**642** sugar factories, collectively capable of yielding ~**35** million metric tons (MMT) of sugar[2]. Uttar Pradesh, Maharashtra, and Karnataka account for over **70%** of the country's total sugar production. While most sugar mills typically operate with crushing capacities ranging from **600** to **5,000** tonnes of cane per day (TCD), there's a noticeable trend of expansion, with some mills even surpassing the **20,000** TCD mark[3]. In the 2021-22 sugar season, **522** units were operational[4] with **60%** of the operational mills located in Uttar Pradesh (highest share in national production) and Bihar.

The sugar industry not only supplies raw materials to the alcohol and beverage sectors but also contributes to fuel blending, aiding in green fuel production and reducing crude oil imports. India surpassed its target of **10%** ethanol blending with petrol ahead of its schedule in 2022 and now aims to achieve **20%** blending by 2025 under the National Biofuel Policy.[5]

By-products of sugar industry

(i) Cogeneration: ~**300** kg of bagasse (a residue from sugar extraction process) is produced per tonne of sugar which can further be converted to ~**130** kilo Watt hour (kWh) of power. India's sugar industry has a total installed co-generation capacity of **~4,200** MW, with integrated mills exporting **~75%** of the co-generation power to grid post captive consumption.[6]

(ii) Ethanol: a key by-product for integrated sugar mills is primarily derived from molasses, a by-product of the sugar industry.

Energy efficiency and decarbonisation potential

As per a study by the Indian Institute of Technology Bombay (IIT Bombay), production of one tonne of sugar releases greenhouse gas (GHG) emissions equivalent to **324** - **834 kg** of carbon dioxide. Sugarcane cultivation accounts for significant GHG emissions in the entire life cycle of sugar production. Coal-based electricity consumption for irrigation and application of chemical fertiliser and cattle manure lead to this high level of emissions. Sugarcane milling accounts for **6-7%** of the emissions, while cogeneration of electricity from bagasse accounts for **2-3%**.[7]

1 Sugar market in India - statistics & facts | Statista
2 Sugar market in India - statistics & facts | Statista
3 BEE presentation on Sugar Sectoral Workshop
4 https://www.ideeksha.in/pages/Sugar-Basic%20info%20on%20Sectors
5 India achieved 10% ethanol blending target ahead of schedule: PM Modi - Times of India (indiatimes.com)
6 Understanding How The Indian Sugar Industry Works – Alpha Invesco
7 Simultaneous production of sugar, power generation from bagasse is environment-friendly, says IIT-Bombay study | Latest News India - Hindustan Times

The sugar sector is now expected to be brought under the ambit of the Bureau of Energy Efficiency's (BEE's) flagship Perform Achieve and Trade (PAT) scheme. As per the Ministry of Power's (MoP) notification dated 6th June 2023, units of sugar plants[8], having energy consumption of **10,000** metric tonne of oil equivalent (MTOE) per year or above will qualify as a Designated Consumer (DC) in Sugar Sector. As per a recent study, the overall energy consumption of this sector is estimated to be **20.28** million MTOE and **~100** sugar plants are expected to be included as DCs under the PAT scheme[8].

At present, the specific power consumption of sugar mills in India is in the range of ~**26-32** kWh/ tonne of cane produced[9]. Implementation of latest energy efficient technologies offers potential to reduce the specific power consumption of the mills to ~**22** kWh/ tonne of cane[10].

Sugar industry in the UK

In the United Kingdom, sugar is derived exclusively from sugar beets and sugar cane due to their sufficient sucrose content for industrial sugar production. In 2022, the UK harvested over **6** MMT of sugar beets, worth ~GBP **223** million (~INR **23** billion), which were further processed into about **1** MMT of sugar, contributing to the broader sugar manufacturing industry with revenue amounting to ~GBP **830** million (~INR **87** billion).

Sugar industries in the UK have implemented several energy efficiency measures and best practises to curb energy consumption and enable decarbonisation. Some of the measures adopted by leading UK sugar manufacturing units such as British Sugar, Tate & Lyle, Ragus sugars etc. include:

- Utilising air-blast oil cooler (adopted by Bury St. Edmunds factory of British Sugar), in place of conventional borehole water cooling systems helps to conserve water, improve cooling efficiency, reduces maintenance costs, and improves plant safety.
- Utilising heat exchangers to recover heat from furnaces, incinerators, static diesel or gas engines, gas turbines and other sources of waste heat generated by systems' exhaust gases.
- Utilising falling film evaporators & multi-film evaporators for producing high-quality sugar syrups or molasses with specific sugar concentrations for further processing into refined sugar or other sugar-based products.
- Leveraging artificial intelligence and automation (such as drones, robotics, manufacturing operations management software, etc.) to enable process optimisation, inventory management, etc.

Indian sugar mills can leverage strengths and capabilities of UK sugar sector to accelerate their journey towards achieving net-zero emissions. Some of the best practices, technologies, and solutions offered by the UK technology providers that can be adopted by Indian sugar mills include:

- IoT based Industry 4.0 energy management solutions
- Carbon capture, utillisation and storage
- Efficient effluent treatment technologies
- Process control and automation solutions
- Low-emission bulk drying technology
- Artificial intelligence/ machine learning based solutions to drive emission reduction
- Fuel switching (including in coking plant) - biomass, hydrogen, and electrification[11]

8 or establishment those are under production of sugar and its variants such as white sugar, brown sugar, and liquid sugar
9 https://www.teriin.org/sites/default/files/2021-08/Sugar_Report.pdf
10 All India seminar on latest energy efficient technologies in Indian sugar industry – organised by STAI
11 https://www.themanufacturer.com/articles/the-sweet-smell-of-decarbonisation/

In view of the above, a one-day **sectoral workshop** was organised in Lucknow, Uttar Pradesh on 21st March 2024 under the Accelerating Smart Power and Renewable Energy in India (ASPIRE) programme[12]. The workshop was jointly organised by the Foreign, Commonwealth and Development Office (FCDO), Government of UK and the Bureau of Energy Efficiency (BEE), Government of India. The theme of the sectoral workshop was "**Best Practices in Energy Efficiency & Decarbonisation in Sugar Sector – A Path for Decarbonisation**". During the workshop, stakeholders deliberated on current and potential market landscape, ongoing and upcoming government interventions and best practices, technologies, etc., to enhance industrial energy efficiency and decarbonisation (IEED) of the Sugar sector. In the workshop, some key organisations from the UK sugar sector presented various leading IEED best practices and technologies adopted in the UK.

Objective of the Workshop

- Appraise stakeholders about Industrial Decarbonisation and Energy Efficiency Knowledge Sharing Platform (IDEEKSHA) platform and its key functionalities.
- Provide an overview of impact of the PAT scheme and the IEED measures implemented in the 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).

Highlights

- **60+** participants from India and the 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, industrial associations, leading sugar manufacturers and technology providers from India and UK

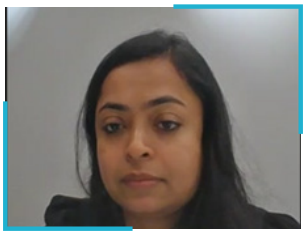
12 Accelerating Smart Power and Renewable Energy (ASPIRE) is a bilateral technical assistance programme being implemented by the Foreign, Commonwealth and Development Office (FCDO), Government of UK in association with the Ministry of Power and Ministry of New and Renewable Energy, Government of India.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

INAUGURAL SESSION

(L – R) Mr. Ramit Malhotra, Mr. Balawant Joshi, Mr. Sunil K. Khandare, Mr. Sandeep Agrawal, and Mr. K. K. Chakarvarti

Speakers

Mr. Sunil K. Khandare
Director, BEE



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

Mr. Sandeep Agrawal
Chief General Manager, BCML

Mr. Ramit Malhotra
Director, KPMG, Lead-Smart Power, ASPIRE Programme Programme

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

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

Key takeaways

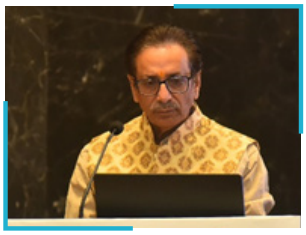
- India holds a prominent position in the global sugar industry, being the largest consumer and the second largest producer of sugar.
- Sugar sector in India is one of the most energy intensive industrial sectors with annual energy consumption of **20.28** million MTOE, highlighting the need for enhancing adoption of energy efficient and sustainable practices/ technologies within the industry.
- About **100** sugar mills, with annual energy consumption of **10,000** MTOE or above are expected to be included as DCs under the PAT scheme next fiscal year, with an aim to drive energy efficiency and reduce the carbon footprint of the sector.
- Sugar sector can make significant strides towards sustainability, contributing to a more energy-efficient and environmentally friendly industrial sector, through focused efforts in adoption of energy efficient measures and low-carbon technologies such as:
    - **Switching to energy efficient equipment**: Upgrading to more energy-efficient machinery and technologies to reduce overall energy consumption.
    - **Enhancing thermal insulation:** Improving insulation in boilers, air preheaters (APH), economisers, and steam lines to reduce heat loss and increase efficiency.
    - **Adopting bagasse dryer**: Implementing bagasse dryers for captive cogeneration plants to improve fuel efficiency.
    - **Transitioning to greener fuel supplies**: Shifting to greener, more sustainable fuel options to reduce carbon emissions.
    - **Integrating AI and IoT-based energy management**: Utilising advanced energy management platforms powered by Artificial Intelligence (AI) and the Internet of Things (IoT) for better monitoring and optimisation of energy use.
    - **Utilising low-carbon effluent treatment technologies**: Adopting low-carbon technologies for effluent treatment to minimise environmental impact.
    - **Implementing waste heat recovery systems**: Installing systems to capture and reuse waste heat, thereby improving overall energy efficiency and reducing emissions

TECHNICAL SESSION I

PERFORM, ACHIEVE AND TRADE SCHEME FOR SUGAR SECTOR

Speakers

Mr. Ashish Ranjan Srivastava
Senior Sector Expert-Sugar, BEE



Mr. Girish Kumar
Senior Energy Consultant, UPSDA

Mr. Anoop Kumar Kanaujia
Assistant Professor, Sugar Engineering, National Sugar Institute (NSI)

Key takeaways

- India is the largest producer of raw sugar, accounting for **16%** (~34 million tonnes) of the global raw sugar production.
- 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.
- BEE has conducted a baseline study of **180+** sugar industries in the country to understand the energy efficiency and decarbonisation potential of the sector, which is expected to be brought under the ambit of PAT scheme. Highlights of the baseline study include:
    - ~**642** sugar factories with varying capacities, ranging from **600** tonnes of cane per day (TCD) to **20,000** TCD, operate in India
    - Operational period in a year for these mills spans between **65** days to **255** days, with an annual average of ~**150** operational days
    - Annual energy consumption of the sugar industry is estimated to be **20.28** million MTOE.

- Uttar Pradesh State Designated Agency (UPSDA) highlighted various initiatives undertaken to enhance energy efficiency and to enable decarbonisation of sugar mills in UP. Some of the initiatives include:
    - Developed Energy Efficiency Financing Platform (EEFP), which aims to facilitate interactions with Financial Institutions (FIs), project developers and other stakeholders for implementation of energy efficiency projects and accelerating financing for the same.
    - Organised 'Investment Bazar Conferences for Energy Efficiency' at five key locations across Uttar Pradesh (including Lucknow, Varanasi, Kanpur, Ghaziabad/ Noida, and Agra) to streamline financing barriers and promote financing in energy efficiency projects.
    - Identified various energy efficiency projects suitable for financing by financial institutions (FI).
    - Organised capacity building programmes for FIs on energy efficiency financing.
    - Developed Demand Side Management (DSM) plans for all the five electricity distribution companies (DISCOMs) in the state. In 2023, three capacity-building programs were conducted specifically tailored for Madhyanchal Vidyut Vitaran Nigam Limited (MVVNL), Dakshinanchal Vidyut Vitran Nigam Limited (DVVNL), and Purvanchal Vidyut Vitaran Nigam Limited (PuVVNL).
    - Conducted capacity building workshops/ training programmes for farmers on energy conservation.
- The National Sugar Institute (NSI) outlined a series of measures aimed at reducing energy consumption in both captive power consumption and process steam, including:
    - ***Captive Power Consumption***:
        - Employing high-tension (HT) motors instead of low-tension (LT) motors in cane preparatory devices
        - Utilising planetary or helical gearing systems as alternatives to conventional gearing systems
        - Implementing fibrisers[13] equipped with swing-type hammers
        - Frequent replacement of knife or hammer tips based on electrical loading on preparatory devices
        - Installing antifriction bearings at head and tail shafts of cane carriers and mill transmission gears
        - Full-fledged automation of the mill house through systems such as automatic cane feed control system (ACFCS)
        - Automating cooling and condensing water/ vacuum processes in the boiling house
        - Introducing variable frequency drives (VFDs) as substitutes for control valves or throttle valves to regulate fluid control
    - ***Process Steam***:
        - Introducing vapor line juice heaters after the last evaporator body to elevate the temperature from 30°C to 48°C, resulting in a reduction of steam consumption by **0.7%** per ton of cane
        - Implementing heat recovery from the sulphur burner, which traditionally uses **7** Kg/cm^2 steam for melting, to produce steam for sulphur melting. Excess heat from SO_2 gas can be scrubbed through heat exchangers, leading to a steam saving of **0.45%** per tonne of cane
        - Utilising cigar condensate to heat raw and sulphited juice (SJ).
        - Modifying the evaporator configuration from quad to quintuple and adjusting the

13 The Fibriser is widely used in the milling plant of the sugarcane industry, where the cane is crushed to extract the juices. This equipment comes along with a series of special hammers combined to provide maximum shredding and extraction.

bleeding/ sweeping arrangement, accordingly, resulting in a steam saving of **1.8%** per tonne of cane.

- Adopting direct contact heaters instead of tubular heaters, resulting in steam saving of **1.40%** per tonne of cane. These heaters enable SJ heating in four stages: (i) first heating using 4th effect swept vapour (68°C-78°C); (ii) second heating with 3rd effect swept vapours (78°C-90°C); (ii) third heating with flash vapours from the flash tank (90°C -92°C), and (iv) fourth heating with 2nd effect vapours (92°C-102°C).

TECHNICAL SESSION II

SHARING OF BEST PRACTICES BY INDIAN SUGAR SECTOR/ ASSOCIATION

Speakers

Mr. Sankalp Suman
Sr. Manager – Sustainability & Climate Change, Indian Sugar Mills Association

Mr. Bipin Patel
Senior Engineer, BCML, Haidergarh

Mr. Chintan Shah
Assistant Vice President, MITCON India

Key takeaways

- Indian Sugar Mills Association (ISMA) highlighted the need for interventions in the sugar industry to enhance energy efficiency and enable decarbonisation. Some of the interventions include:
  - Improved access to credit to meet significant capital expenditure demands.
  - Implementation of carbon credits system for exporting carbon-neutral electricity to the grid through initiatives such as the Carbon Credit Trading Scheme (CCTS).
  - Setting realistic targets in line with industry dynamics and policy considerations.
  - Facilitating technology and information exchange among national and international stakeholders to encourage innovation and collaboration.
- Balrampur Chini Mills discussed about the various initiatives implemented at their Haidergarh (UP) facility to enable energy savings and reduce carbon emissions, namely:
  - Implementation of a centralised distributed control system (DCS) system for sugar and power plant operations.
  - Adoption of electrostatic precipitator (ESP) and bag filters to control air pollution effectively.
  - Utilisation of variable frequency drives (VFD) for fans and motors to ensure efficient operations and conserve energy.
  - Integration of energy efficient motors into their processes.

- Implementation of an effluent treatment plant (ETP) equipped with lamella clarifiers and advanced sewage treatment plant (STP) configurations.
- Adoption of falling film evaporator (FFE) technology to enhance steam economy in the boiling house.

- BCML highlighted about its 'Balram app' (accessible on basic smartphones as well), that is developed for sugarcane farmers in UP state. Some of the key features of the platform include:
  - Delivers essential updates to farmers, including real-time information on cane supply tickets and comprehensive payment histories
  - Provides valuable tools such as a fertiliser calculator that aids farmers in accurately determining the necessary amount of fertiliser for optimal soil fertility
  - Offers insights into crop diseases and their prevention, thereby promoting agricultural awareness and increasing productivity
- MITCON India has identified several energy efficient best practices within the sugar sector, encompassing both cogeneration and process aspects:
  - Cogeneration oriented best practices –
    - Enhancing heat rate efficiency by regulating temperature of high-pressure heater (HPH) and low-pressure heater (LPH) outlet feedwater.
    - Improving heat rate efficiency by addressing air preheater (APH) air ingress and leakages.
    - Maintaining bagasse moisture levels from the sugar mill at or below **50%**.
    - Optimising air supply to boilers to minimise carbon monoxide (CO) emissions and excess air.
    - Deployment of variable speed drives for boiler feed pump (BFP), auxiliary cooling water (ACW), and condensate extraction Pump (CEP) to enhance energy efficiency.
    - Enhancing thermal insulation at critical points such as boiler, APH, economiser, and steam lines to minimise heat loss.
    - Ensuring uniform size of bagasse to enhance combustion efficiency in boilers.
  - Process-oriented best practices –
    - Rationalising process steam requirements through technologies like falling film evaporator, direct contact heater (DCH), and flash heat recovery system.
    - Optimising steam requirements by maximising bleed vapours from the 1st body to the 2nd body evaporator in the pan section.
    - Implementing efficient juice flow and water imbibition control strategies.
    - Upgrading old mill turbines with motor-driven systems.
    - Maintaining a high primary index of fiberiser.
    - Minimising sugar loss at the last mill through increased roll pressure.
    - Substituting conventional gears with energy-efficient helical or planetary gears to reduce energy transmission losses in machines such as feeder table, cane carrier, mill, crystallisers drives, and molasses & magma pumps.

TECHNICAL SESSION III

CASE STUDIES AND LOW CARBON & DIGITAL TECHNOLOGIES FOR SUGAR SECTOR – BY INDIAN EXPERTS

Speakers

Mr. Rajesh Verma
CEO, Environpol Engineers Pvt. Ltd.

Mr. Rohan Kadamb
Analyst, Development Environergy Engineers Pvt. Ltd,

Mr. Kamalesh K Jha
Accredited Energy Auditor, Padmashtdal Energy Services Pvt. Ltd.

Key takeaways

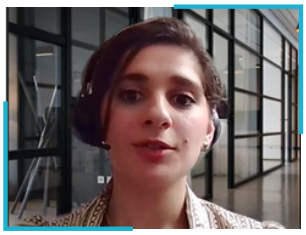
- **Environpol Engineers** emphasised the significance of bagasse dryers in sugar mills for captive cogeneration plants as a pivotal measure in decarbonisation efforts, aiming to enhance efficiency and sustainability. This approach plays a crucial role in reducing GHG emissions by efficiently utilising biomass waste and improving the overall efficiency of sugar mill operations. By thoroughly drying bagasse, a byproduct of sugar production, before its combustion for energy generation, these plants substantially reduce their carbon footprint while maximising energy output. This integration not only promotes environmental stewardship but also ensures economic viability by optimising resource utilisation and lowering operational costs.
- **Development Environergy Engineers** presented about their '**EnEffCo'** solution, a cutting-edge software solution crafted by industry experts, tailored specifically for industry needs. This innovative platform empowers companies to holistically manage energy consumption, facilitating systematic tracking, monitoring, and evaluation of energy system data and operations. Specifically designed for sugar mills, the EnEffCo Solution offers a range of benefits, including the ability to forecast steam demand, monitor boilers for enhanced efficiency, provide decision support for cogeneration operation to maximise bagasse surplus for direct sale, and oversee other systems while triggering alarms in case of deviations from optimal operation modes.

- **Padmashtdal Energy Services Pvt. Ltd (PESPL)** highlighted several measures with significant potential for energy conservation across below segments of the sugar production:
    - Boiler & auxiliary system: bagasse drying, flash stream recovery from boiler blow down, boiler automation etc.
    - Steam distribution networks: steam line insulation, condensate recovery system, steam parameter incl. flow, pressure, temperature monitoring etc.
    - Cogeneration & turbines: Monitoring of specific steam consumption of power turbine, fibrisor/ shredder drive etc.
    - Mill houses: mill automation, installation of VFD on cane carriers, juice stabilisation system with installation of VFD
    - Boiling houses: waste heat utilisation in juice heating, se of planetary gear in crystalliser, etc.
    - Utility systems: cold/hot water distribution management, section wise energy management/ monitoring systems, etc.

TECHNICAL SESSION IV

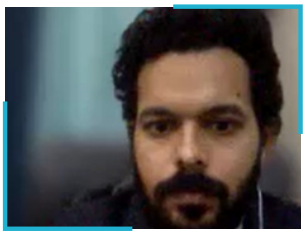
STANDARDS & DECARBONISATION TECHNOLOGIES FOR SUGAR SECTOR: BY INTERNATIONAL & UK TECHNOLOGY & SOLUTIONS PROVIDERS

Speakers



Ms. Ismini Pnevmatikaki
KPMG

Mr. Ulf Ch. Nahrath
Vice President, UK Energy Transition & Infrastructure, Shell International Ltd.



Mr. Harsh Vardhan
Lead – IoT & Blockchain, HTFE (India Partner of Centrica PLC, UK)

Key takeaways

- The UK sugar industry has the lowest production cost globally, with sugar being produced primarily from sugar beets. The wider UK sugar industry, including sugar manufacturing, generates revenue amounting to ~**INR 87.5 billion** (GBP 830 million). The sector is poised for robust growth, projected to expand at a compound annual growth rate (CAGR) of **3.65%**, aiming to surpass a market size of over ~**INR 105 billion** (GBP 1 billion) by 2027.
- The UK government has significantly strengthened its policy support to accelerate decarbonisation efforts within energy-intensive sectors like the sugar industry. Two primary initiatives with substantial funding allocation for low-carbon technologies crucial for sustainability endeavours within the sugar sector include:
    - **GBP 315 billion Industrial Energy Transformation Fund (IETF)**: supports the development and deployment of technologies that enable businesses with high energy use to transition to a low carbon future. The fund is complemented tax regulations, including tax incentives and subsidies, to encourage investments in green technologies.
    - **GBP 1 billion Net Zero Innovation Portfolio Programme**: provides funding for low-carbon technologies and systems.

- UK distinguishes itself for its cost efficiency, driven by technological advancements and sustainable agricultural and supply chain management practices. Some key players in the UK sugar sector include British Sugar, Tate & Lyle Sugars, and Ragus Sugars.
- The strengths and capabilities of UK's sugar sector can be leveraged to facilitate rapid transition of Indian sugar industries' journey to net-zero. Some of the sustainable technologies and best practises adopted by the UK sugar industry to enhance energy efficiency and enable decarbonisation are mentioned below:
    - Circular economy principles
    - Fuel switching (including in coking plant) through use of biomass, hydrogen, and electrification
    - Innovative effluent treatment
    - IoT enabled industry 4.0 energy management solutions
    - Carbon capture and utilisation
    - Process control and automation
    - Steam economy
    - Low-emission bulk drying technologies
    - Artificial intelligence/ machine learning based solutions to drive emission reduction
- Technological innovations from the UK sugar industry that enhance efficiency and sustainability, offering significant environmental and operational benefits to the industry include:
    - Combined heat and power (CHP)
    - Advanced evaporator technology
    - Anaerobic digestion and heating
    - Ventilation, and air conditioning (HVAC) optimisation systems
- **Shell UK** outlined the decarbonisation strategies for the sugar sector across various timeframes:
    - In the short term, focus is on achieving zero-carbon electricity through options such as bio-methane, solar PV, and natural gas.
    - In the medium term, strategies involve battery and onsite storage, including the development of virtual power plants, alongside natural gas and hydrogen blending, as well as carbon capture and storage (CCS).
    - Looking further ahead, long-term goals centre around carbon offsets, utilising either blue or green hydrogen technologies.
- **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.

GENDER EQUALITY AND SOCIAL INCLUSION (GESI)

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

Key takeaways

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 may consider implementation of 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:

- **BCML** is committed to fostering GESI by actively promoting women's participation across domains including increasing the representation of women in both corporate leadership roles and research endeavours, thereby creating a more diverse and inclusive work environment. BCML also promotes women participation in corporate social responsibility (CSR) initiatives.
- **Vedanta Limited** aims to achieve a 30% gender diversity ratio by 2030. In this regard, the company has implemented several measures, including a commitment to hiring 50% women through campus placements and promoting the inclusion of women in managerial decision-making bodies. Additionally, Vedanta is actively hiring LGBTQ personnel and providing sensitisation training to all employees. Initiatives like "Sakhi" are also in place to empower women by raising awareness of their socio-economic and cultural status and helping them access their rights and privileges.
- **Hindalco** is implementing the "Women at Hindalco (WAH)" initiative to ensure equal opportunities for women employees. Their commitment to gender inclusivity is evident in their workforce, with women comprising 8.37% of the total employee base and 8.62% of management positions. Furthermore, 40% of all new graduate engineer trainees are female. The company also focuses on hiring women for lateral positions. Additionally, Hindalco has established a dedicated Prevention of Sexual Harassment (POSH) committee to monitor and address issues related to crimes against women at workplace.
- **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.
- **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

Dr. Ashok Kumar, Deputy Director General, BEE (on the podium),
(L-R) **Mr. K. K. Chakarvarti** and **Mr. Sandeep Agrawal**

- Enhancing energy efficiency and reducing carbon emissions in industries, notably the sugar sector, can play a vital role in advancing sustainability, supporting India's journey toward achieving net-zero emissions, and addressing global concerns about rising temperatures.
- 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. Stakeholders in the Indian sugar sector have already expressed 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 sugar manufacturers and new-age technologies and solutions required to accelerate decarbonisation of the sugar sector.

FEEDBACK FROM THE PARTICIPANTS

- More than **89%** of the participants responded that they were more than satisfied with the outcomes of the workshop[14]
- More than **99%** of the participants rated the quality and content of the delivery as more than satisfactory.[15]
- All technical sessions were highly appreciated by the participants.
- Participants expressed their interest to know more about following IEED technologies from the UK:
    - Waste heat recovery and utilisation output
    - Energy, data management, and reporting
    - Heat treatment technologies
    - Low carbon technologies
- Women accounted for ~**15%** of total employee strength in most of the participating organisations.
- Participating organisations have undertaken various initiatives to promote GESI, including:
    - Encouraging learning and development of new women engineers
    - 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
    - Organising social awareness events
    - Ensuring inclusion of women in all core committees and decision-making processes

> "The workshop was highly beneficial. Suggest to maintain its frequency at least once every quarter"
>
> **- Mr. Santosh Kumar Gangwar, DGM Electrical**
>
> *DCM Shriram Ltd. Sugar Unit-Rupapur Hardoi*

> "The workshop provided invaluable knowledge to all the delegates and was well organised"
>
> **- Mr. Shivpal Singh Yadav, Dy. CC**
>
> *The United Provinces Sugar Co Ltd. Seorahi Kushinagar*

14 provided a 7+ rating on a scale of 10.

WAY AHEAD

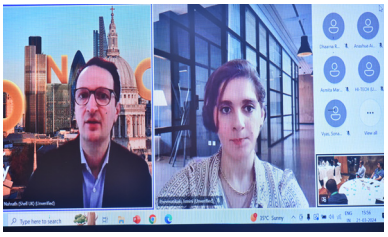
Group photograph of participants

The sectoral workshop has garnered a positive response with substantial participation from esteemed officials from BEE, executive leaders from prominent Indian sugar 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 their best practices and technologies aimed at enhancing industrial energy efficiency and decarbonisation measures within the Indian sugar 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:

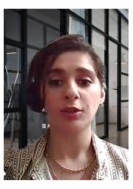
- Guidance and support to large energy-intensive industries, including those in the sugar sector, to identify technologies, solutions, technology suppliers, and financing options for increased adoption of IEED interventions.
- Plan and organise online seminar / B2B meetings with sugar industry stakeholders in close collaboration with UK technology suppliers such as Shell UK, British Sugar, Carbon Clean, Centrica, etc.
- Establish additional discussion forums to facilitate the exchange of knowledge and information, contributing to the formulation of effective policies.

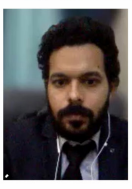
GALLERY


UK Government
iDeeksha




ENERGY EFFICIENCY IN
SUGAR SECTOR -
A PATH FOR DECARBONISATION
Thursday, 21st March 2024
Hotel Renaissance, Lucknow
UK Government
Accelerating Smart Power and
Renewable Energy in India (ASPIRE)
SECTORAL WORKSHOP ON





Annexure

Agenda

Time (IST)	Name of Session	Presenter
Inaugural Session		
09:00 – 09:30	Registration	
09:30 – 09:35	Lighting of Lamp	
09:35 – 09:45	Welcome Address	Mr. Ramit Malhotra, Director, KPMG, Lead-Smart Power, ASPIRE Programme
09:45 – 09:55	Introduction of ASPIRE Programme*	Ms. Sanyukta Das Gupta, Senior Advisor, Smart Power, Climate and Energy Team, British High Commission (BHC)
09:55 – 10:05	Brief overview of industrial energy efficiency (IEE) theme of ASPIRE Programme	Mr. Balawant Joshi, Managing Director, Idam Infra, ASPIRE Programme Team
10:05 – 10:15	Keynote Address by Bureau of Energy Efficiency (BEE)	Mr. Sunil K. Khandare, Director, BEE
10:15 – 10:25	Inaugural Address by Uttar Pradesh New and Renewable Department Agency (UPNEDA)	Mr. Anupam Shukla (IAS), Director, UPNEDA
10:25 – 10:35	Special Address by Balrampur Chini Mills Limited (BCML)	Mr. Sandeep Agrawal, Chief General Manager, BCML
10:35 – 10:40	Vote of Thanks	Mr. K. K. Chakarvarti, Senior Advisor, IDEEKSHA Platform (ASPIRE Programme Team)
10:40 – 10:45	Group Photograph	
10:45 – 11:00	Tea Break and Networking	
Technical Session I: Perform Achieve and Trade (PAT) Scheme for Sugar Sector		
11:00 – 11:05	Moderator	Mr. Sunil K. Khandare, Director, BEE
11:05 – 11:25	PAT Scheme for the Sugar Sector under the Energy Conservation Act	Mr. Ashish Ranjan Srivastava, Senior Sector Expert-Sugar, BEE
11:25 – 11:40	Achievements of Uttar Pradesh State Designated Agency (UPSDA) in Implementation of PAT Scheme in UP	Mr. Girish Kumar, Senior Energy Consultant, UPSDA
11:40 – 12:00	Latest Development in Indian Sugar Industries for Energy Efficiency/ Conservation	Mr. Anoop Kumar Kanaujia, Assistant Professor, Sugar Engineering, National Sugar Institute (NSI), Kanpur
12:00 – 12:15	Q&A	
Technical Session II: Sharing of best practices by Indian Sugar Sector / Association		
12:15 – 12:20	Moderator	Mr. K. K. Chakarvarti, Senior Advisor, IDEEKSHA Platform (ASPIRE Programme Team)
12:20 – 12:35	Supporting the Indian Sugar Industry's journey to Energy Efficiency	Mr. Sankalp Suman, Sr. Manager – Sustainability & Climate Change, Indian Sugar Mills Association (ISMA)

Time (IST)	Name of Session	Presenter
12:35 – 12:50	Best Practices in Energy Efficiency & Carbon Emissions Reduction in Sugar Industries	Mr. Chintan Shah, Assistant Vice President, MITCON India
12:50 – 13:10	Best Practices Presentation from Indian Sugar Industry	Mr. Bipin Patel, Senior Engineer, Balrampur Chini Mill, Haidargarh
13:10 – 13:20	Q&A	
13:20 – 14:00	Lunch Break and Networking	
Technical Session III: Case Studies and Low Carbon & Digital Technologies for Sugar Sector– by Indian Experts		
14:00 – 14:05	Moderator	Mr. K. K. Chakarvarti, Senior Advisor, IDEEKSHA Platform (ASPIRE Programme Team)
14:05 – 14:25	Decarbonisation through Bagasse Dryer in Captive Power Plants of Sugar Mills	Mr. Rajesh Verma, CEO, Environpol Engineers Pvt. Ltd.
14:25 – 14:45	Performance optimisation through predictive modelling	Mr. Rohan Kadamb (Analyst), Development Environergy Services Ltd
14:45 – 15:05	Energy Conservation Opportunity in Sugar Industry	Mr. Kamalesh K Jha, Accredited Energy Auditor, Padmashtdal Energy
15:05 – 15:20	Q&A	
Technical Session IV: Standards & Decarbonisation Technologies for Sugar Sector – by International & UK Technology & Solutions Providers		
15:20 – 15:25	Moderator	Ms. Ismini Pnevmatikaki, KPMG
15:25 – 15:40	Presentation by KPMG* *"Overview of sustainability in sugar sector in the UK", covering:* • *Decarbonisation commitments* • *Policy landscape* • *Leading IEED technologies/ best practises adopted by the UK sugar industries*	Ms. Ismini Pnevmatikaki, KPMG
15:40 – 16:05	Presentation by Shell Technologies* *"Decarbonisation pathways in the sugar industry - A snapshot from the UK perspective"*	Mr. Ulf Ch. Nahrath, Vice President, UK Energy Transition & Infrastructure, Shell International Ltd.
16:05 – 16:10	Q&A	
16:10 – 16:25	Presentation by Centrica PLC, UK* *'Improve Operational Energy Efficiency Predict Breakdowns with Centrica's Wireless, Real-time Technology'*	Mr. Harsh Vardhan, Lead IoT and Blockchain, HTFE (India Partner of Centrica PLC, UK)
16:25 – 16:30	Q&A	
16:30 – 16:45	Presentation by Carbon Clean, UK* *'Carbon Capture, Utilisation and Storage technology to help achieve net-zero'*	Mr. Niraj Singh, Senior Project Development Manager, Carbon Clean, UK

Time (IST)	Name of Session	Presenter
16:45 – 16:50	Q&A	
Session on Importance of Gender Equality and Social Inclusion (GESI) measures in Indian Industries		
16:50 – 17:00	Importance of GESI measures in Indian Industries	Mr. Anurag Singh Sirola, Manager, KPMG, ASPIRE Programme Team
Discussions, Feedback and Concluding Remarks		
17:00 – 17:30	Dr. Ashok Kumar, Deputy Director General, Bureau of Energy Efficiency (BEE) Mr. Sunil K. Khandare, Director, Bureau of Energy Efficiency (BEE) Ms. Sanyukta Das Gupta, Senior Advisor, Smart Power, Climate and Energy Team, BHC* Mr. Ramit Malhotra, Director, KPMG, Lead-Smart Power, ASPIRE Programme Mr. Anurag Singh Sirola, Manager, KPMG, 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 and Networking	

**Virtual presentation*

Attendance Sheet

S. No	Name	Designation	Organisation
1	Mr. Dalip Kumar Tomar	Asst. General Manager	Mawana Sugar Works Mawana (Unit of Mawana Sugars Limited)
2	Mr. Surya Kumar Sachan	Add. General Manager – Electrical	DCM Shriram Ltd., Sugar & Distillery Unit, Hariawan, Hardoi, U.P.
3	Mr. Rohit Yadav	Officer -Electrical	DCM Shriram Ltd., Sugar & Distillery Unit, Hariawan, Hardoi, U.P.
4	Mr. Kamlesh K. Jha	Chief Executive Officer	Padmashtdal Energy services Pvt. Ltd. New Delhi
5	Mr. Alok Kumar Verma	Accredited Energy Auditor	Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)
6	Mr. Deepak Bhawsar	Deputy General Manager - Electrical	Balrampur Chini Mills Limited, Mankapur
7	Mr. Updesh Gupta	Sr. Manager (Electrical)	Bajaj Hindusthan Sugar Ltd. Unit- Maqsoodapur, Dist – Shahjahanpur UP
8	Mr. A. S. Rana	Vice President (Technical)	Belgaum Sugars
9	Mr. V. M. Talawar	Vice President (Technical)	Satish Sugars
10	Mr. Virendra Kumar	Assistant General Manager (Electrical)	Bajaj Hindusthan Sugar Ltd. (BHSL), Gangnauli
11	Mr. Vinay Pratap Singh	Manager (Mills)	Bajaj Hindusthan Sugar Ltd. (BHSL), Gangnauli
12	Mr. Mayakant Shukla	Energy Manager	UPSDA (UPNEDA, Vibhuti Khand, Gomtinagar, Lucknow
13	Mr. Amit Kumar	Project Associate	UPSDA (UPNEDA, Vibhuti Khand, Gomtinagar, Lucknow
14	Mr. Dinesh Chauhan	General Manager (Electrical & Instrumentation)	Balrampur Chini Mills Limited. CAMP OFFICE-HAIDERGARH
15	Mr. Santosh Kumar Gangwar	Deputy General Manager (Electrical)	DCM Shriram Ltd., Sugar Unit - Rupapur Hardoi
16	Mr. Nirupam Kumar Srivastava	Deputy Manager (Electrical)	LH. Sugar Factories Limited, Civil Lines South, Pilibhit, UP
17	Mr. Rajesh Verma	Chief Executive Officer	Enviropol Engineers Pvt Ltd
18	Mr. Prakhar Verma	Manager-Marketing & Sales	Enviropol Engineers Pvt Ltd
19	Mr. Amit Agrawal	Deputy General Manager (Electrical)	Avadh Sugar & Energy Ltd., Unit-New India Sugar Mills, Hata
20	Mr. Dileep Kumar	Chief Manager (Electrical)	Zuari Industries Ltd., Unit – Gobind Sugar Mill, Aira-Khamaria (Kheri)
21	Mr. Akhilesh Kumar	Assistant Manager (Electrical)	Zuari Industries Ltd., Unit – Gobind Sugar Mill, Aira-Khamaria (Kheri)
22	Mr. Tarun Kumar		Daurala Sugar Works, Daurala, Meerut
23	Mr. Harkirat Singh	General Manager	Daurala Sugar Works, Daurala, Meerut

S. No	Name	Designation	Organisation
24	Mr. Dhiraj Gosain	Manager	Daurala Sugar Works, Daurala, Meerut
25	Mr. M.V. Ramesh	Vice President - Cogeneration	NSL Sugars Ltd
26	Mr. KVVSN Murthy	General Manager - Operations	NSL Sugars Ltd
27	Mr. Raghavendra	Manager	NSL Sugars Ltd
28	Mr. VK Tomar	Assistant General Manager – Electrical	Balrampur Chinni Mills Limited
29	Mr. Devesh Kumar	Chief Manager – Instrumentation	Balrampur Chinni Mills Limited
30	Mr. Bipin Pratap Patel	Sr. Engineer – Electrical	Balrampur Chinni Mills Limited
31	Mr. U. S. Jaiswal	General Manager (Project)	K M Sugar Mills Ltd.
32	Mr. Gyan Prakash	Sr. Manager (Electrical & Cogeneration)	K M Sugar Mills Ltd.
33	Mr. Rohan Kadamb	Analyst	Development Environergy Services Ltd
34	Mr. Anoop Kumar Kanaujia	Assistant Professor (Sugar Engineering)	NSI, Kanpur
35	Mr. Khushal Singh	Deputy General Manager (Electrical & Cogeneration)	Bajaj Hindustan Sugar Ltd. Unit- Golagokarannath, Dist. – Lakhimpur Kheri
36	Mr. Abhishek Pandey	Sr. Engineer	The United Provinces Sugar Co. Ltd., Seorahi, Kushinagar.
37	Mr. Shivpal Yadav	Dy. Manager	The United Provinces Sugar Co. Ltd., Seorahi, Kushinagar.
38	Mr. Piyush Kumar Misra	Dy. General Manager	Bajaj Hindusthan Sugar Ltd Barkhera Distt-Pilibhit (UP)
39	Mr. Mudit Pandey	Dy. Manager	Bajaj Hindusthan Sugar Ltd Barkhera Distt-Pilibhit (UP)
40	Mr. Mrityunjay Kushwaha	Deputy Manager (Mechanical)	Balrampur Chini Mills Limited, Haidergarh
41	Mr. Manas Tiwari	Vice President (Strategic Relations)	Dhampur Bio Organics Limited, Delhi HO
42	Mr. Vardan Sharma	Assistant Manager (Compliance)	Dhampur Bio Organics Limited, Lucknow
43	Mr. Chintan Shah	Assistant Vice President	MITCON Consultancy & Engineering Services Ltd.
44	Mr. Sandeep Agarwal	Chief General Manager	Balrampur Chini Mills Limited
45	Mr. Nilesh Kumar Verma	Research Associate (Engineering)	NSI, Kanpur
46	Mr. Girish Kumar	Sr. Energy Consultant	UPNEDA
47	Ms. Sneha Srivastava	Legal Expert	UPNEDA
48	Ms. Priya	Freelancer	Freelancer

S. No	Name	Designation	Organisation
49	Ms. Naysheen	Freelancer	Freelancer
50	Mr. Anil Kumar Sharma	Vice President (Engineering)	Avadh Sugar & Energy Ltd.
51	Ms. Bharati	Director	Padmashtdal Energy
52	Mr. Sankalp	Sr. Manager	ISMA
53	Mr. K. N. Vishwakarma	Sr. Manager	TEIL Ramkola
54	Mr. Shubham Dubey	Engineer	TEIL Ramkola
55	Dr. Ashok Kumar	Deputy Director General	Bureau of Energy Efficiency
56	Mr. Sunil K. Khandare	Director	Bureau of Energy Efficiency
57	Mr. Ashish Ranjan Srivastava	Sr. Sector Expert – Sugar	Bureau of Energy Efficiency
58	Ms. Sanyukta Das Gupta*	Sr. Advisor, Smart Power	British High Commission (ASPIRE Programme Team)
59	Mr. Ramit Malhotra	Director, Lead-Smart Power	KPMG (ASPIRE Programme Team)
60	Mr. Anurag Sirola	Associate Director	KPMG (ASPIRE Programme Team)
61	Ms. Sonam Vyas*	Consultant	KPMG (ASPIRE Programme Team)
62	Ms. Ismini Pnevmatikaki*	Executive	KPMG (ASPIRE Programme Team)
63	Mr. Balawant Joshi	Managing Director	Idam Infra (ASPIRE Programme Team)
64	Mr. K. K. Chakarvarti	Sr. Advisor, IDEEKSHA	Idam Infra (ASPIRE Programme Team)
65	Mr. Dipak Khandare	Associate Director – Industrial Decarbonisation	Idam Infra (ASPIRE Programme Team)
66	Ms. Dhaarna Rawat	Consultant	Idam Infra (ASPIRE Programme Team)
67	Mr. Ulf Ch. Nahrath*	Vice President, UK Energy Transition & Infrastructure	Shell International Ltd.
68	Mr. Harsh Vardhan*	Lead - IoT and Blockchain	HTFE (India Partner of Centrica PLC)
69	Dr. Asmita Marathe*	Manager	Idam Infra
70	Ms. Anashua Aich*	Intern	Idam Infra
71	Mr. Shiva Prasath*	Intern	Idam Infra

**Attended Virtually*

FOR MORE INFORMATION PLEASE CONTACT

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