



NATIONAL ALUMINIUM COMPANY LIMITED

(A Navratna CPSE under Ministry of Mines, Government of India)

Smelter Plant, Nalconagar, Angul – 759 145, Odisha, India

EXPRESSION OF INTEREST (EOI)

for

Identification of Interested Vendors for undertaking the Techno-Economic Feasibility Study, Detailed Engineering and Financial Appraisal for Implementation of Hyper Dense Phase System (HDPS) for Alumina Conveying and Distribution at Potline-3, Smelter Plant, Angul

Last Date & Time for Submission: within 15 days from the publication in NALCO Website,

TABLE OF CONTENTS

1. INTRODUCTION	3
2. BACKGROUND AND PROJECT CONTEXT	3
2.1 Existing Pot Feeding Arrangement at Potline-3	3
2.2 Limitations of the Existing PTM-Based Feeding System	3
2.3 Proposed Hyper Dense Phase System (HDPS)	4
2.4 Intent of the study	4
3. OBJECTIVE OF THE EOI	4
4. BROAD SCOPE OF WORK OF THE CONSULTANT	5
4.1 As-Is Assessment.....	5
4.2 Technology Evaluation and Conceptual Design	5
4.3 Benefit Quantification and Risk Assessment	5
4.4 Basic and Detailed Engineering	6
4.5 Detailed Financial Appraisal	6
4.6 Deliverables	6
4.7 Indicative Time Schedule	7
5. WHO MAY RESPOND — INDICATIVE CAPABILITY REQUIREMENTS	7
6. INFORMATION SOUGHT FROM INTERESTED VENDORS	8
7. ASSESSMENT OF RESPONSES AND WAY FORWARD	8
8. GENERAL TERMS, CONDITIONS AND DISCLAIMER	8
9. EOI SCHEDULE	9
10. SUBMISSION OF EOI RESPONSE AND CONTACT DETAILS	9
11. CONCLUSION	9
ANNEXURE-I: FORMAT OF COVERING LETTER	11
ANNEXURE-II: ORGANISATION PROFILE	12
ANNEXURE-III: EXPERIENCE OF SIMILAR ASSIGNMENTS	13
ANNEXURE-IV: FINANCIAL DETAILS	13

1. INTRODUCTION

National Aluminium Company Limited (NALCO) is a Navratna Central Public Sector Enterprise under the Ministry of Mines, Government of India, and one of Asia's largest integrated primary producers of alumina and aluminium, with operations spanning bauxite mining, alumina refining, aluminium smelting, captive power generation and downstream products.

NALCO's Smelter Plant at Angul, Odisha, has an installed capacity of 4,60,000 TPA of primary aluminium, produced through the Hall-Héroult electrolytic process in four potlines (PL-1 to PL-4) comprising 960 electrolytic pots based on [AP18 / pot technology as applicable] technology. Smooth, reliable and quality-preserving conveying of alumina — both fresh alumina and secondary (fluorinated) alumina from the Fume Treatment Plants (FTPs) — up to the individual pot hoppers is critical for pot feeding regularity, bath chemistry control, current efficiency and specific AlF_3 consumption.

Through this Expression of Interest (EOI), NALCO intends to identify and shortlist reputed, experienced and technically competent consultancy organisations for carrying out a comprehensive Techno-Economic Feasibility Study — including basic & detailed engineering and detailed financial appraisal — for implementation of a Hyper Dense Phase System (HDPS) for alumina conveying and distribution at Potline-3 (PL-3) of the Smelter Plant, Angul.

2. BACKGROUND AND PROJECT CONTEXT

2.1 Existing Pot Feeding Arrangement at Potline-3

At NALCO Smelter, Potline-4 (PL-4) is equipped with a Hyper Dense Phase System (HDPS) based pot feed arrangement, whereas the earlier potlines — PL-1, PL-2 and PL-3 — are fed by overhead travelling cranes / Pot Tending Machines (PTMs). At PL-3, alumina is transported from the storage silos to the pot superstructure hoppers by PTM-mounted filling arrangements, involving crane travel, positioning and manual/semi-manual filling operations at each pot.

2.2 Limitations of the Existing PTM-Based Feeding System

The PTM-based pot hopper filling arrangement at PL-3, while functional, carries inherent limitations that impact safety, environment, alumina quality, pot performance and operating cost:

- Manual / crane-dependent operation with associated risks — operation errors, defective equipment, incorrect crane positioning, and hazardous cleaning activity on pot superstructures and PTMs;
- Alumina spillage at PTM filling and superstructure filling points, leading to dust generation, housekeeping burden and alumina waste in the pot room;
- Alumina dust deposition on busbars and anode rods, deteriorating electrical and mechanical contact — a preliminary OEM assessment (2019) estimated a voltage drop of around 8 mV between anode rod and busbar attributable to dusty busbars, corresponding to an indicative production loss of about 233 t of aluminium per year per potline;
- Dedicated deployment of PTMs and operators for hopper filling — the same assessment indicated about four (4) PTMs and twelve (12) full-time operators engaged in this duty at a potline, with annual maintenance expenditure of the order of USD 0.8 million on the associated filling equipment (filters, filling arms, etc.);

- Substantial PTM travel solely for alumina filling duty — estimated at around 2,160 km per year per potline — consuming PTM life, wheel/rail wear and maintenance windows, and constraining PTM availability for core pot tending operations (anode changing, tapping, covering);
- Risk of pot starvation in the event of delayed alumina delivery, leading to anode effects with attendant energy loss, production loss and increased PFC (CF_4 / C_2F_6) emissions;
- Damage to pot hoods and compromised pot hooding integrity in a dusty work environment, contributing to higher fugitive HF emissions.

2.3 Proposed Hyper Dense Phase System (HDPS)

Hyper Dense Phase conveying technology transports alumina at very low velocity and very high solid-to-air ratio in a fluidised, gravity-assisted mode, through a totally enclosed system from silos to pots. HDPS is the established global best practice for pot feeding in modern aluminium smelters — new potlines are built with HDPS-type pot feed systems and existing facilities are progressively being retrofitted. Within NALCO itself, PL-4 provides an operating in-house reference. The principal benefits are:

- Safety and health: fully automatic, enclosed and 'armless' operation eliminating human intervention, dust exposure, climbing on pots and maintenance in difficult areas;
- Environment: elimination of spillage and dust emission, cleaner pot rooms and superstructures, better pot hooding and reduced HF and PFC emissions;
- Quality and reliability: continuous, self-regulating delivery of alumina to pot hoppers with very high reliability, eliminating pot starvation and associated anode effects;
- Revenue and cost: recovery of production presently lost to busbar contact voltage drop, release of PTMs and manpower from filling duty for core pot tending operations, reduced load and fatigue on PTMs and building structures, and drastically lower maintenance cost — the preliminary OEM assessment indicated reduction of filling-related maintenance expenditure from about USD 0.8 million to about USD 0.02 million per year with full automation and Level-II supervision.

2.4 Indicative Techno-Economics (To Be Validated)

NALCO therefore intends to evaluate the techno-economic feasibility of retrofitting an HDPS-based alumina conveying and distribution system at PL-3 as a brownfield implementation, without disruption to the running potline, with potential for subsequent horizontal deployment at PL-1 and PL-2.

3. OBJECTIVE OF THE EOI

The objective of this EOI is to identify interested and capable vendors — consultancy organisations, engineering firms and HDPS technology providers / OEMs with in-house engineering divisions — who are willing to undertake the Techno-Economic Feasibility Study, Detailed Engineering and Financial Appraisal described herein, and to gauge the available market capability for this assignment.

The responses received against this EOI will enable NALCO to: (i) establish the extent of vendor interest in the assignment; (ii) understand the capabilities, approaches and indicative timelines

available in the market; (iii) firm up the detailed scope of work, qualification criteria and terms for the subsequent Request for Proposal (RFP) / tender; and (iv) build a database of prospective bidders to whom the RFP may be issued.

This EOI is only an invitation to express interest and is a market exploration exercise. It does not constitute a tender or an offer, and issuance of this EOI does not commit NALCO to issue an RFP, award any work, or reimburse any cost to any respondent.

4. BROAD SCOPE OF WORK OF THE CONSULTANT

The broad scope of work for the feasibility study shall include, but not be limited to, the following. The detailed scope shall be furnished in the RFP to shortlisted parties.

4.1 As-Is Assessment

- Detailed study and assessment of the existing PTM-based alumina feeding arrangement at PL-3 — from storage silos and FTP secondary alumina circuit up to pot superstructure hoppers — including PTM deployment, operator engagement, filling cycle times, crane travel, layout, condition and reliability;
- Quantification of the baseline: alumina spillage and waste, dust deposition on busbars/anode rods and consequent voltage drop, filling-related maintenance expenditure, PTM availability constraints for pot tending duties, anode effect frequency attributable to delayed alumina delivery, and associated production and energy losses;
- Sampling and analysis of alumina quality parameters (PSD, fines content, attrition index, flowability, etc.) across the handling chain to quantify degradation;
- Independent validation and updating of the preliminary OEM assessment (2019) referred to at Sections 2.2 to 2.4, to current operating data and price levels.

4.2 Technology Evaluation and Conceptual Design

- Evaluation of available Hyper Dense Phase conveying technologies and global benchmarking with reference plants of comparable configuration, including a structured study of NALCO's own operating HDPS installation at PL-4 (performance, availability, lessons learnt);
- Development of design basis: conveying capacities, redundancy philosophy, integration with fresh alumina silos, GTC/FTP secondary alumina circuit and pot feeding arrangement of PL-3;
- Conceptual engineering including routing, layout, general arrangement, tie-in points, structural adequacy checks and interface with existing facilities;
- Brownfield implementation methodology ensuring zero / minimal disturbance to running pots, including shutdown and tie-in strategy, phasing and construction sequencing.

4.3 Benefit Quantification and Risk Assessment

- Quantification of tangible and intangible benefits — recovery of production lost to busbar contact voltage drop, reduction in anode effect frequency and PFC ($\text{CF}_4/\text{C}_2\text{F}_6$) emissions, filling-related maintenance cost reduction, release of PTMs and manpower for core pot

tending duty, reduced structural loading and fatigue on PTMs and building, improvement in current efficiency, specific AlF_3 and DC energy consumption, and HSE benefits;

- Manpower and PTM redeployment plan consequent to automation of the pot feeding function, in consultation with NALCO;
- Risk assessment and mitigation plan covering technical, execution and operational risks.

4.4 Basic and Detailed Engineering

- Basic engineering: process flow diagrams, air/solids balance, P&IDs, design basis reports, equipment sizing and datasheets (fluidised conveying pipes, air slides, control valves, dosing/storage hoppers, compressors/blowers, dust control equipment), and general arrangement drawings;
- Detailed engineering: layout and routing drawings, civil and structural design and drawings (including structural adequacy check of existing buildings/superstructures for the new system), mechanical detailing, pipeline and support engineering, electrical engineering (SLDs, load list, cable schedules), and instrumentation & control system architecture including integration with the existing pot control / Level-II supervision system;
- Interface engineering with existing facilities — alumina storage silos, FTP/GTC secondary alumina circuit, compressed air systems and pot superstructure hoppers — along with tie-in schemes, shutdown/window planning and constructability review for brownfield execution on a running potline;
- Preparation of Bill of Materials (BOM), detailed technical specifications and tender drawings suitable for floating the NIT for the implementation phase;
- Detailed engineering-based cost estimate with accuracy of $\pm 10\%$, including taxes and duties, spares philosophy and commissioning requirements.

4.5 Detailed Financial Appraisal

- Detailed CAPEX build-up based on BOQ and engineering estimates, including erection, taxes and duties, contingency, escalation and interest during construction;
- Detailed OPEX model for the HDPS versus the existing PTM-based arrangement — energy, compressed air, maintenance, manpower and consumables;
- Quantified benefit streams: production recovery from elimination of busbar contact voltage drop, reduction in anode effect frequency and PFC emissions, filling-related maintenance savings, PTM and manpower redeployment value, and improvement in current efficiency and specific consumption figures;
- Discounted cash flow analysis — IRR, NPV, payback period and profitability index — with sensitivity and scenario analysis on key variables (CAPEX, metal price, energy cost, benefit realisation);
- Financial appraisal in the format and to the standards required for NALCO's capital investment approval process (Board / competent authority), including assistance in preparation of the investment proposal / Board note;
- Assessment of funding options and applicable incentives, if any.

4.6 Deliverables

- Inception Report with detailed methodology and work plan;
- Interim / Draft Feasibility Report for NALCO's review and comments;
- Final Detailed Feasibility Report (DFR) incorporating NALCO's comments — complete with design basis, basic and detailed engineering documents and drawings, BOQ, detailed cost estimate ($\pm 10\%$), implementation roadmap and schedule;
- Detailed Financial Appraisal Report with DCF analysis, sensitivity/scenario analysis and inputs for NALCO's investment approval / Board note;
- Tender-ready technical specification / NIT documents (including drawings and BOQ) for the implementation phase;
- Presentation of study findings to NALCO management.

4.7 Indicative Time Schedule

The complete assignment — feasibility study, detailed engineering and financial appraisal — is expected to be completed within [24–30] weeks from the date of issue of Letter of Award, as per the milestone schedule to be defined in the RFP.

5. WHO MAY RESPOND — INDICATIVE CAPABILITY REQUIREMENTS

This EOI is open to consultancy organisations, engineering firms and HDPS technology providers / OEMs (with in-house or associated engineering consultancy capability), whether Indian or foreign, acting singly or in consortium/MoU arrangement. Respondents should preferably possess the following capabilities. These are indicative requirements to help NALCO assess market capability; the firm qualification criteria for the assignment shall be stipulated in the subsequent RFP.

Sl. No.	Indicative Capability	Supporting Documents
1	Experience in design / engineering / feasibility studies of alumina handling and pneumatic (dense phase / hyper dense phase) conveying systems in primary aluminium smelters, either as a consultant or as a technology provider / OEM.	Company profile, reference list
2	Involvement in at least one HDPS / dense phase pot feeding project (study, engineering, supply or execution) in an operating aluminium smelter, preferably as a brownfield retrofit, during the last [ten (10)] years.	Work orders / completion certificates / client references
3	Adequate financial standing and organisational strength to execute an assignment of this nature, with in-house multi-disciplinary engineering capability (process, mechanical, civil-structural, electrical, instrumentation & control).	Audited financial statements / CA certificate, organisation chart
4	The respondent shall not be under any ban / blacklisting / holiday list of NALCO, any Government of India entity, PSU or any of the respondent's clients as on the date of submission.	Self-declaration on letterhead
5	Consortium / MoU arrangements with technology providers or engineering partners, if any, shall be clearly declared along with the roles of each party.	Consortium agreement / MoU copy

6. INFORMATION SOUGHT FROM INTERESTED VENDORS

Interested vendors are requested to submit the following along with their expression of interest:

- Covering letter as per Annexure-I on the respondent's letterhead, signed by the authorised signatory, confirming interest in undertaking the assignment;
- Organisation profile as per Annexure-II;
- Details of relevant experience / similar assignments, as per Annexure-III, with supporting work orders / completion certificates / reference letters;
- Financial details as per Annexure-IV with audited annual reports / CA certificate for the last three financial years;
- Brief approach and methodology note (maximum [10] pages) describing how the respondent proposes to execute the study, detailed engineering and financial appraisal, including proposed team structure;
- Indicative overall time schedule for completing the assignment;
- Indicative budgetary estimate for the assignment (non-binding, for NALCO's internal planning purposes only; this shall not be treated as a price bid and shall have no bearing on the subsequent tender);
- Comments or suggestions, if any, on the broad scope of work at Section 4, including any additional activities the respondent considers necessary;
- Power of Attorney / Board Resolution in favour of the authorised signatory, and self-declaration of non-blacklisting;
- Any other credentials the respondent considers relevant (brochures, reference lists, technology tie-ups, etc.).

7. ASSESSMENT OF RESPONSES AND WAY FORWARD

EOI responses received within the due date and time shall be examined by a duly constituted committee of NALCO to assess the interest, capability, approach and indicative timelines offered by the market. NALCO may, at its discretion, seek clarifications or additional information from the respondents, and may invite interested vendors for a technical presentation / interaction at NALCO Smelter Plant, Angul or through video conferencing, and/or facilitate a site visit for better appreciation of the existing PL-3 facilities.

Based on the responses, NALCO intends to finalise the detailed scope of work, qualification criteria and commercial terms, and issue the Request for Proposal (RFP) / tender for the assignment to the interested vendors found prima facie capable. Neither submission of a response, nor any interaction pursuant to this EOI, confers any right upon any respondent for issuance of the RFP or award of work.

8. GENERAL TERMS, CONDITIONS AND DISCLAIMER

- This EOI is not an offer or a tender, and is issued with no commitment. NALCO reserves the right to accept or reject any or all responses, and to annul, modify, extend or re-issue this EOI at any stage without assigning any reason and without any liability whatsoever;

- All costs incurred by the respondents in preparation and submission of the EOI response, presentations, site visits, etc., shall be borne entirely by the respondents;
- Mere submission of response or meeting of eligibility criteria does not entitle any respondent to be shortlisted or to be awarded any work;
- All information provided by NALCO in this EOI, and any information shared subsequently, shall be treated as confidential and shall not be used for any purpose other than responding to this EOI;
- Responses received after the due date and time, or incomplete responses, are liable to be rejected;
- In case of any dispute, the decision of NALCO shall be final and binding. Courts at Angul / Bhubaneswar, Odisha shall have exclusive jurisdiction;
- Canvassing in any form shall lead to disqualification of the respondent.

9. EOI SCHEDULE

Last Date & Time for Submission: within 15 days from the publication in NALCO Website

10. SUBMISSION OF EOI RESPONSE AND CONTACT DETAILS

The EOI response, complete in all respects, shall be submitted in a sealed envelope superscribed "EOI Response – Feasibility Study for HDPS Implementation at Potline-3, Smelter Plant" along with the EOI number, addressed to:

Mr. Sruti Ranjan Behera, DGM (Met.), Potline Services

Potline Services Department, Smelter Plant, National Aluminium Company Limited, Nalconagar, Angul – 759 145, Odisha

A soft copy of the response shall additionally be e-mailed to: [sruti.beheranalcoindia.co.in]. For any clarification, respondents may contact: [Cell : +91-94371 63266].

11. CONCLUSION

Through this EOI, NALCO seeks to take a decisive and well-informed step towards modernising the alumina pot feeding system at Potline-3 of its Smelter Plant, Angul, by moving from the existing PTM/overhead-crane-based hopper filling arrangement to a fully enclosed, fully automatic Hyper Dense Phase System — a technology already proven in-house at Potline-4 and established as global best practice in modern aluminium smelters.

The intent of this EOI is therefore threefold: first, to identify vendors — consultancy organisations, engineering firms and HDPS technology providers — who are genuinely interested in and capable of undertaking the study; second, to understand the approaches, capabilities, timelines and indicative costs available in the market, so that the scope and qualification criteria of the

subsequent RFP can be framed realistically; and third, to build the foundation for securing, through the selected agency, an independent and bankable basis for investment — encompassing validation of preliminary assessments, basic and detailed engineering, a detailed financial appraisal aligned with NALCO's capital investment approval process, and tender-ready documentation for the implementation phase.

The envisaged outcome extends beyond a single potline. A successful feasibility-cum-engineering study for PL-3 is intended to serve as the template for horizontal deployment of HDPS at PL-1 and PL-2, thereby delivering enduring gains in safety, health, environment, alumina quality, pot performance and operating cost across the entire Smelter — in keeping with NALCO's commitment to operational excellence and sustainable, technology-driven growth.

NALCO looks forward to responses from capable and experienced organisations willing to partner in this important initiative.

ANNEXURE-I: FORMAT OF COVERING LETTER

(To be submitted on the respondent's letterhead)

To,

Mr. Sruti Ranjan Behera, DGM (Met.), Potline Services, Potline Services Department, Smelter Plant, NALCO, Nalconagar, Angul – 759 145, Odisha

Sub: Response to EOI No. NALCO/SMELTER/PLS/EOI/_01_HDPS /2026-27 – Identification of Interested Vendors for undertaking the Techno-Economic Feasibility Study, Detailed Engineering and Financial Appraisal for Implementation of Hyper Dense Phase System (HDPS) for Alumina Conveying and Distribution at Potline-3, Smelter Plant, Angul.

Dear Sir/Madam,

With reference to the above EOI, we hereby confirm our interest in undertaking the subject assignment and submit our Expression of Interest along with the requisite information. We have read and understood the contents of the EOI document and confirm our acceptance of the terms and conditions stated therein. We certify that the information furnished by us is true and correct, and we understand that NALCO reserves the right to reject our response in the event any information is found to be incorrect or misleading.

Yours faithfully,

(Signature of Authorised Signatory with Name, Designation, Company Seal, Date and Place)

ANNEXURE-II: ORGANISATION PROFILE

Sl. No.	Particulars	Details
1	Name of the organisation	
2	Year of establishment and constitution (Ltd. / Pvt. Ltd. / LLP / Others)	
3	Registered office address	
4	Contact person (Name, Designation, Phone, E-mail)	
5	GSTIN / PAN / CIN (or equivalent for foreign entities)	
6	Core areas of consultancy / engineering expertise	
7	Experience in aluminium smelter projects (years)	
8	Details of technology tie-up / consortium partner for HDPS, if any	
9	Total manpower and details of key technical experts proposed for this study	
10	Certifications (ISO etc.), if any	

ANNEXURE-III: EXPERIENCE OF SIMILAR ASSIGNMENTS

(Details of feasibility studies / basic or detailed engineering of dense phase / hyper dense phase alumina conveying systems executed during the last [seven] years. Attach work orders / completion certificates for each.)

Sl. No.	Client & Plant	Brief Scope of Assignment	Order Value & Reference	Period of Execution	Status
1					
2					
3					

ANNEXURE-IV: FINANCIAL DETAILS

(To be supported by audited financial statements / CA certificate)

Sl. No.	Particulars	FY 2023-24	FY 2024-25	FY 2025-26
1	Annual turnover (₹ Crore)			
2	Net worth (₹ Crore)			
3	Profit after tax (₹ Crore)			

Note: Foreign entities may furnish equivalent figures in USD/EUR along with the exchange rate reference date.

ANNEXURE-V: EVALUATION MATRIX FOR ASSESSMENT OF EOI RESPONSES

The EOI responses received within the due date and time shall be assessed by the duly constituted committee of NALCO against the following indicative evaluation matrix, to gauge the interest, capability, approach and indicative timelines offered by the market. This matrix is indicative and is intended solely to assist NALCO in shortlisting prima facie capable respondents for issue of the subsequent RFP; the firm qualification and evaluation criteria for the assignment shall be stipulated in the RFP.

Sl. No.	Evaluation Criterion	Basis of Assessment / Supporting Reference	Max. Marks
1	Relevant experience in design / engineering / feasibility studies of alumina handling and pneumatic (dense phase / hyper dense phase) conveying systems in primary aluminium smelters.	Company profile and reference list; work orders / completion certificates (Annexure-III).	25
2	Experience in HDPS / dense phase pot feeding project(s) in an operating aluminium smelter, preferably as a brownfield retrofit, during the last ten (10) years.	Work orders / completion certificates / client references (Annexure-III).	20
3	Quality and completeness of the technical approach and methodology proposed for the feasibility study, detailed engineering and financial appraisal.	Approach and methodology note and comments on scope (Section 6).	20
4	In-house multi-disciplinary engineering capability (process, mechanical, civil-structural, electrical, instrumentation & control) and strength of the proposed expert team.	Organisation chart and CVs / details of key experts (Annexure-II).	15
5	Financial standing and organisational strength to execute an assignment of this nature.	Audited financial statements / CA certificate for the last three years (Annexure-IV).	10
6	Realism of the indicative time schedule and appreciation of brownfield execution constraints on a running potline.	Indicative overall time schedule submitted (Section 6).	05
7	Value additions and suggestions on the broad scope of work, including additional activities considered necessary.	Comments / suggestions on Section 4 (Scope of Work).	05
	Total		100

Note: Respondents securing a minimum aggregate score of 60 marks (60%) shall ordinarily be considered prima facie capable and may be shortlisted for issue of the RFP. NALCO reserves the right to seek clarifications, call for a technical presentation / interaction or a site visit, and to modify the weightages or criteria at the RFP stage. Neither the assessment nor any interaction pursuant to this EOI shall confer any right on any respondent for issue of the RFP or award of work.