

ASPIRE Programme

Accelerating Smart Power and Renewable Energy in India

Industrial Energy Efficiency and Decarbonisation Knowledge Sharing (IDEEKSHA) Platform

Policy Roundtable on

Enabling Circular Economy and Resource Efficiency in Aluminium and Cement Sectors: Utilising Spent Pot Lining and other waste products of Aluminium Sector

Date – June 9, 2023 | 10:00 – 14:00 Hrs (IST)
Venue – Conference Room, Bureau of Energy Efficiency,
4th Floor, Sewa Bhawan, New Delhi



BACKGROUND

The **ASPIRE Programme**¹ aims to support India's sustainable and low-carbon energy transition to deliver net-zero commitments, with a focus on accelerating the adoption of industrial energy efficiency and decarbonisation (IEED) technologies/ solutions available globally (including from the UK). In view of this, the ASPIRE Programme in collaboration with the Bureau of Energy Efficiency (BEE) developed the **IDEEKSHA**² platform and organised sectoral workshops for four energy intensive sectors – Aluminium, Cement, Iron & Steel and Textile. The **Aluminium and Cement** sectors are **highly energy-intensive**, with carbon intensity of ~20-ton CO_{2e} per ton of aluminium and 0.576-ton CO_{2e} per ton of cement, respectively. India is the **second-largest** producer of aluminium and cement in the world with a share of ~5.3%³ and ~9%⁴ of global output, respectively. Thus, decarbonisation of these two sectors is critical to enable the country in achieving its goal of **net-zero by 2070**.

In the **IDEEKSHA workshops**, stakeholders deliberated on various best practices, technologies/ solutions and policy interventions required to accelerate decarbonisation of energy-intensive industrial sectors. During the Aluminium and Cement sectoral workshops, 'Circular Economy' and 'Resource Efficiency' were identified as the key focus areas.

In view of the above, the ASPIRE Programme in collaboration with the BEE is organising a **Policy Roundtable** on the theme – '**Enabling circular economy and resource efficiency in Aluminium & Cement sectors: Utilising spent pot lining and other waste products of Aluminium sector**'. The details for the Policy Roundtable are provided below:

Date & Time: 9th June 2023 | 10:00 to 14:30 Hrs (IST)

Venue: Conference Room, Bureau of Energy Efficiency, 4th Floor, Sewa Bhawan, New Delhi

The **Agenda** for Policy Roundtable is attached in Annexure.

¹ **About ASPIRE Programme** – Accelerating Smart Power and Renewable Energy in India (ASPIRE) is a bilateral programme 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 Pvt. Ltd. (India) and Carbon Trust (UK) are the key consortium members.

² IDEEKSHA – Industrial Decarbonisation and Energy Efficiency Knowledge Sharing Platform

³ <https://www.indianmirror.com/indian-industries/2022/aluminium-2022.html>

⁴ <https://www.ibef.org/industry/cement-india>

Opportunity for enabling Circular Economy & Resource Efficiency in Aluminium & Cement sectors

Some of the waste products of Aluminium sector, including Spent Pot Lining (SPL) and other wastes, offer significant potential for being re-purposed as an input for the Cement sector.

About Spent Pot Lining (SPL)

SPL, a by-product of Aluminium sector is formed when the carbon and refractory lining of an Aluminium electrolytic cell, also known as a pot, reaches the end of its useful life. SPL consists of a mixture of carbon, refractory lining materials, and fluoride compounds. SPL is classified as a hazardous waste due to its potential toxicity and corrosiveness as mentioned below:

- Contains toxic fluoride and cyanide compounds that can leach into water sources.
- Exhibits high pH levels, making it corrosive due to the presence of alkali metals and oxides.
- Reactive with water, producing flammable, toxic, and explosive gases.

SPL waste consists of two parts: (i) first cut i.e., the carbon cathode, and (ii) second cut i.e., the refractory portion. Typically, SPL comprises ~60% carbon and ~40% refractory by weight. The specific generation of SPL is estimated to be around 15-25 kilograms per metric ton of Aluminium produced. In the Aluminium smelting industry, the lifespan of a pot is typically around 2500-3000 days, and each pot generates ~55-60 metric tons of SPL.

Key challenges in disposal of SPL through co-processing

- Hardness & Crushability: Challenges in crushing SPL due to its high bond index (~40-45), making the use of a lime crusher impractical compared to limestone (bond index of 13-15).
- Process and maintenance impact: SPL is abrasive, contains variable levels of sodium and fluorine, and has a high ignition temperature for the carbon fraction, which can impact process efficiency and maintenance.
- Chemical Properties and Handling: SPL has the potential to form toxic and inflammable gases, such as Hydrogen, Ammonia and Cyanogen, when in contact with moisture. Careful transportation and feeding methods are required to prevent moisture exposure.
- Homogenisation: Ensuring material homogenisation is crucial before utilising SPL. Alkali and fluoride content can vary significantly, and the segregation of Aluminium metal, carbon material, and refractory material needs to be addressed.
- Storage: Storage of SPL in the open sky or without sealed paved ground is prohibited to ensure proper containment.
- Safety: Safety measures are vital at all stages of SPL handling to mitigate risks and ensure worker well-being.
- Permitting Process: The permitting process for SPL disposal from the Central Pollution Control Board (CPCB) involves lengthy procedures.
- Willingness to pay for co-processing/Proper disposal: Many Aluminium smelters are unwilling to pay even minimum tipping fees for SPL disposal, creating challenges for its proper management.
- Continuous availability of raw material: Ensuring a consistent supply of SPL for utilisation.
- Disposal through unorganised sector: Crucial to find a permanent solution for safe & environmentally friendly disposal of SPL, particularly concerning the unorganised sector.
- Waste Quantification and National Database for SPL: The Indian Cement industry does not have reliable quantification of total SPL available for disposal, including current generation and existing stockpiles. This hinders accurate cost-benefit analysis for long-term SPL disposal through Cement co-processing.

Current practices for disposal of SPL

Historically, SPL has presented a significant environmental challenge, as disposal methods often involved landfilling or improper storage, leading to potential groundwater contamination and soil pollution. Recognising the need for sustainable management of SPL, various stakeholders, including Aluminium smelters, regulators, and waste management experts, have been exploring potential circular economy solutions for SPL.

Opportunity for Circular Economy and Resource Efficiency

In March 2017, the Central Pollution Control Board (CPCB) issued standard operating procedures (SOPs) and checklist for Utilisation of SPL generated from primary Aluminium smelting industries. Under Section 32 of the same, utilisation of SPL for manufacturing of Carbon Mineral Fuel to be used as resource/ energy recovery in Cement kiln has been highlighted. Impact of such SOPs need to be assessed in order to enhance co-processing of SPL in the Cement industry.

The Cement industry, being a major consumer of natural resources, holds immense potential for integrating SPL into its production processes. SPL can serve as a valuable alternative raw material, replacing traditional materials like bauxite, clay, and limestone. By using SPL in Cement production, not only can the Cement industry reduce its dependence on virgin materials, but it can also contribute to lowering the environmental footprint of both the Aluminium and Cement sectors. Additionally, the calcium and silica present in SPL can act as stabilisers, enhancing the mechanical properties of Cement.

Apart from SPL, the Aluminium sector generates various other waste products, such as dross, salt slag, and Aluminium slag, which can be explored for their potential in the circular economy. These waste products can be utilised in sectors like construction, metal recovery, and manufacturing of building materials, reducing the demand for virgin resources, and promoting resource efficiency.

Strengths and Capabilities of UK Aluminium Sector

The UK has demonstrated capabilities in the re-purposing of Spent Pot Lining (SPL) and other wastes from the Aluminium sector as inputs for the Cement sector. This work is being carried out through a combination of research, demonstration projects, and policy support. The UK has a strong research and development (R&D) community that is working on developing new technologies for the re-purposing of SPL and other wastes. UK government's Department for Business, Energy and Industrial Strategy (BEIS) has funded a number of research projects on the re-purposing of SPL, including a project to develop a new process for recycling SPL into cement clinker.

Objectives of the Policy Roundtable

Key objectives of the policy roundtable include:

- Deliberate and explore the potential of utilising SPL from the Aluminium sector in the context of circular economy including identification and evaluation of suitable approaches, technologies
- Identification of policy interventions required to facilitate safe and environmentally friendly disposal or reprocessing of SPL.
- Seek to address challenges related to SPL management, such as its hazardous nature, proper handling, homogenisation, storage, and regulatory directives.

- Foster collaboration & develop effective strategies for sustainable SPL management, contributing to resource efficiency, energy conservation & reduced environmental impact.

Intended Stakeholders

Stakeholders from Bureau of Energy Efficiency (BEE), Jawaharlal Nehru Aluminium Research Development and Design Centre (JNARDDC), Aluminium and Cement industries in India, R&D and industrial associations of the two sectors, regulatory authorities, sectoral experts, Representative of UK industry/ industry association/ R&D institution etc.

Annexure – Draft Agenda for Policy Roundtable

Arial	Session	Presenter
10:00 – 10:30	Registration	
10:30 – 10:35	Welcome Address	ASPIRE Team
10:35 – 10:45	Keynote Address	FCDO Representative
10:45 – 11:00	Inaugural Address	Director General, BEE
11:00 – 11:15	Background Presentation on Circular Economy - Use of Aluminium Waste (Spent Pot Liner) of Aluminium industry as Input Raw material and energy in the Cement Sector	Mr. Dipak Khandare, Associate Director, Idam Infra (ASPIRE Team)
11:15 – 11:40	Presentation on Co-processing Hazardous Waste of Aluminium in Cement Sector	Dr. Anupam Agnihotri, Director, JNARDDC
11:40 – 11:55	Sustainable Way of Handling Aluminum Plant Hazardous Waste in Cement and Steel Industries	Mr. Nitin Tiwari, COO, Vedanta Aluminium, Jharsuguda (Odisha)
11:55 – 12:10	Co-Processing of SPL Mixed Fines in Cement Plants – A Sustainable Solution	Dr. Alka Mishra, General Manager (Sustainability Solutions), Dalmia Cement (Bharat) Limited.
12:10 – 12:25	Presentation by Vikram Cement, a Unit of Ultratech Cement	Dr. Rina Shinde, General Manager (QC), Ultratech Cement Limited
12:25 – 12:40	Views of the Global Cement Concrete Association (GCCA) - India Member Countries	Mr. Kaustubh Phadke, India Head, GCCA
12:40 – 12:55	Open House	
12:55 – 13:10	Virtual Presentation by UK Aluminium/ Cement industry/ industry association/ R&D institution*	Representative of UK industry/ industry association/ R&D institution (TBC)
13:10 – 13:50	Open House	
13:50 – 14:00	Closing Remarks and Way Forward	BEE & ASPIRE Team
14:00 onwards	Lunch and Networking	