UK Government

Bureau of Energy Efficiency
Ministry of Power, Government of India

Knowledge Exchange Platform
Transmitting Knowledge through Best Practices

ASPIRE PROGRAMME

Accelerating Smart Power & Renewable Energy in India

Sectoral Workshop on

BEST PRACTICES IN ENERGY EFFICIENCY IN ALUMINIUM SECTOR

A PATH FOR DECARBONISATION

21st November 2022

Hosted by:
Aditya Aluminium, Lapanga, Odisha
(A Unit of Hindalco Industries Ltd.)

ADITYA BIRLA
HINDALCO

SUMMARY REPORT

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About ASPIRE Program

Accelerating Smart Power and Renewable Energy in India (ASPIRE) is a bilateral program implemented by Foreign Commonwealth and Development Office, Government of UK in association with Ministry of Power and Ministry of New and Renewable Energy, Government of India. KPMG is the lead delivery partner for the ASPIRE programme. Idam Infrastructure Advisory Private Limited (India) and Carbon Trust (UK) are the key consortium members.

ABBREVIATIONS

Abbreviations & Acronyms	
ABG	Aditya Birla Group
ALFED	Aluminium Federation
ASPIRE	Accelerating Smart Power and Renewable Energy in India
BALCO	Bharat Aluminium Company Limited
BEE	Bureau of Energy Efficiency
BESS	Battery Energy Storage Systems
CCU	Carbon Capture Utilisation
CCUS	Carbon Capture Utilisation Storage
CFD	Computational Fluid Dynamics
CPP	Captive Power Plant
DCs	Designated Consumers
DEEP	Demonstration of Energy Efficiency Project
EE	Energy Efficiency
EESL	Energy Efficiency Services Limited
EOT	Electric Overhead Traveling
ESCerts	Energy Saving Certificates
FCDO	Foreign Commonwealth and Development Office
GETs	Graduate Engineer Trainees
GESI	Gender Equality Social Inclusion
GHG	Greenhouse Gas
H_2	Hydrogen
IEED	Industrial Energy Efficiency and Decarbonisation
JNARDDC	Jawaharlal Nehru Aluminium Research Development and Design Centre
KEP	Knowledge Exchange Platform
LMV	Light Motor Vehicle
MSMEs	Micro, Small, and Medium Enterprises
NALCO	National Aluminium Company Limited
$MTCO_2e$	Million Tonnes of Carbon Dioxide Equivalent
MTOE	Million Tonnes of Oil Equivalent
PAT	Perform Achieve Trade
RE	Renewable Energy
R&D	Research & Development

BACKGROUND

The Indian Aluminium industry is the **second-largest producer** in the world with a share of ~**5.3%** of the global output. Indian aluminium industry is highly concentrated with majority of the country's aluminium being produced by the top five companies. Indian aluminium industry in India is thriving at an enviable growth rate of **7%** per annum, which is one of the highest in the world. The Aluminium sector is one of the designated sectors covered under Bureau of Energy Efficiency's (BEE) Perform, Achieve, Trade (PAT) scheme. The fourteen industries from aluminium sector, covered under the PAT scheme, cumulatively consume **10.85 MTOE** and emit **37.13 MTCO$_2$e** annually. These industries offer an energy saving potential of **1.06 MTOE** and decarbonisation potential of **3.63 MTCO$_2$e**. Leading Indian aluminium industries have recently announced several initiatives as part of their decarbonisation and net-zero commitments. Building on this, a one-day sectoral workshop was jointly organised by FCDO and Bureau of Energy Efficiency (BEE) with the support of Hindalco Industries Ltd. (under Aditya Birla Group). The sectoral workshop on "***Best Practices in Energy Efficiency & Decarbonisation in Aluminium Sector***" was organised at Aditya Aluminium, Odisha on 21st November 2022. The workshop covered various aspects of aluminium sector such as impact of PAT scheme, aluminium smelting, alumina refinery, captive power generation, circular economy, and new emerging technologies (e.g., inert anode). During the workshop, the stakeholders deliberated on best practices, technologies and policy interventions required to accelerate decarbonisation of aluminium sector which is not only energy intensive but energy sensitive as well.

Objective of the Workshop

- Share best practices/ technologies for enhancing IEED and identify learnings from UK experience
- Identification of new emerging IEED technologies (e.g., Inert Anode) available globally including from the UK
- Apprise stakeholders on impact of PAT scheme and IEED measures across aluminium sector including smelting, alumina refinery, captive power generation & circular economy

Highlights

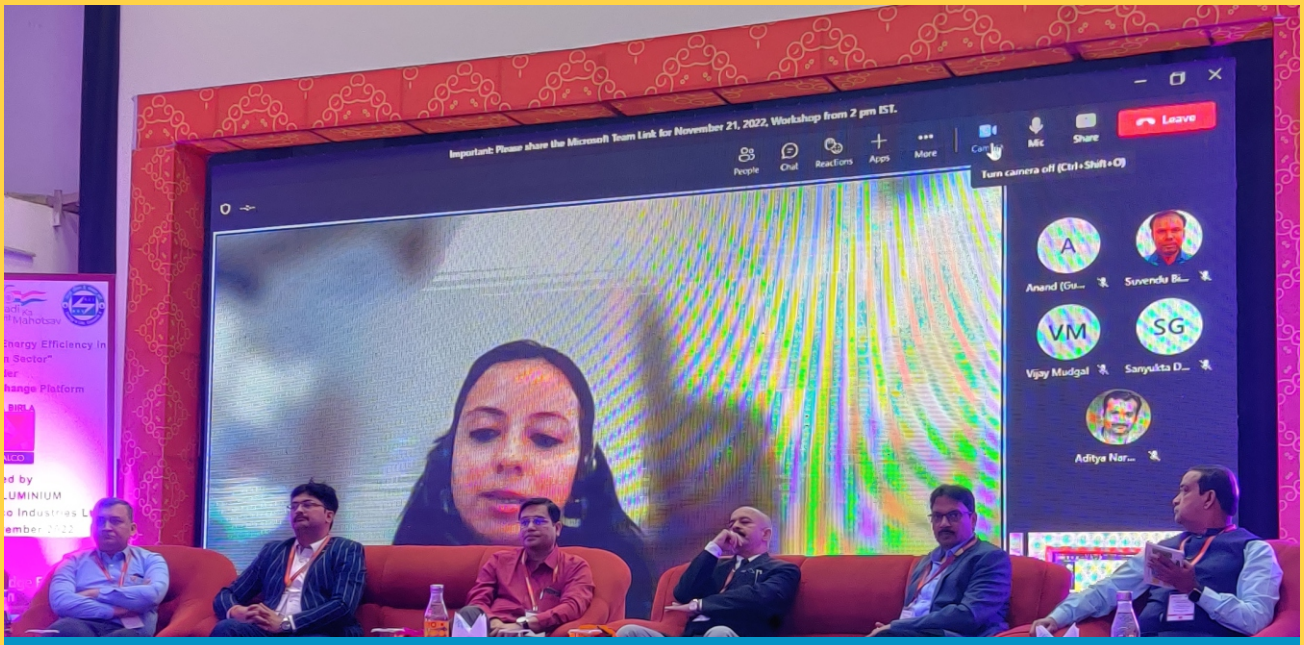
100+
PARTICIPANTS FROM INDIA AND UK

3+
INTERACTIVE SESSIONS

Active participation from government agency, industrial orgnisations and research institutes incl. Directors, senior executives and key officials

16+% WOMEN participants incl. 3 women speakers

INAUGURAL SESSION



(L – R) Ms. Radhika Tomar (virtually), Mr. Sameer Nayak, Mr. Nitin Tiwari, Mr. S. K. Khandare, Dr. Anupam Agnihotri, Mr. Kailash Pandey, Mr. Balawant Joshi

Speakers

Ms. Radhika Tomar

Head – Energy Sector Reform, British High Commission, FCDO

Mr. S. K. Khandare

Director,
BEE

Dr. Anupam Agnihotri

Director,
JNARDDC, Nagpur

Mr. Kailash Pandey

Head - Hirakud Cluster,
Hindalco Industries Ltd

Mr. Sameer Nayak

Plant Head,
Aditya Aluminium

Mr. Nitin Tiwari

COO-Metal,
Vedanta Aluminium

Mr. Balawant Joshi

MD, Idam
Infrastructure Advisory
(ASPIRE Team)

Key Takeaways

- Addressing Indian aluminium industry's carbon footprint is key to enable the country in achieving its target of net-zero emissions by 2070
- **Electricity consumption** accounts for **~60% of total emissions** from aluminium sector followed by **~25% direct emissions** from aluminium processing
- Decarbonisation of aluminium industry can be enabled through focus on switching to RE, resource efficiency, energy conservation, circularity, fuel switching, adoption of emerging low-carbon technologies such as green H_2, CCUS, inert anode, etc.
- Knowledge sharing platforms such as KEP and workshops coupled with proactive participation of aluminium industries has enabled successful roll-out of previous PAT cycles leading to improvement in energy efficiency performance
- Leading aluminium sector industries including Aditya Aluminium have adopted new-age digital technologies such as digital twins, energy analytics using Power BI & AI, etc.
- Hindalco Industries, a leading aluminium manufacturer in India, is working closely with it's R&D arm for modelling of smelter pot-lines to preserve the electrical-thermal-magnetic equilibrium and magnetohydrodynamics

TECHNICAL SESSION I

IMPACT OF BEE'S PAT SCHEME AND OTHER INITIATIVES

Speakers

Mr. S. K. Khandare
Director, BEE

Mr. Jagadeesan V.
Sector Expert, BEE

Key Takeaways

- PAT Cycles I-III (2012-2020) implemented by BEE have resulted in energy savings of 24.34 MTOE and emission reduction of 105.86 $MTCO_2e$ across 13 covered large energy-intensive industrial sectors
- Aluminium is one of the 13 energy intensive sectors covered under PAT scheme
- 14 aluminium industries covered under PAT Scheme cumulatively consume 17.6 MTOE of energy and emit 68.51 $MTCO_2e$
- BEE is undertaking DEEP (Demonstration of Energy Efficiency Project) initiative to implement cutting-edge energy efficiency technologies and widespread energy efficiency measures in the DCs (Designated Consumers)
- BEE has established a **facilitation centre** to encourage and scale-up implementation of energy efficiency measures across the nation through support in accessing project finance
- BEE is in the process of making strategies for wider adoption of cleaner fuels by industries
- Proposed **Institutional Banking of ESCerts** in Energy Conservation (Amendment) Bill, 2022 to ensure liquidity of ESCerts in market - any person can purchase ESCerts or carbon credit certificates on voluntary basis *(has now been notified in bill passed by Rajya Sabha on 13 December 2022)*

TECHNICAL SESSION II

SHARING OF BEST PRACTICES BY ALUMINIUM SMELTER PLANTS AND CIRCULAR ECONOMY

Speakers

Dr. Anupam Agnihotri
Director, JNARDDC, Nagpur

Mr. Jay Prakash Soni
Assistant General Manager, Aditya Aluminium

(L-R) **Mr. Rajesh Kumar Tiwary** (Dy. Manager), **Mr. Sashi Kant Shah** (AGM), **Ms. Ankita Karmakar** (Associate), **Mr. Ramesh Patro** (Head-O&M); Vedanta Aluminium

(L-R)
Mr. K. K. Suryawanshi
(Dy Manager);
Mr. Kiran Vanama
(Associate GM), BALCO

Mr. Deepak Gokhale
General Manager, Aditya Birla Science and Technology Co. Pvt. Ltd.

Mr. Yogendra Bhati
Dy. Manager, Mahan Aluminium

Key Takeaways

- Globally, major aluminium manufacturers such as Alcoa (USA), Rio Tinto Alcan (Canada), Aditya Birla Aluminium (India) and Vedanta Aluminium (India) have committed to **net-zero emissions by 2050**
- Emerging **low carbon technologies** such as **inert anode** offer significant potential in terms of savings in energy & cost along with environmental benefits and improvement in productivity
- Global aluminium manufacturers have made substantial progress in development of inert anode technology, particularly in the areas of anode wear and metal purity. However, its commercial viability and large-scale adoption is expected by 2035

- Aluminium is a permanent metal i.e. it can be recycled infinitely it can be **recycled infinitely** without losing its properties. Hence, considering this and its wide scale application, the aluminium industry needs to be at the forefront of circular economy since bauxite is limited, and **circular economy** offers both economic and environmental benefits
- Aditya Birla Group (Aluminium business) has committed to be carbon neutral by 2050 through focus on the following:
  - Exploring various options for energy substitution including use of RE – development of **1000 MW floating solar** power plant at Hirakud Dam along with other captive solar plants to gradually substitute fossil fuel-based energy
  - Exploring adoption of CCU technology for carbon capture to enable emission reduction
  - Optimise captive power plant system - (i) Benchmarking between identical systems; (ii) Measuring and tracking consumption and upgrading the systems periodically; (iii) Early warning systems, and predictive controls; (iv) Using advanced techniques like computational fluid dynamics for optimisation
- Decarbonisation efforts undertaken by Mahan Aluminium (ABG) include the following:
  - Switch to renewable energy - (i) operational 25 MW solar power plant; (ii) 9 MW floating solar power plant is under consideration
  - CO_2 emission reduction through - (i) use of electric blower for casting table pre-heating in billet casting which was previously done with propane gas; (ii) use of electric powered forklifts resulted in savings in diesel consumption; (iii) use of electric powered vehicles as low-weight carrier/ passenger vehicles to reduce carbon emissions
  - Flue gas desulfurisation – to remove harmful sulphur pollutants from the exhaust gas
  - Deployment of copper insert collector bar to reduce process emissions
  - Removal of hydra operation by direct loading of Wire Rod coils through EOT cranes

Q&A SESSION

1. **What are JNARDDC's views on key enablers for decarbonisation of aluminium sector, particularly the inert anode technology?**

   Electricity accounts for ~**60%** of **aluminium sector's emissions** and all aluminium plants have a captive power source to meet its energy demand. Thus, **greening the electricity supply** would significantly lower the sector's emissions. Further, **inert anode technology** can be a game changer for the sector as it offers potential for reduction of direct process emissions. However, at present, inert anode technology is not economically viable and its large-scale commercial deployment is expected by 2035.

2. **What is the process adopted by Vedanta Ltd. to extract/ recover aluminium from aluminium dross?**

   With the installation of the Runaya Dross Processing facility at Vedanta Ltd., hot dross is removed right away and transferred to Runaya facility. At Runaya facility, liquid metal is collected along with the hot dross and the remaining metal is recovered post cooling by pressing. Through this, Vedanta Ltd. is able to **recover ~33% of aluminium** from the aluminium dross.

TECHNICAL SESSION III (A)

SHARING OF BEST PRACTICES IN ALUMINA REFINERY

Speakers

Mr. Mukesh Chaddha
Former Head Alumina,
JNARDDC, Nagpur

Mr. Sanjaya Kumar Jeena;
Mr. Soumava Das
Mr. Pakruti Ranjan Sahoo
Vedanta Ltd., Lanjigarh

Mr. Siddhalingesh NG
AM-production, Hindalco
Industries Ltd. Belagavi

Key Takeaways

- Alumina refinery industry needs to conduct process audit to identify measures to gradually reduce material and energy consumption
- Need to conduct 'break-point digestion' studies to increase alumina extraction and supersaturation
- Further, 'precipitation modeling' studies should also be conducted to evaluate optimum liquor productivity
- Measures undertaken by Vedanta, Lanjigarh Ltd. as part of its net-zero commitments:
  - 2.5 GW of round-the-clock RE to reduce absolute emissions by 25% by 2030
  - No new coal-based thermal power plants to be developed and existing coal-based power plants to be run only till their useful life
  - Decarbonisation of 100% of the Light Motor Vehicles (LMV) fleet by 2030 and 75% of the mining fleet by 2035
  - Committed to accelerate adoption of hydrogen fuel and diversify into H_2 based fuels

TECHNICAL SESSION III (B)

SHARING OF BEST PRACTICES IN CAPTIVE POWER GENERATION AND BY TECHNOLOGY SUPPLIERS

Speakers

Mr. K. K. Chakarvarti
Mr. K. K. Chakarvarti
Sr. Advisor, KEP

Dr. Michael Kenyon
Senior Materials Engineer, Innoval Technology

Ms. Nadine Bloxsome
Membership & Sustainability Manager, ALFED

Ms. Ankita Wadighare and Mr. Sourav Gorain,
Aditya Aluminium

Mr. Rupak Sarkar
Manager, Vedanta Ltd., Jharsuguda

Mr. Prafulla Chandrakar
Asst. Manager, Vedanta Ltd., Jharsuguda

Mr. Ashwin Majhi
Assistant Manager, Godrej Electricals & Electronics

Mr. Koustav Ghosal
Territory Manager, Atlas Copco

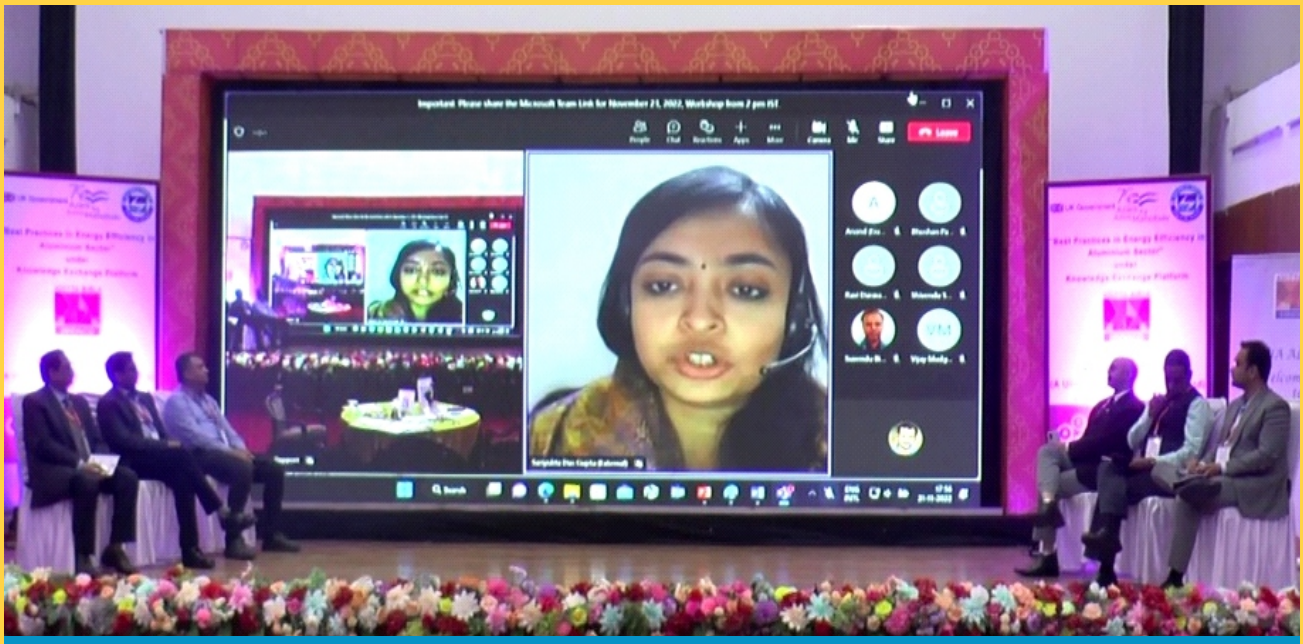
Key Takeaways

- The aluminium sector in the UK contributes ~GBP 10 billion annually to the country's economy and employs 37,000 people directly
- UK aluminium sector offers some key technologies and solutions along with best practices in the areas of electrolysis, material lightweighting, recycling and secondary production, advanced kilns and furnaces, digital technologies, etc.
- Strengths and capabilities of UK aluminium sector can be leveraged to facilitate rapid transition of Indian aluminium sectors' journey to net-zero
- Key organisations from UK aluminium sector such as the UK Aluminium Federation, Innoval Technology, etc. presented their learnings, best practices and technologies

- Entire aluminium production in the UK including recovery and recycling will be net-zero by 2050
- UK aluminium sector offers capabilities in **advanced aluminium recycling techniques** including **upscaling** to ensure incremental energy is utilised for a better finished product
- Aluminium sector needs to focus on following key aspects to achieve decarbonisation:
  - Use of renewable energy for entire electrical energy requirement
  - Direct emission reduction through adoption of inert anode technology for primary production coupled with CCUS and fuel switch (e.g., for thermal energy - plasma torch, hydrogen)
  - Measures to enhance recycling & resource efficiency through increased use of secondary (end-of-life) scrap and increased process and material efficiency
- Atlas Copco offers new age 'Optimiser 4.0' technology for applications in compressors and blowers
- Upcoming green projects at Aditya Aluminium, Odisha:
  - 100 MW green energy in power portfolio by 2024
  - Dual firing arrangement in one boiler - 50% gas and 50% coal firing by 2024;
  - 10 MW floating solar installation by 2023

CONCLUDING SESSION

Speakers



(L-R) Mr. K. K. Chakarvarti; Mr. Kailash Pandey; Mr. Sameer Nayak; Ms. Sanyukta Das Gupta *(virtually)*; Dr. Anupam Agnihotri; Mr. Balawant Joshi; Mr. Anurag Singh Sirola

Ms. Sanyukta Das Gupta

Smart Power Advisor, FCDO, British High Commission

Mr. Kailash Pandey

Head Hirakud Cluster, Hindalco Industries Ltd

Dr. Anupam Agnihotri

Director, JNARDDC, Nagpur

Mr. K. K. Chakarvarti

Sr. Advisor, KEP, ASPIRE team

Mr. Sameer Nayak

Plant Head, Aditya Aluminium

Mr. Balawant Joshi

MD, Idam Infrastructure Advisory (ASPIRE Team)

Mr. Anurag Singh Sirola

Manager, KPMG India, (ASPIRE Team)

Key Takeaways

- **Enhancing energy efficiency and decarbonisation** of industries, particularly **aluminium sector**, is crucial to achieving sustainability & **India's energy transition to net-zero**
- ASPIRE programme intends to support large energy-intensive industries in adoption of low-carbon technologies and solutions through collaboration with global technology suppliers including from the UK
- Aluminium industry stakeholders highlighted the need for **policy interventions** and **technological advancements** to accelerate deployment of **novel and emerging low-carbon technologies** such as **inert anode, green hydrogen, CCUS**, etc.
- **RE and battery energy storage systems** (BESS) offers significant potential to accelerate decarbonisation of aluminium industry since **aluminium manufacturing** is both **energy sensitive** and **energy intensive**. This can be enabled through policy support for manufacturing units for large-scale RE & BESS deployment
- Aluminium industry in India needs to strengthen its capabilities on the R&D front - (a) strive to **ramp up R&D expenditure** (currently India spends ~**0.7% of its GDP** on R&D) to the level of global leading economies (up to **3% of GDP**); and (b) **collaborate with value-chain partners on R&D** opportunities in new-age low-carbon technologies
- **Circular economy** along with **resource efficiency** offers potential to abate ~**15%** of aluminium sector's emissions since aluminium can be recycled infinitely
- Abatement of aluminium sector emissions requires focus on **3 priority areas** –
  - Decarbonisation of **electricity consumption** (~60% emissions);
  - Decarbonisation of **direct emissions** from aluminium processing (~25% emissions);
  - **Recycling** of aluminium scrap through improved sorting methods and **resource efficiency** (together offer potential to abate ~15% of sector's emissions)

FEEDBACK FROM THE PARTICIPANTS

- About **87%** 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)*.
- About **90%** of the participants rated the quality and content of the delivery as more than satisfactory *(provided a 7+ rating on a scale of 10)*
- The technical session on aluminium smelter plants and the circular economy were highly appreciated by the participants
- Many participants recommended more similar sectoral workshops for aluminium sector
- More than **90%** of the participants expressed interest for further focused discussions with international technology providers for enhancing energy efficiency and decarbonisation
- Participants expressed their interest to know more about following IEE/Decarbonisation technologies from the UK:
  - Techniques and technologies for enhanced waste heat recovery, specifically from Kilns
  - Future of power plants including hydrogen fuel based
  - Advanced energy management systems
- **Women** account for **~15-20%** of total employee strength in most of the participating organisations
- Some of the initiatives to promote Gender Equality and Social Inclusion (GESI) undertaken by participating organisations include:
  - Recruiting women employees including increased campus hiring of women GETs
  - Target to employ at least **30% of total staff strength** from **female** and **transgender** categories
  - Learning and training calendar includes gender diversity awareness sessions & courses
  - Hiring of **50% female** employees at entry level along with opportunities to work in different shifts and enhanced opportunities to lead the teams

> *"The workshop offered new learnings about energy reduction in metal and power areas in aluminium sector"*
>
> *- **Ms. Ankita Karmakar**, Assistant Manager*
>
> *Vedanta Limited*

> *"The workshop provided good understanding on best practices followed by various aluminium sector plants and horizontal deployment of the same. This would helpd in further development of new ideas"*
>
> *- **Mr. Deepak Gokhale**, General Manager*
>
> *Aditya Birla Science & Technology Co. Pvt. Ltd.*

> *"An insightful workshop that provided the right platform for sharing of best energy efficient practices and R&D initiatives"*
>
> *- **Dr. Anupam Agnihotri**, Director, JNARDDC*

> *"A platform where every individual can share their knowledge which is useful for the industry"*
>
> *- **Mr. Mukesh Chaddha**, Former Head - Alumina, JNARDDC*

> *"The workshop offered opportunity to witness successful use cases for trials in our plant"*
>
> *- **Mr. Linjaraj Jena**, General Manager NALCO*

> *"Insightful session to understand impact of PAT cycles in aluminum sector and steps taken for decarbonisation"*
>
> *- **Mr. Abhijit Sarkar**, Product Manager, Forbes Marshall*

CONCLUSION

The response to the Sectoral Workshop has been positive with participation of key stakeholders including senior officials from central government agencies - BEE (Ministry of Power) and JNARDDC (Ministry of Mines), executive leadership and mid-level officials of leading Indian aluminium industries, technology providers from the UK and India. The workshop appears to have served its purpose of providing a platform for national and international organisations to share their best practices and technologies for enhancing IEED measures in the Indian aluminium sector. The workshop successfully promoted gender equality and social inclusion (GESI) through the active participation of women stakeholders from large energy-intensive industries. It is expected that this workshop would have a demonstrable and long-lasting on-field impact in due course of time. Further, to keep up the momentum, the following activities are envisaged under ASPIRE to further enable wider adoption of IEED measures and technologies by Indian aluminium industries to achieve net-zero:

- Organise a national level workshop and launch the rejuvenated KEP portal with database of proven/ emerging global technologies, technology providers and financial institutions for enhancing adoption of IEED measures
- Provide handholding support to large energy-intensive industries including from the aluminium sector in identifying technologies & solutions, and technology suppliers to enhance IEED measures
- Organise cross-sectoral workshops and national-level-policy roundtable on similar lines for key industrial sectors including aluminium sector in collaboration with R&D institutions such as JNARDDC and global technology suppliers including from the UK
- Create more discussion forums to facilitate exchange of knowledge and information that will aid in the formulation of policies

For more information please contact:

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KPMG in India
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ANNEXURE

ATTENDANCE SHEET

S.No.	Name	Designation	Organisation
1	Dr. Anupam Agnihotri	Director	JNARDDC, Nagpur
2	Mr. Mukesh Chaddha	Former Sr. Scientist & Head - Alumina	JNARDDC, Nagpur
3	Mr. Kailash Pandey	Head - Sambalpur Cluster	Hindalco Industries Ltd.
4	Mr. Sameer Nayak	President and Unit Head	Hirakud (Odisha)
5	Mr. Nitin Tiwari	COO-Metal	Aditya Aluminum, Hindalco
6	Mr. Rasmi Ranjan Swain	AGM	Industries Limited
7	Mr. Mrinmoy Dhang	Assistant Manager	Vedanta Aluminium Limited
8	Mr. Soumava Das	Deputy Manager	Aditya Aluminium
9	Mr. Pratik Kumar	AGM	Aditya Aluminium Limited
10	Mr. Keshav Karan	Senior Manager	Vedanta Limited, Lanjigarh
11	Mr. Neeraj Agrawal	Deputy Manager	Hindalco Industries Limited,
12	Mr. Anand Kumar Sakalle	Manager	Muri Works
13	Mr. Deepak Gokhale	General Manager	Hindalco Industries Limited,
14	Mr. Siddhalingesh NG	AM-production	Muri Works
15	Mr. Kaushal Gupta	AGM-T&P	Hindalco Industries Limited,
16	Mr. Saitarun Madireddy	AM-Engineering	Muri Works
17	Mr. Abhishek Bondre	Deputy Engineer -Engineering	Aditya Aluminium Ltd.
18	Mr. Shashi Kant Shah	AGM (Lead Potline Technical)	Lapanga
19	Mr. Aritra De	Dy Manager (Potline Process Control)	Aditya Birla Science and
20	Mr. Manisha Dash	AM (Potline)	Technology Co. Pvt. Ltd
21	Mr. Hitesh Bhamra	AGM (Process Head Potline)	Hindalco Industries Ltd.
22	Mr. Ramesh Chandra Patra	Manager (Energy Cell)	Belagavi
23	Mr. Rupak Sarkar	Manager (Power Plant)	Hindalco Industries Belgavi
24	Mr. Sridhar Nayak	Dy. Manager (Compressor House)	Hindalco Industries Ltd.
25	Mr. Shailesh Kumar Sahu	AGM (Cast House)	Belagavi
26	Mr. Rajesh Tiwary	Head Carbon Process	Hindalco Industries Ltd.
27	Mr. Pradeepta Acharya	AGM Carbon	Belagavi
28	Mr. Sachin Kumar Gupta	AGM (Power & Services/Energy Cell)	Vedanta Ltd, Jharsuguda

S.No.	Name	Designation	Organisation
29	Ms. Nikita Gayake	Assistant Manager (Smelter Mechanical)	Aditya Aluminium, Lapanga
30	Ms. Prerna Dipti	Assistant Manager (Smelter E&I)	Aditya Aluminium, Lapanga
31	Ms. Sai Mahathi Bottla	Assistant Manager (Smelter Potroom)	Aditya Aluminium, Lapanga
32	Ms. Raunak Singh	Assistant Manager (Smelter E & I)	Aditya Aluminium, Lapanga
33	Ms. Pallavi Munot	Assistant Manager (Smelter E & I)	Aditya Aluminium, Lapanga
34	Ms. Rashmita Patra	Assistant Officer (Smelter Cast House)	Aditya Aluminium, Lapanga
35	Mr. J P Soni	AGM (Smelter Cast House)	Aditya Aluminium, Lapanga
36	Mr. Saroj Barpanda	Manager (Smelter E & I)	Aditya Aluminium, Lapanga
37	Mr. Sanjay Panda	Assistant Manager (Smelter E & I)	Aditya Aluminium, Lapanga
38	Ms. Monalisa Nag	Junior Engineer (CPP Technical Services)	Aditya Aluminium, Lapanga
39	Mr. Shantanu Senapati	Assistant Manager (CPP MMD)	Aditya Aluminium, Lapanga
40	Mr. Subhrakant Sahoo	Assistant Manager (CPP E&I)	Aditya Aluminium, Lapanga
41	Ms. Priyanka Bisoi	Junior Engineer (CPP E&I)	Aditya Aluminium, Lapanga
42	Ms. Sonali Sao	Manager (CPP Technical Services)	Aditya Aluminium, Lapanga
43	Mr. Somen Mukherjee	Deputy Manager (CPP Operations)	Aditya Aluminium, Lapanga
44	Mr. Ashwin Majhi	Assistant Manager	Godrej Electricals & Electronics
45	Mr. Prafulla Chandrakar	Efficiency I/C Power Plant	Vedanta Ltd, Jharsuguda
46	Mr. Kiran Vanama	Associate GM	BALCO
47	Mr. Krishna Kishor Suryawanshi	Dy Manager	BALCO
48	Mr. Yogendra Singh Bhati	Deputy Manager	Mahan Aluminium, Singrauli, Madhya Pradesh
49	Mr. Karnindra Chaturvedi	Manager	Mahan Aluminium
50	Mr. Vivek Singh	Assistant Manager	Mahan Aluminium
51	Mr. Suresh Biravan	Deputy Manager	Mahan Aluminium
52	Mr. Abhijit Sarkar	Team Lead Jamshedpur Branch	Forbes Marshall
53	Mr. Rudra Chatterjee	Sr Engineer	Forbes Marshall
54	Mr. Reddy	Zonal Sales Manager	Atlas Copco (India) Ltd
55	Mr. Koustav Ghosal	Territory Manager	Copco (India) Ltd
56	Mr. Suraj Sunaerjee	Technical Services Dept- Performance Monitoring and Energy Mgt.- Energy Manager	Hindalco Hirakud

S.No.	Name	Designation	Organisation
57	Mr. Santosh Gupta	Main Plant Operation – Energy Auditor	Hindalco Hirakud
58	Mr. Debashish Padhee	Main Plant Operation	Hindalco Hirakud
59	Mr. Jitesh Paliwal	Boilers Maint- Mechanical	Hindalco Hirakud
60	Ms. Anjali Kumari	Electrical Maintenance	Hindalco Hirakud
61	Mr. Anand Sokal	Assistant Manager	Hindalco Hirakud
62	Mr. Milan Bera	Manager	Hindalco Hirakud
63	Mr. Mukesh Patidar	AVP	ABB GISPL
64	Mr. Balwant Joshi	Managing Director	Idam Infra
65	Mr. Rajiv Shukla	Executive Director	Idam Infra
66	Ms. Dhaarna Rawat	Analyst	Idam Infra
67	Mr. Anurag Singh Sirola	Manager	KPMG
68	Dr. Michael Kenyon*	Senior Materials Engineer	Innoval Technologies
69	Ms. Nadine Bloxsome*	Membership & Sustainability Manager	ALFED
70	Mr. S.K. Khandare	Director, BEE	Bureau of Energy Efficiency
71	Mr. V. Jagadeesan	Aluminium Sector Expert	Bureau of Energy Efficiency
72	Mr. K.K. Chakarvarti	Sr. Advisor	Knowledge Exchange Platform
73	Mr. Lingaraj Jena	General Manager	NALCO
74	Mr. Tarun Kumar Tripathy	General Manager	NALCO
75	Mr. Jagadish Mishra	Senior Manager	NALCO
76	Mr. Saroj Kumar Gouda	Senior Manager	NALCO
77	Mr. Anuj Kumar Panda	General Manager	NALCO
78	Ms. Ankita Karmakar	Associate	Vedanta Ltd, Jharsuguda
79	Mr. Pratap K V Sahoo	R & D	Hindalco Hirakud
80	Mr. Abinash Panigrahi	Manager	Aditya Aluminium
81	Mr. Anirban Banerjee	Manager	Aditya Aluminium
82	Mr. Rohan Khare	Manager	Aditya Aluminium
83	Ms. Pradnya Thakur	Manager	Aditya Aluminium
84	Mr. Gourav Tiwari	Manager	Aditya Aluminium
85	Ms. Ankita Wadighare	Assistant Manager	Aditya Aluminium
86	Mr. Vishal Bodkhe	Manager	Aditya Aluminium
87	Mr. Vaibhav Sharma	Manager	Aditya Aluminium

S.No.	Name	Designation	Organisation
88	Mr. Bhavani Mahapatra	Assistant General Manager	Aditya Aluminium
89	Mr. Jaideep Dasgupta	Assistant Vice President	Aditya Aluminium
90	Mr. Peeyush Prasad Rajguru	Manager	Aditya Aluminium
91	Mr. Suresh Kumar Dash	Manager	Aditya Aluminium
92	Mr. Apurba Karak	Manager	Aditya Aluminium
93	Mr. Sourav Gorain	Manager	Aditya Aluminium
94	Mr. Ashwini Mahapatra	Assistant General Manager	Aditya Aluminium
95	Mr. Girish Rath	Deputy General Manager	Aditya Aluminium
96	Mr. Nishant Shah	General Manager	Aditya Aluminium
97	Mr. Manish Jain	Assistant Vice President	Aditya Aluminium
98	Mr. Kalpatru Samal	Assistant Vice President	Aditya Aluminium
99	Mr. Kamal Pandey	Senior Vice President	Aditya Aluminium
100	Mr. Sangram Kesari Dhal	Assistant Vice President	Aditya Aluminium
101	Mr. Abhaya Mishra	Senior General Manager	Aditya Aluminium
102	Mr. Ghanshyam Parida	Joint President	Aditya Aluminium
103	Ms. Madhusmita Sahoo	Assistant Vice President	Aditya Aluminium
104	Mr. Jagadish Patra	Assistant Vice President	Aditya Aluminium
105	Mr. Nitesh Pal	Energy Consultant	Atlas Copco India Ltd.
106	Mr. Hitesh K	Zonal CTS Sales	Atlas Copco India Ltd.
107	Mr. Kuntal Dey	Senior Sales Engg.	Atlas Copco India Ltd.
108	Ms. Radhika Tomar*	Head – Energy Sector Reform	British High Commission, FCDO
109	Ms. Sanyukta Das Gupta*	Smart Power Advisor	FCDO, British High Commission
110	Dr. Vijay Mudgal*	Manager	Idam Infra
111	Mr. Bhushan Patil*	International Funder Associate	Carbon Trust
112	Mr. Ravi Daswani*	Founding Partner & CEO	Global Nano Network Limited
113	Mr. Shivendu Singh*	Senior Data Analyst	OPEX Group - Operational Excellence (OPEX)
114	Mr. Christopher Pilgrim*	Knowledge Transfer Manager - Materials	Innovate UK KTN

**Attended Virtually*